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Correlation between female body mass and functional movements and skeletal muscle mass

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Abstract

Objective: To investigate the correlation between body mass and functional movements with skeletal muscle mass and skeletal muscle distribution in women, to determine the association between body mass and functional movements with skeletal muscle mass and distribution in women, and to provide theoretical support for improving the performance of body mass and functional movements in women through dietary or exercise improvement, thus providing a basis for maintaining women's health and preventing the adverse effects of low skeletal muscle mass on health and quality of life after menopause or old age. The study was conducted in a randomized sample of Zunyi Medical College.

Methods: A number of female Zunyi medical students were randomly selected, and 78 of them (age, 20.99±2.10 years, BMI, 20.55±1.58 kg/m2) who met the criteria were screened for body composition and functional movement and tested for body mass. Correlation analysis was performed.

Results: 1) Total physical test score, spirometry score, sprint 50m score, and endurance run score were significantly correlated ($P<0.05$), where the correlation between total physical test score and skeletal muscle mass was moderate ($r=0.45$) and the other correlations were weak; 2) skeletal muscles distributed in the trunk were significantly correlated with total physical test score, spirometry score, seated forward bend score, sprint 50m score standing long jump, and endurance run score ($P<0.05$). (2) Skeletal muscles distributed in the trunk were significantly correlated with total physical test scores, lung capacity scores, sitting forward bend scores, sprint 50m score standing long jump, and endurance run scores ($P<0.05$), with the physical test scores moderately correlated with the distribution of skeletal muscles in the trunk ($r=0.483$) and weakly correlated with all other parts. (3) Skeletal muscle mass distributed in the right upper limb, left upper limb, trunk, right lower limb, and left lower limb were not significantly correlated with the total FMS score and each of the FMS scores.

Conclusions: 1) skeletal muscle mass was correlated with female body mass, including physiological function, burst and endurance running; 2) skeletal muscles distributed in the trunk were correlated with female body mass, including physiological function, burst and endurance; 3) female skeletal muscle mass and the distribution of skeletal muscles in the trunk could be improved through diet and exercise to improve female body mass.

Keywords: Women; Skeletal muscle; Constitution; Functional movement

1. Introduction

To investigate the correlation between body mass and functional movements with skeletal muscle mass and skeletal muscle distribution in women, to determine the association between body mass and functional movements with skeletal

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muscle mass and distribution in women, and to provide theoretical support for improving the performance of body mass and functional movements in women through dietary or exercise improvement, thus providing a basis for maintaining women's health and preventing the adverse effects of low skeletal muscle mass on health and quality of life after menopause or old age. The study was conducted in a randomized sample of Zunyi Medical College.

2. Study Subjects and Methods

2.1. Object of the study

Several female students of Zunyi Medical University were randomly selected, from which 78 were selected to meet the criteria, and the inclusion criteria were: (1) BMI was in the normal range according to the National Physical Fitness Test Standard; (2) physical health, no cardiovascular or other diseases affecting exercise or hormone secretion.

Table 1 Basic information (X±S)

	Age (years)	**BMI (kg/m2)**
Subjects (n=78)	20.99±2.10	20.55±1.58

2.2. Experimental method

2.2.1. Test instrument

Body composition was tested using the InBody720; height and weight tester, seated forward bend tester, spirometer, standing long jump tester, sit-up tester, and electronic counter, and functional movement screening was performed using the standard FMS test suite.

2.2.2. Test method

Body composition test method

InBody 720 was used to test the body composition of the study subjects, requiring: fasting in the morning or no food or strenuous exercise within two hours; the subjects took off their shoes and socks, removed the metal objects they carried, sprayed a small amount of water or alcohol on the two metal pieces on the test platform, keeping the metal pieces slightly moist. The subject stood on the test platform with the front palm touching the front metal piece and the back heel placed on the back ground metal piece, both eyes looked forward, after the weight was stabilized the hand grip was held, the thumb touched the upper round metal piece and the remaining four fingers touched the lower metal strip, avoiding a hard grip, the angle between the two arms and the body was 30°, the ID number and other basic information was entered and the test started, the subject was not allowed to talk and no one else was allowed to touch the subject until the end of the test.

