INTERNATIONAL JOURNAL OF MULTIDISCIPLINARY RESEARCH AND ANALYSIS
ISSN(print): 2643-9840, ISSN(online): 2643-9875
Volume 07 Issue 01 January 2024
DOI: 10.47191/ijmra/v7-i01-47, Impact Factor: 7.022
Page No. 384-393

The Effect of Training Methods and Body Mass Index on the Speed and Agility of Klaten SSB Players Age 13-14 Years

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ABSTRACT: In this study, the objectives are: (1) to determine the difference in the effect of zig-zag run and shuttle run training methods on speed and agility; (2) to determine the difference in the effect of low and high body mass index on speed and agility; (3) to determine the interaction effect of zig-zag run and shuttle training models with low and high body mass index on speed and agility in Klaten SSB U 13-14 players. This type of research is experimental research using 2x2 factorial. The population in this study were Klaten SSB players aged 13-14 years who were actively training with 35 people. The sample in this study obtained 20 players. The research instruments used in this study were the 30-meter run to measure speed and the Illinois agility test to measure agility. In this study, the analysis technique used two-way ANOVA. The results of this study indicate that (1) there was an influence on the difference in the speed and agility of the Zig-zag run and shuttle run methods in SSB players Klaten aged 13-14 with a value on the $F_{calculate}$ speed of 5.528 and a sig. value of 0.032 whereas the value on $F_{calculate}$ agility is 7.837 and the Sig.013 where the analysis revealed that the zig-zag run method was more effective in improving agility and Shuttle Run is more efficient in increasing speed. (2) there was a influence of the difference between the index of low body mass and high body mass there was speed and flexibility in the 14-14 years old SSB player Kleten with a rating on the speed of $F_{calculate}$ is 5.490 and Sig. value is 0.032 while the value of the $F_{calculate}$ agility was 5.448 and the sig. score is 0.033 where the results explained that lower BMT increases are more effective on agility than low speed, whereas higher IMT increase is more effectively on the velocity than the speed while increasing high BMT is more effective increasing to speed than agility. (3) There was no influence on the interaction between the exercise method and the body mass index on speed and agility in SSB players Klaten aged 13-14 years with a value against speed $F_{calculate}$ of 2.635 and a value of Sig. 0.124 whereas the value against agility $F_{calculate}$ of 1.252 and Sig. of 0.252. Thus it can be concluded that to train the speed more effectively using the shuttle run method for low or high BMT, whereas to train agility more efficiently using the zig-zag running method for lower or higher BMT.

KEYWORDS: Body mass index, speed, agility, shuttle run, zig-zag run.

I. INTRODUCTION

Sports is a need carried out by a person to maintain his body condition or health to carry out his daily activities. Sports and health have become an interrelated unity in human life [18]. The general definition of *exercise* is physical and psychological activities that aim to improve and maintain a healthy body [14]. Exercise has many benefits; for example, it can improve brain function, increase endurance, avoid obesity, and relieve stress. According to the results of the Indonesian Survey Scale Survey (SSI) results, football is the type of sport that the people of Indonesia most like; out of 100%, football has 21% [25].

Football is a big ball game consisting of 2 teams, and each team contains 11 players each. Football matches are conducted in 2 sessions, and each session is 45 minutes long. The main goal of the game of soccer is to put the ball into the opponent's goal as much as possible and achieve victory. *Football* is a complex game that requires specific training. Players are required to have good physical conditions such as agility, speed, endurance, flexibility, and anthropometric conditions (arms length and leg length) [31]. Football athletes must manage a good position when playing a match. When a soccer player makes a pass, other players must be able to position and pursue the ball. This ability is part of the player's Speed. Speed is an essential component in soccer sports. In addition to Speed, playing football also needs agility in playing the ball and a fit body to compete for 90 minutes or more without feeling tired. [5] reveal the definition of *Speed*, namely "Speed is the body's ability to direct all its systems against loads, distances and times that produce mechanical work. If the coach understands the ability of SAQ's movement speed well, it will quickly determine the speed training program in a form that determines peak performance".

