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EFFECT OF MANNEQUIN-BASED ARM AND NECK THROW TRAINING ON SPEED OF JUNIOR GRECO-ROMAN WRESTLERS IN BANJARMASIN

Nurul Khatimah*[1], Endang Pratiwi[2], and Ahmad Maulana[3]

[1,2,3]*Physical Education Study Program, Faculty of Teacher Training and Education, Universitas Islam Kalimantan Muhammad Arsyad Al-Banjari, Banjarmasin, Indonesia*

* Corresponding Author: *khatimahnurul888@gmail.com*

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ABSTRACT

Junior Greco-Roman wrestlers in Banjarmasin City still frequently make errors when executing throwing techniques, while mannequin-based training is rarely applied by coaches. This study aimed to determine changes in arm-throw and neck-throw execution time after mannequin-based training and to compare the magnitude of change between the two techniques. The study used a quantitative approach with a pre-experimental one-group pretest–posttest design. The sample comprised 20 athletes selected through total sampling, and the instrument was a timed test of five throws on a mannequin measured with a stopwatch. Data were analysed using the Wilcoxon signed-rank test and the paired-samples t-test. The results showed that mean arm-throw time decreased from 21.85 to 18.65 seconds and mean neck-throw time decreased from 22.50 to 19.60 seconds, and both reductions were significant with significance values below 0.001. The 0.30-second difference between the reductions of the two techniques was not significant, with a significance value of 0.527. In conclusion, mannequin-based training was followed by faster execution of both the arm throw and the neck throw, but neither technique improved significantly more than the other, and because no control group was used, the changes cannot be attributed solely to mannequin training.

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INTRODUCTION

Sport is a physical activity that maintains both physical and mental health, and it has become part of everyday human life because it makes the body healthy, strong, fit, and motivated to carry out daily activities (Wati & Setyawati, 2023). Attention to physical exercise has existed for a long time, as Islamic tradition records that the Prophet Muhammad selected young men for battle through contests of strength in the form of wrestling (Khairuddin, 2017). Wrestling is one of the oldest sports known to humankind and is regarded not only as a physical contest but also as a symbol of courage, strategy, and technical skill. As an achievement sport, wrestling is characterised by direct body contact in which athletes attempt to bring the opponent down by pulling, pushing, tripping,

throwing, pressing, and holding until the opponent is pinned to the mat within the rules (Barus et al., 2024). Beyond physical and technical aspects, wrestlers also need systematic mental training to strengthen willpower, maintain emotional stability, and improve individual capability (Kasanrawali et al., 2023).

Wrestling is a leading sport in South Kalimantan because it regularly contributes medals at national championships, PRAPON, PON, and even the SEA Games. The sport is divided into Greco-Roman, men's freestyle, and women's freestyle, and in the Greco-Roman style attacks are permitted only from the head to the waist without using the legs, so throwing techniques dominate training sessions. A correctly executed throw can earn four or five points, and the arm throw is a basic Greco-Roman technique with a high success rate that can be combined into a chain of attacks (Irawan, 2015). A throw is performed by lifting the opponent and then bringing him down onto the mat. Arm-throw skill depends on the arm grip, foot rotation, lifting and pulling the opponent, and controlling him as he falls (Yudi & Hernawan, 2020). The neck throw, in contrast, uses the opponent's neck as a point of control and exploits the opponent's forward momentum to complete the throw. In a competition analysis of takedown techniques, the finishing stage was found to be the main factor distinguishing successful from failed attempts (Aprindo & Wicaksono, 2025).

Throwing techniques also require adequate physical capacity. Grip strength, arm muscle power, and flexibility have been reported to contribute significantly to the success of throws among wrestlers (Alifiansyah et al., 2024). Leg power and flexibility are likewise positively related to arm-throw ability in male wrestlers (Kembara et al., 2022). Balance helps the neuromuscular system withstand static and dynamic loads so that movements can be coordinated effectively (Prayoga & Maulana, 2022). These qualities are developed through training, which is the implementation of a plan to improve sporting ability through theory, practice, methods, and rules that match the intended goals.

Observations of Greco-Roman wrestlers in Banjarmasin showed that junior athletes often execute arm and neck throws incorrectly, for example with poor balance and a loose grip on the opponent's body, so that throws fail to score or even give points to the opponent. Training sessions are dominated by partner drills, while mannequins are rarely used because coaches assume that frequent mannequin practice slows athletes down. In fact, a mannequin allows athletes to repeat throws many times without endangering a training partner, which can reduce the risk of injury. Arm and back muscle strength have also been shown to be strongly related to arm-throw ability in young wrestlers, so throwing practice that loads these muscles is important (Mayasari et al., 2020). Mannequins have also been

used as a training load to develop the bridging technique of wrestlers in relation to flexibility (Erawan, 2010).

