

REVIEW OF DESCRIPTIVE AND INFERENTIAL STATISTICAL OF FOOTBALL KICK BIOMECHANICS JOURNALS

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ABSTRACT

Introduction: *The importance of a statistical analysis approach in biomechanics is because researchers need an objective and accurate method to analyze and draw conclusions. The research purpose was reviewed the use of statistics in biomechanics research on football kick.*

Material and methods: *The research was used qualitative methods and based on documentary analysis methodology with sample of 37 journals. Each journal was analyzed and then compared with a descriptive percentage.*

Result: *The reviews results shown that 27 journals (73%) used mean and SD analysis, 3 journals (8%) used 95% of confidence interval analysis, 1 journal (3%) used narrative analysis, 7 journals (19%) used paired t-test analysis, 5 journals (14%) used the analysis unpaired t-test, 16 journals (43%) used the ANOVA analysis, 4 journals (11%) used regression analysis, 1 journals (3%) used Kendall Tau's correlation analysis, 1 journals (3 %) used Mann Whitney analysis, and 1 journal (3%) used Friedman & Wilcoxon analysis.*

Conclusions: *So it can be concluded that every journal used descriptive and inferential statistics to analyze the results of their research.*

Keywords: Descriptive Statistical, Inferential Statistical, Biomechanics, Football Kick

INTRODUCTION

Statistics is the research of collecting, analyzing, interpreting, presenting, and organizing data (Diggle, 2015). Statistics is the science related to the data used in collecting, compiling, managing, presenting, analyzing and giving interpretation of a set of data so that it can draw conclusions, make estimation and predictions that will come (Ali & Bhaskar, 2016). Statistics are important in sports biomechanics research. There are 2 types of the basic concepts of statistics applied in the research that is descriptive statistics and inferential statistics (Balasundaram, 2020). Descriptive statistics consist of collecting data, compiling data, processing, presenting, and analyzing numerical data. Meanwhile, inferential statistics include probability theory, theoretical distribution, sampling, estimation, hypothesis testing, correlation, comparison, and regression.

Biomechanics is the research of the structure and function of living things (Taiar, 2020). Biomechanics is based on the laws and methods of mechanics with the aim of knowing and understanding in order to utilize, increase or restore human functional capacity. Biomechanics is a scientific discipline that studies the forms and types of movements on the basis of mechanical principles and analyzes a movement. Sports biomechanics is the field of applied biomechanics, whose main purpose was improved sports techniques through investigating and analyzing the movements of skilled players, to design effective training methods, and to reduce the risk of injury (Ae, 2020). The disciplines of biomechanics does not stand by itself, but is supported by other disciplines, such as anatomy, physiology, and physics, then the foundations or principles of the three areas of science that became the basis of a discipline called biomechanics. In addition, basically the main emphasis in biomechanics is the human body because the human

body is a more complex system than most objects encountered in the concept of mechanics. Therefore, biomechanics concerns the human body and almost all bodies of living things.

In the football, biomechanics is well known as a discipline that specifically studies movements such as kicks made by athletes. Researchers analyzed the kick motion that usually done with the help of software motion analysis, such as video image analysis software. Video image analysis software is software that analyzes digital video images, which was developed with the addition of a Data Matching module for biomechanical applications (Kobayashi, 2020). Then, these results will be processed by the statistics which then presents and describes the data with quick and accurate. Biomechanical analysis of football kicks is divided into stages of backswing of knee flexion angle, hip angle during movement, ball contact with the foot. The speed of the kicked ball depends on the speed of the foot before contact with the ball, the position of the body when kicking the ball, the length of the momentum and the angle of the kick (Aziz, 2019). The use of statistics in biomechanical research adjusts to the type and objectives of research. In sports biomechanics research, there are several studies that influence the use of statistics. Quantitative mechanics are considered to be able to provide data with high validity and reliability of measurements, but this approach is also considered to be potentially less meaningful for coaches and athletes. Newton's mechanical approach helps in understanding several aspects of human motion. But the laws of biomechanics are difficult to understand. Qualitative mechanics has more potential to assist understanding in theory when faced with conditions in the field.

