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POROVNÁNÍ TRADIČNÍCH A INOVATIVNÍCH TESTŮ SVALOVÉ ZDATNOSTI

COMPARING AND CONTRASTING TRADITIONAL AND INNOVATIVE MUSCULAR FITNESS TESTING

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Abstract

Muscular fitness is a key component of health, and its accurate assessment is crucial. Due to developments in the field of fitness, there is an increasing need to explore new testing methods tailored to specific conditions and demographic groups. This pilot study focuses on the correlation between traditional and innovative muscular fitness tests, emphasizing their substitutability in a healthy adult population. The study compares established tests such as handgrip strength, push-ups, sit-ups, and standing long jump with innovative tests, specifically dynamometry for assessing the back and legs, squats, and medicine ball throws. The research sample included healthy males and females ($n = 36$) with an average age of 21.3 years. Correlational analysis using Pearson's correlation coefficient revealed a significant positive correlation between handgrip strength and dynamometry of the back and legs ($r = 0.842$, $p < 0.01$), suggesting that these tests assess complementary aspects of muscular strength. Similarly, the medicine ball throw showed a strong correlation with handgrip strength ($r = 0.805$, $p < 0.01$), indicating its effectiveness in assessing explosive strength. In contrast, squats showed a weak correlation with traditional endurance tests, such as sit-ups ($r = 0.125$, $p > 0.05$), indicating the involvement of different muscle groups and aspects of endurance. The identified correlations highlight the complex nature of muscular fitness, where innovative tests may only partially replace traditional methods. However, further research with larger and more diverse samples is needed to confirm these preliminary findings.

Keywords: strength; muscular endurance; fitness assessment

Souhrn

Svalová zdatnost představuje klíčovou složku zdraví, jejíž přesné hodnocení je zásadní. Vzhledem k vývoji v oblasti fitness narůstá potřeba zkoumat nové testovací metody, přizpůsobené specifickým podmínkám a demografickým skupinám. Tato pilotní studie se zaměřuje na korelaci mezi tradičními a inovativními testy svalové zdatnosti, s důrazem na jejich zastupitelnost u zdravé dospělé populace. Studie srovnává zavedené testy, jako jsou síla stisku ruky, kliky, leh-sedy a skok do dálky z místa, s inovativními testy, konkrétně dynamometrií pro hodnocení zad a nohou, dřepy a hodem medicinbalem. Výzkumný vzorek zahrnoval zdravé muže a ženy ($n = 36$) s průměrným věkem 21,3 let. Korelační analýza pomocí Pearsonova korelačního koeficientu ukázala významnou pozitivní korelaci mezi stiskem ruky a dynamometrií zad a nohou ($r = 0{,}842$, $p < 0{,}01$), což naznačuje, že tyto testy hodnotí komplementární aspekty svalové síly. Podobně hod medicinbalem vykazoval silnou korelaci se silou stisku ruky ($r = 0{,}805$, $p < 0{,}01$), což poukazuje na jeho efektivitu při hodnocení explozivní síly. Naopak dřepy vykázaly slabou korelaci s tradičními vytrvalostními testy, jako jsou sedy-lehy ($r = 0{,}125$, $p > 0{,}05$), což naznačuje zapojení odlišných svalových skupin a aspektů vytrvalosti. Zjištěné korelace podtrhují komplexní povahu svalové zdatnosti, kde inovativní testy mohou tradiční metody jen částečně nahradit. Pro potvrzení těchto předběžných zjištění je však zapotřebí dalšího výzkumu na větších a rozmanitějších vzorcích.

Klíčová slova: síla; svalová vytrvalost; hodnocení zdatnosti

Introduction

The paradigm of muscular fitness has evolved in contemporary society, reflecting changes in anthropometric measurements and performance related to physical fitness. Muscular fitness is no longer just a reflection of individual health but a complex interplay of physiological attributes with far-reaching implications for public health. Increasingly, evidence highlights the substantial role of muscular fitness in mitigating the risk of chronic diseases, including cardiovascular and metabolic disorders (Loprinzi, 2018). Furthermore, muscular fitness has emerged as an independent predictor of all-cause and cancer mortality (Artero et al., 2012).

