



Effect Of Standing Cable Pull Over–Torso Training On Improving Javelin Throwing Ability Among FIKK UNM Students

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ABSTRACT

Exercise selection for javelin throwing should address upper-limb capacity and trunk involvement while distinguishing physical-test improvement from throwing performance. This study examined changes following two standing cable pullover–torso training combinations. Eighteen participants were assigned by drawing lots to standing cable pullover–standing cable pullover–torso (SCP-SCP-T; n=9) or standing cable pullover–bench press–torso (SCP-B-T; n=9). Training lasted six weeks, with three sessions per week. Push-up performance, medicine-ball throw score, trunk flexibility, and javelin distance were assessed before training, at week three, and at week six. Descriptive statistics and the main javelin comparisons were verified using the individual data in the research-report appendix. Mean javelin distance increased from 21.20±3.90 to 23.48±3.86 m in SCP-SCP-T and from 21.73±5.58 to 24.96±4.97 m in SCP-B-T. Mean pre-to-week-six improvements were 2.28 m (95% CI 1.91–2.65) and 3.23 m (95% CI 2.69–3.78), respectively; both paired comparisons yielded $p < 0.001$. Between-group comparisons of javelin distance were not statistically significant at baseline ($p = 0.820$), week three ($p = 0.503$), or week six ($p = 0.491$). Physical-test means increased in both groups. Both training combinations were accompanied by improved javelin performance, but the reported between-group comparisons did not establish superiority in throwing distance. The small sample, absence of an untreated control, and incomplete protocol documentation limit causal interpretation and replication.

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1. INTRODUCTION

Javelin throwing requires a combination of physical abilities and full-body movement regulation to produce effective throws. The role of the arm needs to be understood in relation to strike motion and momentum transfer during a series of throws. Biomechanical research on the sequence of strike and arm movements shows the importance of movement organization in explaining differences in javelin throwing performance (Liu et al., 2014). Thus, the improvement of certain physical abilities does not necessarily result in a comparable increase in distance if it is not integrated with throwing techniques.

Strength capacity and explosiveness are part of the demands of throwing numbers. Studies of the biological determinants of throwing number performance place the characteristics of fat-free mass, neuromuscular activation, and muscle properties as elements related to achievement (Zaras et al., 2021). However, these relationships do not justify equating one field test with overall throwing ability. Push-ups, medicine ball throwing, strike flexibility, and javelin throwing tests measure different aspects so changes in each test need to be reported separately.

Weight training can be designed through a combination of movement type, intensity, volume, and frequency. A synthesis of research in adults suggests that various weight training recipes can increase strength and hypertrophy, with responses depending on the characteristics of the program (Currier et al., 2023). For power development, the suitability of motion as well as the relationship of force and speed also need to be considered (Cormie et al., 2011).



Such general evidence is the basis for training selection, but the effectiveness of javelin-specific throwing programs still requires actual measurement of throwing outputs.

The standing cable pullover was chosen in the research report because it contains a weight-pulling movement with the arm swing directed to approach the throwing motion pattern. The torso exercise involves a strike rotation, while the bench press is the distinguishing component of either combination. The research of Marchetti and Uchida (2011) showed that the activity of the pectoralis major muscle was greater than that of the latissimus dorsi in the barbell pullover exercise. The study used a pullover with a barbell; the results cannot be directly considered to prove the effectiveness of standing cable pullover in this program.

Combinations of exercises involving pullover, bench press, and torso movements have also been discussed in Mappanyukki et al.'s (2023) study on rehaencalina–torso. Therefore, the contribution of this study is placed on the reporting of changes in the three measurement times on the two exercise combinations as documented in the report, rather than on the claim that the concept of combination exercises was first introduced. Assessment of repeated changes can help distinguish progress during the program from differences in end-scores between groups.

This study aims to examine the change in javelin throwing ability after standing cable pullover–standing cable pullover–torso (SCP-SCP-T) and standing cable pullover–bench press–torso (SCP-B-T). Javelin throwing distance was the main output of the discussion, while push-up ability, medicine ball throwing score, and strike flexibility were supporting physical outputs. The analysis was directed to answer whether each group experienced an increase and whether the throwing distance differed between groups at the available measurement time.

2. IMPLEMENTATION METHOD

Design, participants, and research venues

The study used two active exercise groups with pretest, three-week measurement (posttest I), and six-week measurement (posttest II). The individual data in the appendix included 18 participants, nine each in the SCP-SCP-T and SCP-B-T groups. The grouping was randomized through a lottery technique as outlined in the study procedure. The observation unit was the participants; three measurements on the same person were treated as paired observations, rather than as distinct participants.

