DEVELOPMENT OF DRIBBLING SPEED INSTRUMENT AND ANALYSIS DRIBBLING SPEED, RELATIONSHIP BETWEEN ANTHROPOMETRIC AND PHYSICAL CONDITIONS AMONG INDONESIAN FUTSAL PLAYERS

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SULTAN IDRIS EDUCATION UNIVERSITY

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ABSTRACT

Dribbling is the basic function of allowing players to maintain control the ball while running past opponents or accelerating into open space. This study aims to develop futsal dribbling sensor instrument (FDSI) based on the analysis of dribbling distance of futsal players in matches, evaluate the validity and reliability, and investigate the relationship between anthropometric factors and physical condition with dribbling speed. This study uses the research and development method. Researcher recruited 132 Indonesian futsal players with Age 19.5 ± 1.1 Years, Height 166.9 ± 5.8 cm, Weight 60.0 ± 8.6 kg. The results revealed that the average dribbling distance of futsal players in matches is 10.55 meters. The initial product in the form of 10 m x 4 m FDSI was revised and the final product was 10 m x 6 m. FDSI presents construct validity with value of Aiken V (0.80) > 0.69, participant acceptability is 93.18%. The concurrent validity of FDSI with the zig zag running test (recount = 0.70, p-value = 0.00, R-Square = 0.50), and reliability (ICC = 0.996, p-value = 0.13. Variation of dribbling speed in futsal are more dominantly determined by agility and cardiovascular endurance (VO2max), while body weight and balance are not so dominant in determining dribbling speed. The results of the relationship analysis showed that there is a significant correlation between weight (r= .21), VO2max (r = .55), agility (r=.63), and dynamic balance (r= .22) with the dribbling speed of futsal players. The other components such as height, leg length, and leg power have no influence on the dribbling speed. The research findings imply that FDSI can be used by coaches to evaluate the dribbling speed of futsal players, during selection or training program. This devise also reduce the human error and bias during player's selection.

PEMBINAAN ALAT ANALISIS KELAJUAN MENGELECEK DAN HUBUNGANNYA DENGAN FAKTOR ANTROPOMETRIK PEMAIN FUTSAL, INDONESIA

ABSTRAK

Mengelecek adalah kemahiran asas pemain futsal untuk mengawal bola semasa berlari melepasi lawan atau menghantar ke arah ruang terbuka. Kajian ini bertujuan bagi membina alat pengesan kelajuan mengelecek pemain futsal (*FDSI*) berdasarkan analisis jarak mengelecek ketika perlawanan, menilai kesahan dan kebolehpercayaan, serta mengkaji hubungan di antara faktor antropometrik dan keadaan fizikal dengan kelajuan mengelecek pemain futsal. Kaedah penyelidikan dan pembangunan telah digunakan dalam kajian ini. Penyelidik telah memilih seramai 132 orang pemain futsal Indonesia berumur 19.5 ± 1.1 tahun dengan ketinggian 166.9 ± 5.8 cm dan mempunyai berat 60.0 ± 8.6 kg. Hasil kajian mendapati purata jarak mengelecek pemain futsal ketika perlawanan adalah sejauh 10.55 meter. Rekaan pertama *FDSI* dengan jarak 10 m x 4 m telah disemak semula dan menentukan produk akhir dengan jarak 10 m x 6 m. *FDSI* menunjukkan kesahan konstuk dengan nilai Aiken V (0.80) > 0.69 dan kebolehterimaan peserta adalah sebanyak 93.18%. Kesahan sejajar *FDSI* dengan ujian mengelecek zig zag adalah (r = 0.70, nilai-p = 0.00. Kebolehpercayaan menggunakan kaedah uji ulang uji adalah (ICC = 0.996, nilai-p = 0.13). Variasi kelajuan mengelecek futsal lebih dominan ditentukan oleh ketangkasan dan daya tahan kardiavaskular (*VO2max*). Manakala berat badan dan keseimbangan tidak begitu dominan dalam menentukan kepantasan mengelecek. Keputusan analisis korelasi menunjukkan terdapat hubungan yang signifikan antara berat badan dengan kelajuan mengelecek pemain futsal, (r = .21), daya tahan kardiovaskular (r = .55), ketangkasan (r= .63), dan keseimbangan dinamik (r= .22). Komponen lain seperti ketinggian, panjang kaki, dan kuasa kaki tidak mempengaruhi kelajuan mengelecek. Hasil kajian menunjukkan bahawa *FDSI* boleh digunakan oleh jurulatih bagi menilai kelajuan mengelecek pemain futsal semasa program pemilihan atau latihan futsal. Alat ini juga dapat mengurangkan kesilapan manusia dan bias dalam pemilihan pemain futsal.

