The Effect of Limb Muscle Strength and Limb Muscle Explosion on 100-m Run Achievement of Faculty of Sport Science Students Manado State University

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Abstract. Achieve this research to obtain empirical data and analyze; (1) the effect of leg muscle strength on the achievement of running 100 m. (2) The effect of leg muscle explosive power on 100-m running performance. (3) The effect of leg muscle strength and leg muscle explosive power together on the 100-m running performance of Faculty Of Sport Science Manado State University students. The type of research is a quantitative approach, a multiple correlation analysis technique. The overall population of Faculty Of Sport Science Manado State University students amounted to 58 athletes, the sample was obtained by using a simple random sampling technique, considering that the population characteristics were the same so the researchers set as many as 20 athletes as samples. Research instrument; (1) measuring the strength of the leg muscles using the "back and leg dynamometer test", (2) measuring the explosive power of the leg muscles using the "Squat-thrush test". Measuring running performance is done by sprinting 100-m. The data were analyzed by a statistical test, namely the r-test (partial and multiple correlations) which was preceded by the test of normality and linearity requirements. The results obtained; (1) there is an influence between leg muscle strength on 100-m running performance. (2) There is an influence between the explosive powers of the leg muscles on the achievement of running 100-m. (3) There is leg muscle strength and leg muscle explosive power simultaneously in the 100-m running performance of Faculty Of Sport Science Manado State University students.

Keywords: muscle strength · muscle explosive power · 100-m run

1 Introduction

A scientific approach to improving sports achievement in modern times cannot be negotiated anymore if we want to talk about sports, especially sports achievements. Achievement sports that are intended in the current development are competitive sports such as athletics, gymnastics, and various other sports and competitions. While the sports achievements achieved are the cumulative result of various business aspects, besides

that, realizing the achievement in question requires a relatively long process, including through "training" or training.

To improve the performance of sports in general and in particular in athletics such as the 100-m run, it is necessary to determine the existence of good physical conditions, some argue that the decline in 100-m running performance is the result of a runner's lack of physical abilities such as leg muscle strength or leg muscle explosive power, while on the other hand questioning the lack of technical maturity, tactics, and mentality of the athletes. In connection with this training issue, it is nothing but preparing athletes or athletes for the basic maturity of physical abilities, techniques, tactics, and mentality. [1].

The fact because there are runners in the 100-m running number, Faculty Of Sport Science Manado State University students are often found just like to run but have not been able to run properly. There are still many who have not been able to run at high speed and perfect running techniques, there are even runners who when entering the finish line are barely able to enter the finish line. This may be due to the strength of the leg muscles, the speed of the leg muscles (muscle explosive power), and also the endurance factor of the leg muscles which are still weak. Seeing the fact that this will certainly have an impact on the ability of his running performance that is not optimal. This fact shows that the lack of training and understanding of each student about the importance of leg muscle explosive power, muscle strength, speed, and endurance of the leg muscles are associated with sprint or sprint running techniques.

In everyday vision and experience, it is clear that in athletic sports, especially in sprint numbers such as the 100-m run, the problem of physical ability will be felt, because to maintain good playing techniques it is necessary and must be supported by a prime physical condition. But whether the physical ability is the accumulation of all components of physical conditions such as; muscle explosive power, muscle strength, muscle endurance, agility, speed, flexibility, balance, and coordination?, Of course, den the expected priority scale. [2].

Running speed training consists of (1) running 10 to 100 m done repeatedly with sufficient rest time, (2) training reactions to sound, movement, or touch cues (done in the form of play)". This shows that running training with a distance of 10 to 50 m is more intended for children aged around 11 years and for adults to run 100-m. [3].

