



The influence of basketball, football and body weight on VO₂max of children with mild intellectual disabilities

Hana Fauziah Sofyani, Sumaryanti

Postgraduate, Sports Science Study Program, Yogyakarta State University, Indonesia

Abstract

This study aims to determine the effect of playing basketball and soccer as well as body weight on the VO₂max of children with mild intellectual disabilities. This research is an experimental research. This study uses body mass index to determine the anthropometric characteristics of body weight and the Rockport Walking Test to measure VO₂max in 24 children with mild intellectual disabilities with an age range of 13-15 years as subjects in this study. Subjects were divided into 4 groups (basketball-normal weight, basketball-overweight, soccer-normal weight and soccer-overweight). The treatment was given 16 times, 3 times a week using basketball and soccer games. The research data were analyzed using one-way ANOVA. Based on the results of the research and the results of data analysis that has been carried out, the following conclusions are obtained: (1) There is a significant difference in the effect between the basketball game group with excess weight, the soccer game group with normal weight and the soccer group with excess weight. On the VO₂max of children with mild intellectual disabilities to the VO₂max of children with mild intellectual disabilities ($p = 0.00 > 0.05$). (2) The soccer game group with normal weight had the highest effectiveness in increasing the VO₂max of children with mild intellectual disabilities.

Keywords: children with disabilities, basketball, soccer, VO₂max

Introduction

Intellectual disability is a disability that is characterized by an indication of limitations in both intellectual function and adaptive behavior which includes many social and practical skills in everyday life that occur before the age of 18 years (Cheung, 2013) [2]. Individuals with intellectual disabilities are considered less active than adolescents their age. The results of a study in Australia found that adolescents with disabilities who lived in quarantine spent most of their time in inactive activities. Only 32% of individuals with intellectual disabilities are considered to be actively participating in physical activities according to Australian national guidelines (Temple & Walkley, 2003) [11]. Based on survey data from the global school-based student health survey (GSHS) and the health behavior in school-aged children (HBSC) it was found that 80.3% of adolescents aged 13–15 years from 105 countries did not fulfill moderate-intensity physical activity. To high with a duration of 60 minutes per day. 31.1% of adolescents aged 15 years from 122 countries in the world are declared inactive, with the proportion of 43% coming from Southeast Asia, America and the Mediterranean, (Hallal *et al.*, 2012) [5].

Individuals with intellectual disabilities tend to be less physically active, are overweight or obese and have lower levels of physical fitness, especially cardiorespiratory fitness (VO₂max) compared to individuals without intellectual disabilities. Physical inactivity is a factor that causes various health problems. Adolescents who are less active have lower physical fitness (Iwandana, Sugiyanto, and Hidayatullah 2018) [7]. The lower the physical fitness, the more symptoms of hypokinetic disease (lack of movement) increase. Lack of movement is a cause of increased risk of cardiometabolic degenerative diseases (decreased organ function), osteoporosis, obsession and poor mental health, (Williams *et al.*, 2018) [13]. Exercise is an activity that requires planned, structured and repeated physical effort to maintain or improve health and fitness (Lieberman, 2015) [9].

Basketball is one example of a popular and fun sport (Librianty, Yufiarti, and Yetti 2021) [8]. Apart from being fun, participating in youth sports such as basketball provides many benefits for children and young people. The intensity in the game of basketball is at a moderate to high level. Speed, agility, strength, explosive power, endurance, flexibility and motor coordination can be improved by playing the game of basketball (Montgomery *et al.* 2008) [10].

The game of soccer is a popular sport, fun and effective because it consists of a type of multipurpose exercise with positive effects (Frediani *et al.* 2020) [3]. Not just for entertainment, soccer has a broad spectrum to fight diseases caused by an unhealthy lifestyle. By practicing soccer 2 x 1 hour per week has a positive impact and can stimulate to improve cardiovascular, cardiometabolic and musculoskeletal fitness (Cerrah and Ertan 2014) [1]. The risk of increasing overweight can be reduced by playing soccer games. In addition, recreational soccer can increase VO₂max in untrained individuals. These benefits are obtained by undergoing exercise with a duration of 45-60 minutes up to three times a week (Wibowo, Syafitri, and Iwandana 2019) [12].

Basketball and soccer games consist of many elements of motion, are easy to play (requires only a few basic techniques such as throwing, catching, dribbling and kicking the ball), flexible (can be modified according to the availability of tools and facilities), and can be played by many people. Fun so that it can be a means of socializing and can increase individual motivation to do physical activity (Iwandana, Falaahudin, and Nugroho 2021) [6]. In Indonesia, there is no research that examines the effect of training programs using basketball and soccer games and body weight on the VO₂max of children with mild intellectual disabilities. Therefore, the researcher wishes to investigate further about the effect of playing soccer and basketball and body weight on the VO₂max of children with mild intellectual disabilities.

