

## Impact of Muscular Strength and Body Composition on the Performance of Young Wrestlers

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### Abstract

The paper has examined how muscular strength and body composition affect wrestling performance in young male wrestlers aged between 18-25 years. The 20 wrestlers took part in the research, and they were subjected to strength tests by 1RM: bench press, squat, and deadlift, and body composition; the skinfold calculus and bioelectrical impedance analysis (BIA). The wrestling performance was measured using the match simulation success, endurance and agility measures. The outcomes revealed that there was a positive relationship existing between muscular strength and wrestling performance ( $r = 0.62$ ) whereby wrestlers with strong or high muscular strength recorded the best results in wrestling performance. Equally, the lean body mass had a positive relationship with wrestling performance ( $r = 0.55$ ) which shows the significance of muscle mass in increasing the endurance, power and technical skills. In their turn, the percentage of body fat was found to interrelate negatively with the performance ( $r = -0.48$ ), which indicates that the lower the body fat, the more agile and efficient one will be in wrestling. The muscular strength along with the lean body mass was found via multiple regression analysis to contribute to 55.3 percent of the variance in wrestling performance with muscular strength as the most notable predictor. The results of the mentioned studies demonstrate the importance of strength and muscle mass in the performance of wrestlers, and body fat percentage is secondary. This research recommends strengthening of the body and building of muscle mass among wrestlers in the management of fat in the body to enhance performance. These findings have practical implications on wrestling coaches and athletes in which specific training methods are relevant. Further studies might also involve studying other factors that affect performance at wrestling.

### Introduction

The importance of wrestling, being one of the most exalted sports of physical activities, is highly maintained since ancient periods and still has a strong presence in the world today. The game demands skill in athletes with a mixture of power, speed, stamina and skillfulness to be able to beat their rivals (Baić et al., 2022). In this spectrum, there are two major elements that are important in determining the success of a wrestler, and that is muscular strength and body composition. The muscular strength is the capacity of a wrestler to provide the force against the resistance, which is essential to make the strong operations such as takedowns, throws, and holds. On the other hand, body composition entails the relationship of the lean mass (muscles and bones) to the fat mass in the body of an athlete (Bölükbaşı et al., 2025). The best body composition in wrestling is that which has a high lean body mass and a lower body fat which may enhance agility, endurance as well as performance in wrestling. It has been shown that strength training is an effective way to increase the muscular strength and performance in most sports (Cerit et al., 2025). Nevertheless, wrestling is an exception due to the competition of the weight classes where competitors have to take care of their weight constituents and maintain the fat percentage of their bodies to compete at their best. Rather than just being in good physical condition and possess adequate strength to hump their competitors, wrestlers should also have a lighter body shape to

stay competitive in their future bouts in the weight classes(Bakhodirovich, 2024). The significance of muscular strength and body composition in wrestling is supported by the study that shows that wrestler having more muscular strength would be better in the performance of the wrestling match. More powerful wrestlers have a higher advantage of making powerful takedowns, to sustain control over their opponents and to endure high intensity wrestling longer. Conversely, the body mass is critical in enhancing the endurance, quickness, and agility of the wrestler in the mat(Skugor et al., 2025). The best body composition that is composed of a higher percentage of muscle mass and lower fat levels makes athletes more agile and better enduring because such are more effective on the field. Despite the fact that muscular strength and body composition are widely researched in most sports, there has been minimal information on their positive and negative influence within the performance of the young wrestlers. Being in a very unfortunate stage of life, young wrestlers, particularly 18-25, require proper training being strength and body structure oriented that would give them a background of success in the sport in the long run. Also, physical aspects of wrestling demand the knowledge of interaction of these factors to enhance overall performance, decrease risks of injury, and enhance a competitive success(Dhillon & Malik, 2023).

This research is particularly narrowed to young wrestlers RYK region, the study seeks to determine the direct effect of muscular strength and body composition on their performance. Through comprehending the relationship between these two variables, coaches, trainers and sports scientists will have a better training and conditioning program that improves the performance of wrestling, aid in the maintenance of the optimal weight classes, and lower the chances of injury.

### **Problem Statement**

Although there has been a lot in literature which has addressed the importance of muscular strength and body composition to athletic performance in different sports, the same study has not been done on young wrestlers therefore very little literature has been written on how these two factors affect the performance of young wrestlers. Wrestling as a sport of weight class gives some special conditions where the weight and the body structure of a wrestler has to be properly balanced. There is a gap in knowledge because there is a lack of research studies focusing on the interaction of the two factors to affect the performance of wrestling, particularly among the youth of the RYK regions. This paper attempts to fill this gap and analyze the impact of muscular strength and body composition on the performance of young wrestlers in an attempt to identify the relationship between the two variables in relation to success in the sport.

### **Significance of the Study**

The importance of this research is in its result that can make a contribution to valuable information about the physical qualities that stimulates wrestling performance. The type of study will empower coaches, trainers, and sports scientists with empirical information to create stronger training programs by placing emphasis on muscular strength and body composition, which are two important factors to the success of wrestling. Knowing the role of these factors in improving the performance of a wrestler would assist in devising specific strength and conditioning programs, which would not only enhance physical performance, but also enable wrestlers to maintain optimum weight dimensions in their competitive fields. Also, the study focuses on young wrestlers aged 18-25 and thus represents an important stage of development during which, with the right training, long-term success in the sport can be achieved. The results will also have viable applications on how to improve performance and avert injuries and the final growth of the wrestling fraternity and its competitiveness.

