# Comparative Examination of Flexibility and Leg Strength between Compound and Recurve Archers

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***Abstract***

*Archery is a target precision sport that requires specific motor skills, including strength, endurance, flexibility, power, and balance, all while maintaining high focus and concentration. The main purpose of the study is to compare the flexibility and leg strength between the compound and recurve archers. Forty (N=40) male archers, twenty (n=20) each from the compound and recurve archers between 16 to 22 years of age from different reputed institutions located in different states and regional SAI training centers who participated at least national and above competitions were randomly selected. The pertaining data on flexibility and leg strength of compound and recurve archers were obtained by administering the sit and reach test (Flexo Measure Tape) and leg strength test (Leg Lift Dynamometer), respectively. The descriptive and independent 't' test statistical techniques were used and tested at 0.05. For flexibility, t = 2.26 (p<0.05), and the mean value of recurve archers is greater than the compound archers. However, insignificant difference was evidenced in the case of the leg strength as the t = 0.26 (p>0.05) among the compound and recurve archers. The result of the study showed significant differences in flexibility and insignificant differences in leg strength between the compound and recurve archers.*

***Keywords: Flexibility, Leg Strength, Compound, Recurve, Archers***

## 1. Introduction

Archery is a sport that involves shooting an arrow with a bow at a target. During the shooting, archers required muscular endurance of upper body, strength for the shoulder girdle (Kolayis & Ertan, 2016). Muscular strength and endurance of the body, balance, and flexibility play a crucial role in determining the outcome of every shot (An, 2018). The correct shooting techniques play an important role in achieving the highest score. The shooting of an arrow at the accurate target face must achieve the highest score (Quan & Lee, 2016). Maximal force is needed in archery for the pulling of the string to make a full draw (Debnath & Debnath, 2018).

In archery, archer has to fix their posture and aim at the centre of the target face to achieve the highest score, for this they need to regulate the body fluctuations, such that the alignment of the arrow remains within the target boundary, and centre of gravity within their base of support (Cerrah and Ertan 2013; Balasubramaniam et al., 2000).

Leg strength plays an important role in maintaining balance and stability during shooting to gain more accuracy. In archery, leg strength is essential for preserving balance, stability, and good posture during the shot. Accuracy and consistency in shooting depend on having a strong foundation, which is facilitated by strong legs. Leg strength also improves one's capacity to sustain the physical strain of frequent shooting and hold the bow stable for extended periods of time. Efficient leg strength plays a crucial role in maintaining the body's centre of gravity and ensuring proper posture, which is essential for accuracy. Enhancing the strength of the legs and core muscles can help minimize postural sway while aiming, resulting in more consistent and accurate shooting. Powerful legs support an archer's ability to uphold correct form and technique during a shooting session, reducing fatigue and preserving accuracy. Leg strength is closely associated with core stability. Strong legs assist in

activating core muscles, which are vital for transferring energy from the lower body to the upper body during both the draw and release phases. Archery demands that the body navigates through various ranges of motion. More robust legs can enhance flexibility and range of motion, potentially lowering the risk of injuries caused by muscle imbalances or incorrect form. Being a static sport, archery requires balance, fine movement control, proper endurance, and strength of the upper body (Cerrah & Ertan, 2013).

Archery is a precision sport; flexibility is an important component in physical performance (Na et al. 2024 & Donti et al. 2022). Flexibility is not only about muscle elasticity, and supports the optimal range of motion, which can reduce the risk of injury, stabilizing body posture, and the mechanism of controlling the bow's draw release (Orban et al. 2024, Koźlenia & Domaradzki, 2021, & Sobrinho et al. 2023). The ability of higher flexibility capacities that support the optimization of techniques in archery (Pristianto & Sudawan, 2021). Flexibility plays a key role in the trunk stabilization capabilities of the archers for maintaining balance when releasing the bow (Utama et al. 2023, & Spratford & Campbell, 2017). The biomechanical demands of maintaining static-dynamic positions during shooting, such as shoulder hyperextension, thoracic rotation, and lumbar stability, require superior flexibility in the hamstrings, hips, and lower back (Cai et al. 2023, & Avrillon et al. 2019). Optimal flexibility plays a role in increasing mobility of the lumber region, improving an individual's functional abilities, and reducing the risk of muscle tension (Kurniawan et al. 2019). Flexibility deficits can lead to abnormal motor compensation, reduced shooting accuracy, and accelerated muscle fatigue (Sarro et al. 2021, Vendrame et al. 2022 & Na et al. 2024).

**2. Objective**

The objectives of the study were to investigate the significant differences in flexibility and leg strength between the compound and recurve archers.

**3. Methods**

A total of forty (N=40) male archers between 16 to 22 years of age, twenty (n=20) each from the compound and recurve archers were randomly selected. The archers participated at least national and above competitions from different reputed institutions located in different states and regional SAI training centers of India. The pertaining data on flexibility and leg strength were collected by administering the sit and reach test (Flexo Measure Tape) in inches and leg strength test (Leg Lift Dynamometer) in kilograms. The descriptive analysis and independent 't' test statistical techniques were used to determine the characteristics of the data and significant mean differences in flexibility and leg strength between the compound and recurve archers. The level of significance was set at 0.05.