Physical Fitness Test

Test in accordance with the requirements of the National Physical Fitness Test Standards, all test items to be completed in one day, including 50 meters and endurance running items after the test to be interval of two hours before the other items tested.

Functional motility screening

The movement functional screening included seven test movements, including active straight knee leg raise, shoulder flexibility, body rotation stability, stability push-up, overhead squat, straight leg lunge squat and hurdle step-up, and three functional sun screening including shoulder joint exclusion, extension exclusion, and kneeling lower back exclusion. The score for each movement was 0 to 3, with a total of 21 points. 3 points were for completing the movement as required, no body swaying in the process, and no pain in the movement and exclusion test; 2 points were for completing the movement with low quality, or completing the movement with a small range of swaying, and no pain in the movement and exclusion test; 1 point was for completing the movement with minimum standards, or completing the movement with A score of 1 is defined as completing the movement at the lowest standard, or completing the movement with significant swaying and no pain in the movement and exclusion test; a score of 0 is given if there is pain in the movement and exclusion test[10].

2.3. Statistical methods

SPSS 26.0 statistical analysis was applied to process the data, and Pearson correlation analysis was used for the measurement data. The statistical results of each data item were expressed in the form of (S) with test a=0.05. Correlation levels: very strong correlation: 0.8-1.0, strong correlation: 0.6-0.8, moderate correlation 0.4-0.6, weak correlation: 0.2-0.4, and very weak correlation or irrelevant: 0.0-0.2.

3. Results

3.1. Correlation of skeletal muscle mass with body mass and functional movements

As shown in Table 2, the total physical test score, spirometry score, sprint 50 m score, and endurance running score were significantly correlated (P<0.05), where the total physical test score was moderately correlated with skeletal muscle mass (r=0.45) and the others were weakly correlated.

Table 2 Correlation of skeletal muscle mass with physical fitness and functional movements

		Total physical test score	Spirometry score	Sitting forward bend	Sprint 50m scoring	Standing Long Jump	Endurance running score	Sit-ups
skeletal muscle mass	R	0.450	0.352	0.201	0.345	0.223	0.361	0.281
	P	0.00*	0.00*	0.77	0.02*	0.50	0.00*	0.13

Note: * indicates that the P value reaches the significance level of 0.05

3.2. Correlation analysis between skeletal muscle distribution and body mass

As shown in Figure 1, the distribution of skeletal muscles in the trunk was significantly correlated (P<0.05) with the total physical test score, spirometry score, seated forward bend score, sprint 50 m score standing long jump, and endurance run score, with the physical test score being moderately correlated with the distribution of skeletal muscles in the trunk (r=0.483) and the others being weakly correlated. The skeletal muscles distributed in other parts of the body were not significantly correlated with the total physical test scores and all scores.

