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The relationship between leg muscle strength and static balance in surfers

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ABSTRACT

Background: Surfing is a type of water sport that involves playing on the waves by using a surfboard to maneuver on the waves. It requires good static balance and good leg muscle strength.
Methods: The method used in the analytical cross-sectional study design. This research was conducted on February 25, 2023. The inclusion criteria for male surfers aged 18-25 years have ever surfed (nor in the training or learning process). According to the screening assessment, the exclusion criteria included individuals who have experienced a lower extremity injury in the last 3 months (except lacerations or injuries with open wounds). The sampling technique used was a nonprobability sampling method with a purposive sampling technique. The number of samples obtained in this research was 46 samples.
Results: Data collection was carried out by measuring leg muscle strength and static balance. Leg muscle strength was measured with a leg dynamometer while static balance was measured with the Stork Standing Test. Based on the non-parametric Spearman rho analysis test, the value of $p = 0.000$ ($p < 0.05$) and the correlation coefficient $r = 0.954$.
Conclusion: Based on the research results, it can be concluded that there was a significant relationship between leg muscle strength and static balance in surfers.

Keywords: leg muscle strength, static balance, surfer, water sport.
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INTRODUCTION

Surfing is a type of water sport in which people use a surfboard to maneuver over the waves. Surfers maintain their balance when hit by waves by using a surfboard. To maintain balance when surfing, leg muscle strength is very important. George Freeth was the first surfer to use surfing to promote it. In addition, Duke Kanamoku—a surfing legend—introduced surfing in Australia in 1915.[1] In 1930, American Robert Koke opened a small hotel near the Rock Hotel in Kuta Hard. He was the first person to bring surfing to Indonesia. In 1960, many Australian surfers came to Kuta Beach to surf. Indonesia, the first place people go to surf is.[2]

Apart from Kuta, Sanur is also an area that has beaches for surfing. In the Sanur area itself, there are water sports events/water games such as surfing. One of the well-known events, namely SVF, 2019 also held the SVF Surfing Competition at Sanur Reef Beach with good waves and winds that supported this competition. There are also quite a lot of surfers in the Sanur area and have an association called "Sanur Surfing Club". Sanur beach has wave characteristics that are suitable for surfing, apart from that, both tourists and residents also surf on Sanur beach.[3] To find waves suitable for surfing, surfers have to swim deep into the beach. In the world of surfing, there is an association called ISA based in California. This association currently has members from more than 70 countries.[4]

This water sports activity has its characteristics, namely the surfer will stand on a surfboard and crash into the waves.[5] It requires good static balance and good leg muscle strength. Leg muscle strength is one of the keys to successful surfing because it plays an important role. Balance is the synchronization that occurs between the coordination of the eyes (vision), body, thighs, knees, and feet.[6] The part of the body that plays an important role in maintaining leg muscle strength and maintaining balance is the feet.[7] In surfing, the feet are the main part of the body that plays an important role.[7] Static balance is the body's ability to maintain an attitude or body position while still. In everyday life, balance is the ability to maintain stable control of the body, both in movement and rest and in simple to complex movements. Surfing is an example of a movement that requires balance.[8]

The component in maintaining static balance, namely the leg muscles, will help you stay still in this situation. Leg muscles also play a role in maintaining the weight of the upper body and in moving the lower body.[9] A surfer can significantly increase or increase the load of muscle strength. The impact of surfers who train too hard will cause weakness in muscle strength so they will easily suffer injuries.[10] Thus, balance in surfing is a very important thing. A surfer must be able to maintain a stable balance because if he is going to hit a wave, he can remain in a balanced position.[11]

Currently, there have been several studies conducted abroad regarding the relationship between leg muscle strength

and static balance in surfers, but there are differences in the results of these studies.[12] Apart from that, this research has never been conducted in Bali or even in Indonesia. Therefore, researchers wanted to know the relationship between leg muscle strength and static balance in surfers in Denpasar City. It is hoped that this research will be useful for physiotherapists to increase their insight and physiotherapists are also expected to be able to determine appropriate preventive measures and interventions for surfers who experience leg muscle weakness or balance disorders so that they remain optimal when surfing.[13]

METHODS

The method used in the analytical cross-sectional study design. This research was conducted on February 25, 2023. The inclusion criteria for male surfers aged 18-25 years have ever surfed (not in the training/learning process). The surfer in question is a surfer who has participated in competitions and will be determined through an interview process, accompanied by physical evidence in the form of a competition participation certificate (participant and champion charter), able to communicate verbally and cooperatively, willing to be a research subject and fill out an informed consent as approval to be a research sample. According to the screening assessment, the exclusion criteria included individuals who have experienced a lower extremity injury in the last 3 months (except lacerations or injuries with open wounds). This was proven through the physiotherapy care process. Have a history of chronic lower extremity injuries such as fractures and tightness in muscle groups. In this study, the research subjects were surfers aged 18-25 years in Sanur with purposive sampling who met the inclusion and exclusion criteria of as many as 48 people.

