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THE EFFECT OF BODY MASS INDEX, BALANCE AND EXPLOSION ON SHOOTING IN FUTSAL

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Abstract. The purpose of this study was to determine the effect of body mass index (BMI), dynamic balance and leg muscle explosive power on the results of women's futsal shooting. The research subjects were 21 athletes of the Netic Ladies Futsal Club with a total sampling technique. The survey method uses an instrument for measuring height using a microtoice device, measuring weight using a digital scale, measuring balance using a modified an balance, limb muscle explosive power using a triple hop jump measurement and measuring shooting results using a fifth circle an shooting through path analysis techniques. Testing data analysis through the requirements of normality test, linearity test and significance test. The results of the study obtained a significant value of BMI on leg muscle explosive power with a significance value (0.618), balance to leg muscle explosive power (0.511), BMI to shooting result (0.587), balance to shooting result (0.080), limb muscle explosive power to shooting result (0.049). The conclusions of the study (1) there is no effect of BMI on leg muscle explosive power, (2) there is no effect of dynamic balance on leg muscle explosive power, (3) there is no effect of BMI on shooting results, (4) there is no effect of dynamic balance on shooting results and (5) there is an effect of leg muscle explosive power on the results of shooting netic women's futsal.

Keyword : body mass index, dynamic balance, explosion power, futsal shooting.

INTRODUCTION

Futsal is the fastest growing indoor sport in the world (Cosmin & Mircea., 2014). This sport is one type of football game which is distinguished by a goal, field, smaller ball and game rules from conventional football which is usually played on a large outdoor field with a larger ball and goal size but futsa. played indoors with a smaller field and goal size (Huang et al., 2013; Lhaksana, 2011).

Indonesian women's futsal actively participated in competitions at the international level and was able to win titles for Indonesia. At the AFF 2016 event, Indonesia was represented by the Jaya Kencana Angel team to take part in the inter-club championship in Southeast Asia which was held in Thailand and Indonesia to win the 2016 AFF title. After going through the penalty shootout and at the 2017 Sea Games, Indonesia had to lose in goal productivity against Vietnam, the Indonesian team had to concede a goal first by Vietnam.

Therefore, the shooting technique is one of the most decisive aspects in the game of futsal, without shooting there will be no chance of a goal to win the match.

In achieving the highest achievement there are four important aspects to be prepared, namely technical, physical, tactical and mental aspects(Lubis, 2013; Sari et al., 2018)starting from preparation, namely the

process of practicing until competing so that athletes can achieve the highest achievement. Physical ability factors that can directly affect shooting skills in female futsal athletes futsal(Mohammed et al., 2014). To get the maximum ball shooting results, the ball must be pushed with good leg explosive power and the ability to maintain body position when shooting properly while shooting and anthropometry of athletes.

Shooting

Shooting is a basic technique in the game of futsal (Daryanto, 2013; Polidoro et al., 2013). This technique can be known as the skill of kicks or shots that lead to the opponent's goal. Shooting the ball (shooting) is an athlete's attempt to manipulate the ball as fast as possible towards the opponent's goal with the back of the foot with the aim of scoring goals.(Nurhasanah et al., 2017). Manipulation of the ball is done with all parts of the body, especially the legs except the arms and hands(Cosmin & Mircea, 2014; Nurwiyandi, 2019). So that the goal of the game is to score as many goals as possible against the opponent's goal to make the team win a match.(Atmojo & Bulqini, 2019).

Shooting Can be done in several attacking situations such as open play, set piece set pieces, penalty kicks, shootouts and power play. The shooting area is divided into three, namely the center area (middle), Ala/flank area (side) and the half space area

between the middle and side areas. (Friday & Faruk, 2019). The shooting action consists of several stages that need to be considered at the initial stage of placing the pedestal beside the ball along with swinging the dominant foot which will hit the ball quickly and strongly because the weight of the futsal ball is quite heavy until the final stage of stepping forward.