Leg muscle strength and leg muscle explosive power are part of the components of physical condition which are an integral part of the other components and cannot simply be improved or maintained. This means that to increase the components of muscle strength and muscle explosive power as a whole, other components must also be considered and developed even though the implementation is carried out with a priority system according to the circumstances or status of each physical component that is desired or needed based on each sport. Before talking more specifically about muscle strength, some limitations of the experts are put forward as stated by "Muscle strength is the ability of muscles to be able to overcome resistance/load, hold or move loads in carrying out sports activities". Another similar limitation is stated by Sajoto as follows, "strength is the ability to use muscles to accept loads while working". On the other hand, the limitation of muscle strength put forward by Ngurah Nala is that "Strength is the ability of the body's skeletal muscles to contract or maximum tension in receiving loads while carrying out activities" [4]. The opinion by Harsono is that "strength is the ability

of muscles to generate tension against a prisoner" [5]. From some of the limitations on muscle strength, it can be formulated that leg muscle strength is the ability of an athlete/player to use muscles, especially the muscles in the legs and lower extremities as well as the muscles around them to receive the maximum load when doing work or sports activities. [6].

In terms of the discussion for this research, the components of leg muscle strength and leg muscle explosive power are the focus of the discussion, considering that this component has a very significant role in mastering techniques in athletics, especially in this study which is limited to running numbers with 100-m running achievement.

2 Method

The method used in this study is a survey method with a correlational study. The design used can be described in the form of a chart. This research is a product moment correlation and multiple correlations:

Information:

X1: Leg muscle strength.

X2: Endurance of leg muscles

Y: Achievement in running 100-meters)

The population is the entire Faculty Of Sport Science Manado State University student totaling 58 athletes, assuming the entire population has the same characteristics. The sample intended in this study was obtained using a simple random sampling technique, considering that the characteristics of the population are the same so the researchers set as many as 20 players who were set as the research sample. The research instruments used in this research are; (1) To measure the strength of the leg muscles, the "back and leg dynamometer test" is used, (2) To measure the explosive power of the leg muscles, the "Squat-thrush test" is used. To measure the performance of running, a sprint of 100 m was carried out. The data obtained will be analyzed with test statistics, namely, the r-test (partial and multiple correlations) which is preceded by tests of normality and linearity requirements Fig. 1. [7].
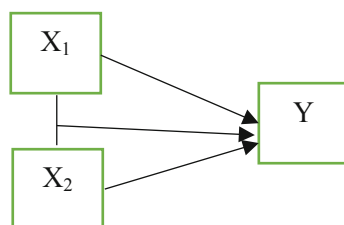

Fig. 1. Research design

3   Results and Discussion

3.1   Results

The calculation results obtained rx_1y observations of rob $= 0.714$ when compared with r table (n,(20); $\alpha = 0.05$) obtained by rtab $= 0.444$. From these results indicate that the value of rob $= 0.714 >$ rtab value $= 0.444$, then from the coefficient of determination $r = (0.714)2$ x $100\% = 50.98\%$, it means that the contribution or positive contribution/influence of leg muscle strength is 50.98% on the 100-m running achievement variable. Thus, this means that Ho is rejected and Ha is accepted which states that there is a positive and significant influence between leg muscle strength $(X1)$ on 100-m running performance (Y) in male students of Faculty Of Sport Science Manado State University.

The calculation results obtained rx_2y observations of rob $= 0.845$ when compared with r table (n,(20); $\alpha = 0.05$) obtained rtab $= 0.444$. From these results, it shows that the rob value $= 0.845 >$ rtab value $= 0.444$, then from the coefficient of determination $r = (0.845)2$ x $100\% = 71.40\%$, it means that the contribution or positive contribution/influence of leg muscle explosive power is 71.40% on the 100-m running achievement variable. Thus, this means that Ho is rejected and Ha is accepted which states that there is a positive and significant influence between leg muscle explosive power $(X2)$ on 100-m running performance (Y) in male students of Faculty Of Sport Science Manado State University.