### Research Objectives

- To determine the prominent impact of muscular strength and physique makeup on the displays of young wrestlers.
- The aim of the study was to explore the effect of muscular strength on the improvement of wrestling performance with regard to power, endurance, and technique execution.
- To determine the relationship between body composition (lean muscle mass and body fat percentage) and agility, stamina, and match performance of young wrestlers.
- To determine the relationship between the muscular strength and body composition to overall performance of young wrestlers.

### Research Hypotheses

**Hypothesis 1:** There is a significant positive correlation between muscular strength and wrestling performance.

- One of the main predetermining factors of success in wrestling is muscular strength because it determines directly whether an athlete can make powerful moves and keep the opponent under control and minimizes the risk of being taken down on the ground. The wrestlers are the ones with greater muscular strength to carry out forceful moves such as takedowns, pushes, and holds with greater efficacy hence enhance their performance during fights. Secondly, the muscle coordination can be improved by means of strength training and it is necessary to the perfect and effective performance of the techniques. This postulation will propose that wrestlers who have higher muscular strength will record higher performance results during the wrestling. The sports scientific research done earlier proves the hypothesis that the stronger the athlete is, the better the overall performance will be. Therefore, this hypothesis aims to establish the truth concerning the performance and success of stronger wrestlers in matches, resulting in the victory in the competition, faster recovery and fatigue resistance in wrestling activities of high intensity.

**Hypothesis 2:** Wrestlers with a higher lean body mass and lower body fat percentage will perform better in wrestling matches.

- In wrestling, the composition of bodies is important in that the optimal body fat to lean muscle mass is the determinant to excellence. Lean body muscle gives the wrestler strength and power to use in this wrestling, whereas the lower body fat enhances better agility, speed, and stamina. The hypothesis is that wrestlers who have a disproportionate quantity of lean body mass and a low body fat percentage will perform better compared to wrestlers who have a large body fats. The values of less body fat and greater lean mass in athletes have been found to Correlate with improved endurance, quicker reaction times, and improved mobility, all of which are valued in the wrestling matches (Wyatt et al., 2019; Jukic et al., 2018). The research will test this hypothesis to confirm that the body structure of wrestlers affects their performance through the effectiveness of being able to perform techniques more efficiently, in the match longer, and have more agility.

**Hypothesis 3:** A combination of muscular strength and favorable body composition will significantly predict wrestling performance outcomes.

- This hypothesis is a combination of two key aspects of physics, such as muscular strength and body composition, which will claim that their combination will be an excellent indicator of a good wrestler. Although both factors will affect the performance independently, the combination of these two factors is likely to have a compound impact. Strong muscles can get one through the heavy techniques being used by a wrestler though an ideal body composition (low body fat and high lean muscles) will improve overall agility, stamina, and velocity. Thus, the hypothesis of the proposed study is the idea that wrestlers combined both with strong performance and good body composition will achieve

a better result than their counterparts who possess only one of these qualities. Past research shows that those who are skilled in strength and body composition are likely to perform highly in different sporting activities (Montenegro et al., 2021). This theory is aimed at shaping the hypothesis that the best body composition, as well as the development of muscular strength, will be the most successful solution because a holistic approach provides the best basis to predict the best results at the matches.

### **Literature Review**

The chapter covers the current studies examining the effect of muscular strength and body structure in wrestling. This review offers a vivid picture of the effects of the two factors of success in athletic performance by analyzing the related literature and conceptualization on the subject matter, especially among the young athletes in wrestling. This review is devoted to the importance of muscular strength and body composition in improving the performance of wrestlers, and its scientific basis, and practical solution are considered.

### **Wrestling Performance and Muscular Strength**

Wrestling mostly relies on muscular strength because the muscular strength is seen as the main determinant of a wrestler pushing with force against resistance. Wrestling is a massively physical sport with notable combative elements, which requires explosive strength to perform such moves as takedowns, pinning, and escapes. In many researches, muscular strength has been found to play an important role in the performance of sporting activities, particularly, wrestling. Strength training is also found to create better results in terms of increasing performance through force production, which plays a very critical role in performing the wrestling techniques (Tavares Junior et al., 2023). (Çağlar et al., 2024) argue that wrestlers with superior muscular strength are in a better position to deliver powerful takedown, resist against the moves of the opponent and stay at the peak performance during the match. Besides, strength training also helps in injury prevention as it strengthens the muscles, tendons, and ligaments to make wrestlers able to suit the high physical demands of the sport. In wrestling, strength is not absolute power but relative strength that can be considered as a ratio of the strength to body weight. This has been crucial especially in weight-class sports such as wrestling where the athletes are required to strike the right balance between weight and strength. Stone et al. showed that wrestlers who had a higher ratio of strength to their weights were better performers in their events since the strength is more productive in respect to their body sizes. This has seen the development of certain strength training regimes that can be used to grow muscle strength with little unwanted weight gaining hence maximizing the strength to weight ratio. A study by (Zahabi et al., 2024) also indicates that the strength training, especially that which is focused on particular muscle groups utilized in wrestling (e.g. shoulders, core or legs), can play a substantial role in the performance of a wrestler. Moreover, it will be able to improve muscle coordination which is essential in performing the complicated wrestling techniques with accuracy and effectiveness.