Muscular fitness can also be assessed through measures of muscular strength and muscular endurance. Muscular strength refers to the maximal force that a muscle or muscle group can generate, while muscular endurance refers to the ability of a muscle group to perform repeated contractions over a specific period of time (Bohannon, 2019). Additionally, a physical fitness assessment may include measures of body composition, cardiorespiratory endurance, and musculoskeletal flexibility (Appelqvist-Schmidlechner et al., 2020). These assessments can provide valuable information about an individual's overall muscular fitness and help identify areas for improvement (Cuenca-Garcia et al., 2022).

The importance of muscular fitness extends into early adulthood, with associations noted between muscular strength and a plethora of health outcomes, including quality of life, academic and workplace success, and even mental health (Appelqvist-Schmidlechner et al., 2020; Vaishya et al., 2024). As sedentary lifestyles become more prevalent, especially within Western societies, the accompanying decline in muscular strength and fitness presents a multifaceted challenge to health (Silva et al., 2020). Thus, our study focuses on the adult population, particularly young adults, to discern the relationship between muscular fitness and a spectrum of health indicators.

Traditional methods of measuring muscular fitness in adults, such as hand-grip strength, push-ups and the standing broad jump, serve as benchmarks within the field (Bohannon, 2019). These conventional tests are complemented by the assessment of endurance, alongside other components of physical fitness (Castro-Piñero et al., 2021). However, the pursuit of novel and possibly more appropriate methods for specific contexts or populations necessitates a continuous search for innovation in fitness testing (Ojeda et al., 2020).

Despite the widespread use of traditional fitness tests, their limitations are apparent, necessitating the exploration of alternative assessments. The validity of the push-up test, a common measure of upper body muscular endurance, remains unconfirmed, with a paucity of evidence supporting its use for this purpose (Castro-Piñero et al., 2021). In line with these findings, the push-up test has also been criticized for its low reliability (Cuenca-Garcia et al., 2022), further underscoring the need for more robust and accurate measures of muscular fitness. Moreover, the handgrip strength test may yield misleading results concerning health outcomes; a study by Cooper et al. (2022) revealed an incongruous positive relationship between body mass index (BMI) and handgrip strength, suggesting that the test might not adequately reflect cardiovascular health risks. This burgeoning recognition of the deficiencies in traditional testing propels the search for more suitable tests, capable of providing a reliable and holistic evaluation of muscular strength and endurance.

The congruence or disparity between traditional and novel tests is pivotal; determining their substitutability or the need for their combination according to situational demands forms a core objective of this research. The rationale lies in the hypothesis that a multi-faceted approach, targeting different body parts and varying in load (e.g., press vs. pull), may provide a more holistic understanding of muscular fitness (Cuenca-Garcia et al., 2022). While laboratory measurements are well-established, field tests offer practicality and versatility, catering to individual and sample-specific nuances (Cooper et al., 2022).

The authors are not aware of any sources that directly analyse multiple alternative tests of muscular fitness. Our research aims to compare traditional and innovative muscle fitness tests to evaluate their potential substitutability and to establish whether a combination of these assessments could provide a comprehensive profile of muscular fitness. The findings aim to contribute to the body of knowledge on physical fitness assessment and its implications for health and society.

Methods

The research conducted was a pilot study, designed to establish preliminary data on the feasibility and potential effectiveness of the chosen test protocols for assessing muscular fitness. This foundational phase is essential for refining research methods, validating testing procedures, and identifying any logistical or methodological challenges that may arise in a larger scale study. Data obtained from this initial investigation will be used to inform and structure future rigorous investigations, with the ultimate goal of enhancing the reliability and validity of fitness assessments in diverse populations. Furthermore, the pilot nature of the study allows for the exploration of participant response to the test battery, thus contributing to the development of standardized protocols that can be replicated in subsequent studies.

