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Kancelarija/Office

Panevropski univerzitet "Apeiron"
Pere Krece 13, 78000 Banja Luka,
Bosna i Hercegovina
tel. +387 (0) 51 247 975,
fax +387 (0) 51 430 921
siz@siz-au.com
www.siz-au.com

Pan-European University "Apeiron"
Pere Krece 13, 78000 Banja Luka,
Bosnia and Herzegovina
tel. +387 (0) 51 247 975,
fax +387 (0) 51 430 921
siz@siz-au.com
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Dragi čitaoci,

U novom decembarskom izdanju našeg Časopisa ponovo imamo rekordan broj radova, Uredništvo je uvrstilo sedamnaest radova, autora iz Crne Gore, Južne Koreje, Srbije, Indonezije, Sjeverne Makedonije, Iraka, Turske, Palestine, Tunisa i Bosne i Hercegovine. U ovom broju ćete pročitati članke koji se odnose na ulogu fizičkog vježbanja na smanjenje adhd sindroma kod djece školskog uzrasta, učinak socijalne tjelesne anksioznosti u odnosu između objektivizirane tjelesne svijesti i tjelesnog poštovanja među takmičarima trbušnog plesa, uticaj fizičke aktivnosti na anksioznost kod studentica, Uticaj vannastavnih aktivnosti na razvoj motoričkih sposobnosti i antropometrijskih karakteristika djece, efekte prilagođenog fizičkog vježbanja na grubomotoričke funkcije i motoričke sposobnosti djece sa poteškoćama, učinak kružnog tabata treninga na gubitak težine i postotak tjelesne masti, strategije za razvoj lokalnog turizma, samoefikasnost inicijalnog učitelja u procesu učenja fizičkog vaspitanja u inkluivnom razredu, odnos fizičke spremnosti na prehrambene navike u ranom djetinjstvu, stanje uhranjenosti i i sastav tijela starijih osoba poslije savjetovanja, modifikacije igre engklek za poboljšanje karaktera, discipline i razmišljanja u ranom dijetinjstvu, mjerenje agresivnog ponašanja ekipa u iračkoj Premier ligi u fudbalu i njegov odnos prema rezultatima i poretku lige za sezonu 2022/2023., primjena tradicionalnih igara na fizičku spremnost igrača badmintona, faktori koji doprinose fizičkoj sposobnosti učenika u islamskim internatima, unapređenje tehnike plivanja perajima, doprinos nekih antropometrijskih mjerenja i plućnih kapaciteta postignućima trkača na 800 metara u Palestini, analiza tehnike rol spajk kod igrača sepak takraw na osnovu biomehaniče analize.

Zahvaljujemo svim autorima, recenzentima i članovima uredništva na uloženom trudu i ovom prilikom pozivamo naše dosadašnje saradnike, a posebno nove, mlade koleginice i kolege, da svojim radovima daju doprinos nastojanju da sportske nauke budu sve značajniji faktor dobrog zdravstvenog stanja ljudi. Nadamo se da će i ovaj broj ispuniti očekivanja šire čitalačke populacije. Želimo svima srećnu i uspješnu novu 2025. godinu!

UREDNIŠTVO ČASOPISA

Dear readers,

In the new December issue of our Journal we have a record number of papers, the Editorial Board included seventeen works by authors from Montenegro, South Korea, Serbia, Indonesia, North Macedonia, Iraq, Turkey, Palestine, Tunisia and Bosnia and Herzegovina.

In this issue, you will read articles the role of physical exercise in reducing adhd syndrome in school-age children, the effect of social body anxiety in the relationship between objectified body awareness and body esteem among belly dance competitors, the influence of physical activity on anxiety in female students, the influence of extracurricular activities on the development of motor skills and anthropometric characteristics of children, the effects of adapted physical exercise on gross motor functions and motor skills of children with disabilities, the effect of circular tabata training on weight loss and body fat percentage, strategies for the development of local tourism, self-efficacy of the beginning teacher in the learning process of physical education in the inclusive class, the relationship of physical fitness to eating habits in early childhood, nutritional status and body composition of the elderly after counseling, modifications of the Engklek game to improve character, discipline and thinking in early childhood, measuring the aggressive behavior of teams in the Iraqi Premier League in football and its relationship to the results and league standings for the 2022/2023 season, the application of traditional games to the physical fitness of players badminton, factors that contribute to the physical ability of students in Islamic boarding schools, improvement of fin swimming technique, contribution of some anthropometric measurements and lung capacities to the achievements of 800 meters runners in Palestine, analysis of roll spike technique in sepak takraw players based on biomechanical analysis.

We would like to thank all the authors, reviewers and members of the editorial board for their eff orts, and on this occasion we invite our previous collaborators, especially new, young colleagues, to contribute their works to the effort to make sports science an increasingly important factor in people's good health. We hope that this issue will meet the expectations of the wider readership. We wish everyone a happy and successful New Year 2025!

EDITORIAL BOARD OF THE JOURNAL

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Original scientific paper *Originalni naučni rad*

Contribution of Some Anthropometric Measurements and Pulmonary Volumes to the Numerical Achievement of 800-Meter Event Runners in Palestine

Loai Hanon[1], Hamed Salameh[2], Ali Qadoume[2], Motasem Aboalia[2], Khaled Qadoume[2], Riadh Khalifa[3]
[1]Ministry of education, Chinese secondary boys' school, Ramallah, Palestine.
[2]Faculty of Physical Education and Sport Sciences, Palestine Technical University- Kadoorie, Tulkarm State of Palestine.
[3] Higher Institute of Sport and Physical Education of Ksar Saïd, University of La Manouba, Tunis, Tunisia

Correspondence:
Ali Qadoume, Higher Institute of Sport and Physical Education of Ksar Saïd, University of La Manouba, Tunis, Tunisia
ali_qadoume2012@yahoo.com

Abstract: *The study aimed to identify the contribution of some anthropometric measurements and pulmonary volumes to the Numerical Achievement of runners in the 800-meter running event at Palestine. The study was conducted on a purposely designed sample of (17) runners in Palestine, aged between (18-22) years. The researchers used the descriptive analytical approach because it suits the nature of the study. Anthropometric measurements were performed related to (age, body mass, height, arm length, leg length, thigh length, lower leg length, instep length, chest circumference, chest circumference with inspiration, abdominal circumference, thigh circumference, Leg calf, upper arm circumference, and related Pulmonary volume measurements. Related Pulmonary volume measurements were performed (VC, FVC, FEV1, FWV1/ FVC%, MVV, TV, RV), and after the data was collected, it was processed statistically using SPSS. The results of the study showed that the anthropometric measurement that have the most contribution In the Numerical Achievement of 800 meters running event runners in Palestine was Height , which contributed to explaining (43.1 %) of the finishing time. The study also found that Pulmonary volume measurements contributed most to the Numerical Achievement For runners of the 800-meter running event in Palestine, was Vital Capacity (VC)which explained (39.1%) of the time Achievement.*
Researchers recommend that the predictive equations that have been developed should be used as predictors for the numerical achievement of the 800-meter running event.
Keywords: *Anthropometric measurements, Pulmonary volumes, Numerical achievement, runners, Vital capacity.*

INTRODUCTION

The 800-meter running competition is one of the middle-distance competitions that is closely linked to the endurance element, and that is why it is called (an endurance race), as the runner in this competition goes through four curved sections and four straights, so it is classified alongside the 400-meter running competition as one of the fiercest, most exciting and thrilling track competitions. This is indicated by the name given to them which "the killers of men or the graveyard of runners". The reason behind this name is the pain and fatigue that the runners of these competitions feel during the race resulting from the accumulation of large amounts of lactic acid because of the incomplete burning of glycogen, which is used as energy fuel in the race by the anaerobic system. Therefore, cyclic respiratory endurance, speed endurance , strength endurance, and performance endurance are considered the most important physical elements for success and achievement in this competition (Salama & Khalifa, 2018).

Achieving hi in this competition depends greatly on what the runners possess. From anthropometric and physiological specifications at the level of the heart muscle, Pulmonarys, nervous and muscular systems, in addition to height, leg length, and a muscular body free of fat (Salameh, 2018), as (Zar et al, 2008; Mande, 2016) to the importance these specifications are by saying that understanding the anthropometric, physical and physiological specifications for each sporting activity is an important and influential factor in sporting achievement, as each sporting activity has its own anthropometric, physical and physiological requirements that pave the way for the player who possesses these requirements to achieve achievement. He added (Gursavek & Mishra, 2012) that it is no less important than the technique used by an athlete in any game, and this requires attention to it by coaches and teachers when selecting players. Parseh & Hassan, 2015 also indicated that the medals obtained by Eastern European players In 1972, and in 1976, attention was paid to the anthropometric, physical, and physiological requirements when selecting talented athletes, according to the requirements of each game, and this was confirmed by many studies that dealt with study-

ing the relationship between anthropometric and physiological measurements with athletic achievement, such as the study (Salama & Khalifa, 2018), which It showed that abdominal circumference and instep length were the most contributing anthropometric measurements to the level of Numerical Achievement for the 800m running event, as they contributed to explaining (13.8%) of the completion time , and a study (Rathore, 2016 & Mishra) that found a significant relationship statistically between height, body mass, leg length, and thigh circumference with the 50-yard speed test, and a study (Singh & Malik, 2015) that showed a statistically significant relationship between height, leg length, shoulder circumference, hip circumference, shoulder diameter, and Elbow, thigh skin thickness, skin thickness of the biceps brachii muscle, 100-meter sprint completion, and a study (Singh & Malik, 2015) that showed a statistically significant relationship between height, leg length, shoulder circumference, hip circumference, shoulder diameter, and elbow diameter, The skin thickness of the thigh, the skin thickness of the biceps brachii muscle, the completion of a 400-meter run, and a study (Omelchenko et al, 2023), the results of which revealed a positive and direct relationship between height and body mass with measurements of pulmonary volumes related to (VT, FEV1, FVC, MV, ERV, IRV, VC, MVV) , and the study (Salameh et al, 2020) which showed that the Pulmonary volume measurements most capable of predicting physical efficiency were (FEV1 , FVC) , which respectively contributed to explaining (73.5, 78.3%) of the efficiency index. Physical fitness, a study (Mazic et al, 2014) showed that there was a statistically significant relationship between the (VC) measurement and players who played boxing and rugby. It also showed that there was a relationship between the (FVC) measurement and players who played Cycling, football, boating, as well as a relationship between measuring (FEV1) And boxing and water polo players, and a study (Yasuaki et al, 2006) which showed that high school football players in Yanazaki Prefecture in Japan are characterized by high levels of Pulmonary volume measurements related to (TLC, VC), and a study (Cheng et al, 2003) Which concluded that people who practice sports activities are characterized by high levels of pulmonary volume measurements (FVC, FEV1, FEV1/FVC%).

Given the importance of anthropometric measurements and pulmonary volumes among runners of the 800-meter running event , this study came as a practical scientific attempt by the researchers to determine the most contributing of these measurements to the Numerical Achievement of the 800-meter running, even in light of the unsatisfactory results achieved by a runner in competition at the national level from here it appears the study problem for the researchers.

METHODOLOGY

Researcher Wen The study was conducted on a purposive sample of (17) elite 800-meter runners in Palestine, and Table No. (1) shows the characteristics of the study sample.

Table 1. *Characteristics of the study sample (N = 17)*

Variables	Measuring unit	Minimum	Maximum	Mean	Standard deviation	Skewness coefficient
Age	Year	19.00	21.00	20.05	.820	-0.117
Body mass	Kg	60.00	74.00	66.20	4.68	.2030
Height	Cm	160.00	183.00	171.23	5.836	.3430

It is clear from the results of Table (1) that the values of the Skewness coefficient are between (± 3) and this indicates that the study sample is subject to the normal distribution.

Study procedures

- Anthropometric measurements were performed related to age, body mass, height, the lengths of (arm, leg, thigh, instep) and the circumferences of (chest, chest with inspiration, abdominal, thigh, calf, and upper arm) using a measuring tape.-Measurements of Pulmonary volumes (VC, FVC, FEV1, FWV1/FVC%, MVV, TV, RV, TLC) were performed using a spirometer.

- A Numerical Achievement measurement was conducted for the 800-meter running event on the track at Palestine Technical University- Kadoorie.

- The study was conducted in the time period 1-8/ 10-8-2023.

The following is an explanation of the study procedures:

***Anthropometric measurements**

First: height and body mass (body weight): To measure height, the researcher used a rectameter device, which is a stand installed vertically on a wooden edge, its length 250cm, the zero is at the level of the wooden base. There is also a stand installed horizontally on the stand so that it can be moved down and up.

The test subject stands on the wooden base with his back facing the stand so that it touches it at three points: the area between the two boards, the furthest point of the pelvis from the back, and the farthest point of the calves of the legs. Care must be taken to pull the body up and look forward, and the stand is lowered until it touches the upper edge of the skull so that the number facing the stand expresses the length. .

Second: The lengths of the limbs include:

•Arm Length: A measuring tape in centimeters is used to measure the arm from lateral edge of acromial process to the end of middle finger when it is straight.

•Leg length: The length of the lower limb is measured using a measuring tape from the greater trochanter of the upper head of the hip joint to the floor.

•Femoral length: Femoral length is measured using a tape measure from the greater trochanter of the superior head of the femur to the lateral edge of the middle of the knee.

•Leg Length: Leg length is measured using a measuring tape from the medial edge of the middle of the knee joint to the medial prominence of the heel.

•Instep length: The instep length is measured using a tape measure from the end of the heel bone to the tip of the big toe.

Third: The circumferences include:

•Chest circumference in the normal position: The chest circumference is taken at a level exactly above the nipple and the average circumference of the maximum inhalation and the minimum circumference during maximum exhalation are calculated.

•Chest circumference during inhalation: The chest circumference is taken as in the previous method, but after the tester takes the maximum breath (inhalation) and holds it until the chest circumference is read.

•Upper arm circumference during diastole: The largest circumference during contraction and relaxation.

•Abdominal circumference: the smallest circumference of the abdomen above the navel 2-3cm.

•Thigh circumference: The largest circumference of the thigh directly below the buttocks.

•Calf circumference: The largest circumference in the calf (Salama, 2018)

Pulmonary Function Measurements

The researchers used an electronic spirometer, type of Astra Touch, American made and manufactured by a company SDI Diagnostics. It is considered one of the modern and accurate devices that measures more than 40 measurements.

Measurement instructions and instructions:

- The measurements were carried out at 10-12 am, at a temperature of 27 degrees Celsius.
- Students who smoke and students who have respiratory diseases were excluded.
- Students were told to eat breakfast at least two hours before the test.
- The students were informed not to engage in any sporting activity before the measurement.

-Measurement Mechanism:

Measurements were performed according to the guidelines of the American Thoracic Society and the European Respiratory Society (ATS/ERS) according to the following steps:

was explained to all players before starting the measurement, with a sample performance for each test.

- Measurements were taken from a sitting position on a chair.

Close the nose with plastic forceps designated for this purpose.

- Players take tests with three attempts for each test, with the best one being recorded.
- (FVC, FEV1) were measured FEVI/FVC%) by the player taking the maximum inhalation and then following it with the maximum exhalation .
- VC was measured by the player breathing three times as a normal breath in the spirometer. On the fourth time,

the player took the maximum inhalation followed by the maximum exhalation, so we obtained measurements (ERV , IRV, SVC, TV) .

- (MVV) was measured by performing a breathing maneuver with the maximum possible inhalation and exhalation for (12) seconds (ATS, 2001) .

-The Numerical Achievement measurement for the 800-meter running event on the Olympic track was taken at Palestine Technical University –Kadoorie.

***Results**

Results related to the first study question, which states:

What are the most anthropometric measurements contribute to the Numerical Achievement of 800-meter event runners in Palestine?

To answer this question, firstly, the researchers found the values of the Pearson correlation coefficient between anthropometric measurements and the Numerical Achievement of 800-meter event runners in Palestine, and Table (2) shows that.

Table 2. *Pearson correlation coefficient between some anthropometric measurements the Numerical Achievement of 800-meter event runners in Palestine (N= 17)*

Anthropometric measurements	Measuring unit	mean	Standard deviation	R-value*
Age	Year	20.05	.820	0.195
Body Mass	Kg	66.20	4.68	-0.607
Height	Cm	171.23	5.836	*-0.657
Arm Length	Cm	73.53	3.18	-0.172
Leg Length	Cm	90.41	4.98	-0.383
Thigh Length	Cm	47.59	4.84	*-0.613
Lower Leg Length	Cm	42.88	2.47	0.373
Instep Length	Cm	26.65	1.58	0.126
Chest Circumference	Cm	84.41	4.43	-0.431
Chest Circumference With Inspiration	Cm	87.82	4.23	-0.352
Abdominal Circumference	Cm	74.24	4.18	0.066
Thigh Circumference	Cm	49.18	2.88	-0.294
Calf (Gastrocnemius) Muscle Circumference	Cm	34.71	2.64	-0.247
Upper Arm Circumference	Cm	28.47	2.62	0.215

**Significance level ($\alpha \leq 0.05$)*

From the results of Table (2), it is clear that there is no a statistically significant relationship at the level of significance ($\alpha \leq 0.05$) between some measurements of anthropometric related to measurements: (age, body mass, arm length, leg length, thigh length, lower leg length, instep length, abdominal circumference, upper arm circumference), and the Numerical Achievement of 800-meter event runners, while there is statistically significant relationship with height, thigh length. In order to determine the contribution of height, thigh length measurements, linear stepwise regression analysis was applied to identify the possibility of developing a predictive equation from some anthropometric measurements height, thigh length as an independent variables with the Numerical Achievement of 800-meter event runners as a dependent variable, and Table (3) shows this.

Table 3. *Results of a one-way analysis of variance to identify the regression coefficient for the predictive equation for Numerical Achievement for 800-meter event runners in Palestine (N=17)*

Model	Source of variance	Sum of Squares	df	Mean Square	F	Sig.	R^2
Height	Regression	0.066	1	0.066	11.383	*0.004	0.431
	Residual	0.087	15	0.006			
	Total	0.153	16				

**Significance level (α ≤ 0.05)*

It is clear from the results of Table (3) that anthropometric measurements contribute most In the numerical achievement for the 800 meter event runners , it was height where the value of (r^2) reached it has (0.431), and to identify the equation of the regression line, the t-test and the beta coefficient were used, and the results of table (4) show this.

Table 4. *Results of the t-test and the beta coefficient of the regression line equation for the contribution of some anthropometric measurements to the numerical achievement of 800-meter event runners (N=17).*

Model	Value	Standard Error	Beta	T	Sig.	R^2
Constant	4.149	0.560	-0.657	7.413	0.000*	0.431
Height	-0.011	0.003		-3.374	0.004*	

**Significance level (α ≤ 0.05)*

It is clear from the results of Table No. (4) that the value of (t) was statistically significant at the significance level (α ≤ 0.0 5), where the measurement contributed Height In interpreting (43.1)% of the numerical achievement of the 800-meter event runners , the proposed equation becomes as follows:

Numerical Achievement for running 800 meters = 4.149 - ((Height (cm) × 0.011))

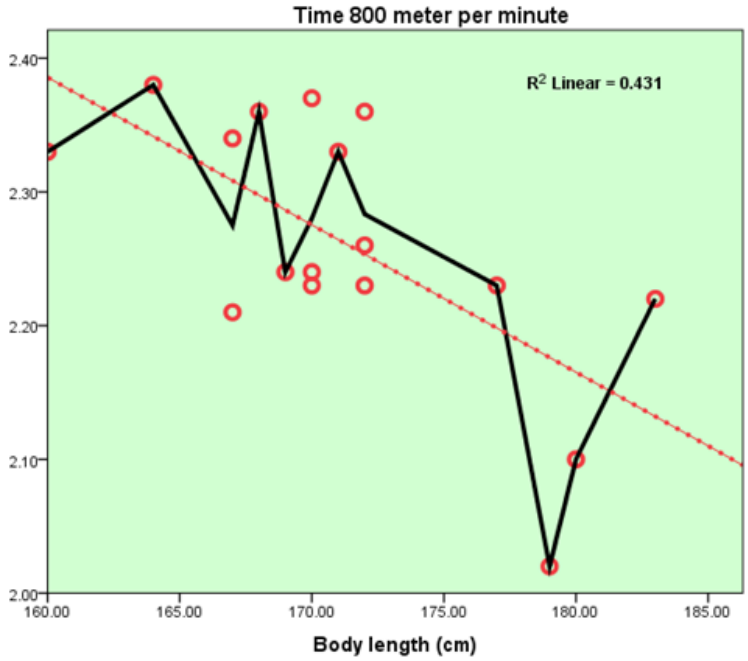

Figure 1. *Height measurement as a predictive in the numerical achievement for the 800 meter event runners*

***Results related to the second study question, which states:**

What are the most Pulmonary volume measurements contribute to the numerical achievement of 800-meter event runners in Palestine?

To answer this question, firstly, the researchers found the values of the Pearson correlation coefficient between pulmonary volume measurements and the numerical achievement of 800-meter event runners in Palestine, and Table (5) shows that.

Table 5. *Pearson correlation coefficient between pulmonary volume measurements and the numerical achievement of 800-meter event runners (N= 17)*

Pulmonary volumes measurements	Measuring unit	Mean	Standard deviation	R-value*
VC	L / min	4.36	0.48	*-0.625
FVC	L / sec	4.22	0.46	*-0.555
FEV1	L / min	4.06	0.46	*0.288
FEV1/FVC%	%	95.52	4.70	0.429
MVV	L / min	164.38	18.92	0.168
TV	L / min	1.45	0.59	0.007
IRV	L / min	1.50	0.46	-0.276
ERV	L / min	1.49	0.65	-0.299
IC	L / min	3.20	0.62	-0.245
RV	L / min	1.06	.110	*-0.496

** Significance level (α ≤ 0.05)*

From the results of Table (5), it is clear that there is no a statistically significant relationship at the level of significance (α ≤ 0.05) between measurements of pulmonary volumes related to measurements: (FWV1/FVC%, MVV, TV, IRV, IC, ERV) and the numerical achievement of 800-meter event runners, while there is statistically significant relationship with (VC, FVC, FEV1, RV) and the numerical achievement of 800-meter event runners. In order to determine the contribution of (VC, FVC, FEV1, RV) measurements, linear stepwise regression analysis was applied to identify the possibility of developing a predictive equation from some Pulmonary volumes measurements (VC, FVC, FEV1, RV) as an independent variables with the numerical achievement of 800-meter event runners as a dependent variable, and Table (6) shows this.

Table 6. *Results of one-way analysis of variance to identify the regression coefficient for the predictive equation for Numerical Achievement for 800-meter event runners in*

Model	Source of variance	Sum of Squares	df	Mean Square	F	Sig.	R^2
VC	Regression	0.060	1	0.060	9.632	*0.007	0.391
	Residual	0.093	15	0.006			
	Total	0.153	16				

**Significance level (α ≤ 0.05)*

It is clear from the results of Table (6) that Pulmonary volume measurements contribute most In the Numerical Achievement of runners in the 800-meter running event in Palestine She was VC The value of (R^2) reached (0.391), and to identify the equation of the regression line, the t-test and the beta coefficient were used, and the results of table (7) show this.

Table 7. *Results of the t-test and the beta coefficient of the regression line equation for the contribution of some Pulmonary volume measurements to the Numerical Achievement of 800-meter event runners (n=17)*

Model	Value	Standard Error	Beta	T	Sig.	R^2
Constant	2.819	0.181	-0.625	15.615	0.000*	0.391
VC	-0.128	0.041		-3.10	0.007*	

**Significance level (α ≤ 0.05)*

It is clear from the results of Table No. (5) that the value of (t) was statistically significant at the significance level (α ≤ 0.05), where the measurement contributed VC explains (39.1)% of the Numerical Achievement of runners in the 800-meter running event , and therefore the proposed equation becomes as follows:

Numerical Achievement for running 800 meters = 2.819 - ((VC (unit of measurement) × 0.12))

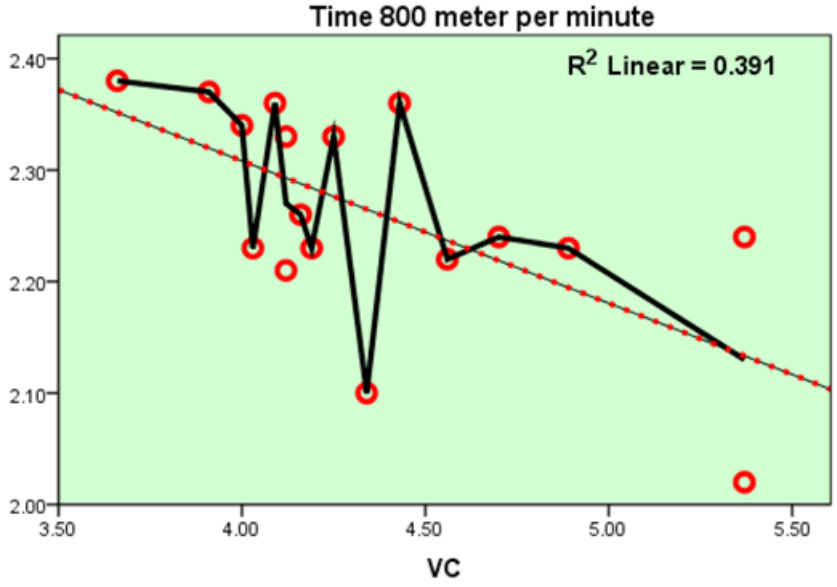

Figure 2. *VC measurement as a predictive in the Numerical Achievement of running 800 meters*

DISCUSSION OF THE RESULTS

Discussing the results related to the first question:

It is clear from the results of Tables (2-4) that anthropometric measurements have the most contribution The Numerical Achievement for the 800-meter running competition among elite runners in Palestine was Height It contributed to explaining (43.1%) of the numerical achievement of runners in the 800-meter running event in Palestine. This result is consistent with the study (Sekarbabu et al, 2021), which showed that height contributed to explaining (31%) of the completion time of the 800-meter competition, and a study (Salameh, 2017), which found that height contributed to explaining (46.3%) of the performance distance in javelin throwing, and the study (Ali and Nasser, 2016), which proved that height contributed to explaining (35%) of the numerical achievement of my test. The broad and vertical jump from stability, among basketball players, and the study of Hanoun (2016) which proved that height was one of the most important anthropometric measurements for predicting the Numerical Achievement of some athletics events, as it contributed to explaining (49%) of the high jump completion distance, (49.2%) of the distance for completing the long jump, and (18.9%) the time for completing the 100-meter sprint, and the study (Rathore, 2016 & Mishra) which showed that height is one of the most important anthropometric measurements related to speed, as well as the study of Singh & Malik (2015) which proved the existence of a positive relationship between height and Numerical Achievement in the effectiveness of the 100-meter sprint, and the researchers attribute this to the distinction of the tall athlete. Step length during fast running, as step length is one of kinematic variables that

plays an important role in running speed and thus finishing the race distance in a small number of steps compared to short stature. Also, the muscular strength of the legs increases as their length increases, thus increasing the length and breadth of the step, and this is what was confirmed. It contains the results of a study (Pourrahim et al, 2021), which found that there is a significant and positive relationship between leg length with the time of running 400 meters, 800 meters, 1500 meters, and a test of the muscular strength of the legs.

Results related to the second study question, which states:

It is clear from the results of Tables (5-7) that Pulmonary volume measurements that contribute most in the Numerical Achievement of the runners of the 800-meter running event in Palestine was Vital Capacity (VC) , which contributed to the interpretation of (39.1%) of the Numerical Achievement of runners in the 800-meter running event in Palestine. The researcher attributes this to the importance of the Vital Capacity (VC)for 800-meter runners because it reflects the true adaptation that has occurred in Pulmonary efficiency and volume as a result of regular training, and improving this measurement means improving the rest of the Pulmonary volume measurements associated with it, which are (ERV, IRV, SVC, TV, ERV, IRV, TV, ERV, IRV, TV, FEV1, FVC, FEVI/FVC) which is obtained by the player breathing three times normally in a spirometer , and on the fourth time taking the maximum inhalation followed by the maximum exhalation. Vital Capacity (VC) measurement is one of the measurements that is very closely related to training. Endurance, and in view of the importance of this physical element for 800 meter event runners, this contribution appeared, as he pointed out as (Salama, 2018) pointed out that the nature of the physical requirements for the 800 meter running event are closely related to the endurance element, and that is why they are called (endurance races), and cyclic respiratory endurance is considered, Endurance and speed, and speed is the most important of these elements for players, so this type of activity depends on the aerobic and anaerobic energy production system, and with a slightly greater percentage on the anaerobic system (lactic acid system), as (Mohamed , 2015) indicated that the approximate percentage of the contribution of energy sources The aerobic and anaerobic components in the 800 meter running event are approximately (60 %) anaerobic, and approximately (4.0 %) aerobic, and this develops the strength and efficiency of the breathing muscles (the diaphragm muscle, the intercostal muscles, the external intercostal muscle, the sternocleidomastoid muscle, and the spinal cord). Which increases the flexibility and expansion of the rib cage during the breathing process, and this allows for better performance of respiratory processes in runners during physical exertion. The density of the surrounding blood capillaries in the alveoli of the lungs also increases as a result of the opening of a number of closed or dormant capillaries or the generation of new capillaries under the influence of Continuous repetitions of performing physical effort, and this leads to an increase in the surface area over which gases are exchanged between the capillaries and pulmonary alveoli, not to mention an increase in the elasticity of the lungs and their ability to expand and contract to perform strong and deep breathing movements, and thus the efficiency of Pulmonary volumes, both static and dynamic, is improved, the most important of which is measuring vital capacity (VC). Which is considered one of the most important functional indicators of lungs and thus an increase in the volume of inspiratory reserve over expiratory reserve in runners because of speed endurance training. In general, the results of the current study were consistent with the studies of (Ja'afar et al, 2023 ; Nehe et al, 2023; Megahed et al, 2023; Abu Seman et al, 2022; Drobnicc et al, 2021; Salameh et al, 2020; Kocahan et al, 2017; Akhade & Muniyappanavar, 2017; Akhade, V., Bhatt et al, 2015; & Muniyappanavar, 2014) which proved three basic and established facts, which are that Pulmonary volume measurements are positively affected by Height and mass, age, and practicing sports activities and competitions that require an element of respiratory cyclic endurance, speed endurance, force endurance, and performance endurance, such as middle- and long-distance running, and football. Basketball, handball, rowing, swimming, boxing, and snowboarding.

Conclusion

It is clear from the results of the study that anthropometric measurements, as well as pulmonary volume, can be used to predict measurements of achievement in the 800-meter running competition.

Conflict Of Interest

No potential conflict of interest relevant to this article was re reported.

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Enhancing Finswimming Technique: A Revolutionary Bifins Training Model for Beginner Athletes

Abdul Kholik[1], Widiastuti[1], Abdul Sukur[1], Muhamad Syamsul Taufik[2], Sunanto[3], Nugroho Susanto[4], Özgur Eken[5], Ratko Pavlovic[6], Septyaningrum Putri Purwoto[7]

[1]Universitas Negeri Jakarta, Indonesia; [2]Universitas Suryakancana, Indonesia; [3]Universitas Nahdlatul Ulama Surabaya, Indonesia; [4]Universitas Negeri Padang, Indonesia; [5]Inonu University, Turkey; [6]University of East Sarajevo, Bosnia and Herzegovina; [7]STKIP PGRI Bangkalan, Indonesia

Correspondence:
Abdul Kholik, Universitas Negeri Jakarta, Indonesia,
abdulkholik_9904921030@mhs.unj.ac.id

Abstract: *Finswimming is an engaging and specialized aquatic sport that demands a blend of strength, endurance, and technical precision. For novice athletes, acquiring the essential finswimming techniques is vital for their growth and long-term success in the sport. This study aims to investigate the effect of using a bifins training model specifically designed for beginner finswimmers on the improvement of their finswimming technique skills. The goal of this study was to evaluate the impact of a finswimming bifins training model on enhancing the technique skills of beginner finswimmers. Conducted at the Universitas Negeri Jakarta Diving Club, HS Agung in East Jakarta, the research involved 40 athletes, divided equally into an experimental group and a control group. The study aimed to assess the effectiveness of the training model by comparing the performance improvements between the two groups. A pretest-posttest control group design was used for this pre-experimental research. Data analysis with SPSS showed a significance (2-tailed) value of 0.000, which is less than 0.05, a T-count of 23.933 with 38 degrees of freedom, and a T-table value of 2.02439. These results demonstrated that the experimental group experienced a significantly greater improvement in finswimming technique skills compared to the control group. Thus, the finswimming bifins training model was found to significantly enhance technique skills for beginners. However, the study's limitation is that it focused exclusively on this specific training model.*

Keywords: *Finswimming Bifins; Training Model; Technique Skills, Beginner Athletes.*

INTRODUCTION

Finswimming, also known as diving, is an evolved form of swimming (Safei et al., 2021). The primary distinction between these two sports lies in the use of specific equipment, such as monofins, bifins, and snorkels (Ehrenfeld, 2017). Sport finswimming is a competitive activity that involves using monofins or bifins and can be performed on the surface or underwater (Vašíčková et al., 2017). It is considered a sport where individuals or teams strive to achieve the best possible results in various national or international competitions (Nualnim et al., 2012). However, finswimming has not been included in the Olympics. The events contested in finswimming are governed by the rules set forth by the Confederation Mondiale des Activités Subaquatiques (CMAS) (Collard et al., 2022) among them are finswimming Surface, finswimming Apnea finswimming Immersion, and Bifin (Hlukhov et al., 2022).

Finswimming has recently emerged as a growing and increasingly popular sport in Indonesia (Downie, 2017; Silva, 2020). Many finswimming clubs in the region are now dedicated to developing young talent. The goal of this coaching is to produce exceptional athletes who have the potential to compete at regional and national levels and serve as role models in international competitions (Castagna et al., 2023). Body flexibility and joint proprioception are crucial factors in assessing the potential of talented swimmers and divers in diving sports (Ganchar et al., 2022), the effectiveness of movements, particularly those involving the limbs is crucial (Möller et al., 2022). To enhance performance in finswimming, physical conditioning is a key component for athlete success. Athletes across all sports require good physical condition to effectively execute techniques and tactics during both training and competition (Downie, 2017; Ehrenfeld, 2017). Similar to other sports, finswimming relies on strength, speed, agility, endurance, flexibility, and balance (Barlow et al., 2016; Cadenas-Sanchez, 2020). The training program should be meticulously structured and systematic, focusing on enhancing both physical fitness and functional capabilities of the body. This approach is essential for athletes to achieve optimal performance (Reigal, 2020). Understanding an athlete's physical condition is crucial for effectively managing their training and maximizing their performance potential.

Observations at diving sports clubs in the DKI Jakarta area have revealed that beginner athletes often face challenges with poor technical skills. This problem is linked to several factors, including ineffective training programs and methods. To address this issue, it is crucial to develop a targeted training program that enhances the finswimming technique skills of beginners. Preliminary research, including an initial needs analysis involving 40 beginner athletes from these clubs, was conducted to understand their specific needs. The subjects were chosen to ensure they had similar characteristics and initial skill levels in finswimming.

Field observations indicate that beginner athletes find it more challenging to grasp finswimming techniques compared to other training materials. Therefore, there is a need to design a specialized finswimming training model tailored for beginners. The existing thing as stated by (Ruotsalainen, 2020) certain applications in this case are translated in the form of applications that are easily accessible by smartphones that cannot be separated from student life. In finswimming lessons, students often struggle to understand the material. This situation suggests that integrating applications easily accessible via smartphones could greatly benefit athletes, making it simpler for them to grasp finswimming concepts.

Previous research in finswimming has primarily focused on analyzing the effects of exercise, basic techniques, physiological aspects, stress, conditioning, tests and measurements, and biomechanics in relation to training strategies. For example, 1:1 interval training significantly increased the speed of the 50-meter bifins, while flexibility had no significant correlation with the 50-meter bifin speed in female athletes (Ayu Kusumaningtyas, 2024). Furthermore, research conducted by (Silva, 2020) according to the needs analysis conducted with beginner finswimming athletes, 85% expressed a strong interest in finswimming, 90% had never read a favorite finswimming exercise book, and 85% had not been exposed to variations in finswimming exercises. Additionally, 95% indicated a need for supportive media for popular finswimming practices. The needs analysis with finswimming coaches revealed that the training material currently provided is not varied, and there is a lack of supportive media. Coaches expressed a preference for book media, as they believe digital books could enhance understanding of finswimming training concepts.

Previous research has highlighted a gap in comprehensive investigations of finswimming training models specifically designed for beginners. Existing studies have not thoroughly examined how such models can effectively help beginners grasp training materials and improve their finswimming skills. This research seeks to address this gap by focusing on a training model that enhances material absorption through more targeted methods. The study introduces a modified finswimming training model for beginners and assesses its impact, offering a novel approach not previously explored. It includes a thorough analysis of finswimming bifins training programs, incorporating variations in both land and water training, and introduces new training models and tools.

The literature indicates that finswimming training models can be effective and facilitate easier implementation for beginners. Most studies agree that these models, when combined with appropriate instruction, can improve skills and performance. Therefore, the innovation in this research will focus on evaluating the effects of the finswimming bifins training model for beginners, specifically in enhancing finswimming technique skills.

MATERIALS AND METHODS

Research Design

This study employs a quantitative research approach (Hafidz et al., 2022), specifically utilizing a pre-experimental design (Purwoto et al., 2024). To determine the effect of using the finswimming bifins training model on improving finswimming technique skills in beginner athletes, a pretest-posttest control group design was used.

Participants and data collection

The research involved 40 beginner athletes, divided into 20 in the control group and 20 in the experimental group. Participants form UNJ Diving Club in HS Agung, East Jakarta.The research period spanned from January 15, 2024, when the director of PPS UNJ issued the decree approving the research proposal, to April 27, 2024, when the final research results report was completed. This training model comprises thirty-six methods designed for beginner finswimming athletes, which have been validated by experts in test and measurement, finswimming training materials, and biomechanics. Each training method is conducted both on land and in the swimming pool. The researcher developed an instrument to measure finswimming technique skills. Expert evaluation confirmed that this instrument is valid and reliable for use. The technique skills instruments are in Table 1 and Table 2 for assessment.

Table 1. *Instruments Finswimming Bifins Technique Skills*

N°	Dimension	Indicators	Motion Description	Value	
				Yes	Not
1	Body	Relaxed Head Position Downward View	Look down Arms parallel to the body Chin facing down Breath through the mouth and nose		
		Streamline Agency Position	Horizontal straight body Horizontal straight head with body Floating body position Relaxed body position		
		Position of Hands Parallel to Legs	Streamline *body posture* Position of the arms parallel to the ears Both arms are straight tightly Fixed view down		
		Pelvic and Knee Position	The position of the pelvis slightly on the water surface Straight knee position Both knees tend to be tight Pelvic relaxation		
		The position of the soles of the feet is tightly parallel to the water surface	The second position of the feet is straight and tight Toes stay straight Immobilized ankle Relax the ankle		
2	Leg	Leg movements centered on the groin	Straight legs aligned groin-centered movements Straight fingertip parallel constant motion		
		Knee Alignment and Knee Movement in Harmony with the Pelvis	Energetic straight knee whole movement of the groin Flutter *Kick* Accelerated movement		
		Ankle Position Parallel to Water Level	Energetic Relax Ankle Relax ankles constant motion Simultaneous movement		
		Constant Leg Movement and Lenk	Limbs remain straight and aligned Regular movement patterns not stiff and hard Strong and powerful limb pedaling		
		The distance of the limbs to the water surface is between 25-30 cm	Straight leg position parallel to the water level Maintained and orderly distance not too tight Not disturbed by each leg movement		
3	Arm	Palm Position Close Paddle	Palm tight paddle position Regular movement constant Harmonious movement		
		Elbow Movement Following Arm Paddling Direction	straight elbows rotate following the pattern Movement sourced from the base of the arm Elbow position higher than palm not broken – broken		
		The position of the swing shoulders moves according to the movement of the arms	chin-level shoulders Both shoulders are the same height left and right Shoulder Relaxation Straight Parallel		

3	Arm	The Position of the Counterweight Shoulder Remains Parallel to the Water Level	Shoulder position to be a counterweight Relax and Stable straight parallel to the water surface stability maintained
		The position of the head remains relaxed following the movement of the arms	Straight Parallel Head relax Look Down be a counterweight to the movement
4	Breath	Head Position Parallel Arm Movement	Straight parallel to the water level Relax, look down Become a Movement Control Motion Balancer
		Rotating Arm Position	straight parallel body Regular movement Powerful Stable Pedaling
		Chest Position	Fixed chest on the shaft Stable motion Stability maintained constant
		Hip Position	straight parallel body Regular movement Powerful Stable Pedaling
		Elbow Position	straight parallel body Fluttering movement Powerful Stable Pedaling
5	Coordi-nation	Breath-arm coordination	Straight parallel to the water level relax Become a Movement Control Motion Balancer
		Foot-breath-hand coordination	straight parallel body Regular movement Powerful Stable Pedaling
		The position of the head and hands touching when the hands rotate	stable Simultaneous constant relax
		Motion Alignment	stable Simultaneous orderly constant
		Right-left hand coordination	stable Simultaneous orderly constant

Table 2. *Assessment of Fin swimming Bifins Skills Instrument*

Statement	Assessment Score
YES	1
NO	0

Statistical analysis

The data analysis for this study involved bibliometric analysis , using sources such as Scopus, Web of Science, Crossref, PubMed, and Google Scholar (Simbolon, 2024; Umar et al., 2022). Bibliometric mapping was performed with the assistance of Publish or Perish, Mendeley, and VOSviewer software. Di sisi lain, kata kunci lebih jarang muncul berada di area hijau. Additionally, SPSS 21 was utilized to conduct descriptive tests, normality tests, and T-tests (Jatmiko et al., 2024).

