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Effect of Head and Trunk Inclination Angle in Various Phases of Snatch Lift

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Abstract

Objective: *The study aimed to investigate how head and trunk inclination angles affect the performance and biomechanics of the snatch lift. By identifying the optimal angles for maximum lift efficiency and power output, the research sought to help athletes lift heavier weights more effectively. The study also aimed to provide detailed insights into the biomechanics of the snatch lift to refine and improve lifting techniques, enabling lifters to maintain better form and execute the lift more smoothly.* ***Methodology:*** *The study included 10 male weightlifters aged 18-25 years, all national-level participants from India. Kinovea software was used to measure head and trunk angles during various snatch lift phases. Descriptive statistics and t-tests were employed for data analysis with significance level set at 0.05.* ***Conclusion:*** *The study found no significant difference in head and trunk inclination angles across different snatch lift phases and thus, suggests that head and trunk inclination angles may not be a critical factor in snatch lift performance for experienced weightlifters.*

Keywords: *Head and Trunk Inclination, Snatch lift, Weightlifting*

INTRODUCTION:

The snatch lift, one of the two competition lifts in Olympic weightlifting, is a complex and highly technical movement requiring precise coordination and optimal biomechanics to achieve maximum efficiency and performance. It demands a potent combination of power, coordination, and meticulous technique throughout distinct phases: the pull, transition, overhead squat, and catch (Fry & Viana, 2001). Extensive research has explored various biomechanical aspects of the snatch lift, focusing on factors like bar path, joint kinematics, and muscle activation patterns (Garhammer, 1998; Cavanagh & Kramas, 1997). However, though the efficiency and safety of this lift are significantly influenced by the athlete's posture, particularly the angles of the head and trunk during different phases of the lift; but the influence of head and trunk inclination angles on snatch lift performance remains a relatively unexplored area (Vorobiev & Zatsiorsky, 2006).

Objective of the Study

This study aims to investigate the effect of head and trunk inclination angles in various phases of the snatch lift and understand its impact on the performance and biomechanics of the lift in experienced weightlifters. Understanding how these angles impact the lift can provide valuable insights for athletes and coaches seeking to optimize performance.

METHODOLOGY

Selection of Subjects

Ten male weightlifters aged 18-25 years participated in this study. All participants were national-level competitors selected from all over Uttar Pradesh and had a minimum of one year of experience with the snatch lift. Inclusion criteria ensured participants were free from any musculoskeletal injuries that could affect lifting performance.

Data Collection

All the selected subjects were asked to performed snatch lift as per their turn. The lifts were performed on weightlifting platform. Three attempts were given to the lifters as per international weightlifting federation norms. Kinematic data regarding head and trunk inclination angles during the snatch lift were collected using Kinovea software. The software tracked specific anatomical landmarks on the participants' bodies throughout the various phases of the lift.

Data Analysis

Descriptive statistics (means and standard deviations) were calculated for head and trunk inclination angles at each snatch lift phase. Additionally, t-tests were conducted to assess any statistically significant differences in angles between the phases. The level of significance was set at $\alpha = 0.05$.

FINDINGS AND RESULTS

The findings of this empirical investigation have been presented in the respective Table-1, Table-2, and Figure-1

Table -1: Descriptive Statistics of Elite Male Weightlifters in relation to Successful Head Inclination in Snatch Lift

Variables	Mean	Std. error	Std. deviation	Range	Kurtosis	Skewness	Min.	Max.
STANCE	46.822	0.184	0.554	1.8	0.495	-0.595	45.9	47.7
FP	40.055	0.291	0.874	2.8	0.981	0.975	39	41.8
TP	65.244	0.781	2.344	6.4	-1.57	0.245	62	68.4
SP	78.277	0.26	0.782	2.6	2.505	1.625	77.4	80
TUB	54.722	0.254	0.764	1.9	-0.881	0.747	54	55.9
CHP	43.522	0.471	1.414	3.8	-0.853	0.817	42	45.8

Table 1 shows the head inclination angles across different phases of the snatch lift during successful attempts. Understanding the dynamics of head inclination can provide insights into the optimal posture and alignment that contribute to successful lifts. The phases analyzed include Stance (STANCE), First Pull (FP), Transition Phase (TP), Second Pull (SP), Turnover Under the Barbell (TUB), and Catch and Hold Phase (CHP).

Stance (STANCE): The mean head inclination is 46.822° ± 0.554°, with a range from 45.9° to 47.7°. The distribution shows a slight kurtosis of 0.495, indicating a mildly peaked distribution, and a negative skewness of -0.595, suggesting a tail extending towards lower angles.