The importance of research in the research design and statistics to discipline sports science to develop statistical methods, so that the quality of research design and analysts is statistical directly affect the field of science (Sainani, 2021). To perform the biomechanical analysis in sports, there are two types of conventional approach, the quantitative research analysis and descriptive qualitative analysis (Dhaka, 2019). On the quantitative approach, movement was analyzed using a set of tool with calculations such as image-based motion analysis using video, automatic motion detection system, electromyography, or force/pressure measurement board. The quantitative data then analyzed using statistics and computer simulations to analyze movement patterns. While the qualitative analysis relied on observation by the coach or motion analyst both direct or *via* videotape. In general, the differences between qualitative and quantitative analysis is qualitative analysis describes in a non-numeric to see the movement as a pattern, while quantitatively describe the movement numerically and usually there is a test of significance. Quantitative research deals with numerical data and uses statistics to analyze data, while qualitative research is concerned with non-numeric data or textual data, content or narrative analysis, coding, themes and so on (Moalusi, 2020). Quantitative research has significance (p-value) which uses a value of 0.05. Definition p-value is probability to sample data, there is no difference between variables researched (Hadjipavlou, 2021). When analyzing on statistical significance of the difference test, a measure of the effect of the difference must be included. This can be seen from the standard deviation of group differences, it can also be seen from the t-test results of the experimental and control groups.

The research purpose was reviewed the statistics using in the biomechanics research of football kick.

MATERIAL AND METHODS

The research was used qualitative method and based on the documentary analysis methodology. In the documentary research method, one analyzes research reports, data, newspaper articles, books, and other documents to investigate certain phenomena (Park, 2021). In this research, information search for analysis was carried out through international journals related to biomechanics research of football kick from 2016-2020. Data collection method was carried out by browsing international journals through Google scholar and science direct. The keyword used to find all the data is "biomechanics kick football". From the search results obtained 37 journals. The criteria for the journals analyzed were (1) original paper and in

English; (2) the research samples are football players; (3) research variable is kick; (4) kick biomechanics journal; (5) including the accredited journal. Each journal is analyzed and then compared with a descriptive percentage. Journal analysis used table data by identifying the author, year of publication, type of research, statistical approach used, statistical program used, significance test methods, and level significance.

RESULTS

Based on the search results, it was obtained 37 journals of football kick biomechanics. Table 1 show publication of the journal biomechanics kicks football which the least to years 2017, while most in 2016.

Variable	Number
Author	
Single	4
More than one	33
Year Publication	
2016	11
2017	2
2018	9
2019	7
2020	8
Type Biomechanics Research	
Quantitative	36
Qualitative	1
Statistical Approach	
Descriptive	2
Inferential	12
Both	23
Statistical Program	
SPSS	17
Matlab	4
PASW	2
Ms. Excel	1
Proc Mixed	1
RStudio	1
Not use	11
Significance Test Methods	
Sig	36
Not use	1
Significance Level	
0.01	2
0.05	34
Not use	1

Statistical Test	Mean	SD	95 % Confidence Interval	Analysis
Use	27	27	3	1
Not Use	10	10	34	36

Statistical Test	Parametric				Non Parametric		
	Paired t-test	Unpaired t-test	ANOVA	Regression	Kendall tau	Mann Whitney	Friedman & Wilcoxon
Use	7	5	16	4	1	1	1
Not Use	30	32	21	33	36	36	36

Based on Table 2 and 3, it shown that researchers in analyzing the research results were used descriptive and inferential statistical approaches. The descriptive statistics used were the mean, SD, 95% confidence interval, and narrative analysis. Meanwhile, the inferential statistics were used paired t-test, unpaired t-test, ANOVA, regression, Kendall tau correlation, Mann Whitney, and Friedman & Wilcoxon.