However, studies that directly examine the execution speed of arm and neck throws after mannequin training among junior Greco-Roman wrestlers, and that compare the change between the two techniques, remain limited. In this study, speed was measured as execution time in seconds, so a shorter time indicates faster execution. Therefore, this study aimed to determine the change in arm-throw execution time before and after mannequin training, to determine the change in neck-throw execution time before and after mannequin training, and to compare the changes in execution time between the two techniques among junior Greco-Roman wrestlers in Banjarmasin City. The findings are expected to serve as a reference for coaches and athletes in designing more effective technical training.

RESEARCH METHODS

This study used a quantitative approach with a pre-experimental research type, specifically a one-group pretest–posttest design in which a single group is measured before and after treatment without a comparison group (Sugiyono, 2019). The design involved two outcome variables, namely arm-throw execution time and neck-throw execution time, and all athletes received training in both techniques, so the two techniques did not represent separate groups. The population consisted of all 20 junior Greco-Roman wrestlers in Banjarmasin City, and because the population was smaller than 100, the entire population was taken as the sample through total sampling. The independent variable was throwing training with a mannequin, consisting of arm-throw training (X_1) and neck-throw training (X_2), while the dependent variable was throw execution time in seconds. The instrument was a practical test of arm and neck throws on a wrestling mannequin (dummy), with time recorded using a stopwatch and supported by a whistle, a mat, test forms, stationery, and documentation. Starting from a ready standing position on the mat, each athlete performed five throws from the upper position after a signal; time was recorded from the signal until the fifth throw, two attempts were allowed, and a throw was considered valid when the mannequin was lifted and brought down completely onto the mat. Execution time was classified as very good (5–10 seconds), good (11–15 seconds), moderate (16–20 seconds), poor (21–25 seconds), and very poor (26–30 seconds). Instrument validity and reliability are essential in quantitative research so that the data obtained can be trusted (Yusup, 2018). Because no test–retest trial was conducted, data consistency was maintained through standardised test procedures, two recorders, and consistent rest periods.

The study was conducted at GOR Hasanudin Banjarmasin in three stages, namely the pretest, the training programme, and the posttest. The pretest was held on Saturday, 14 June 2025, from 16.00 WITA, beginning with a 10–15-minute specific warm-up, after which athletes took turns performing the arm throw and the neck throw with about 10 minutes of rest after each throwing session. The mannequin training programme covering both techniques was then carried out every Tuesday, Thursday, and Saturday from 15.00 WITA for approximately one month, or three sessions per week. After the programme ended, the posttest was held on 19 July 2025 using the same procedure as the pretest so that the two measurements could be compared, and each athlete's time was recorded and processed. Data were analysed with SPSS using descriptive statistics (sample size, minimum, maximum, mean, and standard deviation), the Shapiro–Wilk normality test on pretest–posttest difference scores, the Wilcoxon signed-rank test for the change in each technique because the difference scores were not normally distributed, and the paired-samples t-test on change scores to compare the two techniques, with decisions based on $p < 0.05$.

RESULTS AND DISCUSSION

Results

Data Description

The initial arm-throw measurement was taken to determine the athletes' ability before receiving the training programme, so these data serve as a baseline for comparing their development after mannequin training. The distribution of the arm-throw pretest results is presented in Table 1.

Table 1. Initial Arm-Throw Results

Category	Frequency	Percentage
Good	4	20%
Moderate	6	30%
Poor	5	25%
Very Poor	5	25%
Total	20	100%

Table 1 shows that of the 20 athletes measured, 4 (20%) were in the good category, 6 (30%) in the moderate category, 5 (25%) in the poor category, and 5 (25%) in the very poor category, while none reached the very good category. The mean arm-throw pretest time of 21.85 seconds (SD = 6.95) falls within the poor range (21–25 seconds) of the assessment norm. Half of the athletes (50%) were in the poor and very poor categories, and the other half (50%) were in the moderate and good categories. This distribution indicates that most

athletes had initial arm-throw ability at the moderate to poor level, leaving considerable room for improvement through planned training.

The final arm-throw measurement was taken after the athletes completed the mannequin training programme in order to observe changes compared with the initial results. The distribution of the arm-throw posttest results is presented in Table 2.