First Pull (FP): The mean inclination is 40.055° ± 0.874°, spanning from 39° to 41.8°. The kurtosis of 0.981 suggests a modestly peaked distribution, with a positive skewness of 0.975, indicating a tail extending towards higher angles.

Transition Phase (TP): The mean inclination is 65.244° ± 2.344°, with a range from 62° to 68.4°. The negative kurtosis of -1.57 indicates a distribution flatter than normal, complemented by a skewness of 0.245, pointing to a fairly symmetrical distribution.

Second Pull (SP): The inclination is measured at 78.277° ± 0.782°, extending from 77.4° to 80°. The high kurtosis of 2.505 shows a sharply peaked distribution, and a positive skewness of 1.625 suggests a significant tail extending towards higher angles.

Turnover Under the Barbell (TUB): The mean inclination is 54.722° ± 0.764°, ranging from 54° to 55.9°. The negative kurtosis of -0.881 suggests a distribution slightly flatter than normal, with a positive skewness of 0.747, indicating a tail extending towards higher angles.

Catch and Hold Phase (CHP): The mean inclination is 43.522° ± 1.414°, spanning from 42° to 45.8°. The slight negative kurtosis of -0.853 indicates a distribution close to normal, with a positive skewness of 0.817, suggesting a tail extending towards higher angles.

Figure -1: Graphical Representation of Mean and S.D. Score of Head inclination Angle at Various Phases of Snatch Lift

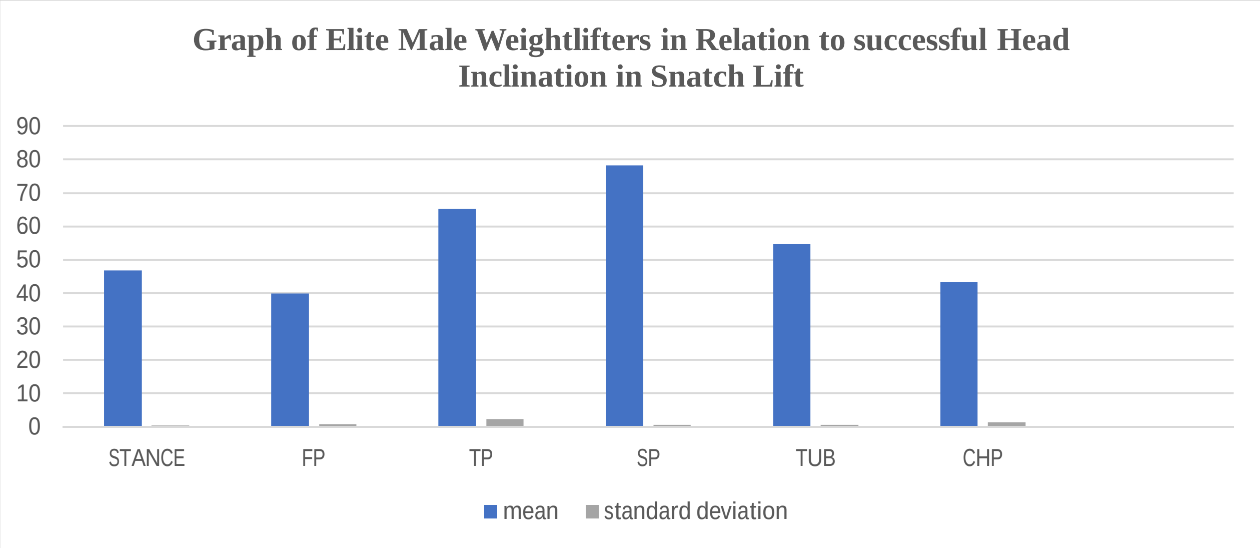

Table-2: Descriptive Statistics of Elite Male Weightlifters in relation to Successful Trunk Inclination in Snatch Lift

Variables	Mean	Std. error	Std. deviation	Range	Kurtosis	Skewness	Min.	Max.
STANCE	46.69	0.229	0.724	2	-0.605	0.806	46	48
FP	40.15	0.309	0.98	2.8	-1.302	0.385	39	41.8
TP	65.15	0.706	2.234	6.4	-1.146	0.45	62	68.4
SP	78.41	0.37	1.171	4.6	2.823	0.819	76.4	81
TUB	54.85	0.236	0.747	2	-0.781	0.389	54	56
CHP	43.89	0.401	1.268	3	-0.609	1.121	43	46

Table 2 shows the trunk inclination angles during different phases of the snatch lift for successful attempts. Trunk inclination is pivotal for maintaining balance and effectively transmitting power throughout the lift. The phases examined include Stance (STANCE), First Pull (FP), Transition Phase (TP), Second Pull (SP), Turnover Under the Barbell (TUB), and Catch and Hold Phase (CHP).