Football games must be supported by good physical conditions, skills (tactics and techniques), and mentality. Regular training needs to be done early on a regular and sustainable basis to achieve an achievement in sports. [13] state, "So that the implementation of training can be organized and directed appropriately and meaningfully, its implementation should be guided by the principles of training in general." Sports training systematically improves athlete performance regarding fitness, skill, and power capacity [16]. [6] explain that "training aims to improve the athlete's ability and work capacity to optimize athletic performance. Exercise is performed in long masses and involves many rhythmic, physiological, psychological, and sociological variables". Based on the definitions of several experts, it is concluded that training is a sporting activity carried out consciously, systematically, gradually, and repeatedly over a relatively long time to achieve the ultimate goal of optimal performance. In simple terms, *exercise* can be defined as any effort to improve general physical fitness through a systematic and repetitive process of increasing exercise load, time, or intensity.

Players carry out exercises due to a form of effort to perfect skills and achieve specific goals. The proper training method needs to be used to increase the speed and agility of athletes. [19] explain, "Basically, training is a process of change for the better, namely to improve physical quality, the functional ability of body equipment, and psychological quality of trainees." *Sports training* is an activity that is carried out at a time and carried out repeatedly, programmed in the principles of training loading in order to create athletes who achieve the highest performance standards. The training program must follow the concept of periodization, compiled and appropriately planned based on the sport so that the athlete's energy system can adapt to the sport's specificity. Success and success in achieving sporting achievements must apply training steps such as training principles, components, and factors. One school that trains soccer skills is the Soccer School (SSB).

Football School (SSB) is a sports organization, especially football, that has a mission to develop the potential of athletes. Establishing a football school aims to produce talented or suitable athletes who can compete with other football schools, please the community, and ensure the organization's survival, especially on the football field. [30] defines a "football school as an institution that provides knowledge or teaches about basic football techniques and basic techniques to students starting from how and mastering football techniques properly and correctly". In addition to exercise, physical condition is also influenced by several factors, including body type, gender, weight, and age. [17] There are three types of weight measured by BMT: standard, thin, and fat. This can be seen from the body's composition, that is, the proportional proportion of height and weighs he more proportional the proportion, the better the fitness. In determining the composition of this body, the measurement of the Body Mass Index is used. BMT is a measure by using Weight and Height. Physical fitness is beneficial to support the child's physical condition significantly to improve his performance in the field of sport. In 2010, the world's child population was 6.7% obese and overweight, and is expected to rise to 9.1% by 2020 [5]. Regarding the physical condition of players in football, the coach must be able to implement training according to the player's body portion measured by the body mass index.

The [2] states, "There are four categories of player development stages, one of which is the formation stage, namely, at the age of 14-16 years. At this stage of formation is included in the early adolescent category, players or athletes experience significant changes in physical, psychological, and emotional development ". According to [28], Growth at the age of 13-14 years, namely, (1) This age is a mass where children experience puberty which is characterized by the development of sexual maturity and very rapid body growth (2) Psychologically, players tend to be unstable because they feel unfamiliar with their new bodies, (3) Physiologically, body growth is speedy, becoming bigger and bigger, which automatically reduces player skills and coordination, and (4) although at this age it is a critical age, it can be improved if given the right portion of the training. Therefore, the coach's role in the formation stage needs to be carried out so that athletes can identify and overcome new challenges and get used to physical, psychological, and emotional changes.

Based on the results of 2 initial observations, observations, and interviews with coaches conducted during training at the Klaten soccer school, in every training, the coach only focuses on mini-games without applying a variety of exercises by body mass index. Another problem is speed; when sparring with other teams, Klaten SSB players receive long balls from their friends, and the players lose the run from the opposing players, resulting in being unable to have the ball. Apart from speed, the agility of Klaten SSB players is also low; this can be seen when making movements, but the players still need to be more flexible and flexible. Agility is also needed to break free from the opponent's control by dribbling past the opponent and attacking to create a goal leading to victory. However, SSB Klaten players still require much training to have good agility. With low physical condition, the results of the first match did not score any goals; the second match was a draw with a score of 1-1. According to the results of interviews with coaches, students only do training if there is an event, so it is ineffective in training. In addition, SSB Klaten only participated in two competitions, including trofeo between SSBs and the Sleman Cup League, but both have yet to win the event. This happens due to the need for the player's physical condition, especially agility and speed.

