



Development of Biomechanical Models to Improve Badminton Athletes' Performance

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Abstract

Biomechanics is the science of the fundamentals of mechanics in muscle activity and the study of the principles of its relationships, the application of the laws of mechanics to living structures, particularly to the human body's movement system, and the study of the structure and function of biological systems using mechanical methods. Objectives: 1) to determine the motion analysis in badminton. 2) to determine the biomechanical analysis of the smash motion in badminton. The research method used in this study was a survey test, a qualitative research type. This research was conducted on the 3rd floor of the FIK UNIMED building. The research targets were determined using purposive sampling. The instruments used in this research were badminton smash movement instruments and documentation instruments, namely personal notes used by the researcher when documenting the analysis of badminton smash movements from a biomechanical perspective. The research results obtained were in the appropriate category. Thus, badminton smash movement techniques, when viewed from a biomechanical perspective, require coordination between joint movement, the movement that occurs, and the muscles involved. The conclusion of the study is that badminton smash movements are in the appropriate category. The recommendations from this study are as follows: 1) For athletes, 2) For coaches, 3) For researchers.

Keywords: *Badminton Athletes, Biomechanical, Performance*

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INTRODUCTION

Badminton is one of the sports that is very popular among Indonesians and can reach the international level. Indonesia has placed badminton players among the best world rankings. Indonesia's success in placing its players in the world rankings is not easy; it requires a long process and relentless effort. There are many badminton clubs spread across various regions. These clubs teach basic badminton techniques, and they also teach how to develop a sportsmanlike spirit.

One of the badminton clubs in Medan City is the P.B UNIMED club. The daily training of P.B UNIMED athletes in Medan City begins with basic techniques in badminton, after which they are given modified exercises based on the basic training. According to Tohar (1992:43), basic badminton techniques are fundamental skills that must be mastered by every badminton player in carrying out badminton activities. Mastery of these basic techniques includes: how to hold the racket, wrist movements, footwork, and focus or concentration. In general, these four techniques must be well mastered in order to play badminton correctly.

After mastering the basic techniques, badminton players are required to master hitting techniques, including the service, lob, dropshot, drive, and smash. The service shot is the shot that opens a badminton game (James Poole, 2008:21). The lob is a shot made from above the head aimed at hitting the shuttlecock high so that it falls near the back doubles line. The lob is widely used in singles games. The dropshot is a shot aimed at making the shuttlecock fall near the net, preventing the opponent from having an opportunity to attack. The drive is a sideways shot from the right or left of the body, making the shuttlecock fly flat over the net. The smash, according to Tony Grice (2002:85), is a fast shot directed downward with power and sharpness to return a short shuttlecock that has been hit upward.

As time went by and the number of athletes increased, there were policies that needed to be implemented related to training venues. In 1963, the training was moved to a multifunctional building in Kelutan. The training sessions themselves were held every Monday, Tuesday, and Thursday, starting from 5:00 PM to 8:00 PM. For achievement-oriented ages, training began from an early age up to adulthood. Regarding facilities and infrastructure, the coach made modifications to the training equipment on his own, and PBSI also assisted with training equipment and shuttlecocks, so there were no issues with the facilities.

Based on observations at PB. UNIMED regarding interviews with the coaches about the athletes, it appears that the athletes have mastered the movements in badminton, but some are still not performing well, particularly the smash movement. One factor that caught the researcher's attention is biomechanics, since the outcome of a smash is determined by correct basic technique. There are still several athletes who are not performing the smash movement well, so students' ability to execute the smash movement is still very limited and varied. Some students can perform it well, while others still lack proficiency in mastering the smash technique.

Biomechanics studies the science of the effects of external forces on the body and the effects produced by these forces (Sigit Hidayat Muryono, 2001:101). Imam (1996:5) argues

that biomechanics is the science that applies the laws of mechanics to living structures, particularly the body's locomotor system, and locomotion is the activity in which the whole body moves by its own power and is generally aided by its weight. In addition to the smash shot, in biomechanics, analyzing an athlete's movement when performing a smash also needs to be observed to determine correct and incorrect movements. The smash is a commonly used stroke because it highly allows pressuring the opponent's play, thus the opponent must always be ready and agile in anticipating it.

Image management is applied to several sports fields, such as motion analysis, game analysis, and physical education. In sports analysis, human movement is one of the key points. The explanation/description of human movement is further researched through biomechanics and so on. With cameras used for analysis, images are obtained without direct contact with the object being measured. In addition, there is minimal unnecessary burden on the player during management or analysis. Therefore, image management is an effective method in the field of sports.

Based on the background above, this study examines the biomechanical analysis of the smash movement of male athletes from P.B UNIMED Sakti in Trenggalek. With this research, it is expected to provide input to badminton coaches so they can optimize the appropriate training methods to support the athletes' performance.