The calculation results obtained rx_1x_2y observations of rob $= 0.858$ when compared with r table (n,(20); $\alpha = 0.05$) obtained by rtab $= 0.444$. From these results indicate that the value of r observations (rob) is greater than the value of r table (rtab) or in other words rob $= 0.858 >$ value rtab $= 0.444$, then from the coefficient of determination $r = (0.858)2$ x $100\% = 73.62\%$, it means that the contribution or positive contribution/influence of the variable leg muscle strength and leg muscle explosive power together is 73.62% on the 100-m running achievement variable, while the remaining 26.39% is determined by the presence of other variables not reached by the researcher. Thus, this means that Ho is rejected and Ha is accepted which states that there is a positive and significant relationship between leg muscle strength $(X1)$ and leg muscle endurance $(X2)$ together with 100-m running achievement (Y) in male students of Faculty Of Sport Science Manado State University.

3.2   Discussion

Based on the results of the analysis which states that there is a positive and significant influence between leg muscle strength $(X1)$ on the 100-m running achievement (Y) in male students of Faculty Of Sport Science Manado State University. This result is indicated by the obtained correlation coefficient of 0.714 while the rtable is 0.444 (rob $= 0.714 >$ rtable $= 0.444$), then from the coefficient of determination $r = (0.714)2$ x $100\% = 50.98\%$, it means that the contribution or positive influence of leg muscle strength is 50.98% on the 100-m running achievement variable, which when compared with the interpretation criteria of the correlation index is in the very strong category. These results are adjusted to Harosono's opinion, that "muscular power and explosive power

are the ability to perform explosive movements, power is the result of the maximum multiplication with the time of execution of the movement, or the ability of a person to perform maximum power with the effort that is done in the shortest possible time". Muscle strength is needed to improve performance in almost all sports. However, it must be known with certainty the use of muscle strength and explosive power itself. Because each sport has a different nature and type of motion. In some sports, coaching requires speed-oriented strength, while in certain sports it is strength-oriented. So the level and type of power or explosive power depend on the type of activity. Furthermore, from the calculation of the coefficient of determination between the variable leg muscle strength on the 100-m running performance, the magnitude of the coefficient of determination $r^2 = 50.98\%$ means that the contribution or influence of leg muscle strength on the 100-m running performance in male students of Faculty Of Sport Science Manado State University is 50.98%. Furthermore, the remaining 49.02% is determined by other variables that cannot be explained one by one or are not discussed in this study.

Based on the results of the analysis which states that there is a positive and significant influence between the variable leg muscle explosive power (X2) on the 100-m running achievement (Y) in male students of Faculty Of Sport Science Manado State University. This result is indicated by the obtained correlation coefficient of 0.845, while rtable is 0.444 or (rob = 0.845 > rtable = 0.444), then from the coefficient of determination r = $(0.845)2$ x 100% = 71.40%, it means that the contribution or positive influence of leg muscle explosive power is 71.40% on the 100-m running achievement variable, which when compared with the interpretation criteria of the correlation index is in the very strong category. These results give the meaning that "endurance of muscle strength and speed is the ability of muscles to be able to overcome resistance/load, hold or move loads repeatedly in carrying out sports activities"[8]. From this opinion, it can be formulated that the explosive power of leg muscle strength is the ability of an athlete/player to use muscles, especially the muscles in the legs and the muscles around them to accept the load repeatedly for a long time doing work or sports activities. Furthermore, from the calculation of the coefficient of determination between the variable leg muscle strength and 100-m running performance, the magnitude of the coefficient of determination r^2 = 71.40% means that the contribution or influence of leg muscle endurance on the 100-m running performance of male students of Faculty Of Sport Science Manado State University is 71.40%. Furthermore, the remaining 28.60% is determined by other variables that cannot be explained one by one or are not discussed in this study.

Based on the results of the multiple correlation test analysis which stated that there was a positive and significant effect between leg muscle strength (X1) and leg muscle endurance (X2) together on the 100-m running achievement (Y) in male students of Faculty Of Sport Science Manado State University. This result is indicated by the acquisition of a multiple correlation coefficient of 0.858, then from the coefficient of determination R Square = $(0.858)2$ x 100% = 73.62%, then from the coefficient of determination R Square = $(0.858)2$ x 100% = 73.62%, it means that the contribution or positive influence of leg muscle strength and leg muscle endurance together is 73.62% on the 100-m running achievement variable, which when compared with the interpretation criteria of the multiple correlation index in the very strong or high category. From these results, it can be concluded that jointly leg muscle strength and leg muscle endurance are the