Method

The population in this study consisted of children with mild intellectual disabilities aged 13-15 years in SLB Negeri in the city of Yogyakarta, amounting to 28 people. The sample is determined with a consideration so that the data obtained is more representative. The sample used is only children with mild intellectual disabilities aged 13-15 years and do not have multiple disabilities. The number of samples obtained amounted to 24 people. The data analysis technique used for hypothesis testing is one-way analysis of variance (ANOVA). Hypothesis testing was carried out with a significant level of = 0.05. SPSS 26 software program is used to test the hypothesis.

Results and discussion

1. Normality test

In this study, the data normality test was carried out using the Shapiro Wilk method with the help of SPSS 26.0 software with a significance level of 0.05 (5%). If the data significance value is greater than 0.05 (5%) then the data is normally distributed.

Table 1: Normality test

Tests of Normality							
	Kelompok	Kolmogorov-Smirnov ^a			Shapiro-Wilk		
		Statistic	df	Sig.	Statistic	df	Sig.
VO ₂ max	A1B1	.310	6	.073	.820	6	.087
	A1B2	.209	6	.200*	.895	6	.346
	A2B1	.174	6	.200*	.941	6	.668
	A2B2	.187	6	.200*	.904	6	.399

* This is a lower bound of the true significance.

a. Lilliefors Significance Correction

Based on the tests that have been carried out, it shows that the data of the entire treatment group is normally distributed because it has a significance value of $p > 0.05$ (5%).

2. Homogeneity test

The homogeneity test of the data is intended to show that two or more groups from a population have the same variance (homogeneous) or not. The homogeneity test of the data in this study used the Leneve Test with the help of the SPSS 26.0 program at a significance value of 0.05 (5%). The decision making criteria is if the arithmetic significance value is > 0.05 (5%), the data variance is homogeneous, whereas if the arithmetic significance value is < 0.05 (5%), the data variance is not homogeneous.

Table 2: Homogeneity test

Levene's Test of Equality of Error Variances ^[a, b]					
		Levene Statistic	df1	df2	Sig.
VO ₂ max	Based on Mean	1.835	3	20	.173
	Based on Median	1.670	3	20	.205
	Based on Median and with adjusted df	1.670	3	19.270	.207
	Based on trimmed mean	1.828	3	20	.175

Based on the results of the homogeneity test above, a significance value of more than 0.05 (5%), it can be concluded that the group data in this study came from a homogeneous population or had the same variance.

3. Hypothesis test results

In this study, hypothesis testing uses two-way ANOVA analysis with the help of the SPSS 26.0 program. The results of hypothesis testing are sorted according to the hypotheses that have been formulated in chapter II. The hypothesis is accepted if the results of the two-way ANOVA test have a significance less than ($\text{sig} < 0.05$), whereas if the statistical significance level is greater than ($\text{sig} > 0.05$), the hypothesis is rejected. The following is a table of the results of the one-way ANOVA analysis:

Table 3: One-way ANOVA test

ANOVA					
VO ₂ max					
	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	27.283	3	9.094	29.821	.000
Within Groups	6.099	20	.305		
Total	33.382	23			

From the One-way ANOVA Test table above, the following results can be obtained:

- The hypothesis which states "There is a difference in the effect between the basketball game group with excess weight, the normal weight soccer game group and the overweight soccer group on the VO₂max of children with mild intellectual disabilities". The results of the analysis after the one-way ANOVA test on the column obtained a significance value of $p = 0.00 < 0.05$ so that H_a was accepted while H_o was rejected. So it can be concluded that there is a difference in the effect of the overweight basketball game group, the normal weight soccer game group and the overweight soccer group on the VO₂max of children with mild intellectual disabilities.
- To see the differences between groups more specifically and to find out which group has the highest effectiveness in increasing VO₂max, a post hoc test was carried out with the LSD formula and a significance level of 0.05 (5%). Here are the results of the post hoc test:

Table 4: Post hoc test

Multiple Comparisons						
Dependent Variable: VO ₂ max						
LSD						
(I) Group	(J) Group	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
A1B1	A1B2	1.92167*	.31883	.000	1.2566	2.5867
	A2B1	-.56833	.31883	.090	-1.2334	.0967
	A2B2	1.68500*	.31883	.000	1.0199	2.3501
A1B2	A1B1	-1.92167*	.31883	.000	-2.5867	-1.2566
	A2B1	-2.49000*	.31883	.000	-3.1551	-1.8249
	A2B2	-.23667	.31883	.467	-.9017	.4284
A2B1	A1B1	.56833	.31883	.090	-.0967	1.2334
	A1B2	2.49000*	.31883	.000	1.8249	3.1551
	A2B2	2.25333*	.31883	.000	1.5883	2.9184
A2B2	A1B1	-1.68500*	.31883	.000	-2.3501	-1.0199
	A1B2	.23667	.31883	.467	-.4284	.9017
	A2B1	-2.25333*	.31883	.000	-2.9184	-1.5883

* The mean difference is significant at the 0.05 level.