METHOD

This study uses a descriptive survey method with a quantitative and qualitative approach (mixed-method). Quantitative approach. The quantitative approach is used to analyze biomechanical data such as speed, joint angles, ground reaction forces, and body acceleration, while the qualitative approach is used to understand the context of technique execution, athletes' perceptions, and coaches' strategies through interviews and documentation. The research subjects are national-level badminton athletes who are undergoing an intensive training program at the PBSI National Training Center (Pelatnas PBSI). The selection of subjects was carried out using purposive sampling technique. The survey in this study refers to comprehensive field data collection, not just filling out questionnaires. Direct Observation and Biomechanical Instruments. This study also involves qualitative data such as interviews, documentation, and field observation notes. Data analysis techniques involve quantitative analysis, that is, numerical data. In this study, the term “survey” includes field data collection based on observation, video recording, and the use of biomechanical instruments, not just filling out questionnaires. A qualitative approach (interviews, observation, documentation) is

used to understand the context and interpretation of movements, while a quantitative approach (biomechanical analysis) is employed to measure and objectively verify technical aspects. Both approaches complement each other to provide a comprehensive picture of shuttlecock athletes' performance and movement efficiency.

RESULTS AND DISCUSSION

Results

The results of the biomechanical analysis of the smash movement of a 20-year-old badminton player at P.B UNIMED fall within the 'appropriate' criteria based on the movement observed from three phases: the initial movement, the follow-through movement, and the landing movement.

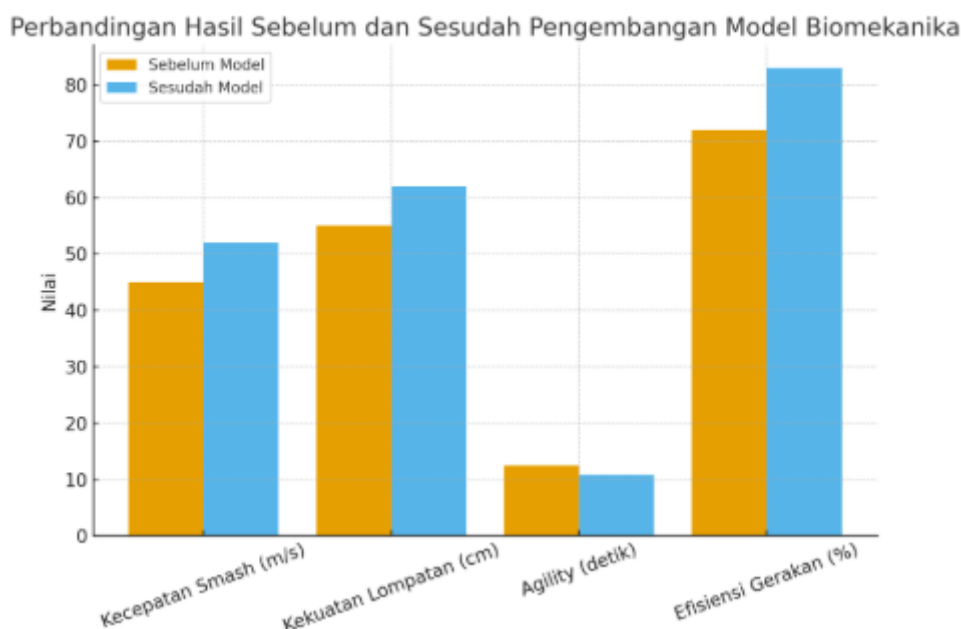


Figure 1. Result

Discussion

P.B UNIMED was established in 1963. The first training took place at the FIK UNIMED Building, 3rd floor. Over time, as the number of athletes increased, a policy had to be adopted regarding the training venue. The training itself is conducted every Monday, Tuesday, and Thursday, starting from 17:00 to 20:00 WIB. For achievement age groups, training starts from early age to adulthood. Regarding facilities and infrastructure, the coach

has made modifications to the training equipment himself, and PBSI has also provided support for training equipment and shuttlecocks, so there are no issues with the facilities.

Based on observations at P.B UNIMED and interviews with coaches regarding the athletes, they have mastered movements in badminton, but there are some who still perform certain movements poorly, specifically the smash. One factor that caught the researcher's attention is biomechanics, because the determining factor for the smash outcome is correct basic technique. There are still several athletes who do not perform the smash well, so students' ability to execute the smash is still very limited and varied; some students can perform it well, while others still lack proficiency in mastering the smash movement skills.

CONCLUSION

As a conclusion to the discussion conducted in the previous chapter, the researcher presents here the results of the study, or what is referred to as the conclusion, obtained from the research titled “Biomechanical Analysis of Smash Movements of 14-Year-Old Male Badminton Athletes at P.B UNIMED” as follows: The badminton training program at P.B UNIMED has been running well and in a structured manner. With this training program, the coach can maximize the athletes' abilities. The training program at P.B UNIMED not only focuses on physical training but also develops the players' mental skills through sparring with other clubs or participation in competitions.

The coach at P.B UNIMED has carried out their role well, as the coach has duties as a planner, leader, mentor, and controller of the training program. With three coaches, all of them aim to educate and maximize the players' talents properly and correctly. The facilities and infrastructure available at P.B UNIMED are adequate, but even though they are sufficient, there is still a need for additional improvements to the infrastructure so that training can run well and effectively.

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