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The influence of balance of leg muscle explosive power and confidence on the climbing success of rock climbing athletes

Bayu Hardiyono[1*], Selvi Atesya Kesumawati[2], Dwi Huriati[3], Agustin Dwi Cahyani[4], Al Kautshar[5]

[123] Pendidikan Olahraga, Universitas Bina Darma, Palembang, Indonesia

[1]bayu.hardiyono@binadarma.ac.id *; [2] kesumawati@binadarma.ac.id [3] ; dwi.hurriyati@binadarma.ac.id ; [4] agustindwicahyani2002@gmail.com ; [5] alkautshar718@gmail.com
*corresponding author

ABSTRACT

This research aims to determine the extent of the influence of three independent variables, namely balance, lower limb muscle explosive power, self-confidence, on the dependent variable, climbing performance. The method used in this study is path analysis, which is a technique employed to investigate the causal relationships between independent and dependent variables. The sample for this research consists of 30 rock climbing athletes. In order to collect research data, various test instruments were used, including (1) Climbing test, (2) Questionnaire, (3) Dynamic balance test, and (4) Belly muscle explosive power test (vertical jump). The data analysis techniques utilized in this study include (1) path analysis, (2) simple correlation, and (3) coefficient of determination. The findings of this study reveal that: (1) out of the six research questions posed, all of them indicate results confirming a direct influence among the variables under investigation. (2) The direct impact of lower limb muscle explosive power on the climbing success of rock climbing athletes exhibits the highest results compared to other problem formulations.

***Keywords**: Balance, Explosive Power, Self-Confidence*

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Correspondence Address:
Bayu Hardiyono
Universitas Bina Darma
Ahmad Yani street No. 3 Plaju, Palambang Indonesia
E-mail: bayu.hardiyono@binadarma.ac.id

INTRODUCTION

Sport is a physical activity carried out according to certain rules with the aim of improving body condition and instilling moral values in its implementation (Hardiyono et al., 2023). In view (Hardiyono, 2019), Sport can also be considered as an effort to improve an individual's quality of life. According to (Amansyah, 2019) (Tangkudung, 2012), The scope of sports activities includes three main aspects: (a) educational sports, (b) recreational sports, and (c) achievement sports. The main goal of sport is to develop aspects such as health, physical fitness, critical thinking abilities, emotional balance, social skills, logical thinking abilities, and moral actions through physical activity and sports. In general, when we talk about sports, we focus on the various types of sports activities that exist, as expressed by (Rudiansyah et al., 2017). The World Health Organization (WHO) has outlined clear guidelines regarding the minimum limit of physical activity required to maintain human health and physical condition,

in accordance with the explanation provided by (Lippi et al., 2020). In relation to achieving achievements as one of the goals of sport, many factors have an impact on achieving these achievements, as explained by (Hardiyono, 2019).

If we pay close attention, performance sports have an important role in bringing greater benefits to the world of sport. Achievement sports are a form of sports activity that involves coaching and developing athletes in a planned, gradual and continuous manner through various competitions, with the intention of achieving high achievements. supported by sports knowledge and technology (Soekardi, 2015). Sports achievements can be a source of pride and increase the self-esteem of individuals, communities and countries. Perseverance in achieving sporting achievements is very broad, for example in the sport of rock climbing which offers a number of medals. (Abadi, 2016) and (Mulki et al., 2022), As time goes by, rock climbing is a sport that has now become very popular in Indonesia and is in demand by various age groups, including men and women, from youth to adults.

Rock climbing is an activity that requires physical ability to reach heights as well as technical skills in placing hands and feet on the cliff surface (Saputra & Rifki, 2019). Rock climbing is generally done in areas with rock contours that have a slope angle greater than 45 degrees and a certain level of difficulty. However, as time goes by, rock climbing can also be done in various locations by creating artificial walls that resemble natural cliffs (Candra & Hidayat, 2023).

According to the explanation (Putri & Khamidi, 2013), Rock climbing can be done in two types of places, namely artificial cliff walls and natural cliff walls. In the sport of wall climbing, there are various competition numbers, including difficult, bouldering and speed categories, as explained (Mulki et al., 2022). These three categories are divided into various competition numbers, including speed numbers for women, speed numbers for men, and even numbers involving groups. Of all these categories, the difficult category is often the favorite of climbers because it offers a huge challenge and receives high awards (Hardiyono, 2019).