The table above presents a pairing test between groups to see the difference in the increase in VO₂max in each group. It can be concluded that the A2B1 group (the soccer game treatment group with normal weight) has a high effectiveness in increasing VO₂max. In general, the results of the hypothesis test state that there is a difference between the basketball game group with excess weight, the normal weight soccer game group and the overweight soccer group on the VO₂max of children with mild intellectual disabilities, it is necessary to review the group in detail, which is significantly different. Here are the differences between each group pair based on the post hoc test results:

- Groups A1B1 and A1B2 had a mean difference of 1.92 with a significant value of $p = 0.00$ ($p < 0.05$), so there was a different effect between groups A1B1 and A1B2 on the average increase in VO₂max of children with mild intellectual disabilities. The average increase in VO₂max in the A1B1 group was higher than in the A1B2 group
- Groups A1B1 and A2B1 have a mean difference of -0.57 with a significant value of $p = 0.90$ ($p > 0.05$), so there is no difference in the effect between groups A1B1 and A2B1 on the average increase in VO₂max of children with mild intellectual disabilities. The average increase in VO₂max in the A1B1 and A2B1 groups is almost the same.
- Groups A1B1 and A2B2 have a mean difference of 1.67 with a significant value of $p = 0.00$ ($p < 0.05$), so there is a difference in the effect between groups A1B1 and A2B2 on the average increase in VO₂max of children with mild intellectual disabilities. The average increase in VO₂max in the A1B1 group was higher than in the A2B2 group.
- Groups A1B2 and A2B1 have a mean difference of -1.92 with a significant value of $p = 0.00$ ($p < 0.05$), so there is a difference in the effect between groups A1B2 and A2B1 on the average increase in VO₂max of

children with mild intellectual disabilities. The average increase in VO₂max in the A1B2 group was lower than in the A2B1 group.

- e. Groups A1B2 and A2B2 had a mean difference of -0.24 with a significant value of $p = 0.467$ ($p > 0.05$), so there was no difference in the effect between groups A1B2 and A2B2 on the average increase in VO₂max of children with mild intellectual disabilities. The average increase in VO₂max in the A1B2 and A2B2 groups was almost the same.
- f. Groups A2B1 and A2B2 had a mean difference of 2.25 with a significant value of $p = 0.00$ ($p < 0.05$), so there was a different effect between groups A2B1 and A2B2 on the average increase in VO₂max of children with mild intellectual disabilities. The average increase in VO₂max in the A2B1 group was higher than in the A2B2 group.

Discussion

The results of the data analysis that have been obtained will be discussed further in this sub-chapter. In this study, it was found that basketball and soccer games could significantly increase VO₂max in children with mild intellectual disabilities, both with normal and overweight/obese weight. Based on the hypothesis testing that has been carried out, two groups of conclusions have been drawn, namely: (1) There is a significant difference in the effect between the main factors of the study, and (2) There is a group that has the highest effectiveness in increasing the VO₂max of children with mild intellectual disabilities. The following is a further explanation of the discussion of the results of the analysis above:

1. Differences in Influence between the Normal Body Basketball Game Group, the Overweight Basketball Game Group, the Normal Weight Football Game Group and the Overweight Football Group on the VO₂max of Children with Mild Intellectual Disabilities.

From the results of hypothesis testing, it can be seen that the four treatment groups have different effects on the VO₂max of children with mild intellectual disabilities. However, seen from the post hoc test, a significant difference only occurred between the groups with elements of normal weight and overweight. While in the type of exercise, the groups with elements of basketball and soccer games did not show significant differences in results.

The treatment group with excess body weight had a lower increase in VO₂max compared to the normal weight group in both basketball and soccer games. Children with normal weight have the advantage of being easier to move and not getting tired easily compared to participants who are overweight.

The treatment groups of basketball and soccer games with normal and excess weight experienced a relatively similar increase in VO₂max. Exercise based on basketball and soccer games is an intermittent exercise and has varying intensity. In addition, the two sports games have similarities in the use of the dominant energy system, namely aerobic and anaerobic. Basketball and soccer games consist of a combination of various movements such as running, walking, sprinting, jumping, kicking, catching and throwing repeatedly so as to improve cardiovascular fitness. The many elements of constructive motion make playing basketball and soccer more fun and can increase motivation to take part in training.