RESULTS

Bibliometric Analysis

Researchers gathered bibliometric data from the most commonly used databases for bibliometric analysis: Scopus, Web of Science, Crossref, PubMed, and Google Scholar. The bibliometric mapping in this analysis was conducted using Publish or Perish, Mendeley, and VOSviewer software. The information obtained is as follows:

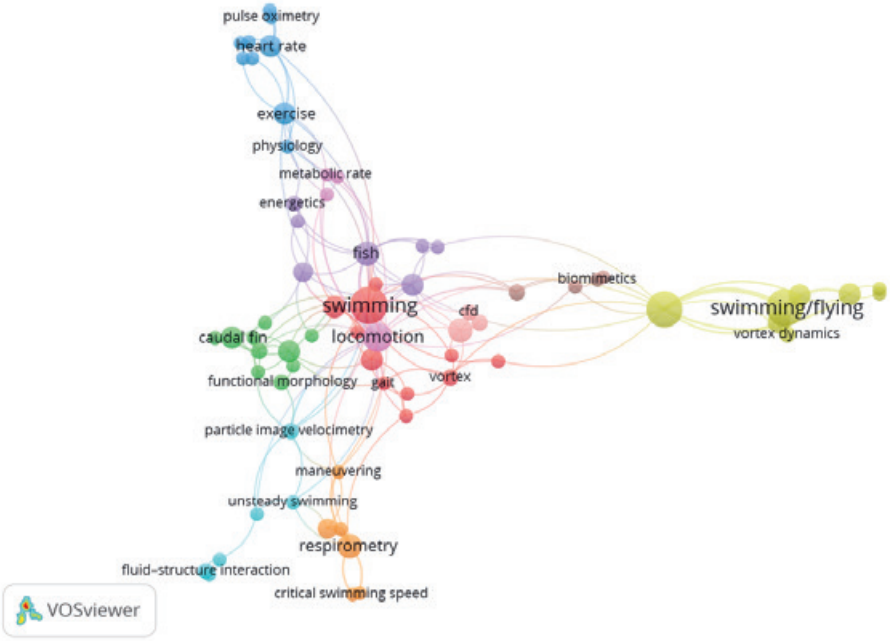

Figure 1. *Visualization of Variable Relationships*

Based on Figure 1 above, it can be seen that the variables Fin swimming, Scuba Diving, and Swimming have been studied by previous researchers.

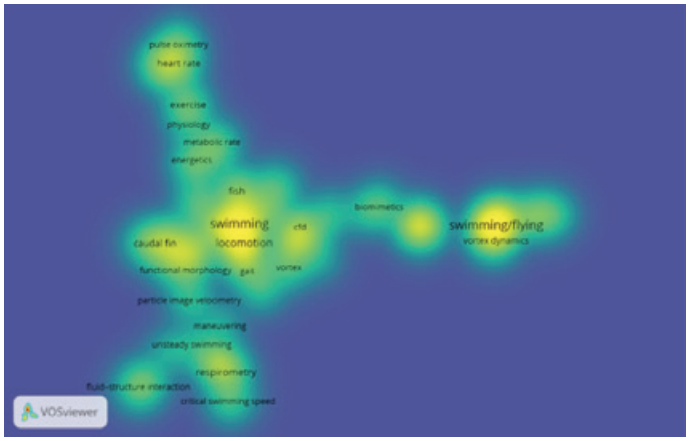

Figure 2. *Keyword Density Visualization Analysis Results*

Figure 2 illustrates the distribution of the keywords «Finswimming,» «Scuba Diving,» and «Swimming.» Each node in the keyword density visualization is colored based on the frequency of items it contains. Specifically, the color of a node reflects the number of items in its vicinity. Keywords that appear frequently are displayed in yellow, while less common keywords are shown in green. In this visualization, «Finswimming,» «Scuba Diving,» and «Swimming» are situated in the greenish-yellow area, indicating that these topics have been extensively studied and researched over the past decade.

Treatment Test of the training Model

Table 3. *Descriptive Results of the Finswimming Training Model Develpoment Test Before Trearment (pretest) and After (posttest)*

Class	N	Mean
Control Group Pretest	20	68.5
Post Test Control Group	20	77.45
Pretest Experimental Group	20	64.35
Post Test Experimental Group	20	91.55

Average *pretest* and *postest* the control group was 68.5 and 77.45. Meanwhile, the treatment group of 64.35 for *pretest* and 91.55 for *posttest*.

Table 4. *Normality Test of Treatment and Control Group Data*

Class	Kolmogorov-Smirnova			Shapiro-Wilk		
	Statistics	Df	Sig.	Statistics	Df	Sig.
Experimental	0.180	20	0.087	0.931	20	0.165
Control	0.109	20	0.200*	0.976	20	0.867

Data normality test results *Pre-test* and *post-test* listed in the table above has *p-value* Sig. 0.165 for the experimental group (treatment) and 0.867 for the control group. Test *Shapiro Wilk* shows > α=0.05, meaning that the data is normally distributed. The data distribution is normal, allowing the use of the Independent Samples Test for the T-test analysis

Table 5. *Independent Samples Test*

		F	Sig.	t	Df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Post Test	Equal variances assumed	.000	1.000	23.933	38	.000	14.100	.589	12.907	15.293
	Equal variances not assumed			23.933	37.991	.000	14.100	.589	12.907	15.293

Based on the table above, the Sig (2-tailed) value is 0.000, which is less than 0.05. The calculated t-value is 23.933 with 38 degrees of freedom, compared to a t-table value of 2.02439. These results indicate a significant improvement in finswimming technique skills following the implementation of the bifins training model.

DISCUSSION

Based on the test results, it can be concluded that the finswimming bifins training model leads to significant improvements in the technique skills of beginner athletes. The findings of this study are consistent with previous research on 1:1 interval training and flexibility concerning 50-meter bifin speed. This indicates that implementing this training model has a notable positive effect on finswimming performance (Ayu Kusumaningtyas, 2024).

Finswimming is a development sport of swimming (Lin et al., 2021), basic swimming skills are needed for beginner athletes so that finswimming skills will be easier to learn (Soni & Vedawala, 2022). The training model must be compiled based on the level of difficulty to facilitate the trainer in delivering the training material, the trainer must understand the difficulty level of the training model before training (Bıyıklı, 2018). The level of difficulty can be analyzed by understanding the model associated with the athlete's ability to train (Bishop et al., 2011; Charron et al., 2020). Bifins are used in finswimming to swim underwater using freestyle (crawl) and breathing using snorkels (Vašíčková et al., 2017). Dolphin-like style is allowed as long as it is underwater and does not exceed the 15-meter mark, either at the start of the start or on each reversal wall. Diving is only allowed for less than 15 meters from the start and on any reversal wall. The snorkel or head must appear on the surface and break the water before the 15-meter mark (Möller et al., 2022).

Exercises for beginners in finswimming bifins must be done in a way that suits their characteristics. Must pay attention to several things, such as coordination, physical endurance, and technique. Coordination, the movements performed must be coordinated and thorough, especially when doing freestyle (crawl) and breathing using a snorkel. Physical endurance, the physical condition of athletes must be maintained optimally, so that they can improve their performance in swimming. Technique, the technique used must be in accordance with the characteristics of bifins, such as freestyle (crawl) and breathing using a snorkel (Lin et al., 2021; Vasícková et al., 2015; Vašíčková et al., 2017).

The training process must be carried out with clear stages. The process is better done in a row. That is, starting from an easy process and then a more difficult training process (Cañas-Jamett et al., 2020; Sammoud et al., 2019). This is done so that athletes can easily understand every movement of finswimming bifins (Castagna et al., 2023). An exercise model created by researchers to help the results of finswimming skills of bifins. So, this model was created for the needs of novice athletes to convince them that learning this material is more fun. Therefore, this model is expected to be a reference for coaches and for the athletes themselves.

CONCLUSION

Based on the data obtained, from the results of field trials and the discussion of the results of the study, it can be concluded that the development of the bifin finswimming training model has a significant impact on enhancing finswimming technique skills. Therefore, to achieve a perfect product, the researcher will give some suggestions: the trainer needs to provide control and master the material well in the process of delivering the exercise material. Trainers must have excellent supervisory skills in training material delivery techniques.

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Measuring the aggressive behavior of the teams in the Iraqi Premier League in football and its relation to the results and ranking of the league for the 2022-2023 season

Yasir Mohammed Hammood[1], Ahmed Khalid Awad[2], Othman Adham Ali[2], Ameer Jaber Mushref[2], Jasim Nafi Hummadi[2]

[1]*AlMaarif University - Physical Education and Sport Science Department, Iraq*
[2]*University of Anbar-College of Physical Education and Sports Sciences, Iraq*

Correspondence:
Othman Adham Ali, University of Anbar- College of Physical Education and Sports Sciences, Iraq
othmanadhamali@uoanbaar.edu.iq

Abstract: *The game of football is one of the games that carries within it a highly competitive nature, and it is not surprising that aggressive behavior often appears on the field due to the intensity of the competition. Aggression in football takes many forms, from tough interventions and rough play to verbal confrontations and unsportsmanlike behavior. The research aims to identify the aggressive behavior of players in the Iraqi Premier League for the season (2022-2023) and its relationship to the league's results and ranking. The research sample consisted of (400) players representing (20) clubs participating in the Iraqi Premier League for the season (2022-2023), and a descriptive survey method was used. For the purpose of research tools, the researchers used the Aggression Behavior Scale developed by (Amer Saeed, 2002). For statistical data analysis, the statistical package (SPSS) was used. The research results showed a correlation between (hatred, aggression, verbal aggression, rejection) and the results and ranking of the research sample. It also showed no statistically significant correlation between (excitability, doubt, indirect aggression) and the results and ranking of the research sample. The researchers concluded that aggressive behavior is related to the results and ranking of the clubs, and that the requirements of the game of football play a major role in the emergence of aggressive behavior. Therefore, the researchers recommend the necessity of focusing on the psychological preparation of the clubs and incorporating it into daily training programs, as well as educating coaches and players through holding awareness-raising lectures on sportsmanship and fair play during sports competitions.*

Keywords: *Aggressive behavior, Iraqi Premier League clubs, Sports psychology, players, football.*

INTRODUCTION

Aggressive behavior in sports psychology has been a subject of great interest in recent years, as sports have become increasingly competitive. The prevalence of aggression in sports has raised concerns about its impact on athletes, clubs, teams, and sports in general. Aggression in sports can be influenced by a variety of factors, including the role of competition and the desire to win, which can fuel aggressive behavior. The strong drive for success and excellence over their competitors often motivates athletes, leading to increased levels of aggression. For example, in football, the pressure to win can lead to increased physical fitness and intense confrontations between players. External factors also play a significant role in promoting aggression in sports. For instance, when spectators engage in hostile or provocative acts, such as jeering or mockery, it can create a hostile environment that encourages aggressive behavior. Additionally, media portrayal of aggression in sports often highlights intense confrontations or physical altercations, which can influence athletes and push them to adopt such behavior. Psychological factors such as personality traits and frustration can also contribute to aggressive behavior.

Football is a sport known for its intensity and physicality, so it is not surprising that aggressive behavior often manifests itself on the field. Aggression in football takes various forms, from tough tackles and rough play to verbal confrontations and unsportsmanlike behavior.

The competitive atmosphere and the pressure to win in football can contribute to aggressive behavior. Players and teams constantly seek to overcome their opponents, creating a sense of urgency and intensity that can be perceived as aggression. The desire to win sometimes overshadows fair play and sportsmanship, leading players to engage in aggressive tactics. Additionally, some referee decisions can fuel aggressive behavior in football, as players may feel unfairly treated, leading to frustration and anger, which in turn may result in retaliatory actions to express dissatisfaction and regain a sense of control.

Aggressive behavior in football has serious consequences for players, including an increased risk of injuries, which can have long-term health implications and prematurely end a player's career. It also has psychological effects, causing elevated levels of anxiety, anger, and tension, negatively impacting the players' mental and physical well-being and their overall enjoyment of the sport. Furthermore, aggressive behavior can disrupt team dynamics, hinder teamwork and tactics, and create internal tension and division among players.

Given the above, it is important to research the manifestations and forms of aggression in teams and their relationship to the outcomes of clubs participating in the Iraqi Premier League for the 2022-2023 season.

The problem of research is one of the problems that receive the attention of many experts and specialists in the sports field due to the impact of this problem on the development of players and their teams' results. Football is a game characterized by technical performance, strength, speed, endurance, and high excitement. Its skillful and tactical aspects are diverse and depend on strong physical contact, which often leads to violence among players.

Through following the researchers and their theoretical and field experience in the field of football, and their meetings with many players and coaches, and following most of the matches and monitoring the players' behaviors, they noticed the emergence of aggressive behavior in many matches where players try to get the ball in any way, leading to many mistakes that result in aggressive behavior. They also noticed that the competitive atmosphere and the pressure to win in football also contribute to aggressive behavior, as players and teams constantly seek to overcome their competitors. This can create a sense of urgency and a desire to win, thereby casting shadows on fair play and sportsmanship, leading players to engage in aggressive tactics. Such events have become familiar on football fields, so the researchers decided to delve into this topic to understand the relationship between the aggressive behavior of players and its relationship to the ranking and results of the teams participating in the Iraqi Premier League for the season (2022-2023), contributing to the development of appropriate solutions to reduce aggression in football fields. Research Objective There are significant meaningful differences in aggressive behavior between the dimensions of aggressive behavior and the ranking of teams participating in the Iraqi Premier League for football. Research Hypothesis There is a statistically significant relationship between the dimensions of aggressive behavior and the ranking of teams participating in the Iraqi Premier League for football.

METHODOLOGY

The researchers used the descriptive method in a survey style to suit the nature of the problem(Ali, 2022). The research community consisted of the clubs participating in the Iraqi Premier League for the season (2022-2023), totaling (20) clubs with (700) players representing 100% of the research community.

As for the research sample, it consisted of (400) players representing (20) participating clubs in the league, accounting for (57%) of the total research community. They were selected using random method, as shown in Table (2).

The sample was divided into three groups. The first group included the top-ranked teams, consisting of (6) teams. The second group included the mid-ranked teams, consisting of (8) teams. The third group included the bottom-ranked teams, consisting of (6) teams, as shown in the following table.

Table 1. *The distribution of teams into three groups*

Clubs advanced in the standings		Clubs in the middle of the standings		Clubs that are behind in the standings	
s	Team ranking	s	Team ranking	s	Team ranking
1	Al-shorta	7	Najaf	15	Zakho
2	Air force	8	Karbala	16	Oil
3	Al-zawraa	9	Nowruz	17	Al-Qasim
4	Al-talaba	10	Maysan oil	18	Central oil
5	Al-kahrabaa	11	Al-Karkh	19	Al-sinaa'
6	Erbil	12	Dohuk	20	Al-Diwaniyah
		13	Al-hodood		
		14	South oil		

Table 2. *Between the distribution of the research population and the players in the research sample*

s	Club name	Total number of players (research community)	Number of players tested (research sample)
1	Al-shorta	35	20
2	Air force	35	20
3	Al-zawraa	35	20
4	Al-talaba	35	20
5	Al-kahrabaa	35	20
6	Erbil	35	20
7	Najaf	35	20
8	Karbala	53	20
9	Nowruz	35	20
10	Maysan oil	35	20
11	Al-Karkh	35	20
12	Dohuk	35	20
13	Al-hodood	35	20
14	South oil	35	20
15	Zakho	35	20
16	Oil	35	20
17	Al-Qasim	35	20
18	Central oil	35	20
19	Al-sinaa’	35	20
20	Al-Diwaniyah	35	20
the total		**700**	**400**

Means of collecting information and research tools

Means of collecting information

- Iraqi Football Association website
- Arabic sources and references
- Aggression behavior scale
- Observation and experimentation
- Personal interview
- Assistant work team

Research tools used

- Questionnaire on the validity of the aggression behavior scale
- Survey form on the aggression behavior scale

Aggression behavior scale

After the researchers reviewed some references, scientific sources, and research on aggressive behavior, the researchers used the aggression behavior scale prepared by (Amer Saeed Jasim, 2002) Appendix (1), which contains (28) items, falling into seven domains as shown in Table (3). This scale is characterized by its validity in measuring the level of aggression among athletes.

Table 3. *The areas of the aggressive behavior scale and the sequence of items in the areas*

s	Scale fields	Sequence of paragraphs in the scale
1	The hatred	2-3-4-5
2	Attacking	6-7-8
3	Excitability speed	9-10-11-12
4	Doubt	13-14-15-16
5	Verbal aggression	17-18-19-20-21
6	rejection	22-23-24
7	Indirect aggression	25-26-27

Scale Correction

The aggressive behavior scale contains (28) items, the first two items (1-28) are not related to the scale, but are intended to accept or reject the form by the respondent. A "Yes" response to positive items is given (one point), and a "No" response is given (zero points), while for negative items, a "Yes" response is given (zero points), and a "No" response is given (one point). Thus, the maximum score that the respondent can obtain on the scale is (26 points), and the minimum score is (zero) points.

Scientific Basis of the Scale

Scale Validity

The aggressive behavior scale was presented to some expert gentlemen with expertise in the research topic, totaling (5) experts, with an additional (2) experts, to determine the content validity and the suitability of the scale items for measuring the intended objectives, and the appropriateness of the expressions in its field, or any suggestions they deemed appropriate to enrich the research. After recording the experts' notes, the aggressive behavior scale was used in the study(Othman Jassim N. H. & Ameer Jaber Mushref, 2023).

Scale Reliability

For the purpose of verifying the reliability of the aggressive behavior scale, the researchers adopted the test-retest method to extract the scale reliability coefficient. The researchers applied the scale to a sample outside the study sample and repeated the test after two weeks on the same sample. After statistically processing the data, it was found that the correlation coefficient ranged from (0.81-0.87) with an average of (0.83), which reflects a high level of reliability and is considered acceptable for the current study purposes(Ali & Hammadi, 2022).

Survey Experiment

The survey experiment was conducted on a sample from the original community outside the research sample, consisting of (20) players, by distributing the Aggressive Behavior Scale form to the players in order to identify the difficulties that may arise in the main experiment, the efficiency of the assistant team, and the time it takes to answer the scale items.

Scale Application

After preparing the scale in its final form, the scale was applied to players of the research sample before (1:30) hour of the match and in the stadiums where the matches were held. The researchers, along with the assistant team, distributed the forms to the players of the research sample and ensured that all questionnaire items were answered before submission.

- (400) forms were distributed to players of the sample clubs.
- (22) forms that did not meet the requirements and were not filled out correctly were excluded.
- The number of forms that underwent statistical analysis was (378) forms.

Statistical Methods

The researchers processed and statistically analyzed the data on the computer using the statistical package (SPSS).

RESULTS

After processing the preliminary results, the descriptive values of the arithmetic means and standard deviations of the scale items were calculated and converted into final scores based on the scale key.

Presentation and Analysis of Aggression Dimensions for the Three Groups

The researchers presented the results achieved to meet the research goal and hypothesis according to the three groups.

Table 4. *Represents values (F) Calculated dimensions of aggressive behavior*

S	Dimensions	value (f) Accountable	value (f) Tabular	Moral
1	The hatred	3.127	3.591	non-significant
2	Attacking	5.722		moral
3	Excitability speed	2.561		non-significant
4	Doubt	1.737		non-significant
5	Verbal aggression	6.417		moral
6	rejection	5.742		moral
7	Indirect aggression	2.142		non-significant

value (f) The tabulation at the significance level (0.05) equals (3.591)

From table (4), it is evident that the calculated value (f) for the dimension (aversion, excitability speed, doubt, indirect aggression) reached (3.127 - 2.561 - 1.737 - 2.142), which is smaller than the tabular value (3.591) at the significance level (0.05), indicating no statistically significant differences between the three groups in the dimension (aversion, excitability speed, doubt, indirect aggression).

It is also clear from table (4) that the calculated value (f) for the dimension (assault, verbal aggression, rejection) reached (5.722 - 6.417 - 5.742), which is greater than the tabular value (3.591) at the significance level (0.05), indicating the presence of statistically significant differences between the three groups in the dimension (assault, verbal aggression, rejection).

The researchers used the Least Significant Difference (LSD) test to determine the significance of differences for the dimensions (assault, verbal aggression, rejection) in favor of any of the groups.

From Table (5) of the dimensions of aggressive behavior (assault, verbal aggression, rejection), it appears that there are statistically significant differences between the mean of the first group (the leading group) and the second group (the middle group) and between the first group (the leading group) and the third group (the lagging group), in favor of the first group (the leading group), while there is no significant difference between the means of the second and third groups, meaning that the difference was random (non-significant).

Table 5. *The significance of the differences for the dimensions (verbal aggression, attack, and rejection) between the arithmetic means of the three groups and the value of the least significant difference.*

Dimensions	Arithmetic mean For groups		Arithmetic means difference	The value of the least significant difference	Moral
Attacking	Advanced group	Middle group	12.76	8.744	moral
	34.72	47.48			
	Advanced group	Late group	9.59		moral
	34.72	44.31			
	Middle group	Late group	3.17		non-significant
	47.48	44.31			

Verbal aggression	Advanced group	Middle group	12.73	12.489	moral
	45.06	57.79			
	Advanced group	Late group	15.13		moral
	45.06	60.19			
	Middle group	Late group	2.4		non-significant
	57.79	60.19			
rejection	Advanced group	Middle group	9.85	8.744	moral
	32.51	42.36			
	Advanced group	Late group	14.21		moral
	32.51	46.72			
	Middle group	Late group	4.36		non-significant
	42.36	46.72			

DISCUSSION

Based on the presented findings, the results indicated statistically significant differences between the three groups, where the leading group is the best in the dimensions of aggression, because its mean is less than the other two groups (the middle and lagging groups). The researchers attribute this to the high technical level and skill that contribute to reducing aggression and controlling it, as well as the high potential of the players in facing situations by controlling their aggressive behavior, even though the tendency towards aggression is an inherent instinct in individuals and exists as an instinct in all people regardless of their genders and colors, as confirmed by (Freud), "The tendency towards aggression is an inherent inclination, meaning the inclination towards aggression and destruction"(Ali et al., 2022).

As the table shows, there are statistically significant differences between the three groups with three dimensions (aggression, verbal aggression, rejection). After the researchers used the "smallest meaningful difference" law to determine the meaningful differences in favor of which of the three groups, the first group shows a low level of aggression towards the second and third groups. The researchers attribute the difference to the fact that the team in the last position shows a greater degree of aggressive behavior than the team in the advanced position. Therefore, the team has nothing to lose as the chance of winning and taking an advanced position seems very low. (Abdul Qader Zitel, 1996) confirmed that "winning and losing play a major role in determining the level of aggression displayed by players during matches, and losers tend to show higher levels of aggression than winners in matches"(Al-Alwani O. A., 2023). Therefore, a match with a significant and important result will arouse a lot of motivation and emotions, leading naturally to more aggressive behavior.

Similarly, researchers attribute these differences to the fact that the level of aggression may be the same for most players, but what differs is the way players respond to aggressive stimuli as well as the difference in the way of expression. Some players control their aggressive energy and direct it in an acceptable manner, while others cannot control their aggressive behavior and are influenced by the same situation. The high technical level reached by the players, especially those in the Iraqi Premier League, and their physical and skillful abilities make them not express their aggression in a manner that contradicts the law and the rules of the game. They find another outlet for venting or sublimating this energy, and their keenness to appear decent in front of the audience prevents them from this behavior. Here, (Qasim, Al-Muhashhash, 1979), points out that "the selection of players is based on their innate and volitional traits, which are of great importance to athletes and can be developed and cultivated over a long period. Among these traits is the self-control and the ability to control behavior for athletes in situations characterized by high arousal"(Hummadi et al., 2024).

CONCLUSIONS

Aggressive behavior is related to the results and ranking of the clubs.

Teams at the top are the best in terms of aggression, while teams at the bottom show a greater degree of aggression.

Most players seek to harm their opponents during the game in order to win.

The requirements of football have a significant role in the appearance of aggressive behavior.

Training and encouraging players to compete fairly and not engage in aggressive behavior.

Training and encouraging players to compete fairly without resorting to aggressive behavior.

Raising awareness among coaches and players through educational programs and lectures about sportsmanship and fair play during sports competitions.

Paying attention to the psychological preparation of clubs and including it in daily training programs.

Developing a culture of fair play and promoting awareness of fair competition and educational interaction based on the principle of winning and losing.

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All authors listed have made a substantial, direct and intellectual contribution to the work, and approved it for publication.
CONFLICTS OF INTEREST
The authors declare no conflict of interest.
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Appendix (1)

Aggressive behavior scale

s	Phrase	yes	no
1	I am ready to answer all questions honestly and faithfully.		
2	I feel relieved when I smell those I hate.		
3	I hate those who compete with me to get something I want.		
4	I love to avenge those who hurt me.		
5	I hate the person who refuses to help me and I resent him.		
6	I respond to the attack with a bigger attack.		
7	I start hitting when I feel a fight.		
8	If I don't fight, I will never get my right.		
9	My face turns red with anger when I fail to achieve something specific.		
10	I get upset over the simplest annoying things.		
11	I almost cry if someone blames me for something I didn't do.		
12	I get upset quickly if people don't believe me when I tell the truth.		
13	I get upset quickly if a friend teases me with something I don't like.		
14	People describe me as skeptical.		
15	I feel that people doubt my actions.		
16	People help each other to exchange their interests.		
17	I speak harshly to those who annoy or provoke me.		
18	I speak to others in a rough manner when they don't understand me.		
19	If someone insults me, I respond in kind.		
20	My sharp tongue makes others fear me.		
21	Responding kindly to others' wrongdoings fixes them.		
22	I rebel against people I hate		

23	I refuse to let a colleague be favored over me by a superior
24	I am characterized by being very objecting
25	I shout at home for the slightest reasons when I am upset
26	I strike my hand forcefully against anything nearby if I make a specific mistake
27	I tarnish my opponent's reputation in front of others
28	I am sure of my answer to all the phrases clearly

Appendix (2)
Experts who expressed their opinions about the aggressive behavior scale

s	Scientific title and name	Workplace	Specialization
1	pro. Hamed Suleiman Hamad	Anbar University - College of Physical Education and Sports Sciences	Sports psychology
2	pro. Amer Saeed Al-Khikani	University of Babylon - College of Physical Education and Sports Sciences	Sports psychology
3	pro. Adnan Fadaous Omar	Anbar University - College of Physical Education and Sports Sciences	Sports/football training
4	Asst. por. Marwan Abdul Latif Abdul Jabbar	Anbar University - College of Physical Education and Sports Sciences	Sports psychology
5	Asst. pro. Fouad Hammad Asal	Anbar University - College of Physical Education and Sports Sciences	Sports/football training

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Modification of the Game Engklek to Improve the Character of Discipline and Thinking in Early Childhood

Susanto[1], Dika Putri Rahayu[1], Hendra Setyawan[2], Ari Iswanto[2]
[1]State Islamic University Sayyid Ali Rahmatullah Tulungagung, Tulungagung, Indonesia
[2]Yogyakarta State University, Yogyakarta, Indonesia

Correspondence:
Susanto, State Islamic University Sayyid Ali Rahmatullah Tulungagung, Tulungagung, Indonesia
susanto.susan@gmail.com

Abstract: *The internalization of disciplinary character values in early childhood between 10-12 years can be done by playing various games, one of which is playing Engklek. Based on the results of observations, children are still lacking in obeying the lines of the engklek field. To determine the effect of game engklek modification on the ability to internalize the character values of discipline and thinking in children aged 10-12 years. This research uses descriptive quantitative research with the type of Pre-Experiment Design research with the One-Group Pretest-Posttest Design design. The sample of this study used all children aged 10-12 years at SD Negeri 3 Clering with a total of 30 children consisting of 16 boys and 14 girls. Data collection techniques used observation and documentation. The assessment indicator used is the accuracy of footsteps on the engklek field. The use of this modification is used to make it interesting so that children are interested in doing it. Based on the results of hypothesis testing through the Wilcoxon test, the sig value = 0.000 was obtained, this shows that there is a significant effect of the crank game modification on increasing the character values of discipline and critical thinking. These results indicate that the modified engklek game can be more effectively used as a physical education learning process in improving the ability to internalize the character values of discipline and thinking in children aged 10-12 years.*
Keywords: *Engklek, Discipline, Character and Thinking.*

INTRODUCTION

The Indonesian nation has many types of traditional games, where traditional games have different characteristics. The utilization of traditional games in order to preserve traditional games requires efforts in introducing and practicing various games in early childhood. Traditional games are one form or form of culture that characterizes a particular culture. Traditional children's games are cultural assets, which are capital for a society to maintain its cultural identity in the midst of other societies. Traditional games are also known as reactive activities that not only aim to entertain themselves, but also as a tool to maintain social relationships and comfort (Prastowo A, 2018). According to Sujarno (2010), traditional games are cultural products of great value to children in order to fantasize, recreate, exercise and as a means to practice polite and skillful living in society. The values contained in Dolanan Anak play a role in aspects of children's growth and development, Dolanan Anak is grouped into 6 groups of Dolanan Anak, namely (1) Games to develop children's cognitive aspects, (2) Games to develop physical motor aspects, (3) Games to develop language skills, (4) Games to develop social emotional aspects, (5) Games to develop aspects of art and creativity, and (6) Games to develop moral aspects and religious values (Suherman, W. S. 2017).

Traditional games are diverse activities, because each place has different types of traditional games (Pratiwi, J. W., & Pujiastuti, H., 2020). This depends on the customs or habits of the area that have been passed down from generation to generation which can affect the shape and name of the traditional game. A traditional game, especially in certain regions, is strongly influenced by the culture and characteristics of the region. This traditional game itself is very fun when done either individually or together (group). Some kinds of traditional games such as cranklek, jump rope, marbles, catfish, bentengan, boy-boyan, snake-ularan, enggrang and many more. In traditional games, children's motivation will be boosted because in traditional games there are many variations and modifications that can be applied in physical education learning. In traditional games, the rules of the game are based on mutual decisions, such as the number of players, the tools used and the length of play can be changed according to mutual agreement (Susanto et al., 2024). In addition, traditional games themselves have existed from ancient times and are played by children from various regions in Indonesia (Iswanto Ari et al., 2024).

Traditional games have now begun to be abandoned and rarely played, children are now turning to modern or sophisticated games such as playstations, video games and online games. Although there are many types of traditional games, many children prefer advanced technology games compared to traditional games, something like this will have an impact on children's interaction patterns later. Many types of traditional games can be a medium to teach various positive things and besides that the child's body will move a lot so that the child's body will be healthy. UNESCO has currently encouraged the preservation of culture called intangible heritage or intangible cultural heritage, where one of them is traditional games in it. As the nation's generation, we must preserve the nation's culture in the form of traditional games. Traditional games are not only played by children, but adults can play them depending on the type of traditional game. Folk games or traditional games for children there are various types depending on the ethnic group that has. In essence, traditional games have elements of physical skills (physical strength), speed of thinking and implementation of social and cultural values. Traditional children's games generally prioritize togetherness, cooperation and harmony of social relations in the community.

Preserving various traditional games, because by including traditional game material for learning, children will feel happier and not get bored quickly. Traditional games in each region have a meaning and history that contains human and cultural values in it (Suryawan, I. G. A. J., 2020). From this explanation, it can be concluded that traditional games are activities of various types originating from various regions in which there is a separate meaning that has been played from time to time for generations and in traditional games there are no fixed rules. Playing traditional games in addition to preserving the nation's culture, also has its own benefits for someone who plays and also children can improve their motor skills, such as running, walking, jumping and others. It is not new what if we see learning physical education sports and health, many use traditional games in every movement activity. These traditional games in learning physical education and health have many benefits, one of which in early childhood can improve the psychological, sociological and physical aspects of children. Learning physical education sports and health using traditional games has many benefits for students (Lubis, A. E, et al., 2023), (Fernando, F. 2020),(Hakiki, N., & Khotimah, K., 2020).

Traditional games can make children play into fun activities, take it seriously, feel encouraged to actualize the potential in the form of movement and behavioral attitudes. Traditional games can thus be used as a way of achieving educational goals. Traditional games can develop sociological and motor skills in children. In addition, traditional games can also be used as a way to increase children's motivation in learning and with this traditional game can help students improve physical fitness. Traditional games can help in the formation of children's character such as the value of sportsmanship, togetherness, honesty, tenacity, patience, agility, creativity and cooperation of course. From this explanation, traditional games have benefits, namely as a way for an educator to increase the motivation of students in learning to achieve an educational goal. In addition, with traditional games, students can increase the value of discipline, cooperation, togetherness and mutual socialization. The following is an explanation of the values that can be developed including physical and character aspects in traditional games in table 1.

Table 1. *Values developed in traditional games in the aspects of discipline character, physical aspects and thinking aspects*

No	Games	Origin	Character Aspects	Physical Aspects	Thinking aspect
1	Engklek	Java	Discipline, cooperation, decision making	Endurance, agility, accuracy, flexibility	Strategizing to maintain body balance
2	Jump rope	Java	Discipline, honesty, cooperation, socializing	Endurance, strength, agility, coordination, balance	Perform balance movements and tactics so as not to get tired easily
4	Run the block	Java	Discipline, self-confidence	Agility, balance, speed, endurance, coordination	Analyze foot movements so that they are correct in supporting the feet so that they can pass through the block
5	Snake eating its tail	Java	Cooperation, confidence, discipline	Balance, coordination	Performing strategies and tactics so that the dragon's tail is not pounced on by the dragon's head
6	Domikado	Maluku	Cooperation, socialization	Creativity, speed	Strategy in choosing a song
7	Cim-ciman	Banyumas, Java	Honesty, discipline, creativity, responsibility, social awareness	Agility, endurance, speed	Doing tactics so that it is easy to touch the game target

Modification of Engklek Game (Letter S Game)

The letter game or Letter S is a form of game that utilizes lifting one leg alternately to jump over the pedestal with the shape of the game track in the form of the letter "S". This game is a modification of the traditional game engklek from Java, tapak geser from Sumatra, where how to play this game using one foot alternately (Ardhika, D. F., 2015), (Drupadi, R. D., & Syafrudin, U. (2020). Engklek games generally have various forms according to the area where the game is played, for example in the form of boxes, circles and so on. This game develops children's discipline character. The discipline in this game is that children take turns doing one-legged jumping movements so as not to collide with other children and put their feet in the pedestal position without missing. Then the location of critical thinking in this game is that children organize strategies to maintain body balance when jumping with one foot and can mention the form of the game. The jumping activity itself is an effort to introduce children to the long jump number (Arga M W., 2024). The modified form of the Engklek game and the aspects of discipline character are described in table 2.

Table 2. *Modified form of Engklek game and discipline value*

Game Shape	Game Modification	Character Aspect	Thinking Aspect
Letter S	Players alternate between doing one-legged jumps on the triangle-shaped media, and jumping with both feet on the box-shaped media.	The child is required to step according to the footstool in the game.	The child analyzes strength, steps, balance in playing the game.

Letter S game, a game that utilizes lifting one leg alternately to jump over a pedestal with the shape of the game track in the form of the letter "S". This game modifies the traditional game engklek from Java, tapak geser from Sumatra, where the way to play this game uses one foot alternately. Engklek games generally have various forms according to the area where the game is played, for example: in the form of boxes, circles and so on. This game develops children's discipline character. The location of discipline in this game is that children take turns to do the crank movement so as not to collide with other children and place the foot in the pedestal position without skipping. Then the location of critical thinking in this game is that children organize strategies to maintain body balance when jumping on one leg and can mention the shape of the game.

1.Competency standards, children are able to: (1) Develop character values of discipline and critical thinking. (2) Perform coordination of movements between eyes, hands and feet. (3) Step by lifting one foot alternately on the pedestal.

2. Basic competencies, children can: (1) Perform movements in accordance with the pedestal media without crossing it and strategize to maintain body balance and predict stride length. (2) Take into account the placement of the foot position in accordance with the pedestal so that the body balance is maintained. (3) Developing visual skills, the ability to walk using one foot alternately on a pedestal.

3. Learning objectives (1) Character aspects: This game aims to improve the character value of discipline. The character of discipline is contained in the movement of stepping by lifting one foot alternately according to the shape of the pedestal. (2) Critical thinking aspect: Organizing strategies so that in performing the movement of lifting one leg alternately, to keep the balance of the body is maintained. In addition, players recognize shape and space.

Equipment and rules. The equipment used in the learning process in post 1 (one) is a line media as a pedestal in the form of an isosceles triangle measuring 30cm as many as 6 pieces and a box-shaped line media measuring 40x40 cm as many as 8 pieces. The angled triangle-shaped lines and box-shaped lines are assembled in parallel placed on a flat ground plane forming the letter (S). and installed parallel towards the track to go to the next post (post 2).

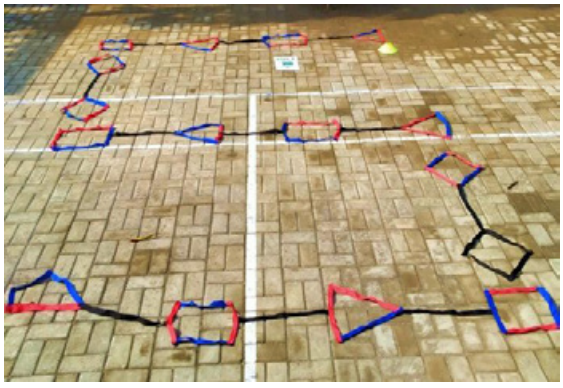

Figure 1. *Shape of the letter S game field*

Implementation: The child does the activity of stepping with one foot alternately on a triangular and rhombus-shaped footstool and jumping with both feet on a box-shaped pedestal. In the following picture, the child demonstrates how to step with one foot alternately on triangular, rhombic and square pedestals.

Figure 2. *Implementation of the letter S game*

Indicators of success: Children can pass all triangular, rhombus and box-shaped footstools by lifting one leg alternately to maintain balance so as not to fall. Based on the explanation above, it can be concluded that, by modifying the traditional game of engklek into a new game, it will provide a vehicle for a more interesting form of play and provide meaning in internalizing the character of discipline in children. But in this study the Enklek game can be used to develop the internalization of character values in early childhood. This allows children to learn about traditional games and learn about various games through the modified Engklek game.

METHOD

This type of research is quantitative research with a pre-experimental design. The research design used the "One-Group Pretest-Posttest Design" design. This design only uses experiments without a control class. Before being given treatment, the experimental group was first given a pretest, then given treatment using a modified Engklek game which was then carried out a posttest. The results of the treatment can be known accurately and can be compared between the conditions before treatment and those that have been given treatment. The following is a description of the "One-Group Pretest-Posttest Design" design. This design can be described as follows (Creswell, 2015: 243). The following is a picture of the research design in Figure 3.

Table 3. *One-Group Pretest-Posttest Design*

Pretest	Treatment	Posttest
01	X	02

Description:
O1 : Pretest results of internalizing the character of discipline and thinking
X : Treatment in the form of a modified Engklek game
O2 : Posttest results of internalization of discipline and thinking characters

The subjects of this study were all 3rd grade students of SD Negeri 3 Clering who were 10-12 years old and the implementation of the research in the odd academic year 2022/2023. This research data collection technique uses observation and documentation techniques. The observation technique was carried out before and after modifying the Engklek game. The first observation was carried out before the Engklek game was implemented, as an initial step to understand the problems in the ability to recognize shapes in children. While in the second observation after the implementation of the game, the researcher used guidelines as an observation tool. This observation guideline was made to observe the process, situation, and use of media by research participants regarding the modification of the Engklek game. The documentation technique is used to record ongoing events. Documents collected in this study are in the form of child data, photos of activities during observation, validation sheets and observation sheets of the ability to internalize character values and thinking on modifications of the Engklek game for children aged 10-12 years. The data collection instrument in this study used an observation sheet of the ability to internalize character values with a grid and validation sheet. Data analysis techniques were carried out using Statistical Package For Social Science (SPSS) for windows evaluation rerleas 23.0 software. The stages of data analysis are as follows: 1) Descriptive analysis, 2) Validity and Reliability Test, if the data is declared valid and reliable, then the analysis is carried out to the next stage, otherwise the data must be re-examined, even if it is necessary to retake the data, with the aim that the validity and reliability of the data are met. 3) Normality test of data on the results of the ability to internalize the value of discipline character before treatment and treatment results. This test is conducted to determine whether the data is normally distributed or not. The normality test used is the Shapiro-Wilk statistical test, 4) If the data is normal then proceed with the parametric statistical test with the T/Test, 5) If the data is not normally distributed using the Wilcoxon non-parametric test, 6) To find out the effect by comparing the results of the pretest and posttest on the target trial using the value $\alpha = 0.05$. If the value of T. Count> T. Table, then there is a significant influence. However, if the value of T count < T table, then there is no significant effect. The research hypothesis if H0: is accepted then there is no difference in the average between the two groups and if Ha: is accepted then there is a difference in the average of the two sample groups.

RESULTS

The results of research on the internalization of disciplinary character values through Engklek games found that when the activity took place, children felt happy because children had never learned about Engklek games. In addition, from the Engklek learning activities, it was found that some children still have difficulty jumping using one foot and with the Engklek game, children more easily absorb the information provided about the introduction of geometric shapes. The results of the assessment of the internalization of disciplinary character values that have been carried out in the pretest can be seen that the number of children who scored in the 0-3 interval was 0 children, while those who scored in the 4-6 interval were 0 children, then those who scored in the 7-9 interval were 16 children, and those who scored in the 10-12 interval were 14 children. From the above scores, it can be described as follows, children who score in the 0-3 interval have a very poor internalization of the value of discipline character, while children who score in the 4-6 interval have the ability to internalize the value of discipline character that is lacking, while children who score in the 7-9 interval have the ability to internalize the value of discipline character that is sufficient, and children who score in the 10-12 interval have the ability to internalize the value of discipline character that is good. Based on the results of the assessment of the ability to internalize the value of discipline character that has been carried out in the posttest, it can be seen that the number of children who get scores in the 0-3 interval is 0 children, then scores in the 4-6 interval are 0 children, then scores in the 7-9 interval are 0 children, then in the 10-12 interval are 30 children.