The difficulty category is one of the segments used in wall climbing competitions, where participants must follow a predetermined route with a certain level of difficulty. This wall climbing approach uses a leading system, starting from the starting point, and participants must attach a lifeline to the runner ring when passing each runner during their journey. Good physical condition is a key element that needs to be fulfilled to achieve optimal performance, as stated. In the world of rock climbing, physical condition has a central role in all sports. An

athlete's success depends largely on their physical condition. (Supriyoko & Mahardika, 2018), states that physical health is a very important factor in improving an athlete's performance, so that an athlete must pay serious attention to their physical condition. (Prima, 2021) also emphasized that physical condition is a crucial element for an athlete to improve and develop optimal athletic performance. Therefore, it is recommended to pay special attention to physical conditions that suit the characteristics and needs of each type of sport.

In the sport of rock climbing, athletes always need optimal physical condition (Candra & Hidayat, 2023). Given the high level of difficulty in the lead category, it is important for them to maintain top physical condition. The difficult category emphasizes three very important aspects of physical condition, namely balance, leg muscle strength, and level of self-confidence. These three physical factors have a key role in achieving extraordinary achievements in difficult category wall climbing. It is believed that rock climbing athletes who have strong physical conditions in these three aspects will be able to achieve brilliant achievements because these three physical conditions have a big influence on the athlete's ability to provide their best performance. (Tika Sharly, 2022) (Hidayatullah, 2020). In rock climbing, it is important to achieve maximum performance because the height of the board and the variety of routes can cause fatigue in the climber. The lead category in rock climbing is often associated with the height of the board and a challenging climbing path (Candra & Hidayat, 2023). Physical condition has a central role in supporting the application of the techniques required in rock climbing. Therefore, having optimal physical condition can make it easier to achieve high performance. In wall climbing, achievement is often measured by the extent to which a climber successfully completes the route to reach the top. Climbers who have good performance tend to be able to complete routes quickly.

Based on the understanding above, researchers with an academic background who care about rock climbing performance wish to identify problems and find solutions. For this reason, research is needed that has direct relevance to training and development of physical condition, especially in the context of balance, leg muscle strength, and level of self-confidence. This is because the training program for difficult category rock climbing relies heavily on developing these dominant physical aspects.

METHOD

In this research, the path analysis method will be used by this researcher. This method has the aim of examining the cause-and-effect relationship between the independent variable and the dependent variable (Kadir, 2015). The population that is the focus of the research is all rock climbing athletes in South Sumatra, numbering around 30 athletes. Because the population is limited to only around 30 athletes, this research decided to involve all members of the population as research subjects. In other words, this research can be categorized as population research. In order to collect research data, various test instruments were used, including (1) climbing test, (2) questionnaire, (3) dynamic balance test, and (4) leg muscle explosive power test (vertical jump). To analyze data and test research hypotheses, various analytical techniques are used, including (1) path analysis, (2) simple correlation, and (3) coefficient of determination.

RESULTS AND DISCUSSION

Results

This research refers to four variables that have been previously determined, namely the climbing success variable for rock climbing athletes in South Sumatra (Y), balance (X_1) which includes the Dynamic Balance Test, leg muscle explosive power (X_2) which is measured via the Vertical Jump Test, and level of self-confidence (X_3) assessed using a questionnaire. This research aims to examine the influence of exogenous variables (X_1, X_2, X_3) on endogenous variables (Y). The aim of this research is to answer a number of research questions, such as (1) is there a direct influence between balance on the climbing success of rock climbing athletes, (2) is there a direct influence between leg muscle explosive power on the climbing success of rock climbing athletes, (3) is there is there a direct influence between the level of self-confidence on the climbing success of rock climbing athletes, (4) is there a direct influence between balance on the level of self-confidence, (5) is there a direct influence between the explosive power of the leg muscles on the level of confidence, and (6) is there There is a direct influence between balance on the explosive power of the leg muscles.

The results of data analysis using SPSS 26 lead us to the results of hypothesis testing in this research, based on a causal model that has been formed theoretically. The theoretical causal model of this research can be explained as follows:

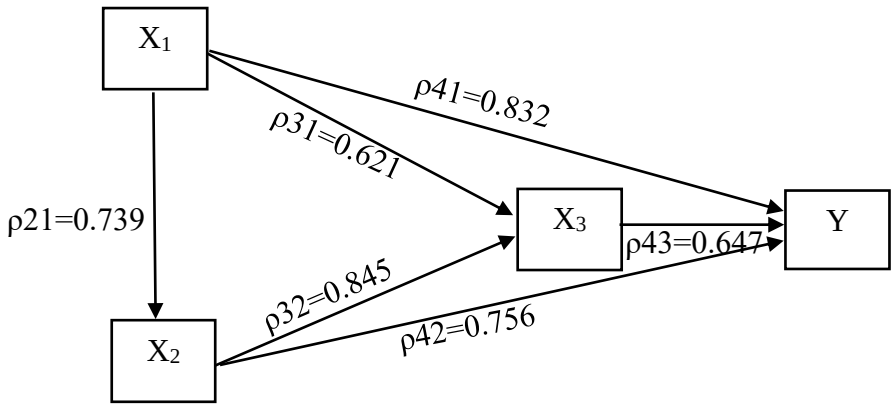

Figure 1: Relationship of X_1 X_2 X_3 Structure to Y

In this causal model, there are six path coefficients, namely ρ41, ρ31, ρ42, ρ32, ρ43, ρ21. Each path coefficient will be tested to determine whether it is significant or not using the t-test. If the tcount value is greater than the ttable value for each path coefficient, then it can be concluded that the causal model has a significant path coefficient. The standard ttable value for a confidence level of 0.05 is 1.32, while for a confidence level of 0.01 it is 2.21. However, if the tcount value is smaller than ttable, then the path coefficient is considered insignificant, and is likely to be removed from the causal model through the model trimming process.

Based on the results of the previous analysis and calculations that have been carried out, it can be stated as follows:

Table 1. previous analysis and calculations that have been carried out

No	Direct Influence	Path Coefficient	DK	t_{count}	t_{table}	
					0.05	0.01
1	X_1 Against Y	0.832	29	8.371	1.69	2.46
2	X_2 Against Y	0.621	29	8.425	1.69	2.46
3	X_3 Against Y	0.756	29	8.011	1.69	2.46
4	X_1 Against X_3	0.845	29	8.291	1.69	2.46
5	X_2 Against X_3	0.647	29	5.231	1.69	2.46
6	X_1 Against X_2	0.739	29	6.755	1.69	2.46

Discussion

The results of the model analysis obtained are the basis for answering hypotheses and formulating conclusions in this research. The following is an explanation of the hypothetical answer:

1. Direct Influence of Balance (X_1) on Climbing Success (Y)

Based on the results of path analysis calculations, it was found that balance (X_1) has a direct positive influence on climbing success (Y), with a path coefficient value of 0.832. The tcount value reaches 8.371, while the ttable value for degrees of freedom (dk) = 29 at the significance level α = 0.05 is 1.69. In other words, the tcount value is higher than the ttable value, so H0 is rejected and H1 is accepted. This indicates that balance (X_1) has a positive and significant impact on climbing success (Y). These findings are also supported by theory, which states that body balance is an important factor in achieving success in climbing. Development of technical skills such as balance, gripping movements, stepping in an infinite variety of ways, positions and angles used when climbing (Hardiyono & Nurkadri, 2018). Similar things were stated (Cahyanigtyas & Muahammad, 2020), stated that in the sport of rock climbing, the ability to position the hands and feet on the platform is very necessary for balance movements that help make it easier for a climber to move from place to place.(Widiastuti, 2015), Balance is the ability to maintain the correct posture and position of the body, both when still (static balance) and when making movements (dynamic balance). The success of climbing is very dependent on the ability to maintain body balance, especially when the athlete is at a height and must maintain balance on a narrow surface, overall, this research confirms that body balance plays an important role and has a direct influence on climbing success in rock climbing.

2. Direct Influence of Leg Muscle Explosive Power (X_2) on Climbing Success (Y)

Based on the results of the path analysis that has been carried out, it is concluded that leg muscle explosive power (X_2) has a direct positive influence on climbing success (Y). The path coefficient for this relationship is 0.621. The tcount value obtained is 8.425, while the ttable value for degrees of freedom (dk) = 29 at the significance level α = 0.05 is 1.69. Therefore, the tcount value is greater than the ttable value, which indicates that leg muscle explosive power (X_2) has a significant positive impact on climbing success (Y). These findings are consistent with the view that rock climbing requires the use of all body parts and relies on physical aspects to carry out explosive movements. This is reinforced by (Khoirunnisa et al.,

2020), Rock climbing is a sport that involves all parts of the body and requires physical components to be able to perform explosive movements. This research also shows that leg muscle power contributes directly to the kinesthetic perception of rock climbing athletes. (Nala, 2015) also identified different types of explosive power, including explosive power, fast explosive power, strong explosive power, and long-lasting explosive power, all of which have relevance in the context of sport climbing.