These components taken for research are speed and agility to determine the physical conditions that can affect the ability to play soccer. Lack of knowledge about the correct training technique, intensity, benefits, and effectiveness of Zig-zag and shuttle run exercises. It is interesting for researchers to investigate these two exercises titled "The Effect of Training Methods and Body Mass Index on the Speed and Agility of Klaten SSB Players Age 13-14 Years".

II. MATERIAL AND METHOD

The method used in this research is the experimental method, which is research that aims to determine the cause and effect and to identify the effects and benefits of Zig-zag run and shuttle run training on increasing the speed and agility of Klaten SSB players aged 13-14 years with a classification of body mass index.

The design used in this research is an experimental method using a 2x2 factorial design. [29] states, "Factorial is an action on one or more variables that are manipulated simultaneously to study the effect of each variable on the dependent variable or the effect caused by the interaction between several variables." This experimental study used three groups that received different treatments: the Zig-zag and shuttle run training models. The following is the research design in this experimental research.

Table 1. Factorial Research Plan 2x2

Training Methods (A) / Body Mass Index (B)	Zig-zag run (A1)	Shuttle run (A2)
BMT Low (B1)	A1,B1	A2,B1
BMT High (B2)	A1,B2	A2,B2

Description:

1. A1B1: Low BMT player group trained using Zigzag run training method
2. A1B2: High BMT players trained using the Zigzag Run exercise method
3. A2B1: Low BMT player group trained using the Shuttle run training method
4. A2B2: High BMI player group trained using the Shuttle run training method

The population in this study were active SSB Klaten soccer players totaling 35 people. With reference to this statement, the combination method is an approach that combines qualitative and quantitative data. The use of a combination method in this study is expected to produce data that is very accurate and in accordance with the real situation of the achievement coaching program at SSB Klaten. The data collection technique in this study used random sampling, because it was based on several considerations looking at the situation in the situation that was happening at that time. Random sampling is a way of taking samples in an arbitrary / random manner without regard to criteria [29]. Each sample in random sampling has the same right to be selected as a research sample. The population in this study consisted of active SSB Klaten soccer players, totaling 35 people. Concerning this statement, the combination method is an approach that combines qualitative and quantitative data. The use of a combination method in this study is expected to produce data that is very accurate and representative of the actual situation of the achievement coaching program at SSB Satria Pandawa

The data collection technique in this study used random sampling because it was based on several considerations looking at the situation in the situation that was happening at that time. Random sampling is a way of taking samples in an arbitrary/random manner without regard to criteria [29]. Each sample in random sampling has the same right to be selected as a research sample. Instrument validity is an important test to do before analyzing data. [29] states, "The reliability test is the extent to which the measurement results using the same object will produce the same data." Meanwhile, the validity test measures whether an instrument is valid. According to [10], the Illinois agility test has a validity coefficient of 0.82 for adolescents and children and a reliability value of 0.92. The 30-meter speed test has a validity value of = 0.92 and a reliability of = 0.94 [22]. Data analysis in the study was assisted by SPSS 25.0 software with two-way ANOVA analysis techniques. With further tests using the Tukey test.

III. RESULT AND DISCUSSION

Result

This study aims to determine the effect of training methods and body mass index on the agility and speed of SSB Klaten U13-14 players. This study uses two groups that will be given different treatments: Zig-zag run and shuttle run. The following are the results of the research analysis:

1. Prerequisite Test
   a. Normality Test

Table 2. Normality Test

Indicator	Kolomogrov-Semirnov	Shapiro Wilk	Note
Pretest_Speed_A1B1	0.200*	0.237	Usual
Posttesr_Speed_A1B1	0.200*	0.609	Usual
Pretest_Speed_A2B1	0.200*	0.881	Usual
Posttest_Speed_A2B1	0.200*	0.212	Usual
Prestet_Speed_A1B2	0.200*	0.609	Usual
Posttest_Speed_A1B2	0.200*	0.907	Usual
Pretest_Speed_A2B2	0.200*	0.212	Usual
Posttest_Speed_A2B2	0.189	0.484	Usual
Prestest_Agility_A1B1	0.200*	0.907	Usual
Posttest_Agility_A1B1	0.200*	0.789	Usual
Pretest_Agility_A2B1	0.200*	0.484	Usual
Posttest_Agility_A2B1	0.200*	0.237	Usual
Pretest_Agility_A1B2	0.200*	0.789	Usual
Postest_Agility_A1B2	0.112	0.881	Usual
Pretest_Agility_A2B2	0.200*	0.908	Usual
Posttest_Agility_A2B2	0.200*	0.098	Usual