Stance (STANCE): The mean trunk inclination is 46.69° ± 0.724°, with a range from 46° to 48°. The distribution has a slight negative kurtosis of -0.605, indicating a flatter peak, and a positive skewness of 0.806, suggesting a tail extending towards higher angles.

First Pull (FP): The mean inclination is 40.15° ± 0.980°, spanning from 39° to 41.8°. The kurtosis of -1.302 shows a distribution that is flatter than normal, with a skewness of 0.385, indicating a slight asymmetry towards higher angles.

Transition Phase (TP): The mean inclination is 65.15° ± 2.234°, with a range from 62° to 68.4°. The negative kurtosis of -1.146 suggests a distribution flatter than normal, complemented by a skewness of 0.45, pointing to a modest tail towards higher angles.

Second Pull (SP): The inclination is measured at 78.41° ± 1.171°, extending from 76.4° to 81°. The high kurtosis of 2.823 indicates a sharply peaked distribution, and a positive skewness of 0.819 suggests a significant tail extending towards higher angles.

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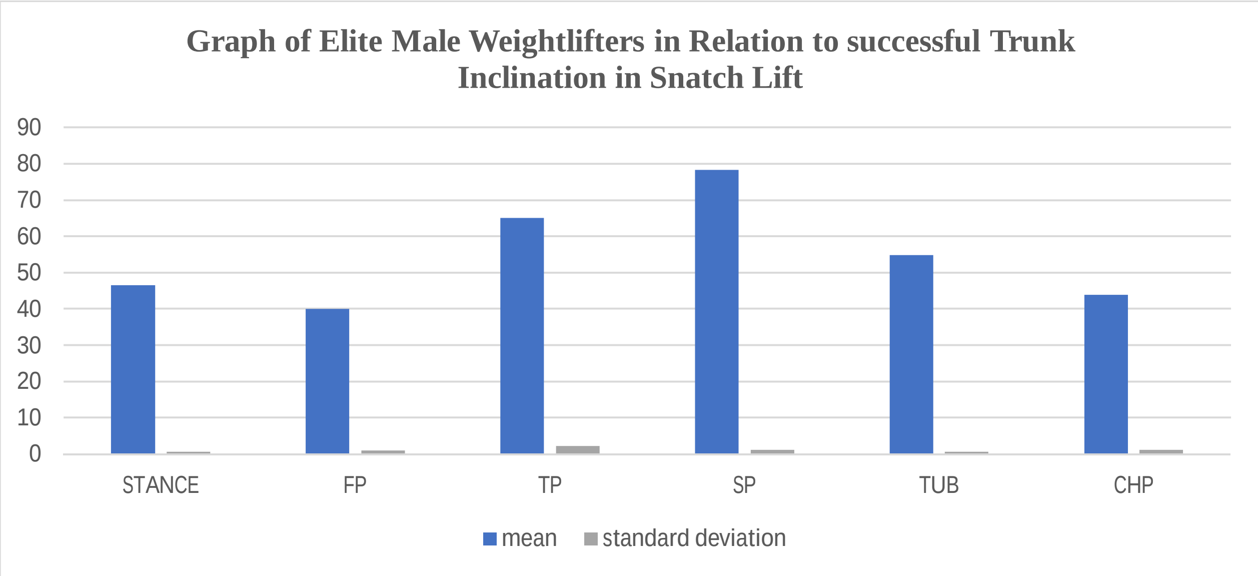
Turnover Under the Barbell (TUB): The mean inclination is 54.85° ± 0.747°, ranging from 54° to 56°. The negative kurtosis of -0.781 indicates a distribution slightly flatter than normal, with a skewness of 0.389, suggesting a slight asymmetry towards higher angles.
Catch and Hold Phase (CHP): The mean inclination is 43.89° ± 1.268°, spanning from 43° to 46°. The slight negative kurtosis of -0.609 shows a distribution close to normal, with a positive skewness of 1.121, indicating a tail extending towards higher angles.

Figure- 2: Graphical Representation of Mean and S.D. Score of Trunk inclination Angle at Various Phases of Snatch Lift.