For produce a fast ball speed depending on the greater the angular velocity and also the force given by the foot when performing the shooting kick technique, the ball speed will be faster (Hidayat & Rusdiana, 2018). To produce a good shooting, the balance of the supporting leg needs to be considered in shooting or the pedestal is much more important to help aim at the target (Bigoni et al., 2017) In addition, when shooting the anthropometric aspects of athletes, namely height and weight, affect shooting results where athletes who have an ideal BMI will help athletes develop shooting skills well and achieve maximum results, but athletes who have a BMI that are too low and are obese will hinder shooting skills to be not optimal.

Body mass index

Body mass index BMI is a component that is calculated from the results of height and weight. BMI is part of anthropometry which directly affects the athlete's appearance (Faridho, 2016). BMI is an aspect that is used for talent search in almost all sports that is adapted to the

character of the game of each athlete's sport. To find the Body mass index value can be calculated by the formula $BMI = \text{weight (kg)} / \text{height (m)}^2$ (Balbasi et al., 2016). To get a BMI value, an athlete must go through measurements of height and weight

Height plays an important role in sports, especially in the search for physical talent, anthropometry. Athletes who have a height that is above average will make it easier to place playing positions and make it easier to develop skills (Fakhrullah, 2017). Height can be measured using a microtoice and stadiometer easy to use and can be anywhere (Baharudin et al., 2017).

Body weight is the total mass of a person's body. with an ideal body weight helps athletes to achieve high performance (Borgen & Garthe, 2011). Overall body weight can be measured using a manual or digital scale.

BMI will affect shooting results where the ideal BMI will help athletes develop shooting skills well and achieve maximum results, but athletes who have a BMI that is too low and obesity will hinder shooting skills from being optimal. (Mahfud et al., 2020). In addition, BMI that is too high and low due to the dynamic movement of futsal shooting skills when shooting can cause a risk of injury if you cannot maintain body balance. A normal athlete's BMI is a concern to regulate athlete nutrition to achieve maximum athlete performance levels in

power(Pantelis T Nikolaidis et al., 2019). Athletes who are too thin have less than optimal explosive power because the muscle mass needed to perform explosive power is not sufficient, while athletes who have a high BMI are too fat, especially in women, to be more easily injured because there is too much fat mass in the body so that muscle unable to perform maximum explosive power and the joints are too heavy to withstand excessive weight.

Balance

Balance is the ability of muscles to maintain postural stability and alignment in either a static or dynamic state(Susiono, 2012). In futsal, which consists of many skills, it is important to have good body stabilization. Postural stability can be defined as a person's ability to maintain their center of gravity (COG).(Rogers et al., 2013). Balance is a very important working component in any work system(Ammoo et al., 2014). In a state of moving and not moving or fixed.

Static balance is the ability to maintain posture or body position when the body is at rest, this skill is used to maintain self-control to keep the organs of the body stable both at rest.(Saddle, 2016). Balance ability is an important component in the development of motor skills (Jadczak et al., 2019). Futsal is a game with mastery of complex physical and movement skills that requires a good level of dynamic body balance in performing motion

performances. Physical movement activities and dynamic technical skills require good body balance at the beginning, execution and continuation of motion when shooting.

Balance when shooting becomes the initial position by placing the foot on the pedestal and then swinging the leg backwards by positioning the center of gravity straight with the ball and adjusting the arm against the swing position of the leg. Then at the shooting stage, the leg swings forward with a fixed COG position then ends the fast movement following the direction of the leg swing that has hit the ball impact in a dynamic balance condition. The balance of athletes when shooting is influenced by aspects of the quality of the muscles when doing explosive power, especially the muscles that work dominantly on the limbs to the maximum.

Explosion power

Explosive power or power is the strength and speed of dynamic, explosive muscle contraction and involves maximum muscle ability in a fast time. This fast muscle strength depends on maximum strength, speed of muscle contraction and intramuscular coordination.(Sidik et al., 2019). Good explosive power development can provide benefitsto prevent the first injury(Vretaros, 2017).