The term "traditional tests" encompasses a set of evaluations that have been long-established and widely utilized across various age groups and continents for the measurement of muscular fitness. These include exercises such as push-ups, sit-ups, standing broad jump, and handgrip dynamometry. Conversely, "innovative" tests are those that have been employed less frequently, with a comparatively weaker body of evidence to support their efficacy, including squats, medicine ball throws, and back-leg dynamometry. These tests are not entirely new or unique; for instance, medicine ball throws are common among children but not as prevalent within adult populations. The selected tests were chosen for their analogous nature in terms of targeted body areas (upper/lower body), type of exertion (strength endurance, absolute strength), allowing for an examination of their theoretical interchangeability in fitness assessment.

Participants

The research sample comprised healthy male and female participants ($n = 36$), with an average age of 21.3 years. Considering the nature and objectives of the research, it was deemed unnecessary to stratify participants by gender. Individuals with a BMI over 30 (kg/m^2) were excluded from the study to maintain a focus on a population representative of standard health parameters. The participants were well-informed about the research procedures and objectives, ensuring informed consent. The group's mean weight was 76.4 kg ($SD = 14.2$ kg), and an average height 177.25 cm ($SD = 11.0$ cm). The study was conducted in accordance with the latest version of the Declaration of Helsinki.

Testing

Anthropometric data were collected with participants' unshod and dressed in lightweight attire. Body weight was determined using an electronic scale (model HN-289, Omron, Japan). Body height was measured using a stadiometer (SECA model 220, Hamburg, Germany). BMI was subsequently computed as the weight in kilograms divided by the square of height in meters (kg/m^2).

To evaluate muscular fitness, seven specific tests were administered, aimed at gauging relative and absolute strength as well as dynamic muscular performance for both upper and lower body. The selected assessments included: squats, push-ups, sit-ups, standing broad jump, medicine ball throw, handgrip dynamometry (model MAP 80K1S, KERN, Kern & Sohn GmbH, Germany), and pulling back-leg dynamometry (model SH5007, Saehan Dynamometer, Saehan Corporation, India).

The testing took place within a single session. A general 10-minute full-body warm-up and technical rehearsal of the tests preceded the actual measurements. A warm-up started with dynamic stretching, like leg swings and arm circles, to activate muscles and improve mobility. This is followed by light cardio (e.g., jogging and jumping jacks) to raise the heart rate and increase blood flow; and bodyweight exercises, such as squats and lunges, further engage key muscles. Participants had two to three attempts for each test, with the best performance being recorded. For the strength endurance tests (squats, push-ups, sit-ups), there was only one attempt. A minimum 5-minute rest was allotted between tests. The order of tests was strategically chosen to ensure that fatigue from preceding activities did not adversely affect subsequent performances: handgrip, standing broad jump (SBJ), medicine ball throw (MBT), back-leg, sit-ups, push-ups, and squats.

Standing broad jump (SBJ)

Participants positioned themselves with feet together, behind a demarcated starting line. They were permitted to use a countermovement or arm swing to facilitate the jump. The objective was to land with both feet simultaneously, stabilizing immediately upon landing without any additional forward movement. If the participant fell backward or made contact with the ground with any other body part, a repeat attempt was granted. Measurement of the jump distance was executed using a tape measure, extending from the starting line to the heel of the foot nearest to the starting line upon landing.

Push-ups

The participant initiated the exercise in a standard push-up position: hands and toes were in contact with the floor, the body extended in a straight line from head to heels, feet set apart marginally, and arms spaced shoulder-width with full extension, forming a perpendicular line to the torso. Maintaining a rigid back and legs, the participant then lowered their body and touch the floor with chest only. A repetition was counted once the participant returned to the starting position. The objective was to execute the maximal number of repetitions without repositioning the hands or toes throughout the duration of the test.

