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Muscular Strength Assessment of Students Enrolled in Measurement and Evaluation in Physical Education at Benguet State University

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https://doi.org/10.5281/zenodo.23723190

ABSTRACT

Muscular strength is an essential component of physical fitness that contributes to functional performance and overall health. This study assessed the muscular strength performance of students enrolled in Measurement and Evaluation in Physical Education at Benguet State University, focusing on differences between male and female students in upper-body, core, and lower-body strength. A descriptive-comparative research design was employed involving 28 students, comprising 12 males and 16 females. Data were collected through Google Forms and field-based muscular strength assessments adapted from established fitness testing protocols, including the trunk lift, one-minute push-up, seven-stage abdominal strength, and leg strength tests. Frequency counts and percentages were used to describe respondents' demographic characteristics and muscular strength performance. Findings revealed that 71.43% of respondents had a normal body mass index. Male students demonstrated higher proportions of excellent ratings in upper-body strength (58.33%) and core strength (16.67%) compared with female students (37.50% and 6.25%, respectively). Conversely, female students achieved a higher proportion of excellent ratings in lower-body strength (87.50%) than male students (66.66%). These findings indicated variations in muscular strength performance across body regions and between male and female respondents. The study concluded that muscular strength profiles differed according to the assessed muscle groups, with males demonstrating more favorable upper-body and core strength classifications and females achieving better lower-body classifications. The findings provide a basis for developing balanced physical education activities and targeted strength-conditioning programs that address students' identified fitness needs.

Keywords: *Physical Fitness, Upper-Body Performance, Core Stability, Lower-Body Performance, Sex Differences, Descriptive-Comparative Research, Fitness Assessment, Body Mass Index, Strength Conditioning*

INTRODUCTION

Muscular strength is an essential component of health-related physical fitness that contributes to functional movement, physical performance, postural stability, and injury prevention. It refers to the ability of a muscle or muscle group to exert force against resistance during a maximal effort (Ratamess et al., 2014). Adequate muscular strength enables individuals to perform daily activities such as lifting, carrying, pushing, and maintaining balance. Beyond its functional benefits, muscular strength supports musculoskeletal health, physical independence, and overall well-being. Ahmad (2018) emphasized its importance in preventing injuries, maintaining bone health, and improving physical confidence, while Muthuraj (2019) associated muscle-strengthening activities with improved body alignment, metabolic function, and physical efficiency.

Muscular strength is commonly examined through upper-body, core, and lower-body performance. Upper-body strength involves the muscles of the arms, shoulders, chest, and upper back, which facilitate lifting, pushing, and pulling movements (Radocy, 2013). Core strength refers to the capacity of the abdominal, pelvic, and spinal muscles to stabilize the body and support coordinated movement. Elson (2018) and Mazzo (2018) explained that core musculature contributes to posture, balance, and the efficient transfer of force between body segments. Lower-body strength, meanwhile, involves the major muscle groups of the hips, thighs, and legs, which support mobility, stability, and locomotion (Thompson, n.d.; Krunoslav, 2019). Collectively, these components provide a broader understanding of muscular fitness and functional capacity.

In physical education, muscular strength assessment provides information about students' physical capabilities and areas requiring improvement. Field-based assessments are particularly useful in educational settings because they are practical, relatively inexpensive, and applicable to groups of students. Cronkleton (2019) described several approaches to assessing muscular strength, while McArdle et al. (2015) and Flynn et al. (2019) discussed performance-based procedures for evaluating muscular fitness. Common assessment activities include the one-minute push-up test, trunk lift test, seven-stage abdominal strength test, and squat-based exercises. These procedures allow instructors to classify physical performance and identify specific muscle groups that may benefit from targeted conditioning activities.

Muscular strength performance may vary according to age, sex, body composition, and participation in physical activities. Previous literature has reported differences in muscular performance between males and females, particularly in upper-body strength. Chen et al. (2019) examined strength differences among male and female college students, while Gentil et al. (2016) reported that both sexes could achieve improvements in upper-body

strength following resistance training. Such findings suggest that muscular strength should be examined not only through general performance but also according to the specific muscle groups assessed. They also indicate the importance of considering individual characteristics when interpreting physical fitness outcomes.

Despite the availability of muscular strength assessment procedures, the application of these measures within specific university populations remains an important area of investigation. Existing literature provides information about muscular strength differences, but findings from other populations cannot automatically describe the performance of students enrolled in a particular physical education course. Furthermore, examining upper-body, core, and lower-body strength together provides a more comprehensive description of muscular fitness than evaluating a single body region. This creates a practical need for institution-specific assessment data that can inform physical education instruction and fitness programming.