### **Body Composition and Performance in wrestling**

The body composition especially the lean to fat mass is an important factor in the performance of wrestling. The more lean muscle mass that a wrestler is combined with less fat percentage in the body towards makes them more enduring and fast as well as be a better wrestler. Body composition influences the responsiveness of the wrestler in his ability to pursue intense bursts of activity that are necessary in both the defense of the player as well as offense on the field. According to the study by (Dağdelen & Yavuz, 2023), wrestlers that have less body fat and greater lean mass of muscles have a greater capacity to perform during aerobic and anaerobic activities, which are part of wrestling matches. Fatness is regarded as a drawback in wrestling, with the extra

fat making movement difficult and reducing the reaction speed, whereas the fit body muscles give the required power and stamina to maintain the efforts during a wrestling bout. This is because the body composition plays a significant role in the context of the requirements of weight-class sports such as wrestling where athletes have to control their body weight in order to remain within a particular weight category. A normal body structure a high depiction of lean muscle mass with low body fats will help wrestlers work at their optimal level and yet still within the particular weight category. This plays a significant role in optimization of performance as well as compliance with competition regulations. According to the works by (Rodríguez et al., 2024), wrestlers who have superior body makeup are more agile, which have greater endurance and better movement quality. The reason behind this is that too much body fat may slow speed and movement and make an athlete difficult to make fast movements or even to recuperate on a hard physical effort. Thus, wrestlers of ideal body building are perceived to have better movements and can outwit their counterparts and maneuver techniques more proficiently.

### **Combinations of Muscular Strength and Body Composition**

Although each process separately is also significant, their combination of the two factors has a significant role in wrestling. Athletes who are large and strong muscularly and demonstrating good body composition (low fat content of the body, high lean tissue mass) are generally good in sports that demand power and stamina as is seen in wrestling. Strength and body composition are synergistic and result in greater overall performance. The studies by Stošić et al. and Hori et al. are helpful in proving the notion that the result of muscular strength and a perfect body complex is a great boost of a wrestler performance. An illustration is that even though muscular strength allows wrestlers to make strong steps, a good body constitution guarantees that they make the steps all with speed and stamina. Male wrestlers who succeed in this complement have more chances to prevail in a match, because the wrestlers are strong enough to overwhelm the opponent and well-built to maintain high intensity performance throughout the match. The two are especially helpful in wrestling since the sport demands explosion and endurance. Individuals with high amounts of lean muscle mass as well as strength levels are more likely to address the requirements of the sport, be able to react fast, and retain the energy levels during the match (Coletta et al., 2025; ŞAHİN, 2023).

### **The Physical Fitness in Wrestling Performance**

The physical fitness who includes strength, endurance, flexibility, and cardiovascular fitness is an important aspect in wrestling performance. Both anaerobic and aerobic capacity is required in wrestling because the athletes must be able to give their utmost in short periods of activity, which are followed by short rest periods. Some of the studies that indicate the importance of physical fitness in wrestling include the research conducted by (Kuru et al., 2025), who point out that wrestlers require the possibility of a holistic fitness profile to be on top. Strength is not a sufficient factor since wrestlers should also have very high cardiovascular fitness rates to be able to sustain stamina and recover fast between matches. Flexibility and mobility is also important, since they enable wrestlers to do numerous forms of movements accurately (Prokopczyk et al., 2024).

### **Research Methodology**

In this chapter, the methodology adopted in conducting the research is clearly described in order to examine the effect of muscular strength and body composition on the performance among the young wrestlers. The principle of the study was to determine how these two variables, that is, muscular strength and body composition relate and affect the performance in wrestling. In this chapter, the research design, research participants, data collection methods, tools, and procedure are described after which the data analysis technique that was applied in order to measure the results is described.

## **Research Design**

The study assumed an experimental format which took a pre-test and post-test format to investigate the influence of muscular strength and body composition change on wrestling performance. Through this design, a comparative study of the data can be made using the data collected during the preceding phase of intervention period be it training or natural observation, and the effects of the independent variables on the dependent variable are made clear. The baseline measures of muscular strength, body composition and wrestling performance were collected in the pre-test stage. The data collected was once more after the intervention or observation period in the post-test stage and this enabled the researchers evaluate the effects on changes in muscular strength and body composition on wrestling performance. The criticality of this research design is because it allows determination of the causal relationships between the two independent variables (muscular strength and body composition) and wrestling performance, and hence, give valuable information about how these variables contribute to the performance of the sport.

## **Participants**

Twenty male wrestlers were used in the study and the subjects were aged between 18 to 25 years and the region of RYK was also used in the study. These subjects were chosen according to the fact that they were active competitors in wrestling during a minimum of one year. The research particularly focused on the young male wrestlers because they are in a developmental stage where the change in the muscular strength and body composition may greatly affect their performance. The criteria used to include the participants meant that they had to have 1 year of competitive wrestling experience, which ensures that they were knowledgeable about the requirements of the sport. The participants were to be also free of any major injury in the last six months because this could confound the findings and affect performance. Those wrestlers who failed to comply with these conditions were locked out of the research. There was a reason behind the sample size of 20 wrestlers, which had enough statistical power on detecting meaningful differences of performance based on changes in muscular strength and body composition. This figure was also viable enough to make sure that every participant was adequately reflected in the testing stages and collected reliable data would be obtained.