Squats

The standard for the squat was established as a deep squat, which necessitates the descent of the upper part of the hip joint below the level of the knee cap (patella), often referred to as a "squat below parallel“. In the upper position, participants were required to achieve full extension, which was monitored for compliance in the knee and hip joints, as well as an upright posture. The width of the stance was not specified, allowing participants to choose a position that felt natural and comfortable, providing flexibility for individual biomechanical differences. Similarly, there was no requirement regarding the position of the arms, allowing them to remain in a position most conducive to maintaining balance and proper form throughout the test. The requirement was to perform the maximum number of repetitions for a duration of two minutes.

Sit-ups

Participants started in a supine position with hands on their shoulders and knees bent at 90 degrees. Ankle support was provided by a researcher. Subjects curled up to touch their knees with both elbows and then reclined until the shoulder blades contacted the mat, completing one repetition. The total count of repetitions within a 60-second period was documented.

Medicine ball throw (MBT)

Subjects initiated the exercise standing with feet parallel, holding a 6 kg, 40 cm diameter medicine ball at chest height using both hands with elbows flexed. The ball was propelled forward by both hands without any rotational movement of the trunk, preceded by a countermovement. The throw distance was quantified from the initial impact point of the ball to the throwing line.

Handgrip dynamometry (handgrip)

Grip strength was measured in a standing position with the shoulder adducted and flexed elbow. Participants performed two attempts with each hand, and the best result from the individual measurements was recorded.

Pulling back-leg dynamometry (back-leg)

The subject assumed a standing position on the apparatus with feet placed together and grasped the handle with both hands. The handle's height was adjusted to align with the subject's knees, and the chain was positioned to pass between the legs, mimicking a partial deadlift motion. It was necessary that the handle did not contact the thighs during the lift.

Statistical Analysis

Descriptive statistics for our dataset was generated using IBM SPSS software, version 20. Within this analytical framework, we also calculated the Pearson rank correlation coefficient to evaluate the strength of association between the variables collected. Following the guidelines suggested by Abbott (2011), the magnitude of the correlation was classified as follows: coefficients of 0.8 or higher were indicative of a very strong relationship; values between 0.6 and 0.8 signalled a strong relationship; coefficients ranging from 0.4 to 0.6 pointed to a moderate relationship; figures from 0.2 to 0.4 were considered a weak relationship; and coefficients below 0.2 were interpreted as a very weak relationship. For the measured values, a test for normality of the data was performed (Shapiro-Wilks).

To elucidate the comprehensive relationship between traditional and innovative muscular fitness tests, comparative analyses were conducted between these two categories. The connection established between the test batteries is not officially recognized but was constructed for the purpose of determining the potential substitutability of the selected tests. Performance rankings were created for participants within each individual test and for the overall test battery. These rankings facilitated the establishment of two separate hierarchies for traditional and innovative tests, respectively. The relationship between these hierarchies was then statistically evaluated to assess the degree of correlation and potential for one category of tests to serve as representative of the other. The ordering of participants' performances in each test was analysed to investigate the relationship between the two categories. Upon statistical examination, a Pearson rank correlation was applied.

Results

Physical fitness assessments were conducted on a group of individuals, resulting in a comprehensive data set including various measures of muscular strength and endurance (Table 1). The mean weight and height of participants were 76.38 kg (SD = 14.16 kg) and 177.25 cm (SD = 11.00 cm), respectively. In assessing handgrip strength, the mean force generated was 48.72 kg (SD = 11.86 kg). The mean force level on the back-leg showed 151.89 kg (SD = 41.32 kg).