2. The Football Game Treatment Group with Normal Weight Has the Highest Effectiveness in Increasing VO₂max.

Based on the post hoc test, the soccer game treatment group with normal weight had the highest increase in VO₂max (13.63%) among the four treatment groups. Football is a very popular game that can be played by individuals from various backgrounds, environments, ages and genders for various purposes. How to play is simple, does not require a lot of special skills, the equipment used is easy to get, the existence of a goal as a target, can be played anywhere and can interact directly with opponents and friends makes the game of football interesting and popular with many people. This can be a motivation for children to actively participate in playing soccer. Individuals with normal weight are more free to move and do not get tired easily. Adolescents with normal weight have stronger lower limb muscles so that they can play dominant soccer games using their feet better than adolescents who are overweight.

Conclusion

Based on the results of the research and the results of data analysis that has been carried out, the following conclusions are obtained:

1. There is a difference in the effect between the overweight basketball game group, the normal weight soccer game group and the overweight soccer group on the VO₂max of children with mild intellectual disabilities.
2. The soccer game group with normal weight had the highest effectiveness in increasing the VO₂max of children with mild intellectual disabilities.

References

1. Cerrah Ali Onur, Hayri Ertan. "The Evaluation of Ground Reaction Forces During Two Different Soccer Throw-In Techniques: A Preliminary Study." *The Evaluation of Ground Reaction Forces During Two Different Soccer Throw-In Techniques: A Preliminary Study*, 2014;5(1):106-12.

2. Cheung Natalie. "Defining Intellectual Disability and Establishing a Standard of Proof: Suggestions for a National Model Standard and Establishing a Standard of Proof: Suggestions for a National Model Standard.", 2013, 23(1).
3. Frediani Jennifer K, Alan Bienvenida F, Jianheng Li, Melinda Higgins K, Felipe Lobelo. "Physical Fitness and Activity Changes after a 24-Week Soccer-Based Adaptation of the U.S Diabetes Prevention Program Intervention in Hispanic Men." *Progress in Cardiovascular Diseases*,2020;63(6):775-85. doi: 10.1016/j.pcad.2020.06.012.
4. Gremeaux Vincent, Mathieu Gayda, Romuald Lepers, Philippe Sosner. "Maturitas". *Maturitas*,2012;73(4):312-17. doi: 10.1016/j.maturitas.2012.09.012.
5. Hallal Pedro C, Lars Bo Andersen, Fiona Bull C, Regina Guthold, William Haskell, Ulf Ekelund, *et al.* "Global Physical Activity Levels: Surveillance Progress, Pitfalls, and Prospects." *The Lancet*,2012;380(9838):247-57. doi: 10.1016/S0140-6736(12)60646-1.
6. Iwandana Dody Tri, Ardhika Falaahudin, Wildan Alfia Nugroho. "Sport Values in Traditional Games as Playing Activities for Children." *TEGAR: Journal of Teaching Physical Education in Elementary School*,2021;4(2):96-100. doi: 10.17509/tegar.v4i2.33798.
7. Iwandana Dody Tri, Sugiyanto, Furqon Hidayatullah M. "Traditional Games to Form Children's Characters In Dieng Plateau Banjarnegara Central Java Indonesia." *Journal of Education, Health and Sport*,2018;8(11):407-15.
8. Librianty Herwina Dewi, Yufiarti, Elindra Yetti. "Teacher Involvement in Active Play and Its Effect on Children's Physical Literacy." *Journal of Physical Education and Sport*,2021;21(4):2236-42. doi: 10.7752/jpes.2021.s4298.
9. Lieberman Daniel E. "Is Exercise Really Medicine ? An Evolutionary Perspective.", 2015, 313-19.
10. Montgomery Paul G, David Pyne B, Will Hopkins G, Jason Dorman C, Katherine Cook K, Clare Minahan L. "The Effect of Recovery Strategies on Physical Performance and Cumulative Fatigue in Competitive Basketball." *Journal of Sports Sciences*,2008;26(11):1135-45. doi: 10.1080/02640410802104912.
11. Temple Vivienne A, Jeff Walkley W. "Physical Activity of Adults with Intellectual Disability." *Journal of Intellectual and Developmental Disability*,2003;28(4):342-52. doi: 10.1080/13668250310001616380.
12. Wibowo Antonius Tri, Asna Syafitri, Dody Tri Iwandana. "Psychological Characteristics of PSIM Yogyakarta Players in Wading the League 2 Soccer Competition in 2019/2020." *Quality in Sport*,2019;9(11):217-25. doi: 10.12775/qs.2019.018.
13. Williams Genevieve, Daniel Aggio, Brendon Stubbs, Shahina Pardhan, Benjamin Gardner, Lee Smith. "Physical Activity Levels in Children with Sensory Problems: Cross-Sectional Analyses from the Millennium Cohort Study." *Disability and Health Journal*,2018;11(1):58-61. doi: 10.1016/j.dhjo.2017.07.002.