International Journal of Movement Education and Sports Sciences (IJMESS)
Annual Refereed & Peer Reviewed Journal Vol. XI No. 1 January-December 2024
Online ISSN 2321-7200 Print ISSN 2348-5604
A UGC Approved & Notified Journal with RJIF Impact Factor .524

Analysis of Centre of Gravity in Various Phases of Snatch Lift

Pramod Kumar Yadav* Prof. Vikram Singh**
*Research scholar, University Sports Board, Banaras Hindu University, Varanasi, UP
**Professor, Department of Physical Education, Banaras Hindu University, Varanasi UP
(Received 11 Feb 2024- Accepted & Published 21 Feb 2024)

Abstract

Objective of the study: - *The purpose of the study was to determine the effect of centre of gravity in various phases of the snatch lift is to understand how different angles impact the performance and biomechanics of the lift. It Determine the most effective centre of gravity that lead to maximum lift efficiency and power output. Identifying the optimal positions that can help lifters to lift heavier weights more effectively. Provide detailed insights into the biomechanics of the snatch lift, which can be used to refine and improve lifting techniques. This can help lifters maintain better form and execute the lift more smoothly.* ***Methodology: -*** *For the present study the sample consisted of 10 male Weightlifting players. The age ranged of the subject 18 to 25 years. Subjects were selected from all over India with minimum achievements of the subjects were national level participant. All the angles' measurements were taken with the help of* Kinovea *in angle during the snatch lift in various phases. For the analysis of data Descriptive and t test was used. The level of significance was set at 0.05 levels.* ***Results:***. ***Conclusion:*** *According to the study there is no significant difference found between different phase of snatch lift in weightlifting Players.* ***Objective:*** *This study investigated the impact of the center of gravity (COG) on snatch lift performance and biomechanics in experienced weightlifters. They aimed to identify the most effective COG position for maximizing lift efficiency and power output. Identifying the optimal COG could help lifters improve their technique and lift heavier weights more effectively and provide detailed insights into the biomechanics of the snatch lift, which can be used to refine and improve lifting techniques.* ***Methodology:*** *The study involved 10 male weightlifters (aged 18-25) who were all national-level competitors selected from all over India. Kinovea software was used to measure COG at various snatch lift phases. Data analysis employed descriptive statistics and t-tests with the level significance set at 0.05.* ***Conclusion:*** *The study found no significant difference in COG across the different snatch lift phases for these experienced lifters.*

Keywords: *Centre of gravity, Snatch lift, Weightlifting*

INTRODUCTION

The snatch lift, a pivotal movement in Olympic weightlifting, demands exceptional coordination, power, and meticulous technique across distinct phases: pull, transition, overhead squat, and catch (Fry & Viana, 2001). Maintaining an optimal center of gravity (COG) throughout these phases is crucial for efficient power transfer and successful lift execution. A well-positioned COG enhances stability, optimizes bar path, and minimizes injury risk (Dong et al., 2023).

Previous research has extensively explored various biomechanical aspects of the snatch lift, focusing on factors such as joint kinematics, muscle activation patterns, and bar path optimization (Garhammer, 1998; Cavanagh & Kramas, 1997). However, a gap exists in our understanding of how the COG shifts and varies across the different snatch lift phases.

Objective of the Study

This study aims to address this gap by investigating the influence of COG in various phases of the snatch lift (stance, first pull, transition, second pull, turnover under the bar, catch and hold) on performance and biomechanics in experienced weightlifters. Understanding these COG variations can provide valuable insights for athletes and coaches seeking to refine technique and maximize lifting efficiency.

METHODOLOGY

Selection of Subjects

Ten male weightlifters aged between 18 and 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. Informed consent was obtained from all participants following a thorough explanation of the study procedures and potential risks involved.

Procedures

Kinematic data regarding the center of gravity (COG) trajectory throughout the snatch lift was collected using Kinovea software. The software tracked specific anatomical landmarks placed on the participants' bodies to capture their movements during the various phases of the lift. Following a designated order, all participants performed the snatch lift on a weightlifting platform, receiving three attempts according to International Weightlifting Federation (IWF) regulations. A balanced sample of 20 snatch attempts (10 successful and 10 unsuccessful) was then selected from the total 30 recorded lifts for further analysis. Prior to data collection, participants were informed about the study procedures and their technical proficiency in the snatch lift was verified, considering their status as national-level weightlifters.

