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Comparative Analysis of Agility Levels Based on Gender in Children Aged 10-12 Years: A Cross-Sectional Study

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ABSTRACT

Introduction: Gross motor skills are related to children's proficiency in various movements and are often used in sports activities. One aspect of gross motor development is agility. Mastery of physical skills in children aged 10-12 years provides a source of enjoyment and achievement, supporting play and other activities. Boys and girls differ both physically and morphologically. Agility impacts the optimization of children's motor skills in solving problems, participating in sports activities, fitness, coordination, and precision of movements. It also influences their concentration levels and academic performance in school.
Methods: This study employed an observational analytical method with a cross-sectional design using purposive sampling. The research was conducted at SD Muhammadiyah 08 Dau, with a total sample size of 116 children. The Hexagon Agility Test was used as the instrument for this study.
Results: The one-way ANOVA test showed no significant difference in agility based on age (p=0.24). However, the Mann-Whitney test results indicated a significant difference in agility levels based on gender (p=0.02).
Conclusion: The study found a difference in agility levels among children aged 10-12 years based on gender. However, there was no difference in agility between the ages of 10, 11, and 12.

Keywords: 10-12 years, gender, agility, motor skills

INTRODUCTION

Every child has a unique developmental process; some develop slowly, while others proliferate. The method of growth and development in children related to body movement is called motor development. Gross motor skills are the body's ability to change positions through the work of large muscles, such as those in the arms, legs, and torso.[1] Gross motor skills are related to a child's proficiency in various movements and are often utilized in sports activities.[2]

Based on developmental stages, the ages of 10-12 years represent the final phase of childhood development. During this period, mastery of physical skills becomes a source of enjoyment and achievement, supporting play and other activities.[3–5] Therefore, the physical education, sports, and health curriculum in elementary schools focuses on teaching the development of fundamental motor skills and aims for improvement at each stage.[6]

During childhood, girls tend to be taller than boys. However, at age 12, boys often experience faster growth than girls. Physically, boys tend to have more substantial muscle mass and bone structure than girls. However, according to a 2018 survey conducted by the Indonesian Internet Service Providers Association (APJII) and the Polling Indonesia survey institute, 66.2% of children aged 10-14 years, out of 171.17 million people in Indonesia, are Internet users. This increased use of gadgets among children has led to a decrease in physical activities, both indoors and outdoors.[5,7] This situation inevitably affects motor development in children, as they need physical activity to enhance muscle fibres, thereby improving the speed of muscle contractions.[8]

One component of gross motor development is agility. Agility is the ability to respond to stimuli, change body positions, alter movement direction, and stop movements quickly, accurately, and efficiently. Agility is a key determinant of movement quality because it plays a crucial role in performing daily activities. Agility is developed by collaborating elements such as strength, speed, balance, coordination, endurance, and flexibility. At ages 10-12, children's activities become more numerous and complex, making agility essential for supporting their future activities.[3]

Previous research indicates that over 20% of children showed insufficient agility, even very low agility, among 100 students aged 9-11 years at SDN 01 Mijan, Kudus Regency. Inadequate development of agility can impact the optimization of children's motor skills, making it difficult to solve problems, perform poorly in sports activities, quickly become fatigued, and struggle with coordination and precision of movements. This will affect the decline in children's physical fitness, where agility is one of its components, consequently affecting concentration levels, which impacts academic performance at school due to the influence of the cortisol hormone in the body. Elevated cortisol levels can reduce cognitive abilities, reaction times, mood, and muscle fatigue.[4,9]

Due to the importance of agility as one of the elements of motor skills for child development, this study aims to assess the comparison of agility levels among children aged 10, 11, and 12 years old, as well as to compare agility levels between boys and girls in these age groups. This research hypothesises that there is no significant difference in agility levels among children aged 10, 11, and 12 years old, and there is a substantial difference in agility levels between boys and girls.

METHOD

This study employed an observational analytical method with a cross-sectional design to compare agility levels based on gender differences in children aged 10-12. Purposive Sampling was used as the sampling technique. The inclusion criteria for the research sample were boys and girls aged 10-12 years with normal, healthy conditions and no history of injury or other disorders who were willing to participate with parental consent. The exclusion criteria were children with contraindications to the research instrument, such as a history of heart disease or injury to body parts, and those who did not obtain parental consent. There was no control group in this study.