Based on the results of the analysis on the normality test, it can be concluded that the shapiro wilk test value is more than 0.05, which means that all of this data is normally distributed.

b. Homogenity Test

Table 3. Homogenity Test

Indicator		Sig.	Note
Speed	Pretest	0.289	Homogeny
	Posttest	0.583	
Agility	Pretest	0.482	
	Posttest	0.588	

Based on the results of the analysis on the normality test, it can be concluded that the shapiro wilk test value is more than 0.05, which means that all of this data is normally distributed.

2. Hypothesis Test

Research hypothesis testing is based on the data analysis results and two-way ANOVA analysis interpretation. The following are the results of hypothesis testing:

a. Hypothesis testing I

Table 4. Hypothesis I on Speed

Source	Type III Sum of Squares	F	Sig.
Exercise Method	1.653	5.528	.032

A sig value was obtained based on the univariate analysis results 0.032 <0.05, the hypothesis "There is an effect of training methods on speed and agility" is accepted.

Table 5. Hypothesis I on Agility

Source	Type III Sum of Squares	F	Sig.
Exercise Method	7.236	7.837	.013

A sig value was obtained based on the univariate analysis results 0.013 <0.05, the hypothesis "There is an effect of training methods on agility" is accepted.

b. Hypothesis testing II

Table 6. Hypothesis II on Speed

Source	Type III Sum of Squares	F	Sig.
BMT	1.642	5.490	.032

A sig value was obtained based on the univariate analysis results 0.032 <0.05, the hypothesis "There is an effect of BMI on speed" is accepted.

Table 7. Hypothesis II on Agility

Source	Type III Sum of Squares	F	Sig.
BMT	5.030	5.448	.033

A sig value was obtained based on the univariate analysis results. 0.033 <0.05, the hypothesis "Is there an effect of BMI on agility" is accepted.

c. Hypothesis testing III

Table 8. Hypothesis III on Speed

Source	Type III Sum of Squares	F	Sig.
Exercise Method * BMT	.788	2.635	.124

A sig value was obtained based on the univariate analysis results. 0.124 > 0.05 means the hypothesis "There is an interaction between training methods and BMT on speed" is rejected.

Table 9. Hypothesis II on Agility

Source	Type III Sum of Squares	F	Sig.
Exercise Method * BMT	1.306	1.414	.252

A sig value was obtained based on the univariate analysis results. 0.252 > 0.05 means the hypothesis "There is an interaction between training methods and body mass index on agility" is rejected.

Discussion

Differences in the effect of training methods on speed and agility in Klaten SSB players aged 13-14

1. **Differences in the effect of training methods on speed in Klaten SSB players Age 13-14**

Based on the results of the analysis above, the sig value is known. 0.032 <0.05, so there is an influence between training methods and speed. Based on data analysis, the average difference between the pre-test and post-test speeds on the Zig-zag run is 1.06, while on the shuttle run, the difference between the pre-test and post-test speeds is 1.16. So, the shuttle run training method is more effective for increasing speed in SSB Klaten U13-14 players.

Zig-zag running, often referred to as "agility training," is an exercise often used in sports training to increase athletes' speed, agility, and coordination. Zig-zag running can affect agility because this training method involves rapid and sudden changes in direction. It forces the muscles to adapt to rapid changes in direction, which helps improve responsiveness and agility. The zig-zag run also requires good coordination between the eyes, brain, and muscles. The athlete must be able to see the correct direction, process the information, and send signals to the muscles to perform the proper movement. This helps improve coordination and reaction time. Zig-zag runs also require good balance. The athlete must be able to keep his or her body balanced while making sudden changes in direction. This exercise helps strengthen the core muscles and improves overall balance. In addition, the zigzag run creates a situation where the athlete must respond quickly to a change in direction or external stimulus. This helps improve reactive speed, which is responding quickly to unexpected situations.

