

USING THE KINEMATIC ANALYSIS FOR DETERMINE THE OPTIMAL DISTANCE BETWEEN THE TWO FISTS IN THE SNATCH WOMAN WEIGHTLIFTERS

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Abstract

This study aims to identify the values of some variables Kinematic with Jordanian weightlifter national team by using different methods to distance between the two fists in the snatch, then compared it with the results achieved from international weightlifters, and explore the best distance between the two fists which achieve the best values for the variables kinematic in the snatch. Researcher used descriptive approach. The sample of study consisted of the best weightlifter in Jordanian National team in 75+ kg. The study included (3) methods for the distance between the two fists, and (17) dependent variables. Statistical analysis was completed with using frequencies and percentages. The study results showed that the values of some variables Kinematic of the study sample was within the results achieved from international weightlifters. The angle method is the best for study simple, because had the best percentage of the variables values kinematic. The researcher recommend coaches to train weightlifters more than methods, and use the kinematic analysis in the process of determining the distance between the fists.

Key Words: kinematic, women, weightlifting, Barbell, snatch.

1. INTRODUCTION:

Weightlifting, an event restricted only to men in the past, has gained popularity among women since the first Women's World Weightlifting Championships in 1987, yet the performance development in this event has not been studied as much in women weightlifters as in men (Gourgoulis et al., 2002; Hoover et al., 2006). And also the popularity of women's weightlifting has grown in recent decades, and women competitors achieved Olympic status at the 2000 Games in Sydney, Australia, as with the men.

The importance of this study through a topic that addressed, it is a scientific serious attempt to use scientific methods and objectivity in the selection of the distance between the fists in the snatch at female weightlifters in proportion to their potential, and to provide the theoretical foundation for coaches and thus employed in the training process for the development of the achievements of digital female weightlifters in the snatch because the coach can't, whatever the technical expertise to prepare champions in weightlifting is not available, has a precise scientific information about the numeric values of mechanical variables affecting the performance.

Therefore, this study aimed to bridge the sex-based gap in the weightlifting research literature by analyzing the biomechanical performance of women weightlifters competing on the national level. and thus providing valuable information for athletes and their coaches to integrate into training and competition, and it is considered an attempt by researcher to explore the changes in the kinematic variables values caused by the different method for distances between the fists in the snatch, which requires a scientific and accurate study to answer the question: What is the best distance between the fists that values? To help coaches and lifters better understand the snatch lift.

The researcher believes that many of coaches depend in determining the distance between the fists on: the player feeling the provisions on the barbell without regard to the mechanical aspects that control better performance, and the Coaches often depends on the distance between the fists of the players on personal experience, which may be insufficient and not objective because female players Different in anthropometric measurements. therefore, this study aimed to identify: the values of some kinematic variables in a study sample using different methods than the distance between the fists in the snatch and compared with the results achieved from international weightlifters, thus identify the best distance between the fists and that achieve the best values of the variables kinematic that affecting on achievement for the study sample.

According to Gourgoulis et al., (2002). The maximum angle of the knee during the first pull phase was $129 \pm 11^\circ$, and the maximum angle of the knee during the second pull phase was $164 \pm 6.47^\circ$, while the knee angle at Maximal height of the barbell was $41.75 \pm 9.9^\circ$, and the drop displacement was 18.6 ± 3.7 cm. As well Hoover, et al., (2006) study, that horizontal displacement toward weightlifter in the first pull phase was 1-8 cm, and the Horizontal displacement toward weightlifter in the second pull phase was 1-14 cm, and horizontal displacement toward weightlifter after beginning of descent from maximum height was 3-17cm. According to Harbili, E. (2012). The barbell height at the end of the first pull was 49cm, and the barbell height at the end of the second pull was 89cm, while Maximum barbell height was 117cm, and the Maximum vertical velocity of the barbell in the first pull was 1.13m/s, and maximum vertical velocity of the barbell in the second pull was 1.08m/s, while the duration of the first pull phases was .51s and the duration of the second pull phases was .15s

2. METHOD:

Experimental Approach to the Problem

This study was descriptive in nature. The data for this study were collected only from female Jordanian national team in the snatch lift for 75+ kg, also (Table 1) shows the characteristics of sample study. And to determine the development of female snatch performance, the data were collected, then analyzed and compared with female weightlifters reported in the World Weightlifting Championships.

