https://doi.org/10.48047/AFJBS.6.Si3.2024.2050-2056

Investigation of Handgrip Strength and Body Balance between the Recurve and Compound Archers

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Volume 6,IssueSi3, 2024

Received: 20Apr2024

Accepted: 05May2024

DOI:
10.48047/AFJBS.6.Si3.2024.2050

Abstract

Background: Archery is a target accuracy sport because the goal is to shoot arrows at the target as precisely as possible. Athletes with good muscular strength and endurance will provide an excellent advantage for archers to perform at their peak. In the sport of archery, balance is needed because it must be able to hold the body while, on the other hand, aiming to release the shot.

Objective: The study aimed to investigate the significant difference in left and right handgrip strength and left and right foot balance between recurve and compound archers.

Method: For this study, thirty (N=30) state-level and above male archers, fifteen (N=15) each for recurve and compound archery, divided into two groups, were selected randomly. The subjects' ages ranged from 16 to 18 (17.00±0.79) years. Handgrip Dynamometer and Stork Stand Test were administered to obtain data on handgrip strength and balance of archers. The descriptive and independent 't' tests were employed, and the level of significance was set at 0.05.

Result: The result revealed the insignificant mean differences in both LHS and RHS between the recurve and compound archers as the respective obtained 't'=1.21 and 1.27 were lesser than the tabulated 't'=2.048 at 0.05 level of confidence (p>0.05). Further, there were also insignificant differences in LFB and RFB between the recurve and compound archers as the calculated 't'=0.55 and 1.03 was lesser than the tabulated 't'=2.048 at 0.05 level of confidence (p>0.05).

Conclusion: Handgrip strength and balance of motor components are the most critical factors in the peak performance of archers. Handgrip strength can provide an excellent advantage for archers in holding the bow longer, pulling a bow, aiming (holding), and releasing arrows. Balance can maintain a stable position and aim at the right target for the archers.

Keywords: Archery, Handgrip strength, Balance, Recurve and Compound.

1. Introduction

Archery is a target accuracy sport, because the goal is to shoot arrows at the target as precisely as possible (1); (2). The physical components required in archery include: physical condition, muscle strength, muscle endurance, and technique (3); (4). Archery in practice is a sport that requires coordination, endurance, flexibility, length of pull, and balance to form good archery techniques (5). Muscular endurance can be defined by the ability to repeatedly produce voluntary strength or to maintain voluntary strength production by certain muscles or muscle groups at sub-maximal levels for a long time (6). The use of arm muscle endurance in archers is when pulling a bow, aiming (holding), and releasing arrows (7). Athletes with good muscular strength and muscular endurance, it will provide a great advantage for archers to perform at their peak (8); (9). In addition, archery requires upper body and core muscle strength that mobilizes major muscle groups (10). In archery, one arm is used to hold (push) the bow in a stable position while the other arm pulls the bowstring, with increased muscle tremors to hold the arrow target alignment until arrow release (11). Grip strength is important in many kinds of sports: grip of golf putter determines effectiveness of strike; battery of special tests permits to prognosticate successfulness in sleigh and bobsleigh; grip strength permits to increase accuracy of archery; grip strength is an informative factor of successfulness and sportsmanship prognostication in hockey; simulation of different grip variants permits to find dependence between strength, area of contact and kind of grip; construction of models permits to prognosticate maximal grip strength; in analysis of mountaineers' physical fitness electric myographic study of grip strength is rather effective (12); (13). Arm muscle strength training in archery is one of the important factors in archery to shoot according to the right targets to get a high score (14). The hand grip strength is an objective component of upper extremity functional integrity, as well as an indication of the individual's muscle strength (15). The hand grip strength is also an indication for the functional completeness of the upper-extremity and one of its most important tasks (16).