The research activities were carried out within the Faculty of Sports and Health Sciences, Makassar State University (FIKK UNM), Jalan Wijaya Kusuma 14, Makassar. The characteristics available in the individual data included age, weight, and height.

Training program

The program lasts six weeks with a frequency of three times per week. The session schedule is stated at 15.30–17.00 WITA. The first group underwent a combination of SCP-SCP-T, while the second group underwent SCP-B-T. Standing cable pullover is described as a movement of pulling the weight from back to front with the body with the body with its back to the tool and the legs open, one foot in front. The movement is repeated in a direction adjusted to the throwing motion. The torso component is described as a torso twist, which is a left and right strike rotation in a standing position. The bench press is an additional distinguishing component in the second group.

Physical ability measurement and javelin throwing

Arm ability was assessed through a valid number of push-ups over a minute. Although the report called it "arm strength", the procedure primarily described the ability to perform repetitive movements or arm and shoulder muscle endurance, rather than a measurement of maximum strength of one repetition. Arm explosiveness was assessed through throwing a 3 kg medicine ball in a sitting position with motion control; participants obtained three chances and the best score was recorded. Because the unit label of the medicine ball throwing unit was inconsistent in the report, the results were presented as scores on the original recording unit without unit conversion.

The flexibility of the strike was measured using a flexometer or bar. The detailed description of the procedure mentions the strike and neck extension test, while the other part of the report mentions the flexion of the strike. The results are presented as a score of flexibility according to the recording, with the inconsistency of the procedure being a limitation. The ability to throw javelin is assessed through three throwing opportunities; the best distance from the valid throw is used as the participant's value. The unit of javelin throwing distance is set as a meter, following the description of the variables in the data table of the results of the study. Weight and height are obtained using scales and height measuring instruments as described in the report.

Data processing and analysis

Analysis was performed on individual data of 18 participants with the presentation of mean and standard deviations for each group as well as the measurement time. The primary analysis included a comparison of throwing distances before and after practice as well as a comparison between groups. Changes from initial to week six were tested with a paired ttest and equipped with a 95% confidence interval (IK) for mean change. Throwing distances at each time were



compared using the t-test of two independent groups. The selection of parametric tests for throwing distance followed the results of the reported Shapiro–Wilk normality examination.

The significance limit was set at $p < 0.05$ and the printed output value of 0.000 was presented as $p < 0.001$. The value of the throwing distance p and the change IK were re-verified from the individual data. The supporting physical variables were displayed descriptively so that the changes could be read without equalizing the physical test results with the throwing performance. The percentage increase was calculated from the difference between the final and initial averages divided by the initial average, so that it was the percentage change in the group average. The final comparison between groups did not use initial value adjustments; the limitations of this analysis were considered because the choice of initial and follow-up value analysis methods can affect the effect assessment (Vickers & Altman, 2001).

3. RESULTS AND DISCUSSION

Early characteristics of participants

The data analyzed included nine participants in each group. The average age of the two groups was around 23 years. The average weight was relatively close to each other, while the average height of the SCP-B-T group was greater than that of the SCP-SCP-T. These initial characteristics are presented in Table 1. The differences in characteristics are noteworthy in a small sample and cannot be considered to have been lost simply because the grouping was done by lot.

Table 1. Initial characteristics of participants according to exercise groups

Features	SCP-SCP-T (n=9)	SCP-B-T (n=9)
Age (years)	23.22 ± 0.44	22.89 ± 0.78
Weight (kg)	65.44 ± 1.94	64.78 ± 1.99
Height (cm)	158.33 ± 2.45	163.78 ± 6.10

Changes in supporting physical abilities

The average push-up ability, medicine ball throwing score, and strike flexibility increased in both groups from the initial measurement to the sixth week (Table 2). In the SCP-SCP-T group, push-up ability increased from 51.44 to 54.89 reps per minute, medicine throwing scores from 3.23 to 3.67, and strike flexibility from 31.56 to 36.00 cm. In the SCP-B-T group, the same values changed from 50.44 to 59.11 reps per minute, from 3.32 to 4.69, and from 33.22 to 41.11 cm.