Table 1. Sample characteristics

Age (y)	Bodyheight (m)	Body mass (kg)	Weightcategory(kg)	Barbellmass (kg)
20	1.72	83	kg 75+	80

Methods for determining the distance between the fists in the snatch

Researcher choose three methods to determine the distance between the two fists: **1- Arm and shoulder method:** a weightlifter raises his arms aside at level of the shoulder and measured the distance between the fist extended arm and joint of shoulder adverse grip Figure (1)

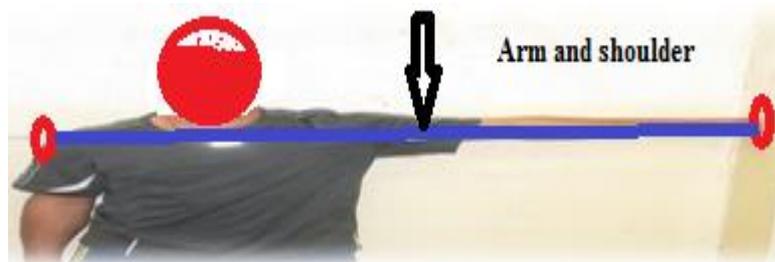


Figure 1. Arm and shoulder method

2- Distance between the elbows Method: Weightlifter raise his arms aside and proving of the elbows so that the level of the shoulders then measure the distance between the elbows. Figure (2)



Figure 2. Method of the distance between the elbows

3-Method of angle : angle measured between the barbell and forearm weightlifter, so ranging angle value between 49-63°, and value at angle reached 55° in study sample, and the most logical opinion in determining the angle according to the classification of body mass range between 56- 61° where this angle, These range from angle where even mass 90 kg. (Faver, M.2007).figure (3)



Figure 3.Angle method

Procedures

Snatch lifts were recorded using one digital camera Fuji (F500) , which captured images at 50 fields per second, a digital camera was positioned on the vertical on Lateral level of the platform at a distance of (6) m from the weightlifter. The researcher was filmed successful attempt of each method by lifting 80 kg in each attempt, luminous markers put on joints of the body opposite the camera (shoulder, elbow, wrist, pelvis, knee and ankle) as well as the barbell side of the camera.

The study variables

The researcher found some of the related studies such as, (Gourgoulis, et al., 2002) ;(Harbili, E.2012) ;(Akkus, 2012), studies. This study included the three independent variables: Arm and shoulder method, distance between the elbows method and angle method, and 17 dependent variable .table (2)

Table 2.The study variables

variable	shortcut
Horizontal displacement away from weightlifter in the first pull (cm)	D1
Horizontal displacement away from weightlifter in the second pull (cm)	D2
Horizontal displacement from weightlifter in the maximum height (cm)	D3
Barbell height at the end of the first pull(cm)	D4
Barbell height at the end of the second pull(cm)	D5
Maximum barbell height(cm)	D6
Drop displacement (cm)	D7
The duration of the first pull(s)	T1
The duration of the second pull(s)	T2
Knee angle in phase grab a moment of barbell (degree/°)	A1
Hip angle in phase grab a moment of barbell (degree/°)	A2
Knee angle in the end of first pull (degrees/°)	A3
Knee angle in the end of second pull (degrees/°)	A4
Hip angle in the end of first pull (degrees/°)	A5
Hip angle in the end of second pull (degrees/°)	A6
Maximum vertical velocity of the barbell in the first pull(m/s)	V1
Maximum vertical velocity of the barbell in the second pull(m/s)	V2

Statistical Analyses

Statistical analysis was completed with using frequencies and percentages

3. RESULTS AND DISCUSSION:

After collection the special data of studysample and after analyzing the images have been successful attempt getting results shown by the Figures (4-9).