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CHAPTER 1

INTRODUCTION

1.1 Introduction

In the futsal game, dribbling is one of the basic characteristics of futsal players (Corrêa, et al, 2016). Dribbling done by controlling the ball and moving in a certain direction to avoid defenders taking the ball (Ganesh, et al., 2019). Therefore, a dribbling technique is needed to get pass the opponent, escape from the opponent's control, open up space for friends with direct the ball into empty space, and create opportunities to shoot at goal.

Investigations on the performance of futsal dribbling skills rarely occur where this can hinder the coach's ability to optimize dribbling training. This is because the lack of special futsal instruments makes investigations on futsal performance is difficult and has hampered research on the performance of futsal skills, especially

dribbling. On the other hand, the existing futsal dribbling instrument has limitations where the test covers several futsal skills including: *dribbling*, *long and short passing, rotation, and shooting* (Farhani, et al., 2019), so that this test is not specific for evaluating futsal dribbling speed and is still general in futsal skills, while in this case future research is needed to help practitioners develop more specific tests into futsal performance, especially those related to skills (Naser, *et al.,* 2017).

Identification of improving dribbling skills is influenced by the height, weight and length of the legs of a player. Burdukiewicz, et al (2014) stated that height, weight, and leg length are included in the morphological characteristics of futsal players. Height is related to body weight and an ideal body will make it easier to do dribbling movements. For futsal players who are tall will reach distances faster than those with short bodies, and players with long legs have a longer reach when compared to players who have short legs so that it affects mastery and dribbling performance. In addition to a proportional body, to play at a high level a futsal player needs to have or develop a large intermittent endurance capacity, leg muscle power, and agility (Naser, et al., 2017). In addition, dynamic balance in futsal dribbling is also important because this skill is carried out while moving (Rahman and Shaharudin, 2018).

1.2 Research background

Sport is defined as one of the oldest traditions and activities carried out by humans, traditionally understood to consist of physical activity (Goebeler, et al., 2021). Futsal

required energy costs on a mixture of anaerobic and aerobic consumption, movement activities, and skill acquisition. In futsal games, futsal players must always move so it is important for every player to master technical skills.

The dribbling technique can be done in 3 ways, namely using the outside foot, the inside foot, and the back foot. In futsal dribbling, foot inside, instep, and outside are effectively used (Álvarez-Kurogi, 2020). This dribbling method must be mastered by each player to outwit opponents based on certain situations.

The data shows that the success of dribbling skills compared to other technical skills is still low (table 1.1). Successful dribbling means the player is able to beat the opponent by maintaining ball possession.

Table 1.1

Percentage of Success in Futsal Basic Techniques for Star Players in Futsal Matches

Futsal Basic Techniques	Percentage of Success
Dribbling	39.06 %
Shooting	44.61 %
Passing	88.47 %

Santos et al (2020)

In addition, Yiannaki et al (2020) has shown unsuccessful dribbling in matches marked by dribbler is tackled by an opponent or loses possession of the ball, including running the ball out of play. Yiannaki et al (2020) analyzed defensive and attacking actions on futsal teams during international tournament matches, the results shown that the number of unsuccessful dribbling is 9 times in the first match, 10 times in the second match, and 16 times in the third match (Yiannaki et al., 2020). Based on

this data, every futsal player needs to improve his dribbling technique well. To improve dribbling technique, apart from training, a futsal dribbling instrument is needed that can measure dribbling speed accurately and control the ball well, so that dribblers can control the ball well. Because of this, it is necessary to design a special FDSI that is able to measure the dribbling speed accurately.