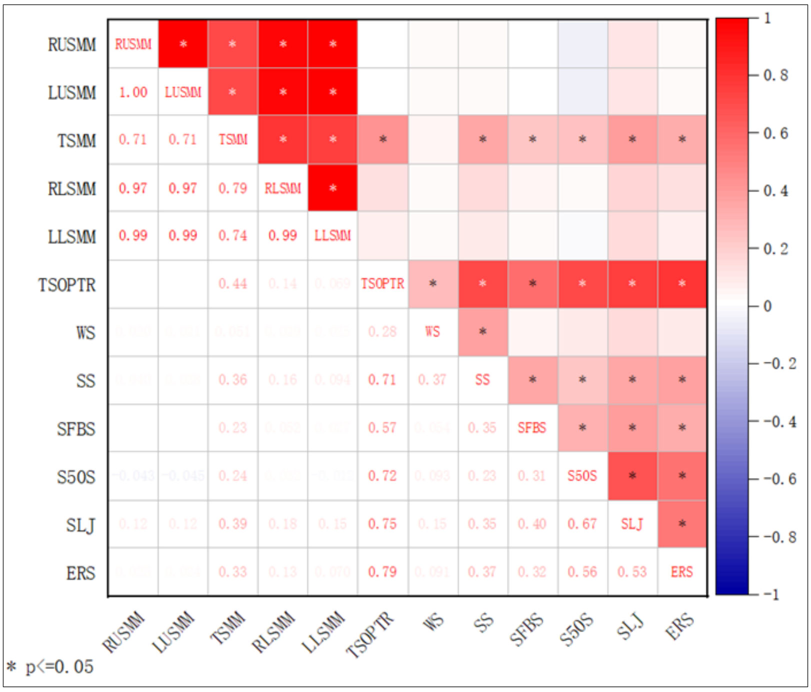

Figure 1 Correlation analysis of skeletal muscle distribution and body mass

Note: RUSMM: Skeletal muscle mass of the right upper limb; LUSMM: Skeletal muscle mass of the left upper extremity; TSMM : Trunk skeletal muscle mass ; RLSMM : Skeletal muscle mass of the right lower extremity ; LLSMM : Skeletal muscle mass of the left lower extremity ; TSOPTR : Trunk skeletal muscle mass ; WS: Weight score; SS: Spirometry score; SFBS: Sitting forward bend score; S50S: Sprint 50m scoring; SLJ: Standing Long Jump; ERS: Endurance running score. The x-axis and y-axis indicate the degree of correlation between the variables.

3.3. Correlation analysis of skeletal muscle distribution and functional movements

As seen in Figure 2, the distribution of skeletal muscle mass in the right upper limb, skeletal muscle mass in the left upper limb, skeletal muscle mass in the trunk, skeletal muscle mass in the right lower limb, and skeletal muscle mass in the left lower limb were not significantly correlated with the total FMS score and each FMS score.

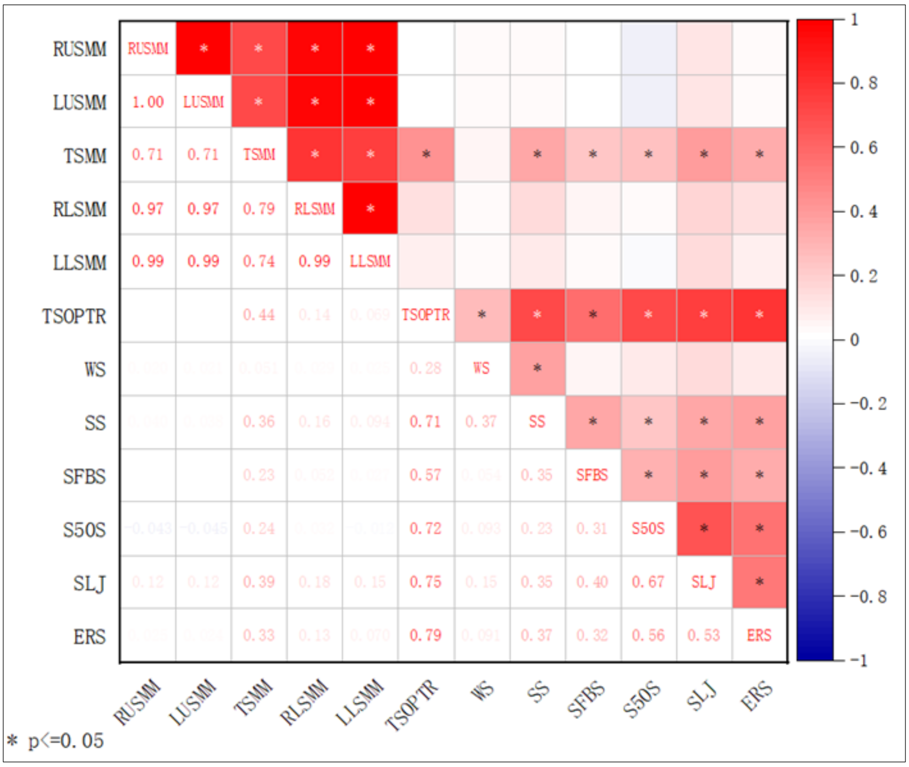

Figure 2 Correlation analysis of skeletal muscle distribution and functional movements