For the muscular endurance tests, participants performed an average of 24.06 push-ups (SD = 12.04 repetitions), reached 228.28 cm (SD = 29.00 cm) in the SBJ, and MBT an average distance of 7.25 meters (SD = 1.57 meters). In the sit-up test, an average of 42.64 repetitions (SD = 5.10 repetitions) was observed, and for the squats performed within 120 seconds, the mean was 82.58 repetitions (SD = 12.24 repetitions).

Tabulka 1./ Table 1.
Průměrné hodnoty vybraných somatických charakteristik a výsledky jednotlivých testů./ Average values of selected somatic characteristics and results of individual tests.

	N	Weight (kg)	Height (cm)	Handgrip (kg)	Back-leg (kg)	Push-ups (N)	SBJ (cm)	MBT (cm)	Sit-ups (N)	Squats (120s) (N)
Mean	36	76.4	177.3	48.7	151.9	24.1	228.3	7.3	42.6	82.6
SD	36	14.2	11.0	11.9	41.3	12.0	29.0	1.6	5.1	12.2

Note. Handgrip= force measured in kg (equivalent to N); SBJ= Standing broad jump; MBT= Medicine ball throw

Tabulka 2./ Table 2.
Výsledky korelační analýzy pro somatické charakteristiky a jednotlivé testy./ The results of the correlation analysis for somatic characteristics and individual tests.

		Weight	Height	Handgrip	Back-leg	Push-ups	SBJ	MBT	Sit-ups	Squats
Weight	Pearson Correlation	1	.787⋆⋆	.786⋆⋆	.760⋆⋆	0.264	.510⋆⋆	.749⋆⋆	0.179	-0.275
	Sig. (2-tailed)		0.000	0.000	0.000	0.120	0.001	0.000	0.296	0.122
Height	Pearson Correlation	.787⋆⋆	1	.615⋆⋆	.640⋆⋆	0.179	.625⋆⋆	.667⋆⋆	0.094	-.436⋆
	Sig. (2-tailed)	0.000		0.000	0.000	0.295	0.000	0.000	0.585	0.011
Handgrip	Pearson Correlation	.786⋆⋆	.615⋆⋆	1	.842⋆⋆	.641⋆⋆	.556⋆⋆	.805⋆⋆	.344⋆	-0.022
	Sig. (2-tailed)	0.000	0.000		0.000	0.000	0.000	0.000	0.040	0.903
Back-leg	Pearson Correlation	.760⋆⋆	.640⋆⋆	.842⋆⋆	1	.680⋆⋆	.667⋆⋆	.832⋆⋆	.399⋆	-0.067
	Sig. (2-tailed)	0.000	0.000	0.000		0.000	0.000	0.000	0.016	0.710
Push-ups	Pearson Correlation	0.264	0.179	.641⋆⋆	.680⋆⋆	1	.560⋆⋆	.676⋆⋆	.483⋆⋆	0.028
	Sig. (2-tailed)	0.120	0.295	0.000	0.000		0.000	0.000	0.003	0.877
SBJ	Pearson Correlation	.510⋆⋆	.625⋆⋆	.556⋆⋆	.660⋆⋆	.560⋆⋆	1	.716⋆⋆	0.174	-0.148
	Sig. (2-tailed)	0.001	0.000	0.000	0.000	0.000		0.000	0.311	0.412
MBT	Pearson Correlation	.749⋆⋆	.667⋆⋆	.805⋆⋆	.832⋆⋆	.676⋆⋆	.716⋆⋆	1	.380⋆	-0.201
	Sig. (2-tailed)	0.000	0.000	0.000	0.000	0.000	0.000		0.022	0.263
Sit-ups	Pearson Correlation	0.179	0.094	.344⋆	.399⋆	.483⋆⋆	0.174	.380⋆	1	0.125
	Sig. (2-tailed)	0.296	0.585	0.040	0.016	0.003	0.311	0.022		0.488
Squats	Pearson Correlation	-0.275	-.436⋆	-0.022	-0.067	0.028	-0.148	-0.201	0.125	1
	Sig. (2-tailed)	0.122	0.011	0.903	0.710	0.877	0.412	0.263	0.488	

Note. SBJ = Standing broad jump; MBT= Medicine ball throw; ⋆⋆. Correlation is significant at the 0.01 level (2-tailed); ⋆. Correlation is significant at the 0.05 level (2-tailed).