From the acquisition of these scores, it can be described that children who get scores in the 0-3 interval have the ability to internalize the value of discipline character that is very lacking, while children who get scores in the 4-6 interval have the ability to internalize the value of discipline character that is lacking, while children who get scores in the 7-9 interval have the ability to internalize the value of discipline character that is sufficient, while children who get scores in the 10-12 interval have the ability to internalize the value of discipline character that is good. The results of the pretest and posttest of 30 children aged 10-12 years will be explained based on the mean, median, mode, standard deviation and variance. In detail can be seen from Table 1 below:

Table 4. *Variable Description*

Statistics	Pretest	Posttest
Average	2.867	3.723
Median	3.023	4.034
Mode	2.456	4.012
Standard Deviation	0.256	0.267
Variance	0.087	0.090

Based on Table 1, it can be seen that there is an effect of giving Engklek games, which is indicated by an increase in the statistical value of the pretest and posttest. The mean value of the pretest was 2.867 while the posttest was 3.723. The pretest median and mode values were 3.023 and 2.456 while the posttest values were 4.034 and 4.012. Standard deviation and variance values tend to remain from pretest values of 0.256 and 0.087 to posttest values of 0.267 and 0.090. Validity and reliability data test results. The validity test is seen based on the Pearson correlation value between the indicators and the total number of indicators. Called valid if the r value (correlation) is greater than r table or sig value. < alpha (0.05). The validity test results are as follows:

Table 5. *Pretest Validity Test Results*

Indicator R count Sig.	Description	Indicator R count Sig.	Description
Pretest 1	0.768	0.000	Valid
Pretest 2	0.834	0.000	Valid
Pretest 3	0.767	0.000	Valid

Based on Table 2, the value of r count> r table (0.256) and sig.< alpha (0.05) so it can be concluded that the pretest indicator items are declared valid.

Table 6. *Posttest Validity Test Results*

Indicator R count	Sig. Description	Indicator R count Sig.	Description
Posttest 1	0.812	0.000	Valid
Posttest 2	0.823	0.000	Valid
Posttest 3	0.818	0.000	Valid

Based on Table 3, the value of r count> r table (0.256) and sig.< alpha (0.05) so it is concluded that the pretest indicator items are declared valid. As for the reliability test, the Cronbach's Alpha value is used. If the Cronbach's alpha value> 0.60 then it is declared reliable. It can be seen in Appendix 24, the pretest Cronbach's alpha value is 0.812. This value is greater than 0.60 so it is concluded that the pretest indicator items are reliable. The posttest Cronbach's alpha value is 0.823, this value is also greater than 0.60 so it is concluded that the posttest indicators are reliable. Normality test is conducted to test whether the data analyzed is normally distributed or not. This data calculation was carried out using the Saphiro-wilk test statistics. The data testing criteria can be seen in table 7:

Table 7. *Normality Test*

Treatment		Shapiro-Wilk		
		Statistic	Df	Sig.
Data	Pretest	.857	59	.000
	Posttest	.743	59	.000

Data is said to be normal if the Sig. Saphiro-Wilk test> alpha = 0.05. Based on Table 4, it was found that the Sig. value of pretest and posttest was smaller than 0.00 so it was decided to reject Ho. So it is concluded that the data is not normally distributed. In testing the normality assumption, it was concluded that the data was not normally distributed so that the statistical method used to determine the difference in the effect of two paired samples was the Wilcoxon statistic. The results of the Wilcoxon test are as follows:

Table 8. *Wilcoxon Test*

	Posttest – Pretest
Z Count	-6.501[b]
Sig. (2-tailed)	.000

If the sig value. Wilcoxon test statistics < alpha (0.05) or Zhitung> Ztabel (1.96) then Ho is rejected. Based on Table 5, the sig value = 0.000 < alpha (0.05) was obtained so that it was decided to reject Ho. and it was concluded that there was an effect of cranklek game modification on the ability to internalize disciplinary character values in children aged 10-12 years.

DISCUSION

Based on the exposure to the results of testing the modification of the Engklek game where the game is made with different shapes and materials from the previous Engklek game, this makes children interested in playing the game. and the results of treatment before and after modification of the Engklek game there is a significant difference. Thus, the Engklek game that has been modified is quite eThe Engklek game can apply children's disciplinary character, for example teaching the value of discipline to players who are willing to obey the agreed rules of the game (Jiwandono, 2020). Research also shows that the traditional game of engklek contains several educational values, namely moral education values, social education values, and cultural education values (Jamaludi, 2023). This can be beneficial for children's character building, such as harmonizing honesty, discipline, mutual respect, fairness, cooperation, and love and pride in the culture of the country (Setiawan et al., 2021). Engklek can help improve children's character, such as honesty and hard work, because it is a traditional game that aims to teach children about the process of achieving goals. This game can also help improve gross motor skills in early childhood, which is an important aspect in children's character development.

In addition, engklek games can also optimize students' cognitive abilities and shape early childhood character. Restoring children's games to traditional games as children's games can be an alternative in creating a generation with superior character (Nur, H., 2013). Traditional games can also be used as a learning medium, there are character values contained in the game, if used as a learning medium, namely honesty, discipline, hard work, creativity, curiosity, independence, communicative, responsibility and respect for achievement (Helvana, N., & Hidayat, S., 2020). Traditional games have many benefits and can stimulate child development (Al Ningsih, Y.R., 2021). Traditional games are still relevant to be preserved in the current era of globalization and support is needed from various parties to preserve them such as community fiber educators in general (Hayati, S. N., & Hibana, H. 2021). Traditional games as a learning medium that can stimulate the formation of children's character, especially in early childhood (Nurhayati, I., 2012). These traditional games contain various positive values that are very good to develop which not only include cognitive aspects, but also motor, affective, language, social, emotional, spiritual and ecological aspects (Dewi, K. Y. F., & Yaniasti, N. L., 2016). There are benefits contained in the traditional game of Engklek in the aspect

of gross motor development in children (Indriyani, D et al., 2021). The Engklek game, which is quite popular with children, turns out to have an effect on children's cognition, this can be seen in the way children carry out strategies in every game to achieve their goals (Pertiwi, D. A., et al., 2018). In addition, the ethnomamathematics-based engklek game can also improve children's thinking skills (Wijayanti, R., & Trisiana, A., 2018), (Susanto, S. et al., 2022). The modified engklek game in another study also turned out to be able to provide understanding to children in solving a problem (Fitriyah, A., & Khaerunisa, I., 2018).

CONCLUSION

The results of research and discussion regarding the modification of the Engklek game on the internalization of disciplinary character and thinking in children aged 10-12 years can be concluded that, by modifying the traditional game of engklek, it turns out that children are more interested and happy to do it, because the modification of engklek developed in the form of engklek is more interesting with various shapes such as box shapes, triangular shapes and colored lines. The modified Engklek game makes an effective game used as a learning process for internalizing disciplinary character and thinking skills in children aged 10-12 years. In addition, by modifying traditional games, it is hoped that it will participate in preserving the culture of playing traditional games in the archipelago.

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Conflict of Interest
The authors declare that there are no conflicts of interest.

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Nutritional Status and Body Composition in a Sample of Adults After Nutrition Counseling

Hajnalka Požar[1], Sanja Šumonja[1], Nataša Čamprag Sabo[1], Nataša Sekulić[1], Valentin Puškaš[1], Čaba Požar[2]
[1]College of Vocational Studies for the Education of Preschool Teachers and Sports Trainers, Council of Study Programs in Health Care and Professional Nutritionist Dietitian, Subotica, Republic of Serbia
[2]Primary School "Petefi Brigada", Kula, Republic of Serbia

Correspondence:
Hajnalka Požar, College of Vocational Studies for the Education of Preschool Teachers and Sports Trainers, Council of Study Programs in Health Care and Professional Nutritionist Dietitian, Subotica, Republic of Serbia, pozarh@gmail.com

Abstract: *Obesityis one of the most common risks for chronic non-communicable diseases. The aim of this work was to assess changes in nutritional status and body composition in working adults after nutrition counseling. The research was conducted during 2022 at the College of Vocational Studies in Subotica, Serbia. The initial assessment included 31 participants and 18 participants in the control assessment. Data on physical activity were collected by a questionnaire. Nutritional status and body composition were determined using the bioimpendancescale (InBody 230). The five-months nutrition counseling included practical tips for a balanced diet and physical activity. Pearson's correlation coefficient and Wilkoxon's rank test were applied for the statistical analysis. A quarter of participants had a sedentary lifestyle and only 13% of them are physically active at least 150 minutes a week. The average BMI 27.7 kg/m², and 62% of participants were overweight or obese. The respondents weighed an average of 26.6 kg, i.e. 31.2% of fat tissue. After the conuseling, a third of participants experienced a decrease in percentage of fat tissueand abdominal fat and 40% had an increase in muscle mass. However, 48% of respondents had an increase in BMIafter counseling.*
The body weight, body mass index or the amount of adipose tissue did not change significantly after nutrition conuseling, butthe deviation of the actual compared to the ideal body masssignificantly greater. After the nutrition counseling, an increase in muscle mass, i.e. lean body mass and total body waterwas determined.
Keywords: *BMI, fat mass, muscle mas, total body water.*

Abbreviations: *non-communicable diseases (NCDs); body mass index (BMI), ideal body mass (IBM), relative body mass (RBM). actual body mass (ABM), Fat mass (FM), percentage of fat mass (PFM), Abdominal fat (AF), muscle mass (MM), total body water (TBW, kg), clean (fat-free) body mass (CBM),*

INTRODUCTION

Overnutrition and obesity represent a significant public health problem and one of the most important risk factors for the development of chronic non-communicable diseases (NCDs). Obesity is an excessive, progressive accumulation of body fat. Obesity occurs when caloric intake is greater than energy needs for a long period of time, which means that there is an imbalance between nutrient intake and energy consumption (Simić B, 1998).

Obesity increases overall mortality. The life expectancy of obese adults is about 5 years shorter compared to optimally nourished people. Obesity is thought to be responsible for 1.2 million deaths annually globally. About 7% of the total funds intended for the treatment of all diseases are spent on the treatment of obesity and its consequences in Europe (Simonyi, Bedros, Wittmann, 2022). An increase in BMI by 5 kg/m² increases morbidity from cardiovascular diseases by 40%, diabetes by 60-120%, but also overall mortality by 30%. (Croatian Medical Association, 2014).

According to Eurostat data, 53% of the adult population in the countries of the European Union have a body mass index above 25 kg/m². A better economic status and a higher level of education of the population is associated with a higher incidence of obesity (Eurostat, 2024). In Serbia, more than half of the population (57.1%) is overnourished, i.e. pre-obese (36.3%) and obese (20.8%). Excess body weight poses a significant problem from an early age, given that in Serbia 29.5% of children and youth are overweight (12.9% of children aged 5-14 are obese, and 16.6% are moderately obese) (Institute of Public Health of Serbia, 2021).

Abdominal, central obesity poses a particular health risk. Visceral fatty tissue releases free fatty acids, which leads to increased infiltration of the liver and muscles by fat cells and cell resistance to insulin. Over a long period of time, central obesity can lead to diabetes mellitus, disorders of lipid status and cardiovascular diseases. These data indicate that it is necessary to change the approach to solving this problem. Reducing BMI by 5-10% significantly

reduces the risk of all comorbidities of obesity. Proper, balanced nutrition and regular physical activity are of key importance in achieving energy balance and optimal nutrition. Contemporary society and the rhythm of life require that all information that is important for the promotion of a proper lifestyle be available in a digital environment, preferably through different types of media (Ash, Contento, Olfert & Koch, 2023). It has been shown that nutrition counseling, as a part of multi-component programs, may improve dietary habits in obese adults (Al-Nimr, 2020). Individualized consultations are the most common method for the weight management of overweight and obesity in adults (Williams, 2019).

The aim of the work is to assess the changes in nutritional status and body composition of the adult, working population after a five-month online nutrition counseling.

MATERIAL AND METHODS

The research was conducted as a prospective, evaluation study in the period from May to October 2022. The sample consisted of employees at the College of Vocational Studies for the Education of Preschool Teachers and Sports Trainers in Subotica. Participation in the research was voluntary, anonymous and free of charge, which the participants confirmed by signing a written informed consent. The research was approved by the Ethics Committee of the College in May 2022. As part of the research, basic demographic data, data on physical activity and anthropometric measurements were collected. Data were collected at the beginning of the research (initial assessment) and after the nutrition counseling (control assessment).

Data on the frequency and level of physical activity at work and in free time on a weekly basis were collected using a questionnaire created for research purposes. Based on physical engagement at work and in free time, physical activity level (PAL) is classified as follows: low level of physical activity/sedentary style (PAL 1.4), moderate level of physical activity/moderately active style (PAL 1, 5), and a high level of physical activity/active (PAL 1.6) and a very active style (PAL 1.7) (National Agricultural Library, 2022).

Anthropometric measurements included measurement of body height (HW), body mass (WW). To measure body composition, a device based on the principle of bioelectrical impedance (model InBody 230) was used. Thefollowing data were obtained: body mass (TM, kg), fat mass (kg), percentage of adipose tissue (%), amount of abdominal fat (kg), body water (kg), muscle mass (kg), clean-lean body mass (kg), recommended control of fat mass (kg) and muscle mass (kg) in order to achieve ideal body mass, recommended daily energy intake (kcal).

The obtained values are classified according to the reference values proposed by the manufacturer of the apparatus for measuring body composition into the following categories: 1. Low; 2. Extremely low; 3. Optimal; 4. Borderline elevated and 5. Increased value (InBody230, 1996).

Body height (TV, cm) of the subjects was measured by an anthropometer using the Martin procedure. Based on anthropometric measurements, the following anthropometric indicators were calculated: body mass index (BMI kg/m^2), ideal body mass (IBM), relative body mass (RBM).

Classification of the body mass index (kg/m^2) of the subjects was carried out according to the recommendations of the World Health Organization (WHO, 1995).

In order to determine the deviation of the current body mass from the optimal one, the BMI (kg) of the subject was determined according to the Lorenz formula: BMI = TVcm–100–(TVcm-150/ 4 ♂ or 2.5 ♀ (Novaković, Mirosavljev& Jevtić, 2005).

In order to determine the percentage deviation of the actual body mass (ABM) from the ideal (IBM), the relative body mass (RBM, %) was determined, according to the formula: (RBM = ABM / IBM x 100). The values are classified as: 1. Risk for malnutrition (≤89%); 2. Optimal nutrition (90-109%); 3. Excessive body mass (110-119%) and 4. Obesity (≥ 120%) (Simić, 1998).

After the initial assessment, nutrition counseling was conducted. The nutrition counseling included electronic educational material with practical tips for a balanced diet and recommendations for physical activity that was delivered to the participants on a monthly basis for five months.

The statistical program package IBM Statistics SPSS 20 was used for the statistical analysis of the data. The data were presented using descriptive statistical analysis. The non-parametric Pearson's $\chi 2$ test was used to examine the correlation between two characteristics. Wilcoxon's rank test was used to analyze changes in anthropometric measures and indicators, as well as the direction of those changes after counseling. Values $p \leq 0.05$ were considered statistically significant.

RESULTS

In the initial assessment31 employees participated, 21 women (68%) and 10 men (32%), with an average age of 44 years. The first basic group was divided into two age categories: 1. younger respondents ≤ 44 years (n 15, 48%), and 2. older respondents ≥ 45 years old (n 16, 52%). The majority (75%) of respondents stated that they live in the city, with an average of three family members. More than half (59%) of respondents is engaged in the teaching process, while 41% of respondents are employed in auxiliary or administrative jobs.

The control assessment included 18 employees (58%), 12 women (39%) and 6 (19%) men. The median age of the subjects at the follow-up assessment was 42 years. The results related to physical activity at work and in free time are shown in **table 1.**

Half of the respondents are engaged in the work that is not physically demanding. A greater number of employees under the age of 45 are engaged in physically undemanding jobs and they significantly more often use a car as a means of transportation ($\chi 2$=0.472, p=0.007**).

Taking into account physical activity at work and during free time, a quarter of respondents have a sedentary lifestyle. Half of the respondents indicated that they are moderately physically active in their free time; a quarter is physically active for at least half an hour a day, while only 13% is physically active for 150 minutes a week.

At the initial survey, 42% of employees stated that there was a change in body mass in the previous three months from the beginning of the survey. In a third of cases, it was an increase in body weight. In the period between February and May 2022, 20% of respondents gained an average of 2-4 kg in body weight, and 13% gained 5 to 10 kg.

Table 1. *Physical activity at work and in free time at the initial assessment*

Variables	Total N (%)	Age ≤ 44 year	≥ 45 year	Correlation with age
Physical activity at the workplace				
1. Physically demanding	4 (13)	2 (7)	2 (7)	χ^2=-0.111; p=0.551
2. Physically moderately demanding	9 (29)	3 (10)	6 (19)	
3. Physically undemanding (sitting)	18 (51)	10 (32)	8 (26)	
Physical activity in free time				
1. Easy	8 (26)	5(16)	3 (10)	χ^2=0.000;
2. Moderate	15 (48)	5 (16)	10 (32)	p=1.000
3. Intensive	8 (26)	5 (16)	3 (10)	
Frequency of engaging in additional physical activities				
1. Everyday	4 (13)	3 (10)	1(3)	χ^2=-0.156; p=0.401
2. Several times a week	12 (39)	3 (10)	9 (29)	
4. Occasionally	14 (45)	8 (26)	6 (19)	
5. Never	1 (3)	1 (3)	-	
Time spent on additional physical activities during the week				
1. 15-25 minutes	8 (26)	4 (13)	4 (13)	χ^2=-0.039; p=0.834
2. 30-45 minutes	8 (26)	4 (13)	4 (13)	
3. 45-60 minutes	1 (3)	-	1(3)	
4. over 60 – 150 minutes	9 (29)	4 (13)	5 (16)	
5. over 150 minutes	4 (13)	2 (7)	2 (7)	
6. I am not physically active	1 (3)	1 (3)	-	
Means of transport when arriving/departing from work				
1. Hiking	3 (10)	1 (3)	2 (7)	χ^2=-0.129; p=0.490
2. Bicycle	4 (13)	2 (7)	2 (7)	
3. Motorcycle, e-bike	1 (3)	1 (3)	-	
4. Car	20 (64)	8 (26)	12 (39)	
5. Public transport	3 (10)	3 (10)	-	
Lifestyle				
1. Sedentary	8 (26)	5 (16)	3 (10)	χ^2=0.000;
2. Moderately (weakly) active	15 (48)	5 (16)	10 (32)	p=1.000
3. Active lifestyle	8 (26)	5 (16)	3 (10)	

Change in body weight in the previous three months				
1. Yes	13 (42)	6 (19)	7 (23)	χ^2=0.078;
2. No	13 (42)	6 (19)	7 (23)	p=0.675
3. I don't know	5 (16)	3 (10)	2 (7)	
Change in body weight in the form of:				
1. Increases	10 (32)	6 (19)	4 (13)	χ^2=-0.306; p=0.094
2. Reductions	3 (10)	-	3 (10)	

30 subjects participated in the analysis of body composition by bioelectrical impedance at the initial assessment, and 18 (58%) subjects participated in the control assessment.

Excessive body mass was found in 55% of respondents. After counseling, 7 (23%) respondents experienced a reduction in body weight, although this did not affect the change in body weight categorization. In 11 (36%) subjects, there was an increase in body weight in the five-month period.

Based on the calculation of the ideal body weight, the subjects had an average of 18 kg of excess body weight at the initial assessment. At the control measurement, 14 (45%) subjects (p=0.008) experienceda significant increase in the deviation of the ABM compared to IBM. According to RBM at the initial assessment, excessive weight was identified in 81% of the respondents.

The average value of BMI was 27.7±7.4 kg/m^2. An increase in BMI was found in two thirds (62%) of the subjects and one third were found to be obese (BMI ≥ 30 kg/m2). Observing by age categories, overweight was more prevalent in the older and obesity in the younger age group (total 17%, compared to 13%), although the correlation was not significant (χ2=-0.034; p=0.856). At the control measurement, 6 (19%) subjects had a decrease in BMI. Only in one respondent, the decrease in BMI affected the change in BMI categorization, while an increase in BMI was registered in a statistically significantly larger number of employees(p=0.001) (table 2).

Table 2. *Anthropometric data of the subjects at the first and control assessment, the number and direction of registered changes after the nutrition counseling*

Variables	Initial assessment (n 30. 97%)		Control assessment (n 18. 58%)		Wilcoxon rank test		The significance of the change
	$\bar{X}$ ± SD	Range	$\bar{X}$ ± SD	Range			
Body height (cm)	172.0±9.2	156-189	172.7±8.7	156-188			
Body mass (BM. kg)	83.5±24.9	50.6-168.0	77.65±24.9	51.9-155	Reduced: Raised: Unchanged:	7 11 0	Z = -1.177 p = 0.239
BM classification	N (%)		N (%)				
2. marginally low 3. optimal 5. elevated	1 (3) 13 (42) 17 (55)		- 12 (39) 6 (19)		Reduced: Raised: Unchanged:	0 1 17	Z = -1.000 p = 0.317
Category average	4.1 ±1.1		3.7 ±1.0				
Ideal body mass (IBM. kg)	64.9 ±7.4	53.6-78.5	65.2 ± 7.1	53.6-78.5			
Deviation of the actual BM compared to the ideal (kg)	18.3 ±21.9	-95 - +9	12.4 ± 21.2	-7.7-82.5	Reduced: Raised: Unchanged:	4 14 0	Z = -2.635 p = 0.008**
Relative body mass (RBM. %)	128.2±33.2	85-231	117.9±30.0	87 -214	Reduced: Raised: Unchanged:	7 11 0	Z = -1.286 p = 0.198
Classification of RBM	N (%)		N (%)				

1. ≤ 89% (malnutrition)	2 (7)		1 (3)		Reduced: Raised: Unchanged:	2 2 14	Z= 0.000; p= 1.000
2. 90-109% (optimal nutrition)	7 (23)		8 (26)				
3. 110-119% (excessive nutrition)	7 (23)		5 (16)				
4. ≥ 120% (obesity)	15 (48)		4 (13)				
Category average	3.13 ± 1.0		2.7±0.9				
Body Mass Index (BMI. kg/ m^2)	27.7 ±7.4	18.4-52.0	25.7±6.9	19.1-47.9	Reduced: Raised: Unchanged:	6 12 0	Z = -0.874 p = 0.382
Classification of BMI	N (%)		N (%)				
1.< 18.5 (malnutrition)	1 (3)		-		Reduced: Raised: Unchanged:	1 15 2	Z = -3.350 p = 0.001**
2.18.5 - 24.9 (optimal nutrition)	11 (35)		-				
3.25 - 29.9 (excessive nutrition)	10 (32)		12 (39)				
4.30.0 - 34.99 (obesity 1°)	3 (10)		-				
5. 35.0 - 39.99 (extreme obesity 2°)	4 (13)		6 (19)				
6. > 40.0 (morbid obesity 3°)	2 (7)		-				
Category average	3.1 ±1.3		3.7 ±1.0				

** *Statistically significant difference at p ≤ 0.01 level.*

The largest number (75%) of respondents at the initial assessment had an increased amount of fat mass, abdominal fat and percentage of fat tissue, thus a significant risk for the development of NCDs. Excessive amount of fat mass was significantly more often registered in highly educated respondents, who are employed in the teaching process (p= -0.045). At the control assessment, about a third of the subjects had a decrease in fat mass (n=9; 29%), percentage of fat tissue (n=11, 4%) and abdominal fat (n=12.4%), but these changes were not statistically significant. Fat mass indicators of the subjects at the initial and control measurement, number and direction of registered changes after the nutrition counseling are presented in table 3.

Table 3. *Fat mass indicators of the subjects at the initial and control assessment, number and direction of registered changes after the nutrition counseling*

Variables	**Initial assessment (n 30. 97%)**		**Control assessment (n 18. 58%)**		**Wilcoxon rank test**		**The significance of the change**
	$\bar{X}$ ± SD	**Range**	**$\bar{X}$ ± SD**	**Range**			
Fat mass (FM. kg)	26.6±15.2	8.5-84.0	23.5±14.6	6.0 -71.9	Reduced: Raised: Unchanged:	9 9 0	Z = -0.458 p = 0.647
Classification FM (kg)	*N (%)*		*N (%)*				
1. low 2. marginally low 3. optimal 4. borderline elevated 5. elevated	1 (3) 1 (3) 5 (16) 2 (7) 21 (68)		2 (7) - 5 (16) 2 (7) 9 (29)		Reduced: Raised: Unchanged:	4 0 14	Z = -1.890 p = 0.059
Category average	4.4 ±1.1		3.9 ±1.4				
Percentage of fat mass (PFM. %)	31.2±10.2	6.0-50.0	28.1±10.4	5.8 -46.4	Reduced: Raised: Unchanged:	11 6 1	Z = -1.731 p = 0.083
Classification of PFM	*N (%)*		*N (%)*				

1. low	-		1 (3)		Reduced:	1	Z = 0.000
3. optimal	7 (23)		3 (10)		Raised:	1	p = 1.000
5. elevated	23 (74)		14 (45)		Unchanged::	16	
Category average	4.5 ±0.9		4.4 ± 1.5				
Abdominal fat (AF. kg)	14.1 ±6.1	5.7-30.0	12.4 ± 6.2	2.3- 27.5	Reduced:	12	Z = -1.541
					Raised:	5	p = 0.123
					Unchanged:	1	
Classification AF	*N (%)*		*N (%)*				
1. low	-		1 (3)		Reduced:	1	Z = 0.000
3. optimal	7 (23)		3 (10)		Raised:	1	p = 1.000
5. elevated	23 (74)		14 (45)		Unchanged:	16	
Category average	4.5 ±0.9		4.4 ± 1.5				
Recommended control of fat mass (kg)	-12.6 ±14.2	-70- +2	-10.5 ±14.6	-57.3-+5.1			
Classification	*N (%)*		*N (%)*				
Range: - 70 to -1 kg	27 (87)		15 (48)		Reduced:	7	Z = -0.52
Range: + 0.5 to +2 kg	3 (10)		3 (10)		Raised:	11	p = 0.601
					Unchanged:	0	
Range Average:	-12.6 ± 14.2		-10.5 ± 14.6				

** *Statistically significant difference at p ≤ 0.01 level.*

At the control assessment a large number of respondents experienced an increase in muscle mass (n=12, 39%) and a statistically significant increase in lean mass (n=14, 45%). As a result, a significant increase in the amount of body water (bound to glycogen in the muscles) was registered (table 4).

Table 4. *Indicators of the subjects' muscle composition at the first and control assessment, number and direction of registered changes after nutrition counseling*

Variables	**Initial assessment (n 30. 97%)**		**Control assessment (n 18. 58%)**		**Wilcoxon rank test**		**The significance of the change**
	$\bar{X}$ ± SD	**Range**	**$\bar{X}$ ± SD**	**Range**			
Muscle mass (MM. kg)	30.8 ±8.4	18.7-49.1	30.2 ± 8.18	19.6 -47.4	Reduced:	6	Z = -1.679
					Raised:	12	p = 0.093
					Unchanged:	0	
Classification of MM	N (%)		N (%)				
1. low	3 (10)		1 (3)		Reduced:	1	Z = -1.081
2. marginally low	2 (7)		1 (3)		Raised:	5	p = 0.279
3. optimal	12 (39)		11 (36)		Unchanged:	12	
4. borderline elevated	2 (7)		-				
5. elevated	11 (36)		5 (16)				
Category average	3.5 ± 1.3		3.4±1.1				
Total body water (TBW. kg)	40.6±10.4	25.6-62.8	39.9 ±10.3	26.4 -61.0	Reduced:	5	Z = -2.061
					Raised:	12	**p = 0.039***
					Unchanged:	1	
Classification TBW	N (%)		N (%)				
1. low	2 (7)		-		Reduced:	0	Z = -2.000
2. marginally low	2 (7)		1 (3)		Raised:	4	**p = 0.046***
3. optimal	14 (45)		12 (39)		Unchanged:	14	
4. borderline elevated	1 (3)		-				
5. elevated	11 (36)		5 (16)				
Category average	3.6 ± 1.3		3.5 ± 1.0				
Clean (fat-free) body mass (kg)	55.3±14.0	34.8-50.6	54.2±13.6	36.1 -83.2	Reduced:	4	Z = -2.266
					Raised:	14	**p = 0.023***
					Unchanged:	0	

Classification of CBM	N (%)		N (%)				
1. low	1 (3)		-		Reduced:	0	Z = -1.342
2. marginally low	1 (3)		-		Raised:	2	p = 0.180
3. optimal	15 (48)		13 (42)		Unchanged:	16	
5. elevated	13 (42)		5 (16)				
Category average	3.8 ±1.2		3.6 ± 0.9				
Recommended control of muscle mass (kg)	1.4 ± 2.5	0.0-8.3	1.5 ± 2.2	0.0-6.9			
Classification of recommended control odmuscel mass	*N (%)*		*N (%)*				
Range: 0.0 kg (optimal)	20 (65)		11 (36)		Reduced:	8	Z = -1.956
Range: + 0.5 to 8 kg	10 (32)		7 (23)		Raised:	1	p = 0.050
					Unchanged:	9	
Range Average:	1.4 ± 2.5		1.5 ±2.2				

** Statistically significant difference at the p ≤ 0.05 level.*

DISCUSSION

Employees with an average age of 44 participated in the initial assessment. Only 58% of employees, average age 42, responded to the control assessment after the six-month advisory work. It is possible that a large number of respondents after the initial assessment and nutrition counseling did not become more aware of the importance of regular body weight control in order to prevent NCDs. Based on the average age at the control assessment, it can be assumed that younger respondents are more aware of the importance of body weight control.

Respondents included in this research predominantly perform sedentary jobs, which is expected considering the nature of jobs in higher education. The results of the national survey on the health of Serbian residents show that residents of urban areas, with a higher level of education and with higher incomes, are more inclined to a sedentary lifestyle (Institute of Public Health of Serbia, 2021). Only 13% of respondents are physically active for at least 150 minutes a week, as recommended by the WHO for adults in order to prevent NCDs (WHO, 2018). Looking at the physical activity habits of the adult population of Serbia, a national survey shows that only 9.7% of adults engage in physical activity for at least 30 minutes a day. The same study showed that physical activity decreases with age and that young people aged 18-24 are the most active (Institute of Public Health of Serbia, 2021). In this research, a quarter of the respondents were physically active for at least an hour a day. At the initial measurement, the subjects of the older age group (>45 years) were physically active more regularly and longer than the younger subjects. It is possible that due to the presence of chronic diseases, older respondents are more aware of the importance of physical activity in controlling and preserving their health, or that physical activity is prescribed to them as part of the treatment of the underlying disease.

Based on BMI values, more than half of the respondents were overweight, which reflects inadequate habits related to nutrition and physical activity. Only a third of the respondents had a normal weight status. This result is in accordance with data on the state of nutrition at the national level (Institute of Public Health of Serbia, 2021).

After six months of counseling, a large number of employees (37-39%) experienced a significant increase in body weight and body mass index, and a quarter also experienced an increase in fat mass and abdominal fat. Taking into account that a certain number of respondents at the initial measurement indicated a significant increase in body weight in the previous three months before the survey, it can be concluded that the trend of increasing body weight continued even after the implementation of the nutrition counseling. In the case of the aforementioned respondents, counseling had no effect on changing habits related to nutrition and physical activity.It is possible that the counseling was not effective due to the length of its duration, intensity, form in which it was carried out. Or it is possible than nutrition counseling is not enough to lead to significant changes in eating habits. In a study conducted by Al.Nimr et al. in a sample of obese adults, a 12-week intensive nutrition counseling program contributeted to a significant weight reductionas well as a decrease in waist circumference (Al-Nimr,2020). Williams et al. concluded that individualized consultations with dietitians have small but significant effect on the control of body weight (Williams, 2019. It is clear the differences in methodology, outcomes that are monitored lead to different results of the effect of various interventions on body weight.

The main weaknesses of this study are related to the relatively small and unrepresentative sample, and especially to the number of respondents who responded to the control assessment. Changes in the frequency, duration, and intensity of physical activity after counseling were not monitored, nor were changes in eating habits, so it cannot be asserted with certainty whether counseling had an effect on changes in eating habits and physical activity. The advantages of the research are related to the use of objective methods for assessing body composition as well as numerous indicators of nutritional status. The obtained results can be used for planning similar studies or public health interventions aimed at reducing the risk factors of NCD's in the working population.

CONCLUSION

Insufficient physical activity, sedentary lifestyle and excessive nutrition are significantly represented in the examined group of employees in a higher education institution.

The body weight, body mass index or the amount of adipose tissue did not change significantly after nutrition conuseling. After the nutrition counseling and the six-month follow-up, there was an increase in the mentioned parameters and a significantly greater deviation of the actual compared to the ideal body mass. After the nutrition counseling, an increase in muscle mass, i.e. an increase in lean body mass and total body waterwas determined which may be the result of increase in physical activity. However, the mentioned changes were not reflected in changes in body weight or in the amount of fat mass, which indicates that the respondents did not change eating habits and that possibly they tried to influence the reduction of body weight by means of physical activity.

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Relationship Between Physical Fitness and Dietary Habits of Early School-age Children

Zorica Stankovska[1], Serjoža Gontarev[2], Žarko Kostovski[2]
[1]Ss. Cyril and Methodius University Skopje, St. Kliment Ohridski Faculty of Pedagogy, North Macedonia
[2]Ss. Cyril and Methodius University Skopje, Faculty of Physical Education, Sport and Health, North Macedonia

Correspondence:
Zorica Stankovska, Ss. Cyril and Methodius University Skopje, St. Kliment Ohridski Faculty of Pedagogy, North Macedonia
zoricakostovska.stankovska@gmail.com

Abstract: *The aim of this research was to investigate whether individual dietary habits are associated with the physical fitness of early school-age children. In children and adolescents, physical fitness is negatively correlated with cardiorespiratory diseases, high blood pressure, abdominal obesity, overall obesity, skeletal health impairment, hyperinsulinemia, insulin resistance, atherogenic lipid profile, and other metabolic risk factors. Previous research has confirmed the link between low levels of physical fitness in young people and several factors, such as improper dietary habits. Most studies investigating the impact of dietary habits on health have focused on the effect of diet on changes in weight and body composition. Skipping breakfast, snacking, or consuming sugary drinks are associated with higher body mass index (BMI) or waist circumference (WC) in adults and children. The study was conducted on a sample of 940 participants, randomly selected from several primary schools in the Skopje region. The sample was divided into two subsamples by gender, comprising 466 male participants and 474 female participants. The study used 7 criterion variables (fitness tests) and 2 predictor variables. Differences between groups were determined by one-way multivariate and univariate analysis of covariance (MANCOVA and ANCOVA) with partialization by age (age was treated as a fixed covariate). The results of the study showed that boys who reported eating breakfast every day showed better results in aerobic fitness, running 20 meters with progressive speed increase (20m shuttle run test - Stg), and running 20 meters with progressive speed increase (VO2 max), which was not the case for girls. Dietary habits, such as fruit consumption, did not have a statistically significant impact on physical fitness (motor status) in this study.*

Keywords: *children, physical fitness, dietary habits.*

INTRODUCTION

Monitoring physical fitness is a powerful predictor of health status in childhood, adolescence, and adulthood (Guedes, et al., 2012; Blair, et al. 2001; Williams, 2001; Myers, et al., 2004; Warburton, et al. , 2006; Ortega et al., 2008). Even in children and adolescents, physical fitness is negatively correlated with cardiorespiratory diseases, high blood pressure (Ruiz, et al., 2006), abdominal obesity (Brunet, et al. 2007), overall obesity (Ruiz, et al., 2006; Ortega, et al., 2007.), skeletal health impairment (Moliner-Urdiales, et al., 2010.), hyperinsulinemia (Gutin, et al., 2004.), insulin resistance (Gulati, et al., 2003.), atherogenic lipid profile (Mesa, et al., 2006), and other metabolic risk factors (Rizzo, et al., 2007). Previous research has confirmed the link between low levels of physical fitness in young people and several factors such as genetic, biological, familial, environmental, behavioral, gender, low income, improper diet, inadequate levels of physical activity, sedentary habits, and excess body fat (Ortega, et al., 2008; Hainer, et al., 2009; de Andrade, et al., 2015; de Andrade, et al., 2016). Several dietary habits have been associated with early progression of overweight and obesity (Isacco et al., 2011., Moreno and Rodriguez, 2007., Mota et. al., 2008.). Most studies investigating the impact of dietary habits on health have focused on the effect of diet on changes in weight and body composition. Skipping breakfast, snacking, or consuming sugary drinks are associated with higher body mass index (BMI) or waist circumference (WC) in adults (Duvigneaud et al., 2007., Holmback et al., 2010.) and children (Isacco et al., 2011, Moreno and Rodriguez, 2007 ,Motaetal., 2008). Furthermore, it has been shown that objectively measured levels of habitual physical activity correlate with cardiorespiratory fitness (CRF) assessed by direct measurement of VO2max in children (Dencker et al., 2006, Ekelund et al., 2001), which is considered a marker of health status (Hurtig-Wennlof, A., Ruiz, J. R., Harro, M., & Sjostrom,M. 2007)). To date, a limited number of studies have investigated the relationship between dietary habits and CRF in children. Although risk factor analysis is now a new challenge in many research fields, including health promotion, sociodemographics, kinesiology, and behavioral sci-

ences (Guedes, et al., 2012; Condello, et al., 2016), very few studies have explored the association between physical fitness and risk factors (Grao-Cruces, et al., 2014; Castro-Piñero, et al., 2012).

MATERIALS AND METHODS

Participants

The study was conducted on a sample of 940 participants, randomly selected from several primary schools in the Skopje region. The sample was divided into two subsamples by gender, comprising 466 male participants and 474 female participants. The sample included all students for whom parental consent was obtained to participate in the project and who were psychophysically healthy and regularly attended physical and health education classes.

Variables

Sampled The study used 7 criterion variables (fitness tests) and 2 predictor variables.

Criterion variables for flexibility, musculoskeletal fitness, motor fitness, and cardiorespiratory fitness: sit-and-reach (FLE), handgrip dynamometry (HG), standing long jump (SLJ), sit-ups in 30 seconds (SIT30), 4 x 10-meter shuttle run test (4X10M), 20-meter shuttle run test with progressive speed increase (Stg), maximal oxygen uptake during a progressive 20-meter run (VO2 max).

Predictor variables: Frequency of breakfast consumption during school days, Weekly frequency of fruit consumption.

Methodology

For all variables measured on interval or ratio scales, the following basic statistical parameters were calculated: mean (X), standard deviation (SD). Differences between groups were determined by one-way multivariate and univariate analysis of covariance (MANCOVA and ANCOVA) with age partialization (age was treated as a fixed covariate).

RESULTS

Table 1. *Differences in Motor Status Between Groups of Male Participants Based on Frequency of Breakfast Consumption During School Days*

	Value	F	Hypothesis df	Error df	Sig.	n^2
Wilks' lambda	0.99	0.86	7	455	.538	.013

	Don't have breakfast every day		Have breakfast every day		F	Sig.	n^2
	Mean	SD	Mean	SD			
FLE	14.54	6.80	14.55	6.16	0.01	.937	.000
HG	13.86	3.82	14.01	4.65	0.06	.803	.000
SLJ	113.34	23.45	117.37	24.45	3.22	.073	.007
SIT 30	13.11	5.40	13.89	5.33	2.47	.117	.005
4x10m	14.83	2.27	14.50	2.00	2.91	.089	.006
Stg	3.63	1.55	3.94	1.59	4.19	**.041**	.009
VO2max	48.56	3.67	49.21	3.52	4.40	**.037**	.009

In Table 1, the results of multivariate analysis of covariance between groups of male participants based on whether there is a computer in their child's room are shown. From the obtained results, according to Wilks' Lambda Rao's F-approximation, which is 0.86, and the level of statistical significance Sig .538, it is evident that there are no statistically significant differences between groups. From the results of univariate analysis of covariance with age

partialization, it can be determined that statistically significant differences were obtained in 2 variables: maximal oxygen uptake (VO2max) at the level of p=.037, and for the variable shuttle run 20 meters with progressive increase in speed (distance covered) (Stg) at the level of p=.041.

From the multivariate analysis of covariance (Table 2), with Rao's F-approximation of 1.83, and a significance level of Sig .079, it is visible that there are no statistically significant differences between groups. Furthermore, from the analysis of univariate analysis of covariance with age partialization and from the obtained results, it can be said that there are no statistically significant differences in any of the seven variables among the participants formed based on how often they eat breakfast during school days.

Table 2. *Differences in Motor Status Between Groups of Female Participants Based on Breakfast Consumption Frequency During School Days*

	Don't have breakfast every day		Have breakfast every day		F	Sig.	n^2
	Mean	SD	Mean	SD			
FLE	16.77	6.16	17.74	6.79	2.57	.110	.005
HG	12.56	4.94	12.80	4.09	0.20	.658	.000
SLJ	106.26	23.36	103.65	20.89	1.84	.175	.004
SIT 30	11.53	5.42	12.27	4.77	2.01	.157	.004
4x10M	15.49	2.00	15.52	2.06	0.11	.739	.000
Stg	3.17	1.14	3.10	1.13	0.59	.443	.001
VO2max	47.62	2.96	47.27	3.14	0.90	.343	.002

	Value	F	Hypothesis df	Error df	p.	n^2
Wilks' lambda	0.97	1.83	7	459	.079	.027

In Table 3, differences in motor status between groups of male participants based on their weekly frequency of fruit consumption are shown. From the multivariate analysis of covariance with Rao's F-approximation of 0.34, and a significance level of Sig .935, it is evident that there are no statistically significant differences between groups. Furthermore, from the univariate analysis of covariance with age partialization and the obtained results, it can be observed that there are no statistically significant differences.

