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A Comparative Study of Somatotypes (Mesomorph and Endomorph) on Physical Strength Performance in Men

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Abstract

The distribution of fat and muscle plays a crucial role in motor performance. While individuals with a mesomorphic body type (muscular) exhibit faster neuromuscular response, which enhances the effectiveness of explosive exercises, those with an endomorphic body type (muscular-fat) demonstrate greater endurance capacity.
This study aimed to:

- Investigate the relationship between somatotypes (mesomorph and endomorph) and physical strength performance in men.

In light of this aim, the researchers proposed the following hypothesis:

- There is a statistically significant relationship between somatotypes (mesomorph and endomorph) and physical strength performance.

The researchers adopted the descriptive correlational method as appropriate for the nature of this study. The experiment was conducted on a sample of 12 advanced-level male powerlifting athletes from Duhok Governorate, divided into two groups (somatotypes), each consisting of 6 players, selected purposefully based on fat and muscle indices. The experiment involved three physical strength tests performed sequentially:(Bench Press, Squat, Deadlift)
Statistical tools used included mean, standard deviation, coefficient of variation, skewness, Pearson correlation coefficient, and t-test.
The researchers arrived at the following conclusions:

1. No statistically significant differences were found between the mesomorphic and endomorphic groups in isolated exercises (e.g., bench press), indicating that increased muscle mass does not significantly affect the performance of exercises relying on neuromuscular efficiency and the balance of small muscle groups.
2. Significant differences were observed in favor of the endomorphic group in compound exercises (e.g., squat and deadlift), confirming that compound, absolute-strength-based movements depend more heavily on total muscle mass and the ability to generate muscular torque.

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1-Introduction

Physical strength is regarded as one of the main foundations for maintaining overall health and achieving high levels of athletic performance. It can be defined as the capacity of the muscular system to generate enough force to perform both everyday movements and complex sport-specific tasks with efficiency and precision. This physiological ability is essential for improving balance and coordination, enhancing functional fitness, and reducing the likelihood of musculoskeletal injuries, metabolic syndrome, and chronic illnesses such as cardiovascular disease, diabetes, and osteoporosis. In recent years, international organizations in sports science and medicine have agreed on the vital contribution of resistance training—including modalities such as weightlifting, powerlifting, and functional strength exercises—in stimulating muscle hypertrophy, increasing bone mineral density, supporting cardiovascular and metabolic health, and optimizing neuroendocrine responses associated with both muscular endurance and maximal strength. (1)

Despite the comprehensive understanding of these mechanisms, continuous debate exists about the extent to which somatotype variations influence strength development and athletic outcomes. Somatotypes, which reflect inherent body composition and physiological tendencies, play a key role in determining performance potential. Two major body types have been the focus of extensive scientific investigation concerning strength: the mesomorphic and the endomorphic types. The mesomorphic type is typically identified by a muscular frame, broad shoulders, narrow waist, and an enhanced ability to develop muscle mass—traits associated with higher baseline concentrations of anabolic hormones such as growth hormone and testosterone (2). In contrast, the endomorphic type possesses larger overall body mass that includes both muscle and significant fat tissue, accompanied by a slower metabolic rate. Although endomorphs may display strong absolute force due to their body mass, excess adipose tissue can reduce efficiency in explosive or high-velocity actions requiring rapid neuromuscular activatio. (3)

Empirical evidence indicates that mesomorphic athletes tend to outperform others in both relative and absolute strength measures, showing better results in activities that require a combination of power, endurance, and motor control. Their balanced muscle-to-fat ratio, along with efficient neuromuscular coordination, enables them to sustain elevated levels of performance across a wide range of athletic events. Conversely, endomorphic athletes, despite their high absolute strength, often encounter difficulties in precision- or speed-oriented tasks because of biomechanical restrictions caused by increased body fat (4). Nevertheless, current studies emphasize the adaptability of the endomorphic type, revealing that individualized and well-structured training programs focused on fat reduction while maintaining lean mass can considerably enhance their strength-to-weight ratio and overall performance .(5)

These morphological differences become particularly significant in powerlifting, a discipline based on three principal lifts: the bench press, squat, and deadlift. Success in these lifts depends not only on raw strength but also on biomechanical precision, intermuscular coordination, and optimal body composition that allow the athlete to generate maximal force safely and effectively. Therefore, the athlete's somatotype serves as an essential determinant in achieving peak performance in these compound movements, influencing both competition results and susceptibility to injury under heavy loads.