The correlation matrix presented reveals significant relationships between various measures of muscular fitness. The results of the statistical analysis are clearly presented in the following Table 2.

The correlation matrix presented reveals significant relationships between various measures of muscular fitness (table 2). Notably, there was a strong positive correlation between weight and handgrip ($r = .786$, $p < .01$), back-leg a MBT suggesting that heavier individuals tend to exhibit better results in these tests. This pattern is consistent with the positive correlation found between weight and back-leg ($r = .760$, $p < .01$), underlining the association between body mass and strength measures.

Height was significantly correlated with handgrip ($r = .0615$, $p < .01$), back-leg ($r = .640$, $p < .01$), SBJ ($r = .625$, $p < .01$), MBT ($r = .667$, $p < .01$), indicating that taller individuals might have an advantage in these strength tests. However, height was not significantly correlated with push-ups performance ($r = .179$, $p > .05$), indicating that push-up ability may not be influenced by a person's stature. The analysis also showed a negative correlation with squats ($r = -.436$, $p < .05$), indicating an inverse relationship between these two variables.

The standing broad jump (SBJ) was positively correlated with back-leg ($r = .660$, $p < .01$), which could indicate that overall explosive leg power contributes to back strength, or vice versa. The MBT showed strong positive correlations with handgrip ($r = .805$, $p < .01$), suggesting that handgrip strength is a good predictor of absolute strength. It was also significantly correlated with back-leg ($r = .832$, $p < .01$) and SBJ ($r = .716$, $p < .01$), reinforcing the association between these tests.

Interestingly, a negative correlation was found between weight and squats performance ($r = -.275$, $p > .05$), although it was not statistically significant, suggesting a potential trend that heavier individuals might perform fewer squats in this time frame.

In examining the correlation data, traditional tests displayed a varied range of associations among themselves. Handgrip showed positive correlations with both SBJ ($r = .556$, $p < .01$), push-ups ($r = .641$, $p < .01$) and sit-ups ($r = .344$, $p < .05$). This indicates that the muscular strength measured by handgrip is somewhat reflective of the abilities required for push-ups, sit-ups and explosive leg strength.

In contrast, the innovative tests presented significant correlations with both the traditional tests and among themselves. The back-leg correlated strongly with handgrip ($r = .842$, $p < .01$;), indicating a possible relationship between overall muscular strength and the specific back and leg muscles assessed in this test. Squats, however, showed not a significant relationship with back-leg ($-.067$, $p > .05$) and MBT ($-.201$, $p > .05$). The MBT demonstrated the highest correlation with back-leg dynamometry ($r = .832$, $p < .01$).

A comparison of the two sets of tests – traditional versus innovative – was conducted (Table 3). The analysis revealed a substantial positive correlation between the rankings of traditional and innovative tests ($r = 0.835$, $p < 0.01$), suggesting a strong concordance between them.

Tabulka 3./ Table 3.
Výsledky korelační analýzy pro tradiční testy a inovativní testy./ The results of the correlation analysis for traditional tests and innovative tests.

		Innovative tests	Traditional tests
Innovative tests	Pearson Correlation	1	.835⋆⋆
	Sig. (2-tailed)		.000
	N	36	36
Traditional tests	Pearson Correlation	.835⋆⋆	1
	Sig. (2-tailed)	.000	
	N	36	36

Note. ⋆⋆. Correlation is significant at the 0.01 level (2-tailed)

Discussion

The objective of this research was to compare traditional and innovative tests by examining their correlations and potential substitutability. Results indicate that in certain cases, tests demonstrated a strong relationship: handgrip with back-leg ($r = .842$), handgrip with MBT ($r = .805$) and SBJ with MBT ($r = .716$). However, in other instances, a weak relationship was reported, such as between squats and sit-ups. Thus, only specific combinations of tests may serve as potential substitutes. The correlation between sets of test suggests that they could be interchangeable (r = .835), although it is important to consider that they were created for the purposes of this research.