Performance improving is the main goal of every player. Player can use different technologies to achieve the best results. Today, advances in science, new technology and modern techniques have contributed to improving the performance of players in various sports. The use of modern technology is not limited to competitive sports, more and more equipment is used in recreational sports, fitness monitoring and physical rehabilitation. The greatest advances need to be made in competitive sport through the use of new sensors and sensor systems. The main problem in the developing of dribbling instrument is used a sensor system. In line with this, Shroff, Ting, and Lam (2019), stated that development research procedures help improve instrument items and designs. This new system provides player and their coaches with information that they cannot obtain with conventional tools and equipment (Hribernik, et al., 2021).

Besides that, special Futsal Dribbling Sensor Instrument (FDSI) was developed based on the analysis of the dribbling distance carried out by futsal players during the match. This statement is supported by Zeljko et al (2020) that the test needs to be carried out at a distance that imitates the special performance of futsal Corrêa, et al (2016) states that successful futsal dribbling is affected by the distance between attackers trying blocking or grabbing the ball with his closest teammate.

The dribbling speed of futsal players can be influenced by anthropometric factors and physical conditions. The role and interpretation of anthropometry and physiology as indicators of futsal development programs (Stubbs-Gutierrez and Medina-Porqueres, 2020). In previous studies, anthropometric variables have also been measured in the newly developed Reactive Agility (RAG) test specifically for futsal (Sekulic et al., 2019).

Futsal is a high-intensity intermittent sport in which acceleration and short sprints are performed at maximum or sub-maximal intensity. These attempts are punctuated by a brief recovery period, for 2 parts of a 20 minute downtime. Aerobic endurance plays a key role in player performance (Berdejo-del-Fresno, Moore, and Laupheimer, 2015). A high level of aerobic endurance ability allows players to be active throughout the game, especially in the latter part of the game. Aerobic capacity also plays an important role in the regeneration process. Thus, team performance can improve throughout the season if aerobic endurance is increased. In line with this, Milanez et al (2011) stated that VO2max plays a key role in determining the amount of exertion felt by individuals during futsal. In addition, Gioldasis (2018) suggested that the futsal coach should develop the aerobic endurance of the players to achieve higher scores in technical skills during the whole game.

Dribbling the ball requires agility to better control the ball. Agility helps coordinate movements and facilitates mastery of technique to produce effective and efficient dribbling movements. High performance requires agility as in the act of changing positions and completing actions quickly and reducing space in defensive play (Tanyeri and Oncen, 2020). In addition, Sekulic et al (2021) also state that futsal

players also need to have good agility, good endurance, and good ball handling techniques in order to outperform opponents.

Futsal is an indoor sport with high intensity and competitive (Chen, et al., 2020). Therefore, futsal players must have highly developed abilities with repeated sprinting, leg muscle power, along with ball skills in passing, dribbling and shooting, as well as developed coordination (Zeljko, et al., 2020). Burhaein, Ibrahim, and Pavlovic (2020) stated that leg muscle power plays a role when dribbling. Leg muscle power affects the ability of the legs to keep their feet in dribbling by increasing the frequency of steps.

Futsal is played in a smaller field which causes constant pressure from the opponent so that it requires the player to make decisions quickly and high sprint ability under pressure. This activity is characterized by great variability in the intensity of neuromuscular tension. For this reason, takes muscle power in every futsal action (Kocić et al., 2016). In addition, muscle power is the best predictor of change of direction performance required by dribbling techniques (Castillo-rodri'guez et al., 2012), thus futsal training conditioning should be targeted to maximize lower body reactive strength in dribbling skills (Sekulic et al., 2021). Thus it can be said that good leg muscle power is a requirement in futsal dribbling speed.