Futsal is a sport that favors physical and technical combat. Movement activities that are carried out briefly and quickly, as

well as shooting skills in futsal, are carried out quickly on a ball that has a fairly heavy weight. So that explosive power is needed to kick both close and long distances towards the goal, duel physically, protect the ball, head the ball and throw the ball for a goalkeeper.

The match is played with high intensity using many dynamic skills, with rapid changes to outperform the opponent, it is necessary to use explosive power that is more dominant in the leg muscles. (Nez et al., 2018). The explosive power of the leg muscles at the time shooting There are several leg muscles that contract and support muscles large muscles that contract such as the primary tibialis anterior muscle, gastrocnemius, quadriceps, hamstring and second muscles or other supporting muscles in shooting movements.

So that in shooting the athlete is required to remain in a stable position to maintain the pedestal and the position of the body that is carrying out dynamic movements by maintaining the muscles, especially the legs. To produce a maximum shooting rate, the leg muscles must work explosively with strong and fast when swinging and when impacting the ball.

Therefore, the aim of this study was to examine the effect of body mass index, dynamic balance and leg muscle explosive power on shooting results in female futsal athletes.

METHOD

Quantitative research is a method for testing certain theories by examining the relationship between variables (Sugiyono, 2012). In this study the data in the form of numbers are analyzed using statistical data and based on the philosophy of positivism which is used to examine the population and samples, data collection using research instruments, quantitative data analysis with the aim of testing the established hypothesis (Alfianika, 2018). With survey techniques in collecting data in the field further through path analysis techniques. Path analysis is the relationship of influence between independent variables, intervening variables and dependent variables.

By testing each variable using a predetermined test instrument for each variable. The independent variables are body mass index and dynamic balance, the intervening variable is leg muscle explosive power and the dependent variable is shooting futsal with the design of testing the object of research by providing physical, anthropometric and skill tests.

To obtain BMI data using a height test instrument using a microtoice tool, to measure weight a digital scale is used, to measure shooting results using a fifth circle test, to measure balance using a modified an balance test and to measure leg muscle explosive power using a triple hop instrument. jump.

By testing the two structural subs 1 with the equation $X3 = PX3X1 + PX3X2 + e1$ and structural subs 2 $Y = PYX1 + PYX2 + PYX3 + e2$.

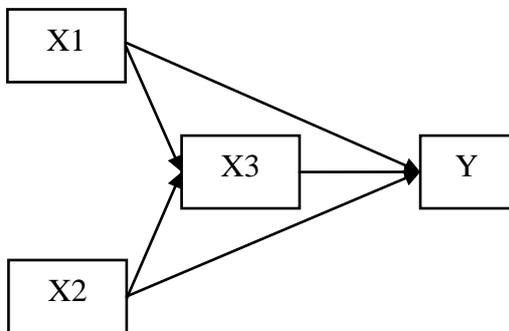


Figure 1. Research Design (Source: Noor, 2011)

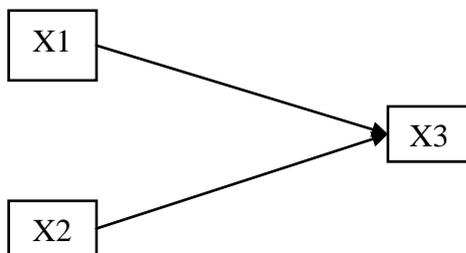


Figure 2. Structural Subs 1

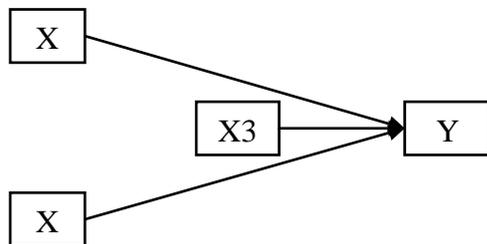


Figure 3. Structural Subs 2

Information :

X1 : Body mass index

X2 : Balance

X3 : Explosive leg muscle power

Y : Shooting

From the data obtained through the descriptive analysis stage, the normality test of the data using the normality test of Estimated Error using the liliofers technique, linearity test and path analysis test The research was carried out on the Netic Ladies

Cibinong futsal team with a total sample of 21 athletes in the Planet Futsal field, Cibinong , Bogor Regency.

