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THE EFFECT OF DEVELOPMENT OF MUSCULAR BALANCE ON SOME DYNAMIC PARAMETERS AND LEVEL OF ACHIEVEMENT FOR CLEAN AND JERK SKILL FOR WEIGHTLIFTERS

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Abstract

Purpose. This study aims to determine the impact of the development of muscular balance on the dynamics of performance and level of achievement for Clean and jerk skill for weightlifters. And applied study on a sample of (10) weightlifters with the upper levels, and the average age (18.80 ± 6.37 years), height (160.80 ± 9.31 cm) and weight (75.72 ± 12.67 kg) and age training (7.20 ± 4.54 years) of the experimental group, while the average age (19.60 ± 3.50 years), height (168.80 ± 8.16 cm) and weight (81.08 ± 14.12 kg) for the control group. The researchers used the experimental approach, they designed two groups, one experimental of (5) players and the other controlled of (5) players.

Methods. The experimental group underwent to the proposed training program, which contains similar exercises for

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motor performance skill Clean and jerk and development exercises muscular balance involved in skill. The control group underwent traditional training program. The training program of muscular balance Continued for three months (3 per week) and the training session lasted 2 hours. The pre and post photograph for the two control and experimental used a video camera Brand Panasonic, frequency 25 frames in the second. The analysis of motor used Maxtraq on line Manual Version 5.5, physical and performance tests.

Results. There were statistically significant differences between the experimental and control groups in muscular balance and dynamic performance parameters Clean and jerk skill. The effectiveness of the training program to increase muscular balance, improved dynamic performance and the level of achievement of the weightlifters.

Conclusions. These results must be taken into account by the coaches and weightlifters for the development of muscular balance for improved dynamic performance and the level of achievement for Clean and jerk skill.

Key Words: Weightlifters, Training, Muscular balance, Clean and jerk, Dynamic parameters.

Introduction

In Olympic Weightlifting, there are two Olympic lifts, the clean and jerk and the snatch. Mastery of these lifts develops the squat, deadlift, power clean and split jerk while integrating them into a single movement of unequalled value in all of strength, Muscular balance and conditioning. The Olympic lifters are without a doubt the world's strongest athletes. These lifts train athletes to effectively activate more muscle fibers more rapidly than through any other modality of training. The explosiveness that results from this training is of vital necessity to every weightlifter (Glassman, 2010).

Muscle balance is a vital component to injury prevention. Whether you choose to lift weights or calisthenics to maintain muscle strength and endurance, you need to focus on muscle balance. The major muscle group's work in pairs and those muscle pairs need to be balanced in terms of strength and flexibility. For example, we bend our elbow by using the biceps muscle. Its pair is the triceps muscle. The triceps muscle must be willing to stretch for the bicep muscle to contract and bend the elbow fully (Zatsiorsky, Prilutsky, 2012).

Biomechanics is the science involved in understanding the effects of applied internal and external forces on a person's body. When it comes to sports and fitness training, application of body mechanics means the use of proper form when weightlifting (McGinnis 2013, Greene, Roberts, 2005).

The amount of work (W) is obtained by multiplying the force (F) by the distance (H) over which it acts to raise a weight of mass (m) kilograms, you must apply a force of (m*g) Newton to overcome the gravitational acceleration (g) (McGinnis 2005, Greene, Roberts, 2005, Baechle, Earle, 2008, Arus, 2013).

There is also a need to investigate less skillful performers. In particular, the regulation of balance may be a limiting factor in both safety of lifting and improvement of skill. For example forward-backward stability must be maintained by keeping the line of gravity of the body bar system over the anteroposterior base of support side-to-side, stability must be maintained through sufficient left right symmetry to

keep the line of gravity located over the mediolateral base of support and forward-backward mobility must be adjusted to allow the greatest application of muscle torque. Given the potentially conflicting needs for stability and mobility in the anteroposterior plane and the need for left-right symmetry in the mediolateral plane, it is likely that performers of disparate skill levels resolve these challenges in different manners (Frank, Jackie, 2003).

The lifts develop core strength like nothing else. They work a vast array of muscles to achieve a muscular balance between the front and back muscles of the body. This contrasts with many sports and daily activities that under develop the back, abdominal and scapular muscles and overdevelop shoulder and pectoral muscles. Most don't realize it, but Olympic weightlifting has one of the lowest injury rates of all sports. One key component that often gets overlooked is muscle balance. Probably the most commonly seen muscle imbalance that results from weightlifting is inadequate rhomboid and middle trapezius muscle mid-back exercises in relation to pectoral or chest exercises. The result is short and strong pectoral chest muscles, and over-lengthened and weak mid-back muscles resulting in forward rounded shoulders. These forward rounded shoulders can be the source of numerous pain syndromes in the shoulders (Heitkamp et. al., 2001), or weakness in the muscles of the group the right or left side of the weightlifters, which affects the level of performance.

To improve the level of performance that must be addressed by taking into account the balance of muscle is the primary focus of any weightlifting program. Once the imbalance is created, it becomes increasingly difficult to reverse the longer and neglected muscles.