Performing zigzag movements requires using various muscles, including leg, hip, and core muscles. This exercise can help develop the muscle strength needed to achieve maximum speed. Zigzag running can help improve leg muscle strength and endurance. This can increase speed in the long run, as solid leg muscles can generate greater power when running. By performing zigzag runs, athletes will be more aware of their body position in space. This helps improve body awareness, essential for achieving maximum speed and avoiding injury.

2. **Difference in the influence of training methods on agility on SSB Klaten aged 13-14**

Based on the results of the analysis above, the sig value is known. 0.013 <0.05, so there is an influence between training methods and agility. Based on data analysis, the average difference between pretest-posttest agility on the Zig-zag run is 2.209, while on the shuttle run, the difference between pretest-posttest agility is 1.432. So, the Zig-zag run training method is more effective for increasing agility than the Zig-zag run on SSB Klaten U13-14 players.

The increased agility results from muscle strength and strength in the lower extremities that increase with short-distance running exercises and movements to change body direction. When doing this exercise, there will be a repetition of acceleration, which is characteristic of rapid changes in direction and considered the power of action [23]. According to [11], shuttle run

training is oriented toward footwork and speed based on sprinting movements by changing direction and body position, which also trains body balance as a component of agile movement to improve agility.

In line with the results of this study, which showed an increase in agility caused by the shuttle run training program, [12] conducted a study that aims to determine the effect of shuttle run and ladder drill training on agility in 20 students at Macan Putih Soccer Academy Kediri. The agility test results in the experimental group with shuttle run (10 students) showed an average value of 17.34 seconds for the pretest and 17.12 seconds for the posttest. The pretest and posttest results, which show a difference of 0.22 seconds, indicate that the shuttle run significantly increases agility. According to [12], shuttle run training can increase agility because when doing shuttle runs, isometric contractions occur to keep the legs and feet moving due to isotonic, isometric, and isometric contractions which in turn occur when reducing running speed to change direction. Eccentric contractions occur when the hip muscles, knee extensors, and hip extensors slow the forward momentum of the body and move the body to a new position. Doing shuttle runs during training will make the body adapt to improve agility. [9] conducted a study to determine whether there are differences in the effect of shuttle run and ladder drill training on improving agility in 30 futsal players divided into two groups with a four-week training program. The results of the study in the shuttle run group (15 futsal players) measured using the Illinois agility test showed an average agility score of 17.46 (posttest) and 16.77 (pretest), with a difference of 0.69. The significance value of 0.001 < α 0.05 indicates that the shuttle run affects the agility of futsal players. Shuttle runs aim to train body movement and speed, especially in the lower extremities. Shuttle run training increases muscle contraction and adaptation of the nervous system in producing motion to provide changes in muscle fibers that make muscles respond to movement more effectively, making it easier for the body to change direction quickly. Then repeated and systematic training will increase the agility needed by soccer players.

The comparison between the shuttle run and the three-corner drill in this study showed that both had no significant difference. However, based on the difference between the pre-test and post-test values of the two exercises, the shuttle run (1.84) is better at improving agility than the three-corner drill, which has a value of 1.76. This result aligns with the research findings of [27] , which concluded that a shuttle run is more effective than three corner drills in improving the agility of 30 extracurricular soccer students at Muhammadiyah Gisting Junior High School. These results indicate that the shuttle run is more effective than the three-corner drill.

Agility involves the ability to move and the capacity to run fast while stopping and starting to run again immediately [15]. According to [21] the difficulty level in developing agility is higher than in developing other physical fitness elements because agility represents the embodiment of other physical physical fitness, namely speed, strength, and balance. Therefore, when someone tries to improve their agility, they need to plan an exercise method that includes elements to increase agility. [1] have made practical efforts to improve agility, they gave 36 men's soccer players from U19 and U17 teams quick eight-week strength training (three time per week). The teams were divided into two groups: the control group and the experimental group. Illinois test results showed that fast strength training effectively improved the experimental group's agility performance.

