

Original Article

Comparative Analysis of Isolated Versus Compound Weightlifting Patterns on Core Strength in Female Gym Participants

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Abstract

Objective: To compare the effects of Isolated versus Compound weightlifting patterns on core strength among female gym participants.

Study Design: A comparative cross-sectional study was conducted.

Place and duration of study: A cross-sectional comparative study was carried out on 186 healthy female gym members, aged 20 to 30 years.

Material and Methods: A cross-sectional comparative study was carried out on 186 healthy female gym members, aged 20 to 30 years. The participants were separated into two categories: Isolated weightlifting (n=93) and Compound weightlifting (n=93). Core strength was then evaluated through the Plank Test and Leg Lowering Test. Data analysis was conducted using SPSS v.25, employing the Mann Whitney test for comparison among these groups.

Results: In descriptive analysis, mean and standard deviation of age and BMI came out to be 25.73 ± 2.91 and 25.52 ± 15.41 respectively. In inferential analysis, we used Shapiro-wilk test on age and BMI to check the normality. Normality value was 0.001, therefore we used a non-parametric, Mann Whitney test to compare the plank timing and leg lowering angles between compound and isolated weight lifting groups. P-value of both were 0.001 which showed statistically significant differences between compound and isolated weight lifting groups.

Conclusion: Compound weightlifting patterns lead to better core strength than isolated ones among female gym participants. Therefore, including compound exercises can enhance core engagement and overall strength advantages.

Keywords: Compound exercises, Core strength, Isolated exercises, Leg lowering test, Plank test, Weightlifting patterns

1. Introduction

The core muscles are essential for stabilizing the torso, supporting posture, and enabling effective force transfer during dynamic activities.⁽¹⁾ Enhancing these muscles not only boosts athletic performance but also lowers the likelihood of musculoskeletal injuries.⁽²⁾ In recent years, weightlifting has gained popularity among female gym participants, with training approaches broadly classified into two groups: isolated exercises, which target a specific muscle group, and compound exercises, which involve multiple joints and muscle groups simultaneously. Isolated patterns are often recommended for targeted hypertrophy or rehabilitation purposes. Women generally have lower core muscle mass than men, influenced by hormonal and anatomical

factors, which increases the need for specific core strengthening to prevent lower back pain, pelvic floor dysfunction, and other musculoskeletal issues.⁽³⁾ Although the benefits of weightlifting for strength and posture are well established, there is limited research comparing the effects of isolated versus compound weightlifting patterns on core strength specifically in female gym participants.⁽⁴⁾ Isolated exercises are used to isolate specific muscles without engaging surrounding muscle groups. While in comparison, compound patterns focus on the execution of more than one joint and muscle group at once and are more favorable in the quest to achieve a balanced level of fitness.

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These drills require greater coordination and muscle recruitment from various regions of the body. Some classic examples of compound exercises are squats, bench press, and deadlifts. All of which target multiple muscle groups, but require a significant amount of core engagement for stability and power output.⁽⁵⁾ Although both modalities offer advantages, the evidence regarding their distinct impact on core strength in female groups is still scarce.⁽⁶⁾ This study aimed to investigate whether isolated or compound weightlifting patterns elicit greater improvements in core strength.

Beyond enhancing posture and performance, a well-conditioned core also plays a significant role in safeguarding spinal health and facilitating efficient movement mechanics.⁽⁷⁾ By supporting optimal alignment and distributing loads evenly during physical activity, core strength can reduce the risk of overuse injuries and improve movement efficiency in both training and daily tasks.^(8,9) This is especially relevant for gym-based populations, where exercise intensity and load progression can place considerable demands on trunk stability.

In physiotherapy core strengthening has a major role in reducing lower back pain. Weak core muscles often lead to compensatory movements and strain in the lower back. Strengthening of these muscles reduces the strain from such compensatory movements providing relief.⁽¹⁰⁾

In addition, weightlifting offers female participants unique physiological benefits that extend beyond muscular development.^(4,11) Having a strong core also helps alleviate lower back pain which is one of the main issues women face and aids in child bearing as it also helps avoid excessive bulging due to weak core muscles. During pregnancy, the baby's weight exerts pressure on these muscles. Weak pelvic floor and core muscles can lead to a bulging or sagging pelvic floor which can lead to urinary incontinence (loss of urine when sneezing or coughing). Prolapse of pelvic organs also occurs. Strong pelvic floor muscles prevent excessive bulging or distension, control the increased pressure, and assist in the delivery. Strong core and pelvic floor muscles, Improved posture aids in back pain relief, Reduction of back pain, Improved pushing

force during delivery, and faster postpartum recovery during pregnancy due to increased weight of baby.⁽¹²⁾