Table 3. *Differences in Motor Status Between Groups of Male Participants Based on Weekly Frequency of Fruit Consumption*

	Value	F	Hypothesis df	Error df	p.	n^2
Wilks' lambda	1.00	0.34	7	455	.935	.005

	Less than once a day		Once a day or more		F	Sig.	n^2
	Mean	SD	Mean	SD			
FLE	14.77	6.57	14.28	6.19	0.52	.470	.001
HG	13.77	3.81	14.17	4.92	0.74	.389	.002
SLJ	115.85	24.23	115.92	24.08	0.04	.847	.000
SIT 30	13.48	5.30	13.76	5.45	0.14	.706	.000
4x10M	14.69	2.03	14.54	2.20	0.35	.554	.001
Stg	3.83	1.60	3.82	1.56	0.07	.787	.000
VO2max	49.03	3.70	48.91	3.46	0.04	.841	.000

According to Wilks' Lambda, Rao's F-approximation (Table 4) which is 1.06, and the significance level Sig .387, it can be said that there are no statistically significant differences between groups of participants at the multivariate level. Furthermore, from the analysis of univariate analysis of covariance with age partialization among female participants based on their weekly frequency of fruit consumption, it can be stated that no statistically significant differences were found.

Table 4. *Differences in Motor Status Between Groups of Female Participants Based on Weekly Frequency of Fruit Consumption*

	Less than once a day		Once a day or more		F	Sig.	n^2
	Mean	SD	Mean	SD			
FLE	17.53	6.78	17.21	6.36	0.36	.549	.001
HG	13.09	5.17	12.36	3.63	2.35	.126	.005
SLJ	104.43	21.94	104.91	21.92	0.18	.670	.000
SIT 30	12.01	5.20	11.95	4.91	0.02	.885	.000
4x10M	15.51	2.13	15.51	1.95	0.09	.766	.000
Stg	3.15	1.15	3.10	1.12	0.14	.713	.000
VO2max	47.16	3.03	47.63	3.10	1.10	.296	.002

	Value	F	Hypothesis df	Error df	p.	n^2
Wilks' lambda	0.98	1.06	7	459	.387	.016

DISCUSSION

Daily breakfast can be considered a healthy eating habit. Indeed, daily reported breakfast consumption has been associated with healthier BMI, lipid profiles, and greater physical activity among European children (Papoutsou et al., 2014). However, skipping breakfast was not associated with lower physical activity, poorer physical fitness, or more sedentary time among European adolescents (Cuenca-Garc´ıa et al., 2014), and similar results were found among British adolescents (Corder et al., 2011). The findings of this study show that boys who reported eating breakfast daily had better results in aerobic fitness, which was not the case for girls.

Cardiorespiratory fitness assessed during shuttle run tests has been found to be associated with healthy eating habits in children (Sandercock et al., 2010). Similarly, healthy eating habits have recently been linked to overall fitness in children (mile run, squats, push-ups, height, and weight) (Edwards, Mauch, & Winkelman, 2011). Longitudinal analyses have revealed a positive association between reported breakfast consumption and aerobic fitness. This shows that the effect may vary depending on the type of physical fitness. Insufficient data on the quality of reported breakfast consumption limit the discussion of these results.

Dietary habits (fruit consumption) did not have a statistically significant impact on physical fitness in this study. This is not in line with the awareness that nutrition is an important part of athletic performance, especially in childhood and adolescence, as it enables optimal growth and development (Purcell et al., 2013). Further studies are needed to deeply explore the relationship between food consumption habits and physical fitness.

CONCLUSION

The aim of this study was to investigate whether individual dietary habits are associated with the physical fitness of early school-age children. Boys who reported eating breakfast daily showed better results in aerobic fitness, as indicated by the 20-meter shuttle run test with progressive speed increase (Stg) and the progressive speed increase in the 20-meter run (VO2max), which was not the case for girls. Dietary habits, such as fruit consumption, did not have a statistically significant impact on physical fitness test results (motor status) in male and female participants in this study.

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Self-Efficacy of Pre-Service Teacher Professional on The Physical Education Learning Process in Inclusive Class: Is It Different from Regular Class?

Ismail Gani[1], Sugeng Purwanto[1], Yuyun Arie Wibowo[1], Luthfie Lufthansa[2], Khotim Hanifudin Najib[3], Oscar Ndayizeye[4]

[1]Universitas Negeri Yogyakarta, Indonesia; [2]Universitas Insan Budi Utomo, Indonesia; [3]Universitas Sarjanawiyata Tamansiswa Yogyakarta, Indonesia; [4]Ecole Normale Superiure, Burundi

Correspondence:
Ismail Gani, Universitas Negeri Yogyakarta, Indonesia
ismailgani@uny.ac.id

Abstract: *Self-efficacy of physical education teachers is critical for maximizing learning in both regular and inclusive classes. The purpose of this study is to determine the difference in pre-service professional students' levels of self-efficacy for physical education learning in regular and inclusive classes.*

This is a comparative study employing a survey method. Purposive random sampling was used in this study. The sample includes pre-service physical education students. The questionnaire was distributed to 120 respondents, but only 62 were willing to complete it. The instrument employs a self-efficacy questionnaire in regular class and a self-efficacy questionnaire in inclusive class. Each questionnaire contains 15 statement items with response options ranging from 1 to 4. Based on the self-efficacy questionnaire in regular class, the Cronbach alpha score of 0.89 indicates that the questionnaire is reliable; in inclusive class, the same questionnaire yields a 0.92 Cronbach alpha value.

The Paired T Test is used to analyze the data, and the resultant sig value is 0.00. This score can be regarded as indicating a significant difference in pre-service students' self-efficacy in regular class physical education learning versus inclusive class physical education learning. Descriptively, the mean degree of self-efficacy in the regular class is 49.37, while in the inclusive class it is 44.03.

These findings show that compared to regular class, inclusive class have a mean self-efficacy level that is lower. Policymakers may want to take these findings into account when deciding what additional resources to offer pre-service students so they may benefit from inclusive class.

Keywords: *Self-Efficacy, Pre-Service, Teacher, Physical Education, Inclusive Class.*

INTRODUCTION

The provision of opportunity for children with special needs is leading to innovative advancements in schooling across multiple nations. Many countries are gradually transitioning their schools to inclusive education and integration (Avramidis & Kalyva, 2007). The implications of Article 31 paragraph 1 of the 1945 Indonesian Constitution for the advancement of education can be comprehended as a citizen's right, meaning that all citizens, including those with special needs, have the right to acquire education (Intifadha & Tuasikal, 2017). In the United States, students with special needs must be included in general education programs by law (Mrug & Wallander, 2002). Every provincial Ministry of Education in Canada has committed to an inclusive education model (Hutchinson & Specht, 2019). Special courses in public schools in Korea have grown significantly since the revision of the special education law was approved (Kwon & Block, 2017). Since 2005, the French education system has advocated for a transition aimed at enabling the integration of students with disabilities. For example, special classes are gradually diminishing (Vieira et al., 2024). Since the early 2000s, inclusive education services in Saudi Arabia have swiftly evolved, with increases in the quantity and quality of services offered to students with disabilities (Aldosari, 2022). The study was inspired by legislation promoting the transition from regular to inclusive education (Overton et al., 2017). The study's findings found that, despite difficulties, children with special needs received a variety of services, with minimum assistance from support staff and the school environment, as well as pedagogical adaptations to guarantee meaningful participation in Physical Education classes.

Prospective teachers, particularly those in physical education, must be prepared to provide inclusive classes. Teachers are acknowledged as the primary agents of inclusive education (Vieira et al., 2024). Globally, students with

disabilities are increasingly attending general education, including physical education (Campos et al., 2013)1995. Physical education teachers' activities have an essential role in making students with disabilities' learning experiences more relevant (Haegele & Sutherland, 2015). Unfortunately, teachers' lack of preparation in managing physical education with special needs students has a negative impact on students. One of the challenges in England is that the National Curriculum for Physical Education (NCPE) was specifically developed to support inclusive physical education. However, stated that some teachers were unable to meet NCPE objectives (Haycock & Smith, 2010)the central objective of this study is to examine the extent to which PE teachers have been able to achieve the government's inclusion policy goals articulated in the 2000 National Curriculum for Physical Education (NCPE. When the goals are not achieved, the learning experience of students with disabilities in Physical Education can suffer, regardless of the teacher's best intentions.

The success of physical education in inclusive classes is influenced by a teacher's self-efficacy. Self-efficacy is a socio-cognitive term defined as the belief in one's ability to deal with obstacles (Shoji et al., 2016). Self-confidence and a sense of responsibility can influence professional decisions and teaching approaches (Lauermann & Berger, 2021). Individuals with low self-efficacy are more likely to give up easily, while those with high self-efficacy are motivated to persist, even after encountering a negative experience. However, self-efficacy has negative consequences, including burnout. According to research, teacher self-efficacy is a stronger predictor of burnout than well-being (An & Tao, 2024). The same study results reveal that teachers who have stronger self-efficacy and embrace a student-centered approach report experiencing less burnout (Friesen et al., 2023).

Several research investigate the experiences of physical education teachers during the physical education learning process with children with special needs (Gani et al., 2023; Hutzler et al., 2019; Suryobroto et al., 2022). Several studies on self-efficacy for inclusive learning were found to be useful. Research on self-efficacy for slow learner students was also conducted by (Putri & Fakhruddiana (2019). The study identified significant differences in self-efficacy among students from three universities in Serbia particularly in teaching students with disabilities (Jovanović et al., 2014). This study evaluated prospective teachers' self-efficacy for teaching intellectual disabilities, physical disabilities, and the blind. Several studies revealed minimal findings about prospective teachers' self-efficacy in teaching physical education to students with disabilities in Indonesia. Although the perspective of students with disabilities is essential, most research on physical education focuses on physical education teachers' beliefs and attitudes toward typical students (Beamer & Yun, 2014). Similar research is required in Indonesia due to the necessity of self-efficacy and the availability of relevant literature. Innovation in specialized research on physical education learning, as well as analysis by comparing self-efficacy in regular and inclusive classes. The purpose of this study is to find out the differences in students' levels of self-efficacy when learning physical education in normal classes and inclusive classes.

MATERIALS AND METHODS

Participants

This comparative study employed a survey method, targeting pre-service physical education students. A purposive random sampling technique was utilized, resulting in a sample of 120 respondents. However, only 62 participants (aged 20-25 years) completed the survey. The sample consisted of both male and female students, all of whom were in the final year of their education program. All participants provided informed consent before participating in the study. The inclusion criteria were pre-service physical education students currently enrolled in the program, while the exclusion criteria were those who had prior experience teaching in inclusive or regular classes.

Procedure

The study involved the administration of a self-efficacy questionnaire in two different contexts: regular class and inclusive class. The instrument is structured based on 3 dimensions of self-efficacy including level, generality, and strength (Bandura, 1997). The self-efficacy dimension is also cited in several studies (Jamil, 2018; Pinkerton, D & Cecil, 2000; Putri & Fakhruddiana, 2019). Each questionnaire consisted of 15 statement items with response options ranging from 1 (strongly disagree) to 4 (strongly agree). The questionnaire has been assessed by 5 expert judgments including 2 academics and 3 practitioners. Academics consist of psychology lecturers and adaptive physical education lecturers. Meanwhile, the 3 practitioners consist of 2 physical education teachers at inclusive schools,

and 1 teacher at a special school. All items have high content validation because the V value is higher than the Aiken standard value (>0.8) (Aiken, 1985). The average of all items has a V value of 0.92. This coefficient of 0.857 can be considered to have adequate content validity (Hendryadi, 2017).

The questionnaire distribution was conducted both online and offline to ensure a higher response rate. Participants were instructed to reflect on their experiences in regular and inclusive class settings before responding to the items. The data collection process took approximately two weeks. The Cronbach alpha reliability score for the self-efficacy questionnaire in the regular class was 0.894, indicating high reliability. Similarly, the questionnaire administered in the inclusive class setting yielded a Cronbach alpha value of 0.921.

Statistical Analysis

Data analysis was conducted using SPSS version 26 (IBM, Armonk, NY, USA). Descriptive statistics were first calculated to summarize the demographic characteristics of the participants. The primary analysis involved comparing self-efficacy scores between the regular class and the inclusive class using paired sample t-tests to determine if there was a significant difference. The significance level was set at $p < 0.05$.

- H0: $\mu D=0$
- Ha: $\mu D\neq 0$

H0: There is no significant difference in the self-efficacy levels of pre-service professional students for physical education learning in regular and inclusive classes.

Ha: There is a significant difference in the self-efficacy levels of pre-service professional students for physical education learning in regular and inclusive classes.

We can conclude if our null hypothesis *H0: $\mu D=0$*, should be rejected or retained by observing the p-value in the Paired Samples T Test table, if the p-value is less than .05 then we reject the null hypothesis but if p-value is >.05, then we retain the null hypothesis.

Ethical Considerations

This study was conducted following the ethical standards of the responsible institutional committee on human experimentation and in accordance with the 2008 revision of the Helsinki Declaration. Ethical approval was obtained from the Local Ethical Committee of the university. Participants' confidentiality was strictly maintained throughout the study, and no identifying information was collected.

RESULTS

Prerequisite Test

The prerequisite test for normality was carried out and the findings indicated that all data is normally distributed because the sig value is more than 0.05. According to the Kolmogorov-Smirnov criterion, the level of self-efficacy of pre-service students in regular class physical education learning is 0.66. Pre-service students in inclusive class physical education learning have a self-efficacy rating of 0.20. The outcomes can be looked at in the table below.

Table 1. *Normality Test*

	Kolmogorov-Smirnov[a]		
	Statistic	df	Sig.
TotalSelfEfficacyReg	.1	62	.06
TotalSelfEfficacyInc	.1	62	.20

Paired T Test

Data analysis using the Paired T Test yielded a sig value of 0.00. This score can be regarded as indicating a significant difference in pre-service students' self-efficacy in regular class physical education learning versus inclusive class physical education learning. According to statistical results, the mean level of self-efficacy in the regular class is 49.37, whereas in the inclusive class it is 44.03. These findings show that the mean level of self-efficacy in the normal class is higher than in the inclusive class. The results can be explained in the following table 2&3:

Table 2. *Paired T Test*

		t	df	Sig. (2-tailed)		Effect Size
Pair 1	SelfEfficacyReg - SelfEfficacyInc	7.46	61	.00	Cohen's d	0.809

Table 3. *Paired Samples Statistics*

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	SelfEfficacyReg	49.37	62	5.85	.74
	SelfEfficacyInc	44.03	62	7.27	.92

The p-value in the Paired T Test table is 0.00, which is less than the standard significance level of 0.05. if the p-value is less than .05 then we reject the null hypothesis but if p-value is >.05, then we retain the null hypothesis, it provides strong evidence to reject the null hypothesis (H0). By rejecting the null hypothesis, we conclude that there is a significant difference in pre-service students' self-efficacy for physical education learning between regular and inclusive classes. The difference is in favor of the regular class, as the mean self-efficacy in regular classes (49.37) is higher than in inclusive classes (44.03), as indicated by the mean difference of 5.33. The findings also show that there is a difference in self-efficacy of prospective teachers in the learning process between regular classes compared to inclusive classes, t (62) = 7.46, p = 0.00, Cohen's d = 0.80. Self-Efficacy of prospective teachers in the learning process between regular classes (M = 49.37, SD = 5.85) compared to inclusive classes (M = 44.03, SD = 7.27). Based on the Cohen's d value (0.80), the difference is included in the high criteria.

DISCUSSION

The findings of this study show that there is a significant difference in pre-service students' self-efficacy in regular class physical education learning versus inclusive class physical education learning. Based on statistical findings, it is obvious that the level of self-efficacy in inclusive classes is lower than in regular classes. These findings are comparable to those of study (Cipkin & Rizza, 2003), which discovered that instructors with special education (PLB) or general education backgroundsoften prefer to work in general education settings rather than inclusive ones. As a result, inclusive learning environments rely heavily on teachers' motivation to achieve positive student learning outcomes. Limitations of self-confidence were also highlighted in a study of 180 international teachers who work with autistic students (Baek et al., 2024). The findings of this study indicates a strong desire to make accommodations in classrooms for autistic students; however, there is a notable lack of confidence in doing so. According to the study's findings, physical education teachers in various other nations are equally hesitant to educate students with disabilities (Hodge et al., 2009)Japan, the US and Puerto Rico. The research method was explanatory multiple-case study situated in the theory of planned behaviour. The primary data sources were attitude surveys and interviews. Survey data were analysed with descriptive statistics and the interview data were analysed using a constant comparative method. Results indicate that the teachers' beliefs tended to vary on inclusion and teaching students with disabilities. Paradoxically, they expressed compelling intrinsic motives while voicing a multiplicity of concerns on teaching students with disabilities. They all desired greater opportunities for relevant professional development, which should be made available more frequently by school districts. © 2009 Taylor & Francis.»,»author»:[{«dropping-particle»:»»,»family»:»Hodge»,»given»:»Samuel»,»non-dropping-particle»:»»,»parse-names»:false,»suffix»:»»},{«dropping-particle»:»»,»family»:»Ammahb»,»given»:»Jonathan O.A.»,»non-dropping-particle»:»»,»parse-names»:false,»suffix»:»»},{«dropping-particle»:»»,»family»:»Casebolt»,»given»:»Kevin M.»,»non-dropping-particle»:»»,»parse-names»:false,»suffix»:»»},{«dropping-particle»:»»,»family»:»LaMaster»,»given»:»Kathryn»,»non-dropping-particle»:»»,»parse-names»:false,»suffix»:»»},{«dropping-particle»:»»,»family»:»Hersman»,»given»:»Bethany»,»non-dropping-particle»:»»,»parse-names»:false,»suffix»:»»},{«dropping-particle»:»»,»family»:»Samalot-Rivera»,»given»:»Amaury»,»non-dropping-particle»:»»,»parse-names»:false,»suffix»:»»},{«dropping-particle»:»»,»family»:»Sato»,»given»:»Takahiro»,»non-dropping-particle»:»»,»parse-names»:false,»suffix»:»»}],»container-title»:»International Journal of Disability, Development and Education»,»id»:»ITEM-1»,»issue»:»4»,»issued»:{«date-parts»:[[«2009»]]},»page»:»401-419»,»title»:»A diversity of voices: Physical education teachers' beliefs about inclusion and teaching students with disabilities»,»type»:»article-journal»,»volume»:»56»},»uris»:[«http://www.mendeley.com/documents/?uuid=ba9c75b5-dca3-40e5-8c32-3a75a66552cd»]}],»mendeley»:{«formattedCitation»:

»(Hodge et al., 2009. This finding is in line with earlier research, which found that physical education teachers are unprepared or lack understanding about adapting students who have disabilities in physical education (Qi et al., 2017) this study examined the perceptions of Hong Kong physical education (PE. A study conducted in Malaysia by (Bari et al., 2011) found that Physical Education teachers are less skilled in offering inclusive Physical Education. According to research findings, most Sri Lanka Physical Education teachers are hesitant to include children with disabilities in their regular Physical Education lessons (Nanayakkara, 2022).

Several factors can affect prospective teachers' self-efficacy in inclusive educational settings. One key factor of self-efficacy in inclusive classes is a lack of direct experience working with students with special needs. This remark is confirmed by research findings, which reveal that those with minimal experience show poorer self-efficacy than those with special education teaching experience (Baek et al., 2024). Consistent statements indicate that contact with people with disabilities has an impact (Wray et al., 2022). A comparable study found that the more pre-service physical education teachers engage with students with disabilities, the more likely they are to acquire attitudes and self-efficacy for inclusive physical education (Braksiek, 2022). Emotional intelligence is another factor that can influence prospective physical education teachers' self-efficacy in inclusive classrooms. Emotional intelligence also influences teachers' self-efficacy for inclusive practices, particularly when adjusting instruction for children with disabilities (Voulgaraki et al., 2023)obviating social inequalities and reducing social exclusion. In the direction of equal opportunities, empowerment and social inclusion, the emotional intelligence and emotional literacy of teachers plays a decisive factor. The study investigated the relationship between physical education teachers' emotional intelligence and their self-efficacy, regarding the inclusion of students with physical, sensory and intellectual disabilities. One hundred and fifty physical education (PE. Other elements influencing PE teachers' self-efficacy include their capacity to supervise students, time and space constraints, and institutional support (das Neves Salles et al., 2020). Further research is needed to identify additional elements that impact self-efficacy in inclusive physical education settings.

Self-efficacy is a key aspect in improving the physical education learning process in inclusive classrooms as it directly impacts teaching practices and can benefit students (Wray et al., 2022). Self-efficacy in teaching planning has been found to explain the majority of the variation in behavior (das Neves Salles et al., 2020). This conclusion is backed by study on 96 teachers, which found that self-efficacy influences attitudes toward inclusive education in Mataram City (Fitriatun, 2016). According to general education research, teacher self-efficacy improves student academic accomplishment (shahzad, khurram; Naureen, 2017). Self-efficacy and self-esteem have a significant impact on an individual's success and failure. They influence a person's attempts to achieve their objectives. People with high self-efficacy are more likely to attempt an activity than those with low self-efficacy (Kevin, 2020).

The low self-efficacy of prospective physical education teachers in inclusive physical education has a number of negative implications. According to research, teacher self-efficacy is a stronger predictor of burnout than well-being (An & Tao, 2024). The same study found that teachers who have stronger self-efficacy and promote a student-centered approach experience less burnout (Friesen et al., 2023). Similarly, research involving 400 teachers revealed a significant direct relationship between self-efficacy and burnout (Chen et al., 2024)»ISSN»:»18736297»,»abstrac t»:»Considering the essential role of teachers and their characteristics in language education, their emotions are the main focus of recent studies. Emotions such as burnout which usually happens due to stress, can hinder their career progress so it needs to be addressed as it affects both learners and teachers respectively. Another construct is self-efficacy which contemplates the teachers' confidence in their aptitudes and it may reduce the probability of burnout and prevent job stress. Also, Emotional intelligence (EI. According to research findings, self-efficacy influences the connection between burnout attitudes and personal achievement characteristics (Vieira et al., 2024). Educators who experience burnout tend to manifest a tendency to view themselves negatively, harbor beliefs about their inability to carry out their important tasks competently, and experience pessimistic affection towards their students and/or colleagues (Zhang et al., 2022)numerous studies have investigated antecedents of teacher burnout in order to provide recommendations to alleviate it. Although the studies pay attention to either the role of environmental factors, such as school culture, or individual factors, such as gender, in contributing to teacher burnout, they less frequently examine how teacher burnout is concurrently influenced by both factors. Thus, this study aims to understand the relationship between clan culture and burnout by examining the mediation effect of emotional labor and the moderating effect of gender. A sample of 467 primary and secondary schoolteachers from China participated in this study. The result demonstrated the following: (1.

Increasing the self-efficacy of aspiring physical education teachers in inclusive classrooms requires a special focus. Self-efficacy can be developed by arranging inclusive physical education training conducted by relevant parties. Knowledge of inclusive education policy boosts teachers' self-efficacy beliefs (Wray et al., 2022). Several research findings included examples of training to promote self-efficacy. Research found that pre-service teachers' self-efficacy in inclusive learning rose after taking in e-learning supplements (Kwon & Block, 2017). Similar improvements explain how brief online interventions boost teacher self-efficacy in educating autistic students (Baek et al., 2024). Furthermore, the infusion-based model is is recommended for teacher education programs, as it has been demonstrated to effectively prepare physical education teachers for inclusive education (Healy et al., 2016). This model demonstrates that all disability ideas are interwoven throughout the curriculum, so that pre-service and in-service instructors build capabilities to educate students with disabilities, as well as a positive attitude.

Teacher Professional Education is designed to generate teacher candidates who are well-prepared and confident in handling inclusive physical education classrooms. The Pre-Service Teacher Professional Education Program represents a significant advancement in educating potential certified professional teachers (Arifa & Prayitno, 2019) secondary and early age levels must have competencies and qualifications that meet national education standards. The Pre-service Teacher Professional Education Programs is a breakthrough to prepare certified professional teacher candidates. Teacher's requirements for academic qualifications are at least bachelor and must also have an educator certificate obtained through a certification program. With the end of certification through Teacher Professional Education and Training Programs, the entire certification process is taken through Teacher Professional Education Programs. This study uses a qualitative approach with library research method to find out ways in which the Pre-service Teacher Professional Education Programs policy meet the needs of professional teachers in Indonesia. In the implementation of Pre-service Teacher Professional Education Programs, there are still some challenges, namely: (1. Sports teacher training programs, when developed properly and attentively, can be an important road to meaningful inclusive sports classes (Suryobroto et al., 2022). The literature has established the role of teacher training programs in fostering teacher attitudes towards inclusive education (Braksiek, 2022). In terms of the impact of prospective teachers' poor self-efficacy in inclusive physical education, greater attention should be directed to addressing this issue. Models and curricula for physical education teacher professional education might incorporate numerous models as well as relevant research findings, as stated in the preceding paragraph. The pre-service physical education teacher education curriculum should prioritize increasing potential teachers' awareness of inclusive education and providing hands-on experience with students with special needs.

CONCLUSIONS

This study shows that there is a substantial difference in pre-graduate students' self-efficacy for learning in regular classes versus learning in inclusive classes. Inclusive classes had lower self-efficacy for learning than regular classes. In the era of equitable education without student differentiation, prospective teachers play a crucial role in managing learning for students with special needs. The findings of this study can be utilized to support the need for solutions to improve teacher self-efficacy in physical education learning in inclusive classes. Policymakers should create more opportunities for pre-service students to participate in inclusive classes through curriculum designs, learning methodologies, and other relevant approaches. It is also hoped that the findings of this study will serve as the foundation for future research into the elements that influence prospective teachers' self-efficacy in dealing with physical education in inclusive classes.

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The effect of tabata circuit training on weight loss and body fat percentage

Danny Eka Wahyu Saputra[1], Sigit Nugroho[2], Putriana Damayanty[2], Puji Asmawati[3]
[1]Department of Sports and Health, Faculty of Vocational Studies, Universitas Negeri Yogyakarta, Indonesia,
[2]Department of Sports Science, Faculty of Sports and Health Sciences, Universitas Negeri Yogyakarta, Indonesia,
[3]Department of Godean Health Centre 1, Sleman District Health Office, Yogyakarta, Indonesia

Correspondence:
Danny Eka Wahyu Saputra, Department of Sports and Health, Faculty of Vocational Studies, Universitas Negeri Yogyakarta, Indonesia, dannyeka@uny.ac.id

Abstract: *A shift in lifestyle from active to passive movement and limited time for exercise as well as a lack of public knowledge about exercise programs are obstacles to achieving a successful exercise program. The aim of this research is to determine the effect of Tabata Circuit Training on weight loss and body fat percentage of Perigon Fitness Studio Yogyakarta members. This research is an experimental research with instruments in the form of measurement tests, namely measuring body weight with a body scale, measuring body fat with a skinfold caliper. The population in this study were all members of Perigon Fitness Studio Yogyakarta who took part in the Tabata Circuit Training training program from February to March 2020, totaling 58 people. The research sample used was 18 people taken using purposive sampling technique. The data analysis technique uses the t test (paired sample t test) at a significance level of 0.05. The results of this study show that the results obtained were a reduction in body weight of 2.83% and a reduction in body fat of 6.14%. These findings suggest that Tabata circuit training is an effective intervention for reducing body composition. However, further research is needed to explore the long-term effects, potential individual variations, and the role of additional factors such as diet and exercise adherence.*

Keywords: *weight, body fat, tabata circuit training.*

INTRODUCTION

The rapid development of science and technology in this era has spurred society to adapt to changes, especially in increasingly busy and practical lifestyles. Automation in various aspects of daily life, such as transportation and food delivery services, has had a significant impact on people's physical activity. This phenomenon causes a lack of physical activity, which in turn can cause health problems such as overweight or obesity. According to (Friedman & Wallace, 2023; Kadir, 2015; Marpaung & Sari, 2022) Obesity is a condition in which excess body fat accumulates, endangering health and increasing the risk of various diseases, including cardiovascular disease, metabolic syndrome and insulin resistance. The 2018 Riskesdas results show an increase in obesity rates in Indonesia, reaching 21.8%, compared to 14.8% in 2013. This indicates the need for public awareness to adopt a healthy lifestyle, including exercise, in order to maintain body health and prevent an increase in obesity rates.

Sport is an effective form of physical activity to maintain body fitness (Da Silva et al., 2022; Sax van der Weyden et al., 2022; Scoubeau et al., 2023). Aerobic exercise, as explained by Akmarawita (2015), can improve physical fitness and burn fat, helping a person maintain an ideal body weight. Apart from that, weight training also provides significant benefits, such as increasing muscle strength and weight control (Nasrulloh, 2018). One interesting exercise method to research is High Intensity Interval Training (HIIT), as explained by (Permatasari, D., Purnawati, S., Imron, M. A., Satriyasa, B. K., Adiputra & Sugijanto, 2017) and (Vidiari J & Indira, 2017). HIIT is a combination of high-intensity exercise with rest periods, known to be effective in burning calories and increasing muscle oxidative capacity. Tabata training, as a form of HIIT, offers short but intensive training sessions with the potential for significant weight loss (Pearson, S.J., Macaluso, A., & Hussain, 2015). The effects of physical exercise therapy on weight control: its regulation of adipocyte physiology and metabolic capacity (Hyun Jung Park et al., 2023), Effect of Tabata training program on body fat reduction in healthy inactive women (Ljubojević et al., 2023) explain that Tabata training exercise program (4 months) is beneficial for reducing body fat in healthy inactive women.

While the studies mentioned demonstrate that exercise, particularly HIIT and Tabata, is effective in weight management, there are several limitations that should be considered. Some studies may have had a limited sample size

and lacked diversity, making it difficult to generalize the results to all populations. Additionally, the relatively short duration of the studies and a lack of attention to other factors such as diet and lifestyle may limit the conclusions that can be drawn. Furthermore, the focus of the research is often limited to weight loss, while other benefits of exercise such as mental and cardiovascular health are underemphasized. To gain a more comprehensive understanding, further research with stronger designs and longer durations is needed.

This research will focus on the effect of Tabata circuit training on weight loss and body fat percentage in members of Perigon Fitness Studio Yogyakarta. This fitness center offers various classes using this exercise method, but the exact impact it has on the body condition of the participants is not yet known (Baifa et al., 2023; Kusparlina et al., 2023; Youcef et al., 2022). Therefore, it is hoped that this research can contribute to understanding the effectiveness of Tabata circuit training as a method for treating overweight among people who actively exercise.

MATERIALS AND METHODS

Research Participants

This study was an experimental study using a one-group pretest-posttest design. This design was carried out by giving a pretest (initial measurement), then providing the treatment, and finally conducting a posttest (final measurement). This study was conducted at Perigon Fitness Studio Yogyakarta for 1 month, from February to March 2020.

The population in this study were all members of Perigon Fitness Studio Yogyakarta who participated in the Tabata Circuit Training program, totaling 58 people. The sampling technique used was purposive sampling, with the criteria: (1) female, (2) aged 18-35 years, (3) having overweight nutritional status (BMI 25-29.9 kg/m2), (4) willing to be a research respondent. The number of samples that met the criteria was 18 people.

Research variable

The independent variable in this study is Tabata Circuit Training, Tabata Circuit Training is a high-intensity interval training method consisting of 8 exercise stations with a work-to-rest ratio of 20 seconds and 10 seconds of rest, repeated for 4 minutes. The movements used include: jumping jack, push-up, sit-up, lunge, dumbbell rows, squat, mountain climber, sumo squat. Body weight is the body measurement weighed in a clothed state without any equipment, measured in kilograms (kg). Percentage of body fat is the amount of fat contained in the body, measured using a skinfold caliper, expressed as a percentage (%).

Research methods

In this research, the type of research used was experimental (quasi-experimental) with One Group Pre-test and Post-test Design, namely an experiment carried out on one group only without a comparison group being treated. Pretest and posttest design is a technique to determine the effects before and after giving treatment.

The data analysis technique used in this study was the t-test (paired sample t-test). The paired sample t-test was used to determine the effect of Tabata Circuit Training on reducing body weight and body fat percentage. The steps in the data analysis are as follows:

Normality Test

Before conducting the hypothesis test, the researcher first tested the normality of the data using the Shapiro-Wilk test. This test was conducted to determine whether the data were normally distributed or not.

Homogeneity Test

After the normality test, the researcher conducted a homogeneity test using Levene's test. This test was carried out to determine whether the variance of the data was homogeneous or not.

Hypothesis Test

After the normality and homogeneity tests were carried out and the data were found to be normally distributed and homogeneous, the researcher conducted a hypothesis test using the paired sample t-test.

The paired sample t-test was used to determine the effect of Tabata Circuit Training on reducing body weight and body fat percentage. This test was conducted by comparing the pretest and posttest data of the study participants. The hypothesis testing was carried out at a significance level of 0.05 ($\alpha = 0.05$). If the p-value obtained from the paired sample t-test was less than the significance level ($p < 0.05$), it was concluded that there was a significant effect

of Tabata Circuit Training on reducing body weight and body fat percentage. The data analysis was performed using SPSS (Statistical Package for the Social Sciences) software version 25.0.

In summary, the data processing method in this study involved normality and homogeneity tests, followed by hypothesis testing using the paired sample t-test at a significance level of 0.05 to determine the effect of Tabata Circuit Training on reducing body weight and body fat percentage.

RESULTS

This research aims to determine the effect of tabata circuit training on weight and body fat reduction in Perigon Fitness Studio Members. The results of pretest and posttest research on body weight results that have been given the Tabata circuit training method are as follows:

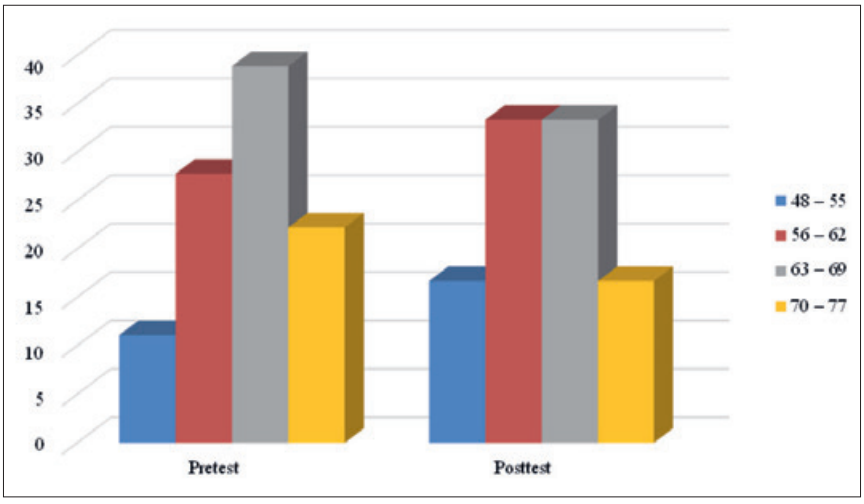

Figure 1. *Diagram of Pretest and Posttest Body Weight Research Results*

Based on the graph above, it can be seen that there is a difference in body weight in columns 3 and 4. The frequency in the pretest column 3 (38.89%) decreased to (33.33%) in the posttest and in the pretest in column 4 (22, 22%) decreased to frequency in the posttest (16.67%).

Based on the statistical results of the research results, the results showed that the influence of Tabata Circuit Training on body weight among Perigon Fitness Studio Members was obtained by the mean (mean) pretest = 64.86 and the mean (mean) posttest = 63.02. Thus, calculating the percentage increase is done in the following way:

$$\text{Percentage increase} = \frac{\textit{Mean difference}}{\textit{Pretest mean}} \text{ X } 100\%$$

$$\text{Percentage increase} = \frac{1.84}{64.86} \text{ X } 100\%$$

Percentage increase = 2.83%

Based on the results of the calculations above, it can be interpreted that the influence of Tabata Circuit Training on body weight among Perigon Fitness Studio Members has decreased by 2.83%.

When measuring body fat, the results of the pretest and posttest body fat percentage were as follows:

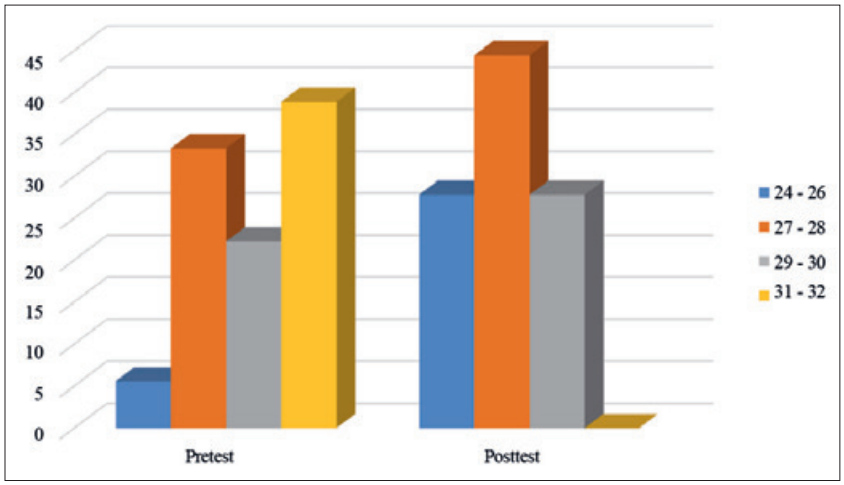

Figure 2. *Diagram of Pretest and Posttest Body Fat Research Results*

After displaying it in diagram form, it can be seen that there is a difference in body fat in columns 2 and 4. In the pretest frequency in column 2 (33.33%) it increases to (44.44%) in the posttest, and while the frequency in the pretest results in column 4 (38.89%) it drops to 0% frequency in the posttest category.

The influence of the Tabata Circuit Training exercise model on body fat among Perigon Fitness Studio Members obtained a mean (mean) pretest value = 29.60% and a mean (mean) posttest = 27.77%. Thus, calculating the percentage increase is done in the following way:

$$\text{Percentage increase} = \frac{\textit{Mean difference}}{\textit{Pretest mean}} \times 100\%$$

$$\text{Percentage increase} = \frac{1.82}{29.60} \times 100\%$$

Percentage increase = 6.14 %

Based on the results of the calculations above, it can be interpreted that the influence of Tabata Circuit Training on body fat among Perigon Fitness Studio Members has decreased by 6.14%.

Hypothesis testing was carried out to determine the effect of Tabata circuit training on weight loss and body fat percentage in Perigon Fitness Studio Members. Hypothesis testing used the t test (paired sample t test).

Based on the results of the t test on the body weight of Perigon Fitness Studio Members, it was obtained that the calculated t value was (8.352) > t table (2.109), and the p value (0.000) was <0.05. Meanwhile, the results of the t test on the body fat of Perigon Futness Studio Members obtained a calculated t value (15.772) > t table (2.109), and a p value (0.000) < 0.05. Based on these results, it can be interpreted that there is a significant influence of the Tabata Circuit training method on weight loss and body fat percentage among Perigon Fitness Studio Members.

DISCUSSION

This study aimed to investigate the effect of Tabata circuit training on reducing body weight and body fat percentage in Perigon Fitness Studio members (Campo et al., 2021). The results showed a 2.83% decrease in body weight and a 6.14% decrease in body fat percentage among the participants. Compared to previous studies, Tabata circuit training in this research proved to be more effective in reducing body weight and body fat percentage. This is evidenced by a p-value of 0.000 (p<0.05), indicating highly statistically significant results (Aliberti et al., 2021). As stated by Maillard et al. (2017), high-intensity circuit training is effective in reducing fat levels and body weight.

"Tabata training is a type of HIIT exercise with a working time of 20 seconds and a rest time of 10 seconds consisting of 10 movements (sets) performed 4 times (Popowczak et al., 2022)." Tabata training engages the entire body and muscles in each movement, not just focusing on specific muscles as in conventional resistance training (Saputra et al., 2023). Tabata circuit training focuses on overall performance training and provides resistance and exercises for all muscle groups, making it more effective in increasing fat oxidation and reducing waist circumference (Ramírez-marrero et al., 2014). The combination of HIIT and resistance training in the Tabata circuit training program has been proven effective in improving muscle strength and endurance, as well as cardiovascular fitness (Susanто et al., 2022).

As stated in previous research, Tabata circuit training has been shown to be effective in improving biochemical and physical parameters in women with obesity (Palaniit et al., 2017). This study demonstrated significant improvements in lipid profile, body mass index, and cardiovascular endurance after the Tabata training program. Additionally, Macura et al. (2015) reported that Tabata circuit training can increase muscle strength and flexibility in a group of women. These improvements in physical capacity can contribute to more effective reductions in body weight and body fat percentage.

Regarding variations in the training protocol, Andersson-Karlöw et al. (2021) found that differences in the duration and intensity of Tabata training did not significantly affect the results of body weight and body composition reduction. This indicates that Tabata training remains effective within a range of different protocols, as long as the principles of HIIT are maintained. Based on the research findings, the decrease in body fat percentage (6.14%) was greater than the decrease in body weight (2.83%). This can be explained by the fact that Tabata circuit training not only reduces body fat but also can increase muscle mass. Body weight is not only determined by body fat, but also influenced by bone mass, muscle, and other bodily organs (Donnelly et al., 2009).