Tabrizi, Abbasi, and Sarvetani (2013), stated that balance is important in futsal player performance. Balance means the power to keep the center of mass of the body at the base its support with the least or most stable oscillations so that it can control movement properly and correctly (Burhaein, Ibrahim, and Pavlovic, 2020). Futsal

players need balance development. This is because futsal is a sport that involves a lot of cutting, pivoting, zig-zag running, sudden stopping and running movements. The relationship between balance ability and risk of injury may be greater for sports that involve high-risk movements such as zig-zag running (Lee and Tan, 2020). Balance in the game of futsal includes the ability to attack and defend (offence-defence). Balance also includes the strength of the player's body balance (power balance) when conducting a one-on-one duel, or when keeping the ball in control when the ball is about to be seized by the opponent. Dribbling skills are carried out to outwit opponents with various kinds of tricks whose implementation is carried out quickly so that ball control efforts are needed (Taga and Asai, 2012). Maximum body balance is needed so that ball control when dribbling can be done well. Body balance can provide better performance and positional advantage over the opponent, with efficient scoring and anticipation in determining the game (Alvares, et al., 2020).

1.3 Problem Statement

The low success of dribbling skills causes this technique to be rarely used in futsal matches in Indonesia. Kusuma (2021) in an analysis of dominant techniques in professional men's futsal matches found that compared to passing, dribbling techniques are only carried out by 9%, The low dribbling in professional futsal matches in Indonesia is due to low dribbling ability, therefore additional training is needed for dribbling techniques and also need a test kit or instrument that combines technique with physical conditions to determine the extent of each futsal player's dribbling abilities. Previously, there were several futsal dribbling tests, but there were

weaknesses in the tests. First, dribbling in a zig zag manner from Subagyo Irianto (1995) where the test is only carried out in a zig zag manner and has a validity of 0.559 and a reliability of 0.637. Second, the futsal dribbling test from Narlan et al (2017) which developed a special test for futsal skills. The dribbling test is carried out straight and through obstacles. However, the test was only piloted on a sample of high schools and the validity and reliability for dribbling was not explained. Third, the dribbling test from Dewi and Pakpahan (2018) which also developed the futsal dribbling test, where the test is carried out in zig zags back and forth. The weakness of the dribbling test is that it was only tested on a sample of high schools. The fourth is the dribbling zig zag running test, this zig zag running test is a dribbling test that was produced not from RnD research, this test was used by Ahmed, Naji, and Hrebid (2021) in their research testing specific exercises for teaching dribbling skills for female students. The weakness is this test only carried out in a zig zag pattern, the zig zag running dribbling test is only applied to female students, not applied to futsal players, there is no validation and reliability test. In addition, the accuracy of calculating the speed of the test results is also incorrect because the calculations are carried out by the examiner using a stopwatch and counting the time to the nearest second from the examiner gives the start signal to the participants until the participants return to the start line again.

The manual calculations using a stopwatch, human error can occur in the accuracy of time calculations. This is because it is influenced by the examiner's interpretation in determining when the examinee's leg or body has passed a predetermined point. In addition, because pressing the start and stop button on the stopwatch is still done manually, the accuracy of the time calculation is different from

the original due to human reaction errors related to the start and stop times. Therefore, this research was conducted with the purpose to design and develop a special sensor based instrument for futsal dribbling skills and assessing its validity and reliability on Indonesian futsal players.

1.4 Specific Research Objectives

Before the evaluation procedure of the FDSI is considered in evaluating dribbling to measure the speed of futsal dribbling, the ability of the test to obtain valid and reliable measurements must be demonstrated. An acceptable trial of validity and reliability for such testing procedures will reinforce the continued use of similar procedures in measuring dribbling for practice and research. Judging from the research background and the problem statement, this research begins by analyzing the dribbling distance of players in the match as the basis for making a dribbling test instrument. Thus the specific objectives of this research are as follows:

1. To measure dribbling distance of Indonesian national futsal player in a match.
2. To design a valid and reliabile Futsal Dribbling Sensor Instrument (FDSI) to measure dribbling speed among Indonesia national futsal player
3. To determine the relationship between anthropometry and physical condition with the futsal dribbling speed among Indonesia national futsal player.

1.5 Research Question

1. What is the dribbling distance of Indonesian national futsal player during a match?
2. What is the validity and reliability of FDSI to measure the dribbling speed of futsal players?
3. Is there any relationship between anthropometry and physical condition with futsal dribbling speed?