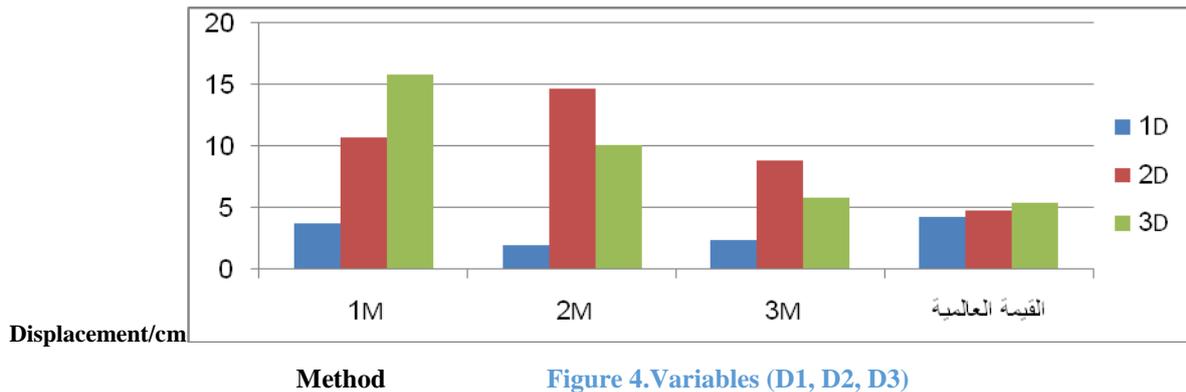


Figure (4) clearly shows that horizontal displacement away from weightlifter in the first pull (D1) was 3.72 cm in the method (M1) and 2 cm in the method (M2) and 2.35 cm in the method (M3), It is within the results achieved in the (Harbili, E. 2012) study, which ranged between 1.25 - 4.26 cm. While the horizontal displacement away from weightlifter in the second pull (D2) 10.70 cm in the method (M1) and 4.70 cm in the method (M2) and 8.82 cm in the method (M3), which they are a greater than the results achieved in the (Harbili, E. 2012) study, which ranged between 1.55-4.74 cm and researcher believes that will increase the resistance on the arms and thus will become the next phase difficult and tedious. while horizontal displacement from weightlifter in the maximum height(D3) was 15.88 cm in method (M1) and 10 cm in the method (M2) and 5.88 cm in the method (M3), they are the largest of the results achieved in the (Harbili, E. 2012) study, which ranged between 4.20-5.41 cm.

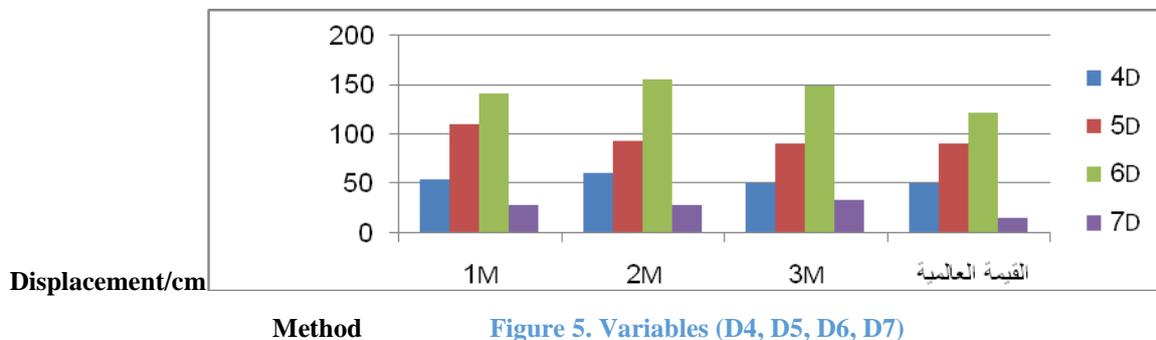


Figure (5) clearly shows that barbell height at the end of the first pull (D4) was 54 cm in the method (M1), and 61.18 cm in the method (M2), and 51.19 cm in the method (M3), which they are near of the achieved results in the (Harbili, E. 2012);(Akkus, H. 2012) which ranged between 49- 52 cm, except the method (M2) was high. while the barbell height at the end of the second pull (D5) was 110 cm in the method (M1) and 93.53 cm in the method (M2) and 91.43 cm in the method (M3), which they are near of the achieved results in the (Harbili, E. 2012);(Akkus, H. 2012), studies which ranged between 89- 117 cm, except the method (M1) it was high. While the maximum barbell height was 142 cm in the method (M1) and 156 cm in the method (M2) and 150 cm in the method (M3), which they are more than the achieved results in the (Harbili, E. 2012);(Akkus, H. 2012), studies which ranged between 117-133 cm, due to attributed it lag of weightlifter in the rotation and go down under the weight. While the drop displacement (D7) was 28.27 cm in the method (M1), and 28.90 cm in the method (M2), and 34.16 cm in the method (M3) which they are more than the achieved results in the (Harbili, E. 2012);(Akkus, H. 2012), studies which ranged between 13-21 cm.