RESULTS AND DISCUSSION

From the data obtained, it must go through data processing with descriptive statistical analysis techniques to find the total sample, lowest value, highest value, average value, standard deviation, variance and frequency distribution. Then through the data normality test phase using the Estimation Error normality test using the Liliofers technique, linearity test and path analysis hypothesis testing using SPSS version 22.

Descriptive Analysis

Table 1. Statistical Data of Research Results

Descriptive Statistics						
	N	Min	Max	Sum	mean	Std. Dev
X1	21	30	76	1050	50.00	10,000
X2	21	19	54	1050	50.00	10,000
X3	21	31	67	1050	50.00	10,000
X3	21	32	71	1050	50.00	10,000

Data Normality Test

Estimated error using the liliofers technique using a value of 0.05. From the total sample results, the L0 table value is obtained for the number of samples as many as 21 people, namely 0.193. By testing if $L0 \text{ Count} < L0 \text{ Table}$ then the data is normally distributed and if $L0 \text{ Count} > L0 \text{ Table}$ then the data is not normally distributed.

Table 2. Normality Test Results of Estimated Error

Error	L0 Count	L0 Table	Conclusion
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X3 over X1	0.102	0.193	Normal
X3 over X2	0.126	0.193	Normal
Y over X1	0.133	0.193	Normal
Y over X2	0.147	0.193	Normal
Y over X3	0.152	0.193	Normal

From the results of the normality test of the data that has been obtained, the data between the variables in the study is included in the category of normally distributed data.

Linearity Test

The next stage is linearity test by testing if $L0\ Count > 0.05$ then it can be concluded that there is a linear effect between variables and if $L0\ Count < 0.05$ then it can be concluded that there is no linear effect.

Table 3. Linearity Test Results

Variable	L Count	Sig (0.05)	Conclusion
X3 to X1	0.826	0.05	linear
X3 to X2	0.117	0.05	linear
Y to X1	0.460	0.05	linear
Y to X2	0.024	0.05	linear
Y to X3	0.312	0.05	linear

From the results of the linearity test of the data that has been obtained, the data between variables in the study has a significant linearity.

Test Path Analysis

Table 4. Substructural Test Results 1

Variable	Beta	tcount	Sig =0.05
X1 to X3	0.118	0.507	0.618

X2 to X3	0.156	0.671	0.511
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Table 5. Results of Substructural Test 2

Variable	Beta	tcount	Sig =0.05
X1 to Y	(-0.110)	(-0.554)	0.587
X2 to Y	0.372	1,860	0.080
X3 to Y	0.413	2.066	0.49

Based on the table above, it can be concluded that from the results of the analysis of research data, it was found that the significance value of the influence of the body mass index on the explosive power of the leg muscles was $0.618 > 0.05$, so the body mass index did not give a significant direct effect on the explosive power of the leg muscles with the percentage of direct influence obtained. of (0.118) or 11.8% and the remaining 89.2% is influenced by other variables.

In a dynamic futsal game and requires a greater composition of leg muscle mass than fat mass so that body weight is expected to be more dominant by muscles. However, BMI cannot describe the quality and quantity of muscles in the legs specifically that affect explosive power in the leg muscles. If the athlete has a BMI that is too high and too low, it will reduce the quality of the explosive power of the leg muscles (PT Nikolaidis, 2014). From the results of the study, it was found that the female futsal athlete Netic had a normal BMI and good explosive power. However, BMI is not a significant aspect that affects leg muscle

explosive power (PT Nikolaidis & Ingebrigtsen, 2013).

The significance value of the effect of dynamic balance on leg muscle explosive power was $0.511 > 0.05$ so that dynamic balance had no effect on leg muscle explosive power for female netic futsal athletes with the percentage of direct influence of dynamic balance on leg muscle explosive power as much as 0.156 or 15.6% and 84,4% influenced by other variables.