In the sport of archery balance is needed because it must be able to hold the body while on the other hand aiming to release the shot (17). Balance is the ability to maintain the neuromuscular system (nerve-muscle system) in a static condition, or control the nerve-muscle system so as not to fall or collapse; or the ability to maintain the neuromuscular system in a static condition, or control the neuromuscular system in an efficient position or attitude while moving (18). Balance is defined as the relative ability to control the centre of mass or centre of gravity against the base of support (19). Balance ability is related to skill level for archers, with the more proficient archers displaying greater balance ability prior to the arrow shot (20).

2. Objective

The objective of the present study is

1. To investigate the significant mean differences in left and right handgrip strength between recurve and compound archers.

2. To investigate the significant mean differences in left and right foot balance between recurve and compound archers.

3. Methods

3.1 Selection of Subjects and Test

For the present study, thirty (N=30) male archers played state level and above, and fifteen (n=15) each from recurve and compound archer groups were selected randomly. The age of the subjects was ranged between 16 to 22 (19.00±0.79) years. All the archers were right-handed shooters. The height and weight of the recurve archers ranged between 164 cm to 177 cm (170.08±3 and 55kg to 70kg (60.27±5.13), respectively, and the compound archers ranged between 167 cm to 180 cm (172.7±3.93 and 56kg to 71kg (64.27±4.61) respectively.

3.2 Collection of Data

The data on handgrip strength and body balance were collected from each fifteen (n=15) recurve and compound archers by administering the Handgrip Dynamometer and Stork Stand Test, respectively. The data on handgrip strength and body balance were expressed in kilograms and seconds.

3.3 Data Analysis

The descriptive and independent 't' tests were employed to determine the data characteristics and significant mean differences in handgrip strength and body balance between the recurve and compound archers. The level of significance was set at 0.05.

4. Results

The pertaining handgrip strength and balance data were treated using descriptive analysis to find the mean (M), standard deviation (SD), and others. The independent 't' test was used to find out the significant differences in left and right handgrip strength (LHS & RHS) and left and right foot balance (LFB & RFB) between the recurve and compound archers, as shown in table 1 and 2.

Table 1: Descriptive and Mean Comparison of Left and Right Handgrip Strength between Recurve and Compound Archers.

Variables	Group	n	M	SD	MD	SED	df	t-value	p
LHS	Recurve	15	44.80	3.75	1.73	1.43	28	**1.21**	0.24
	Compound		46.53	4.07					
RHS	Recurve	15	47.67	3.87	1.80	1.42	28	**1.27**	0.22
	Compound		49.47	3.91					

Insignificant at 0.05, where tabulated $t_{(0.05)}(28)= 2.048$

Table 1 reveals the mean (M) and standard deviation (SD) of LHS for recurve and compound archers were 44.80±3.75 and 46.53±4.07, respectively. Further, the mean (M) and standard deviation (SD) of RHS for recurve and compound were 47.67±3.87 and 49.47±3.91, respectively. There were found insignificant mean differences in both LHS and RHS between the recurve and compound archers as the respective obtained 't'=1.21 and 1.27 were lesser than the tabulated 't'=2.048 at 0.05 level of confidence ($p>0.05$). However, the mean value of the

compound is greater than the recurve in both LHS and RHS. The graphical presentation of means of LHS and RHS between the recurve and compound of archers is shown in figure 1.