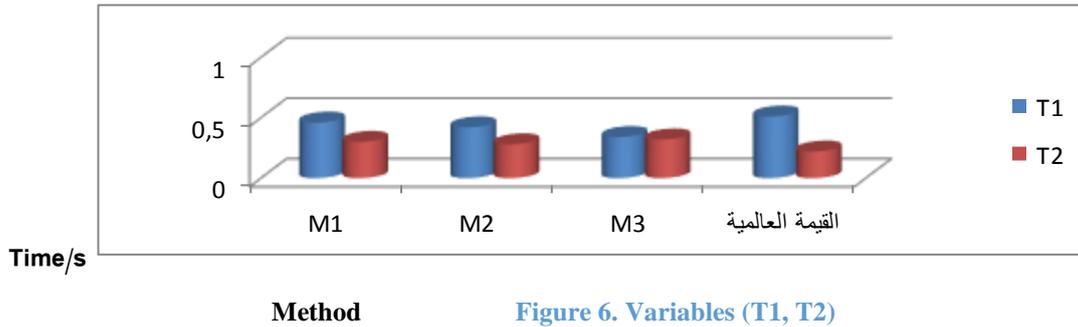


Figure 6. Variables (T1, T2)

Figure (6) clearly shows that the duration of the first pull (T1) was .46 s in the method (M1) and .42s in the method (M2), and .34s in the method (M3) which they are lower than the achieved result in the (Harbili, E. 2012) study, which amounted to .51 s. While the duration of the second pull (T2) was .30s in the method (M1) and .28s in the method (M2) and .33s in the method (M3), which they are near of the achieved results in the (Haijun, G. & Xinna, H. 2012) study which ranged between .18 –.28s

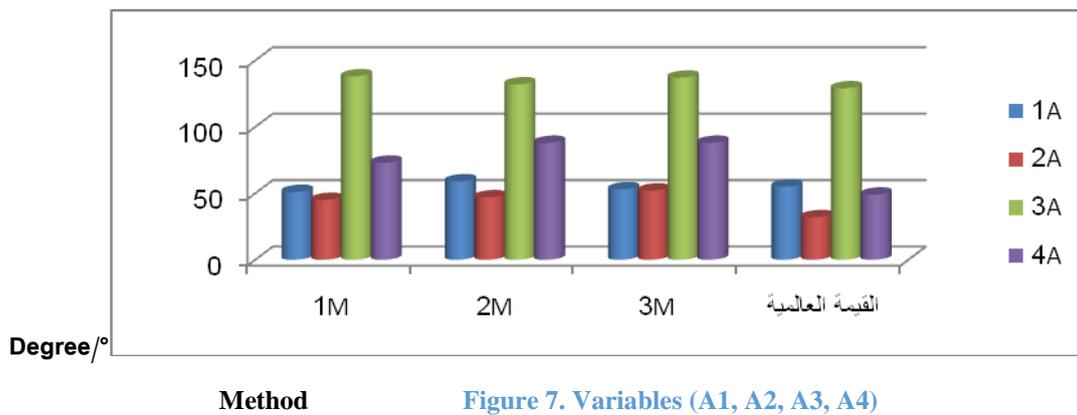


Figure 7. Variables (A1, A2, A3, A4)

Figure (7) clearly shows that the knee angle in phase grab a moment of barbell (A1) was 51° in the method (M1) and 59° in the method (M2) and 53° in the method (M3), which it is within the results achieved in the (Gourgoulis, et al., 2002) study, which ranged between 42-67°. While the hip angle in phase grab a moment of barbell (A2) was 45° in the method (M1) and 47° in the method (M2) and 52° in the method (M3), which they are more than the achieved results in the (Haijun, G. & Xinna, H. 2012) study which ranged between, 25-35°. While the knee angle in the end of first pull (A3), was 138° in the method (M1), and 132° in the method (M2) and 137° in the method (M3), which they are within the results achieved in the Gourgoulis, et al, (2002) study, which ranged between 118-140°. while the knee angle in the end of second pull (A4) was 73° in the method (M1) and 88° in the method (M2) and 87° in the method (M3), which it is more than the achieved results in the (Haijun, G. & Xinna, H. 2012) study, which ranged between 28-69°