Engaging in structured resistance training can improve bone mineral density, aid in metabolic health, and support hormonal balance, all of which contribute to overall well-being.⁽¹³⁾ These benefits highlight the importance of selecting effective training patterns that maximize results while addressing the specific biomechanical and physiological needs of women in resistance-based fitness programs.⁽¹⁴⁾

2. Materials & Methods

This was a comparative cross-sectional. This study was conducted in various gyms across Islamabad and Rawalpindi, Pakistan, over the course of 6 months. Participants: 186 healthy female gym participants aged 20–30 years were recruited through purposive sampling. Participants were recruited using a non-probability convenience sampling technique. We used Epitool to determine our sample size, applying the standard deviation for the plank test from a previous study as our gold standard for core strength assessment. With a 95% confidence interval, this approach estimated a sample size of 186.⁽¹⁵⁾ Participants were included if they had a minimum of six months of consistent weight training experience, defined as engaging in weight training at least 3 sessions per week, each lasting 30 to 60 minutes, at a moderate to high intensity, with no history of musculoskeletal injury in the past six months. Exclusion criteria included pregnancy, recent surgery, chronic back pain, current injuries, participation in other structured core-specific programs, or the use of medications that could affect core strength or weightlifting performance. Participants were then categorized into the following two groups based on their existing training patterns:

Group A (Isolated weightlifting): Exercises focused on single muscle groups (For example, planks (rectus abdominis, transverse abdominis), and russian twists (obliques

Group B (Compound weightlifting): Multi-joint exercises engaging several muscle groups

simultaneously. For example, squats (quadriceps, hamstrings, gluteus maximus, erector spinae, core stabilizers) and deadlifts (hamstrings, gluteus maximus, erector spinae, trapezius, forearm flexors, and core stabilizers). The Plank Test and Leg lowering Test was used to assess core strength. For Plank test the participants were instructed to perform the plank in a prone position, with elbows placed directly under the shoulders and forearms resting on the ground. The body was maintained in a straight line from head to heels, with the neck neutral, core muscles engaged, gluteal muscles slightly contracted, and hips neither sagging nor elevated. Feet were positioned hip-width apart, and participants were asked to maintain steady breathing throughout the exercise.

As the scoring of the Plank test was in categories, we marked plank time according to categories in SPSS as Category 1 as very poor <15 sec, Category 2 as poor 15-30 sec, Category 3 as below average 30-60 sec, Category 4 as average 1-2 min, Category 5 as above average 2-4 min, Category 6 as very good 4-6 min, Category 7 as excellent >6 min. For the leg lowering test participants were positioned supine on a flat surface with the pressure biofeedback unit (inflatable cuff) placed beneath the lumbar spine at the level of L4-L5 and inflated to 40 mmHg. Arms were placed alongside the trunk with palms facing downward for stability. Both hips were flexed to 90° with knees extended. Participants were instructed to slowly lower their legs while maintaining the pressure at 40 mmHg by engaging the deep abdominal muscles. Any deviation of more than 10 mmHg from baseline was considered a point of failure, and the angle of hip flexion at that moment was recorded.

The scoring for leg lowering test was also in categories, therefore we marked leg lowering angle according to categories in SPSS as Angle 0 as excellent, Angle 15 as very good, Angle 30 as above average, Angle 45 as average, Angle 60 as below average, Angle 75 as poor, Angle 90 as very poor. Data was analyzed using SPSS v.25. A non-parametric test, Mann Whitney test was used to compare data between groups. A p-value <0.05 was considered statistically significant. An analytical

cross-sectional study was conducted at the study at the Institute of Chest Diseases Hospital Kotri, Sindh. A non-probability purposive sampling technique was used. The sample size was calculated using a formula, 95% confidence level, a 5% margin of error, alpha 0.05, and P=16.5% from a previous study a sample of 212 considered. The study was conducted March to August 2025. Patients aged 18 years and above, All Tuberculosis Patients who took anti TB medication at least for one month. Willing to participate and provide informed consent. Exclusion Criteria: Patients aged below 18 years, TB Patients who were seriously ill and or unable to hear and speak will be excluded, Those unwilling to provide informed consent

3. Results

A total of 186 female gym participants were included, with a mean age of 25.73 ± 2.91 years and mean BMI of 25.51 ± 15.4 kg/m².

Table 1: Frequency and Percentage of Plank Time of Compound Weightlifting Participants

	Frequency	Percentage
Very poor	0	0
Poor	0	0
Below average	0	0
average	21	22.6
Above average	53	57
Very good	18	19.4
excellent	1	1.1

Table 2: Frequency and Percentage of Plank time in Isolated Weightlifting Participants

	Frequency	Percentage
Very poor	2	2.2
Poor	14	15.1
Below average	46	49.5
Average	29	31.2
Above average	2	2.2
Good	0	0
Excellent	0	0

Compound group mean rank 135.70 vs. isolated group 51.30. Mann–Whitney test showed a statistically significant difference ($p = 0.001$), with compound lifters sustaining plank positions longer.