Note: RUSMM: Skeletal muscle mass of the right upper limb; LUSMM: Skeletal muscle mass of the left upper extremity; TSMM : Trunk skeletal muscle mass ; RLSMM : Skeletal muscle mass of the right lower extremity ; LLSMM : Skeletal muscle mass of the left lower extremity ; TSOPTR : Trunk skeletal muscle mass ; Active straight knee leg lift : ASKLL; Shoulder joint flexibility: SJF; Body spin stability: BSS; push up :PU; Step up the hurdle: SUTH; Squat over top: SOT; Squat with straight leg bow: SWSLB;The x-axis and y-axis indicate the degree of correlation between the variables.

4. Discussion

The results of this study showed that total physical test score, spirometry score, sprint 50 m score, and endurance running score were significantly correlated ($P<0.05$), in which the correlation between total physical test score and skeletal muscle mass was moderate ($r=0.45$), and the others were weakly correlated. Sprint 50m tests speed, burst, lower limb muscle strength and neuromuscular reaction speed, and it has been proved that balance is an important factor for fall prevention in elderly people, and lower limb muscle strength and neuromuscular control are associated with balance[11-13].Although the correlation between skeletal muscle mass and 50 m running in women was only demonstrated in this study, and no causal relationship between the two was proven, it is possible to show the association between the two. Then if we improve the skeletal muscle quality in women through exercise or dietary modification, then to some extent we can regulate the speed quality, burst, lower limb muscle strength and neuromuscular reaction speed in women, thus preventing falls in women after menopause or into old age, or the maintenance of 50m and other related qualities is beneficial to prevent falls in women after menopause or into old age.

In this study, distribution of skeletal muscles in the trunk was significantly correlated ($P<0.05$) with total physical test scores, spirometry scores, seated forward bend scores, sprint 50 m scores standing long jump, and endurance running scores. Distribution in trunk skeletal muscles was correlated with sitting forward flexion scores, which was similar to the findings of Binbin Huang [14]et al.The reason for this may be that the magnitude of muscle force in the study of Alizadehkhaiya [15] is related to the skeletal muscle mass. In the study of Alizadehkhaiya [15], the muscle strength was related to the skeletal muscle mass, while the rectus abdominis, internal and external oblique abdominis, and iliopsoas muscles used in the process of sit-up centripetal flexion were all classified as trunk muscles [15].Ishida [16] et al. found thatThe thickness of the external abdominal obliques is related to the maximum expiratory flow rate. The external abdominal obliques are one of the sit-up power muscles, and the trunk needs to be flexed centripetally with forceful exhalation to increase abdominal pressure so as to complete the sit-up movement. Therefore, the more skeletal muscle mass of the trunk, the greater the possibility of the thickness of the external abdominal oblique muscle, the more conducive to the exhalation movement during exercise, conducive to 1 minute of sustained force, thus better repetition of the sit-up action.

5. Conclusion

- Skeletal muscle mass is correlated with female body mass, including physiological function, burst and endurance running;
- Skeletal muscle distribution in the trunk is correlated with female body mass, including physiological function, burst and endurance;
- Female skeletal muscle mass and skeletal muscle distribution in the trunk can be improved through diet and exercise to improve female body mass and reduce the risk of falls after menopause or in old age. The risk of falls after menopause or in old age.

Compliance with ethical standards

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Disclosure of conflict of interest

Before the publication, we had the consent of all authors. All authors approve the ranking order. We declare that there is no conflict of interest in the article.

Statement of informed consent

Each participant signed a statement of informed consent obtained from all individual participants included in the study.

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