The research was conducted in October 2023, starting with the distribution of informed consent forms to the parents/guardians of the children, resulting in a sample size of 116 individuals who met the inclusion and exclusion criteria. Subsequently, agility tests were conducted using the Hexagon Agility Test instrument, with a reliability of 0.938 and a validity of 0.896. Before conducting the research, the researcher demonstrated how to perform the Hexagon Agility Test to the respondents.

The measurement began with the child standing barefoot in the middle of a hexagon with a side length of 50 cm and facing forward. The child jumped the hexagon lines upon the command "start," then returned to the centre and repeated by jumping to the other five sides of the hexagon clockwise. The test was performed for three circuits with two rest phases in between. The agility score in this measurement was obtained through the average of two test sessions. Univariate and bivariate analyses were used in this study. Univariate analysis was aimed to describe the characteristics of variables, including age, gender, and BMI. Then, bivariate analysis was conducted using IBM SPSS version 25 software, starting with normality test using Kolmogorov-Smirnov, followed by one-way ANOVA to analyse the comparison of ages 10, 11, and 12 years, and Mann-Whitney test to analyse the comparison of gender in children aged 10-12 years.

RESULTS

The framework of the research implementation process can be seen in Figure 1.

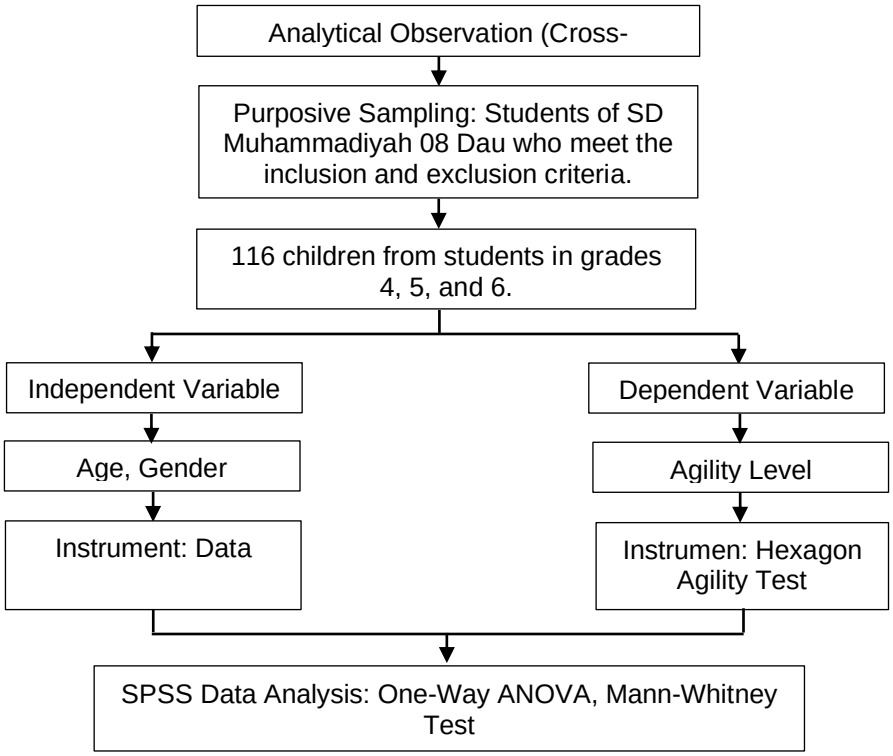

Figure 1. Research Framework

In this study, 116 samples met the inclusion and exclusion criteria of the research sample. Age, gender, and BMI are the characteristics of the research sample presented in Table 1.

Table 1. Characteristics of Research Respondents

Respondent Characteristics	Frequency	Percentage (%)
Age		
10 Year	37	32
11 Year	43	37
12 Year	36	31

Continuation of Table 1. Characteristics of Research Respondents

Respondent Characteristics	Frequency	Percentage (%)
Age		
10 Year	37	32
11 Year	43	37
12 Year	36	31
Gender		
Male	61	53
Female	55	47
Body Mass Index		
Underweight	16	11
Normal	71	68
Overweight	15	8
Obesity	14	13

Table 1 shows that the dominant data distribution based on age characteristics is 11 years old, with 43 children (37%). The majority, based on gender characteristics, is male, with 61 children (53%) out of a total sample of 116 children. Meanwhile, based on BMI, there are 16 children (11%) classified as underweight, 71 children (68%) as usual, 15 children (8%) as overweight, and 14 children (13%) as obese. The Average Agility Level based on Age Level can be seen in Table 2.