Table 3: Frequency and Percentage of Leg Lowering Angles of Compound Weightlifting Participants

	Frequency	Percentage
Excellent	22	23.7
Good	32	34.4
Above average	29	31.2
Average	10	10.8
Below average	0	0
Poor	0	0
Very poor	0	0

Table 4: Frequency and Percentage of Leg Lowering Angle of Isolated Weightlifting Participants

	Frequency	Percentage
Excellent	0	0

Good	0	0
Above average	2	2.2
Average	27	29
Below average	37	39.8
Poor	22	23.7
Very poor	5	5.4

Compound group mean rank 48.98 vs. isolated group 138.02, also statistically significant ($p = 0.001$). Lower angles indicate better core control, showing compound lifters had superior stability.

Table 5: Mean and Standard Deviation of Plank time and Leg lowering of compound weight lifting & Isolated weight bearing participants

Groups	Compound Weightlifting	Isolated Weightlifting
Parameters	Mean $\pm$ S.D	Mean $\pm$ S.D
Plank time	4.98 $\pm$ 0.68	3.16 $\pm$ 0.784
Leg lowering angle	19.35 $\pm$ 14.26	60.16 $\pm$ 13.7

4. Discussion

This study set out to compare the effects of isolated versus compound weightlifting patterns on core strength in female gym participants. The results revealed a statistically significant difference between the two groups ($p < 0.05$), indicating that the choice of training pattern can meaningfully influence core strength development.

Participants who performed compound movements such as squats, deadlifts, and bench presses demonstrated greater improvements in core strength compared to those engaging in isolated exercises. This supports the idea that multi-joint exercises recruit a wider range of muscles, including deep stabilizers, resulting in superior overall core activation and

strength.⁽¹⁶⁾ Our sample of 186 females, evenly divided between the two patterns, showed that compound training consistently outperformed isolated training across both plank and leg-lowering tests, with the statistical outcomes supporting rejection of the null hypothesis.

Findings from related literature offer both supporting and contrasting perspectives. For example, a randomized clinical trial assessing two different exercise programs, one focused on core-specific movements and another combining core with balance training reported significant improvements in core strength for both interventions, although no significant difference between the two ($p > 0.05$).⁽¹⁶⁾ While this outcome differs from ours, it still underscores the value of targeted core training.

Similarly, EMG-based studies have shown that isolated core exercises can produce higher peak activation in specific muscles such as the rectus abdominis and erector spinae compared to certain integrated movements.⁽¹⁷⁾ These findings suggest that isolation work may be more effective for targeted hypertrophy, whereas integrated, functional patterns are more beneficial for multi-muscle coordination. This distinction helps explain why our results favor compound training for overall core performance, but does not discount the utility of isolated exercises for focused muscle development.

Evidence from strength training research also supports our conclusions. A within-participant comparison of single versus multi-joint lower body resistance training found that multi-joint movements were significantly more effective for strength gains ($p < 0.05$).⁽¹⁸⁾ Likewise, Gottschall et al. reported that compound exercises engaging both proximal (abdominal, lumbar) and distal (deltoid, gluteal) muscles generated greater overall activation than isolation work, with all p -values < 0.05 .⁽¹⁹⁾

Additional studies have highlighted the role of integrating core activation with breathing techniques such as deep breathing during crunches, rotational

crunches, leg raises, and planks in further improving performance in plank tests and McGill's torso endurance measures.⁽²⁰⁾ This suggests that programming variables beyond exercise selection, such as breathing and bracing strategies, can further enhance training outcomes.

From a practical perspective, our findings indicate that compound lifts are more effective for building functional core stability, making them especially relevant for athletes and individuals seeking performance improvements. However, isolated exercises remain valuable for targeting specific weaknesses, aesthetic goals, or rehabilitation purposes. Program design should therefore be guided by the trainee's objectives: compound exercises for functional and sports performance, and isolation work for muscle-specific development or recovery.

In summary, this study contributes to the evidence base favoring compound weightlifting patterns for enhancing core strength in females. By engaging multiple muscle groups and demanding greater stabilizer recruitment, compound lifts appear to provide broader benefits for core stability than isolated exercises. Future research should explore the long-term effects of these patterns, their impact on different populations, and their role when combined within periodized training programs

Conclusion:

Compound weightlifting patterns are associated with significantly greater core strength than isolated patterns in female gym participants. Integrating multi-joint exercises into training programs may yield superior functional benefits and overall stability. Further research should explore the long-term adaptations of these training modalities across diverse populations.

Limitations:

This study employed a cross-sectional design, which limits causal inference. The sample size was relatively small, and core strength assessment relied on a single field test. Future longitudinal studies with

electromyographic analysis could provide deeper insights into muscle activation patterns.

Disclosure /Conflict of interest:

Authors declare no conflict of interest.

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