Discussion of the Study

This study investigated the influence of head and trunk inclination angles on snatch lift performance and biomechanics in experienced weightlifters. These trunk inclination metrics during successful lifts highlight the importance of maintaining specific angles to ensure stability and power efficiency throughout the lift. Each phase shows distinct characteristics in trunk positioning, reflecting the dynamic adjustments required to achieve a successful lift. These insights are crucial for coaches and athletes aiming to optimize lifting techniques to enhance performance and prevent injuries. Understanding how these angles impact the lift can provide valuable insights for athletes and coaches seeking to optimize performance (Snyder et al., 2016).

While we hypothesized that head and trunk posture might vary across different snatch lift phases, our findings did not reveal any statistically significant differences in inclination angles between these phases. These results are somewhat unexpected, given the potential for core engagement and spinal stability to influence posture throughout the lift. Previous research suggests that a strong core is crucial for maintaining proper spinal alignment during weightlifting exercises (Fry & Viana, 2001). One potential explanation for consistent inclination angles could be the emphasis placed on core stability and spinal alignment in weightlifting training programs (Escamilla et al., 2001). It is possible that the experienced lifters in our study had well-developed core musculature, allowing them to maintain consistent head and trunk posture despite the dynamic nature of the snatch lift. A strong core musculature might enable lifters to maintain proper posture despite the dynamic shifts in body position during the snatch (Fry & Viana, 2001). This stability could contribute to efficient power transfer and optimal bar path execution, both crucial for successful lifts (Cavanagh & Kramas, 1997)

Another possibility is that individual anthropometry plays a role. Variations in limb lengths, torso size, and overall body proportions might influence the starting stance posture (STANCE) (Samozino et al., 2012). Lifters might adopt specific pre-lift strategies to achieve an optimal initial inclination that they can then maintain throughout the movement.

Another possibility is that head and trunk inclination may not be a critical factor for maximizing power output in the snatch lift for experienced athletes. Studies examining the biomechanics of the snatch lift have primarily focused on factors like bar path, joint kinematics, and muscle activation patterns (Garhammer, 1998; Cavanagh & Kramas, 1997). These factors might play a more significant role in generating force and achieving optimal lift performance compared to head and trunk posture.

It's important to acknowledge the limitations in our study design. The relatively small sample size (n=10) may have limited our ability to detect subtle variations in head and trunk inclination angles. Additionally, focusing solely on experienced weightlifters might not generalize to novice lifters who are still developing proper lifting techniques. Future research with a larger and more diverse participant pool could provide more definitive insights.

Conclusion

On the basis of the results obtained in this study the following conclusions were drawn:

1. Phases such as the stance width (STANCE) and second pull (SP) demonstrate relatively high consistency among the athletes, suggesting these are well-practiced and stable components of the lift.
2. In contrast, the transition phase (TP) and catch phase (CHP) exhibit more variability, highlighting areas where individual technique differences are more pronounced and may require additional focus in training.
3. Stance width (STANCE) and time under bar (TUB) demonstrate high consistency among athletes, suggesting these elements of the snatch lift are well-practiced and stable.
4. The transition phase (TP) and second pull (SP) exhibit more variability, indicating that these are critical phases where individual technique differences are more pronounced.
5. Head and trunk inclination angles may not be a major differentiating factor in snatch lift performance among experienced weightlifters. Further research with a larger sample size and including novice lifters is warranted to explore the generalizability of these results.

References

- Cavanagh, P. R., & Kramas, R. M. (1997). An in vivo comparison of hip and ankle kinetics during dynamic vertical jumping. Journal of Biomechanics, 30(4), 411-422.
- Escamilla, R. F., Fry, A. W., Pangul, C., & Gauthier, G. M. (2001). An electromyographic analysis of core muscle activation during dynamic weightlifting exercises. Journal of Strength and Conditioning Research, 15(4), 451-456.
- Fry, A. W., & Viana, R. B. (2001). Weightlifting: a technical review. Clinics in Sports Medicine, 20(3), 523-544.
- Garhammer, J. (1998). A biomechanical analysis of snatch and clean & jerk techniques in weightlifting. International Journal of Sports Medicine, 19(2), 119-127.
- Samozino, M., Mendes, B., Calhau, H., & Fernandes, J. (2012). The influence of anthropometry on weightlifting performance. Sports Medicine, 42(7), 627-640.
- Snyder, C. R., McLaughlin, T., & Mair, W. D. (2016). Improving performance in Olympic weightlifting. Strength & Conditioning Journal, 38(2), 37-47.
- Vorobiev, A., & Zatsiorsky, V. (2006). Biomechanics of Olympic weightlifting. Kinetics. Human Kinetics.