When futsal athletes make strong and fast explosive movements, there is a change in the center of gravity so that dynamic balance affects only postural stability and to reduce the risk of falling during landing, especially for female athletes. However, this will not be optimal and will only run for a fraction of a second if the postural stability is not supported by good muscle ability (Anolopoulos et al., 2015). When the muscle condition is not strong, the dynamic balance will not be optimal to maintain muscle postural stability when doing explosive power, especially in the leg muscles. So that the dynamic balance aspect is not a significant aspect to affect the explosive power of the leg muscles (Erkmen et al., 2010). Therefore dynamic balance is not a significant variable that affects the explosive power of the leg muscles, this is because dynamic balance only helps changes in motion when the body performs explosive muscle movements, especially the explosive

power of the leg muscles for only a fraction of a second.

From the results of research data analysis, it was found that the significance value of the direct effect of body mass index on shooting results was $0.587 > 0.05$, so it can be concluded that the body mass index does not have a significant effect on the shooting results of Netic's women's futsal. With the percentage of direct influence as much as (0.110) or (-11%).

From the results of the analysis of futsal data, female netic athletes have different BMIs in the category of severe underweight to fall-overweight and have different shooting results. So that athletes in any BMI category can do good shooting because the aspect of BMI is too general to affect the shooting results of athletes so that the effect of BMI on shooting female futsal athletes is not significant (Lusiana, 2015). BMI in overweight futsal athletes allows the body to have more muscle mass than fat mass so that overweight athletes can do good shooting. Shooting is a complex series of basic motion performances so that BMI has no significant effect on shooting (Frey & Chow, 2006).

However, if the athlete is overweight which is caused by the dominance of free fat mass, especially in female athletes from adolescence to adulthood, this will hinder the rate of shooting so that the shooting results

are not optimal and the body is too heavy so that it is prone to injury.

The significance value of the direct effect of dynamic balance on shooting results is $0.080 > 0.05$, so dynamic balance has no significant effect on shooting results for women's futsal athletes, with a beta value of 0.372 or 37.2% and 62.8% influenced by other variables.

Dynamic balance is one of the physical components that directly affect futsal shooting (Agustiawan, 2018; Rosita et al., 2019). In the implementation of shooting to get good shooting results, dynamic balance is needed to be mastered by athletes to maintain postural stability when doing fast movements during a series of shooting. However, dynamic balance in female athletes has no significant effect on shooting results. This shows that athletes with different dynamic balance abilities can get maximum shooting results. However, dynamic balance is not a significant aspect to affect shooting results for female futsal athletes (Evangelos et al., 2012; Nagasawa et al., 2011). This is because to produce a fast and strong shooting rate, dynamic balance must be balanced with good and maximum muscle quality to maximize postural stability when shooting.

The significance value of the effect of leg muscle explosive power on shooting results is $0.04 > 0.05$, then leg muscle explosive power has a significant direct effect on shooting results for female futsal

athletes with a direct percentage of 0.413 or 41.3% and 59,7% of the other variables from these results is the biggest influence on the research that has been carried out on female futsal athletes.

Explosive power is a very important aspect that can affect athletes' shooting results (Ermassi et al., 2011). With maximum explosive power, it will produce maximum shooting performance. In this study, leg muscle explosive power is one of the most decisive components of physical condition in futsal shooting results (Arifin, 2017; Nazala, 2016). This is caused by the weight of the futsal ball which is quite heavy so that the athlete's leg muscles must work more explosively quickly and strongly which will produce a faster ball impulse when impacting the ball and the ball will reach the goal faster.

CONCLUSION

Based on hypothesis testing, it can be concluded that (1) there is no effect of BMI on leg muscle explosive power, (2) there is no effect of dynamic balance on leg muscle explosive power, (3) there is no effect of BMI on shooting results, (4) there is no effect dynamic balance on the shooting results and (5) there is an effect of leg muscle explosive power on the shooting results of netic ladies futsal athletes.

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