## **Variables**

Two independent variables were studied: muscular strength and body composition and one dependent variable, which was the wrestling performance.

## **Independent Variables**

### **Muscular Strength:**

Muscular strength can be described as the highest energy that a muscle or muscles can put against a resistance. Power is also very important in wrestling as it helps to perform strong actions, to hold back their opponents and to avoid injuries. As a muscular strength measure, the experiment used one-repetition maximum (1RM) tests on three major exercises, namely, bench press, squat, and deadlift. These exercises have been selected due to the fact that they thoroughly measure various components of strength which are important in wrestling performance. The bench press is used to test strength of the upper body, which is vital in takedowns and manageability of the upper body of the opponent. Squat tests lower body strength, which cannot be neglected in the process of wrestling, as well as making effective takedowns. The deadlift is important in assessing the strength of the posterior chain, which is necessary in picking and maintaining the body when performing wrestling actions. The subjects in both exercises had to do warm-up sets then they were made to add weight progressively to the maximum weight that they could pull to lift one time.

**Body Composition:**

Body composition is a body percentage of fat, bone, and muscles. In wrestling, having the best body composition is essential in performance and weight control. Wrestlers have to maintain a balance between muscles mass and the fat of the body so as to be successful in their particular weight classes without compromising on strength and agility. Body composition was determined by skinfold caliper assessment and bio electrical impedance analysis (BIA).

- Four body parts, which included, were used to measure the skin folds, they were the triceps, subscapular, suprailiac and abdominal parts. These sites were selected as they are usually used to measure percentage of fat in the body of athletes. The percent of body fat obtained by use of the calipers was then computed and an important parameter of agility and endurance of a wrestler.
- BIA was also utilized to ensure a more detailed analysis concerning the body composition with reference to skinfold measurements. BIA is the test that determines the resistance to an electrical current of the body tissues and on that basis lean body mass along with fat mass and total body water can be estimated. Such an approach was selected due to its capability of supplying further information on the general body composition of the participant.

**Dependent Variable****Wrestling Performance:**

The primary dependent variable of this study was wrestling performance which was measured using several measures. The most important key performance assessment tool was the match simulation in which the participants would execute a sequence of wrestling techniques including takedowns, escapes, reversals, and so on, in controlled conditions. To evaluate the overall performance, the number of successful attempts of each technique was calculated and noted. Choosing this simulation, it is possible to state that it is quite close to the conditions of the real wrestling match, where both physical and technical wrestling skills can be evaluated. Endurance tests and agility testing were done to supplement the match simulation. Anaerobic endurance, which is an important element of wrestling performance since matches involve brief bouts of intense activity, was measured by the 300-meter sprint. Lower body power was measured with the vertical jump test that is relevant in the performance of takedowns and explosiveness. Besides, T-test agility test was applied to the measurement of the lateral movement and reaction time because it is critical in making swift transitions during a wrestling match. And lastly, the kinematic analysis was carried out to determine the performance and effectiveness of the wrestling techniques. The wrestling exercises of the participants were filmed with the help of video cameras and examined with the help of Kinovea software to determine the time, angles, and movement execution. This program assisted in measuring the technical skill of every participant on his wrestling activity and gave ample information in terms of how the strength and body structure of the wrestlers affected their technique.

**Data Collection Methods**

The collection of data was made in two stages: pre-test and post-test.

**Pre-Test Phase**

At the stage of pre-test, a set of measurements was taken on participants as well. The 1RM tests involved on bench press, squat, and deadlift were used to test muscular strength. The participants were made to do a warming-up period, and then gradually increase the weight to find out their maximum weight when doing both exercises. The analysis of body composition was conducted with the help of skinfold caliper and BIA. The measurements of the skinfold were performed at the pre-defined body parts, and the lean body mass of the participants, its fat mass, and total body

water were measured with the use of the BIA device. These measurements were applied to compute the body fat percentage and determine the general body composition of the participants. The level of wrestling performance was evaluated on the basis of match simulation, in which wrestlers engaged in a simulation of wrestling and their ability to perform common strategies and their victories were counted. As well, the T-test agility, vertical jump test and 300 meter sprint were done to determine the endurance, explosive power and agility of the wrestlers. Kinetic analysis was done to estimate the execution of technique.

### **Post-Test Phase**

Muscular strength, body composition and wrestling performance were repeated on the same measurement during the post-test phase. The post-test enabled comparison of the pre-test and post-test results so as to determine any variation in strength, body composition, and performance of the participants due to the period of intervention. In case of an intervention (say, a strength training program or a concentration on the optimization of body composition), any difference in the post-test data would tell us how these factors influenced wrestling results.

### **Data Analysis**

Data obtained were analyzed with the help of SPSS or any other statistical program. The steps that were used in the analysis are as follows:

#### **Descriptive Statistics**

The background parameters of the participants, namely muscular strength, body composition, and performance were summarized using descriptive statistics. The mean, standard deviation and the range of every variable were determined both in the pre-test phase and in the post-test stage.

