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Comparison of Illinois agility test results between normal and overweight body mass index in basketball extracurricular members at SMAN 3 Surabaya

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Abstract

Background: One of the essential components in basketball is agility, both in offense and defense. Basketball players are required to master and carry the ball to the opponent's area using techniques quickly. One of the factors that influence a basketball player's performance is an ideal body, which can be measured by Body Mass Index (BMI). According to a study, excess BMI can affect body movement and flexibility by 9.15%. The Illinois Agility Test involves movements such as turning, zig-zagging, and sprinting around six cones arranged in a "T" shape.

Purpose: This study aims to compare the results of the Illinois Agility Test between normal and overweight BMI in basketball extracurricular members at SMAN 3 Surabaya.

Materials and Methods: This research is a comparative non-experimental study, with subjects being members of the basketball extracurricular at SMAN 3 Surabaya. The measurement tools used in this study are the Illinois Agility Test for agility and Body Mass Index (BMI). Data analysis was conducted using IBM SPSS Statistics 23, where the normality test used was Shapiro-Wilk, the homogeneity test was Levene's Test for Equality of Variances, and the hypothesis test was Independent Sample T-Test.

Results: The normality test results showed $p > 0.05$, indicating that the data in this study were normally distributed. The homogeneity test showed $p > 0.05$, indicating that the data were homogeneous. The Independent Sample T-Test results showed a p-value of 0.002 ($p < 0.05$), indicating a significant difference between the Illinois Agility Test results of those with normal BMI and those with overweight BMI.

Conclusion: There is a significant difference in the Illinois Agility Test results between individuals with normal BMI and those with overweight BMI.

Keywords: Illinois Agility Test; Agility; Body Mass Index (BMI); Basketball

1. Introduction

Basketball is a sport played by two teams, where each team consists of five main players and seven substitute players (Supriatna, 2023). In basketball, there is a combination of aerobic and anaerobic activities, as well as physical abilities such as muscular strength, cardiovascular endurance, flexibility, speed, and agility (Gaol et al., 2024). Basketball players require good physical condition to improve their basic technical skills, which enables them to achieve victory (Agung Prabowo et al., 2023). One important component in basketball is agility, both in offense and defense. Basketball players are required to master and carry the ball to the opponent's area using techniques quickly (Conrad, 2014). One factor

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that affects a basketball player's performance is having an ideal body, which can be assessed through body mass index (BMI). BMI is a standard ratio of weight to height often used as an indicator of an athlete's health. Agility is defined as the rapid movement of the entire body with changes in speed or direction in response to a stimulus (Popowczak et al., 2022a), referring to the ability to change direction quickly without losing balance (Acar and Eler, 2019). Agility is influenced by several factors, including age, gender, body type, motivation, and body mass index (Mubarani et al., 2017).

Based on research, athletes with a normal body mass index (BMI) tend to have better agility than athletes with an excessive BMI (Hidayat et al., 2022). According to a study by Asadi (2016), there is no correlation between height, body fat, and sprinting; however, a positive correlation exists between body mass and agility in Tunisian basketball players. Another study by Popowczak et al. (2022a) shows that agility decreases as BMI increases (above 26.27). Further research indicates that excess BMI affects body movement and flexibility by 9.15% (Apriliningtias et al., 2021).

2. Material and methods

2.1. Study Design

This study is a non-experimental comparative research, where the purpose of this type of research is to compare two or more groups or variables without manipulating or intervening. The aim of this study is to determine the comparison of Illinois Agility Test results between normal BMI and overweight BMI among the basketball extracurricular members of SMAN 3 Surabaya.

2.2. Population and Sample

Based on the number of basketball extracurricular members at SMAN 3 Surabaya, and using inclusion criteria, the total population is 30 people. Therefore, the total sample required for this study is 30 people.

2.3. Measurement

The measurement tools used in this study include the Illinois Agility Test, which requires equipment such as a measuring tape, stopwatch, cones, and writing materials (pen, notebook), as well as BMI measurements, which require a scale to measure body weight and a stadiometer to measure height.

2.4. Intervention

Subjects who are willing and meet the inclusion criteria will undergo BMI measurements using a scale and a stadiometer to determine whether the subject falls into the categories of underweight, normal, overweight, or obesity.

After the BMI measurement is conducted, the Illinois Agility Test will be performed to determine which category the subject falls into.

2.5. Statistical Analysis

Data were analyzed using SPSS. Normality was assessed using the Shapiro-Wilk test, and between-group differences were evaluated using the independent t-test. Significance was set at $p < 0.05$.