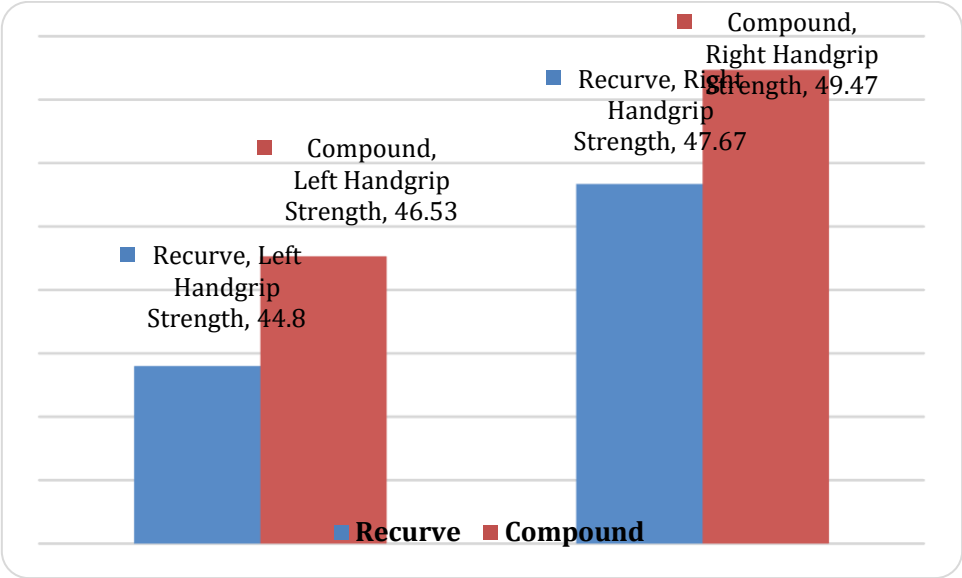

Figure 1: Means of LHS and RHS between the Recurve and Compound of Archers

Table 2: Descriptive and Mean Comparison of LFB and RFB between Recurve and Compound Archers.

Variables	Group	N	M	SD	MD	SED	df	t-value	p
LFB	Recurve	15	49.20	19.59	3.53	6.37	28	**0.55**	0.58
	Compound		45.67	14.99					
RFB	Recurve	15	56.87	20.66	6.60	6.39	28	**1.03**	0.31
	Compound		50.27	13.60					

Insignificant at 0.05, where tabulated $t_{(0.05)}(28) = 2.048$

Table 2 reveals the mean (M) and standard deviation (SD) of LFB for recurve and compound were 49.20±19.59 and 45.67±14.99 respectively. On the other hand, the mean (M) and standard deviation (SD) of RFB for recurve and compound were 49.20±19.59 and 45.67±14.99 respectively. Further, there were insignificant differences in LFB and RFB between the recurve and compound archers as the calculated 't'=0.55 and 1.03 was less than the tabulated 't'=2.048 at 0.05 level of confidence (p>0.05). However, the mean value of recurve is greater than the compound archers in both LFB and RFB. The graphical presentation of the means comparison in both LFB and RFB between the recurve and the compound is shown in figure 2.