At Benguet State University in La Trinidad, Benguet, students enrolled in Measurement and Evaluation in Physical Education participate in activities intended to develop their understanding of physical fitness assessment. However, the original study identified limited available information describing the muscular strength performance of these students across different body regions. Establishing their performance classifications and examining differences between male and female respondents may provide useful evidence for identifying areas of relative strength and weakness. Such information can assist physical education instructors in planning appropriate conditioning activities and strengthening the practical application of fitness assessment within the university.

Accordingly, this study assessed the muscular strength performance of students enrolled in Measurement and Evaluation in Physical Education at Benguet State University. It specifically described the respondents' demographic and physical characteristics and examined their performance in upper-body, core, and lower-body strength assessments. The investigation also compared the distribution of performance classifications between male and female students using descriptive statistics. By providing localized evidence on muscular fitness, the study sought to support more informed physical education instruction and the development of balanced strength-conditioning activities.

Research Problem

Muscular strength is an important component of health-related physical fitness that contributes to functional movement, physical performance, and musculoskeletal health. Its development depends on several factors, including age, sex, body composition, and

physical activity participation (Ratamess et al., 2014; Tackett, 2017). Previous studies have identified differences in muscular strength between male and female individuals, particularly in upper-body performance. Chen et al. (2019) examined muscular strength differences among college students, while Gentil et al. (2016) demonstrated that both males and females could improve their strength through resistance training. These findings indicate the importance of examining muscular performance across different body regions rather than relying on a single assessment.

Despite the availability of established fitness assessment procedures, limited institution-specific evidence was identified in the original study regarding the muscular strength performance of students enrolled in Measurement and Evaluation in Physical Education at Benguet State University. In particular, information describing their upper-body, core-body, and lower-body strength classifications was needed to understand variations in performance between male and female students. Without these data, physical education instructors may have insufficient information to identify specific muscular fitness needs and develop appropriate conditioning activities.

This study addressed this practical concern by assessing the muscular strength performance of enrolled students and comparing the distribution of performance classifications between male and female respondents. The findings were intended to provide baseline information for physical education instruction, fitness assessment, and the development of balanced muscular strengthening activities within the university.

Assumptions of the Study

The study was guided by the assumption that muscular strength performance could be described through established field-based fitness assessments targeting the upper body, core, and lower body. These assessments were considered practical measures of muscular fitness within the physical education setting, consistent with the assessment approaches discussed by McArdle et al. (2015) and Flynn et al. (2019). The study also assumed that respondents understood the prescribed testing procedures, performed the activities according to the provided instructions, and accurately reported their results through the data collection instrument. Additionally, the study assumed that individual characteristics, including age, sex, height, weight, and body mass index, were relevant descriptive factors when examining muscular strength performance (Tackett, 2017; Williams, 2019).

Objectives of the Study

The general objective of this study was to assess and compare the muscular strength performance of male and female students enrolled in Measurement and Evaluation in Physical Education at Benguet State University.

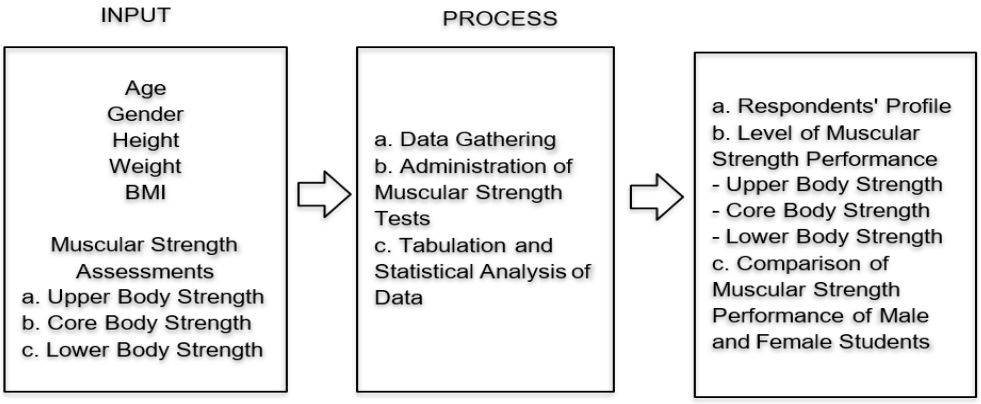
Specifically, the study aimed to:

1. Describe the respondents' profiles in terms of age, gender, height, weight, and body mass index.
2. Determine the respondents' muscular strength performance classifications in terms of upper-body, core-body, and lower-body strength.
3. Compare the distribution of muscular strength performance classifications between male and female students across the three assessed body regions.