Data Analysis

Kinematic data obtained from Kinovea was exported and analyzed using Microsoft® Excel® 2021 MSO (Version 2404 Build 16.0.17531.20152) 64-bit. Descriptive statistics (means and standard deviations) were used to characterize the COG position across these phases. Additionally, to determine if there were any statistically significant differences in COG between the different phases, t-tests were conducted. The significance level was set at $\alpha = 0.05$.

FINDINGS AND RESULTS

The analysis revealed no statistically significant differences in COG between the different snatch lift phases for these experienced lifters. However, descriptive statistics provide insights into the COG characteristics for each phase. The findings of this empirical investigation have been presented in the respective Table-1 and Figure-1

Table- 1: Descriptive Statistics of Elite Male Weightlifters in Relation to Successful Centre of Gravity in Snatch Lift

Variables	Mean	Std. error	Std. deviation	Range	Kurtosis	Skewness	Min.	Max.
STANCE	0.571	0.008	0.024	0.06	0.195	-1.321	0.53	0.59
FP	0.748	0.007	0.023	0.07	-0.144	0.793	0.72	0.79
TP	0.855	0.008	0.024	0.08	0.088	0.467	0.82	0.9
SP	1.002	0.013	0.04	0.12	-0.024	0.689	0.96	1.08
TUB	0.842	0.024	0.072	0.17	-1.664	-0.75	0.74	0.91
CHP	0.551	0.018	0.056	0.17	-0.125	0.873	0.49	0.66

Table 1 shows the center of gravity (CoG) dynamics during different phases of the snatch lift. Understanding the variations in CoG can provide critical insights into the biomechanical efficiency and stability required for 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 CoG is 0.571 ± 0.024, with a range from 0.53 to 0.59. The distribution shows a slight kurtosis of 0.195, indicating a mildly peaked distribution, and a negative skewness of -1.321, suggesting a tail extending towards lower values.

First Pull (FP): The CoG mean is 0.748 ± 0.023, spanning from 0.72 to 0.79. The negative kurtosis of -0.144 suggests a distribution close to normal, with a positive skewness of 0.793, indicating a tail extending towards higher values.

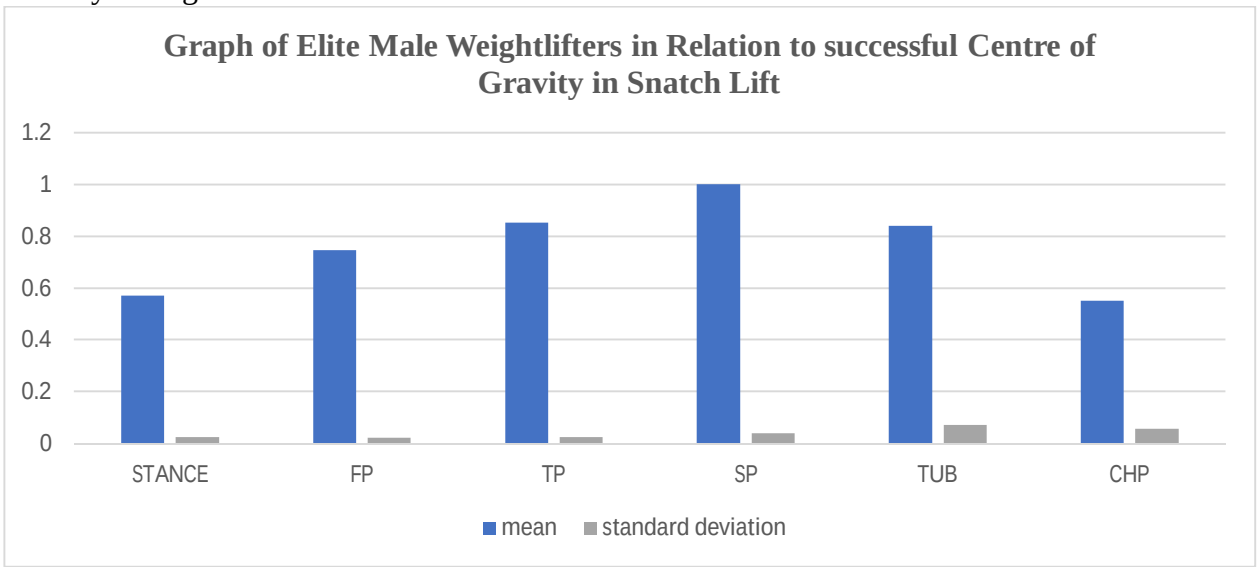
Transition Phase (TP): The mean CoG is 0.855 ± 0.024, with a range from 0.82 to 0.9. The slight positive kurtosis of 0.088 indicates a distribution very close to normal, complemented by a skewness of 0.467, pointing to a modest tail towards higher values.