Thus, Tabata circuit training has been shown to be effective in reducing body weight and body fat percentage. The difference in the effectiveness of Tabata circuit training in this study compared to previous research may be due to differences in the sample, duration, and training protocols used (Gibala & McGee, 2008). Nevertheless, Tabata circuit training has the advantage of training the entire body intensively in a relatively short time. This makes the training more practical and can be recommended as an alternative training program for reducing body weight and body fat percentage (Boutcher, 2011). Furthermore, the combination of HIIT and resistance training in the Tabata circuit training program also provides other benefits, such as increased muscle strength and endurance, as well as cardiovascular fitness (Gibala et al., 2012). Therefore, Tabata circuit training can be an effective and efficient choice for individuals aiming to achieve their goals of reducing body weight and body fat percentage.

In its implementation, it is necessary to adjust the intensity, duration, and frequency of training according to the individual's abilities and physical condition (Tabata et al., 1996). Additionally, the support of a healthy lifestyle, such as a balanced diet, is also crucial to the success of the body weight and body fat percentage reduction program (Donnelly & Smith, 2005). Overall, the results of this study indicate that Tabata circuit training can be an effective alternative training program for reducing body weight and body fat percentage. Further research is needed to explore more deeply the physiological mechanisms and factors that influence the effectiveness of Tabata circuit training in the context of body weight and body fat percentage reduction.

CONCLUSION

This study demonstrated that Tabata circuit training is an effective exercise program for reducing body weight and body fat percentage in members of Perigon Fitness Studio. The results showed statistically significant decreases in both body weight (2.83%) and body fat percentage (6.14%). The combination of high-intensity interval training (HIIT) and resistance training in the Tabata circuit training program proved to be more effective than previous studies. This is likely due to the comprehensive nature of the training, which engages the entire body and targets multiple muscle groups simultaneously.

Based on the findings, Tabata circuit training can be recommended as an efficient and practical exercise option for individuals seeking to lose weight and reduce body fat. The time-efficient nature of the training, with just 20 minutes per session, makes it a convenient choice for those with busy schedules. To maximize the effectiveness of Tabata circuit training, it is important to personalize the intensity, duration, and frequency of the training based on each individual's fitness level and physical condition. Additionally, a balanced diet and overall healthy lifestyle should be supported to complement the exercise program and achieve sustainable weight management. While this

study provided valuable insights, there are some limitations that should be considered. The sample size was relatively small, and the study was conducted within a specific fitness studio setting. Expanding the research to a larger and more diverse population could provide additional insights into the broader applicability of Tabata circuit training.

Furthermore, future studies could explore the long-term effects of Tabata circuit training, as well as investigate the underlying physiological mechanisms that contribute to the observed reductions in body weight and body fat percentage. Incorporating objective measures of body composition, such as dual-energy X-ray absorptiometry (DEXA) scans, could also provide a more comprehensive assessment of the training's impact. Overall, the findings of this study suggest that Tabata circuit training is a highly effective exercise program for reducing body weight and body fat percentage. With its efficient and comprehensive approach, Tabata training can be a valuable addition to the toolkit of fitness professionals and individuals seeking to improve their overall health and fitness.

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The Effects of Adapted Physical Exercise on Gross Motor Function and Motor Abilities in Child With Multiple Disabilities

Doris Molnar[1], Romana Romanov[1], Zoran Milić[2]
[1]Faculty of Sports and Psychology Novi Sad, University Educons, Republic of Serbia
[2]Faculty of Education, Sremska Kamenica, University Educons, Republic of Serbia

Correspondence:
Zoran Milić, Faculty of Education, Sremska Kamenica, University Educons, Republic of Serbia
zoranmilic@yahoo.com

Abstract: *This case study aims to determine the effects of adapted physical exercise on gross motor function and motor abilities in a child with multiple disabilities. The subject is a 12-year-old boy diagnosed with a multiple disabilities with limitations identified within physical, mental and sensory integrity. The applied experimental treatment, defined according to his needs and abilities, consisted of an exercise program implemented for 4 months, twice a week for 45 minutes and is programmed with the aim of myofascial relaxation, passive stretching, corrective-compensatory effects and the development of gross motor skills and strength. The instruments used to test the initial and final state are the clinical test for assessing the gross motor function of children with cerebral palsy "GMFM-Gross motor functional movement measure-88" and the Eurofit battery test for assessing motor abilities. Variables based on a specific group of GMFM test items indicate that the gross motor function assessed at the final measurement were improved by 6% compared to the initial measurement. In the measured variables of the Eurofit battery test, positive changes in the results were achieved in the standing broad jump, sit and reach, plate tapping, sit ups in 30 seconds, while the result of the bent arm hang test remained unchanged. The results in this study suggest that the application of the experimental program had a positive effect on the motor abilities and gross motor function of child with multiple disabilities.*

Keywords: *adapted physical exercise, multiple disabilties, cerebral palsy, gross motor function.*

INTRODUCTION

UNICEF data (2021) indicates that around 240 million children globally have a developmental disability, emphasizing the need to address this issue and provide support through a multidisciplinary approach. From the perspective of the kinesiology field, one form of support can be provided through adapted physical activity programs. The term "developmental disability" refers to the limitation of the opportunity to participate in the community life of a typical population under the same conditions as other members of that community, impacting physical, mental, sensory, speech-language, and socio-emotional functions and behavior. When a child is affected by the combined impact of two or more disabilities on their functional status (Rapaić, 2016), it is referred to as multiple disabilities (MD). The presence of difficulties including speech, learning, compromised mental and physical integrity, sensory impairments, and challenges with behavior and social skills, along with several associated disorders, infers cerebral palsy as a contributing factor to multiple disabilities in children (Milićević, 2016). Cerebral palsy (CP) is a term used to describe a non-progressive group of disorders resulting from permanent damage during the prenatal, natal, or early postnatal period to the white and gray matter of the cerebrum, basal ganglia, cerebellum, and brain stem (Romanov, 2020). Characteristics of CP visible in accordance with the kinesiology status are the presence of paralysis or paresis, involuntary movements, impairment of intellectual integrity, epilepsy (Rapaić, 2016), reduced mobility due to impairment of muscle tone, muscle atrophy or hypertrophy, ataxia, loss of elasticity of ligaments and tendons, shortening of spastic muscles. Due to various limitations, the quality of life of children with MD, primarily CP, greatly relies on societal support. Adapted physical exercise (APE) plays a significant role in improving motor status and enhancing psycho-social abilities, offering children with developmental disabilities opportunities for advancement (Mensch et al., 2019; Salapura, 2018). This study aims to determine the effects of APE on motor abilities and gross motor function in a child with MD.

Research Design

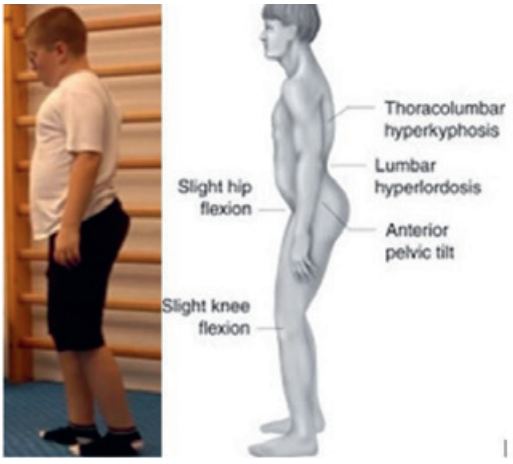
This experimental research was carried out using a case study method, involving data collection at two distinct time points.

Case description

The subject is a 12-year-old boy with multiple disabilities, primarily cerebral palsy. According to the "Gross Motor Function Classification System" his impairment is graded as GMFCS II-second level. Aside from physical education classes, he has never had additional programmed physical activity. The subject's parents confirmed their child's participation in the research through written consent.

The primary diagnosis of the subject includes multiple disabilities, encompassing:

- Cerebral palsy - non-specific G809,
- Impairment of intellectual integrity, categorized as "moderate intellectual disability F71.1" according to the "International Classification of Diseases" (ICD-10, Version: 2019),
- Visual impairment- Hyperopia (+2.0 and +9.5); binocular vision disorder; Horizontal Nystagmus; Torticollis (ocular torticollis); Mixed astigmatism,
- Obesity due to excess calories E66.



Picture 1: *Characteristics of the Lower Cross syndrome according to Professor Janda's approach in participant*

In the subject's postural status, characteristics of scoliosis, lumbar lordosis and pes planus are visible. His locomotor pattern aligns with individuals diagnosed with Lower Cross Syndrome (Picture 1), as outlined by Professor Janda V. (Page et al., 2010).

Experimental treatment

The experimental program is a form of APE, structured according to the findings of initial assessments. The treatment lasted for 4 months, with one session conducted twice a week for 45 minutes each. Each training session began with myofascial relaxation, followed by walking with gradually increasing intensity, warm-up and corrective exercises. The exercises in the main part of the training, which varied by the level of assistance provided, adaptation, and intensity are presented in Table 1.

Table 1. *Exercise plan (4 months)*

Exercise	1st month	2nd month	3rd month	4th month
Maintaining balance on unstable surface	Until falling	Until falling	-	-
Walking between lines separated by 20cm	x10 times	x10 times	-	-
Walking between lines separated by 10cm	-	-	x10 times	-
Walking on short beam	-	-	-	x10 times
Placing the foot on 20cm stepper	10 times each leg, 3 sets	15 times each leg, 3 sets	-	-
Stepping up and down the stepper	-	-	8 times each leg, 3 sets	15 times each leg, 3 sets
Climbing up and down the stairs	-	-	-	10 steps up and down, 4 sets
Assisted squats	8x3 sets	10x3 sets	10x3 sets-no assistance	12x3 sets no assistance
Leg extensions	12x3 sets	15x3 sets	1kg weight, 12x3 sets	1kg weight, 15x3 sets
Adapted plank hold	5sec x 4 sets	8sec x 4 sets	10sec x4 sets	15sec x 4 sets
Modified push ups	-	-	5 x 3 sets	8 x 3 sets

Instruments

For the assessment of gross motor skills, the standardized clinical test for children with CP, „Gross Motor Function Measure-88 (GMFM-88)" was used. This battery consists of a total of 88 tests grouped into 5 variables based on body position: A-lying and rolling (17 tests); B-sitting (20 tests); C-crawling and kneeling (14 tests); D-standing (13 tests); E-walking, running, jumping (24 tests). To evaluate motor abilities, the standardized "Eurofit" test battery (Council of Europe, 1988) was used, which is valuable from the perspective of the kinesiology profession. This test is recommended for school-age children of typical development and is applicable to children with developmental disabilities that match the subject's profile (Golubović et al., 2012; Erol et al., 2022). For this study, 5 out of 8 tests were selected based on the participant's capabilities, focusing on assessments of speed and coordination of limb movement (plate tapping), flexibility (sit and reach), muscle strength and endurance (sit-up, bent arm hang), and explosive strength (standing broad jump). The results of these tests are expressed in measured units, specifically in centimeters, seconds, or the number of repetitions completed.

Data analysis

As this study followed a case study method, the collected data was analyzed across two time points and presented in both textual and tabular formats.

RESULTS

The overall GMFM-88 test score increased by 6%, and the results of the initial and final measurements, along with their differences, are presented in Figure 1. The figure illustrates a noticeable percentage variance between the two measurements across all assessed variables, except for variable A, which assesses the skill of lying and rolling (initial and final = 96.08%). The largest difference is identified in variable E, which increased by 11.11% after treatment. The values of variable B increased by 6.67%, variable C by 7.15%, and variable D by 5.12%.

The motor abilities tested by the Eurofit battery test are presented in Table 1. A difference between the two measurements was noted in all measured variables, except for the variable "bent arm hang".

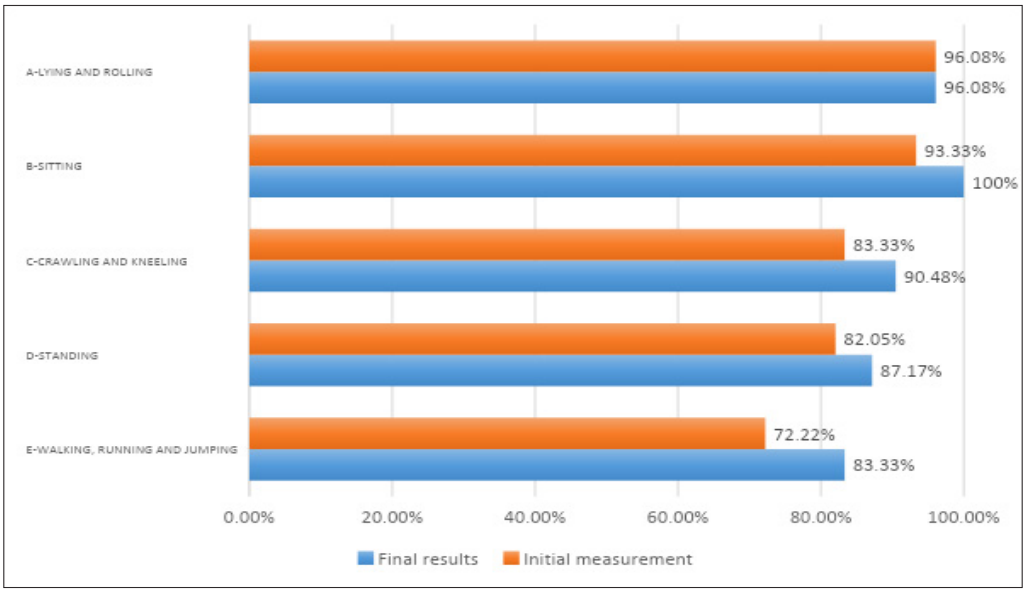


Figure 1. *Gross motor funtional measure „GMFM-88"- initial and final measurement*

Table 2. *Results of two measurements of the Eurofit battery test*

Test	Initial measurement	Final measurement
Standing broad jump	44.2 cm	67 cm
Plate tapping	16 rep	18 rep
Sit-ups	0 rep	7 rep
Bent arm hang	0 s	0 s
Sit-and-reach	-19 cm	-8 cm

cm-centimeters; rep-number of repetition; s-seconds

DISCUSSION

The purpose of this study was to determine the effects of this program based on APE, on gross motor function and motor abilities of child with MD, where CP is the primary condition. According to available literature, there are various programs of APE that can influence motor abilities and gross motor function in children experiencing similar impairments to the participant (Salapura, 2018; Kwon et al., 2015;). In this study, the primary focus was on an individualized approach, adapting the training process according to participant's needs, abilities and improvement, while changes were evident over the course of the study. Positive changes in gross motor function, observed in 4 out of 5 variables of the GMFM-88 test with an overall 6% increase, affirm previous findings that structured physical exercise influences gross motor functions, which is supported by Bhutia et al. (2015). In the study of Lee, Sung and Yoo (2008), it is noticed that it is not necessary to test the variables in participants with high level of functionality. In this study, a high level of functionality was identified for variable A, and significant differences in variables D and E were confirmed as in the previously mentioned study.

Enhanced outcomes in Variable B were noted specifically in trunk muscle strength, leading to improved gross motor function in transitioning from lying to sitting position. Based on the difference in results between the two measurements of Variable C, which assessed crawling and kneeling skills, there is a noticeable improvement. The participant's visual impairments, such as astigmatism affecting image distortion and orientation perception, result in difficulties in tasks such as crawling upstairs. In addition to foot and lower limb deformities, these impairments also affect the skills measured by variable D, which are related to maintaining balance while standing. The achieved benefit is significant, considering that CP is predominantly characterized by changes in the neuro-muscular status of the lower limbs, as confirmed by Dewer et al. (2015), which indicates poor postural control and static as well as dynamic balance.

People with CP encounter difficulties in everyday activities such as walking and stair climbing due to a combination of neuromuscular impairments, including spasticity, muscle weakness, decreased joint flexibility, and poor

coordination. These factors collectively impact their mobility and independence. Recognizing this, the program incorporated exercises aimed at developing core stability, with the goal of enhancing the nervous system's ability to respond to balance loss by activating trunk muscles for proprioceptive stimulation. This resulted in a significant outcome where the participant successfully accomplished independent climbing and descending stairs unaided (Picture 2), greatly enhancing his motor independence and facilitating daily tasks. The results of this study are consistent with the results of the Dodd, Taylor and Graham (2003) study, which indicate that the applied program of APE in the domain of muscle strength gave the best results for the variable E.

Picture 2. *Difference in climbing stairs with alternating steps between initial and final measurement*

For the evaluation of motor skills, an adapted version of the Eurofit test battery was used, encompassing tests applicable to subjects condition. The following motor skills were tested: plate tapping, standing broad jump, bent arm hang, sit and reach, and sit-ups. Even though abilities such as coordination and movement frequency were not targeted in this treatment, the results of "plate tapping" have improved. This test is well-suited for assessing coordination in individuals with the impairments that the subject has, as it does not require a high level of precision or comprehension. An example of this is a study that assessed upper extremity coordination in children with CP, which could not be used in this case due to the subject's visual impairment (Abdullah et al., 2014). Additionally, it is commonly used in kinesiology for children of typical development at subjects age. Coordination is commonly deficient in this population, due to brain damage causing disruptions in reflexes, which manifest as challenges in coordinating and integrating fundamental movement patterns (Winnick & Porretta, 2016, p. 517). The ability to perform the maximum range of motion, or flexibility, was also improved by the program, specifically through passive stretching during the warm-up and cool-down phases of the training. The application of muscle stretching is based on the assumption that it will increase muscle flexibility, preserve joint flexibility for efficient movement, and prevent or delay the need for orthopedic surgical interventions. The variable for assessing strong endurance of abdominal muscles, "sit-up," is another reflection of treatment effectiveness. Strength is an important aspect of normal motor functioning, which is deficient in individuals with CP, even in those at high functional levels, which may be due to disrupted neuronal mechanisms and changes in muscle tissue. In the past, strength training in individuals with CP was considered inadequate due to the belief that it would contribute to increased muscle tone and abnormal movement patterns. Today, strength training in individuals with CP is part of physical therapy and aims to address muscle weakness, balance, walking speed, and gross motor skilss (Merino-Andrés et al., 2022). The participant's capacity for strong endurance in the arms and shoulder area is not sufficiently developed under the influence of treatment for the participant to independently maintain the body in position for bent arm hang test. Tests of explosive strength, such as the standing broad jump, are rarely utilized in studies focusing on the motor abilities of children with CP. Still, they can complement testing by providing additional insights into motor function. Based on the final outcomes of the standing broad jump test within the Eurofit battery test and Variable E (walking, running, and jumping) from GMFM-88, it is evident that the treatment has positively influenced the explosive strength of the lower limbs. While

explosive strength is equally significant as maximum muscle strength for overall motor function, it is often overlooked in assessments, leading to a scarcity of literature on the subject. It is assumed it is not heavily emphasized because the primary goal of therapy for children with cerebral palsy is to improve motor functions necessary for daily activities.

CONCLUSION

The positive effects of the experimental program on gross motor function and motor abilities in subject are evident, particularly in standing, walking, jumping, and running (variable D and E), with notable improvements in stair climbing skills. This study confirms the findings of previous studies, it is not necessary to do a retest for variables in which the respondent shows a high level of functionality. The results of this case study can be a good basis for research that by its nature has a similar goal and would refer to a larger number of participants, where it would certainly be important to include a control group. Nevertheless, the results of this study can be used only for practical purposes as an example in which adapted physical exercise can be applied to a person with very similar conditions, ie locomotor skills in multiple disabilities.

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The Impact of Extracurricular Physical Activities on the Development of Motor Skills and anthropometric characteristics in 12 Year School Children

Fatmir Pireva[1], Shemsedin Vehapi[1], Ardita Pireva[2]
[1]Faculty of Physical Culture and Sport, AAB College, Prishtina; [2]Social Gymnasium "Ahmet Gashi", Prishtina

Correspondence:
Shemsedin Vehapi, Faculty of Physical Culture and Sport, AAB College, Prishtina
shemsedin.vehapi@universitetiaab.com

Abstract: *This study aims to establish differences in anthropometric characteristics and motor-basic skills between children who actively engage in sports outside of regular learning activities and those who are inactive. The study included 100 male children aged 12 years, from elementary school "TREPÇA" in Istog. Fifty of them are actively involved in different sports, while the other fifty are not active besides the school PE classes. The methods used to achieve the objectives of this study include descriptive statistical methods (measures of central tendency, distribution, and correlations), as well as the T-test method to confirm differences between the groups. The results were analysed using SPSS 20.0 software. In the anthropometric domain, statistically significant changes are observed in all variables except for thigh circumference, and these changes favour active children. Similarly, there are statistically significant changes in motor skills in all variables, except for the variable of standing long jump, again in favour of active children. Based on the anthropometric parameters, it can be concluded that the biological development and growth of these children are normal for their age. The distribution of results in anthropometric and motoric variables is normal, with slight asymmetry and predominantly positive values. After analyzing the results, it is clear that statistically significant changes were observed in most of the assessments conducted in this study. In the anthropometric domain, significant statistical differences were found in all variables except arm span. Likewise, in the basic motor skills domain, the active student group consistently outperformed their inactive peers in all tests, indicating higher proficiency levels among the active cohort.*

Keywords: *Extracurricular Activities, Physical development, Motor Skills, Differences.*

INTRODUCTION

With the advancement of modern technology, a decrease in the time spent by individuals engaging in various activities has been observed, allowing for more leisure time. However, this technology tends to make individuals more passive in its use, along with increased access to electronic devices. This passivity is also evident among primary school students, who often spend their free time passively, including watching television, playing video games, and using other technological devices. During this critical period of their development, physical activity is a key factor for healthy growth and development of children. Previous research unequivocally indicates that a high level of physical activity of children is closely related to a high level of motor skills (Fisher et al., 2005). Here are some of the positive effects of regular physical activity among them. Improved heart and blood vessel health, muscle, and bone growth improved mental health, maintenance of a healthy weight, improved cognitive intelligence, improved immune system, improved hormonal balance, improved social skills, prevention of chronic diseases, decreased risk of depression and anxiety (Burhaein, Tarigan, et al., 2021). The lack of necessary movement for the body can lead to limitations in basic motor skills and laziness. One of the main reasons for this laziness is the lack of activity and insufficient movement. However, with the increasing access to technology and the rise in the standard of living, there are also opportunities to encourage physical activities among children. Those who engage in free activities (such as sports or team games) meet their needs for movement and are more oriented towards healthy growth and development. To address this problem more systematically, a study has been conducted in a primary school, where a low level of motor skills was observed among students. The aim of the study is to prove the impact of extracurricular physical activity on the development of anthropometric characteristics which are related to the longitudinal factor and the circumference of the upper and lower extremities as well as explosive strength of legs and arms and speed of arm movement frequencies as important movement skills for the age of the students with whom the research was carried out.

Batričević (2008.) had made discriminative analysis of motor and functional abilities between sport active and inactive pupils and concluded that sportsmen are at a much higher level than non-sportsmen when it comes to explosive strength, sprint speed, vital lung capacity, systolic and diastolic arterial blood pressure, and that the difference between is statistically significant. According to the study by Ross, C. E., & Wu, C. L. (2011), there is a positive link between physical activity and academic performance in adolescents. They found that adolescents who were more engaged in physical activities had better academic outcomes compared to those with lower levels of physical activity.

Research Objective:

The aim of the study is to verify differences between groups of students actively participating in sports clubs and those who only attend regular physical education classes in school, in both motor and anthropometric spaces.

Sample of Participants:

The sample consists of 100 sixth-grade male students, aged 12 years ± 6 months from Kosova, from "Trepça" primary school in Istog municipality. Among them, 50 students of the same age participate in regular exercises in various sports, while the other 50 do not engage in any regular sports activities, except for 2 hours of physical education at school.

Sample of Variables:

Anthropometric Variables:

Body Weight: Kilograms (kg). Body weight is measured using a digital scale. The individual stands barefoot on the scale, with the weight evenly distributed between both feet.

Body Height: Centimeters (cm). Height is measured using a stadiometer. The individual stands straight with their back against the stadiometer or wall, heels together, and arms at their sides. The head is positioned so that the Frankfurt plane is parallel to the floor.

Length of the Arm: Centimeters (cm). Arm length is measured from the acromion (bony point on the shoulder) to the tip of the middle finger with the arm extended naturally by the side. A measuring tape is used for this.

Arm Span: Centimeters (cm). Arm span is measured by having the individual stand against a wall with their arms fully extended horizontally. The distance from the tip of one middle finger to the other middle finger is measured using a measuring tape or wall-mounted ruler.

Length of the Leg: Centimeters (cm). Leg length is measured from the top of the greater trochanter (hip bone) to the floor with the individual standing straight. A measuring tape is used to take this measurement on the outer side of the leg.

Thigh Circumference: Centimeters (cm). Thigh circumference is measured at the midpoint between the hip and the knee (often the largest part of the thigh) while standing with feet slightly apart. A flexible measuring tape is used to wrap around the thigh to obtain the measurement.

Calf Circumference: Centimeters (cm). Calf circumference is measured at the widest part of the calf muscle while the individual is standing with weight evenly distributed. A flexible measuring tape is used for this measurement.

Basic Motor Skills Variables:

Standing Long Jump: Centimeters (cm). The individual stands behind a marked line with feet shoulder-width apart. Without a running start, they jump as far forward as possible, landing on both feet. The distance from the starting line to the nearest point of contact on the landing (usually the heels) is measured using a measuring tape.

Standing High Jump: Centimeters (cm). The individual stands next to a vertical measuring device (wall-mounted ruler). They jump from a standing position and reach upward as high as possible. The highest point touched by their fingertips is recorded, and the difference between standing reach height and jump height is calculated to determine the jump distance.

20m Sprint: seconds (s). The individual runs 20 meters as fast as possible from a standing start. Timing begins at the start signal and ends when the individual crosses the 20-meter mark. A stopwatch or electronic timing system is used to record the time.

Medicine Ball Throw: Centimeters (cm). The individual sits or stands behind a marked line and throws a 1-kilogram medicine ball as far forward as possible using a chest pass motion. The distance from the starting line to where the ball first lands is measured using a measuring tape.

3x10m Shuttle Run: seconds (s). The individual sprints back and forth between two lines that are 10 meters apart, completing three sprints for a total of 30 meters. Timing starts at the go signal and ends when the individual crosses the finish line. A stopwatch or electronic timing system is used to record the time.

Chest Pass: Centimeters (cm). The individual stands behind a marked line and throws a basketball from chest height using both hands, aiming for maximum distance. The distance from the starting line to where the ball first lands is measured using a measuring tape.

Wall Pass: (number of passes in a 10 sec). The individual stands at a set distance from a wall and throws a ball against it, attempting to complete as many consecutive passes as possible within a 10 seconds. The total number of successful passes made is recorded.

Statistical Analysis:

The methods applied in this paper include descriptive statistical methods (measures of central tendency, dispersion), as well as scientific methods of condensing and transforming results. The results were processed using the computer program SPSS, version 27.0.

For each variable, central and dispersion parameters have been calculated. Differences in anthropometric characteristics and motor variables were determined using a discriminatory parametric procedure alongside a t-test for small independent samples, with a statistical significance of $p < 0.05$.

RESULTS

In the table nr. 1, are presented data regarding the discrepancy between two arithmetic means, T-test values, and significance levels. Upon analysing these outcomes, it becomes evident that statistically significant alterations have been detected across the majority of the assessments conducted in this study. Within the anthropometric space, notable statistical variances are evident across all variables, apart for arm span, where the active students (M = 150.40, SD = 13.06) showed the similar results compared to nonactive students (M= 148.42, SD=79.78) t (.916), p = .362.

Within the motoric space there are significant statistical differences in all variables at the statistical level p = .000 showing the dominance in favour of active group of students.

Table 1. *t – Test*

Group		N	M	SD	t	df	Sig.
Body Weight	Active	50	51.91	10.58	5.917	98	.000
	Nonactive	50	41.03	8.21	5.917	98	.000
Body Height	Active	50	157.38	9.37	5.894	98	.000
	Nonactive	50	147.74	6.75	5.894	98	.000
Length of the Arm	Active	50	68.40	4.98	4.826	98	.000
	Nonactive	50	64.35	3.22	4.826	98	.000
Arm Span	Active	50	150.40	13.06	.916	98	.362
	Nonactive	50	148.42	7.99	.916	98	.362
Length of the Leg	Active	50	91.360	6.67	5.008	98	.000
	Nonactive	50	85.462	4.98	5.008	98	.000
Thigh Circumference	Active	50	49.48	5.61	3.380	98	.001
	Nonactive	50	45.69	5.60	3.380	98	.001
Calf Circumference	Active	50	33.62	3.51	4.289	98	.000
	Nonactive	50	30.85	2.90	4.289	98	.000
Standing Long Jump	Active	50	151.32	19.62	-.169	98	.001
	Nonactive	50	151.94	16.93	-.169	98	.001
Standing High Jump	Active	50	33.00	5.54	3.412	98	.001
	Nonactive	50	29.62	4.29	3.412	98	.001
20m Sprint	Active	50	4.12	0.27	-4.393	98	.000
	Nonactive	50	4.36	0.29	-4.393	98	.000

Medicine Ball Throw 1kg	Active	50	634.00	183.99	8.108	98	.000
	Nonactive	50	413.34	56.39	8.108	98	.000
3x10m Shuttle Run	Active	50	9.71	0.56	-5.514	98	.000
	Nonactive	50	10.59	0.98	-5.514	98	.000
Chest Pass	Active	50	847.00	1.20	4.393	98	.000
	Nonactive	50	734.01	1.37	4.393	98	.000
Wall Pass	Active	50	11.46	0.93	10.450	98	.000
	Nonactive	50	8.70	1.62	10.450	98	.000

DISCUSSIONS

Observations reveal that statistically significant shifts predominantly favour the active student cohort. This observation leads to the conclusion that consistent engagement in diverse sporting activities has substantially contributed to enhanced developmental outcomes concerning body height, extremity dimensions, and measurements of thigh and calf circumferences. Similarly, within the domain of basic motor skills, changes exhibited across all tests favour the active student group, denoting superior proficiency levels in this cohort compared to their inactive counterparts. Notably, the active student group demonstrates superior performance across variables assessing explosive arm and leg strength, as well as movement execution speed.

Through application of the T-test methodology, it becomes apparent that the active student cohort consistently outperforms their inactive counterparts across both anthropometric and basic motor skills domains, underscoring the significant benefits associated with regular engagement in physical activities. In the schools from which the participants were drawn, students receive only two hours of physical education per week. This limited exposure is insufficient to support the optimal physical development of children. In contrast, children who participate in extracurricular sports activities 3-5 times per week consistently demonstrated superior performance across nearly all tested variables, with particularly pronounced differences observed in motor skills. In comparison to existing literature, our findings echo those of previous studies that have explored the impact of extracurricular physical activities on anthropometric and motor skill development among school-aged children. For instance, a study The positive effects of the additional exercises program in addition to regular physical education classes are also indicated by the results of earlier research (Marković, 2017; Kukolj, 2006; Nešić et al., 2013). (Pireva et al. 2017) in the research conducted on a sample of 100 young pupils aged 14-15 The purpose of the study was to prove the possible difference between the basketball players and the pupils in some anthropometric characteristics, basic motor skills and situational motor skills. In order to define these changes of anthropometric characteristics, 18 motoric variables were applied for basic motor and situational motor skills. The results show that there are statistically significant differences and that there is a statistically significant difference between basketball players and pupils, where basketball players have better results in all tests of basic motor and situational motor skills. The results have shown that the regular engagement of children in basketball schools can enhance the skills and knowledge of young players and make a significant difference. Additionally, our study contributes to the existing body of literature by providing further insights into the specific anthropometric and motor skill parameters that are influenced by extracurricular sports participation. Such nuanced analyses add depth to our understanding of the multifaceted relationship between physical activity and developmental outcomes among school-aged children.

CONCLUSION

The results of this study indicate significant differences between students actively participating in extracurricular sports and those who only attend regular physical education classes, with the former group showing more favorable outcomes. These findings underscore the importance of increased engagement in regular physical activities, which significantly enhances children's anthropometric and motor development.

Additionally, our study extends the existing literature by offering specific insights into the anthropometric and motor skill parameters most affected by extracurricular sports participation. This detailed analysis contributes to a deeper understanding of the complex relationship between physical activity and developmental outcomes in school-aged children.

Moreover, our findings emphasize the need for educational programs that promote regular sports participation as a core component of children's physical development. By corroborating and expanding upon prior research, this study reinforces the value of evidence-based interventions aimed at improving the physical health and developmental trajectories of young learners.

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The Influence of Physical Activity on the Level of Anxiety in Female Students

Dušan Stupar, Igor Beretić, Milan Nešić
Faculty of Sport and Psychology, TIMS, Novi Sad, Republic of Serbia

Correspondence:
Dušan Stupar, Faculty of Sport and Psychology, TIMS, Novi Sad, Serbia
dusan.stupar@tims.edu.rs

Abstract: *To examine the impact of physical activity (FA) on students' mental health, primarily on the manifestation of anxiety symptoms (DAS), a study was conducted on 116 females, aged, 21,37 ± 5.70 years. All respondents are undergraduate students of the Faculty of Sport and Psychology, TIMS, from Novi Sad, Serbia. For the purposes of this research, two measuring instruments were used, (DASS-21) and (GSLTPAK). The first of them is a shortened version of the scale of Depression, Anxiety and Stress, and the second is a short form of Godin's free time exercises. Analyzing the obtained results, it was possible to determine a significant negative correlation of light physical activity with the level of anxiety (r = -0.379, p = 0.000), but intense physical activity also showed a statistically significant correlation (r = -0.257, p = 0.024). Unlike them, moderate physical activity did not exhibit a statistically significant correlation (r=-0.122, p=0.121). Using multiple regression analysis, it was determined that light physical activity is a statistically significant predictor of anxiety level (Unstd.Beta=-0623, p=0.000), and in that case the model explains 22.1% (R2adjust=0.221). The obtained results coincide with previous research that confirms the positive effects of physical activity on mental health. In this sense, the application of light physical activity can contribute to reducing anxiety among students.*
Keywords: *physical activity, mental health, anxiety, female students.*

INTRODUCTION

Many benefits of physical activity have been proven before, including the fact that physical activity can significantly affect the mental health of students. The pressure of academic obligations, parental and environmental expectations, as well as the turbulence of the transition to adulthood in this population can cause high levels of stress, anxiety and depression. In that case, physical activity proved to be an excellent method for reducing the symptoms of negative pathological conditions. The aggravating circumstance for this population is precisely the fact that the most significant decline in physical activities occurs precisely in the period of beginning university studies (Kwan, Cairney, Faulkner &Pullenaiegum, 2012). Research has shown (Craft, Perna, 2004) that physical activities, in addition to improving health, also affect a better mood, reducing muscle tension, releasing endorphins, the so-called hormones of happiness or good feeling. At the same time, a large number of studies confirm the fact that regular physical activity can help reduce stress and anxiety (Anderson & Shivakumar, 2013, Vancampfort, Stubbs, Koianagi, 2017, Kandola & Stubbs, 2020, Singh, Olds, Curtis, et al., 2023). It has also been confirmed (Bayram & Bilgel, 2008) that young people are increasingly susceptible to anxiety disorders, with female students often reporting higher levels of stress and anxiety compared to their male counterparts. Anxiety as a negative psychological state is accompanied by a feeling of fear, worry and tension, which can often be without a clear or justified cause. Some of the symptoms of anxiety are "pounding" and rapid heartbeat, dizziness, fainting, sweating. If this condition is not treated in time, i.e. if it becomes excessive and long-lasting, it can significantly impair daily functioning and quality of life (American Psychiatric Association, 2013, National Institute of Mental Health, 2024). Further research (Grim, Hortz & Petosa, 2011) confirms that the biggest decline in physical activity occurs at the beginning of academic studies, which leads to a decrease in recommended physical activities after the age of 24. The situation is similar in Serbia (Stupar, Beretić & Međedović, 2023). Anxiety is particularly common among students, and several studies indicate that a significant portion of students experience anxiety symptoms while studying. The American College Health Association standardized the National College Health Assessment (NCHA) survey to determine a wide range of health problems that affect students and their academic achievement. Their data shows that 86% of respondents experienced moderate or high levels of stress in the past 12 months, where the most reported symptoms were anxiety (22%), depression 18%, which is in line

with the results from 2018 (American College Health Association, 2021). On the other hand, at universities in Serbia, during the COVID-19 pandemic, research showed that 33.6% of students had symptoms of anxiety, and in addition to the standard pressure from parents due to academic obligations, a stressful and uncertain period of time was cited as a special reason (Višnjić, Kok, Višnjić, Jovanović & Marković, 2023). In light of the aforementioned points, the purpose of this paper is to examine the impact of physical activity levels on different aspects of the mental health of students, particularly focusing on the reduction of anxiety symptoms in female students.

MATERIAL AND METHODS

Sample of respondents

All respondents, 116 of them, are undergraduate female students at the Faculty of Sport and Psychology, TIMS, based in Novi Sad, Serbia. Their average age was 21.37 years (SD=5.70), average height 167.31 m (SD=6.50), and average body weight 59.50 kg (SD=7.86). In relation to physical activities, the majority of respondents reported engaging in light physical activities with an average score of 3.88 (SD=2.53), on a scale from 0 to 7, followed by moderate physical activity with an average of 2.77 (SD=2.13), and finally intense physical activity with an average score of 0.94 (SD=1.86), as the least exercise. The anxiety level had an average score of 6.25 (SD=5.46), which indicates a high variability of the observed population, given that the range was from 0 to 25.

Sample of measures

The measuring instruments used were (DASS-21) and (GSLTPAK).

(DASS-21) is a 21-item self-report scale of depression, anxiety, and stress dimensions, with each dimension consisting of 7 items, on a scale from 0 (not at all applicable to me) to 3 (completely applicable on me). The symptoms of feeling worthless, loss of interest and lack of satisfaction were used to assess the depression subscale. The anxiety subscale assesses symptoms such as autonomic arousal, skeletal muscle effects, subjective feelings of distress, and situational anxiety. The stress subscale focuses on symptoms of chronic tension, irritability, and inability to relax (Lovibond & Lovibond, 1995). Scores on each subscale are summed and then multiplied by two to obtain a composite score, with higher scores indicating greater symptom intensity. This scale is well validated and widely used in the young adult population to assess psychological status.

The Godin Questionnaire for Physical Activity in Leisure Time (GSLTPAK) is a questionnaire that measures the level of physical activity in leisure time. Participants assessed the frequency of strenuous, moderate and mild activities in which they engaged during a week. (GSLTPAK) is Godin's questionnaire that determines the level of physical activities in free time, where the participants estimate the frequency of light, moderate and intensive activities they engaged in during a week. To calculate the total amount of physical activity, each activity category was multiplied by the following values: Strenuous physical activity: number of days multiplied by 9, Moderate physical activity: number of days multiplied by 5, Mild physical activity: number of days multiplied by 3. The resulting values were then summed to obtain a weekly leisure time physical activity score (Godin, 2011). This questionnaire is practical for assessing the level of physical activity and provides information about different intensities of activity.

Statistical analysis

Descriptive statistics were used to describe the baseline characteristics of the sample of subjects, including age (AGE), body height (BH), body mass (BM), level of light (LIGHTACT), moderate (MEDACT), and vigorous physical activity (INTACT), as well as level anxiety (ANXLEVEL). Arithmetic mean (Mean) and standard deviation (SD), as well as minimum and maximum values were calculated for each variable. Pearson's correlation analysis was used to examine the relationship between the intensity of physical activity (LIGHTACT, MEDACT, INTACT) and the level of anxiety (ANXLEVEL). The Pearson correlation coefficient (r) was used to measure the strength and direction of the linear relationship between two variables. P-values (p) were used to assess the statistical significance of these correlations, with a value of $p < 0.05$ considered statistically significant. in order to identify significant predictors of anxiety level, multiple regression analysis was applied using the backward method (ANXLEVEL). In this analysis, all variables were initially included in the model and then gradually eliminated until the optimal model was reached. The data analysis involved utilizing the Statistical Package for Social Sciences (SPSS) version 26.0 by SPSS Inc. in Chicago, IL, USA.

RESULTS

Table 1. *Distribution of respondents according to the level of physical activity (Godin, 2011).*

Godin Scale Score	Interpretation	Number of respondents	% Number of respondents
24 units or more	Active	20	17.24%
14 – 23 units	Moderately Active	33	28.44%
Less than 14 units	Insufficiently Active/Sedentary	63	54.32%
		116	100 %

The classification of the level of physical activity in relation to the total score of respondents is given in Table 1. Formula for calculating Total leisure activity score= (9 × Strenuous) + (5 × Moderate) + (3 × Light).

Table 2. *Pearson's correlation coefficient between intensity of physical activity and anxiety level (n = 116).*

Variables	ANXLEVEL	p
LIGHTACT	-0.379	0.000
MEDACT	-0.122	0.121
INTACT	-0.257	0.024

Light activity (LIGHTACT), Medium activity (MEDACT), Intensive activity (INTACT), level of anxiety (ANXLEVEL), $p < 0.05$ was considered statistically significant

Research reports (Table 2) clearly show a strong negative correlation between light physical activity and anxiety levels, with greater intensity of light physical activity associated with lower levels of anxiety. Also, a p- value of 0.000 indicates a statistically significant correlation. Again, the correlation between moderate physical activity and the level of anxiety was determined, which is negative, but weak and not statistically significant ($p > 0.05$). This means that moderate physical activity in this sample has no significant effect on the level of anxiety. At the same time, the analysis of the obtained results found that there is a negative correlation between intense physical activity and the level of anxiety, i.e. that higher intensity of intense physical activity is associated with lower levels of anxiety. At the same time, the strength of this correlation is statistically significant, but also weaker compared to that of light physical activity with a p-value of 0.024. Therefore, the findings imply that higher levels of light and intense physical activity could be beneficial in reducing anxiety levels.