#### **Pearson Correlation Coefficient**

The strength and direction of relationship between muscular strength, body composition and wrestling performance were determined using Pearson correlation. This analysis was used to identify the level of relationship between each of the independent variables and the dependent variable. As a good example, it was predicted that wrestlers of greater muscular strength would perform better on the parameter of a match simulation; and those with a more favorable body composition to demonstrate better agility and endurance.

#### **Multiple Regression Analysis**

To determine the prediction of wrestling performance according to muscular strength and body composition, a multiple regression was performed. The regression model has made it possible to examine the extent to which these two factors can account for the variation in wrestling performance. This offered a deeper insight into the manner in which muscular force and body composition relate to determine the performance outcomes.

#### **Reliability and Validity**

Test-retest reliability was determined to guarantee the viability of the information through repeated measurements of muscular power, body composition, and wrestling performance of a selected number of respondents. This has made the results be consistent with time and the measuring instruments employed in the study reliable. Validity of the study was ensured by adopting well-known techniques of measuring muscular strength (1RM tests), body composition (skinfold calipers and BIA), and wrestling performance (match simulation, endurance tests, kinematic analysis). Such tools and methods are popular in sports science and have been confirmed by other studies in the past, and therefore the results obtained could have been accurate and relevant to the research objectives.

### Ethical Considerations

The institutional review board/ ethics committee gave ethical consent to the study. Informed consent was given by all the participants who participated in the study, and the participants were informed about the purpose, the procedures involved, and the risks attached to the study. It was also explained to them that they had a right to leave the study whenever they wanted without repercussions. The data that was gathered by the researcher was preserved in terms of confidentiality by anonymizing the data and by restricting access of information to the authorized personnel. On this matter, the study conformed to all ethical provisions with the view of taking care of the well-being of the participants and integrity of the research process.

### Results

In this chapter, the results of the analysis of the collected data are introduced in details. The objective of the study was to determine the connection among muscular strength, body composition and performance wrestling. There were three major statistical processes through which the analysis was done; descriptive statistics, correlation and multiple regression. All these techniques provide information on the way in which changes in muscular strength and body structure affect wrestling performance among young athletes. The results of each of these analyses are described below.

### Descriptive Statistics

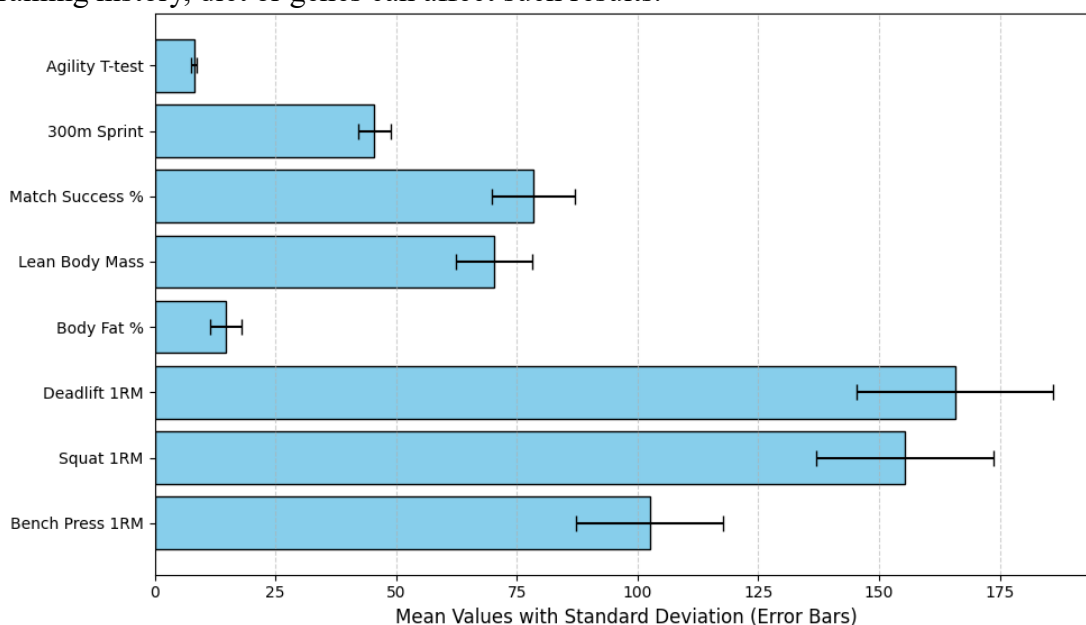
The descriptive statistics give an overview of central tendency, dispersion and the distribution of the data giving information about the nature of the sample and other important variables in the investigation. We used the present research to undertake measurements of muscular strength, body composition and wrestling performance in 20 male wrestlers between the ages of 18 and 25 years. A table with the descriptive statistics of these variables is presented in Table 1.