According to [20] combine training that focuses on strength, speed, and rapid agility in training called speed, agility, and quickness (SAQ). This training was conducted for twelve weeks with a U19 football player. The teams were divided into control groups and experiments, each with 66 players during the study. Research shows that SAQ effectively improves agility when players play with or without the ball. [4] also researched SAQ, but they focused more on speed, agility, and acceleration. It was found that doing SAQ training for eight weeks could improve football players' speed, agility, and acceleration. SAQ training can improve football players' performance and increase their strength during high-speed movement activities, such as slowdown performance, body change performance, and planned speed performance.

Shuttle run involves lateral movement and sudden change of direction. By doing these exercises regularly, athletes will develop the ability to move quickly and smoothly, which is essential in various sports match situations. Shuttle runs create training situations that reflect the conditions of the sports game, where directional changes and rapid moves occur frequently. By doing this simulation, athletes can get used to the physical and mental demands they face in the game.

It is important to note that agility is a complex skill, and shuttle run training should be integrated into the training program in a balanced manner with other exercises that support agility development. With consistency and integrity, the shuttle run can be a crucial element in improving athlete agility.

Difference of low and high BMT influence on speed and agility in SSB players Klaten aged 13-14

1. **Difference in influence of low and high body mass index on speed in SSB players Klaten aged 13-14**

Based on the results of the above research, it is known that low, high body mass index influences speed and agility. This is demonstrated by the univariate analysis of sig value < 0,05. So, the second hypothesis is accepted. Based on analysis data, the

average pre-test-posttest rate at low BMT rates is 0.862, while at high BMT, it is 1.357. In this study, high BMT can increase effectively compared to low BMT.

The Body Mass Index (BMI) is a measure used to measure the ratio between a person's weight and height. Although the BMI is generally used to assess weight status, little direct evidence connects it specifically to an athlete's speed. Speed in the context of sports is more influenced by factors such as muscle strength, running techniques, agility, and endurance. However, weight and body mass distribution can affect speed in some ways. The strength/weight ratio: Players with a high strength ratio to their weight may be able to generate a significant push when running. This can help increase speed, especially when starting or accelerating.

Players with a balanced body mass distribution and good agility can change directions quickly and maintain their speed more effectively. Players with sufficient muscle mass, especially in the legs, can produce explosive forces that help reach maximum speed. However, this is only sometimes directly correlated with BMT, as BMT only measures weight relative to height and needs to consider body composition or muscle distribution. Players with a balanced weight or according to their physical needs may have better endurance, allowing them to maintain speed during long run periods.

Although there are several aspects in which weight and body mass distribution can affect speed, it is essential to remember that speed in the context of sports like football is influenced by a combination of various physical and technical factors. Speed increases generally require exercises focusing on strength development, detonation, running techniques, and agility rather than just looking at BMT values. Therefore, a more holistic evaluation of an athlete's physical and skills is more relevant in the context of sports and achievement of maximum speed.

This investigation is also in line with a study conducted by [7] on the relationship between body mass index and agility and speed in university players. This study stated that there is a significant relationship between BMT and Agility and Speed.

2. Difference in influence of low and high body mass index on agility in SSB players Klaten aged 13-14

Based on the results of the above research, it is known that low and high body mass index influence agility. This is demonstrated by the univariate analysis of sig value < 0,05. So, the second hypothesis is accepted. Further, based on analysis data, the average differential pretest-posttest on low flexibility BMT is 2.172, whereas, on high flexibility pretext, BMT is 0.692. Then, low BMT can increase effectively compared to high BMT.

Excess weight directly reduces agility due to the friction of fatty tissue in muscle fibers so that muscle contractility becomes reduced. So, weight affects a person's agility level. Height is part of anthropometry that influences the contribution given at a small point to a person's agility [26].

High body fat and weight are very much needed in football because an ideal weight helps football players get their best out, while overweight players can lower their ability. The ideal height and weight, of course, will support the player's performance. In some sports, including futsal, a high posture, an ideal weight, and good physical condition will support high athletic performance [2].