Table 2. Final Arm-Throw Results

Category	Frequency	Percentage
Very Good	2	10%
Good	3	15%
Moderate	8	40%
Poor	4	20%
Very Poor	3	15%
Total	20	100%

Table 2 shows that of the 20 athletes, 2 (10%) were in the very good category, 3 (15%) in the good category, 8 (40%) in the moderate category, 4 (20%) in the poor category, and 3 (15%) in the very poor category. Compared with the pretest, the distribution shifted: athletes appeared in the very good category, which was previously empty, the moderate category grew from 6 to 8 athletes, and the very poor category decreased from 5 to 3 athletes. Overall, the proportion of athletes in the moderate to very good categories rose from 50% to 65%, and the mean posttest time of 18.65 seconds (SD = 6.44) now falls within the moderate range (16–20 seconds). Nevertheless, 35% of athletes remained in the poor and very poor categories, indicating that the training had a positive effect but that the improvement was not yet evenly distributed among all athletes.

The initial neck-throw measurement was taken to determine the athletes' basic ability before mannequin training, so these data serve as a baseline for evaluating the effectiveness of the training method. The distribution of the neck-throw pretest results is presented in Table 3.

Table 3. Initial Neck-Throw Results

Category	Frequency	Percentage
Good	4	20%
Moderate	6	30%
Poor	7	35%
Very Poor	3	15%
Total	20	100%

Table 3 shows that of the 20 athletes, 4 (20%) were in the good category, 6 (30%) in the moderate category, 7 (35%) in the poor category, and 3 (15%) in the very poor category, with no athlete reaching the very good category. The poor category contained the largest

number of athletes, and the mean neck-throw pretest time of 22.50 seconds (SD = 7.02) also falls within the poor range (21–25 seconds). A total of 50% of athletes were in the poor and very poor categories, while the remaining 50% were in the moderate and good categories. This distribution shows that most athletes were at a moderate to poor level, so an appropriate training programme was needed to improve neck-throw skill as a whole.

The final neck-throw measurement was taken after the entire training series had been completed to assess changes in ability relative to the pretest. The distribution of the neck-throw posttest results is presented in Table 4.

Table 4. Final Neck-Throw Results

Category	Frequency	Percentage
Very Good	1	5%
Good	5	25%
Moderate	6	30%
Poor	6	30%
Very Poor	2	10%
Total	20	100%

Table 4 shows that of the 20 athletes, 1 (5%) was in the very good category, 5 (25%) in the good category, 6 (30%) in the moderate category, 6 (30%) in the poor category, and 2 (10%) in the very poor category. Compared with the pretest, the good category increased from 4 to 5 athletes and one athlete reached the very good category, while the poor category fell from 7 to 6 athletes and the very poor category fell from 3 to 2 athletes. The proportion of athletes in the moderate to very good categories rose from 50% to 60%, and the mean posttest time of 19.60 seconds (SD = 7.31) now falls within the moderate range (16–20 seconds). These results indicate a shift towards better ability, although 40% of athletes were still in the poor and very poor categories, suggesting that the training method requires further evaluation.

Prerequisite Analysis Tests

The Shapiro–Wilk test was applied to the pretest–posttest difference scores of each technique to determine the appropriate paired test of change. The results of the normality test on the difference scores are presented in Table 5.

Table 5. Normality Test of Difference Scores

Variable	Sig. Shapiro–Wilk	Description
Arm-throw difference (pre–post)	0.008	Not normal
Neck-throw difference (pre–post)	0.005	Not normal

Table 5 shows that the arm-throw difference score (pretest–posttest) had a significance value of 0.008 and the neck-throw difference score had a significance value of 0.005. Both values are below the 0.05 significance level, so the difference scores of the two techniques do not meet the normality assumption. Normality was checked on the difference scores rather than only on the separate pretest and posttest scores because the analysis concerns change within the same athletes. Consequently, the change in execution time for each technique was analysed with the non-parametric Wilcoxon signed-rank test as the main analysis, and a homogeneity test was not required because the analysis used paired tests.

A normality check was also conducted on the difference between the arm-throw and neck-throw time changes of each athlete to choose the appropriate test for comparing the magnitude of change between the two techniques. The results are presented in Table 6.

Table 6. Normality Test of the Difference in Time Change between the Two Techniques

Variable	Sig. Shapiro–Wilk	Description
Difference in time change between arm throw and neck throw	0.602	Normal
Number of subjects	20	Same athletes performed both techniques

Table 6 shows that the Shapiro–Wilk test on the difference between the arm-throw and neck-throw time changes produced a significance value of 0.602. Because this value exceeds 0.05, the distribution of the difference in time change between the two techniques does not differ significantly from a normal distribution. The analysis involved 20 athletes, and all of them performed both techniques, so the change data of the two techniques are paired. Accordingly, the paired-samples t-test could be used to compare the magnitude of time change between the two techniques while still observing the other analysis assumptions.