3. Direct Influence of Self-Confidence (X_3) on Climbing Success (Y)

By referring to the results of the path analysis that has been completed, it is concluded that self-confidence (X_3) has a direct positive influence on success in climbing (Y). The path coefficient for this relationship is 0.756. The tcount value obtained is 8.425, while the ttable value for degrees of freedom (dk) = 29 at the significance level $\alpha = 0.05$ is 1.69. Therefore, the tcount value is greater than the ttable value, which indicates that self-confidence (X_3) has a significant positive impact on climbing success (Y).

The results of the analysis indicate that there is a direct influence between the level of self-confidence and success in climbing. According to (Hardiyono, 2020), One of the factors that contributes to achievement is psychological factors. Psychological factors are factors that arise from a person's psychology, such as tension, excitement, self-confidence and anxiety. Every athlete or player must have felt tension, excitement, anxiety and self-confidence. In other words, the level of self-confidence influences success in climbing. As previously explained, and supported by theory, it can be concluded that self-confidence is a very important psychological factor and is the key for an athlete to achieve high performance and extraordinary achievements. Therefore, in the context of coaching and training in sports associations students, the task of every physical education teacher, coach, or sports coach is to instill values such as discipline, self-confidence, perseverance, tenacity, thoroughness, calm, passion, and the spirit not to give up (James Tangkudung dan Wahyuningtyas Puspitorini, 2012). The level of self-confidence plays a very important role in determining the extent to which a person can succeed and achieve high achievements in the sport of wall climbing. Self-confidence, in this context, is a person's belief that they have the abilities and capacities necessary to achieve certain achievements. When someone has achieved high levels of achievement, this can increase their level of self-confidence significantly.

4. Direct influence of balance (X_1) on self-confidence (X_3)

Based on the results of the path analysis that has been carried out, it is concluded that balance (X1) has a direct positive influence on self-confidence (X3). The path coefficient for this relationship is 0.845. The tcount value obtained is 8.291, while the ttable value for degrees of freedom (dk) = 29 at the significance level α = 0.05 is 1.69. Therefore, the tcount value is greater than the ttable value, which indicates that balance (X1) has a significant positive impact on self-confidence (X3), from the findings of the analysis above, it can be concluded that balance has an important role in influencing the level of self-confidence of rock climbing athletes. This is in accordance with the theory which states that balance affects an athlete's ability to maintain their position when standing or hanging on only one leg or hand. In carrying out such actions, good technique, calmness, and self-confidence are necessary. These factors are positive keys in achieving achievements for rock climbing athletes, Hardiyono. B. (2020), therefore, understanding and developing balance must be an integral part of the coaching and training of rock climbing athletes. Training that supports physical and mental balance can help athletes deal with situations that require stability and confidence, which can ultimately improve their performance in this sport.

5. Direct influence of leg muscle explosive power (X_2) on self-confidence (X_3)

Based on the results of the path analysis that has been carried out, it is concluded that Limb Muscle Explosive Power (X_2) has a direct positive influence on self-confidence (X_3). The path coefficient for this relationship is 0.674. The tcount value obtained is 8.291, while the ttable value for degrees of freedom (dk) = 29 at the significance level α = 0.05 is 1.69. Therefore, the tcount value is greater than the ttable value, which is mengindikasikan bahwa Leg Muscle Explosive Power (X_2) has a significant positive impact on Self-Confidence (X_3)

6. Direct influence of balance (X1) on leg muscle explosive power (X2)

Based on the results of the path analysis that has been carried out, it is concluded that balance (X_1) has a direct positive influence on Limb Muscle Explosive Power (X_2). The path coefficient for this relationship is 0.739. The tcount value obtained is 6.755, while the ttable value for degrees of freedom (dk) = 29 at the significance level α = 0.05 is 1.69. Therefore, the tcount value is greater than the ttable value, which indicates that balance (X_1) has a significant positive impact on Leg Muscle Explosive Power (X_2).

CONCLUSION

In drawing conclusions based on research findings with four variables, namely exogenous variables (balance, leg muscle explosive power), intervening variables (self-confidence), and endogenous variables (climbing results), it can be stated that all six research questions asked in this study shows that there is a direct influence between the variables being studied. In other words, the research results state that these variables have an interrelated relationship and have a direct impact on each other in the research context of their influence on success in rock climbing. This reveals the complexity of the relationship between balance, leg muscle explosive power, self-confidence, and climbing results, and its relevance in understanding the factors that influence performance in this sport.

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