Conceptual or Theoretical Framework

The study adopted the Input-Process-Output (IPO) Model as its conceptual framework to systematically organize the assessment of muscular strength performance among students enrolled in Measurement and Evaluation in Physical Education at Benguet State University. The framework identified the respondents' characteristics and muscular strength assessments as inputs, the procedures for gathering and analyzing data as the process, and the resulting performance classifications and descriptive comparisons as outputs. The input component included the respondents' age, gender, height, weight, and body mass index, together with their performance in upper-body, core-body, and lower-body strength assessments. These variables provided the descriptive information necessary to characterize the respondents and evaluate their muscular fitness. Previous literature identified physical characteristics and sex-related differences as relevant considerations in muscular strength performance (Sports Medicine, 2002; Tackett, 2017; Williams, 2019). The process component involved collecting respondent information through Google Forms, administering the prescribed muscular strength assessments, recording performance scores, and classifying results according to the established assessment rubrics. Frequency counts and percentages were used to summarize the collected data and describe differences in performance classifications between male and female respondents. The output component consisted of the respondents' demographic and physical profiles, their muscular strength classifications across the three assessed body regions, and the descriptive comparison of male and female performance. The framework provided an organized approach to examining muscular fitness and generating information relevant to physical education instruction and strength-conditioning activities.

Figure 1. Paradigm of the Study



METHODOLOGY

Research Design

The study employed a descriptive-comparative research design to assess the muscular strength performance of male and female students enrolled in Measurement and Evaluation in Physical Education at Benguet State University. The descriptive component examined the respondents' demographic and physical characteristics, including age, gender, height, weight, and body mass index, while the comparative component examined differences in muscular strength performance classifications between male and female students. This design was appropriate because the investigation focused on describing existing physical fitness characteristics and comparing performance across upper-body, core-body, and lower-body strength assessments without manipulating variables or introducing experimental interventions. Consistent with the descriptive research approach discussed by Venable and Ripley (2002), the study utilized quantitative data to characterize the respondents and examine observed patterns in their muscular strength performance.

Research Locale or Study Setting

The study was conducted at Benguet State University, located in the municipality of La Trinidad, Benguet, Philippines. La Trinidad is situated in the northern part of Luzon and is adjacent to Baguio City. The university served as the research setting because the respondents were enrolled in Measurement and Evaluation in Physical Education, a subject involving the application of physical fitness assessment procedures. The study was undertaken during the educational conditions associated with the new normal, when students were situated in different locations and online platforms were used to facilitate data collection. This context influenced the administration and reporting of muscular strength assessments, particularly the use of Google Forms to collect respondents' profiles and recorded performance results.

Participants or Data Sources

The participants consisted of 28 students enrolled in Measurement and Evaluation in Physical Education at Benguet State University, comprising 12 males (42.86%) and 16 females (57.14%). Their ages ranged from 20 to 39 years, with the largest proportion belonging to the 24–26-year age group. The respondents also differed in height, weight, and body mass index, providing descriptive information relevant to their muscular fitness profiles. Their enrollment in the subject made them appropriate participants because the investigation specifically concerned students undertaking physical fitness assessment activities. The sample provided information about the muscular strength performance of this particular group

Research Instruments or Materials

The study utilized a Google Forms questionnaire and field-based muscular strength assessment instruments. The online questionnaire collected the respondents' age, gender, height, weight, body mass index, and recorded muscular strength performance. The assessment procedures were adopted and adapted from the FITNESSGRAM®/ACTIVITYGRAM® Test Administration Manual and Topend Sports Fitness Testing Protocols (The Cooper Institute, 2013; Topend Sports, n.d.). Upper-body performance was evaluated using the Trunk Lift Test or One-Minute Push-Up Test, while core-body strength was assessed through the Seven-Stage Abdominal Strength Test. Lower-body performance was assessed using leg strength exercises, including chair squats, unweighted squats, and single-leg lunge-squats with rear-foot support. Performance was classified using the prescribed assessment rubrics, with results summarized under excellent, good, fair, and poor categories.