Table 2. Average Agility Level based on Age Level

Age Level	**Average Agility Level**	
	Number (n)	Mean
10 Years	37	21.41
11 Years	43	20.49
12 Years	36	22.22

Based on Table 2, the average agility level for 10-year-olds is 21.41, for 11-year-olds is 20.49, and for 12-year-olds is 22.22. The interpretation of agility values for these three age groups is considered sufficient. The interpretation of Agility Level based on Gender can be seen in Table 3.

Table 3. Interpretation of Agility Level based on Gender

Gender	**Description of Agility Level**			
	Very Good	Good	Fair	Poor
Boy	1	21	22	17
Girl	0	5	29	21

Based on Table 3, it can be concluded that the number of boys with a reasonable interpretation of agility, 21 children (34%), is higher than that of girls, which is five children (9%). Additionally, the interpretation of poor agility values is also higher in girls, with 21 children (38%), compared to boys, with 17 children (28%). The results of the Comparison Test of Agility based on Age Levels 10, 11, and 12 Years can be seen in Table 4.

Table 4. Comparison Test Results of Agility Based on Age Levels 10, 11, and 12 Years

Agility	**p-value**
	0.24

Based on Table 4, the significant result of the one-way ANOVA test is 0.24. This means there is no significant difference in agility among children aged 10, 11, and 12 years because the significance value is > 0.05. The results of the Comparison Test of Agility Levels for Ages 10-12 Years based on Gender can be seen in Table 5.

Table 5. Comparison Test Results of Agility Levels for Ages 10-12 Years based on Gender

Agility	**p-value**
	0.02

The significant result of the Mann-Whitney test in Table 5 indicates a difference in agility levels between boys and girls. This can be inferred from the significance value < 0.05, which is 0.02.

DISCUSSION

Comparison of Children's Agility Levels based on Age Levels 10-12 Years

Agility is one component of children's motor development. Agility is formed due to the collaboration of strength, speed, balance, coordination, and flexibility.[10] Agility becomes crucial for children to engage in various physical activities in their daily lives and sports activities, both general and specific.[4] Agility is considered excellent if the average hexagon agility test score is less than 12 seconds. After analyzing the data, it was found that the agility of children aged 10-12 years at SD Muhammadiyah Dau has the same interpretation, which is sufficient.

The one-way ANOVA analysis results indicate no difference in agility based on the ages of 10, 11, and 12 years. This finding is consistent with the findings of Lutz Thieschafer and Dirk Busch (2022), who stated that no significant differences were found in closely spaced ages due to developmental maturity being one of the main contributing factors

to the differences between age groups.[11] From a physical perspective, the growth in height and weight between the ages of 10-12 years is relatively similar. This lack of difference can also be attributed to the physical education curriculum in elementary school grades 4-6, which has a similar learning approach by focusing on the development of locomotor, non-locomotor, and manipulative movement skills and striving for improvement in each phase through variations and combinations with other skills, such as dribbling a ball.[6]

In grade 4, learning focuses on introducing and varying basic movements through games. In grade 5, combinations and basic techniques of games with a sports context are emphasized. As children progress to grade 6, further development of variations and combinations is demanded through competitive sports games, including more complex and realistic game techniques and situations. These exercises also enhance agility in children, such as running back and forth and using obstacles in activities involving variations and combinations of walking and running while dribbling a ball.[12]

Current technological developments can also affect children's motor development, of which agility is one component. This can be linked to the sedentary level of elementary school-aged children, which exceeds its limit due to the influence of gadgets. Research reveals that elementary school-aged children and adolescents should spend at most 2 hours daily screen time.[13] However, children aged 10-12 years at SD Muhammadiyah 08 Dau spend more than 2 hours playing with gadgets daily. Due to this behaviour, children's physical activity will decrease, essential for increasing muscle mass, balance, cardiovascular fitness, and reducing body fat, all of which impact children's agility.[14]