**Table 1 Descriptive Statistics for Muscular Strength, Body Composition, and Wrestling Performance**

Variable	Mean	Standard Deviation (SD)	Min	Max
Bench Press 1RM (kg)	102.5	15.2	85	130
Squat 1RM (kg)	155.3	18.4	130	185
Deadlift 1RM (kg)	165.7	20.3	140	200
Body Fat Percentage (%)	14.7	3.2	9.5	21.5
Lean Body Mass (kg)	70.2	7.9	60.0	81.5
Match Simulation Success (%)	78.3	8.6	64	90
300m Sprint Time (sec)	45.5	3.3	40	53
Agility T-test Time (sec)	8.2	0.6	7.0	9.5

Results of the 1RM strength of the bench press, squat and deadlift show variation among the subjects. The mean bench press 1RM measured 102.5 kg, the squat 1RM measured 155.3 kg and deadlift was 165.7 kg. The standard deviations of each of these variables (15.2 kg, 18.4 kg and

20.3 kg respectively) mean that a great amount of variation of the strength occurred among the participants. There was a marked variance in the level of strength displayed by some wrestlers and the lower values of others exhibiting individual capabilities of strength displayed by them. Regarding body composition, the mean data on the body fat percentage was 14.7, and the standard deviation was 3.2, which means that the majority of participants had intermediate body fat percentage. But there was a variation of body fat and some wrestlers had a much lower body fat percentage and some had high percentage of body fat. Lean body mass average was 70.2kg and standard deviation of 7.9kg indicated that the muscle mass was moderately distributed among individuals. The wrestlers that had a higher lean body mass probably had more muscle strength which is essential in successful wrestling performance. About the performance in wrestling, the average success in matches was 78.3 that means on an average wrestlers were successful in their wrestling performances in the simulated matches. The 300m sprint completed in 30 seconds with an average of 45.5, indicates that wrestlers in the study had average results in endurance tests. On the same note, agility T-test had an average figure of 8.2 seconds meaning that the majority of the participants had good agility and this is what is needed in wrestling as it demonstrates swiftness in transition, movement effectiveness. The descriptive statistics prove that the participants of the present study also exhibited a variation of values concerning strength, body composition, and performance. Such a difference is common in a research of athletes, because personal variables like training history, diet or genes can affect such results.



**Figure 1 Bar chart displaying the mean values and standard deviations of muscular strength, body composition, and wrestling performance variables**

### Correlation Analysis

Correlation analysis which was done by Pearson was intended to determine the relationship between muscular strength, body composition, and wrestling performance. This predicts the weight and the course of the correlation between two variables, and it is through such that the relationship between the two factors is seen to be affected. Table 2 shows the results of the correlation analysis. The correlation analysis presented in Table 2 demonstrated that there were various significant relationships:

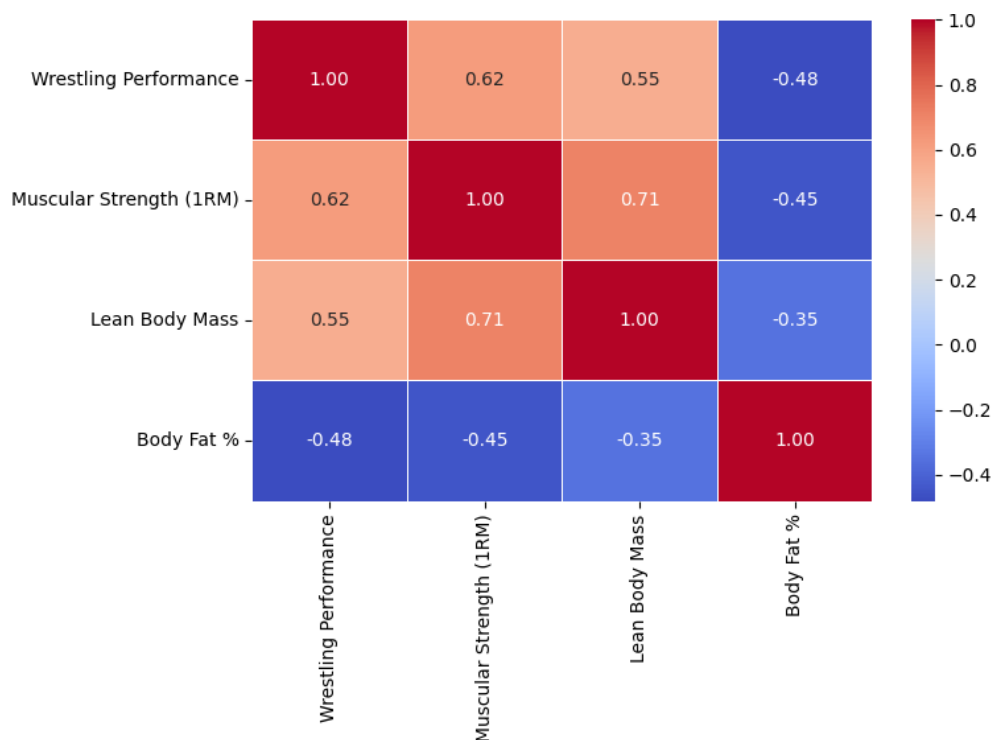
### **Table 2 Pearson Correlation Between Muscular Strength, Body Composition, and Wrestling Performance**

<b>Variable</b>	<b>Wrestling Performance</b>	<b>Muscular Strength (1RM)</b>	<b>Body Composition (Lean Mass)</b>	<b>Body Composition (Body Fat %)</b>
Wrestling Performance	1	0.62	0.55	-0.48
Muscular Strength (1RM)	0.62	1	0.71	-0.45
Body Composition (Lean Mass)	0.55	0.71	1	-0.35
Body Composition (Body Fat %)	-0.48	-0.45	-0.35	1

There were moderate positive relationships between muscular strength (expressed in 1RM bench press, squat and deadlift assessments) and wrestling performance ( $r = 0.62$ ,  $p < 0.05$ ). This is an indication that wrestlers that had greater strength performed excellently on the simulation of the match.