3. Results

Table 1 Mean, standard deviation and homogenity of subject characteristics

Gender	Average	
	Body Mass Index	**Age**
Male	23.89 ± 2.81	16.38 ± 0.50
Female	21.30 ± 2.75	16.36 ± 0.49

The general data of the subjects, which consisted of three criteria age, body mass index, and gender was tested for homogeneity. Based on the data in the table above, the average BMI for males is 23.89 ± 2.81, and the average age is 16.38 ± 0.50. For females, the average BMI is 21.30 ± 2.75, and the average age is 16.36 ± 0.49.

Table 2 Normality Test

Gender		Illinois Agility Test Result	
		Mean	p
Male	BMI Normal	16.44 ± 1.397	0.218
	BMI Overweight	18.36 ± 0.624	0.588
Female	BMI Normal	18.75 ± 1.327	0.246
	BMI Overweight	21.98 ± 0.826	0.919

Based on the data in the normality test table above, it is known that the Illinois Agility Test results for males with normal BMI have a p-value of 0.218 (p > 0.05), and the Illinois Agility Test results for males with overweight BMI have a p-value of 0.588 (p > 0.05), which indicates that the data in this study follow a normal distribution. For females, the Illinois Agility Test results for those with normal BMI have a p-value of 0.246 (p > 0.05), and the Illinois Agility Test results for females with overweight BMI have a p-value of 0.919 (p > 0.05), which also indicates that the data in this study follow a normal distribution.

Table 3 Hypothesis Test

Illinois Agility Test Result	Mean Difference	Sig. (2-tailed)
Male	-1.91	0.003
Female	-3.22	0.000

Table 3 Based on the data in the table above, the mean difference in the Illinois Agility Test results for males between normal BMI and overweight BMI is -1.91 (s), as the mean Illinois Agility Test result for normal BMI is lower compared to overweight BMI. The p-value obtained is 0.003 (p < 0.05), which indicates that there is a significant difference between the Illinois Agility Test results for males with normal BMI and overweight BMI. Meanwhile, the mean difference in the Illinois Agility Test results for females between normal BMI and overweight BMI is -3.92 (s), as the mean Illinois Agility Test result for normal BMI is lower compared to overweight BMI. The p-value obtained is 0.000 (p < 0.05), indicating that there is a significant difference between the Illinois Agility Test results for females with normal BMI and overweight BMI.

4. Discussion

The subjects in this study are the members of the basketball extracurricular at SMAN 3 Surabaya, totaling 30 individuals, with the average BMI for males being higher compared to females. Current physical activity patterns tend to shift towards a sedentary lifestyle, which is caused by technological advancements and leads to an increased risk of obesity. This is supported by research (Kumala et al., 2019) on adolescents, where smartphone usage exceeds 2 hours per day. The use of smartphones is performed daily to access social media and online games.

The Illinois Agility Test is a method for measuring agility that has been used in many studies and has been proven to have good validity and reliability (Kaya et al., 2022). The Illinois Agility Test combines sprinting, change of direction, zig-zag running, acceleration, and deceleration (Dawes, 2018). The results obtained for the male group with normal BMI had an average time of 16.44 seconds (s), while the overweight male group had an average time of 18.36 seconds (s). For the female group, those with normal BMI had an average time of 18.75 seconds (s), and the overweight female group had an average time of 21.98 seconds (s).

Based on the data analysis results, the Illinois Agility Test for the normal BMI group had an average time of 17.52 seconds (s), while the overweight BMI group had an average time of 19.41 seconds (s). The results from the Independent Sample T-Test showed a significance value of p = 0.002 (p < 0.05), indicating that there is a significant difference in the Illinois Agility Test results between the normal BMI and overweight BMI groups of the basketball extracurricular members at SMAN 3 Surabaya.

The difference in the Illinois Agility Test results between normal BMI and overweight can assist coaches in determining player positions and adjusting game strategies, both in practice and during matches, by considering individual agility abilities based on their BMI. The risk of injury is more likely to occur in individuals with an overweight BMI compared to those with a normal BMI, due to the greater strain on the joints during rapid and repetitive movements (Laver et al., 2020).

Limitations

The limitations of this study include confounding factors such as the subjects' fatigue levels and motivation, which could affect the final results, as well as the subjects' basketball experience or training levels. Differences in fitness levels or playing experience can significantly impact agility test results. The relatively small sample size and the fact that the study was conducted at only one school may also influence the research outcomes. A study with a larger and more diverse sample across different locations could provide more representative results.

5. Conclusion

There is a significant difference in the Illinois Agility Test results between the normal BMI and overweight groups. This can help coaches determine player positions and adjust game strategies, both in practice and during matches.

Compliance with ethical standards

Disclosure of conflict of interest

No conflict of interest to be disclosed.

Statement of ethical approval

This research has received a research ethics certificate.

Statement of informed consent

All research samples have received information regarding research procedures and signed a consent form.

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