Data Gathering Procedure

Data collection began with securing permission from the appropriate authorities to conduct the study among students enrolled in Measurement and Evaluation in Physical Education. The respondents were informed about the purpose of the investigation, and informed consent was obtained before their participation. They were also assured that the information collected would be treated confidentially and used for research purposes. Following the orientation, the respondents performed the prescribed core-body strength assessment and selected one upper-body and one lower-body strength exercise from the available assessment activities. Each activity was conducted using the provided instructions and scoring rubrics. After completing the exercises, respondents recorded their performance scores and identified the corresponding muscular strength classifications. They subsequently completed a Google Form containing their demographic and physical characteristics and assessment results. The collected responses were organized, tabulated, and prepared for statistical analysis.

Data Analysis

The collected data were analyzed using descriptive statistical techniques, particularly frequency counts and percentages. These measures were employed to summarize the respondents' age, gender, height, weight, and body mass index classifications. The same statistical procedures were applied to determine the distribution of muscular strength performance across upper-body, core-body, and lower-body assessments. Frequencies represented the number of respondents within each performance category, while percentages expressed the proportion of respondents relative to the corresponding group size. Percentages were calculated using the formula P=fN×100P = \frac{f}{N} \times 100P=Nf×100 where *(P*) represented the percentage, (f) the observed frequency, and (N) the total number of respondents in the relevant group. Male and female performance distributions were compared descriptively using their respective group totals of 12 and 16 respondents.

Ethical Considerations

The study adhered to ethical principles of informed consent, confidentiality, and responsible research conduct. Permission to conduct the study was secured from the appropriate authorities, and participants were informed about its purpose and the procedures involved in the muscular strength assessments. Informed consent was obtained before data collection, and participants were assured that their personal information and assessment results would be treated confidentially and used solely for research purposes. The collected data were presented in aggregated form to protect respondents' identities and maintain confidentiality throughout the reporting of findings.

RESULTS AND DISCUSSION

Profile of the Respondents

This section presents the demographic and physical characteristics of the 28 students enrolled in Measurement and Evaluation in Physical Education at Benguet State University, including their age, gender, weight, height, and body mass index.

Age (years)	Frequency	Percentage (%)
20–23	10	35.71
24–26	13	46.43
27–30	3	10.71
31–33	0	0.00
34–36	1	3.57
37–39	1	3.57

Total	28	100.00

Table 1. Age of the Respondents

Table 1 shows that the largest proportion of respondents (46.43%) belonged to the 24–26 age group, followed by those aged 20–23 (35.71%). The respondents' ages ranged from 20 to 39 years, indicating that the participants were predominantly young adults.

Table 2. Gender of the Respondents

Gender	Frequency	Percentage (%)
Male	12	42.86
Female	16	57.14
Total	28	100.00

Table 2 indicates that female respondents comprised 57.14% of the participants, while males accounted for 42.86%. The distribution provided the basis for describing muscular strength performance separately for male and female students.

Table 3. Weight of the Respondents

Weight (kg)	Frequency	Percentage (%)
47–56	7	25.00
57–66	15	53.58
67–76	3	10.71
77–86	3	10.71
Total	28	100.00

Table 3 reveals that most respondents (53.58%) weighed between 57 and 66 kg, followed by those weighing 47–56 kg (25.00%). The recorded weights ranged from 47 to 82 kg, reflecting variations in the physical characteristics of the participants.

Table 4. Height of the Respondents

Height (m)	Frequency	Percentage (%)
1.40–1.50	3	10.71
1.51–1.60	10	35.71
1.61–1.70	11	39.29
1.71–1.80	4	14.29
Total	28	100.00

Table 4 shows that the largest proportion of respondents (39.29%) had heights ranging from 1.61 to 1.70 m, followed by those measuring 1.51–1.60 m (35.71%). The recorded heights ranged from 1.40 to 1.72 m.

Table 5. Body Mass Index of the Respondents

BMI classification	Frequency	Percentage (%)
Underweight	0	0.00
Normal	20	71.43
Overweight	8	28.57
Obesity	0	0.00
Total	28	100.00

Table 5 indicates that most respondents (71.43%) were classified as having a normal body mass index, while 28.57% were overweight. No respondents were classified as underweight or obese. These findings describe the participants' BMI distribution, although BMI alone does not establish muscular fitness or physical performance.

Muscular Strength Performance of Male and Female Students

This section presents the muscular strength performance classifications of male and female students in terms of upper-body, core-body, and lower-body strength.