Being overweight strongly influences players' movement patterns; players are required to move smoothly when carrying their opponents' balls, so one of the factors affecting the agility of futsal players is the tendency to be overweight or have abnormal BMT. This aligns with a study [24] in the journal Body Mass Index with Futsal Player Agility, which states that a reasonably high BMT has lower agility. This is because the higher the BMT, the heavier the player's body is, so the player's movement is slowed down, while futsal games require agility to overcome all opponent constraints. This is also confirmed by the FTI UAD FC Yogyakarta research results, which show that BMT has a positive and significant relationship to agility. Agility tends to be very specific to the appearance of different movements, and the demand to make rapid changes in movement patterns is visible in futsal games [8].

According to [3] explained that being overweight directly reduces agility, where excess weight tends to lead to muscle imbalance in the trunk and fat tissue friction in muscle fibers so that muscle contraction becomes reduced. The muscle in contracting and producing tension requires some energy or strength. Strength leads to the output of energy from muscle contractions and is directly related to the amount of tension produced by muscular contractions, thereby increasing muscle strength through tension levels, hypertrophy, and recruitment of muscle fibers. Since force is one of the components of speed, the greater the force of a movement, the larger the explosive energy that occurs over time will be able to increase agility. [26] on Body Mass Index (BMT), body weight plays a vital role in agility. Excess weight directly reduces agility due to the friction of fatty tissue in muscle fibers so that muscle contraction becomes reduced, reduced muscular contraction resulting in decreased speed and agility. By having a normal BMT, the player can move quickly. If the BMT is too thin, it will result in a lack of balance that can affect agility.

Interaction of differences in the influence of exercise methods and body mass index on speed and agility in SSB players Klaten aged 13-15

1. **Interaction of differences in the influence of exercise methods and body mass index on speed in SSB players Klaten aged 13-15**

Based on the results of the above research, it is known that there is no interaction between the influence of the exercise method and the low or high body mass index on agility. The univariate analysis of the value sig proves this. 0,124 > 0,05. So, the third hypothesis is rejected.

Weight and height can affect the speed of a football player through several factors. However, it is essential to remember that speed is determined not only by weight and height alone but also by several other factors, including muscle strength, running techniques, endurance, and fatigue.

One influence of the speed of a football player is that the longer steps, the higher players tend to have longer steps. If the move can be directed efficiently, the high player can cover the distance faster than the shorter player.

A higher weight can give the player an advantage in generating a more significant push when running. This push is essential to get maximum speed when starting a run or when accelerating. In addition, players with higher body weight may have greater body inertia. These inerties can provide additional stability and strength, which can help players maintain their speed and prevent unwanted directional changes.

More efficient muscle growth can also affect the athlete's running speed. A player with a balanced weight can have more muscle mass, especially in the legs. A larger muscular mass can produce a greater force to push the body forward at maximum speed. Some studies suggest that players with higher weights may be more efficient inining their speed during more extended run periods. This can be beneficial in matches where players must perform long sprints or maintain speed over long periods.

Although there are potential advantages of weight and height, it does not mean that a shorter or lighter player cannot be a fast player. Many other factors, such as muscle strength, running techniques, and agility, also play an essential role in determining a football player's speed.

In addition, the position of players on the field can also influence the extent to which weight and height play a role in speed. For example, a player who plays as an attacker or winger may be more focused on maximum speed, while a defender might be more emphasizing agility and the ability to respond to the change of direction quickly.

Speed in the context of exercise involves several factors not limited to the Body Mass Index (BMT). Several factors besides BMT, which is the s, strength of Oto. Muscle strength is the main factor in determining the speed. Strong muscles, especially the legs, can produce greater push power when running, which helps increase speed. The second is explosion, which is the ability to generate energy quickly. Increased explosion power, especially in the legs, can accelerate movement and give an advantage in reaching maximum speed. The third is the flexibility of the muscles and joints, inefficient movement, and optimal step length. Flexible muscles can optimize the range of movements, which can increase speed.

It is important to remember that speed in the context of sports is the result of the complex interaction between these various factors. Therefore, a holistic and coordinated approach to physical and technical training can help players increase their speed effectively.