Hypothesis Testing

The Wilcoxon signed-rank test was used to compare arm-throw execution time before and after training because the difference scores were not normally distributed. A lower time indicates faster execution, and the test results are presented in Table 7.

Table 7. Wilcoxon Test Results for the Arm Throw

Technique	Pretest (s)	Posttest (s)	Reduction (s)	Z	Sig. (p)	Description
Arm throw	21.85	18.65	3.20	−3.948	< 0.001	Significant

Note: n = 20 athletes. Time reduction = pretest time minus posttest time.

Table 7 shows that the mean arm-throw execution time decreased from 21.85 seconds (SD = 6.95) in the pretest to 18.65 seconds (SD = 6.44) in the posttest, a mean reduction of 3.20 seconds or about 14.6%. The Wilcoxon signed-rank test produced Z = −3.948 with p < 0.001, which is below 0.05, indicating a significant difference between pretest and posttest times. Therefore, the first null hypothesis was rejected, and arm-throw execution time in the sample became shorter after the training period. However, because the study did not use a control group, this result shows a change following the training programme rather than proof that the mannequin was the sole cause of the change.

The Wilcoxon signed-rank test was also used to compare neck-throw execution time before and after training because the difference scores were not normally distributed. The test results are presented in Table 8.

Table 8. Wilcoxon Test Results for the Neck Throw

Technique	Pretest (s)	Posttest (s)	Reduction (s)	Z	Sig. (p)	Description
Neck throw	22.50	19.60	2.90	−3.943	< 0.001	Significant

Note: n = 20 athletes. Time reduction = pretest time minus posttest time.

Table 8 shows that the mean neck-throw execution time decreased from 22.50 seconds (SD = 7.02) in the pretest to 19.60 seconds (SD = 7.31) in the posttest, a mean reduction of 2.90 seconds or about 12.9%. The Wilcoxon signed-rank test produced Z = −3.943 with p < 0.001, which is below 0.05, indicating a significant difference between pretest and posttest times. Therefore, the second null hypothesis was rejected, and neck-throw execution time in the sample became shorter after the training period. This conclusion is limited to execution time and does not directly prove improvement in aspects other than speed, such as technical accuracy or throwing success in competition.

To assess whether the magnitude of change differed between the two techniques, a change score was calculated for each athlete as pretest time minus posttest time, and the two change scores were compared using the paired-samples t-test because they came from the same athletes. The results are presented in Table 9.

Table 9. Comparison of Time Change between the Two Techniques

Comparison	Arm Change	Neck Change	Difference in Change	Paired t-test	Conclusion
Mean reduction	3.20 s	2.90 s	0.30 s	t(19) = 0.65; p = 0.527	Not significant
Normality of difference between changes	—	—	p = 0.602	n = 20	Normality assumption met

Table 9 shows that the mean reduction in arm-throw time was 3.20 seconds, whereas the mean reduction in neck-throw time was 2.90 seconds, giving a difference of 0.30 seconds between the two techniques. The normality assumption for the difference between the two changes was met ($p = 0.602$), and the paired-samples t-test on the change scores yielded $t(19) = 0.65$ with $p = 0.527$. Because p is greater than 0.05, the third null hypothesis was accepted, meaning that there was no statistically significant difference between the changes in arm-throw and neck-throw execution time. Thus, execution time decreased for both techniques, but there is insufficient statistical evidence to claim that one technique is more effective than the other, so the 0.30-second difference is descriptive and should not be interpreted as a significant advantage.

Discussion

Effect of Mannequin-Based Arm-Throw Training on the Speed of Junior Greco-Roman Wrestlers in Banjarmasin City

Mean arm-throw execution time decreased from 21.85 seconds in the pretest to 18.65 seconds in the posttest, a reduction of 3.20 seconds. Since a lower time indicates faster execution, this descriptive result shows an improvement in execution speed in the sample after the training period. The Wilcoxon signed-rank test yielded $Z = -3.948$ and $p < 0.001$, confirming a statistically significant difference between pretest and posttest times. However, because the design had no control group and all athletes practised both techniques, the change cannot be attributed solely to mannequin training, since regular club training, familiarity with the test, and other factors may also have contributed.