Table 6. Muscular Strength Performance of the Respondents

A. Upper-Body Strength (Trunk Lift/One-Minute Push-Up Test)

Respondents	Excellent	Good	Fair	Poor
Male (n = 12)	7	4	1	0
Percentage (%)	58.33	33.33	8.33	0.00
Female (n = 16)	6	9	0	1
Percentage (%)	37.50	56.25	0.00	8.33

B. Core-Body Strength (Seven-Stage Abdominal Strength Test)

Respondents	Excellent	Good	Fair	Poor
Male (n = 12)	2	8	0	2
Percentage (%)	16.67	66.66	0.00	16.67

Female (n = 16)	1	6	2	7
Percentage (%)	6.25	37.50	12.50	43.75

C. Lower-Body Strength (Leg Strength Test)

Respondents	Excellent	Good	Fair	Poor
Male (n = 12)	8	3	1	0
Percentage (%)	66.66	25.00	8.34	0.00
Female (n = 16)	14	2	0	0
Percentage (%)	87.50	12.50	0.00	0.00

Upper-Body Strength

The upper-body strength assessment revealed that 58.33% of male respondents achieved an excellent rating, compared with 37.50% of females. Meanwhile, 33.33% of males and 56.25% of females were classified as good. These results indicate a higher proportion of excellent upper-body performance classifications among male students.

The findings are consistent with Chen (2019), who reported greater upper-body muscular strength among male college students. Physiological differences in muscle mass and body composition may contribute to variations in strength performance. Paoli (2015) similarly discussed sex-related differences in muscle development, while Gentil et al. (2016) found that both males and females could achieve improvements in upper-body strength through resistance training. These findings suggest that targeted conditioning activities may benefit students regardless of their initial performance classifications.

Core-Body Strength

The core-body strength assessment showed that 66.66% of male respondents achieved a good rating, while 16.67% were classified as excellent. Among females, 37.50% received a good rating, 6.25% were classified as excellent, and 43.75% were categorized as poor. These findings indicate more favorable core-body strength classifications among male respondents. This pattern is consistent with Chen (2019), who identified differences in abdominal muscular strength between male and female students. Variations in lean muscle mass and physiological characteristics may contribute to differences in core performance. However, the descriptive results do not establish the specific factors responsible for the observed differences.

Lower-Body Strength

The lower-body strength assessment revealed that 87.50% of female respondents achieved an excellent rating, compared with 66.66% of males. The remaining 12.50% of females were classified as good, while 25.00% of males achieved a good rating and 8.34% were categorized as fair. These results indicate a higher proportion of excellent lower-body performance classifications among female students. The findings are consistent with Chen (2019), who discussed the relative strength of lower-body musculature among females. However, other literature has reported greater absolute lower-body strength among males (Journal of Lifestyle Medicine, 2017; Ketchum, 2019). The present findings therefore describe the performance classifications of the respondents rather than establishing a general advantage in absolute lower-body muscular strength.

Overall Muscular Strength Performance

Overall, male respondents demonstrated higher proportions of excellent ratings in upper-body and core-body strength, while female respondents achieved a higher proportion of excellent ratings in lower-body strength. These differences suggest that muscular fitness performance varied according to the body region assessed. The findings are generally consistent with literature describing sex-related variations in muscular strength and body composition (Chen, 2019; Paoli, 2015). Nevertheless, the results were based on descriptive performance classifications and should not be interpreted as evidence of statistically significant differences. The findings support the importance of balanced physical education activities that address upper-body, core-body, and lower-body fitness needs among students.

General Discussion

The study concluded that muscular strength performance varied between male and female students across the assessed body regions. Male respondents demonstrated higher proportions of excellent performance ratings in upper-body and core-body strength, while female respondents achieved a higher proportion of excellent ratings in lower-body strength. These findings indicate that muscular fitness performance differed according to the muscle groups assessed, highlighting the importance of considering individual strengths and areas for improvement when developing physical education and fitness programs. Based on the findings, physical education instructors are encouraged to implement balanced strength-training programs that address upper-body, core-body, and lower-body fitness. Targeted exercises may be incorporated to improve weaker muscle groups, particularly upper-body and core-body performance among female students. Schools may also consider integrating practical muscular strength assessments into regular fitness evaluations to monitor students' physical performance. Future studies should involve larger

samples and appropriate inferential statistical analyses to examine differences between groups. Additional factors, including physical activity levels, training backgrounds, and lifestyle characteristics, may also be investigated to provide a broader understanding of muscular strength performance.