Second Pull (SP): CoG is measured at 1.002 ± 0.040, extending from 0.96 to 1.08. The kurtosis of -0.024 shows a distribution very close to normal, and a positive skewness of 0.689 suggests a tail extending towards higher values.

Turnover Under the Barbell (TUB): The mean CoG is 0.842 ± 0.072, ranging from 0.74 to 0.91. The negative kurtosis of -1.664 indicates a flatter distribution than normal, with a negative skewness of -0.75, suggesting a tail extending towards lower values.

Catch and Hold Phase (CHP): The mean CoG is 0.551 ± 0.056, spanning from 0.49 to 0.66. The slight negative kurtosis of -0.125 suggests a distribution close to normal, with a positive skewness of 0.873, indicating a tail extending towards higher values.

These center of gravity metrics across the phases of the snatch lift illustrate the biomechanical adjustments required for successful execution. Each phase shows distinct characteristics in CoG positioning, reflecting the dynamic nature of this complex movement. These insights are crucial for coaches and athletes aiming to optimize lifting techniques to enhance performance and stability during the lift.



Discussion of the Study

This study examined the center of gravity (COG) trajectory across various phases of the snatch lift in experienced weightlifters. Contrary to our initial hypothesis, the results revealed no statistically significant differences in COG between the different snatch lift phases (stance, first pull, transition, second pull, turnover under the bar, catch and hold). These findings may suggest that for highly skilled lifters, maintaining a consistent COG throughout the lift is an essential aspect of efficient technique, regardless of the specific phase (Fry & Viana, 2001).

A possible explanation lies in the emphasis placed on core stability and postural control in weightlifting training programs (Fry & Viana, 2001). Experienced lifters may have developed a strong core musculature, allowing them to maintain a relatively constant COG despite the dynamic shifts in body position throughout the snatch lift. This stability might contribute to efficient power transfer and optimal bar path execution, which are crucial for successful lifts (Garhammer, 1998; Cavanagh & Kramas, 1997).

It is important to acknowledge that the present study focused on experienced, national-level weightlifters. Their well-developed technique and movement patterns might not be generalized to novice lifters who are still acquiring proper snatch lift mechanics. Future research could explore COG variations in less experienced lifters to determine if COG adjustments play a role in technique development during the learning stages. Additionally, studies investigating the effectiveness of specific training interventions aimed at improving core stability and COG control could provide valuable insights for weightlifting coaches and athletes (Escamilla et al., 2001).

While our findings did not identify significant COG differences between phases, the descriptive statistics provide some insights into COG characteristics for each phase. Interestingly, the COG exhibited a progressive increase from stance to second pull, followed by a decrease during turnover under the bar and the catch (excluding the slight initial rise in first pull). This pattern aligns with the biomechanics of the snatch lift, where the lifter transitions from a lower posture at the beginning to a higher position at the second pull, before receiving the bar overhead in a lower squat position (Cavanagh & Kramas, 1997).

Although statistically insignificant, the observed skewness in some phases suggests potential areas for further investigation. For example, the negative skewness in stance and turnover under the bar might indicate a tendency for some lifters to adopt a slightly lower COG position during these phases. Future studies with larger sample sizes could explore these potential variations and their relationship to individual anthropometry or lifting strategies.

CONCLUSION

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

1. There were no significant differences in COG between various phases of the snatch lift in experienced weightlifters. This suggests that maintaining a consistent COG might be a hallmark of efficient technique for highly skilled lifters. Future research with larger and more diverse participant pools could provide more generalizable insights and explore COG variations in relation to lifter experience and technique development.
2. The descriptive data provides a foundation for further investigation into the nuanced characteristics of COG throughout the snatch lift. This knowledge can be utilized to develop more effective training programs, refine lifting technique, and ultimately enhance performance and safety for weightlifters.

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.
- Dong, K., Yu, T., & Chun, B. (2023). Effects of core training on sport-specific performance of athletes: A meta-analysis of randomized controlled trials. Behavioral Sciences, 13(2), 148.