2. **Interaction of differences in the influence of exercise methods and body mass index on agility in SSB players Klaten aged 13-15**

The results of the analysis showed sig. The value 0.252 > 0.05 means there is no significant interaction between the method of training the zig-zag run and shuttle run with high BMT, low speed, and agility in the player SSB Klaten U13-14. Based on these two training methods with body mass index of speed and flexibility, there is no interaction. The method of practice, zig-zag run and shuttle run, improves the speed and agility of the player of the SSB platen, and the low and high BMT also affect speed and elasticity.

Agility in the context of fitness is the ability to move quickly and smoothly, including changing direction and speed and responding quickly to changing situations. Although the Body Mass Index (BMT) is not directly related to agility, several other factors can affect a person's ability to move, including muscle and core strength, which play a crucial role in agility. Shuttle runs involve many movements that utilize the leg and core muscles. Strengthening these muscles helps increase strength and momentum, which is critical to moving quickly and smoothly. Strong muscles and a stable core help maintain balance, enable rapid change of direction, and support efficient body movements.

As with speed, running techniques can also affect agility; good running techniques can improve agility, including using legs and body positions and selecting appropriate steps to optimize directional changes and speed shifts. Foot explosiveness also influences agility; good explosivity helps players start dashing and respond effectively to changing field conditions. Besides, good

balance and body stability play an essential role in agility. Maintaining balance while performing fast movements helps prevent injury and allows players to respond better to changes in direction.

Rapid and cognitive responses are needed in physical conditions, especially agility, as reactions involve the ability to respond quickly to changing situations. Rapid reaction skills and cognitional abilities, such as fast decision-making, can improve player agility. Muscle and joint flexibility also play a role in agility. Flexible muscles allow a more extensive range of movements, which can help in making movements faster and smoother. In addition to the condition of a player's body, one thing affects a person's agility, namely experience and technical skills; players with experience and good technical skills in a particular sport tend to have a higher level of agility. This is because experience can form an automatic reaction to a game situation.

Therefore, agility is not the result of a single factor but of a combination of various physical and technical elements. Although BMT is not directly involved in agility, attention to factors such as strength, running techniques, and balance can help increase a person's agility in fitness.

IV. SIMPULAN

Based on the results of the research and the results of the data analysis that has been done, the conclusion is that there is an effect of the Zig-zag run and shuttle run training method on speed and agility in Klaten SSB players U13-14 years; there is an effect of low and high body mass index on speed and agility in Klaten SSB players U13-14 years, There is no interaction effect between training methods and body mass index on speed and agility in Klaten SSB players U13-14 years. This study has implications for this research; the first is theoretical implications. Theoretically, this research is likely proper as a scientific study and can be further developed about zig-zag runs and shuttle runs to increase speed and agility. The second is practical implications; the study's results can be used as a consideration for coaches, football coaches, coaching students, and further researchers in creating appropriate training programs to increase speed and agility in SSB players. Thus, training becomes more effective and will get results that the coach expects. In addition, there are recommendations, namely to coaches and other researchers, given the following suggestions: For the coach, based on the results of the research that has been done, it proves that to increase speed more effectively with the shuttler run method than the zigzag run. Furthermore, agility is more effective with the zigzag training method than the shuttle run. Trainers are advised to choose training methods tailored to the needs and situation in the training process; the zig-zg run and shuttle run are proven to increase the speed and agility of SSB players, seen from the pretest and posttest data, which has increased significantly. Each method has advantages and disadvantages, so a coach must be careful in choosing methods for team needs. Further Researchers, namely, further researchers, are expected to be able to replace the attribute variables considering that several factors affect speed and agility, including leg muscle explosiveness, gender, step length, age, and fatigue. Future researchers can also control and quarantine the activities carried out by the sample. Next is to set the training time to be more effective.

ACKNOWLEDGEMENTS

The author would like to express his deepest gratitude to all students who have been willing to complete this research. It's a journey of growth, discovery, and collaboration, and it wouldn't have been possible without the support, guidance, and contributions of many individuals and entities. As a big expression of gratitude, I express my appreciation to those who have played an important role in making this effort a reality.

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