- The positive correlation between lean body mass and wrestling performance ( $r = 0.55$ ,  $p$  less than equal to  $0.05$ ) showed the relationship between the wrestling performance and the muscle mass of wrestlers. This is in line with the fact that muscle mass improves strength and stamina which is required in sport of wrestling. The increase in muscle mass enables the wrestlers to wrestle with increased intensity and energy, and thus enhance their performance in most of the wrestling activities.
- There was a negative relationship between body fat percentage and wrestling performance ( $r = -0.48$ ,  $p < 0.05$ ). The wrestlers, who had lower fat percentage in their bodies they possessed, were usually found to perform better in the match simulation and other performance indices. This observation goes in line with the fact that a smaller body fat enhances agility, speed, and stamina; this is all that is needed in wrestling.
- The independent variables also had correlations between them. There was very high positive correlation between lean body mass and muscular strength ( $r = 0.71$ ,  $p < 0.05$ ) implying that those wrestlers that possessed more muscle mass were stronger. Conversely, the percentage of body fat had a negative relationship with the muscular strength ( $r = -0.45$ ) and the lean body mass ( $r = -0.35$ ) meaning that wrestlers with a high percentage of body fat are less likely to have muscle mass and strength.

The correlation test shows clearly that body fat percentage negatively affects the performance of wrestling, whereas lean body mass and muscular strength have a significant role in wrestling performance, particularly in activities that require endurance and agility.



**Figure 2 Heatmap illustrating the Pearson correlation matrix between muscular strength, body composition, and wrestling performance**

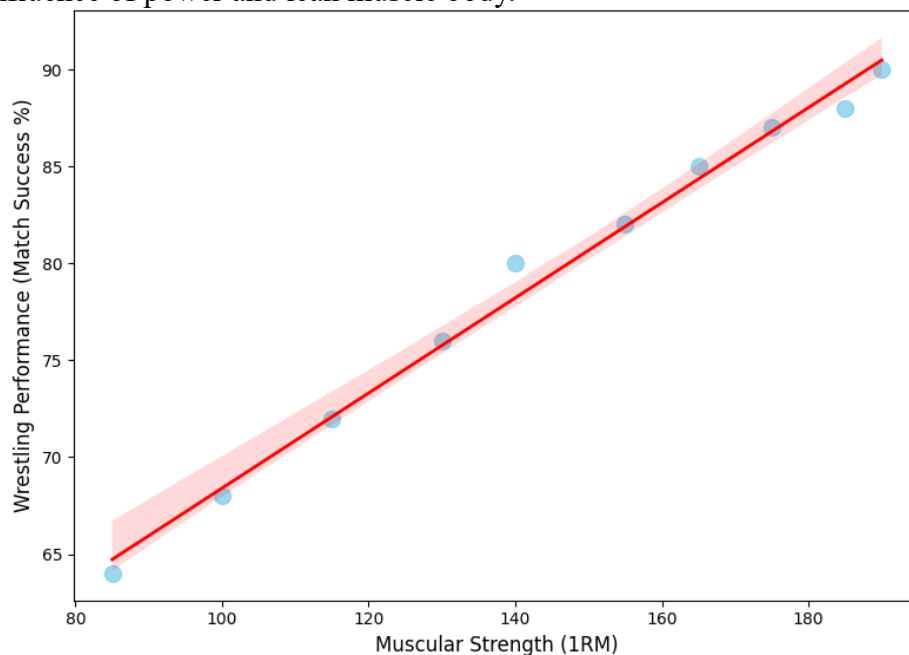
### Multiple Regression Analysis

In a further attempt to establish the influence of muscular strength and body composition on wrestling performance, a multiple regression analysis was studied. The aim of the analysis was to determine the extent to which muscular strength and body composition would explain the differences in the performance of wrestling. The regression analysis findings were found in Table 3. **Table 3 Multiple Regression Analysis Predicting Wrestling Performance**

Predictor Variable	Beta Coefficient	Standard Error	t-value	p-value
Muscular Strength (1RM)	0.47	0.08	5.88	0.0001
Lean Body Mass (kg)	0.34	0.09	3.78	0.002
Body Fat Percentage (%)	-0.19	0.12	-1.58	0.13
R <sup>2</sup> (Adjusted)	0.553			

The multiple regression indicated that 55.3% of the performance in wrestling is explained ( $R^2 = 0.553$ ,  $p < 0.05$ ). This means that muscle strength and body composition can be considered to be important predictors of wrestling performance. The strongest impact by the independent variables was on muscular strength whose beta coefficient was 0.47 ( $p = 0.0001$ ). This indicates that there is a close relationship between the increase in muscular strength and performance of wrestling activities. Lean body mass also had a positive influence on the performance, which has a beta coefficient of 0.34 ( $p = 0.002$ ). This implies that wrestlers having increasing muscle mass had high chances of succeeding in the technical performance as well as physical performance. The body fat percentage, however, did not make a significant predictor of wrestling performance ( $-0.19$ ,  $p$

0.13). Although the relationship between body fat and performance was negative, it was not significant in the range of explaining the difference in the outcomes of the performance with the adoption of muscular strength and lean body mass. The above finding implies that although body fat influences agility and endurance, it does not have a direct influence on wrestling performance unlike the influence of power and lean muscle body.