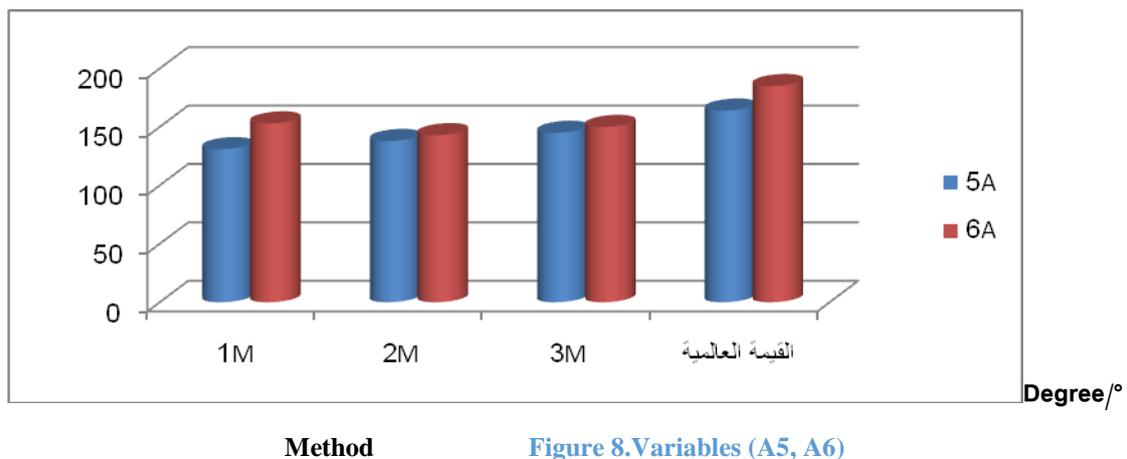
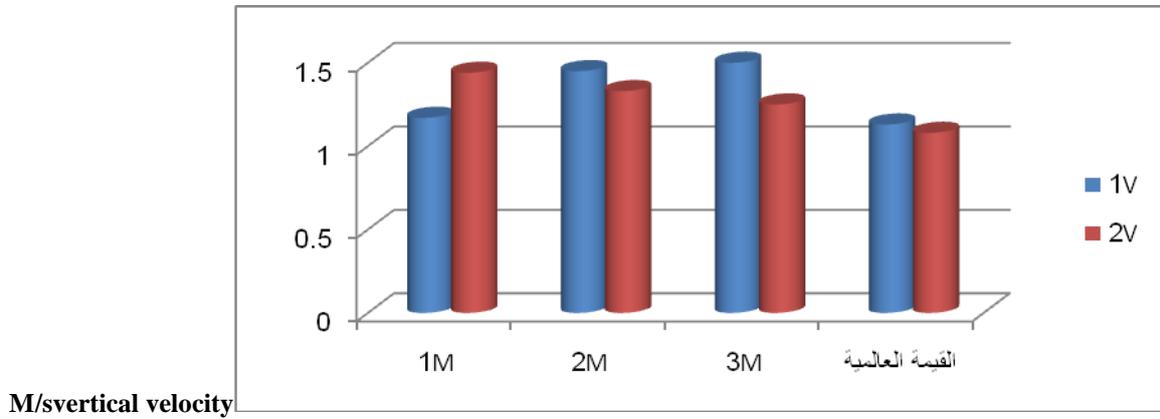


Figure 8. Variables (A5, A6)

Figure (8) clearly shows the hip angle in the end of first pull (A5) was 131° in the method (M1) and 138° in the method (M2) and 145° in the method (M3), which they are lower than the results achieved in the (Akkus, H. 2012) study, which ranged between 158-170°. While the hip angle in the end of second pull (A6), was 153° in the method (M1) and 143° in the method (M2) and 150° in the method (M3), which they are lower than the results achieved in the (Akkus, H. 2012) study, which ranged between 158-170°

method(M3).whichthey are lower than the results achieved in (Akkus, H. 2012) study,which ranged between 180-190°.and may be caused that weakness in the muscles of the thighs and torso andlack in theflexibility body joints , considers flexibility of weightlifter an important in role in the effectiveness of performance art in weightlifting as well as the rest of the fitness of other elements.