Table 2. Changes in the average physical ability of the supporting on the three measurements

Variabel	Groups	Beginning	Week 3	Week 6
Push-ups (reps/minute)	SCP-SCP-T	51,44 ± 1,01	53,00 ± 0,87	54,89 ± 0,78
Push-ups (reps/minute)	SCP-B-T	50,44 ± 0,73	55,78 ± 0,83	59,11 ± 0,78
Medicine ball throw (score)	SCP-SCP-T	3,23 ± 0,08	3,46 ± 0,09	3,67 ± 0,20
Medicine ball throw (score)	SCP-B-T	3,32 ± 0,10	4,46 ± 0,23	4,69 ± 0,22
Strike flexibility (cm)	SCP-SCP-T	31,56 ± 1,13	34,33 ± 0,87	36,00 ± 0,87
Strike flexibility (cm)	SCP-B-T	33,22 ± 1,39	37,00 ± 1,12	41,11 ± 1,05

The value is presented as an average ± standard deviation; $n=9$ per group at any given time. The medicine ball score follows the original recording unit that has not been consistently labeled in the report; no unit conversion is performed. The type of flexibility test needs to be confirmed because the report mentions flexion and extension in different sections.

The change in the average of the physical test descriptively was greater in the SCP-B-T group. However, the group already had a higher average of medicine ball scores and predictability. The report noted the initial difference between the two variables at $p=0.039$ and $p=0.013$, respectively. Therefore, the interpretation of the final score must take into account the initial inequality and not equalize the final difference with the effect of the controlled program on the initial score. Improvements in the supporting test also need to be separated from the main results of the throwing distance.

Changes in javelin throwing distance

The average throwing distance of the SCP-SCP-T group increased from 21.20±3.90 m to 22.39±3.94 m in the third week and 23.48±3.86 m in the sixth week. In the SCP-B-T group, the average distance increased from 21.73±5.58 m to 23.89±5.23 m and 24.96±4.97 m. Developments in the three measurement times as well as the comparison between groups are presented in Table 3. All participants in the individual data recorded a higher sixth-week distance than the baseline value, as shown in Figure 1.

Table 3. Javelin throwing distance and comparison between groups

Measurement time	SCP-SCP-T (m)	SCP-B-T (m)	p intergroup
Beginning	21.20 ± 3.90	21.73 ± 5.58	0,820
Week 3	22.39 ± 3.94	23.89 ± 5.23	0,503



Week 6	23,48 ± 3,86	24.96 ± 4.97	0,491
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The distance value is the mean ± the standard deviation; n=9 per group. The p-value is derived from a double-sided independent t-test at each time, calculated from the participants' individual data.

The increase in the mean from baseline to week six in the SCP-SCP-T group was 2.28 m (95% IK 1.91–2.65; $t(8)=14.18$; $p<0.001$), equivalent to 10.75% of the baseline average. The SCP-B-T group increased by 3.23 m (95% IK 2.69–3.78; $t(8)=13.74$; $p<0.001$), equivalent to 14.88% of the baseline average. The confidence interval describes the uncertainty of the mean change in each group; neither is a confidence interval of difference in effects between programs.