**Figure 3 Regression plot showing the positive relationship between muscular strength (1RM) and wrestling performance (match success percentage)**

### Discussions

The findings of this paper can be of great use to the research of the roles of muscular strength and body composition on the performance of young wrestlers. The results confirm the hypothesis in that both muscular strength and body composition are very important in increasing wrestling performance. The descriptive statistics, correlation analysis and multiple regression analysis of the study are useful in identifying significant relationships among these variables that bring a better insight of how each of the variables combines to contribute to the performance outcomes. A major observation was that there was a positive relationship between muscular strength and wrestling performance. The correlation coefficient of 0.62 denotes a moderate but sustained association amid the strength of the subjects (assessed with the help of 1RM tests in bench press, squat, and deadlift) and their successes in simulating matches. This result is in line with the past studies, which state the strength to be critical in performing wrestling moves like taking downs, escaping, and being in control of your opponent. The wrestlers who had more muscular capacity were in a position to generate muscular power that was required to cause these techniques to work efficiently and they performed better overall. This was further supported by the regression analysis that indicated that muscular strength was the best predictor of wrestling performance which explained significant amount of the variation in the performance outcomes.

Also, the researchers have determined that lean body mass had a positive relation with wrestling performance the correlation coefficient being 0.55. This implies that wrestlers who have greater percentage of muscle mass will have better results in matches simulation, endurance and agility tests. In wrestling, muscle bulk is a crucial aspect since it simply equates to strength and power where the latter is crucial in the application of techniques being forceful and effective. Furthermore, lean muscle mass helps improve endurance and agility of a wrestler so that he/she

can perform at high level during the period of a match. The results should be likened to the research conducted before highlighting the significance of muscle mass as an indicator of the overall athletic performance, especially in such sports as wrestling, which involve intelligence and power. On the other hand, body fat percentage showed a negative relationship with the performance in wrestling ( $r = -0.48$ ), meaning that wrestlers with lower percentages of body fat perform better. It was not to be expected that this negative association was absent as having too much body fat may impede agility, mobility, and general physical efficiency. The wrestlers who have a lower percentage of body fat tend to be more agile and faster, which are very important in wrestling to perform the techniques and recover upon being on the defensive. But using muscular strength and lean body mass as a control in the regression equation, body fat percentage failed to produce a significant determination of performance results. This implies that though low body fat has a certain benefit, the strength and lean muscle mass is what has a more direct impact regarding success in wrestling. More muscular and stronger wrestlers can most appropriately perform forceful actions and maintain control despite their marginally elevated percentage of body fats. The results of this research highlight the relevance of a moderate method to training, as it is necessary to build the strength, but also to optimize the body composition. Muscle-building strength training combined with appropriate nutrition that is used to maintain an ideal body fat percentage may enhance wrestling performance greatly. Also, these findings indicate that the exercises, which can improve the upper and lower body strength, should be given priority by wrestlers, whereas those, which can strengthen endurance of the muscle and explosive power, need to be prioritized. Finally, the research establishes that muscular strength and the lean body mass are most effective summary predictors of wrestling performance with the establishment of muscular strength as the most predominant predictor. Body fat percentage has an effect on performance but the effect is of a secondary nature compared to muscle mass and strength. These results can be useful to coaches and athletes to usher training programs that extend towards building strength, maximizing body mass, and body composition, then adding value to performance in wrestling. It may be expanded that future studies may be able to pay much closer attention to further research on the contributions of other physical factors, including flexibility and cardiovascular conditioning, in conjunction with muscular strength and body composition to give a more comprehensive picture of what makes wrestlers successful.

### **Conclusion**

The aim of this study was to examine how muscular strength and body composition affect wrestling performance of young male athletes. It was found that both lean body mass and muscular strength have significant impacts on the wrestling performance with muscular strength being the strongest predictor of the wrestling performance. Stronger wrestlers demonstrated superiority in the simulated matches because strength is the key to successful performance of thrustful methods like takedowns and reversals. The research has also established a positive correlation between lean body mass and performance with the high muscle mass leading to enhanced endurance, agility and performance of the techniques. These findings are an indication that strength, agility and general wrestling success is dependent on muscle mass. Moreover, the percentage of body fat was found to have a negative impact on the performance of wrestlers meaning that wrestlers who had low percentages of body fat usually performed better. Nevertheless, the percentage body fat was not a good predictor with regard to performance when body muscular strength and lean body mass were controlled implying that whereas being skinny is good, muscle mass and muscle power significantly influence the outcome of performance. The paper also highlights the importance of detailed training modalities towards muscle building and the best body build. Increasing muscle mass and strength and controlling body fat should be the focus of wrestlers to improve overall performance. The study adds to the existing agreement of research on the physical aspects

affecting wrestling performance and gives important information that would help coaches and athletes. The study could be further extended in the future by conducting research on other physical properties, and their correlation with muscular strength and body composition.

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