Table 2 and 3 shown that 27 journals (73%) used mean and SD analysis, 3 journals (8%) used 95% confidence interval analysis, 1 journal (3%) used narrative analysis, 7 journals (19 %) used paired t-test analysis, 5 journals (14%) used unpaired t-test analysis, 16 journals (43%) used ANOVA analysis, 4 journals (11 %) used regression analysis, 1 journal (3%) used Kendall tau correlation analysis, 1 journal (3%) used Mann Whitney analysis, and 1 journal (3%) used Friedman & Wilcoxon analysis.

DISCUSSION

Football is a complex and exhaustive team sport that requires a high level of tactics, technique and physical ability to succeed (Dolci, 2020). Football is a game of kicking a ball and requires a variety of basic technical of movements. The efficiency of motion will increase the maximum ability in basic technic movements. Movement studies can be carried out in the field of sports biomechanics. Biomechanics is used to evaluate the movements a player makes, so that players can improve their abilities, and find out their weaknesses. Biomechanics is the research of human movement, which used the principles of mechanics and the application of anatomy. Football biomechanics research involves not only one or two authors but more than two authors. This can be called a biomechanics research team. Teamwork in research can produce quality research. While the approach or type of biomechanical research can be done with quantitative and qualitative approaches. Sports biomechanics science was provided quantitative and qualitative evaluation of sports performance, especially on the kinematics and kinetics of the sports movement (Szabo, 2020).

Every research requires statistics, just as biomechanical research requires statistics to analyze the research results and draw conclusions from the research results. Statistics is a scientific method for collecting, organizing, and analyzing statistical data (Bao, 2020). Through statistical analysis, can be described circumstances, conditions, or the fact that researched and also can be obtained a logical conclusion. The use of statistics as a tool is based on exact data so that we can draw logical conclusions, make accurate and steady decisions, and can predict things that might happen in the future, and what concrete steps might need to be taken. In general, in the football kick biomechanics journal, researchers analyze their research results used descriptive and inferential statistics. Regarding the statistical program/statistical software used,

most researchers use SPSS, but there are some researchers who use other programs such as Matlab, PASW, RStudio, Proc Mixed, and Microsoft Excel. SPSS and Minitab are very common among researchers who do not have the competence to use advanced statistical tools. The statistical software of SPSS and Minitab are easy to use as they are designed primarily to be graphical user interfaces, although some coding may be involved in advanced data analysis (Okagbue, 2020).

Statistics involves collecting, describing, and analyzing data. Descriptive statistics aims to provide descriptions of data and information characteristics; while inferential statistics perform analysis and draw conclusions. In essence, descriptive statistics explain the characteristics of the data systematically including several data analysis techniques, namely: data distribution, central tendency, and data presentation. In the characteristics of data distribution, central tendency is an important aspect, which is used to describe or explain all images from a set of data and representative and typical distributions. The analysis of central tendency consists of the arithmetic mean or average; the median or observed value located in the middle of the data; the mode or the most appears data; and the size of data distribution consisting of standard deviation and variance to describe the characteristics of the data distribution (Li, 2020). Descriptive statistics used as the first analysis, for further data can be conducted the testing of hypotheses. Data presentation is displayed in the form of images or schemes in the form of histograms, graphs, graphic info and others. The substance of descriptive statistics is provided a summary of the data in an easy to understand form.

The mean is a measure of data centralization, considered the primary measure for running and understanding all complex statistics. The mean is an estimate of a certain value that represents all data. SD (Standard Deviation) is a measure of the spread of data. The size of the spread is used to describe how widespread or scattered quantitative data is. Confidence interval is estimated expressed in the form of a continuum of values within an interval would have missing level smaller than the estimates expressed in figures alone. The amount of confidence interval is 95%. If the measured biomechanical variable is a ratio scale, the appropriate analysis to describe this variable is the mean. The review results stated that the descriptive statistics used in various biomechanical studies of football kicks are mean, SD, 95% confidence interval, and narrative analysis. Mean, minimum, maximum, and Standard Deviation (SD) were calculated as descriptive statistics (Godry, 2020). There were 27 journals (73%) used mean and SD analysis, 3 journals (8%) used 95% confidence interval analysis, 1 journal (3%) used narrative analysis. Many journals use means in football kick mechanics journals.