Additionally, a sedentary lifestyle will also affect children's BMI, increasing the risk of obesity.[15] Looking at the overall picture, a percentage of 30% is found to have an interpretation of poor agility. This can be associated with BMI factors in children aged 10-12 at SD Muhammadiyah 08 Dau. Table 1 shows 15 overweight children (8%) and 14 children classified as obese (13%). Research by Dewi et al. (2023) states that the agility of children with overweight BMI is considered poor compared to children with normal weight BMI. This is because exceeding the standard weight limit requires more significant effort to move the additional weight, resulting in fatigue and reduced physical activity.[8]

Agility impacts a child's basic movement skills, which help them adjust their play activities with other children and their ability to engage in sports. This is related to a child's physical fitness, which influences their concentration level and the efficiency of transferring information from short-term to long-term memory as a student. Additionally, agility can impact adults, as body agility is necessary in work situations.[16] Agility facilitates the execution of complex movements, reduces the risk of falls or injuries, and supports the techniques used during exercise.[17]

The results of this study indicate no significant difference in the comparison of ages 10, 11, and 12 years. This aligns with the theory from the research journal by Lutz Thieschafer and Dirk Busch (2022), stating that maturity contributes to the comparison between age groups. However, the study sample is specific to one school, which may have unique characteristics that cannot represent other populations.

Comparison of Agility Levels in Children Aged 10-12 Years Based on Gender

Based on the Mann-Whitney analysis, the obtained significance value is 0.02, indicating a difference in agility levels among children aged 10-12 years based on gender. Males have a higher interpretation of good agility levels than females, with 34% (21 children) for males and only 9% (5 children) for females. This is consistent with the findings of a study by Golle in 2015, which stated that girls aged 9-12 years have poorer agility levels than boys.[18]

A study by Sabrina (2021) found that the level of physical fitness in girls is lower than in boys. This is attributed to girls having lower confidence and ability to engage in physical activities. Additionally, girls participate less in sports and physical activities than boys. From a morphological perspective, lower agility in girls can be linked to a higher percentage of body fat in girls than in boys. An increase in body fat percentage in individuals can decrease agility.[8] Therefore, girls tend to focus more on academic pursuits, participate less in physical activities, and are less likely to engage in activities that enhance motor skills and sports performance.[19]

According to the Sports Development Index 2021, 78% of males dominate sports participation compared to 22% of females. From this data, it can be inferred that the role of women in sports activities still needs to meet expectations. This is influenced by social solid constructs surrounding sports, often portrayed as a realm for men to showcase strength and speed. At the same time, women are usually associated with traits of weakness and gentleness.[20]

According to Apriloka (2020) on motor development, boys tend to excel in gross motor skills compared to girls. This is attributed to boys' tendency to engage more in outdoor play with their friends outside of school, which provides additional practice for their gross motor skills.[21] This is in line with the activities of boys aged 10-12 years at SD Muhammadiyah 08 Dau, who prefer engaging in physical activities such as soccer and badminton compared to girls who prefer passive activities, such as sitting and chatting with peers during school break times. Therefore, on average, male students will be more active in physical activities than female students, increasing muscle fibre size that enhances muscle contraction speed.

Muscle strength is one of the components of agility. A research journal by Luz et al. (2017) noted that motor activities between boys and girls differ. Girls engage in locomotor activities such as running and jumping, while boys engage in locomotor and manipulative activities such as ball games. These differences may explain why male students excel in certain sports activities.[22]

Significant differences in agility levels were found in the comparison based on gender. Boys demonstrated better agility levels than girls. This difference may be attributed to morphological factors and varying physical activity levels between genders. However, further analysis is needed to understand the influence of social and environmental factors more deeply. The limited sample size and potential biases in measuring agility levels among 10-12-year-old students at SD Muhammadiyah 08 Dau are constraints of this study. Additionally, the uncontrolled level of physical activity outside

of school and gadget usage among children may influence the study results. Therefore, further research with a more comprehensive design is needed to strengthen these findings.

CONCLUSION

Based on the findings of this study, it can be concluded that there is a difference in agility levels between boys and girls aged 10-12 years old. Boys have better agility levels compared to girls. However, when comparing different age groups (10, 11, and 12 years old), no significant difference in agility levels was found at SD Muhammadiyah Dau. This could be attributed to maturation development and relatively similar physical education curricula in elementary schools.

This study highlights the need for more attention to gender differences in physical activity and the development of exercises that can help improve agility in girls. However, the study has several limitations, including a limited sample size and the potential bias of gadget usage affecting children's physical activity. Therefore, further research is needed to validate these findings in a broader context and with a more comprehensive methodology.

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