The search for alternative muscular strength tests primarily pertains to individuals with health impairments or those with physical or mental limitations (McGough et al., 2019; Reychler et al., 2018). These are often simpler versions of tests that, while proven valid, are not suitable for the general population. For practical application among healthy adults, it is crucial to have a range of field tests capable of objectively evaluating the level of selected strength levels. This allows for the inclusion of more demanding tests. An example is the two-minute squat test, which is both physically and mentally demanding because of the intense muscle burn experienced during the exercise.

Dynamometry is a valid and reliable method for measuring muscular fitness, but it can yield misleading results regarding health. Cooper et al. (2022) discovered a positive relationship between BMI and handgrip strength. This relationship suggests that obese individuals may exhibit strong results in absolute muscular strength. Nonetheless, these individuals are at risk of sarcopenic obesity later in life and fall into a risk category for other lifestyle-related diseases. Our measurements indicate that the same relationship applies to the back-leg test. The relationship between anthropometry, BMI, and dynamometry is complex and must be contextualized for specific groups (Murphy et al., 2014). Furthermore, it is important to assess body fat distribution, as individuals with a larger waist circumference and high BMI typically show lower handgrip strength levels (Keevil et al., 2015).

The observed strong correlation between handgrip and back-leg dynamometry in our study likely reflects underlying physiological and biomechanical commonalities. Handgrip strength is not merely a function of hand and forearm muscles; it also engages the upper body's synergistic muscular actions (Vaishya et al., 2024). Similarly, back-leg dynamometry requires the activation of the posterior chain muscles, which include the lower back, gluteus, and hamstrings-muscles that also play a role in maintaining an effective grip (Martín-Fuentes et al., 2020). This suggests that individuals who exhibit greater handgrip strength may inherently possess a well-developed posterior muscular chain, contributing to stronger performance in back-leg dynamometry.

Muscular endurance testing was conducted using traditional tests such as push-ups and sit-ups. It was observed that push-ups were challenging for some individuals (1-5 repetitions), which implies that the test may assess maximum strength rather than endurance. This could be related to the moderate correlation between these tests (r = .483). Squats test was used as an innovative alternative, yet it demonstrated only a weak correlation with traditional tests (r = .125, .028 respectively). It is evident that tests targeting the upper and lower body reveal differences and cannot be directly substituted for one another. However, lower body endurance could be more closely related to health parameters (Alcazar et al., 2018), suggesting the importance of including such tests in evaluations.

Explosive strength tests are often included in the evaluation of muscular fitness. The tests we selected, the MBT and the SBJ, demonstrated a strong correlation (r = .716), suggesting they could be used interchangeably. However, it is debatable whether this type of strength is suitable for testing across all age groups or whether more universally applicable methods should be considered. The SBJ, for instance, imposes a relatively high load on the knee joints and spine (Eagles et al., 2016; Schäfer et al., 2023), making it a good option for younger individuals but perhaps unsuitable for older adults. Thus, the MBT represents a less strenuous alternative that also showed a strong correlation with dynamometry, indicating its efficacy in assessing absolute strength.