Table 3. *Backward method multiple-regression analysis of the anxiety level with significant predictor variables (n = 116).*

Variables	Unstd.Beta	Beta	t	p	R	R^2_{adjust}	Std.Err.Est.	F	P
LIGHTACT	-0.623	-0.379	-3.948	0.000	0.471	0.221	5.402	8.793	0.000

Light activity (LIGHTACT), Unstd.Beta = Unstandardized regression coefficients values, Beta = Standardized regression coefficients values, t = Standardized regression coefficients significance test, p = Standardized regression coefficients level of significance, R = Multiple correlation coefficient, R^2_{adjust} = Adjusted determination coefficient, Std. Err. Est. = Standard error of the estimate, F = Multiple regression analysis significance tests, P = Multiple correlation level of significance.

The obtained results (Table 3), above all the negative coefficient (Unstd Beta) in the statistical model show that increased light physical activity is associated with decreased anxiety. Also, the Beta coefficient shows the relative contribution of this variable in the model, which further emphasizes the importance of the relationship between light physical activities and anxiety levels. Furthermore, the statistical significance ($p = 0.000$) emphasizes the strong predictive power of light physical activity on anxiety levels. The results obtained from the multiple regression analysis reveal a noteworthy finding: there is a significant negative correlation between light physical activity and anxiety levels. The resulting model shows that it explains 22.1% of the variability in anxiety levels, which is a fairly signifi-

cant contribution. At the same time, this means that there are other factors that should be investigated as potential predictors of anxiety levels.

DISCUSSION

Based on an examination of these results in conjunction with prior correlational analyses, it becomes clear that both light and intense forms of physical activity may have a profound impact on reducing anxiety levels. This suggests the potential for further research to explore the mechanisms behind this impact and to consider practical applications that can use these insights to develop strategies aimed at reducing anxiety through the promotion and encouragement of physical activity.

Comparison with Recent Studies

The results of this research are consistent with similar ones that confirm that physical activity can have a positive effect on mental health. Earlier research also confirms that it can be very effective in reducing symptoms of anxiety and depression in the student population as well (Liu & Shi, 2023, Liu et al, 2024). The group of authors Kandola et al. (2020), have just researched that topic and concluded that light and moderate physical activities, such as walking and yoga, led to a statistically significant reduction in anxiety in a large group of young adults. This implies that light physical activity that is not too physically and mentally demanding, and at the same time can be easily organized and integrated into everyday life, actually has the most significant impact on mental health. The same conclusions were reached by the authors Schuch et al. (2019), who through a meta-analysis, aimed to determine the effects of exercise on anxiety, confirmed that both light and vigorous physical activities can contribute to mental health, with the best effects observed with less intense exercises. All these findings follow the results obtained in this research, where a statistically significant correlation was obtained between light physical activities and lower levels of anxiety in female students who engaged in the same more regularly.

This is consistent with the significant correlation between light physical activity and lower anxiety levels observed in this study, where students who engaged in more frequent light activities reported reduced anxiety. The non-significant relationship between moderate physical activity and anxiety observed in this study contrasts with some recent research. For example, (Liu & Shi, 2023) found that moderate-intensity physical activity significantly reduced anxiety among university students. Additionally, our finding that intense physical activity had a weaker but still significant negative correlation with anxiety is supported by Meyer et al. (2020). They found that while intense physical activity was beneficial for reducing stress and anxiety, its effects were less pronounced compared to light or moderate exercise.

Interpretation of Findings

Research has shown that there is a fairly strong connection between mainly light physical activities and a lower level of anxiety in female students. This can be explained by the fact that walking or leisurely cycling, which belong to light physical activities, are closer to students who meet academic requirements. In addition, this type of physical activity does not require too much mental stress or fatigue, which is why they are more interesting for students. The ability to reduce cortisol levels while exercising and create a feeling of relaxation without overexertion is the main advantage of light physical activities over others (Kandola et al., 2020).

Similar research results, which indicate that intense physical activity had a weaker but statistically significant correlation with anxiety, were also obtained in the work of (Meir et al., 2020). In their work concerning the mental health of students during the COVID-19 pandemic, it was confirmed that intense physical activities had the effect of reducing anxiety and stress, but compared to light and moderate physical activities, the effects were smaller. The main problem they see is that high-intensity exercise requires serious engagement, which in conditions where they are exposed to academic pressures, can limit their ability to engage regularly, thereby reducing their overall impact on mental health. The importance of high-intensity exercises is also discussed by the author's research (Schuch et al., 2019), who believe that these exercises can initially increase the level of stress, but if practiced over a longer period of time, they can improve emotional resilience. This is in line with the results of this research, where intense activity showed a weaker, although significant, effect on anxiety.

On the other hand, the analysis of the data obtained in this research revealed the lack of a statistically significant relationship between moderate physical activity and anxiety, which is not in accordance with some recent studies.

Thus, in the research of (Liu & Shi, 2023), confirm the exact opposite thesis, namely that moderate physical activity has a significant positive effect on reducing anxiety among students. At the same time, this difference can be attributed to the very definition of moderate activities that are measured through studies or to differences in the student population. In the mentioned research, moderate activity was observed as part of an organized and well-structured program, which resulted in a reduction of anxiety. Also, the reason for not obtaining a statistically significant correlation between moderate physical activities and anxiety may also be a consequence of irregular exercise, i.e. exercising them. Only well-structured moderate activities such as fitness classes can ultimately contribute to better health outcomes (Meier et al., 2020). If moderate activities are less pleasant and sporadic, then in that case they will not cause a positive effect like light physical activities.

In a post-pandemic study (Liu & Shi, 2023), regular physical activity was shown to be associated with lower levels of anxiety, which could be explained by the adoption of positive coping styles among college students and improved psychological resilience. Other authors (Atalay & Gencoz, 2008) emphasize that physical activity plays a key role in reducing anxiety and strengthening self-confidence regarding body appearance. This especially applies to young women who are exposed to various influences of society and the environment. It has already been mentioned that numerous studies have confirmed that the transition from high school to college represents a period of decline in physical activity (McMaster University, 2011), and this is also confirmed by a study published in the International Journal of Behavioral Nutrition and Physical Activity (Aira, et al 2021). In this sense, this research also confirmed the significant impact of physical activities, in this case light, but also intense, on reducing the level of anxiety of female students.

Implications

The obtained results indicate the importance of light physical activities, and we should think in that direction, and this type of activity, which includes walking, yoga, light running, should be used as effective interventions to reduce anxiety among students. Considering the simple organization of these types of activities, it would be good if they were included in all universities and available to all students during their studies.

Limitations of the Study

Certainly, subjectivity when filling in data on physical activity and the level of intensity thereof, as well as memory bias can be considered as a limitation. It should also be emphasized that longitudinal research would certainly provide more data for the analysis of this problem.

CONCLUSION

Based on the obtained results and their analysis, it could be concluded that engaging in primarily light and intense activities had a statistically significant impact on reducing the level of anxiety among female students. Light physical activity appeared as the most significant predictor, as shown by statistically negative correlations and regression coefficients. Also, intense physical activity showed a statistically significant negative correlation with anxiety levels, while moderate physical activity did not show a statistically significant effect. In this sense, this research also confirmed that physical activities can really affect the reduction of anxiety in students, especially in female students. In this sense, it is necessary to work on the promotion and availability of physical activities to the student population.

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The Mediating Effect of Social Physique Anxiety in the Relationship Between Objectified Body Consciousness and Body-Esteem among Belly Dance Participants

Park, Grace[1], Hwang, Hyang-Hee[2]
[1,2]Kangwon National University, Department of Sport Science, South Korea
[2]Kangwon National University, Department of Smart Health Science and Technology Convergence, South Korea

Correspondence:
Hwang, Hyang-Hee, Kangwon National University, Department of Sport Science, Department of Smart Health Science and Technology Convergence, South Korea; phyhee@kangwon.ac.kr

Abstract: *The purpose of this study was to examine the mediating effect of social physique anxiety in the relationship between objectified body consciousness and body-esteem among a sample of belly dance participants. The subjects consisted of 347 adult women (aged 20 and older) who participated in belly dancing in Korea. In July 2022, the convenience sampling and self-evaluation writing methods were used as URL delivery methods through an online Google questionnaire. For data analysis, confirmatory factor analysis, reliability analysis, frequency analysis, and Baron & Kenny's (1986) mediator regression analysis were conducted using SPSS 26 and AMOS 26 software. The results are as follows. Social physique anxiety completely mediates the relationship between physical surveillance and body-esteem (a sub-factor of objectified body consciousness), but it does not have a mediating effect on the relationship between physical shame and body-esteem. Meanwhile, it partially mediates the relationship between control beliefs and body-esteem. Based on these findings, belly dance instructors must make efforts to develop, organize, and implement programs that help correct objectified body consciousness and foster positive and self-directed body-esteem by reducing social physique anxiety. It is hoped that the results of this study can be used as a theoretical basis for participating in belly dance as well as practical/basic data for the development and growth of belly dance on a larger scale.*

Keywords: *Belly dance, Objectified Body Consciousness, Body-Esteem, Social Physique Anxiety, Leisure Activities.*

INTRODUCTION

Since the turn of the 21st century, as social and public interest in improving the quality of life and participating in leisure activities have increased, practical dance has become popular, due to its psychological and emotional benefits such as physical training, artistry, creativity, and expressive development (Kim, 2011). In this regard, practical dance refers to dancing in which people voluntarily participate and enjoy on their own (Park, 2021). Although it has been mostly recognized as a "hobby" that only a few people undertake, there is a growing interest in learning and/or making a living in various genres such as K-POP dance, street dance, choreography, and belly dance (Kim, 2009). In Korea, practical dance has been recently established as a subject in art high schools and colleges (Jeong, 2018), and its positive influence in society, culture, and education has greatly expanded (Kim, 2011). In particular, belly dance, introduced in Korea around 1995, is not only easy to learn, but it also strengthens flexibility and creates a beautiful attitude, which, in turn, helps train a healthy body and foster positive emotions.

In related research on the physical benefits of belly dance, Jang (2012) found that metabolic syndrome factors are improved, helping to prevent certain diseases that frequently occur in obese middle-aged women and improving blood lipid levels and arterial blood flow rates, thus lowering potential risk factors for the vascular system. In addition, Choi (2009) indicated that an aerobic exercise with music (barefoot) and movements using the abdomen are effective for muscle exercises that move internal organs in this region of the body. Specifically, belly dance's shimmy movement is a total body exercise that is effective for removing waist fat, increasing physical vitality, and improving health-related issues, due to aging, poor blood circulation, and lack of exercise (Kim, 2008; Park, 2013). Meanwhile, developing the ability to express emotions and foster self-expression has garnered interest since the early 2000s, in recognition of the value of proper body consciousness, thus contributing to the popularization of practical dance (Kang, 2013; Yang, 2017; Jang, 2021). As for Korea, the perception of belly dance has been recognized as an effective rhythmic exercise that can cultivate both the mind and body, while emphasizing its beauty, expertise, and artistry.

The motivation for this research is twofold; 1) the social demand in correcting body anxiety and increasing body consciousness and body-esteem (Lee, 2009); and 2) the limited research on this topic. In this study, there are three psychological variables that belly dance participants experience. First, objectified body consciousness refers to the distorted psychological tendency to deliberately control and damage the body by recognizing it as an object, without respecting the body itself (McKinley & Hyde, 1996). It is also a factor that significantly affects the quality of life and mental health of belly dance participants, especially those who are sensitive to public gaze due to body exposure. Second, social physique anxiety refers to situational anxiety that predicts a negative evaluation of one's body type (Hart, Leary, & Rejeski, 1989). In other words, it means worrying about other people's evaluations of one's body type, rather than the ability to perform the physical tasks at hand (Kim, 2014). Third, body-esteem is an important factor that is not naturally established and fixed, but is transformed through one's growth and maturity. In other words, it is defined as one's attitude toward the body (Kim, 2005), which is especially important for belly dance participants pursuing an attractive body. Therefore, this study examines the mediating effect of social physique anxiety in the relationship between objectified body consciousness and body-esteem among a sample of belly dance participants.

McKinley (1999) found that objectified body consciousness and body respect have a negative (−) correlation, especially among women, while Lee (2004) indicated that high self-esteem or body control belief does not directly help maintain appearance satisfaction. However, appearance satisfaction has a significant effect on self-esteem. In related research, a sample of female college students in dance fitness classes believed that the higher the positive body shape evaluation, the more desirable the physical self-concept (Nam, 2009). Moreover, Yang Eun-sim (2010) found that female dancers place social physique anxiety into the relationship between self-objectification and body dissatisfaction. Based on these findings, this study presents the following hypotheses:

Hypothesis 1 (H1). Social physique anxiety has a mediating effect between surveillance and body-esteem, as a sub-factor of objectified body consciousness.

Hypothesis 2 (H2). Social physique anxiety has a mediating effect between body shame and body-esteem, as a sub-factor of objectified body consciousness.

Hypothesis 3 (H3). Social physique anxiety has a mediating effect between objectified body consciousness and body-esteem, as a sub-factor of appearance control beliefs.

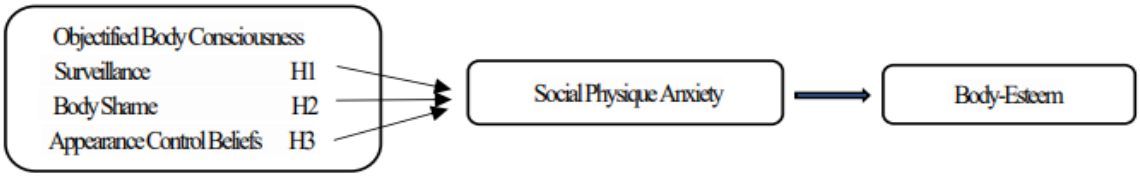

Figure 1. Theoretical Model

METHOD AND TOOLS

The subjects in this study consisted of 347 women (aged 20 and older) participating in belly dancing in Korea. In July 2022, convenience sampling and self-evaluations were conducted through an online Google questionnaire. Based on the demographic characteristics in Table 1, 63 people (18.2%) were aged 20–29, 89 (25.6%) were aged 30–39, 130 (37.5%) were aged 40–49, and 65 (18.7%) were aged 50 or older. According to their occupations, 233 (67.1%) were classified as ordinary persons, while 114 (32.9%) were classified as belly dance instructors. As for their participation periods, 41 (11.8%) had participated for less than one year, 55 (15.9%) had participated for one to three years, 53 (15.3%) had participated for three to five years, and 198 (57.1%) had participated for more than five years. Additionally, 65 non-participants (18.7%) and 282 (81.3%) participants had experience in belly dance performances/competitions.

Objectified Body Consciousness: Kim, Yoo, and Park (2007) developed a body consciousness scale (regardless of gender) by adapting the objectified body consciousness scale of McKinley & Hyde (1996). Following Lee (2012), we used 14 questions, with three sub-factors: surveillance, body shame, and appearance control beliefs.

Social Physique Anxiety: Kim, Kim, and Kim (2014) developed a social physique anxiety questionnaire for female college students. Following (2018), we used 14 questions.

Body-Esteem: Mendelson & Wheit (1998) developed a 23-question body-esteem scale for adults and adolescents. Following Oh (2014), we used 19 of these questions. In total, our study includes 51 questions based on a five-point Likert scale, with four questions on demographic and sociological characteristics.

Table 1. *Demographic and Sociological Characteristics and Frequency Analysis*

		N	%
Age	20–29 years old	63	18.2
	30–39 years old	89	25.6
	40–49 years old	130	37.5
	Over 50 years of age	65	18.7
Occupation	Ordinary persons	233	67.1
	Belly dance instructors	114	32.9
Participation period	Less than a year	41	11.8
	One to three years	55	15.9
	Three to five years	53	15.3
	More than five years	198	57.1
Belly dance performances/competitions Participation status	None	65	18.7
	Yes	282	81.3
Total		347 people	100%

Data Processing

For data analysis, confirmatory factor analysis, reliability analysis, frequency analysis, and Baron and Kenny's (1986) mediator regression analysis were conducted using SPSS 26 and AMOS 26 software.

Validity, Reliability, and Correlation Analysis

The content validity of the questionnaire in this study was reviewed by one supervisor and three doctors, while the structural validity was conducted by confirmatory factor analysis. Following Kim (2010), the model fitness index is less than or equal to a normed x^2 (NC) value of 3.0, less than or equal to a RMSEA value of .08, less than or equal to a RMR value of .05, and more than or equal to a GFI, NFI, CFI, and TLI value of .90. Meanwhile, x^2/df (= CMIN/df) is determined to be a good model if the value is 3.0 or less, or a very satisfactory model if the value is 2.0 or less. In this study, the x^2 (334.428), df (149), and x^2/df (2.244) values were found to be good, while the values for CFI (.956), TLI (.944), GFI (.913), and NFI (.924) met the model's suitability criteria. In addition, the RMSEA value was .06, indicating a good model fit. As for convergent validity, it is determined to be secure when the CR value is .7 or higher and the AVE value is .5 or higher (Kim, 2020). As shown in Table 2, the AVE value for appearance control beliefs (a sub-factor of objectified body consciousness) was slightly lower at .405. However, since the CR values were between .793~.931, convergent validity was secured. Finally, if Cronbach's α is .60 or higher, then the reliability is confirmed. Specifically, a value of .70~.80 is considered as good and a value of .80~.90 is considered as very high (Song, 2012). In this study, Cronbach's α values were found to be high, since they were between .760~.965, while Pearson's correlation analysis showed that there was no multicollinearity issue (.158~.601).

Table 2. *Validity, Reliability, and Correlation Analysis (*p < .05, **p < .01, ***p < .001)*

		CR	Cronbach'α	AVE	A1	A2	A3	B	C
A. Objectified Body Consciousness	1. Surveillance	.799	.784	.579	.761				
	2. Body Shame	.908	.912	.665	.350**	.815			
	3. Appearance Control Beliefs	.793.	.792	.405	.053	.332**	.636		
B. Social Physique Anxiety		.931	.965	.820	.390**	.601**	.488**	.906	
C. Body-Esteem		.887	.760	.728	.158**	.581**	.416**	.405**	.853

Notes: A1: Objectified Body Consciousness Surveillance, A2: Objectified Body Consciousness Body Shame, A3: Objectified Body Consciousness Appearance Control Beliefs, B: Social Physique Anxiety, C: Body-Esteem

RESULTS

The Mediating Effect of Social Physique Anxiety in the Relationship between Surveillance and Body-Esteem, as A Sub-Factor of Objectified Body Consciousness

As a result (Table 3) of verifying the regression coefficient of Model 1, the first condition for the mediating effect analysis was satisfied because surveillance was positively significant to social physique anxiety, with β = .390 and *p* = .000. In Model 2, surveillance had a positive effect on body-esteem, with β = .158 and *p* = .00, satisfying the second condition. In Model 3, surveillance had a *p*-value of .05 or more for body-esteem, which was not statistically significant, whereas social physique anxiety was statistically significant to body-esteem, with β = .405 and *p* = .000. In other words, surveillance had a direct positive impact on body-esteem, but its influence disappeared after social physique anxiety was introduced. Thus, Hypothesis 1 is supported.

Table 3. *The mediating effect of social physique anxiety in the relationship between surveillance and body-esteem, as a sub-factor of objectified body consciousness (*p < .05, **p < .01, ***p < .001)*

M	Step	B	SE	β	t(p)	F(p)	R^2	adjR^2
1	(Constant)	1.176	.208		5.647***	61.852***	.152	.150
	Surveillance → Social physique anxiety	.427	.054	.390	7.865***			
2	(Constant)	2.749	.093		29.498**	8.884**	.025	.022
	Surveillance → Body-esteem	.072	.024	.158	2.981**			
3	(Constant)	2.550	.090		28.237***	33.821***	.164	.159
	Surveillance → Body-esteem	.000	.024	.000	.008			
	Social physique anxiety → Body-esteem	.169	.022	.405	7.570***			

The Mediating Effect of Social Physique Anxiety in the Relationship between Body Shame and Body-Esteem, as A Sub-factor of Objectified Body Consciousness

As a result (Table 4) of verifying the regression coefficient of Model 1, the first condition for the mediating effect analysis was satisfied, since body shame was positively significant to social physique anxiety, with β = .601, *p* = .000. In Model 2, body shame had a positive effect on body-esteem, with β = .581 and *p* = .000, satisfying the second condition. In Model 3, body shame had a positive effect on body-esteem, with β = .528, *p* = .000, whereas social physique anxiety was not statistically significant because the *p*-value was .05 or higher. In this regard, the third condition was not satisfied. Meanwhile, body shame was found to have no mediating effect on body-esteem through social physique anxiety. Thus, Hypothesis 2 is rejected.

Table 4. *The mediating effect of social physique anxiety in the relationship between body shame and body-esteem, as a sub-factor of objectified body consciousness (*p < .05, **p < .01, ***p < .001)*

M	Step	B	SE	β	t(p)	F(p)	R^2	adjR^2
1	(Constant)	.865	.143		6.040***	194.859***	.361	.359
	Body shame→ Social physique anxiety	.600	.043	.601	13.257***			
2	(Constant)	2.252	.061		37.020***	175.756***	.338	.336
	Body shame→ body-esteem	.242	.018	.581	13.257***			
3	(Constant)	2.220	.064		34.788***	89.585***	.342	.339
	Body shame→ body-esteem	.220	.023	.528	9.654***			
	Social physique anxiety→ body-esteem	.037	.023	.088	1.612			

The Mediating Effect of Social Physique Anxiety in The Relationship between Objectified Body Consciousness and the Sub-Factors Appearance Control Beliefs and Body-Esteem

As a result (Table 5) of verifying the regression coefficient of Model 1, the first condition for the mediating effect analysis was satisfied, since appearance control beliefs was positively significant to social physique anxiety, with β = .488, p = .000. In Model 2, the second condition was satisfied, since appearance control beliefs had a positive effect on body-esteem, with β = .416, p = .00. In Model 3, appearance control beliefs had a positive effect on body-esteem, with β = .286 and p = .000, while social physique anxiety was statistically significant, with β = .266 and p = .000 . Hence, the third condition was also satisfied. In Model 2, the influence of appearance control beliefs on body-esteem was β = .416, whereas a partial mediating effect was found because social physique anxiety decreased to β = .286 in Model 3. We also found that appearance control beliefs (as a sub-factor of objectified body consciousness) had an indirect positive effect on body-esteem through social physique anxiety. Hence, Hypothesis 3 is supported.

Table 5. *The mediating effect of social physique anxiety in the relationship between objectified body consciousness and the sub-factors appearance control beliefs and body-esteem (*p < .05, **p < .01, ***p < .001)*

M	Step	B	SE	β	t(p)	F(p)	R^2	adjR^2
1	(Constant)	.931	.183		5.074***	107.567***	.238	.235
	Appearance control beliefs → Social physique anxiety	.633	.061	.488	10.371***			
2	(Constant)	2.366	.080		29.686***	72.006***	.173	.170
	Appearance control beliefs → Body-esteem	.225	.027	.416	8.486***			
3	(Constant)	2.263	.080		28.285***	50.399***	.227	.222
	Appearance control beliefs → Body-esteem	.155	.029	.286	5.264***			
	Social physique anxiety → Body-esteem	.111	.023	.266	4.898***			

DISCUSSION

This study verified the mediating effect of social physique anxiety in the relationship between objectified body consciousness (including surveillance, body shame, and appearance control beliefs) and body-esteem among a sample of belly dance participants. Based on the findings, surveillance had an indirect positive effect on body-esteem through the complete mediation of social physique anxiety. Additionally, body shame had a direct positive effect on body-esteem, with no mediating effect of social physique anxiety, whereas appearance control beliefs had an indirect positive effect on body-esteem through partial mediation of social physique anxiety. In this research, surveillance refers to monitoring one's body to fit the ideal body image imposed by society, due to repeated self-objectification (McKinley & Hyde, 1996; Spitzack, 1990), while body shame refers to the shame perceived when one believes that his/her body and appearance do not match the ideal body image presented by society (Seo, 2011). As for appearance control beliefs, it refers to the internal characteristics that make one believe that he/she can control his/her appearance and body (Kim et al., 2007). Among the belly dance participants in this study, surveillance, body shame, and appearance control beliefs had a positive(+) effect on body-esteem.

These results are in line with Song Soon-ja's (2017) study of adult women participating in yoga, which reported that objectified body consciousness had a positive effect on positive thinking. In this case, the higher the surveillance and appearance control beliefs, the higher the subjective satisfaction and appearance control beliefs among positive thinking. In addition, the studies by Kim (2023) (a Pilates participant) and Kang (2023) (a college student majoring in dance) reported that surveillance had a positive effect on body-esteem, partially supporting the results of this study. The findings of related research are as follows. First, Lee (2009) verified that the higher the surveillance, the higher the body-esteem, self-esteem, emotional state, and vitality, which indirectly supports the results of this study, while Jeong (2015) found that the appearance control beliefs of female college students participating in leisure sports had a positive effect on their weight and physical function. Second, Taylor (1989) explained that people who believe that they can control themselves have higher self-esteem and psychological and physical well-being, while Tucker (1981)

stated that people who exercise regularly have higher body satisfaction, which, in turn, improves their emotional stability, confidence, and happiness. Third, Jeong Yong-Hak (2015) found that appearance control beliefs had a negative effect on external persistence. This indicates that the more one controls the body, the lower the tendency to show off to the public, which is in line with the result that higher inner self-esteem leads to lower ostentatious tendencies or narcissism (Lee, 2004). Furthermore, improving appearance control beliefs through participation in sports increased internal self-esteem and lowered conspicuous tendencies, which indirectly supports the results of this study.

Based on the aforementioned research, participants in daily fitness activities, such as belly dance, Pilates, and leisure sports, can overcome objectified body consciousness through continuous body training and related development. As for belly dance, it consists of various movements that highlight femininity (e.g., the chest, abdomen, and pelvis), as seen in the two-piece costumes with high body exposure. In this regard, participants can gradually improve their surveillance and body shame during practice or stage preparation as well as cultivate their appearance control beliefs. Meanwhile, the accumulation of exercise through belly dance can bring positive body changes (e.g., weight loss, body shape correction, and physical strength) as well as increase one's self-satisfaction and body-esteem. This confirms the importance of belly dance as a leisure activity that can help improve body consciousness and body respect, while increasing both personal and public value.

Finally, belly dance should be promoted as a desirable practical dance that can enhance one's self-concept, values, and overall view of life by improving participants' body consciousness and confidence. This is especially pertinent in today's society, which continues to emphasize the importance of body appearance, regardless of gender. Meanwhile, body-esteem is influenced by various demographic and sociological characteristics, such as age, gender, weight, body type, and psychological, emotional, and social influences, all of which change over time. As for the quality of life and social relationships, they may vary, depending on the level of awareness of one's body. Therefore, based on the empirical results in his study, it is important to recognize belly dance as a way to improve one's body-esteem by overcoming objectified body consciousness and social physique anxiety. At the same time, belly dance can help internalize desirable body values by training the mind and body through continuous voluntary participation, healthy and beneficial experiences, and emotional and behavioral immersion.

CONCUION AND SUGGESTIONS

The purpose of this study was to examine the mediating effect of social physique anxiety in the relationship between objectified body consciousness and body-esteem among a sample of belly dance participants. Based on the findings, belly dance has a positive effect on body-esteem by correcting and improving participants' negative attitudes and perceptions of their body and alleviating social physique anxiety. Such participation also promotes one's quality of life, satisfaction, and wellness, which are especially important in today's image-based society. Additional conclusions are as follows. First, people with high objectified body consciousness should cultivate body-esteem by preventing psychological and emotional contraction, due to the negative factors of social physique anxiety. In this regard, belly dance instructors should determine how to improve participants' confidence by identifying their strengths and individual characteristics. Second, belly dance instructors should induce participants to improve their body awareness through various educational programs and teaching methods. Third, belly dance instructors, managers, and executives should consider the effectiveness of belly dance and provide various activities, such as performances, competitions, and festivals, not just classes. In Korea, belly dance has become increasingly recognized as a leisure activity that can positively impact one's body shape, physical strength, athletic ability, and artistic literacy.

Finally, the suggestions of this study are as follows. First, in order to generalize the results, future research should employ a sample survey method that only targets the survey respondents. Second, future studies should specifically investigate and interpret the emotional and psychological issues of the participants. Third, since this study did not include face-to-face interviews, due to the COVID-19 pandemic, future research should include such interviews to support the findings. Fourth, since the subjects in this study mainly consisted of older participants, subsequent studies should equalize the age distribution of the sample group and separate the instructors from the general public. Finally, future qualitative studies should include observations, in-depth interviews, and participants' narratives.

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Paper review
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Factors Contributing to the Physical Fitness of Students in Islamic Boarding Schools: Sistematic Literature Review

Aan Wasan[1], Sandi Prayudho[2]
[1]*Department Sport Recreation, Faculty Sport Science, Universitas Negeri Jakarta, Indonesia*
[2]*Department Sport Science, Faculty Sport Science, Universitas Negeri Jakarta, Indonesia*

Correspondence:
Aan Wasan, Department Sport Recreation, Faculty Sport Science, Universitas Negeri Jakarta, Indonesia
aanwasan@unj.ac.id

Abstract: *There are several studies that discuss the factors that affect physical fitness in general, but none have discussed specifically about the factors that contribute to the physical fitness of students in Islamic boarding schools. The purpose of this study was to find out what are the factors that contribute to the physical fitness of students in Islamic boarding schools. The method used in this study is literature review using the Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) method. Articles searched through Google Scholar and obtained 8 national articles. The results of 8 selected articles revealed that the factors that contribute to the physical fitness of students include internal and external factors. Internal factors, including age, sex, genetics (heart capacity, posture, obeistas, hemoglobin and muscle fibers), intrinsic motivation, physical activity, lifestyle (nutritional status and sleep quality). External factors, including facilities and infrastructure (field, physical education teachers, curriculum, and trainers), and extrinsic motivation (Islamic boarding school regulations, and Islamic boarding school support). Conclusion new findings in this study, that each Islamic boarding school has differences based on rules or habits that cause differences in physical fitness factors that occur in students. Islamic boarding schools that support their students to do physical activity tend to have good physical fitness, while Islamic boarding schools that do not support their students to do physical activity are the main factors that cause lack of physical fitness in students.*

Keywords: *Factors, Physical Fitness, Santri, Islamic Boarding School.*

INTRODUCTION

Indonesia is the largest multicultural country in the world, this is characterized by many ethnic, ethnic, religious, and cultural groups (Nugraha, 2020). This has led to many educational institutions, one of which is pesantren(Widianto, Kristiyanto, & Liskustyawati, 2019)Ponorogo. This research uses descriptive method with survey research. The selected sample was 150 students with a purposive sampling technique. Data collection techniques using the Indonesian Physical Fitness Test (TKJI. Pesantren is an original Indonesian Islamic education (Hidayatulloh, Saepulmillah, Nugraha, & Hasanah, 2022). Pesantren is a religious educational institution that teaches, develops, and disseminates Islamic religious sciences.

Pesantren is the oldest Islamic educational institution in Indonesia(Almira, Hasan, & Dhita, 2021). According to Junaedi (2017: 172) pesantren are educational institutions that have elements, such as 1) kiai (teachers) as caregivers; 2) students studying Islam; 3) classical books written by earlier scholars (dominies) and in Arabic; 4) teaching system with recitation or madrasah; and 5) huts or dormitories for the students to live in. Along with the times, pesantren have undergone many changes. In addition to studying religious science, pesantren also add general subjects in the learning curriculum (Widianto et al., 2019)Ponorogo. This research uses descriptive method with survey research. The selected sample was 150 students with a purposive sampling technique. Data collection techniques using the Indonesian Physical Fitness Test (TKJI. This causes students to have a lot of burden to carry out their daily activities.

Physical Fitness is the ability and ability of the body to carry out a physical activity without causing significant fatigue (Wulandari & Jariono, 2022). Physical fitness is a need that needs to be met by a person in order to carry out his daily activities properly, efficiently and effectively. In addition, physical fitness can also be a benchmark for whether or not a person's physical condition is good (Najib et al. 2021). According to Caspersen, physical fitness can be categorized in health such as cardiorespiratory endurance, muscle strength. In addition, it is also related to skills such as speed and strength (Fühner, Kliegl, Arntz, Kriemler, & Granacher, 2021)efforts have been undertaken by for instance the World Health Organization (WHO.

Good or bad body fitness can be seen from the factors that affect it. In previous studies, there were factors related to students' physical fitness, such as physical activity, anxiety, and body mass index (BMI) (Alamsyah, Hestiningsih, & Saraswati, 2017)go to school and other activities that support learning. In children and adolescents physical fitness is often forgotten especially in early adolescence, even though physical fitness is very useful to support physical work capacity in order to achieve high learning achievement. This study aims to investigate factors related to physical fitness in adolescent students at SMKN 11 Semarang. This research investigates three aspects related to physical fitness of students, i.e. Physical Activity Level, Anxiety Level and Body Mass Index. The study was conducted on students of class XI in the age range 15 - 18 years. This type of research is an analytical survey with cross sectional approach. The population is a student of grade XI with a total of 525 students, then the sample was taken as many as 183 students. Primary data consists of questionnaires to determine physical activity and anxiety levels, while weight and height measurements are required to find out the Body Mass Index. In addition, physical fitness measurements were performed using the Cooper Test method. Meanwhile, secondary data in the form of information of active student of class 2015 is obtained from the administrations office's student center. Statistical analysis is using Spearman rank test and Pearson Product Moment correlation test. From the result of bivariate test at α=0,01, resulted in a significant positive relationship between physical activity with physical fitness (p=0,000 and r= 0,314. In addition, there is an influence between genders on students' physical fitness (Nurmitasari & Zaidah, 2020). According to Nurhasan (2011) there are internal and external factors in physical fitness. Internal factors are factors that have been inherent and settled in an individual, such as genetics, age, gender, and so on. External factors are factors obtained from outside, such as exercise, physical activity, lifestyle and nutritional status (Arifin, 2018). In addition, in Prianto's research (2022), factors that affect physical fitness, namely food and nutrition, sleep and rest, life habits, gadgets, and the environment (Prianto, Utomo, Abi Permana, Mutohir, & Suroto, 2022).

Based on the factors that affect physical fitness described above, it is still not explained the factors that affect the physical fitness of students specifically. For this reason, the author wants to know more about what factors contribute to the physical fitness of students in Islamic boarding schools.

METHOD AND MATERIALS

The design of this study uses the literature review method. A literature review study is a research design using secondary data related to a particular topic. The literature review study aims to conclude the theory from some of the results of previous research. This article review data collection method uses Google Scholar access for national research journal articles and international research journals. The literature review data collection stage uses the Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) flow method. The search for research journals is determined on criteria (1) variables according to needs, write down, (2) data collection methods are consistent, (3) research results are measured valid, (4) data analysis is clearly and precisely defined.

Researchers searched for articles on the topic of physical fitness factors in Islamic boarding schools, using google scholar databases for national and international articles. Google scholar was chosen because of its ease of access to get complete and in-depth articles. In addition, the keywords "santri" and "pondok pesantren" can only be searched in national research. To find articles that match the research objectives, researchers use Indonesian and English keywords. Keywords in Indonesian, including factors, physical fitness, students, boarding schools. Keywords in English, including factors, physical fitness, students, boarding school. The use of English words aims to get articles written by international researchers published in international journals.

The selection of study types is carried out through a screening process and determination of eligibility to be made in the meta-analysis. In the selection of studies in this study using several criteria, namely 1) articles related to sports and physical fitness of students 2) published in the last 8 years. Next, the researcher selected all titles and abstracts to check for duplication using the mendeley application. Search results and the process of selecting articles will be outlined using a flow chart. The 2020 Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) flowchart was used to summarize the study selection process.

RESULT

From the search that has been carried out by researchers found 9 national journals in the last 8 years that have been reviewed and obtained a variety of research methods and different results. The following is the author's name (year), research title, type of journal, study design, and factors that affect the physical fitness of students.

Table 1. *Article Review*

No	Author (year)	Title of study	Journal Type	Study Design	Factors Contributing to Santri's Physical Fitness
1.	(Al-Jamil, Sugiyanto, & Sugihartono, 2018)	Analysis of Physical Fitness Level of Islamic Boarding School Education Students in Kotaa Bengkulu	Kinestetik	Descriptive Qualitative	Physical activity patterns of pondok pesantren students, nutrition, physical education learning curriculum, facilities and infrastructure, teaching staff, extracurriculars with a frequency of once a week.
2.	(Wahab, Kusnadi, & Listyasari, 2021)	Physical Fitness Profile of Santri Riyadlul'ulum Wadda'wah Islamic Boarding School Tasikmalaya City	Poduim: Siliwangi *Journal of Sport Science*	Descriptive Qualitative	Physical activities carried out regularly by santri
3.	(Mubarok, Ginanjar, & Mudzakir, 2022)	Socialization of Physical Fitness Activities in Increasing Body Immunity of Darul Ma'arif Indramayu Islamic Boarding School Students during the New Normal Adaptation Period	Jornal Berkarya	Discussion, socialization, and evaluation	Lifestyle habits
4.	(Wahyu, Simanjuntak, & Atiq, 2017)	Physical Fitness Survey of Santri (Men) at Darul Khairat Islamic Boarding School Pontianak City	Journal Keolahragaan	Descriptive Survey	Islamic boarding schools have not paid attention to the physical fitness of santri, as seen from the facilities and infrastructure
5.	(Wijaya, Hudah, & Kresnapati, 2021)	Physical Fitness Level for Santri Putra Age 12-16 Years at Addainuriyah Islamic Boarding School 2 Pederungan Semarang	*Journal of Physical Activity and Sports*	Descriptive Quantitative Survey method	Self-motivation, exercise regularly, and rest while sleeping for at least 8 hours
6.	(Agus & Mudzakir, 2020)	Comparison of Physical Fitness of Students in Islamic Boarding Schools and in Regular Schools	Jurnal Kependidikan Jasmani dan Olahraga	*Ex-Post Facto*	Differences in the management of Islamic boarding schools, residences, climate, weather, living habits, physical education curriculum
7.	(Dian, Adi, & Andiana, 2018)	Sports Motivation Survey for Men Santri Sabillurrosyad Gasek Islamic Boarding School Malang	Prosiding Seminar Nasional Ilmu Keolahragaan	Descriptive Survey method	Lack of support from the lodge to perform sports activities, (Extrinsic Motivation)
8.	(Rejalestio & Sugihartono, 2022)	Fitness Level of Santri Boarding School in Rejang Lebong Regency	*Athena : Physical Education and Sports Journal*	Descriptive Qualitative	Lack of understanding of educators in Islamic boarding schools,

DISCUSS

Physical Fitness

According to the United States Department of Health and Human Services (USDHHS) physical fitness can be defined as a person's ability to perform daily tasks with vigor and alertness, without feeling significant fatigue with

enough energy to enjoy leisure time and be able to meet unexpected emergencies (Saunders et al. 2020). Physical fitness was found to have a relationship as a marker of a person's health. Physical fitness can be classified into cardiorespiratory, muscle strength, and neuromotor. Observational data showed that cardiorespiratory fitness in particular was positively associated with health indicators, including cardiometabolic, bone, and mental health, as well as muscle strength and movement skills (Joensuu et al., 2021).

Physical fitness is divided into two categories, namely health-related fitness and fitness related to skills. Health-related physical fitness, namely body composition, flexibility, cardiorespiratory endurance (aerobic endurance), muscle strength and muscle endurance (Sukamti & Zein, 2016; Mutaqin, 2018). Physical fitness is an important thing for students, because student activities in Islamic boarding schools are different from students in public schools (Al-Jamil et al., 2018) Santri who have good physical fitness, will be able to follow every activity in the Islamic boarding school well. This is in line with Prabowo's opinion (2022) that the better the level of physical fitness, the better a person will be in carrying out an activity. (Prabowo, Raibowo, eko nopiyanto, & restu illahi, 2022).

Factors of Santri's Physical Fitness

The good and bad of physical fitness can be seen through the factors that influence it. There are internal and external factors that affect physical fitness, such as genetics, age, gender, physical activity, nutrition, and healthy living habits (Fadilah & Adriani, 2023). Santri has differences with students in general, students who live in an Islamic boarding school have special factors that affect body fitness, such as physical activity, lifestyle (nutritional status and sleep quality), facilities and infrastructure (field, PJOK teachers, curriculum, and trainers), and motivation (self-will, boarding school regulations, and Islamic boarding school support) (Agus & Mudzakir, 2020; Al-Jamil et al., 2018; Dian et al., 2018; Mubarok et al., 2022; Rejalestio & Sugihartono, 2022; Wahab et al., 2021; Wahyu et al., 2017; Wijaya et al., 2021).

Physical activity on the physical fitness of santri

In several studies found, it is explained that doing physical activity is the main factor that affects the physical fitness of students (Agus & Mudzakir, 2020; Al-Jamil et al., 2018; Mubarok et al., 2022; Wahab et al., 2021; Wijaya et al., 2021). This is explained by Wahab et. al., (2021) in his research that students who carry out regular physical activities, their physical fitness is included in the good category (Wahab et al., 2021). Other studies report that there is a relationship between physical activity and physical fitness (Muharamda & Effendi, 2020; Setiawan, Munawwarah, & Wibowo, 2021; Syampurma, 2018). In addition, regular physical activity is not limited only to improving cardiorespiratory and muscular fitness, bone and cardiometabolic health, and positive effects on weight status, but also improving mental health and social health (Kapoor, Chauhan, Singh, Malhotra, & Chahal, 2022). Thus, life habits and physical activity will have an impact not only on the physical fitness of students, but also on the mental and social health of students. According to Ardella (2020), physical activity at the age of 12-18 years is at least 60 minutes per day with moderate to strong intensity. If you want to get health, you can do 20 minutes or more for 3-4 days a week (Ardella, 2020).