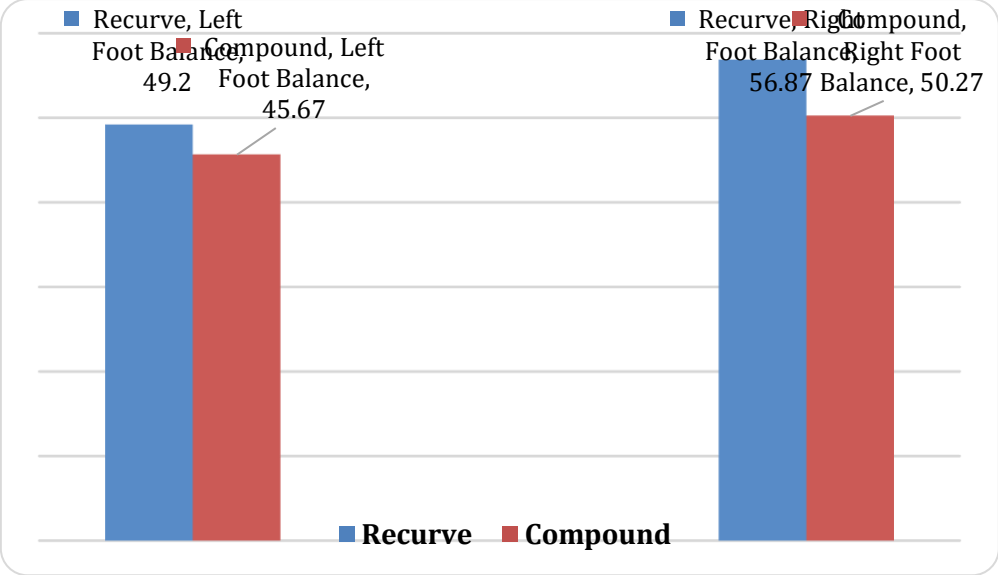

Figure 2: Means of LFB and RFB between the Recurve and Compound of Archers

5. Discussion of Finding

The finding of the present study shows that in the results of the independent 't'-test, there was an insignificant difference in the LHS and RHS between the recurve and compound archers. The results might be that both hands are equally important in the performance of pulling a bow, aiming (holding), and releasing arrows. In archery, because of both hands are used to grab bow and string, the hand grip strength for both hands significantly impacts the performance and scoring in an advantageous way (21). The arrow and the bow can be held with the right or left hand if they are at the point of choice of hand (22). Ideally, the same force dominates the both hands (23); (24); (25).

However, the mean value of compound archers is greater than the recurve archers in both LHS and RHS. The results might be due to the compound players possessing more strength and endurance of hand muscle. Because the compound bow is heavier than the recurve bow, the poundage of the bow is also more significant than the compound bow. Compound archers must hold the bow steady and aim without undue muscle fatigue.

Again, there was an insignificant difference in LFB and RFB between the recurve and compound archers. The result might be due to the fact that the LFB and RFB of both recurve and compound archers are equally important. Both the left and right feet balance the whole body weight equally. However, the mean value of the recurve is greater than the compound archers in both LFB and RFB. The results might be because the length of the recurve bow is longer than that of the compound bow. Therefore, recurve archers need to balance the bow in a more stable position. Therefore, trainers need more concentration and focus on balance training to decrease body sway in recurve and compound archery. This training could be organized with visual feedback during shooting.

6. Conclusion

Handgrip strength and balance are the essential factors responsible for achieving archers' peak performance. Handgrip strength can provide an excellent advantage for archers to hold the bow in a stable position, pull a bow, aim (holding), and release the arrows. Good balance can maintain a stable position and aim at the right target for the archers. Therefore, the coaches,

trainers, and archers must understand how knowing muscular handgrip strength and balance affects performance.

7. References

1. Simsek D, Cerrah AO, Ertan H, Soylu AR. A comparison of the ground reaction forces of archers with different levels of expertise during the arrow shooting. Sci Sports. 2019; 34(2): e137–45.
2. Sarro KJ, Viana TDC, De Barros RML. Relationship between bow stability and postural control in recurve archery. Eur J Sport Sci. 2021; 21(4): 515–20.
3. Setiakarnawijaya Y, Dlis F, Tangkudung J, Asmawi M. Correlation study between arm muscle endurance and arm length and accuracy of 30-meter arrow shots in a national round. J Phys Educ Sport. 2021; 21: 2357–63.
4. Taha Z, Musa RM, Majeed APPA, Alim MM, Abdullah MR. The identification of high potential archers based on fitness and motor ability variables: A Support Vector Machine approach. Hum Mov Sci. 2018; 57: 184–93.
5. Tan SL, Koh KT, Kokkonen M. The perception of elite athletes' guided self-reflection and performance in archery. Reflective Pract. 2016; 17(2): 207–20
6. Salonikidis K, Papageorgiou K, Meliadis A, Arabatzi F. Force steadiness during submaximal isometric plantar and dorsiflexion in resistance training: experienced vs non-experienced individuals. Cent Eur J Sport Sci Med. 2021; 34(02).
7. Putra GN, Hidayatullah MF, Purnama SK. Relationship of Arm Muscle Strength, Arm Muscle Endurance, Abdominal Strength and Balance with Arrow Achievement. Int J Multidiscip Res Anal. 2022; 5(01).
8. Arkin I, Budak M. Trunk stabilization, body balance, body perception, and quality of life in professional physically disabled and able-bodied archers. Sport Sci Health. 2021; 17(4): 881–9.
9. Hamilton BR, Guppy FM, Barrett J, Seal L, Pitsiladis Y. Integrating transwomen athletes into elite competition: the case of elite archery and shooting. Eur J Sport Sci. 2021; 21(11): 1500–9.
10. Suppiah PK, Musa RM, Wong T, Kiet K, Abdullah MR, Bisyri A, et al. Sensitivity prediction analysis of the contribution of physical fitness variables on Terengganu Malaysian youth archers' shooting scores. Int J Pharm Sci Rev Res. 2017; 43(1): 133–9.
11. Savvides A, D Giannaki C, Vlahoyiannis A, S Stavrinou P, Aphamis G. Effects of dehydration on archery performance, subjective feelings and heart rate during a competition simulation. J Funct Morphol Kinesiol. 2020; 5(3): 67.
12. Limonta E, Cè E, Gobbo M et al. Motor unit activation strategy during a sustained isometric contraction of finger flexor muscles in elite climbers. J Sports Sci. 2016; 34(2): 133-142.
13. MacKenzie SJ, Boucher DE. The influence of golf shaft stiffness on grip and club head kinematics. J Sports Sci. 2016; 11: 140-14.
14. Sezer SY. The Impact of Hand Grip Strength Exercises on the Target Shooting Accuracy Score for Archers. Journal of Education and Training Studies. 2017; 5(5): 6. https://doi.org/10.11114/jets.v5i5.2194