The observed correlations among tests likely arise from underlying physiological and biomechanical factors. For instance, the strong relationship between handgrip and back-leg dynamometry may be due to shared engagement of the posterior chain muscles, including the lower back, gluteus, and hamstrings, which contribute to strength in both upper and lower body assessments. This suggests that individuals with higher handgrip strength often possess a more developed posterior chain, supporting better back-leg performance. Similarly, the moderate correlation between handgrip and the MBT may stem from the coordinated upper body power required in both tests, though achieved through different muscular pathways. In contrast, the weak correlation between squats and sit-ups likely reflects the distinct muscle groups and endurance types each test engages; squats emphasize lower body endurance, more closely tied to health factors like balance and mobility, while sit-ups primarily test core endurance. The strong relationship observed between MBT and SBJ suggests these tests share a demand for explosive lower body power, though the SBJ places more strain on the knees and spine, making it potentially more suitable for younger individuals, while MBT serves as a less strenuous alternative for assessing upper body power. Understanding these physiological relationships helps clarify why certain tests correlate and supports more targeted selection based on fitness attributes and population needs.

Once again, it is confirmed that for a comprehensive assessment of muscular fitness, it is necessary to use multiple tests targeting different body parts and measuring various parameters such as muscular endurance, absolute strength, or explosive strength (Schlegel et al., 2023). A significant relationship between the individual traditional and innovative tests was only evidenced in certain cases. It is not yet possible to definitively determine which tests provide the best diagnostic value for health in a healthy adult population, hence they must be carefully selected, combined, and sensitively interpreted (Bohannon, 2019).

In line with the stated arguments, it can be asserted that traditional muscle fitness tests have limited interpretive value, and their interrelationships do not always accurately reflect an individual's overall fitness. Therefore, it is essential to consider the use of alternative testing methods that better align with current scientific findings and reflect shifts in the understanding of muscle fitness and its significance in overall physical conditioning. The perspective on muscle fitness and approaches to its assessment are gradually evolving. For instance, the commonly used sit-up test, often regarded as a standard, could be replaced by more suitable tests that more accurately evaluate muscular strength and functional capacity.

The search for new testing methods is also translating into everyday practice. Teachers and coaches often find themselves in situations where they must select the most appropriate test tailored to a specific individual or group. Various factors, such as age, anthropometry, health limitations, and movement preferences, can significantly influence test selection. For this reason, it is essential to have a broader range of tests available, allowing for adjustments that better reflect these individual characteristics.

Based on the findings from this study, it would be useful to conduct a longitudinal study to track the evolution of test correlations over time, particularly in the context of individuals' regular training. Such a study could reveal the effect of sustained exercise on parameters of strength and endurance captured by both traditional and innovative tests. In addition, a larger study with a more diverse set of participants would help validate our initial findings and ensure that the observed correlations are robust across different demographic groups and are not simply due to the size or composition of our sample.

As a pilot study, this research provides valuable preliminary data, yet it comes with inherent limitations that must be acknowledged. The sample size, while sufficient for exploratory purposes, is relatively small, which may limit the generalizability of the findings to larger and more diverse populations. Additionally, as the scope of a pilot study is inherently exploratory, the results primarily serve to inform and refine hypotheses, methods, and procedures for subsequent, more comprehensive studies. The selection of tests, though varied, may not encompass all aspects of muscular fitness, and the division into traditional and innovative categories, while conceptually useful, may oversimplify the complexities of physical fitness assessment. From a practical application perspective, we must acknowledge that we do not have strong, robust data, and therefore we cannot yet fully recommend the use of innovative tests

Conclusion

This pilot study highlights the crucial role of muscular fitness in overall health, which justifies its rigorous evaluation. Although the innovative tests explored show some degree of correlation with traditional tests, suggesting that they may serve as a partial alternative, establishing a direct replacement remains challenging. The development of an innovative test battery presents a compelling argument that, in certain scenarios, this suite could replace traditional tests used for healthy adult populations. However, the conclusions drawn from this research apply specifically to a healthy adult population and emphasize that finding an exact equivalent in fitness assessment is difficult and requires further validation. It is important to consider that this is a pilot study, and further research is needed to confirm the conclusions. Until then, it would be advisable to use the innovative tests with caution.

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