Meanwhile, inferential statistics differ greatly from descriptive statistics, because inferential statistics perform data processing, data analysis, so that they can make decisions or conclusions so that they tend to lead to analysis and testing of theories or hypotheses; or in other words inferential statistics have a lot to do with probability theory, significance level, correlation coefficient, and hypothesis testing. The results of the review state that the inferential statistics used in various biomechanical studies of football kicks are paired t-test, unpaired t-test, ANOVA, regression, Kendall tau correlation, Mann Whitney, and Friedman & Wilcoxon. Parametric test is considered as inferential statistic which is widely used in football kick biomechanics journals. Statistical parametric mapping allows continuous comparison of biomechanical variables at other time points than discrete local optima (McErlain-Naylor, 2020).

Hypothesis testing about the difference between the two parameters from two groups can used t-test. Paired t-test is an analysis in which the samples influence each other (correlate). The two data tested came from the same sample group resulting in two data distributions, namely the initial test and the final test. Unpaired t-test (independent) is an analysis in which samples whose existences do not influence each other. Analysis of Variance (ANOVA) or analysis of variance was used to test the hypothesis that states the average difference from more than two groups of samples, either by design simple randomized design or group-within design treatments. In principle, it is possible to test the mean difference with the t-test statistic of more than two groups. However, repeated testing with t-test statistics can increase the occurrence of type I errors (significance level α). Regression analysis is a typical analysis technique for correlation

studies. Correlation analysis is an analysis that seeks to see whether there is a relationship between two or more variables, measuring the strength of the relationship, making predictions based on the strength of the correlation. This analysis technique is useful for researching variables that have a relationship based on the theory previously built so that the direction of the linkage is expected to be found. The significance test for the correlation coefficient is obtained from the Model Summary table in the first row if <0.05 means significant. The review results stated that there were 7 journals (19%) used paired t-test analysis, 5 journals (14%) used unpaired t-test analysis, 16 journals (43%) used ANOVA analysis, and 4 journals (11%) used analysis regression.

Non-parametric testing was rarely used in the football kick journal biomechanical. Non-parametric analysis was conducted because of the non-normality and ordinal nature of all Likert scale response data (McErlain-Naylor, 2020). The Kendall tau, Mann Whitney and Friedman & Wilcoxon correlation is a non-parametric test where tests are carried out on data where the parent distribution is not normally distributed or the scale is at the ordinal or nominal level. The Mann Whitney test is a substitute for the t test where the assumptions of normality and homogeneity are not required. This test is used to test two free samples that are sorted according to rank. Meanwhile, Friedman & Wilcoxon was used to test related samples. This test determines the magnitude of the significant difference between paired data taken from one sample. The review results stated that there is 1 journal (3%) used Kendall tau correlation analysis, 1 journal (3%) used Mann Whitney analysis, and 1 journal (3%) used Friedman & Wilcoxon analysis.

CONCLUSION

The review results of football kick journal biomechanics stated that researchers in analyzing the research results used two types of descriptive and inferential statistics. From the 37 journals in the review, there were 27 journals (73%) used the mean and SD analysis, 3 journal (8%) used 95% confidence interval analysis, 1 journals (3%) used the narrative analysis, 7 journals (19%) used paired t-test analysis, 5 journals (14%) used unpaired t-test analysis, 16 journals (43%) used ANOVA analysis, 4 journals (11%) used regression analysis, 1 journal (3%) used Kendall tau correlation analysis, 1 journal (3%) used Mann Whitney analysis, and 1 journal (3%) used Friedman & Wilcoxon analysis.

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