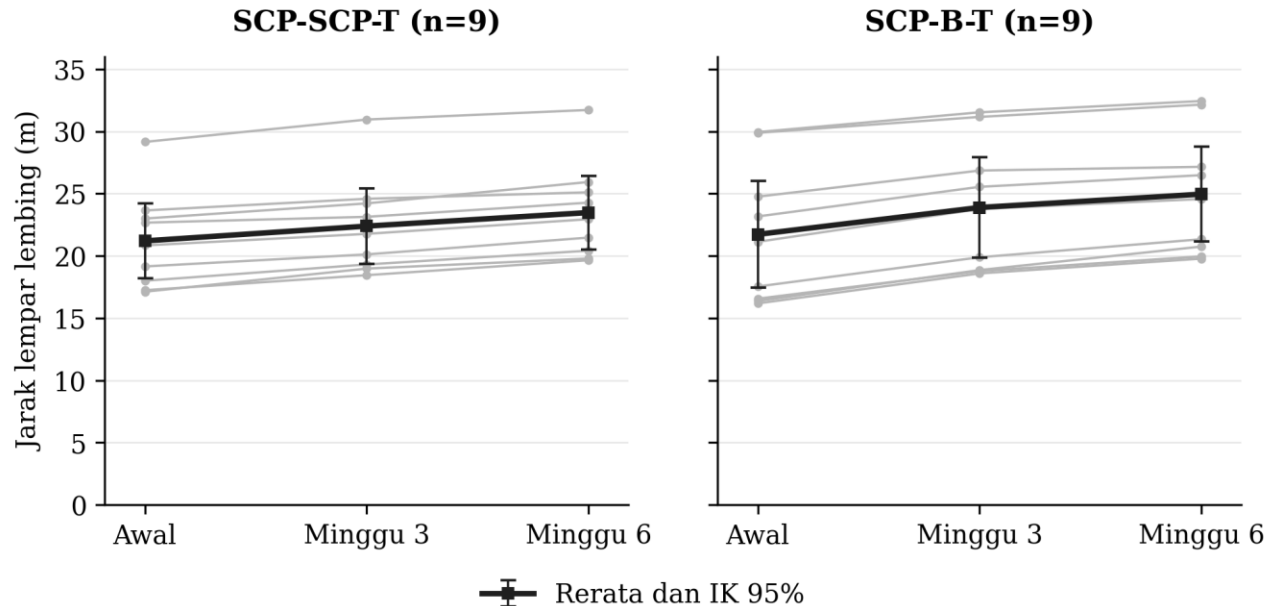


Figure 1. Changes in javelin throw distance in the standing cable pullover–standing cable pullover–torso (SCP-SCP-T) and standing cable pullover–bench press–torso (SCP-B-T) groups.

The gray line connects the measurements of the same participants; the black square marker shows the average. The error bars show a 95% average confidence interval (IK) at each time, calculated using the t distribution with 8 free degrees. Each panel contains nine participants. The interval is not the IK of the difference in effects between programs. Data are from the appendix of the research report.

In the comparison of throwing distances between groups, the p-value was 0.820 at the beginning, 0.503 at the third week, and 0.491 at the sixth week. With a $p<0.05$ limit, the results did not show the difference in throwing distance between groups at all three measurement times. The increase in each group and the difference between programs answered different statistical questions. Therefore, the numerically larger increase in SCP-B-T was not enough to establish its superiority based on the intergroup comparisons used in the report. Nor did the insignificant results prove that the two programs were equal.

The meaning of physical change and transfer to the throw

The increase in physical tests in both groups corresponded to the likelihood of adaptation to repetitive weight training. The literature suggests that the strength response is influenced by load selection, volume, and frequency (Currier et al., 2023). However, the one-minute push-up measurements in this study could not be used to conclude an increase in maximum strength or hypertrophy. The change in the medicine ball score describes an improvement in the throw test, but not a direct measurement of javelin release speed or mechanical power in watts.

Standing cable pullover conceptually trains the arm swing pattern with upper body involvement. Electromyography studies on barbell pullover show pectoralis major and latissimus dorsi involvement, with greater pectoralis major activity (Marchetti & Uchida, 2011). This suitability provides a plausible explanation for movement selection, but current research does not record electromyography and therefore cannot confirm specific muscles as a mechanism of enhancement. The addition of a bench press also cannot be separated as a single cause because it is a comparison of the exercise package, not a single component in a factorial design.

Torso exercises may be related to the ability to regulate strike motion, but the flexibility score does not measure all aspects of coordination or stability. Studies on stretching exercises show that changes in range of motion are influenced



by the type and duration of the exercise (Thomas et al., 2018). In this study, the inconsistency of the mention of flexion and extension tests limited the determination of the actual improvement of motion function. Therefore, the interpretation was limited to the increase in the recorded flexion test score and was not expanded to evidence of an increase in overall mobility or strike function.

Transfer to throwing distance requires the integration of physical ability with technique. The principle of power development emphasizes the compatibility between the demands of motion, loading, and the ability to generate force quickly (Cormie et al., 2011). Biomechanical findings also show that the sequence of strike and arm motion is part of throwing performance (Liu et al., 2014). This helps explain why the increase in larger support tests does not automatically result in significant differences between groups in throwing distance. This study did not measure initial speed, release angle, release velocity, or inter-segment coordination, so the explanation of the technique remains an interpretation based on the literature.

Comparison with previous research and implications of exercise

Previous research on rehaencalina–torso combinations has shown that similar movement combinations have been of concern in the development of javelin throwing exercises (Mappanyukki et al., 2023). Comparisons with these studies need to consider the characteristics of participants, exercise definitions, dosage, and methods of analysis. Similar training terms are not enough to equalize protocols or results. In this study, the most directly supported conclusion is that there is an improvement during the program in both groups, with inconclusive evidence of differences in throwing distances between groups in the reported measurements.

For trainers, both combinations can be considered in the preparation of support exercises, while still monitoring technique output and throwing distance. Monitoring of the third week helps to see progress during the program, while the results of the sixth week provide a final picture in the study range. These findings have not established a weight recipe that can be copied immediately because the dosage documentation is inconsistent. The literature on periodization also shows the need to pay attention to the organization of the load when assessing the results of the exercise (Williams et al., 2017). The choice of program in practice needs to be accompanied by records of loads, reps, attendance, participant responses, and implementation conditions in order for changes to be better interpreted.