Accordingly, this study aims to investigate the relationship between mesomorphic and endomorphic body types and physical strength performance among male powerlifters. By comparing performance outcomes across the three main lifts and correlating them with anthropometric and physiological parameters, this research offers evidence-based insights for coaches, sports scientists, and rehabilitation specialists. The findings are expected to guide the design of targeted strength-training programs that optimize performance, reduce injury risk, and make effective use of each athlete's natural morphological characteristics. In this way, the study highlights the necessity of tailoring training regimens according to individual somatotypes to support personalized strength development within competitive powerlifting and beyond.

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2. Methodology

Research Methodology

A descriptive–comparative research approach was adopted, as it aligns well with the study's goal of comparing outcomes between different somatotype groups.

Population and Sample

The study population consisted of 30 powerlifting athletes from Northern Iraq. A sample of 12 was selected, divided into two groups based on their somatotypes, all recruited from the Duhok Governorate.

Sample Homogeneity

Both groups were matched for an average body mass of approximately 90 kg. Statistical homogeneity was confirmed for the variables of age, height, body mass, and training age. Skewness coefficients were within the acceptable ±1 range:

Table (1) shows

Variable	Mean	SD	Skewness
Age (years)	30.67	1.92	0.075
Height (cm)	178.89	1.01	0.672
Body Mass (kg)	88.75	0.87	–0.441
Training Age (years)	2.84	0.58	0.318

Instruments and Tools

InBody Body Composition Analyzer (e.g., InBody 770), reliable for assessing body fat and lean mass (multielectrode BIA) (McLester et al., 2020;).

• InBody 270 also demonstrates high reliability.

• Platform: minimum 2.5 × 2.5 m, maximum 4 × 4 m.

• Barbell: standard powerlifting bar, 28–29 mm diameter, ≤ 2.2 m length; knurling marks 81 cm apart (USAPL specification) (turn0search18).

• Plates/collars: weight accuracy within ±5.25% or ±10 g; collars = 2.5 kg each.

• Bench and Squat Racks: meet International Powerlifting Federation (IPF) 2024 standards.

Tests and Measurements

• Anthropometry: conducted on Wednesday, 5 February 2025.

• Performance Tests (sequenced per IPF rules):

1.Squat (Back Squat)

2.Bench Press

3.Deadlift

Field Procedure

•Pilot 1 (1 Feb 2025): introduced athletes to testing protocol and familiarization.

• Pilot 2 (2 Feb 2025): verified functionality of equipment and trained the assisting team.

Main Experiment (5 Feb 2025)

At Ahmed Fawzi Hall, Duhok Pre-test protocol: no training for 12 h, no food/drink for 6 h, urinate, wash/dry hands and feet, remove metal accessories.

Body Composition: input demographics into InBody, take baseline reading, participant holds handles properly for measurement.

Performance Tests: Squat, Bench Press, Deadlift—performed under official Iraqi Powerlifting Federation judges until technical failure.

Statistical Methods

Data were analyzed using: mean, coefficient of variation, mode, skewness coefficient, and calculated t-tests

Variables

5 .Results

4.1 Presentation of Results

Table 2 shows the means, standard deviations, t-values, and significance levels for the mesomorphic and endomorphic groups in the three powerlifting movements.