Method **Figure 9. Variables (V1, V2)**

Figure (9)clearly shows the maximum vertical velocity of the barbell in the first pull (V1) was .17 m / s in the method (M1) and 1.45 m / s in the method (M2) and 1.50 m / s in the method (M3) which they are more than the achieved results in the (Harbili, E. 2012) study, which amounted to 1.13 m /s. While themaximum vertical velocity of the barbell in the second pull (V2) was 1.44 m / s in the method (M1), and 1.33 m / s in the method(M2) and 1.25 m / s in the method(M3), which they are more than the achieved results in the (Harbili, E. 2012) study, which amounted to 1.08 m / s. To identify the order of study variables in the methods used, Table (3) shows that.

Table 3.The order of study variables

Variables	D1	D2	D3	D4	D5	D6	D7	T1	T2	A1	A2	A3	A4	A5	6A	V1	V2	% Percentage
methods	order																	
M1	1	2	2	2	3	1	2	1	2	2	1	3	1	3	1	1	3	33
M2	3	3	3	3	2	3	1	2	3	3	2	1	3	2	3	2	2	29
M3	2	1	1	1	1	2	3	3	1	1	3	2	2	1	2	3	1	38

Table (3) clearly shows a percentages obtained by each method, depending on the number of variables which were its values similar to those achieved values in World Championships. And figure (10) shows the percentages of each methods.

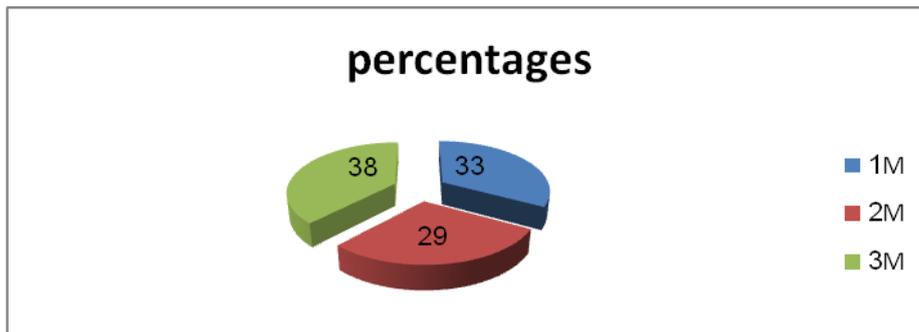


Figure (10) percentages of method

Figure (10) clearly showsthe third method (M3) that depend on the angle, was the best due to achieved a percentage of 38% compared to the other method, while achieved the first method (M1) second place by 33%, and achieved second method (M2) third place by 29%.

4. CONCLUSIONS:

In the present study, that some of the variables kinematic values of the study sample were near of the results achieved international weightlifters, as well the third method is the best methods for the study sample, and the kinematic values of variables t different from one method to the other. The researcher recommends coaches to train weightlifters more than methods, and use the kinematic analysis in the process of determining the distance between the fists, and focus on the good physical preparation for the weightlifters, especially muscle strength and flexibility.

5. REFERENCES:

- Akkus, H. (2012). Kinematic Analysis of the Snatch Lift with Elite Female Weightlifters during the 2010 World Weightlifting Championship. *Journal of Strength and Conditioning Research*, 26(4), 87-905.
- Faver, M. (2007). The first pull in weight lifting movements Colorado, springs.
- Gourgoulis, V. Aggeloussis, N. Antoniou, P. Chritoforidis, C. Mavromatis G. & Garas, A. (2002). Comparative 3-Dimensional kinematic analysis of the snatch technique in elite male and female Greek weightlifters. *Journal of Strength and Conditioning Research*, 16, 359-366.
- Haijun, G. & Xinna, H. (2012). Part movement characteristics analysis of adolescent weightlifter's body, Hebei institute of Physical Education, China, 123-126.
- Harbili, E. (2012). A gender-based kinematic and kinetic analysis of the snatch lift in elite weightlifters in 69-kg category. *Journal of Sports Science and Medicine*, 11, 162-169.
- Hoover, D. Carlson, K. Christensen, B. & Zebas, C. (2006). Biomechanical Analysis of Women Weightlifters during the Snatch. *Journal of Strength and Conditioning Research*, 20(3), 627-633.
- Malone, L. (1999). Relationship between performance characteristics and player classification in Wheelchair Basketball Shooting of Elite Male Players, Unpublished Doctor of Philosophy Thesis University of Alberta Edmonton, Alberta.