Throwing techniques require sufficient arm and leg muscle strength to achieve maximal results, as shown in a study of the waist throw among male wrestlers (Citrawati et al., 2024). Arm muscle strength has also been found to contribute to throwing ability in judo athletes, a combat sport with similar throwing demands (Basri et al., 2023). These findings are consistent with the present result, in which mannequin-based arm-throw practice was followed by faster execution. A stronger grip and arm help control the opponent more steadily, leg power provides explosive drive when lifting and turning, and waist flexibility facilitates trunk rotation so that the throw can be completed quickly and effectively.

This finding is also in line with research reporting that arm muscle strength and back muscle strength were strongly related to arm-throw ability among provincial junior wrestlers (Mayasari et al., 2020). This suggests that the mannequin not only makes technique easier to learn but also provides a physical stimulus to the main muscles

involved, enabling athletes to perform the arm throw with better speed and control. Overall, arm-throw execution time became shorter after the training period, but this result is not sufficient to conclude that aspects other than speed also improved or that the change was entirely caused by the mannequin.

Effect of Mannequin-Based Neck-Throw Training on the Speed of Junior Greco-Roman Wrestlers in Banjarmasin City

Mean neck-throw execution time decreased from 22.50 seconds in the pretest to 19.60 seconds in the posttest, a reduction of 2.90 seconds, indicating faster execution in the posttest. The Wilcoxon signed-rank test yielded $Z = -3.943$ and $p < 0.001$, so the difference between pretest and posttest times was statistically significant. As with the arm throw, this result reflects a change after the training period, but the absence of a control group does not allow a definite causal attribution to mannequin training alone.

The neck throw controls the opponent by using the neck as a point of support, allowing the athlete to complete a throw or takedown effectively. This principle agrees with the present finding that mannequin-based neck-throw practice was followed by a reduction in mean execution time from 22.50 to 19.60 seconds, reflecting more efficient control during execution. Training media that allow athletes to see and repeat a movement many times have likewise been shown to improve waist-throw technique more than conventional learning (Jahrir & Aziz, 2025).

Mannequins have also been used as a lifting load to develop the bridging technique of wrestlers in relation to flexibility (Erawan, 2010). Thus, neck-throw execution time in the sample was shorter after the training period, and this interpretation is limited to the variable actually measured, namely execution time, without extending it to strength, accuracy, or throwing success, which were not measured separately.

Comparison of Changes in Execution Time between the Two Techniques

Mean arm-throw time decreased by 3.20 seconds, whereas mean neck-throw time decreased by 2.90 seconds. To test whether this difference in change was meaningful, each athlete's change scores for the two techniques were compared using the paired-samples t-test, which yielded $t(19) = 0.65$ with $p = 0.527$, so the difference in change was not statistically significant.

Literature on the components of throwing techniques helps explain their movement demands but cannot replace a direct test of the difference in change between the two techniques in the present data. Because the comparison test was not significant, the 0.30-second difference in mean reduction is not sufficient to conclude that the arm throw is more

effective, since the conclusion must rest on the comparison test rather than on two separate statistics or significance values. Direct comparisons of two training methods have also been made in other sports, for example between multi-ball training and partner training in table tennis skills (Saleh & Saleh, 2019).

The results show that execution time decreased for both techniques, but no significant difference in change was found between the arm throw and the neck throw. Therefore, the data do not support prioritising one technique on the grounds of greater effectiveness, and coaches may continue to include both techniques with a mannequin as part of technical training according to the athletes' needs and the coach's technical judgement.

CONCLUSIONS AND SUGGESTIONS

Based on the analysis of data from 20 junior Greco-Roman wrestlers in Banjarmasin City, mean arm-throw execution time decreased from 21.85 seconds (SD = 6.95) to 18.65 seconds (SD = 6.44), a mean reduction of 3.20 seconds, and the Wilcoxon test showed a significant difference ($Z = -3.948$; $p < 0.001$), while mean neck-throw execution time decreased from 22.50 seconds (SD = 7.02) to 19.60 seconds (SD = 7.31), a mean reduction of 2.90 seconds, which was also significant ($Z = -3.943$; $p < 0.001$); therefore, execution time for both techniques changed between the pretest and the posttest. However, the reductions in arm-throw time (3.20 seconds) and neck-throw time (2.90 seconds) did not differ significantly, $t(19) = 0.65$; $p = 0.527$, so this study found no evidence that either technique produced a significantly greater change in execution time. Because there was no control group, the changes in both techniques cannot be attributed solely to mannequin training, as regular club training, learning effects from repeated testing, and other factors may have contributed; future studies are therefore recommended to use a comparison group, standardise test procedures, and examine the validity and reliability of the measurements.

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