The data analysis was carried out with the help of SPSS 25.0 software on a laptop. Data analysis included both univariate and bivariate analyses. Univariate analysis comprised descriptive statistics such as frequency distribution, standard deviation, and mean for age, gender, and duration. Bivariate analysis is an analysis to describe the relationship between two variables, namely the independent variable, namely leg muscle strength, and the dependent variable, namely static balance. These variables have the same data scale, namely the independent variable includes an ordinal scale, and the dependent variable includes an ordinal scale. The bivariate analysis used in this research was the Spearman rho correlation test method.[14]

RESULTS

It is known that the highest distribution of samples based on age is 25 years, namely 10 samples (20.8%). This study used male participants aged 18-25 years because in this age range they have matured physically and psychologically and are still actively surfing. Using male gender because men and women have differences in muscle strength and body response in maintaining balance.[15] There are differences in physical growth between men and women, women's bodies tend to be smaller than men's bodies. Therefore, in this study, only male samples were taken in the research to minimize bias.[16] Sample distribution based on leg muscle strength with 1 (2.1%) poor category, 3 (6.3%) below average, 7 (14.6%) sufficient, 15 (31.3%) good, and very good 22 (45.8%). The distribution is based on static balance with the categories being very poor at 0, poor at 4 (8.3%), moderate at 8 (16.7%), good at 16 (33.3%), and very good at 20 (41.7%). %). Table 2 shows that there is a significant relationship between leg muscle strength and static balance in male surfers aged 18-25 years in the city of Denpasar as evidenced by the value of p = 0.000 (p<0.05) and the correlation coefficient value is 0.954 and is positive. A positive value indicates that there is a unidirectional relationship with a very strong correlation level because the value is between 0.76-0.99.

DISCUSSION

Based on the results of data testing using non-parametric Spearman Rho analysis, it was found that the p-value = 0.000 (p<0.05) and the correlation coefficient value of 0.954. This shows that there is a significant relationship with a very strong and directly proportional correlation

Table 1. Frequency distribution of subject characteristics

Characteristics	Category	Frequency	Percentages (%)
Ages	18	4	8.3
	19	2	4.2
	20	5	10.4
	21	7	14.6
	22	7	14.6
	23	7	14.6
	24	6	12.5
	25	10	20.8
	Total	48	100
Leg muscle strength	Under	1	2.1
	Below average	3	6.3
	Enough	7	14.6
	Good	15	31.3
	Very Good	22	45.8
	Total	48	100
Static Balance	Under	0	0
	Below average	4	83
	Enough	8	16.7
	Good	16	33.3
	Very Good	20	41.7
	Total	48	100

Table 2. Relationship between Leg Muscle Strength and Static Balance

Variable Correlation	Correlation	*P Value*
Leg Muscle Strength -Static Balance	0.954	0.000

level between leg muscle strength and static balance in surfers aged 18-25 years at Sanur Beach. In this study, the results of measuring leg muscle strength with static balance showed several things. One of them is that the better the leg muscle strength of the sample, it refers to a good or stable static balance.

Leg muscle strength is the result of muscle contraction activity, which has different levels of quality.[17] The quality of physical performance is determined by the condition of the muscles themselves. Developing leg muscle strength requires regular, continuous, systematic training, starting with age-appropriate basic techniques, taking into account the athlete's performance and growth.[18] Surfers can increase the load gradually to prevent loss of strength and reduce the risk of injury caused by overtraining.

Balance or stability traditionally refers to a situation where opposing forces are balanced.[19] It is very important in almost every movement and is sometimes referred to as postural control, which includes the ability to maintain body balance in the force of gravity by keeping the center of body weight in the same position.[20] Balance is supported by components controlling balance including sensory information systems, synergistic postural muscle responses, muscle strength, adaptation systems, and joint range of motion.[21]

Most subjects have excellent, good, and moderate levels of static balance and excellent, good, and sufficient levels of leg muscle strength. According to Ramdan Pelana's research in 2015, balance or stability is defined as a state of balance between opposing forces. It is an important part of almost every athletic activity. Postural control is the ability to maintain balance in conditions of gravity by paying attention to the location of the body's center of gravity. The synergistic response of the sensory information system and postural muscles are elements that control balance, including muscle strength.[22]

This research is also supported by research conducted by Posa et al., found that with good strength in leg muscles, a person can maintain good static balance while standing. The limbs, known as the support area or support base, affect posture control because they respond to changes in posture caused by swaying. From the statements and research results that have been described, previous studies have answered the research hypothesis that leg muscle strength is related to static balance in surfers in Denpasar City. This means that the better the leg muscle strength, the better the static balance when the surfer stands on the surfboard.[23]

As the previous debate has shown, this study has a number of shortcomings. First, even with the complete sampling technique, the sample size is constrained. This resulted from the surfer's strength in their legs, which limited the sectors in which studies could be conducted. Secondly, there are still a lot of environmental elements that researchers are unable to control.

CONCLUSION

Based on the results of research, there was a significant relationship between leg muscle strength and static balance in surfers in Denpasar City. Further study may use prospective randomized control trial design to evaluate the effect of muscle strength to the static balance in surfers.

ETHICAL CLEARANCE

Universitas Udayana granted approval for this study under registration number 266/UN14.2.2.VII.14/LT/2023. Additionally, informed consent from the survey participants was supplied, endorsing the sampling technique.

CONFLICT OF INTEREST

No conflicts of interest declared.

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AUTHOR CONTRIBUTIONS

CIAP created the study design principles, composed the article, and conducted the data analysis. The people in charge of gathering data and editing the paper were IDGAK, IGAA, and IMNW.

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