1.6 Null Hypothesis

Based on the 3 research question, researcher formulated 7 hyphothesis:

Null Hypothesis ($H_0$1):

There is no significant relationship between height and dribbling speed among Indonesian national futsal players.

Null Hypothesis ($H_0$2):

There is no significant relationship between body weight and dribbling speed among Indonesian national futsal players.

Null Hypothesis ($H_0$3):

There is no significant relationship between leg length and dribbling speed among Indonesian national futsal players.

Null Hypothesis ($H_0$4):

There is no significant relationship between cardio endurance and dribbling speed among Indonesian national futsal players.

Null Hypothesis ($H_0$5):

There is no significant relationship between agility and dribbling speed among Indonesian national futsal players.

Null Hypothesis ($H_0$6):

There is no significant relationship between leg muscle power and dribbling speed among Indonesian national futsal players.

Null Hypothesis ($H_0$7):

There is no significant relationship between balance and dribbling speed among Indonesian national futsal players.

1.7 Significant of the study

Dribbling is one of the basic techniques in futsal that every player needs to master, therefore players must practice their dribbling skills. Therefore, an appropriate and consistent futsal dribbling instrument is needed in measuring futsal dribbling skills. Previously there were several instruments that had been used to measure dribbling skills, but there were still few and weaknesses in the distance traveled and the dribbling test pattern carried out. Therefore, there is a question about how to develop

a dribbling test instrument whose distance is adjusted to the dribbling distance of players in the match and what about other dribbling patterns.

For this reason, this research is important. This research is based on a needs analysis regarding the need for a new futsal dribbling instrument to measure the level of futsal dribbling skills, the researcher uses a test distance based on the dribbling distance performed by futsal players in the previously analyzed match. This research can provide a new futsal dribbling instrument model and add to the treasury of existing futsal dribbling instrument models. This study will provide direct information about the characteristics of futsal players with height, weight, leg length, cardio endurance, agility, leg muscle power, and balance that can predict the success of futsal dribbling actions that are tested with the developed FDSI. It also benefits the peoples involved as stated below.

1.7.1 Futsal Coaches

For futsal coaches, this instrument can be used as a reference to evaluate the dribbling skills and effectiveness of futsal players' dribbling training. The research results can distinguish the dribbling performance of futsal players with the characteristics of the player's height, weight, leg length, cardio endurance, agility, leg muscle power, and balance. Therefore, for the National futsal team, this instrument can be used to detect talented individuals in futsal.

1.7.2 Futsal Players

For futsal players, this instrument will determine their dribbling abilities so that players can try to improve their dribbling skills. This instrument can also be used by players to carry out dribbling exercises such as learning optimal dribbling techniques, improving dribbling speed, reviewing dribbling performance during games.

1.8 Limitation of the study

The research was conducted to develop a Futsal Dribbling Sensor Instrument (FDSI). In testing the FDSI using futsal players aged between 18-27 years. Therefore, the results may not represent the population of other age groups in using this FDSI. The results of this study can also be influenced by the willingness and effort of the sample in carrying out the test procedure when testing the instrument. However, samples are constantly encouraged to do their best. The sample was also instructed to provide researchers with information about the implementation of the dribbling test if they had difficulty.

1.9 Delimitation of the Study

Subject of study analysis of dribbling distance, test re-test dribbling tests instrument, and correlation studies is limited to futsal players. The subjects used were between 18-27 years old. The subjects for the futsal dribbling distance analysis study were all

professional futsal players who participated in the grand final of the 2021 Indonesian Futsal League competition. While the subjects for the test re-test of the dribbling test instrument and the correlation study were limited to futsal players who has not history of injury to the foot. So that the research subject is limited to futsal players who meet these inclusion criteria.

1.10 Operational Definition

An explanation of the variables measured and observed in this study is shown below:

1.10.1 Futsal Dribbling Sensor Instrument (FDSI)

Futsal Dribbling Sensor Instrument (FDSI) was designed with analysis dribbling distance futsal players in matches with varied patterns (loop, meandering, zig zag, and straight), and considers the characteristics of height, weight, leg length, cardio endurance, agility, leg muscle power, and balance possessed by futsal players. This instrument developed using sensor technology to start and finished point of the test. The device developed by using a tracking system from each and every point from start up to the finish.