15. Çalışkan S, & Gökbel H. Association between Handgrip Strength with Hand Choice and Hand Skill, Journal of General Medicine. 1997; 7: 195-203.

16. Landers DM, Boutcher SH, & Wang MQ. A Psychobiological Study of Archery Performance. Research Quarterly for Exercise and Sport. 1986; 57(4): 236-244. https://doi.org/10.1080/02701367.1986.10605403

17. Debnath S, Debnath S. Performance evaluation by image processing techniques in archery–a case study. Int J New Technol Sci Eng. 2016; 3(1): 1–6.

18. Azhar RC, Sukamti ER, Subekti OB, and Arianto AC. Muscle Endurance, Muscle Strength, Coordination, and Balance as Predictors of Archery Accuracy. International Journal of Multidisciplinary Research and Publications. 2023; 5(11): 125-129.

19. Sibley KM, Beauchamp MK, Van Ooteghem K, Paterson M, Wittmeier KD. Components of standing postural control evaluated in paediatric balance measures: A scoping review. Arch Phys Med Rehabil. 2017; 98(10): 2066–78.

20. Hrysomallis C. Balance Ability and Athletic Performance. Sports Medicine. 2011; 41(3): 221-32.

21. Nicolay CW, & Walker AL. Grip Strength and Endurance: Influences of Anthropometric Variation, Hand Dominance, And Gender. Int. J. Ind. Ergon. (2005); 35: 605-618. https://doi.org/10.1016/j.ergon.2005.01.007

22. Sezer SY. The Impact of Hand Grip Strength Exercises on the Target Shooting Accuracy Score for Archers. Journal of Education and Training Studies. 2017; 5(5): 6-16.

23. Gabriel YFN & Andy CCF. (2001). Does Elbow Position Affect Strength and Reproducibility of Power Grip Measurements. Physiotherapy. 2001; 87: 68-72. https://doi.org/10.1016/S0031-9406(05)60443-9

24. Gilbert JC& Knowlton RG. (1983). Simple Method to Determine Sincerity of Effort During a Maximal İsometric Test of Grip Strength. Am. J. Phys. Med. 1983; 62: 135-144.

25. Kolayiş IE & Mimaroğlu E. Effects of the Heart Beat Rate and Aiming Time on the Shooting Score in the Training Environment of Archery National Team. International Journal of Human Sciences. 2008; 5(1): 1-18.