Variables	Mesomorphic Group (Mean ± SD)	Endomorphic Group (Mean ± SD)	t-value	p-value
Bench Press (kg)	117.83 ± 7.49	112.50 ± 7.58	1.225	0.249
Squat (kg)	121.33 ± 7.39	136.67 ± 10.33	2.957	0.014
Deadlift (kg)	141.67 ± 5.32	151.67 ± 6.06	3.040	0.013

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Significance level: $p \leq 0.05$

From Table 2, the following observations can be made:

No significant differences were found between the mesomorphic and endomorphic groups in the bench press performance, as the p-value (≥ 0.05) indicates no statistically significant differences.

Significant differences were observed between the two groups in both squat and deadlift, as the p-values (≤ 0.05) indicate statistically significant differences favoring the endomorphic group.

Discussion of Results

The lack of a significant difference in bench press performance between the two somatotype groups can be explained by several practical and physiological considerations.

First, the nature of the bench press itself plays an important role. This exercise mainly targets the chest and shoulder muscles and is considered more of an isolated movement compared with compound lifts that involve larger muscle groups. Because of this, its outcome depends more on local muscle strength and technique than on overall body mass or total muscle volume. (10)

Second, neuromuscular coordination and technical skill can have a decisive impact. When athletes from both groups have similar levels of technical proficiency and control over the movement, differences in body structure may not lead to noticeable variations in lifting performance . (11)

A third explanation relates to muscle fiber composition. If one group has a higher percentage of slow-twitch (Type I) fibers, this could influence performance during moderate-repetition sets, as these fibers are more resistant to fatigue but generate lower peak force.(12)

Previous research comparing powerlifters from various weight divisions supports these interpretations. The results indicated that mesomorphic lifters usually dominate in middleweight categories (75–100 kg) because of their better strength-to-weight ratio, while endomorphic lifters tend to excel in the super-heavyweight divisions (>120 kg), benefiting from greater total body and muscle mass. This pattern shows that increases in total muscle mass are closely linked with improvements in maximal lift performance, particularly in the squat and deadlift, even when accompanied by a higher fat percentage.

In other words, it is muscle mass, not body fat, that appears to determine absolute strength in heavy compound lifts.

The significant differences observed in squat and deadlift results between mesomorphic and endomorphic participants can also be understood through the nature of these exercises. Both movements engage multiple large muscle groups—mainly the back, gluteal, and thigh muscles—and depend heavily on maximal force production. Athletes with greater muscle mass are typically capable of generating more torque, which directly enhances their performance in these demanding lifts.(13 , 14)

The wider standard deviation noted in the endomorphic group (for example, ±10.33 kg in squat performance) suggests greater variability in strength levels, which might reflect differences in training experience, muscle adaptation, or technical precision among individuals . (15)

Findings from several studies support this interpretation. West et al. (2021) reported that compound exercises such as the deadlift rely primarily on absolute muscle mass rather than relative strength. Suchomel et al. (2018) found a strong association between maximal strength (1RM) and muscle cross-sectional area, particularly in multi-joint exercises. Similarly, Enoka and Duchateau (2016) emphasized that neuromuscular efficiency plays a larger role in moderate-load or isolation movements (like the bench press), whereas structural factors such as muscle size and total body mass dominate during maximal-load efforts.

7 .Conclusion

There were no statistically significant differences between the mesomorphic and endomorphic groups in isolated exercises like the bench press. This indicates that increasing muscle size alone does not necessarily

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improve performance in isolated movements, which depend more on technical skill and neuromuscular efficiency.

Clear and significant differences appeared in compound lifts such as the squat and deadlift, favoring the endomorphic group. These results confirm that absolute strength is more strongly influenced by total muscle mass and the ability to generate greater torque through large muscle groups.

Recommendations

Athletes with greater muscle mass should focus on compound exercises such as squats and deadlifts to make full use of their strength potential.

Athletes with less muscle mass should emphasize neuromuscular training and isolated movements like the bench press to refine coordination and improve efficiency.

Coaches and trainers are advised to use compound lifts as a more accurate measure of total body strength, while employing isolation exercises mainly to assess muscle balance and technical precision.

Acknowledgement

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