1.10.2 Height

Height is an important factor influencing the success of almost all sports (Masanovic, et al., 2019). According to Gusic et al (2017), each sport requires different anthropometric characteristics that related to the characteristics of the motion required in each of sports, achievement, and on the other hand related to the player selection profile and long-term training processes. Galy et al (2015) also stated that anthropometric performance, especially height can be a parameter that helps futsal coaches determine the objective basis for talent identification and provide training to develop certain playing styles. Regarding the importance of height, this research considers the height of futsal players in testing the validity of the developed FDSI.

1.10.3 Weight

Players who have a normal weight plus or exceeds the ideal body weight, it will be difficult for players to carry out tasks in futsal in every playing position. Junior et al (2016) stated that overweight can harm sports performance. Kooshaki et al (2014) stated that dribbling skills decreased with increasing body fat. Therefore, this research considers the body weight of futsal players in testing the validity of the developed FDSI.

1.10.4 Leg Length

The legs are the same as the feet from the groin down to the soles of the feet, are the lower limbs, namely the entire leg plus the pelvis, measured through the vertical distance between the soles of the feet to the groin where the measurement is standing upright (Saladin, 2007). According to ISAK (2001), leg length was measured from trochanter to tibiale laterale. There are differences in the leg length of soccer players and semi-professional futsal players that can affect the technique, tactics, and role of players in special situations (Karimi, et al., 2015). Therefore, this research considers the leg length of futsal players in testing the validity of the developed FDSI.

1.10.5 Cardio Endurance *(VO_{2max})*

Futsal players who will compete at the highest level must focus on developing aerobic capacity (Spyrou, et al., 2020). VO2max is a description of a person's aerobic capacity in using maximal oxygen per minute. A direct assessment of match VO2 shown that players must be able to work at an intensity of 50-55 ml.kg-1 min-1 to play futsal professionally. According to Naser et al (2017) VO2max needs to be assessed on futsal players because they better reflect differences in competitive levels. Therefore, this study considers the cardio endurance (VO2max) of futsal players in testing the validity of the developed FDSI.

1.10.6 Agility

Agility is body movement accompanied by speed and direction that changes (Young et al., 2021). Liu et al (2021) state that the ability to slow down, accelerate, and change movements in a short time is called agility. Agility is an important indicator in futsal games because in futsal games there are frequent changes of direction, sudden movements, quick decisions making to maintain ball control (Gioldasis, 2016). Milanović, et al (2011) stated that in particular, agility plays a role when a player is dribbling and the opponent is trying to grab the ball. Therefore, this research considers the agility of futsal players in testing the validity of the developed FDSI.

1.10.7 Leg Muscle Power

Leg muscles which are part of the lower body need to be increased in power when players are trying to achieve high performance (Spyrou, et al., 2020). This is because, leg muscle power plays a role in high-level abilities such as shooting, passing, dribbling futsal (Naser, et al., 2017). According to Naser and Ali (2016) that higher muscular power will provide an advantage in terms of maintaining the strong muscle contractions needed during many actions in futsal games. Therefore, this research considers the leg muscle power of futsal players in testing the validity of the developed FDSI.

1.10.8 Dynamic Balance

Dynamic Balance is an important aspect of many sporting activities, such as preventing falls and reducing the risk of injury. In addition, poor balance is associated with an increased risk of injury, particularly ankle and knee injuries. Poor balance, altered motor control, or lack of neuromuscular control have all been described as predictors of lower limb injury risk in players (Lee and Tan, 2020). Therefore, this study considers the dynamic balance of futsal players in testing the relationship with dribbling speed.

1.10.9 Dribbling Speed

According to Gioldasis (2018), a team with a high level of success in dribbling has the potential to create a bigger space to score goals. Dribbling is defined as a technique that can be used by players to move the ball accompanied by the direction the player wants without being seized by the opponent, so that in the implementation of dribbling, the ability to change the speed is needed which is done by accelerating or stopping suddenly (Herman and Engler, 2011). The dribbling speed in this research was used to test the valid and reliable FDSI developed.