basic components of biomotor as a good mover to improve the movement ability of techniques in carrying the ball, throwing, dribbling, putting the ball into the basketball hoop or running fast which in this case is running 100-m because an athlete's good physical condition will determine his achievement; as Sajoto said, that "physical condition is one of the indispensable requirements in every effort to improve athlete achievement, it can even be said to be the basis of an achievement prefix"9. Physical condition is a unified whole that cannot be separated, both improvement and maintenance means that every effort to improve physical condition, then must develop all these components although it needs to be done with a priority system. From the results of the analysis of the multiple correlation test and the R square test which stated that there was a positive and significant effect between leg muscle strength and leg muscle endurance together on the 100-m running achievement in male students of Faculty Of Sport Science Manado State University, this has proven that the two variables in the form of leg muscle strength and leg muscle endurance have made a positive contribution to the 100-m running performance. This is reinforced by the results of the multiple correlation coefficient of $Ry1,2 = 0.858$ with a coefficient of determination of R Square $= 0.736$. This means that the contribution or contribution of leg muscle strength and leg muscle explosive power together in the 100-m running achievement is 73.62%. Furthermore, the remaining 26.38% is determined by other variables that are not explained one by one or are not discussed in this study. With the results obtained, it shows that both leg muscle strength and leg muscle endurance, which have a high level of explosive power and strength and speed and is supported by fast and precise movements, will have a positive impact on the activity of the 100-m sprint technique. Thus it can be said that leg muscle strength and leg muscle explosive power together have a positive and significant effect on the 100-m running performance of male students of Faculty Of Sport Science Manado State University.

4   Conclusion

4.1   Conclusion

Based on the results of research and discussion, several conclusions can be drawn as follows.

1) There is an influence between leg muscle strength on the achievement of running 100 m in Faculty Of Sport Science Manado State University students.
2) There is an influence between the explosive powers of the leg muscles on the 100-m running performance of Faculty Of Sport Science Manado State University students.
3) There is an effect between leg muscle strength and leg muscle explosive power simultaneously on the 100-m running performance of Faculty of Sport Science Manado State University students.

4.2   Suggestion

1) To improve the 100-m running performance for male students of Faculty of Sport Science Manado State University, it is necessary to pay attention and prepare good

physical abilities, the physical abilities referred to include muscle strength and muscle explosive power, especially the leg muscles as well as the presence of other physical condition components that also affect the ability of athletes or students, especially in performing running techniques.

2) As input for coaches and coaches in applying appropriate training methods to improve mastery of techniques, especially mastery of the 100-m running technique and in general on all basic techniques in athletics.

3) It is recommended that further research involves other components of physical condition, such as muscle reaction speed and leg muscle power, initial speed and movement speed, and coordination.

4) The results of this study may provide additional information for further research.

Authors' Contributions. The author in this study served as the head of the research and coordinated the entire series of research activities.

References

1. R. R. Pate, B. A. MacClenaghan, and R. J. Rotella, *Scientific foundations of coaching*. Saunders College Publishing, 1984.
2. D. Nurhasan *et al.*, *petunjuk Praktis Pendidikan jasmani*. Surabaya: Unesa University Press, 2005.
3. P. Mutalib, *Mengukur Kemampuan Fisik Pengolahraga Secara Sederhana*. Jakarta: Arcan, 1984.
4. N. Nala, "Prinsip pelatihan fisik olahraga," *Denpasar Univ. Udayana*, 1998.
5. M. Harsono and G. Sugiantoro, *Latihan Kondisi Fisik*. Bandung: ANKOR-MENPORA-(SORI), 1988.
6. C. Harsono, *Aspek-aspek Psikologi dalam Coaching*. Jakarta: CV Tambak Kusuma, 1988.
7. T. O. Bompa, "Theory and Metodologi of Training (Dubuque, Iowa: Kendall/Hunt Publishing Company,)," 1990.