One study reported no significant results between physical activity and physical fitness (Suryadinata, Wirjatmadi, Adriani, & Lorensia, 2020)due to the poor conduction of physical activities. Meanwhile, a high level of physical activity positively affects the quality of life. However, irrespective of the numerous studies reported on the correlation between age, weight, and physical activity, there is limited study on the differences of physical activities in the geriatric and adult groups of obese and non-obese people. This study, therefore, aims to investigate the effect of age and weight on physical activity in geriatric and adult groups. Design and methods: The purposive sampling technique was used to obtain data from 154 respondents from community-integrated health care in Surabaya, East Java, Indonesia. These respondents were equally divided into two groups of adult (21-60 years. These results are influenced by other factors. According to Wiarto (2013) explained the level of physical fitness influenced by age, sex, genetics, food, smoking. Genetic factors have an effect on heart capacity, posture, obeistas, hemoglobin and muscle fibers.

A healthy lifestyle towards the physical fitness of students

In addition, life habits are another factor that affects the physical fitness of students (Agus & Mudzakir, 2020; Al-Jamil et al., 2018; Mubarok et al., 2022). A study reports that there is a relationship between a healthy lifestyle and

physical fitness (Abhinaya & Wahjuni, 2022). Lifestyle plays a very important role for health. In sociology, lifestyle is life for a person (Kamakhya, 2017). A healthy lifestyle is a way to live by maintaining all health conditions, which include drinks, food, nutritional consumption and daily behavior, it could be that in a sport it is able to manage health and be able to prevent all things that have the potential to cause disease (Monzera & Maria Ulfah, 2022).

The busy schedule of activities in Islamic boarding schools makes the lifestyle of students irregular. According to the observations that the author made, the lifestyle of students tends to be monotonous and irregular, such as lack of physical activity, irregular eating, messy sleep schedules and so on. A study reports that sleep quality has a close relationship with physical fitness (Gunarsa & Wibowo, 2021; Putra, 2019). Similar to sleep quality, nutritional status is also related to physical fitness (Cocca, Verdugo, Cuenca, & Cocca, 2020). Eating food has an influence on nutritional status, good nutritional status will support physical fitness Nutritional status in the good category if you get enough nutrients that can be used by the body to help physical growth, development of thinking, activeness, and general health. Nutritional status is lacking if the body receives nutrients in an excessive capacity that causes negative and harmful effects for body. Energy needs are determined by basal metabolism, age, physical activity, temperature, environment, and health, and the recommended amount of energy obtained from 50-60% carbohydrates, 25-35% protein, and 10-15% fat (Tangke, Katiandagho, & Rochmady, 2020).

Facilities and Infrastructure for the physical fitness of students

A study reports that there is a relationship between facilities and infrastructure on physical fitness (Saleh & Ramdhani, 2020). Another study reported that one of the factors that causes students to have low fitness is the lack of physical activity caused by inadequate facilities and infrastructure in Islamic boarding schools (Bangun & Zaluku, 2019). Sports facilities and infrastructure have a significant influence on sports participation (Sayyd, Zainuddin, Ghabban, & Altowerqi, 2021).

Motivation to exercise is expected physical fitness of students

Another factor that affects physical fitness is motivation. According to Mylsidayu (2014: 27-28) individual behavior in sports is influenced by motivation, namely intrinsic motivation and extrinsic motivation. Intrinsic motivation comes from within the individual himself to do sports activities, while extrinsic motivation comes from outside the individual to do sports activities. Research reports that intrinsic motivation has a greater influence than extrinsic motivation. Intrinsic factors that influence students to participate in sports activities include talent, physique, skills, and hobbies. In addition, extrinsic factors, including parents, friends, teachers, coaches, and schools (Nurwakhid, n.d.).

According to Mylsidayu (2014: 29) Exercise motivation is influenced by internal factors and external factors. Internal factors include, desire to grow and develop, express oneself, and hope. External factors include available facilities, facilities and infrastructure, training methods, training programs and environment. This means that there needs to be a combination of motivation between students and Islamic boarding schools, because the achievement of maximum physical fitness through high exercise motivation supported by high movement activities are two factors that influence each other (Nopiyanto & Dimyati, 2018).

CONCLUSION

Based on the description above, it can be concluded that the physical fitness of students is influenced by internal and external factors. Internal factors, including age, sex, genetics (heart capacity, body posture, obeistas, hemoglobin and muscle fibers), intrinsic motivation, physical activity, lifestyle (nutritional status and sleep quality). External factors, including facilities and infrastructure (field, physical education teachers, curriculum, and trainers), and extrinsic motivation (Islamic boarding school regulations, and Islamic boarding school support).

New findings in this study, that each Islamic boarding school has differences based on rules or habits that cause differences in physical fitness factors that occur in students. Islamic boarding schools that support their students to do physical activity tend to have good physical fitness, while Islamic boarding schools that do not support their students to do physical activity are the main factors that cause lack of physical fitness in students.

The combination of internal motivation in students and support from Islamic boarding schools will improve the physical fitness of students. Understanding the importance of physical fitness is a factor in the emergence of motivation in students and support from Islamic boarding schools. Further research is needed on intervention or

support from Islamic boarding schools for physical activity carried out by students as an effort to improve physical fitness.

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Paper review
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Implementation of Traditional Games on the Physical Condition of Badminton Athletes: Literature Review

Frans File Manihuruk, Ahmad Nasrulloh, Sigit Nugroho, Sumaryanto, Sumaryanti, Sulistiyono, Sumarjo, Yudik Prasetyo

Sport Science Study Program, Yogyakarta State University, Indonesia

Correspondence:
Frans File Manihuruk, Sport Science Study Program, Yogyakarta State University, Indonesia
fransfilemanihuruk.2022@student.uny.ac.id

Abstract: *The focus of the data presented in the literature review aims and focuses on describing traditional games, physical conditions and badminton. The method used in this research is a literature review by following the literature review procedure. Search for articles used for literature review using Google Scholar with the criteria of articles indexed by National Sinta, Copernicus International and Scopus International. Traditional games are games passed down from ancestors and preserved from generation to generation until today in Indonesia. Traditional games in Indonesia have different characteristics in each region in Indonesia and can be applied to training programs. Traditional games can improve various aspects of badminton's physical condition and can be used as part of a badminton training program.*

Keywords: *Traditional games, physical condition, badminton.*

INTRODUCTION

Traditional games are a symbol of knowledge passed down from generation to generation and have various functions or messages behind them (Rianto & Yuliananingsih, 2021). Traditional games are a cultural product that has great value in the context of fantasizing, recreation, creation, exercise and also as a means of practicing social life, skills, politeness and dexterity (Andriani, 2012). Traditional games are a means of playing for children and are beneficial for children's health, physical condition, fitness and growth and development. There are also positive values contained in traditional games, for example honesty, cooperation, sportsmanship, mutual help, responsibility and discipline (Husein, 2021).

Traditional games are games that make children feel happy and excited when playing traditional games (Kamid et al., 2022; Putranta et al., 2022). In line with this statement, Mashuri concluded that traditional games are games that have been preserved from their ancestors from generation to generation and have noble values that can act as reinforcement in increasing character values (Mashuri, 2021).

All regions of the Indonesian archipelago have their own traditional games with regional characteristics and are played using their respective regional languages (Hayati & Hibana, 2021). Each region in Indonesia has its own traditional games according to the culture they have and passed down from their ancestors (Syamsurrijal, 2020). Based on the description above, it can be concluded that traditional games are a culture that has developed to this day and are games inherited from the history of our ancestors which have positive values for society and have many benefits so that they have become national identity.

Traditional games are not just games but traditional games can also be used in sports learning and training methods (Handoko & Gumantan, 2021). This can be seen from traditional games being used as a learning medium to improve psychomotor, social, concentration and motor skills as well as being used as a training medium for sports in an effort to improve physical conditions such as VO_2 Max, agility, balance, endurance and speed (Kusumawati, 2018). The above opinion is in line with Kylasov's opinion which states that traditional sports are not only games for enjoyment but can be used as a method of learning and training in an institution and in sports branches (Kylasov, 2019) and Sun's opinion states that traditional games should be a very easy method. used in the learning process or as a training method in a sport (Sun, 2016).

In Indonesia, there are many kinds of traditional games or traditional sports such as gobak sodor, galah hadang, engklek, congkak, dragon snake, marbles, stilts and rope jumping (Sari et al., 2019). As traditional games develop, they have become a sports training program (Bile et al., 2021). One sport that already has training sessions using tra-

ditional games to improve physical conditions such as VO_2Max, agility, speed, endurance and balance is badminton.

Badminton is a game sport that uses a tool in the form of a racket to hit *the shuttlecock* which is the object and *the shuttlecock must not fall* on its own court. The idea of this game is to drop or turn off *the shuttlecock* as quickly as possible in the opponent's defensive court by passing it over the net to get a point and defend one's own court from the opponent's attack (Islamiah & Sepdanius, 2019). Badminton is a sport that demands very complex physical conditions such as VO_2 Max speed, agility, flexibility and balance. Research conducted by Pratama et al stated that there is a significant influence of traditional games on increasing agility and speed (Pratama et al., 2021).

Furthermore, research conducted by Flaviani showed that there was a significant effect of providing the gobak Sodor training program on the agility of badminton athletes (Flaviani et al., 2023). ; 1Traditional games are actually very good for physical training, and mental and physical condition improvement is determined by the training load given in traditional games (Bire et al., 2022). A traditional game training program that is given with the correct dosage will be able to provide changes, namely improving physical condition, increasing the capacity of skeletal muscles to burn glucose and fat for energy during exercise (Anggriawan, 2015). if an athlete has been through the process verycomplex exercise. At the rehearsal process the role of exercise physiology makeing absolutebasis in modifying training program. Sports Physiology is a branch of physiology that studiesthe physiological changes in the body when a person exercise . By knowing the changes thatoccur in the body, one can design an exercise program for making optimal changes asexpected. Errors in applying management training load, will adversely affects physiologicalcondition of the athlete. Pulse is high, often feel dizzy, interference with digestion andmetabolism, is the consequences of fatigue and overtraining, thus affecting the performanceof the athlete to achieve optimal performance.

The traditional game training program is provided continuously with an increase in training load so it can have a positive impact on the physical condition of badminton athletes and the traditional sports training program contains benefits that can improve physical, mental condition, good concentration and leadership spirit (Azahari, 2017) . From the opinion above, it is in line with the results of research conducted by Manihuruk et al which stated that traditional games have an effect on physical conditions such as concentration, agility and endurance of badminton athletes (Manihuruk et al., 2023) . It can be concluded from the opinions above that traditional games can be applied and included in badminton training programs to improve physical condition.

Based on previous studies and studies, this research aims to examine the implementation of traditional games on the physical condition of badminton athletes using a literature review method, because there are not many studies that have carried out treatment using traditional games to improve the physical condition of badminton athletes.

RESEARCH METHODS

This research uses a qualitative method, a descriptive model in the form of a literature study that uses literature reviews to strengthen research analysis. This research begins by searching for related literature, then collecting literature that is used to analyze important terms in studying, and obtaining discussions, then drawing conclusions based on the results that have been achieved. Literature study is a research design by collecting data sources related to a topic. Liverature review research is research that examines and analyzes previous research which then makes a summary according to the objectives (Hiver et al., 2024; Zhang et al., 2024) . The time span of the journals used for study is 2014-2023 with the characteristics of articles indexed by Sinta National, International Copernicus and International Scopus. Search for internet-based articles, namely Google Scholar, to further analyze several published articles that were used as references for the study in this research and those related to the title of this research, namely "Implementation of Traditional Games on the Physical Condition of Badminton Athletes".

RESULTS AND DISCUSSION

The review process was carried out on selected scientific articles based on topics related to this research Implementation of Traditional Games on the Physical Condition of Badminton Athletes. There is 1 National Sinta 2 indexed article and 1 International Copernicus indexed article which is reviewed based on the author's name, year of publication, journal index, research methods and research results. The following is a review of the articles that have been reviewed:

Table 1. *Journal Review*

Authors/ year	Title	Research methods	Journal Index	Research findings
Manihuruk et al., (2023)	Exploration of The Traditional Game of Galah Hadang: Does it Effect the Concentration, Agility and Endurance of Early Age Badminton Players?	This study used an experimental method	Sinta 2	The results showed a sig value of p= 0.00 (< 0.05) so that it was concluded: There is an influence of the traditional game of galah hadang on increasing the concentration of early age badminton athletes, there is an influence of the traditional game of galah hadang on increasing the agility of early age badminton athletes, and there is an influence of the traditional game of galah hadang on increasing the endurance of early age badminton athletes.
Flaviani et al., (2023); 1	The Effectiveness of Gobak Sodor Game on Inc increasing Agility in PB Athletes Mega Citra	This type of research is experimental research	Copernicus	The results showed that the value of the T test analysis (15.24) was greater than the value of the T table (1.729) so it could be concluded that there was an effect of the Gobak Sodor game on increasing the agility of Pb athletes. Mega Image. Analysis of research data manually without using SPSS. The frequency of exercise is 3 times a week according to the training schedule, the number of meetings is 16 times. The traditional game of gobak sodor is a cultural heritage that can be played by all ages and needs to be applied by coaches for training methods to increase agility in badminton athletes.

From the results of the literature review that has been discussed previously, there are several discussions that are mutually beneficial in training the physical condition of badminton athletes through traditional games, because so far from the author's knowledge, searching for articles with the title traditional games to improve the physical condition of badminton athletes has not been done much. Traditional games can improve physical condition and develop character (Adi et al., 2020). Traditional games applied in training sessions make athletes move more actively to fulfill or achieve the expected physical conditions (Hussain & Cheong, 2022; Irwansyah et al., 2022).maintain health, and achieve athletic excellence. Yet, there is evidence that GMS levels of children are on a decline globally. Therefore, the main purpose of this study was to investigate the effectiveness of traditional cultural games (TCG

Based on table 1 above, it can be seen that traditional games have a significant effect on improving the physical condition of badminton athletes. Traditional games often require high physical endurance because they require intensive and continuous movement. Traditional games such as gobak sodor, engklek or jumping rope require good strength and endurance. These exercises can indirectly help increase endurance and muscle strength which is important in badminton. Traditional games also involve movements that require agility and good balance, such as jumping, dodging, and turning. This skill is very important in the game of badminton, where athletes need to have the ability to move quickly and change direction with agility. Through traditional games, badminton athletes can improve agility and balance.

Traditional games can be a valuable addition to a badminton athlete's training to improve the athlete's physical condition. Through traditional games, athletes can develop and improve various physical and non-physical skills that are important for optimal performance in badminton athletes. Keeping these benefits in mind, coaches and athletes can incorporate traditional game elements into their training programs to achieve better results in badminton matches.

Traditional Games Definition

Traditional games are a form or form of culture (Tyas & Widyasari, 2023). Traditional games are a type of game in a particular area that is based on that culture or area (Gustira et al., 2023). Traditional games are a form of oral folklore because they are obtained through oral tradition, the nature or characteristics of traditional games are

old, their origins are unknown, who the creator is and where they come from (Aulia & Sudaryanti, 2023). Usually it is spread by word of mouth and sometimes undergoes changes or forms even though it is based on the same thing inherited from ancestors (Saputri & Katoningsih, 2023). In Indonesia itself, it is difficult to know exactly when and where traditional games started, sometimes traditional games have the same concept but only have different names for each region (Erwanda & Sutapa, 2023).

The main characteristics of traditional games are that they are usually simple, use materials that are easily found in the surrounding environment, and support social interaction between players (Muharrahman et al., 2023). Traditional games often reflect cultural values, social norms and habits in a society, and play a role in forming identity and solidarity between players but can also improve physical conditions (Marcheta & Kareem, 2023). The existence of traditional games is very important to preserve the cultural heritage of a nation, so that traditional games can be played in sports training program sessions such as badminton and traditional games that can train physical conditions, as well as educate a person in terms of character and can foster sportsmanship.

Physical Condition

Physical condition is an important element and is the basis for developing techniques, tactics and strategies (Yu & Mohamad, 2022). Physical condition is one of the requirements that is very necessary in efforts to improve an athlete's performance, even as a starting point for starting sports achievements (Ramadan et al., 2023). Physical ability is the ability to function the body's organs in carrying out physical activities (Rahmi et al., 2023). Physical abilities are very important to support developing psychomotor activities. Skilled movements can be performed if physical abilities are adequate. Physical condition is a complete unit of components that cannot be separated, either for improvement or maintenance (Nasrulloh et al., 2021). This means that in an effort to improve physical condition, all of these components must develop.

Physical condition status can reach an optimal point if you start training from an early age and do it continuously and continuously, guided by the basic principles of training (Nugroho et al., 2021). The status of a person's physical condition can be determined by means of an assessment in the form of an ability test. Physical conditioning training also has a big influence on increasing athletes' self-confidence and reducing the risk of injury. Guided by the description above, it can be interpreted that in achieving sporting achievements, physical condition factors are very important to develop and train (Irsyad et al., 2023).

Playing traditional games regularly can also help in increasing physical endurance and heart strength. Activities such as running, jumping, or doing intense movements in traditional games can burn calories, increase heart rate, and increase lung capacity, this is important for badminton athletes because they need good endurance to survive the match long and capable of performing a series of rapid movements repeatedly. Regular traditional games can provide many benefits for badminton athletes, both physically and mentally. A combination of varied physical training and developing mental skills can help athletes achieve their best performance on the field.

The Influence of Traditional Games on the Physical Condition of Badminton Athletes

Traditional games can develop athletes' gross and fine motor skills, such as balance, movement control and sensory sensitivity. These motor skills are important in badminton to carry out precise and precise movements. Traditional games involve movements that require good body flexibility, such as squatting, flexing the body, or stretching the muscles. This increased flexibility can help prevent injury and increase the athlete's range of motion, which is important in badminton for achieving more effective shots.

Traditional games involve movements that require good coordination between eyes, hands and feet. Training with traditional playing methods can help improve athletes' speed and coordination, which are important physical condition factors in badminton. Traditional games require active use of body muscles, such as jumping, pushing, or pulling. Training with traditional games can help strengthen the main muscles needed in badminton, such as the arms, legs and core muscles. Traditional games involve intense and repetitive movements, such as running, jumping, or moving quickly to chase a shuttlecock, so traditional games help increase the endurance of badminton athletes who require high stamina.

CONCLUSION

Traditional games are games passed down from ancestors and preserved from generation to generation until today in Indonesia. Traditional games in Indonesia have different characteristics in each region in Indonesia and can be applied to training programs. Traditional games can improve various aspects of badminton's physical condition and can be used as part of a badminton training program.

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Strategies for Developing Local Wisdom-Based Sport Tourism to Achieve Sustainable Development Goals (SDGs) in South Sulawesi Province

Ikadarny[1], Haeril[1], Muh. Ilham Aksir[1], Suparman[2], Nur Indah Atifah Anwar[1], Nurul Fadilah Aswar[3], Yudik Prasetyo[4], Susanto[5]

[1]*Faculty of Sports Science and Health, Makassar State University, Indonesia*
[2]*PJKR STKIP YPUP Makassar, Indonesia*
[3]*Faculty of Economics, Department of Management, Makassar State University, Indonesia*
[4]*Sports Science Study Program, Faculty of Sports, Yogyakarta State University, Yogyakarta, Indonesia*
[5]*State Islamic University Sayyid Ali Rahmatullah Tulungagung, Tulungagung, Indonesia*

Correspondence:
Ikadarny, Faculty of Sports Science and Health, Makassar State University, Indonesia
ikadarny@unm.ac.id

Abstract: *This study explored the development strategies of sport tourism based on local wisdom in South Sulawesi Province to achieve the Sustainable Development Goals (SDGs), particularly in poverty reduction. The SDGs, adopted in Indonesia through Presidential Regulation No. 59 of 2015, prioritized poverty alleviation as a primary goal. This research assessed the potential of sport tourism by leveraging the diversity of nature and local culture to enhance the rural economy. South Sulawesi, rich in natural and cultural resources, offered significant potential for sport tourism. Activities such as marathons at the Maros GeoPark, mountain biking in Malino Pine Forest, and jet ski festivals at Tanjung Bira Beach attracted tourists and stimulated the local economy. However, the decline in tourist visits highlighted the need for new strategies. A qualitative method was used to analyze the potential and obstacles in sport tourism development. The results showed that sport tourism based on local wisdom could reduce poverty through job creation and increased income from tourist spending. The elements of "something to see," "something to do," and "something to buy" in South Sulawesi enhanced tourism appeal and the local economy. Challenges such as infrastructure, stakeholder coordination, and community training needed to be addressed. This study suggested better traffic systems, effective communication, and the enhancement of local human resource capacities. An inclusive approach in planning and managing tourist destinations was expected to maximize economic benefits while preserving the local environment and culture, making sport tourism based on local wisdom a sustainable development model for South Sulawesi.*

Keywords: *Sport, Tourism, Development, Local wisdom.*

INTRODUCTION

Sustainable Development Goals (SDGs) is a new global development platform agreed upon by 193 member countries of the United Nations (UN). The SDGs serve as a continuation of the Millennium Development Goals (MDGs), which ended in 2015 (Aji & Kartono, 2022). The globally scoped Sustainable Development Goals were later adopted in Indonesia as part of the sustainable development goals outlined in Presidential Regulation No. 59 of 2015. These goals have been integrated into national and regional development agendas, extending down to the village level (Natalia & Maulidya, 2023).

One of the primary objectives of the Sustainable Development Goals (SDGs) is "No Poverty," aimed at eradicating poverty. Poverty is a multidimensional issue that has broad impacts on individuals and society. It not only affects the economic aspect but also leads to other social problems (Komalasari, 2023). Poverty remains a major issue in Indonesia, with the number of poor people reaching 26.36 million (BPS Indonesia, 2023). This figure indicates that poverty levels in Indonesia are still quite high, with much of it concentrated in rural areas (Purwanti, 2024).

The high level of poverty in rural areas has driven urbanization, with residents migrating from villages to cities in an attempt to escape poverty, drawn by job opportunities and higher wages in the industrial and service sectors of urban areas. This phenomenon aligns with Todaro's Migration Theory, which states that the primary motivation for workers to migrate is the expectation of higher wages (Todaro & Smith, 2006). Excessive urbanization can lead to various issues, not only in the destination cities but also in the rural areas left behind. Problems in cities include

increasing poverty rates, the rise of slum settlements, higher urban crime rates, air and noise pollution, among other issues (Syafira & Triani, 2021). In rural areas, the depletion of human resources due to migration to cities can hinder significant development (Yanuar et al., 2023).

One strategy to reduce rural poverty is by optimizing the local potential in each region (Setiadi & Pradana, 2022). Tourism is one sector that can be leveraged, as it can generate demand in both consumption and investment, which in turn drives the production of goods and services (Hidayatullah & Suminar, 2021). Tourists spend money, which directly increases market demand for tourism-related goods and services. This creates new opportunities to boost rural incomes and generate employment (Eddyono, 2021). South Sulawesi is a province with significant tourism potential, as evidenced by its geographic conditions, which offer abundant natural resources. In addition to these natural assets, South Sulawesi's rich cultural diversity is also a major attraction for cultural tourism, enticing international tourists to visit (Surur et al., 2014). However, according to data from BPS South Sulawesi (2023), the number of tourists visiting the province decreased by 28.76%. In January 2023, only 1,090 international tourist arrivals were recorded, compared to 1,530 in December 2022.

One strategy to attract both domestic and international tourists to South Sulawesi is by developing new tourism markets, such as sport tourism. Sport tourism, a combination of sports and tourism, is a growing sector that has been drawing increasing numbers of tourists worldwide (Jiménez-García et al., 2020). As a branch of sustainable tourism, sport tourism offers a solution that balances conservation needs with economic demands, particularly for communities surrounding tourist destinations (Zhao & Xia, 2020). This highlights the importance of exploring and developing strategies to optimize the benefits of sport tourism. Such an approach involves local communities not only as beneficiaries but also as active stakeholders in managing and developing sport tourism (Ridwanullah et al., 2021). Through direct participation, communities can contribute to environmental conservation while simultaneously enhancing their economic well-being (Hidayat et al., 2024). By focusing on local economic empowerment, this approach is relevant not only to the global sustainable development agenda but also to local needs for job creation and economic diversification. Sport tourism, based on local wisdom, can become a development model that provides broad benefits, from poverty reduction to environmental preservation (K et al., 2023).

This research became highly relevant in the present context, as many local communities struggled to find economic development alternatives that were not only financially profitable but also sustainable and ethical. The increasing pressure on natural resources and the environment required innovative and inclusive approaches to tourism development that prioritized environmental sustainability and the socioeconomic well-being of local communities (Manurung et al., 2019). Based on the above background, the problem formulation of this research aimed to identify the obstacles faced by the government and local communities in utilizing tourism potential, as well as the effective strategies for developing sport tourism. By understanding the factors that influenced the success and failure of sport tourism development initiatives, stakeholders could develop more effective strategies to promote local economic empowerment through sustainable tourism.

RESEARCH INSTRUMENTS

This research employed a qualitative analysis method, which is a series of systematic, factual, and accurate investigations into social phenomena that provide a comprehensive and holistic overview of tourism potential as a location for sport tourism and the development strategies for sport tourism-based tourism in South Sulawesi. The study aimed to offer a better understanding of the situation or issue being studied. The research was conducted in the province of South Sulawesi. The steps to select the subjects as samples involved determining the areas for the study, considering locations that had the most frequent direct interaction with the local community as a clear selection criterion to ensure that the cases were relevant to the research problem. The research locations included the Maros GeoPark, where marathon running around the GeoPark could be developed as a form of sport tourism; the Malino Pine Forest in Gowa Regency, where mountain biking (MTB) could be promoted; and Tanjung Bira Beach in Bulukumba Regency, where a Jet Ski Festival could be established as a sport tourism event.

The stages of this research began with selecting the tourism locations: GeoPark in Maros Regency, Malino Pine Forest in Gowa Regency, and Tanjung Bira Beach in Bulukumba Regency. This was followed by the development of research instruments, including documentation, interview guidelines, and observation checklists, to collect data through in-depth interviews with community members from various levels and by observing their work processes and interac-

tions in the development of sport tourism. The collected data were analyzed using thematic analysis to identify themes, patterns, and relationships within the data, providing a holistic understanding of sport tourism development strategies. The data analysis technique employed was the interactive model of analysis, focusing on three components: data reduction, data display, and conclusion drawing, which included stages of inference and verification (Miles et al., 2019).

RESULT

The results of this research indicated that the development of sport tourism based on local wisdom in South Sulawesi Province offers significant potential to achieve the Sustainable Development Goals (SDGs), particularly in reducing poverty in rural areas. By leveraging local natural and cultural assets, such as the Maros GeoPark, Malino Pine Forest in Gowa Regency, and Tanjung Bira Beach in Bulukumba Regency, sport tourism can become an effective alternative to boost the local economy and create jobs. Activities like marathons, mountain biking, and jet ski festivals not only showcase the beauty of the local environment but also stimulate the economy through increased tourist spending and local market demand.

This research identified that the element of "something to see" in sport tourism based on local wisdom in South Sulawesi is highly appealing to tourists. One example is the Maros GeoPark, which offers unique and stunning geological scenery. The diverse rock formations and biodiversity in this area create a rich and educational visual experience. Visitors can enjoy the natural beauty while learning about the geological processes that shaped the region, making it a tourist destination that is not only attractive but also informative.

In addition to the breathtaking scenery, this research also highlighted the element of "something to do," which involves various sporting activities at the Malino Pine Forest and Tanjung Bira Beach. At the Malino Pine Forest, visitors can enjoy the challenging activity of mountain biking, inviting them to explore beautiful natural trails. Meanwhile, Tanjung Bira Beach offers thrilling experiences through jet ski activities, providing tourists with the opportunity to enjoy excitement on the water. These activities are not only entertaining but also promote an active lifestyle, attracting visitors from diverse backgrounds.

The element of "something to buy" in the development of sport tourism also holds significant potential to boost the local economy. As the number of tourists increases, the demand for local products and services will also rise. Local communities can seize this opportunity to sell handicrafts, souvenirs, and regional delicacies. The sale of these products not only provides additional income but also allows the community to introduce local wisdom to tourists. Thus, the development of sport tourism based on local wisdom not only focuses on the tourism experience but also emphasizes the economic empowerment of the community through sustainable local trade.

Despite its significant potential, this research also identified several obstacles to the development of sport tourism. Key challenges include a lack of adequate infrastructure, coordination among stakeholders, and the need for training for local communities to enable them to participate effectively in this sector. Therefore, the main recommendations from this research emphasized the importance of establishing a good traffic management system, effective communication between the government and the community, and enhancing local human resource capacity to support sustainable sport tourism development.

The study also highlighted the need for an inclusive and sustainable approach to sport tourism. By actively involving local communities in planning and implementation, sport tourism can not only provide economic benefits but also aid in the preservation of the environment and local culture. Community participation in the management of tourist destinations can mitigate negative environmental impacts and ensure that the benefits of tourism are equitably shared among all parties involved.

Overall, the development of sport tourism based on local wisdom in South Sulawesi can serve as a beneficial and sustainable development model. With the right strategies, sport tourism can support the achievement of the Sustainable Development Goals (SDGs) by reducing poverty, protecting the environment, and enhancing the quality of life for local communities. This research provides valuable insights into how sport tourism can be optimized to achieve sustainable development goals while respecting and leveraging local wisdom.

DISCUSSION

The development of sport tourism based on local wisdom in South Sulawesi Province represents a promising strategy to support the achievement of the Sustainable Development Goals (SDGs), particularly in addressing poverty.

The SDGs, as a global agenda adopted in Indonesia through Presidential Regulation No. 59 of 2015 (Amirya & Irianto, 2023), emphasize poverty alleviation as one of the main objectives. In South Sulawesi, with its rich natural and cultural potential, the development of sport tourism can make a significant contribution to reducing poverty in rural areas. Sports activities combined with tourism, such as marathons, mountain biking, and jet ski festivals, offer opportunities to enhance the local economy and create new jobs, which can directly increase the income of local communities.

This research demonstrates that sport tourism in South Sulawesi can enhance tourism appeal through engaging elements such as "something to see," "something to do," and "something to buy." The GeoPark of Maros offers unique geological beauty, the Pine Forest of Malino provides challenging mountain biking trails, and Tanjung Bira Beach presents exciting jet ski activities. These elements not only enrich the tourist experience but also have great potential to attract more visitors, thereby increasing the demand for local products and services. With the rise in tourist spending, local communities can gain greater economic benefits from the sale of handicrafts and regional delicacies.

This research aligns with the impact analysis of sport tourism conducted in the Thousand Islands, which showed that the development of sport tourism can have a significant positive effect on the well-being of local communities. The study found that sports activities integrated with tourism not only attract visitors but also increase local income through job creation and enhanced demand for local products and services. This reflects a similar potential in South Sulawesi Province, where sport tourism based on local wisdom can be an effective tool for poverty alleviation (Widyaningsih et al., 2020).

However, the development of sport tourism is not without its challenges. This research identifies key obstacles such as inadequate infrastructure, poor coordination among stakeholders, and the need for training for local communities. These challenges must be addressed for sport tourism to develop optimally. Effective traffic management, clear communication between the government and the community, and capacity building for local human resources are essential steps to support the sustainable development of sport tourism. This will ensure that the potential of sport tourism can be maximized for the benefit of the local economy.

In line with the efforts to develop tourist villages in Klungkung Village, Jember Regency, which aim to enhance economic independence based on local potential, the development of sport tourism in South Sulawesi also focuses on leveraging local resources to stimulate the economy. Both studies emphasize the importance of recognizing and optimizing existing resources, whether in the form of tourist attractions, culture, or sports activities, to improve the welfare of local communities. Furthermore, the research in Klungkung indicates that optimal management of local potential involves various aspects such as amenities, accessibility, and information. This aligns with the challenges faced in the development of sport tourism, where adequate infrastructure and coordination among stakeholders are crucial. By conducting surveys and in-depth discussions, the study in Klungkung can provide valuable insights into how similar strategies can be applied in the context of sport tourism to address existing obstacles and ensure sustainable development (Mulyono et al., 2024).

This research identified that local wisdom-based sport tourism provides "something to see," "something to do," and "something to buy," which can enhance the tourist appeal in South Sulawesi. For instance, GeoPark in Maros Regency offers unique geological views, while Pine Forest in Malino and Tanjung Bira Beach provide sports activities such as mountain biking and jet skiing. Additionally, these activities have the potential to improve local skills and increase community income through the sale of local products and services related to tourism.

This study aligns with the analysis of the tourism potential of Blue Lagoon Beach in Bali, which also emphasizes the importance of the components "something to see," "something to do," and "something to buy" in developing tourist attractions. At Blue Lagoon Beach, research indicated that despite its significant potential, management needed improvement to offer appealing attractions and adequate facilities. This reflects the necessity for a well-planned strategy to optimize tourist appeal, similar to the approach taken in the development of local wisdom-based sport tourism in South Sulawesi. Furthermore, the study of Blue Lagoon Beach identified various facilities that could support tourist activities, including shopping venues and additional services. This relates to the findings that indicate sport tourism not only offers sports activities but also creates opportunities for tourists to purchase local products. By developing suitable facilities in both Blue Lagoon Beach and in the context of sport tourism, these locations can enhance the tourist experience and provide economic benefits to the local community (Paramitha, 2022).

An inclusive and sustainable approach is crucial in the development of sport tourism. Active participation of local communities in the planning and implementation of sport tourism projects ensures that economic benefits are

also felt by the local community. Furthermore, involving the community in managing tourist destinations can aid in the preservation of local environment and culture. By engaging the community directly, negative impacts on the environment can be minimized, and the profits from tourism can be distributed fairly. This approach aligns with the principles of the Sustainable Development Goals (SDGs), which prioritize sustainability and social welfare.

The active participation of communities in managing tourist destinations not only supports economic sustainability, but also helps preserve the environment and local culture. This is in line with research findings in Bulukumba which show that the involvement of various stakeholders, including community groups such as Pokdarwis, is crucial for tourism sustainability and improvement (Ahmad et al., 2024). Overall, the development of local wisdom-based sports tourism in South Sulawesi has the potential to be an effective and sustainable development model. With the right strategy, sports tourism can not only support the achievement of the SDGs by reducing poverty and protecting the environment, but also improve the quality of life of local communities. This research provides valuable insights into how sports tourism can be optimized to achieve sustainable development goals while respecting and utilizing local wisdom. This positions sports tourism as a promising alternative for development in areas rich in natural and cultural potential, such as South Sulawesi. Especially in preserving traditional sports so that the next generation of the nation can maintain and utilize traditional sports as a vehicle in various aspects of development and education (Susanto et al., 2022).

CONCLUSION

The development of sport tourism based on local wisdom in South Sulawesi offered a potential solution to reduce poverty in rural areas. By leveraging the natural and cultural potential of locations such as GeoPark Maros Regency, Malino Pine Forest, and Tanjung Bira Beach, sport tourism could enhance the local economy through job creation and increased income from tourism. Sporting activities such as marathons, mountain biking, and jet ski festivals not only promoted the beauty of nature but also encouraged tourist spending, which positively impacted the local economy.

However, the development of sport tourism in South Sulawesi faced challenges such as inadequate infrastructure, poor coordination among stakeholders, and the need for training for local communities. Therefore, it was essential to implement inclusive and sustainable strategies by involving the community in the planning and management of tourist destinations. This approach would not only maximize economic benefits but also assist in the preservation of local environments and cultures. With the right strategies, sport tourism could serve as an effective and sustainable development model, aligned with the Sustainable Development Goals (SDGs), while providing long-term benefits for local communities.

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Paper review
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The Role of Physical Exercise in Reducing ADHD Symptoms in School-Aged Children

Uloga fizičkog vježbanja na smanjenje adhd sindroma kod djece školskog uzrasta

Olivera Krivokapić

Primary School "Ratko Zarić", Nikšić, Montenegro

Correspondence:
Olivera Krivokapić
Primary School "Ratko Žarić", Nikšić, Montenegro
krivokapicoliver@gmail.com

JU Osnovna Skola "Ratko Zarić", Nikšić, Crna Gora

Korespondencija:
Olivera Krivokapić
JU Osnovna Škola "Ratko Žarić", Nikšić, Crna Gora
krivokapicolivera@gmail.com

Abstract: *Attention Deficit Hyperactivity Disorder (ADHD), characterized by developmentally inappropriate levels of attention, hyperactivity, and impulsivity, is considered one of the most common neurodevelopmental disorders in school-aged children. The number of children diagnosed with ADHD is steadily increasing in most developed and developing countries. This disorder often coexists with other neurodevelopmental disorders such as conduct disorder, specific learning disorders, depression, anxiety, and mood disorders. The global prevalence rate of ADHD is over 5%, and it is about three times more common in males than in females. Symptoms of attention deficit and hyperactivity disorder can hinder academic progress. According to numerous studies, physical activity can help alleviate symptoms and enable students to better focus on school and other daily tasks. Therefore, this paper is dedicated to analyzing the positive impacts of organized physical exercise on ADHD syndrome in school-aged children through a review of some key research studies.*

Keywords: *attention deficit, hyperactivity, school-age, physical exercise*

Sažetak: *Poremećaj pažnje i hiperaktivnosti (ADHD) koji karakteriše razvojno neodgovarajući nivo pažnje, hiperaktivnost i impulsivnost, smatra se jednim od najčešćih neurorazvojnih poremećaja u školskom uzrastu. Broj djece sa dijagnozom ADHD je u konstantnom porastu u većini razvijenih i zemalja u razvoju. Ovaj poremećaj često ima komorbiditete sa drugim neurorazvojnim poremećajima kao što su poremećaj ponašanja, specifični poremećaji učenja, depresija, anksioznost i poremećaji raspoloženja. Globalna stopa prevalencije ADHD je preko 5% i oko tri puta je češća kod muškaraca nego kod žena. Simptomi poremećaja pažnje i hiperaktivnosti se mogu smatrati ograničenjima za akademski napredak. Prema brojnim istraživanjima fizička aktivnost može pomoći u poboljšanju simptoma i omogućiti učenicima da se bolje fokusiraju na školske i druge svakodnevne obaveze. Iz tog razloga, ovaj rad je posvećen analizi pozitivnih uticaja organizovanog fizičkog vježbanja na ADHD sindrom djece školskog uzrasta kroz pregled nekih referentnih istraživačkih studija.*

Ključne riječi: *poremećaj pažnje, hiperaktivnost, školski uzrast, fizičko vježbanje*

INTRODUCTION

Attention Deficit Hyperactivity Disorder (ADHD), characterized by developmentally inappropriate levels of attention, hyperactivity, and impulsivity, is considered one of the most common psychiatric disorders and the most prevalent neurodevelopmental disorder in childhood (Gapin and Etnier, 2010). This disorder is typically not diagnosable through medical laboratory tests. Diagnosis is primarily based on reports from parents and teachers, given the learning difficulties caused by attention deficits and/or its fluctuations, impulsivity, and anxiety (Rowland et al., 2002).

Attention Deficit Hyperactivity Disorder (ADHD) has a prevalence of approximately 5.5% worldwide (Er-

UVOD

Poremećaj pažnje i hiperaktivnosti (ADHD) koji je karakteriše razvojno neodgovarajući nivo pažnje, hiperaktivnost i impulsivnost, smatra se jednim od najčešćih psihijatrijskih poremećaja i kao najčešći neurorazvojni poremećaj u detinjstvu (Gapin and Etnier, 2010). Ovaj poremećaj se najčešće ne može dijagnostikovati putem medicinskih laboratorijskih testova. Dijagnoza se uglavnom zasniva na izvještajima roditelja i nastavnika, s obzirom na smetnje u učenju zbog nedostatka pažnje i/ili njene fluktuacije, impulsivnosti i anksioznost (Rowland et al., 2002).

Poremećaj deficita pažnje i hiperaktivnosti (ADHD) ima prevalenciju od oko 5,5% širom svijeta (Erskine et

skine et al., 2017). ADHD is characterized by symptoms of inattention or hyperactivity/impulsivity that persist for at least 6 months to a degree that is inconsistent with the child's developmental level, negatively impacting social and academic activities (American Psychiatric Association & DSM Task Force, 2017). ADHD is associated with a higher risk of comorbid mental disorders, substance use disorders, and impairments in social, academic, and professional functioning (Erskine et al., 2016). This disorder negatively affects social, academic, emotional, and psychological functioning, and imposes significant costs on society and the healthcare system. It is estimated that about 60% of children diagnosed with ADHD continue to have the disorder into adulthood (Sibley et al., 2017).

The number of children diagnosed with ADHD is steadily increasing, while the number of children engaging in physical exercise is decreasing, and the number of children being treated for ADHD with stimulant medications is higher than ever (Meppelink, 2016). Children with ADHD are at greater risk of being less physically fit, are more likely to be obese, and typically have lower functional cognitive abilities and comprehension skills, making academic progress more challenging for this group. They display poorer skills in sports activities, have inferior athletic abilities, and exhibit below-average motor performance and physical fitness (Golubović, 2014). Additionally, children with ADHD are characterized by persistent and disruptive patterns of inattention, hyperactivity, and/or impulsivity. The purpose of this study was to determine whether physical activity reduces ADHD symptoms in children and improves other health-related issues associated with this disorder.

METHOD

In this review paper, several studies from the Web of Science (WOS) database were examined, focusing on research results related to the impact of physical exercise on reducing ADHD symptoms in school-age children. After reviewing 86 scientific papers, those involving children and adolescents aged 6-18 years, from primary and/or secondary school, were selected.