REFERENCES

Ahmad, K. (2018). Benefits of muscular strength and endurance. Ask Health News. https://askhealthnews.com/2010/benefits-of-muscular-strength-and-endurance/

American College of Sports Medicine. (2018). ACSM's guidelines for exercise testing and prescription (10th ed.). Wolters Kluwer.

Cespedes, E. (2017). Core strength: Benefits and exercises. Healthline. https://www.healthline.com/health/fitness-exercise/core-strength-exercises

Chen, G., Liu, L., & Yu, J. (2019). A comparative study on strength between American college male and female students in Caucasian and Asian populations. Sport Science Review. https://jamesalexandermichie.com/wp-content/uploads/2019/02/Sport-Science-Review-A-Comparative-Study-on-Strength-between-American-College-Male-and-Female-Students-in-Caucasian-and-Asian-Populations.pdf

Cronkleton, E. (2019). What is muscular strength, and what are some exercises you can do? Healthline. https://www.healthline.com/health/exercise-fitness/muscular-strength

Dineshwori, L. (2020). 5 strength-training exercises to build a bigger upper body. TheHealthSite. https://www.thehealthsite.com/fitness/5-strength-training-exercises-to-build-a-bigger-upper-body-728422/

Elson, L. (2018). Understanding and improving core strength. Harvard Health Publishing. https://www.health.harvard.edu/blog/understanding-and-improving-core-strength-2018090414662

Fitness Testing. (n.d.). Push-up test protocol.

Flynn et al. (2019). Assessing your muscular strength and endurance. Medicine LibreTexts. https://med.libretexts.org/Bookshelves/Health

Frey, M. (2021). The best lower body strength exercises. Verywell Fit. https://www.verywellfit.com/best-lowerbody-weight-training-exercises-3498517

Gentil et al. (2016). Comparison of upper body strength gains between men and women after 10 weeks of resistance training. ResearchGate. https://www.researchgate.net/publication/294120181_Comparison_of_upper_body_strength_gains_between_men_and_women_after_10_weeks_of_resistance_training

Ketchum, D. (2019). Is there a difference between female and male muscles? LIVESTRONG.com. https://www.livestrong.com/article/355987-female-male-muscles/

Krunoslav. (2019). Lower-body anatomy for weightlifters: Leg and hip muscles. Bodybuilding Wizard. https://bodybuilding-wizard.com/lower-body-muscles-leg-and-hip-anatomy/

Mazzo, L. (2018). Why core strength is so important (it has nothing to do with sculpting a six-pack). Shape. https://www.shape.com/fitness/tips/why-its-so-important-have-core-strength

McArdle, W. D., Katch, F. I., & Katch, V. L. (2015). Essentials of exercise physiology (5th ed.). Wolters Kluwer.

Muthuraj, M. (2019). Importance of muscular strength and endurance in physical fitness. eFitnessHelp. https://www.efitnesshelp.com/muscular-strength-and-endurance

Radocy, L. (2013). Why is upper body strength important? SportsRec. https://www.sportsrec.com/12680945/why-is-upper-body-strength-important

Ratamess, N., Alvar, B., Evetoch, T., Housh, T., Kibler, W., Kraemer, W., & Triplett, N. (2014). Progression models in resistance training for healthy adults. Medicine & Science in Sports & Exercise, 41(3), 687–708.

Sports Medicine. (2002). Muscle strength testing.

Tackett, C. (2017). Factors affecting muscular strength. American Fitness Professionals & Associates. https://www.afpafitness.com/research-articles/factors-affecting-muscular-strength

The Cooper Institute. (2013). FITNESSGRAM®/ACTIVITYGRAM® test administration manual (4th ed.). Human Kinetics.

Thompson. (n.d.). Lower body strength and its importance. LIVESTRONG.com. https://www.livestrong.com/article/lower-body-strength

Topend Sports. (n.d.-a). 7-stage abdominal strength test. https://www.topendsports.com/testing/tests/abstrength.htm

Topend Sports. (n.d.-b). Trunk lift test.

Williams, T. (2019). Muscular strength in women compared to men. LIVESTRONG.com. https://www.livestrong.com/article/509536-muscular-strength-in-women-compared-to-men/

Wood, R. (2008). 7-stage abdominal strength test. Topend Sports. https://www.topendsports.com/testing/tests/abstrength.htm