Limitations of the study

The sample included only 18 participants, so the accuracy of the comparison between groups and the generalization of results was limited. There were no groups without exercise; the improvement could not be completely separated from the repetition of tests, other exercises, or factors that lasted six weeks. Grouping by lottery did not eliminate the initial inequities in the small sample. The reported analyses also did not test the interaction of time and groups or adjust for initial differences, so they did not provide a controlled comparative effect estimate.

Documentation is inconsistent regarding medicine ball test units, types of flexibility tests, exercise doses, and population details and timing of implementation. This information needs to be verified against measurement forms and exercise logs before the program is replicated. The report also does not provide a complete record of compliance, additional exercises, and adverse events; the absence of records does not constitute full compliance or evidence of the absence of injury. In addition, the neuromuscular mechanisms and kinematics of throwing are not measured. These limitations make program recommendations to be read as limited implications of the available data, rather than proof of the universal superiority of a combination of exercises.

4. CONCLUSION

SCP-SCP-T and SCP-B-T exercises were conducted for six weeks, three times per week, with increased javelin throwing distance and average supporting physical tests in study participants. The mean initial distance increase through week six was 2.28 m and 3.23 m, respectively, with $p < 0.001$ in pairs. However, comparisons of throwing distance between groups at the baseline, third week, and sixth week did not reach statistical significance. Based on the available analyses, the advantage of the throwing distance of either combination could not be established. A larger sample, consistent dose documentation, and analyses that account for initial values and repeated changes were needed to strengthen the comparative effectiveness assessment of both programs.

BIBLIOGRAPHY

Cormie, P., McGuigan, M. R., & Newton, R. U. (2011). Developing maximal neuromuscular power: Part 2—Training considerations for improving maximal power production. *Sports Medicine*, 41(2), 125–146. <https://doi.org/10.2165/11538500-000000000-00000>



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- Currier, B. S., Mcleod, J. C., Banfield, L., Beyene, J., Welton, N. J., D'Souza, A. C., Keogh, J. A. J., Lin, L., Coletta, G., Yang, A., Colenso-Semple, L., Lau, K. J., Verboom, A., & Phillips, S. M. (2023). Resistance training prescription for muscle strength and hypertrophy in healthy adults: A systematic review and Bayesian network meta-analysis. *British Journal of Sports Medicine*, 57(18), 1211–1220. <https://doi.org/10.1136/bjsports-2023-106807>
- Liu, H., Leigh, S., & Yu, B. (2014). Comparison of sequence of trunk and arm motions between short and long official distance groups in javelin throwing. *Sports Biomechanics*, 13(1), 17–32. <https://doi.org/10.1080/14763141.2013.865138>
- Mappanyukki, A. A., Sumaryanto, Kriswanto, E. S., Mappaompo, M. A., & Purwanto, D. (2023). The comparison between the influence of rehaencalina-rehaencalina-torso (RRT) and rehaencalina-bench press-torso (RBT) training on javelin throwing ability. *Jurnal SPORTIF: Jurnal Penelitian Pembelajaran*, 9(2), 325–338. https://doi.org/10.29407/js_unpgri.v9i2.20893
- Marchetti, P. H., & Uchida, M. C. (2011). Effects of the pullover exercise on the pectoralis major and latissimus dorsi muscles as evaluated by EMG. *Journal of Applied Biomechanics*, 27(4), 380–384. <https://doi.org/10.1123/jab.27.4.380>
- Thomas, E., Bianco, A., Paoli, A., & Palma, A. (2018). The relation between stretching typology and stretching duration: The effects on range of motion. *International Journal of Sports Medicine*, 39(4), 243–254. <https://doi.org/10.1055/s-0044-101146>
- Vickers, A. J., & Altman, D. G. (2001). Analysing controlled trials with baseline and follow up measurements. *BMJ*, 323(7321), 1123–1124. <https://doi.org/10.1136/bmj.323.7321.1123>
- Williams, T. D., Tulusso, D. V., Fedewa, M. V., & Esco, M. R. (2017). Comparison of periodized and non-periodized resistance training on maximal strength: A meta-analysis. *Sports Medicine*, 47(10), 2083–2100. <https://doi.org/10.1007/s40279-017-0734-y>
- Zaras, N., Stasinaki, A. N., & Terzis, G. (2021). Biological determinants of track and field throwing performance. *Journal of Functional Morphology and Kinesiology*, 6(2), Article 40. <https://doi.org/10.3390/jfmk6020040>
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