**4. Results**

The data of flexibility and leg strength were treated by employing descriptive analysis to find out the mean (M) and standard deviation (SD). The independent 't' test was employed to find out the significant mean differences of flexibility and leg strength between the compound and recurve archers, as shown in table 1.

**Table 1: The Descriptive and Mean Comparison of Flexibility and Leg Strength between the Compound and Recurve Archers.**

| Variables | Group | N | M | SD | MD | SED | df | t-value | Sig. p |
|---|---|---|---|---|---|---|---|---|---|
| **Flexibility** | Compound | 20 | 13.10 | 2.55 | 2.04 | 0.77 | 38 | 2.65* | 0.01 |
| | Recurve | | 15.14 | 2.32 | | | | | |
| **Leg Strength** | Compound | 20 | 94.58 | 25.53 | 2.08 | 8.14 | 38 | 0.26 | 0.80 |
| | Recurve | | 92.50 | 25.96 | | | | | |

**Significant at 0.05, where tabulated $t_{(0.05)}(38)=2.024$*

Table 1 reveals that the mean (M), and the standard deviation (SD) of the compound and recurve archers in flexibility were 13.10±2.55 and 15.14±2.32 respectively. There were significant mean differences in flexibility among the compound and recurve archers, as the calculated 't' = 2.65 is

greater than the tabulated 't' = 2.024 at 0.05 level ($p<0.05$). The mean values of the recurve archer are higher than those of the compound archer in the case of flexibility.

In case of the leg strength, the mean (M), and standard deviation (SD) of the compound and recurve archers were 94.58±25.53 and 92.50±25.96 respectively, and there were insignificant mean differences in leg strength between the compound and recurve archers, as the calculated 't' = 0.26 is lesser than the tabulated 't' = 2.024 at 0.05 level ($p>0.05$). However, the mean value of the compound archer is higher than that of the recurve archer in the leg strength.

The graphical representation of the mean comparison of flexibility and leg strength between the compound and recurve archers is shown in figure 1.

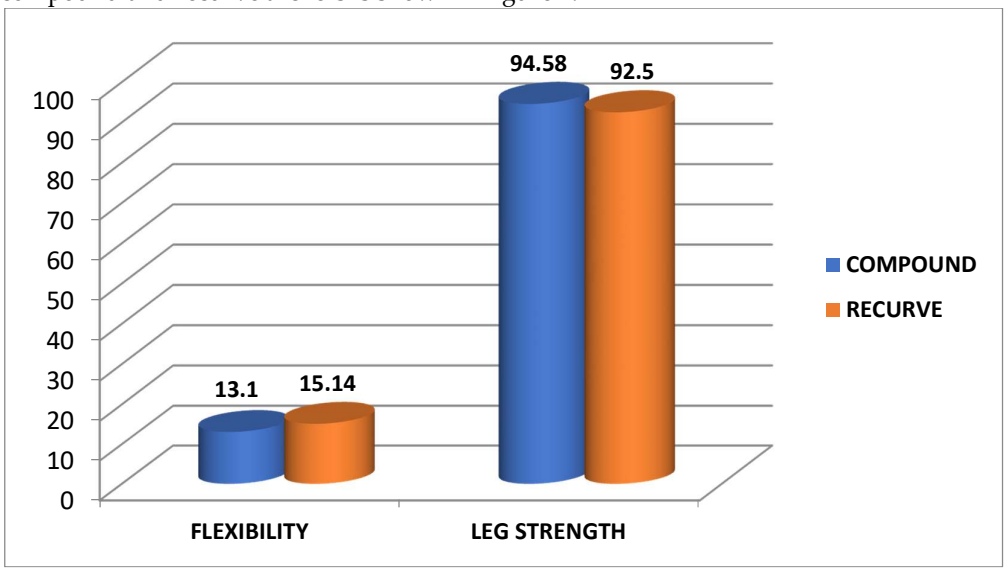


**Figure 1: Mean Comparison of Flexibility and Leg Strength between the Compound and Recurve Archers.**

**5. Discussion**

The finding of the present study reveals that there was the significant mean difference in flexibility between the compound and recurve archers. The result might be due to both compound and recurve archers have different impacts on their shooting. Recurve bows often require more flexibility and strength in the back and shoulders to maintain the full draw weight throughout the shot, requiring more muscular endurance and flexibility to maintain good form and draw length consistency. Recurve archers have flexibility in their fingers and wrists for a clean, controlled release, while compound bows often offer greater flexibility through their mechanical design and let-off. This means compound bows are more accessible for archers who might have limitations in flexibility or strength.

In the case of leg strength, insignificant mean difference between compound and recurve archers. The results might be that a stable standing position is the foundation of shooting a bow. A stable and balanced stance depends on the leg strength of the shooting position of both compound and recurve archers.

**6. Conclusion**

The result of the study showed significant differences in flexibility between the compound and recurve archers. And, there were insignificant differences in leg strength between the compound and recurve archers. However, the mean value of the compound archers is higher than the recurve archers in the case of leg strength. Archery coaches, archers, and physical education teachers should understand the importance of specifically determining the objective of the present study to develop the importance of flexibility and leg strength fitness components in the vital role of enhancing the performance of archers.

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**Informed consent**
Written informed consent was obtained from all individual participants included in the study.
**Ethical approval for study protocol**
The study was approved by the Institutional Human Ethics Committee, Manipur University, Imphal.

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**Conflict of Interest**
The authors declare no potential conflict of interest.

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