Hoza and Smith (2014) conducted a review study indicating the positive effects of organized physical activity on reducing ADHD symptoms in children. Specifically, in this review paper, the authors searched for studies that investigated the impact of physical exercise on children with ADHD, where researchers attempted to determine whether physical activity was more effective in reducing ADHD symptoms in children than sedentary activities. The physical activity programs in this study

al., 2017). ADHD karakterišu simptomi nepažnje ili hiperaktivnosti/impulsivnosti, koji traju najmanje 6 mjeseci do stepena koji nije u skladu sa razvojnim nivoom djeteta, što ima negativan uticaj na društvene i akademske aktivnosti (American Psichiatric Association, & DSM Task Force, 2017). ADHD je povezan sa većim rizikom od komorbidnih mentalnih poremećaja i poremećaja upotrebe supstanci, kao i socijalnih, akademskih i profesionalnih oštećenja (Erskine et al., 2016). Ovaj poremećaj ima negativan uticaj na društveno, akademsko, emocionalno i psihološko funkcionisanje i stvara visoke troškove za društvo i zdravstveni sistem. Smatra se da oko 60% djece sa dijagnozom ADHD ima taj poremećaj i u odrasloj dobi (Sibley et al., 2017).

Broj djece sa dijagnozom ADHD-a je u konstantnom porastu, dok broj djece koja vježbaju opada, a broj djece koja se liječe od ADHD-a stimulativnim lekovima je veći nego ikada (Meppelink, 2016). Djeca sa ADHD-om su u većem riziku da budu manje fizički sposobna, veća je vjerovatnoća da će biti gojazna i obično imaju niže funkcionalne kognitivne sposobnosti i vještine razumevanja, što otežava akademski napredak ovoj grupi djece. Ona pokazuju lošije veštine u sportskim aktivnostima i imaju inferiorne sportske sposobnosti, kao i ispodprosječne motoričke performanse i fizičku spremnost (Golubović, 2014). Pored toga, djecu sa ADHD karakterišu uporni i narušavajući obrasci nepažnje, hiperaktivnosti i/ili impulsivnosti. Svrha ove studije bila je da se utvrdi da li fizička aktivnost smanjuje simptome ADHD-a kod djece i poboljšava druga zdravstvena pitanja povezana sa ovim poremećajem.

METOD RADA

U ovom preglednom radu razmotrene su neke studije iz baze podataka Web of Science (WOS) u kojima su prezentovani rezultati istraživanja uticaja fizičkog vježbanja na umanjenje ADHD-simptoma kod djece školskog uzrasta. Nakon razmatranja 86 naučnih radova odabrane su one u kojima u ispitanici bili djeca i adolescenti osnovnoškolskog i/ili srednješkolskog uzrasta od 6-18 godina.

Hoza i Smith, (2014) su sproveli pregledno istraživanje koje ukazuje na pozitivne efekte organizovane fizičke aktivnosti na umanjenje ADHD simptoma kod djece. Konkretno, u ovom preglednom radu pomenuti autori su pretraživali izvore za studije koje su se zasnivale na uticaju fizičkog vježbanja na djecu sa ADHD-om u kojima su istraživači pokušali utvrdili da li je fizička aktivnost efikasnija u smanjenju simptoma ADHD-a kod djece od sedentarnih aktivnosti. Programi fizičke aktivnosti u ovoj studiji uključivali su opcije fizičke aktivnosti u zatvorenom i na

included both indoor and outdoor physical activities, such as active games, yoga, guided walks, cycling, and more. The studies analyzed focused on children and/or adolescents aged 6-18 years who had been previously diagnosed with ADHD and were randomly assigned to one of two groups. One group participated in physical activities, while the other engaged in stationary classroom activities, such as art projects. As part of the group equalization process, the groups were balanced by gender, chronological age, and ADHD risk status (Hoza, 2014). The physical activities were selected based on age-appropriate activities and games to maintain participants' interest. At the end of the 12-week study, the two groups were compared to determine which group benefited more from physical activity. The hypothesis was confirmed that the group of children at risk of ADHD experienced statistically greater reductions in ADHD symptoms by participating in physical activity sessions compared to the group involved in sedentary classroom activities.

In his research study, Zang (2019) included 574 participants with ADHD, aged 6-18 years, who took part in an experimental treatment. Two hundred seventy-six (276) participants were assigned to the group that engaged in daily physical activities, while 298 participants were placed in the control group. The results of this analysis showed that levels of anxiety and depression were significantly reduced through physical activity in children with ADHD (MD: -1.84; 95% CI: [-2.65 – (-1.03)], P = .00001). Hyperactive/impulsive symptoms (MD: -0.01; 95% CI: [-0.32 – 0.29], P = .93) and inattention symptoms (MD: -0.22; 95% CI: [-0.51 – 0.08], P = .15) were also reduced through physical exercise, but the results were not statistically significant. This analysis showed that issues with thinking (MD: -3.49; 95% CI: [-5.51 – (-1.47)], P = .0007), social problems (MD: -5.08; 95% CI: [-7.34 – (-2.82)], P = .0001), and aggressive behavior (MD: -3.90; 95% CI: [-7.10 – (-0.70)], P = .02) were significantly reduced in participants with ADHD who were part of the physical activity program group. The results of this study indicate that the effects of physical exercise contribute to reducing anxiety, depression, and aggressive behavior, while also improving socialization skills in children with ADHD. Therefore, based on the results obtained in this study, the author concludes that physical exercise should be significantly more integrated into the daily lives of children with ADHD.

Seven key studies were conducted to assess the effects of aerobic exercise in children with ADHD (Tantillo et al., 2002; Mackune et al., 2003; Kang et al., 2011; Chang et al., 2012; Verret et al., 2012; Pontifex et al.,

otvorenom prostoru, uključujući aktivne igre, jogu, šetnje sa vodičem, vožnju bicikla, i sl. Analizirane su studije fokusirane na djecu i/ili adolescente uzrasta od 6-18 godina kojima je prethodno dijagnostikovan ADHD poremećaj i nasumično su odabrani i raspoređeni u jednu od dvije grupe. Jedna grupa je učestvovala u fizičkim aktivnostima, a druga u sedentarnim aktivnostima u učionici, kao što su umjetnički projekti. Kao dio procesa ujednačavanja grupa, grupe su uravnotežene po polu, hronološkom uzrastu i statusu rizika od ADHD (Hoza, 2014). Fizička aktivnost je odabrana u skladu sa aktivnostima i igrama prilagođenim uzrastu kako bi se održao interes učesnika. Na kraju studije, koja je trajala 12 nedelja, dvije grupe su upoređene da bi se utvrdilo koja grupa je imala veće koristi od fizičke aktivnosti. Potvrđena je hipoteza da je grupa djece sa rizikom od ADHD imala statistički veće efekte u smanjenju simptoma ADHD učešćem u sesijama fizičke aktivnosti u poređenju sa grupom koja je učestvovala u sedentarnim aktivnostima u učionici.

U svojoj istraživačkoj studiji Zang (2019) je obuhvatio 574 učesnika sa ADHD poremećajem uzrasta od 6-18 godina koji su učestvovali u eksperimentalnom tretmanu. Dvije stotine sedamdeset šest (276) učesnika je raspoređeno u grupu koja je svakodnevno upražnjavala fizičke aktivnosti, dok je 298 učesnika raspoređeno u kontrolnoj grupi. Rezultati ove analize su pokazali da su nivo anksioznost i stanje depresije značajno umanjene fizičkom aktivnošću kod djece sa ADHD sindromom. (VMD: -1,84; 95% CI: [-2,65 – (-1,03)], P=.00001). Hiperaktivni/impulsivni simptomi (VMD: -0,01; 95% CI: [-0,32 – 0,29], P=.93) i simptomi nepažnje (VMD: -0,22; 95% CI: [-0,51 – 0,08], P=.15) takođe su umanjeni fizičkim vježbanjem ali rezultati nisu bili statistički značajni. Ova analiza pokazala je da su problemi u razmišljanju (VMD: -3,49; 95% CI: [-5,51 – (-1,47)], P=.0007), socijalni problemi (VMD: -5,08; 95% CI: [-7,34 – (-2,82)], P=.0001), i agresivno ponašanje (OMU: -3,90; 95% CI: [-7,10 – (-0,70)], P=.02) značajno umanjeni kod učesnika sa ADHD poremećajem koji su pripadali grupi koja je uključena u program fizičkih aktivnosti. Rezultati dobijeni u ovoj studiji ukazuju na efekte fizičkog vežbanja koji doprinose umanjenju stanja anksioznosti, depresije i agresivnog ponašanja, a doprinosi razvijanju sposobnosti socijalizacije kod djece koja pate od ADHD poremećaja. Stoga, prema dobijenim rezultatima u ovoj studiji, autor zaključuje da fizičke vježbe treba da budu znatno više uključene u svakodnevni život djece sa ADHD poremećajem.

Sedam referentnih studija je realizovano u cilju procjene efekata aerobnog vježbanja kod djece sa ADHD sindromom (Tantillo et al., 2002; Mackune et al., 2003; Kang

2013; Choi et al., 2015). The inclusion criteria were as follows: children and/or adolescents aged 6–18 years with a confirmed diagnosis of ADHD. Studies were selected that evaluated ADHD symptoms, considering primary outcomes such as inattention, hyperactivity, and impulsivity, and secondary outcomes associated with ADHD symptoms, such as anxiety, socialization disorders, and cognitive abilities. The average duration of the aerobic exercise program (running, obstacle course, exercises with music) was about 5 weeks; the average session length was 50 minutes, with an average exercise frequency of two to three times per week. Intensity was monitored using a heart rate monitor. The intensity ranges were similar: 50–75% of maximum heart rate. The results of these studies suggest that physical exercise is effective as an supplementary therapy to prescribed pharmacological treatments for reducing behavioral disorders that interfere with learning and academic performance. This is significant even for children and adolescents who do not respond to pharmacological treatment or who seek alternative treatments (Gapin et al., 2011; Archer & Kostrzewa, 2012). As shown in this research, physical exercise programs reduce ADHD symptoms and have better long-term outcomes for children and adolescents (Bervid & Halperin, 2012).

Montava et al. (2022) published a comprehensive review aimed at analyzing the effects of physical activity, exercise, and sports on executive function in children and adolescents diagnosed with ADHD, through an examination of the results from relevant research studies in this field. This paper reviewed studies from the Web of Science (WOS) database published up to August 2021, focusing on research involving children and adolescents aged 6 to 18 years with a diagnosis of ADHD. The exclusion criteria included participants younger than 6 years and older than 18 years, as well as subjects who were athletes or had a diagnosis of another disorder. The results presented in this study indicate significant effects of physical activity in reducing symptoms of ADHD and the potential for improving the quality of life for children and adolescents with ADHD syndrome.

Christiansen et al. (2019) demonstrated in their review study that moderate to intense aerobic exercise improves attention control functions in children with ADHD, based on the findings of the following research:

Heier et al. (2017) obtained results in their study indicating that organized exercise can be beneficial for behavior management, establishing better socio-emotional skills, and enhancing cognitive functions. Research by Urbin et al. (2015) suggests that physical exercise posi-

et al., 2011; Chang et al., 2012; Verret et al., 2012; Pontifek et al., 2013; Choi et al. 2015). Kriterijumi za uključivanje su bili sledeći: deca i/ili adolescenti uzrasta 6–18 godina sa ustanovljenom dijagnozom ADHD. Izabrane su studije koje procjenjuju simptome ADHD-a, uzimajući u obzir primarne ishode, kao što su nepažnja, hiperaktivnost i impulsivnost i sekundarne ishode sa simptomima ADHD kao što su anksioznost, poremećaji socijalizacije i kognitivne sposobnosti. Prosječno trajanje programa aerobnog vježbanja (trčanje, savladavanje poligona, vježbe uz muziku) je bilo oko 5 nedelja; srednje trajanje sesija je bilo 50 min, sa prosječnom učestalosti programa vježbanja od dva do tri puta nedeljno. Intenzitet je praćen monitorom srčane frekvencije. Opsezi intenziteta su bili slični: 50–75% od maksimalnog broja otkucaja srca. Rezultati ovih istraživanja sugerišu da fizičko vježbanje efikasano i kao dopunska terapija uz već propisanu farmakološku terapiju za smanjenje poremećaja ponašanja koja ometaju učenje i akademski učinak. Ovo je značajno čak i za djecu i adolescente koja ne reaguju na farmakološko liječenje ili koji traže alternativne tretmane (Gapin et al., 2011; Archer & Kostrzeva, 2012). Kao što je pokazano u ovom istraživanju, programi fizičkog vježbanja umanjuju ADHD simptome i imaju bolje dugoročne rezultate za djecu i adolescente (Bervid & Halperin, 2012).

Montava et al. (2022) su objavili veoma obuhvatan pregledni rad rad koji ima za cilj da analizira efekte fizičke aktivnosti, vježbanja i sporta na izvršnu funkciju kod djece i adolescenata sa dijagnozom ADHD kroz pregled rezultata referentnih istraživanja u ovoj oblasti. U ovom radu su analizirane neke studije iz baze Web of Science (WOS) koje su objavljene do avgusta 2021. godine i oduhvatale su rezultate istraživanja sprovedenih na djeci i adolescentima od 6 do 18 godina starosti sa dijagnozom ADHD. Kriterijumi isključenja bili su ispitanici mlađi od 6 godina i stariji od 18 godina zatim subjekti koji su bili sportisti, ili subjekti sa dijagnozom drugog poremećaja. Rezultati koji su predstavljeni u ovom istraživanju ukazuju na veoma značajne efekte fizičke aktivnosti na umanjenje simptoma ADHD poremećaja i mogućnosti poboljšanja kvaliteta života djece i adolescenata koji imaju ADHD sindrom.

Christiansen et al. (2019) su u svom preglednom istraživanju pokazali da umjereno do intenzivno aerobno vježbanje omogućava poboljšanju funkcija kontrole pažnje kod djece sa ADHD sindromom kroz rezultate sljedećih istraživanja:

Heier et al., (2017) su u svom istraživanju dobili rezultate koji ukazuju da organizovano vježbanje može biti korisno za kontrolu ponašanja, uspostavljanje boljih socio-emocionalnih vještina i razvijanje kognitivnih funk-

tively impacts cognitive abilities and behavior management in children with ADHD. Furthermore, they confirmed improvements in neurobehavioral functions that facilitate a reduction in impulsivity and hyperactivity, as well as enhancements in attention and executive functions. In addition, physical exercise programs contributed to a decrease in behavioral problems caused by ADHD syndrome and fostered better relationships between parents and children (Chan et al., 2018). Results from the research conducted by Wigal et al. (2019) confirm that the neurophysiological effects induced by physical activity counteract the pathological effects caused by ADHD, thereby emphasizing the need for significantly greater inclusion of physical activity in organized programs aimed at reducing symptoms of this disorder in children.

The findings of these studies indicate positive effects of physical exercise on the reduction of attention/hyperactivity disorders (ADHD) in children with this syndrome. However, studies analyzing the effects of various types of physical activities on children with this disorder have been quite rare.

Dong et al. (2023) conducted a study analyzing the effects of different types of physical activity on children with ADHD syndrome. In this study, motor skills, attention problems, social issues, cognitive flexibility, inhibition overcoming, and working memory were identified as outcome indicators for comparing the effects of different models of physical activities. The authors employed a method of searching databases including PubMed, Embase, and Web of Science, looking for randomized controlled trials on the effects of physical exercise in children with ADHD. The search timeframe extended from the creation of the database until October 2022. A total of 31 studies were included, and the results showed that perceptual-motor training was the most effective in improving motor skills and positively impacting working memory. For attention problems and cognitive flexibility, water-based exercises proved to be the most effective. Riding exercises had the greatest impact on improving social skills, while cognitive-motor training had the most significant effect on overcoming inhibition.

DISCUSSION AND CONCLUSION

The implementation of appropriate physical exercise programs can not only enhance sensory-motor skills but also increase self-confidence and improve communication and social interaction skills in children. Exercise is an important tool for children with ADHD during their developmental stages. Aerobic exercises or perceptual motor training are beneficial for children with this neurocija. Istraživanja Urbin et al., (2015) upućuju da fizičko vježbanje ima pozitivan uticaj na kognitivni sposobnosti i upravljanje ponašanjem kod djece sa ADHD poremećajem. Pored toga, oni su u svom istraživanju potvrdili poboljšanja neurobihejvioralnih funkcija što omogućava smanjenje impulsivnosti i hiperaktivnosti, poboljšanje pažnje i izvršnih funkcija. Osim navedenog, programi fizičkog vježbanja omogućili su smanjenje simptoma poremećaja ponašanja prouzrokovanih ADHD sindromom i razvijanje boljih veza između roditelja i djece (Chan et al., 2018). Rezultati istraživanja (Wigal et al., 2019) potvrđuju da su neurofiziološki efekti izazvani fizičkom aktivnošću suprotni patološkim efektima izazvanim ADHD-om, pa fizička aktivnost treba da bude u znatno većoj mjeri zastupljena u organizovanim programima usmjerenim na smanjenje simptoma ovog poremećaja kod djece.

Rezultati navedenih istraživanja su ukazali na pozitivne efekte fizičkog vježbanja na umanjenje poremećaja pažnje/hiperaktivnosti (ADHD) kod djece sa ovim sindromom. Međutim, veoma rijetke su bile studije u kojima su analizirani efekti raznih vrsta fizičkih aktivnosti na djecu sa ovim poremećajem.

Dong et al., (2023) su realizovali studiju u kojoj su analizirati efekte različitih vrsta fizičke aktivnosti na djecu sa ADHD sindromom. U ovoj studiji, motoričke sposobnosti, problemi sa pažnjom, socijalni problemi, kognitivna fleksibilnost, prevazilaženje inhibicije i radna memorija su određeni kao indikatori ishoda za upoređivanje efekata različitih modela fizičkih aktivnosti. Autori ove studije su primijenili metodu pretraživanja baza podataka PubMed, Embase i Web of Science u kojima su tražili randomizovana kontrolisana ispitivanja o efektima fizičkog vježbanja kod djece sa ADHD sindromom. Vremenski okvir pretrage je bio od kreiranje baze podataka do oktobra 2022. godine. Uključena je ukupno 31 studija, a rezultati su to pokazali da je perceptivno-motorički trening bio najefikasniji u pogledu poboljšanja motoričkih sposobnosti i pozitivnog uticaja na radnu memoriju. Za probleme sa pažnjom i kognitivnu fleksibilnost kao najefikasnije su se pokazale vežbe u vodi. Najveći uticaj na poboljšanje socijalnih vještina je imalo vježbanje jahanja. Za prevazilaženje inhibicije najveći uticaj je imao kognitivno-motorički trening.

DISKUSIJA I ZAKLJUČAK

Primjena odgovarajućih programa fizičkog vježbanja ne samo da može povećati senzomotoričke vještine, već i povećati samopouzdanje i poboljšati vještine komunikacije i socijalne interakcije kod djece. Vježbanje je važno sredstvo za djecu sa ADHD poremećajem u fazi razvoja. Aerobne vežbe ili perceptivni motorički trening

developmental disorder. Both short-term and long-term exercises can improve blood flow to the brain, increase attention levels and information processing capacity, reduce impulsivity, and enhance inhibitory control, thereby improving interpersonal relationships. When it comes to selecting exercises, planned and combined exercise courses should be chosen, with content emphasizing the intensity of exercise and perceptual motor activities combined with cognitive tasks (such as motor planning skills). This approach can effectively enhance the perceptual and cognitive functions of children with this disorder. Furthermore, the benefits of physical exercise in ADHD therapy include low costs, easy implementation, absence of side effects, active patient involvement with improved cooperation, non-invasiveness, as well as additional psychological and physiological benefits. However, while the results of available studies on moderate-intensity aerobic exercise indicate a reduction in ADHD symptoms in children, other modalities and intensities of exercise, as well as effects in adults, have not been sufficiently researched. Additionally, the results of this systematic review and meta-analysis should be interpreted with caution due to the small number of studies and the heterogeneity of the samples included, as well as the different criteria for establishing the presence of ADHD in school-aged children. Given the significance of this issue for society as a whole and the quality of life of individuals with this disorder, more studies involving a larger number of participants are needed to obtain consistent and relevant results applicable in practice. Existing results should initiate further well-designed randomized controlled trials examining physical exercise as an additional or standalone therapy for individuals with ADHD syndrome.

su korisni za decu sa ovim neurorazvojnim poremećajem. I jednokratne i dugotrajne vežbe mogu poboljšati protok krvi u mozgu, povećati nivo pažnje i kapacitet obrade informacija, smanjiti impulsivnost i povećati inhibicionu kontrolu, čime se poboljšavaju međuljudski odnosi. Kad je u pitanju odabir vježbi, treba izabrati planirane i kombinovane kurseve vježbi, a sadržaj treba da naglasi intenzitet vježbanja i perceptualne motoričke vježbe u kombinaciji sa kognitivnim zadacima (kao što su vještine motoričkog planiranja). Ovaj pristup može efikasno poboljšati perceptualne i kognitivne funkcije djece sa ovim poremećajem. Dalje, prednosti fizičkog vježbanja u terapiji ADHD poremećaja uključuju niske troškove, laku implementaciju, odsustvo nuspojava, aktivnu ulogu pacijenta uz poboljšanu saradnju, neinvazivnost, kao i dodatne psihološke i fiziološke koristi. Međutim, dok rezultati dostupnih istraživanja aerobnog vježbanja umjerenog intenziteta ukazuju na umanjenje simptoma ADHD-a kod djece, drugi modaliteti i intenziteti vježbanja, kao i efekti kod odraslih, nisu dovoljno istraženi. Takođe, rezultati ovog sistematskog pregleda i metaanalize treba prihvatiti sa oprezom zbog malog broja studija i heterogenost obuhvaćenih uzoraka kao i različitih kriterijuma utvrđivanja prisutnosti ADHD poremećaja kod djece školskog uzrasta. Zbog značaja ovog problema za društvo u cjelini i kvalitet života osoba kod kojih je prisutan ovaj poremećaj potrebno je realizovati više studija kojima će se obuhvatiti veći broj ispitanika da bi se dobili dosljedni i relevantni rezultati primjenjivi u praksi. Postojeći rezultati treba da iniciraju dalje dobro osmišljene randomizovane kontrolisane studije koje ispituju fizičko vježbanje kao pomoćnu ili samostalnu terapiju za osobe sa ADHD sindromom.

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Short notice *Kratko saopštenje*

Analysis of Roll Spike Techniques in Sepak Takraw Players Reviewed Based on Sport Biomechanics

Sulaimans, Agus Raharjo, Andry Akhiruyanto
Faculty of Sport Science, Universitas Negeri Semarang, Semarang, Indonesia

Correspondence:
Sulaimans, Faculty of Sport Science, Universitas Negeri Semarang, Semarang, Indonesia
sulaiman@mail.unnes.ac.id

Abstract: *Roll spike is a common competitive offensive technique in sepak takraw. Of course, biomechanical analysis is required to achieve effective and efficient results. However, this has not received specific emphasis in the studies conducted. Aside from that, no biomechanical analysis of roll spikes has been conducted on the training ground. The aims of this research are as follows: (1) to examine the factors that influence the success of the roll spike technique, and (2) to determine the effectiveness and efficiency of the movement. The research used a quantitative survey with four male participants of sepak takraw players on the right flank position. The research instruments included a vertical jump, height and weight measurements, and an anthropometer. The data analysis technique was quantitative descriptive analysis, using the formula* $\omega = V_r / r$ *and observations with Kinovea. The findings in this research revealed that body height, leg length, leg power, foot kick angle, and ball impact angle in the air all have an effect on the roll spike technique. The roll spike was executed effectively and efficiently, including the preparatory phase, jumping, foot contact with the ball in the air, and landing. It was determined that anthropometry, biomotor factors, and the proper stages in performing the roll spike technique all affected how it performed. This study has the potential to provide information and evaluation material for sepak takraw coaches looking to improve the performance of their athletes. Despite the limitation of relatively small samples, the application employed remains straightforward. Future studies should investigate larger samples and more advanced applications to acquire comprehensive results.*

Keywords: *Analysis, roll spike, Sepak takraw, sports biomechanics.*

INTRODUCTION

Nowadays, sepak takraw is growing very rapidly, as seen by its competition in international events (Aji & Yudhistira, 2023). Although sepak takraw is a team game, a team needs to have good fundamental techniques (Aji & Yudhistira, 2023). Basic techniques include kick-off, inside kicks, horse kick serve, toe kicks, outside kicks, thigh kicks, header, sunback spike, and roll spike (Yudanto et al., 2022). Naturally, once these basic techniques are mastered, they will serve as the team's main resource for combining games to win the match (Aji & Yudhistira, 2023).

Besides, sepak takraw has an acrobatic element, as evidenced by various techniques that require courage to execute technical maneuvers gracefully and attractively to get optimal results. Acrobatic movements, such as roll smashes, are characterized by somersaults in the air (Bais et al., 2023). Smashes in sepak takraw are classified into numerous types, including sunback spikes and roll spikes (Yudanto et al., 2022). In this instance, the roll spike smash is a very fascinating and beautiful smash method because it involves a high success rate of somersault movement that kills the opponent (Aji & Yudhistira, 2023). However, the roll spike is one of the more difficult smash techniques to master. Thus, performing the roll spike technique demands a great deal of confidence. In addition to courage, the rolling spike technique involves flexibility, precision, power, and effective and efficient movements. When it comes to effective and efficient movements, sports biomechanics is undoubtedly the domain.

Biomechanical analysis aids athletes and coaches by determining muscle strength and movements in specific techniques, allowing them to increase performance (Umar & Utama, 2018). Biomechanics is a mechanical concept that studies the anatomical movements of the body during sports (Candra et al., 2021; Umar & Utama, 2018; Yadav, 2016). Sports biomechanics analysis, similar to the rolling spike technique, is required to improve point scoring in sepak takraw matches.

Obviously, studies that discuss biomechanical analysis in sports performance already exist, such as studies from Hollander et al concerning the correlation of static and dynamic foot posture in running performance (Hollander et al., 2019), the effect of walking speed on healthy participants in terms of biomechanical aspects (Fukuchi et al.,

2019), the influence of strength training in terms of biomechanics and neuromuscular long-distance runners (Trowell et al., 2020), analysis of the ability to run a short distance of 100 meters (Rahadian, 2019), analysis of Klay Thompson's three-point shooting movement in a basketball match (Darumoyo, 2019), analysis football players passing in terms of biomechanics (Badawi et al., 2021), running analysis supported by sensors related to speed effects (Hollis et al., 2021), analysis of shooting accuracy at a distance of 6 meters in petanque athletes in terms of biomechanics (Mahardika et al., 2021), analysis of basic martial arts techniques in terms of biomechanics (Suryo Putro et al., 2023), analysis of service movements for sepak takraw in terms of biomechanics (Wulandari & Irsyada, 2019), service accuracy tests in sepak takraw games (Irawan et al., 2021), analysis of sepak takraw serves using a depth camera motion caputre system (Kaharuddin et al., 2019), the effect of fixed and moving drill methods on ball reception results in sepak takraw (Mahardika et al., 2023).

Based on a review of several pieces of literature, they are still focusing on secondary data research, namely meta-analysis which focuses on athletic sports, such as looking at movement efficiency in running. Similar studies have also been carried out in basketball, football, and martial arts, especially in the aspects of basic hitting, serving, and shooting technique accuracy. Some research on sepak takraw only examined serving with samples collected from schools, rather than athletes who had completed programming at regional training centers. In other words, the analysis of rolling spike techniques with samples is limited to regional training athletes who received no special attention from the evaluated studies.

The authors performed field interviews and observations to help rationalize the problem. As academics, the authors believe that further examination of movements when conducting sepak takraw techniques is required. This is because sepak takraw athletes lack control over the power and angle at which they launch a rolling spike. Aside from that, it was discovered that trainers at regional training facilities were still inexperienced with biomechanical analysis and had never carried it out. In this regard, the authors sought to perform research on rolling spike analysis using the most recent information and to obtain useful data. The purpose of this study is to identify the factors that influence success in completing the roll spike technique for sepak takraw players, as well as to determine the effectiveness and efficiency of the roll spike movement.

MATERIAL & METHODS

Participants

This study is a quantitative description using a field test survey approach (Akhiruyanto et al., 2022; Yudhistira & Tomoliyus, 2020). The purpose of this study is to analyze the rolling spike technique of sepak takraw players from a biomechanical perspective. The authors conducted quantitative tests and measurements with numerical findings, whereas qualitatively the author can interpret the data based on in-depth observations as detailed in the narrative. Participants in this study were sepak takraw athletes in the smasher position, specifically second place, four male participants aged 20-23 years with heights ranging from 157 to 173 centimeters. Participants were chosen through purposive sampling using the following criteria: (1) trained athletes from the Central Java region, and (2) male.

Procedure/Test protocol/Skill test trial/Measure/Instruments

The research procedures are as follows (1) the authors are aided by three research assistants in carrying out data gathering through videos, photos, and measurement tests. (2) The authors gathered data to be examined and analyzed, and (3) the authors presented it in narratives and figures as an interpretation of the findings. The reported results are descriptive regarding height and weight, leg power, leg length, and roll smash accuracy, followed by biomechanical analysis in the form of jump initiation, ball impact angle, and ball movement speed.

Data collection and analysis / Statistical analysis

Data collection techniques included observations and measurement tests using a Canon 1200D camera, Kinovea 0.8.1.5, vertical leap instruments, height and weight measurements, and an anthropometer (Wiriawan, 2017). The quantitative data analysis technique used was quantitative descriptive analysis, which used the formula $\omega = V_r / r$. This procedure was performed using the Kinovea 0.8.1.5 application. The next stage is reflective meaning, which takes the form of observations presented in narrative writing.

RESULTS

The results section interprets descriptive data such as body height, leg length, vertical jump, initial jump angle, ball impact angle, and smash results. The findings of this study are shown in Table 1 below:

Table 1. *Results of quantitative descriptive analysis in terms of biomechanics*

Number of Athletes	Height (cm)	Leg Length (cm)	Vertical jump	Jumpstart angle (degrees)	The angle of impact of the ball in the air (degrees)	Smash ball speed (m/s)	Roll spike	Category
1.	157	84	76	132°	78°	12.2 m/s	36	Good
2.	173	93	95	135°	75°	15 m/s	45	Very good
3.	172	95	90	137°	77°	15.3 m/s	43	Very good
4.	170	97	83	139°	79°	13 m/s	40	Good

The descriptive analysis yielded measurements and observations of four athletes, including body height (157-173 centimeters), leg length (84-97 centimeters), vertical jump (76-95 centimeters), initial jump angle (132-139 degrees), angle of impact of the ball in the air (75-79 degrees), ball smash speed (12.2-15.3 m/s), and rolled spike results (36-43 times). These findings are displayed graphically in Figure 1 as follows:

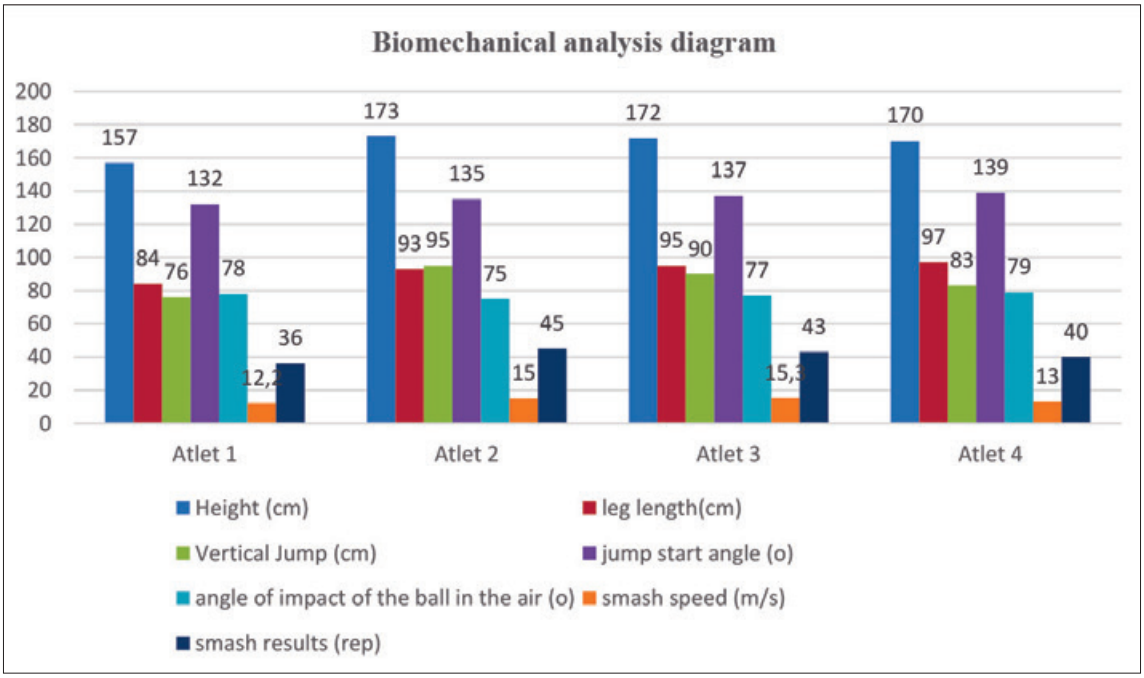

Figure 1. *Results of quantitative descriptive analysis in terms of biomechanics*

Figure 2. *Preparatory phase*

Figure 3. *Repulsion phase*

Figure 4. *Impact phase in air*

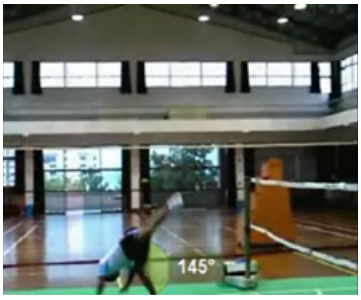

Figure 5. *Landing phase*

DISCUSSION

The purpose of this study is to analyze the factors that influence the success of the roll smash technique, as well as determine the effectiveness and efficiency of movements used by sepak takraw players when performing the roll spike technique. According to the findings in Table 1, athletes with a height of 172-173 centimeters, a leg length of 93-95 centimeters, and a vertical jump of 90-95 centimeters can get higher roll spike results. The authors found that body height, leg length, and leg muscle power all influence the rolling spike findings.

The study found that an initial jump angle of 135^{o} -137^{o} yields better roll spike results than 132^{o}. In this situation, if the jump's beginning angle is too large or too tiny, it expends a lot of energy and becomes too heavy to push up. Aside from that, the results of the rolling spike are controlled by one factor: the initial angle of the jump. The results of the rolling spike are controlled by one factor: the starting angle of the jump, which impacts whether or not the leg's muscular power to jump upwards is optimal.

The research results revealed that the ball's angle of impact in the air is between 75^{o} and 77^{o}, resulting in a better rolling spike. This means that a smaller ball hit in the air will cause the smashed ball to dive into or strike the net, whereas a larger ball hit at a steeper angle will be flatter and may go out of court. Thus, analyzing the angle of impact in the air during a rolling smash is critical.

The results showed that the rolled spike with a higher speed of 15m/s-13m/s was more difficult for athlete 1 to accept with an average ball speed of 12.2 m/s and a rolled spike score of 36, athlete 2 with an average ball speed of 15 m/s and a roll spike score of 45, athlete 3 had an average ball speed of 15.3 m/s and a roll spike score of 43, while sample 4 had an average ball speed of 13 m/s with a roll spike score of 40. This data revealed that rolling spikes with speeds ranging from 15 to 13 m/s are more difficult for opponents to accept. However, this study used an accuracy test, which prevented the ball speed from being maximized while keeping the target direction on target.

According to the findings, some elements influence roll smash in sepak takraw players. The precision of the roll spike is controlled by body height, leg length, and leg muscular strength. According to studies, the smash is a compound movement, which means that it cannot be ideal unless the athlete masters the smash technique well (Ramawan et al., 2021). The success of a smash is influenced by several series of movements such as steps, support, jumping, and hitting while in the air. Aside from that, a smash in sports is determined by the way the body is positioned (Ramawan et al., 2021). In this case, the athlete's height and leg length are used to describe body posture. Height is a vital

factor in executing a smash well. For example, volleyball players who are above average height will be more ideal and simpler to smash the ball in the air (Ramawan et al., 2021).

Aside from that, body structure is associated with sporting activities, implying that body structure is used in sports that need physical performance (Saleh & Syahrul, 2019). Anthropometric measures can be used to study body structure in health and sports research. The goal of anthropometric measurements is to learn about the body's parts so that we can identify them separately. Furthermore, the study states that the activity of measuring the human body is called an anthropometric test, which aims to measure body weight, height, length of body segments such as leg length, body composition such as muscles, bones, organs, body circumference from head, liver, wrists, pelvis, and thighs (Saleh & Syahrul, 2019). As a result, the authors can conclude that body structure, specifically the athlete's height and leg length, has an impact on smash success. The more perfect the height in the sepak takraw sport, the easier it will be to perform smashes in practice and compete in matches.

Smash success is generally related to athletes with strong leg muscles. Football, volleyball, basketball, and sepak takraw are all demanding sports that require strong leg muscles. Another study suggests that good leg muscular power will produce ideal outcomes in smash ability, which means that easier it is to get the ball up and then carry out the smash technique (Gustiawan et al., 2021). Power in the sport sepak takraw is associated with a fast and strong upward jumping force, the higher the upward jump and the momentum, the better results it will produce. The higher the jump when executing a smash, the more optimal the resulting smash will be. In this case, the higher the jump during the smash, the closer the distance the ball falls and the shorter the time taken (Gustiawan et al., 2021).

According to a different study, having strong legs improves smash movements, but having sufficient strength is undoubtedly the first step toward building strong legs (Hakim et al., 2022). This indicates that generating adequate leg muscular power takes methodical stages of training rather than happening suddenly. Power is a mix of strength and speed; therefore, we will naturally achieve better results if we combine fundamental strength training with sport-specific speed training (Yudhistira, 2023). According to the authors' research, sepak takraw athletes with more vertical ability yield better smash results.

In addition, it is necessary to monitor the efficacy and efficiency of movement from the first preparation phase to the phases of upward jumping movement, ball contact in the air, and landing on the spot to produce roll spike results. In this case, the initial preparatory stance analysis begins with the athlete turning his back to the net at a distance of about 0.5 - 1 meter, left leg in front, and then taking a stance by bending the knees of both legs not too deeply, with a foot angle of about 80 degrees which aims of waiting for the ball to be passed. In addition, in a relaxed position, the player's eyes are always focused on the ball, after the ball reaches the highest point of the bounce or pass (Hanif, 2017). This is, of course, driven by the notion of balance. If we want to produce steady movements, we must have a ready attitude that allows for good balance. Equilibrium refers to control and coordination, whereas stability refers to the level of resistance provided by the individual to resist the influencing forces (Daharis et al., 2022)

During the upward jumping movement phase, the athlete instantly steps forward with his left foot and bends his knee to jump. The jump angle is roughly 137 degrees while pushing off the floor to bring the body up (Hall, 2007). When moving the body higher, the striking foot comes before the supporting leg, therefore it pushes with one foot, specifically the left foot. Perform a backward somersault to push yourself up. In this instance, the player must have appropriate leg muscle strength. The more powerful the player, the higher his body may be thrown from the net, allowing him to easily strike the ball into the opponent's area. Leg length also significantly supports jumping (Rezaei et al., 2013). Jumping is required to complete a rolling spike. The combination of leg muscle power and leg length results in a high jump, which raises the center of body weight well over the net and allows the ball to be smashed in any direction according to the planned objective (Hamdan et al., 2012).

After the initial jump is completed properly by rotating the body in the air, the following step is hitting the ball with the rear of the foot. To turn the body in the air, keep an eye on the ball and maintain balance. If the ball bounces close or low, the body movement in the air must be quick to meet the ball with a punch; otherwise, the ball will instantly descend toward the net, and if the player is late, the shot will be caught in the net. On the other hand, if the pass/bounce ball is high, the player adjusts the rotation of his body in the air so that the timing between the rotation and the arrival of the ball is perfect for the smash. As a result, the speed of rotation of the body in the air is controlled so that the timing is correct for the fall of the ball to be hit. The body's radius (body roll) can be lengthened or short-

ened while in the air to allow for faster or slower rotation. This is consistent with the theory of rotational (angular) motion, which states that rotational speed (angular) is inversely proportional to the radius of rotation.

The longer the body radius, the slower the rotation; conversely, the shorter the radius, the faster the rotation (Hidayat, 2005). The ball is hit while the foot is at its highest reach, without waiting for the ball to hit the ground. The impact of the blow between the hitting foot and the ball occurs when the hitting foot is practically straight and the ball strikes the top of the ball (the hitting foot is above the ball), causing the ball to bounce strongly and quickly onto the opponent's court. This is by the formula: linear speed (the toughness of the blow) is exactly related to the rotation speed and radius of the batter (Arifin, 2016). The player can control the direction of the ball hitting the opponent's field goal by twisting the leg to the left, straight, or right as desired. The player's buttocks and legs must be flexible; one of the benefits is the ability to direct the ball to the appropriate aim (Hidayah & Akhiruyanto, 2023).

In the landing phase, after the blow in the air, the next movement is the continuation movement, which consists of completing the backward rotation and landing on the floor in the same position as when it began. To keep the body balanced, land with both legs stretchy and knees slightly bent. If balance is insufficient, both hands can assist by resting on the floor (Cahyaningrum et al., 2018). As a result, the biomechanical analysis of the roll smash technique aims to ensure that the roll smash technique, from the beginning to the end of the movement, can achieve the biomechanical principles, namely the movement's effectiveness and efficacy.

CONCLUSION

Based on the findings of the research and discussion, it is possible to conclude that body height, leg length, leg muscle power, foot kick angle, and ball impact angle in the air all have an impact on the roll spike technique. Roll spike is effective and efficient in all phases of play: preparation, jumping, contact with the ball in the air, and landing. Furthermore, ideal body anthropometry is crucial in performing good smash movements; athletes should then go through technical training to make the movements more automatic, and then increase coordination movements to improve the rolling spike. The intention is that this research will provide information and evaluation material for sepak takraw coaches, allowing them to improve the performance of their athletes. However, there are some limitations to this study, such as the small sample size and the simplistic application. As a result, if additional study is to be replicated, larger samples and more complex applications are required to acquire comprehensive results.

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