The elevation of Clean and jerk skill requires high muscular balance of weightlifters to accomplish and shows through dynamic analysis of the skill during performance, it also requires a lot of training to reach the technical performance optimization to develop the skill to accomplish the maximum weight of the weightlifters can be lifted. The researchers have observed through his experience in the field of weightlifting and biomechanics that there is a tendency

in the bar raised on one side during the performance of the weightlifters to raise Clean and jerk which affects the level of achievement of the elevation. Prompting researchers to conduct this study aims to determine the impact of the development of muscular balance on the dynamics of performance and level of achievement for Clean and jerk skill for weightlifters.

Methods

The study was conducted applied on a sample of (10) weightlifters with the upper levels, and the average age (18.80 ± 6.37 years), height (160.80 ± 9.31 cm) and weight (75.72 ± 12.67 kg) and age training (7.20 ± 4.54 years) of the experimental group, while the average age (19.60 ± 3.50 years), height (168.80 ± 8.16 cm) and weight (81.08 ± 14.12 kg) for the control group. The researchers used the experimental approach, they designed two groups, one experimental of (5) players and the other controlled of (5) players. The experimental group underwent the proposed training program, which contains similar exercises for motor performance Clean and jerk skill and development exercises muscular balance involved in skill. The control group underwent to traditional training program. The training program of muscular balance Continued for three months (3 per week) and the training session lasted 2 hours (Lukjanow,

Falamejow, 1972, Carl, 1976, Lear, 1991, Ebada, 2003).

The training program of Experimental group aims to develop of the muscular balance related to Clean and jerk skill for weightlifters, where it continued for (12) weeks of (3) units per week, where the weightlifters executed the program in preparation period by applying circle training (Appendix 1).

The researchers to measure muscular balance, dynamic parameters and performance level of Clean and jerk skill sample individuals who search through reference survey done by the researchers for reference the research in weightlifting sport to determine methods of measuring the maximum level of achievement Clean and jerk skill, who were possible to the following tests that have been used in many research's and studies and tests (Right grip, Left grip, Clean pull, Jerk push, Good Morning, Snatch balance) (N. Hori et. al., 2006, Hamlyn et. at., 2007, Robert et. al., 2008, Ebada, 2011). Dynamic parameters were measured for control and experimental group by using pre and post photography by a video camera Brand Panasonic of frequency 25 Field / sec .which has been filmed from the front to see how bar inclined from a straight line as the Figure 1

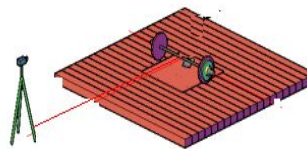


Figure 1. Position of the camera during filming



Figure 2. Sequence pictures to perform a clean -and jerk skill

The researchers analyzed motor skill of study for members of the experimental and control groups in both pre and post measurements, where (20) attempts were analyzed by using a program (MAX TRAQ) Online Manual Version 2.2 for dynamic analysis According to the following dynamic model Figure 3:

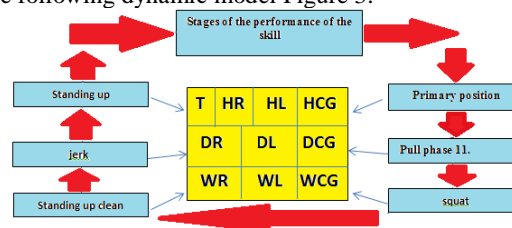


Figure 3. Dynamic model of the dynamic parameters to stages of skill Performance of study.

Time(T) have been identified to each stage of the performance and the height of the bar was measure from the ground to the right sides (HR) and left (HL) and height of body mass center of gravity (HCG) on the ground to each stage of the performance as the Figure 4:



Figure 4. The height of the bar above the ground from the right sides (HR) and left (HL) and height of body mass center of gravity (HCG).

Vertical distance was also measured to both sides of the bar right (DR) and left (DL) and the vertical distance of the body mass center of gravity (DCG) in each stage for the stage that followed as the form 5:

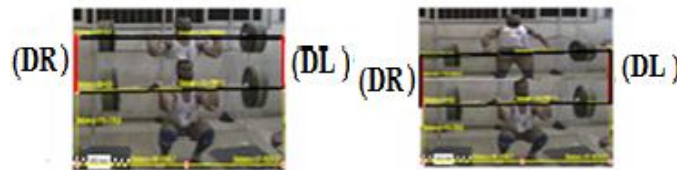


Figure 5. Vertical distance to both sides of the bar right (DR) and left (DL).

Mechanical work was calculated for the left (WL) and right (WR) side of the bar and the body's center of gravity by the following equations

$$WR = (DR * F) \text{ where } (F) = \text{raised weight} / 2 * (9.8)$$

$$WL = (DL * F) \text{ where } (F) = \text{raised weight} / 2 * (9.8).$$

$$WCG = (DCG * F) \text{ where } (F) = (\text{raised weight} + \text{body weight}) * (9.8).$$

The statistical analysis of the control and experimental data SPSS was used to apply formulas statistical by calculating: average, standard deviation, Mann-Whitney and Wilcoxon test.

Results

Table 1. Statistics-test for the muscular balance and dynamic parameters of Mann - Whitney between Experimental and Control group to pretest.

| Variables | | Experimental group | | Control group | | z | p. | |
|-------------------|----------------|--------------------|---------|---------------|---------|---------|--------|-------|
| | | Average | SD. | Average | SD. | | | |
| Muscular balance | Right grip | Kg. | 34.000 | 1.732 | 32.600 | 2.191 | -1.514 | 0.130 |
| | Left grip | Kg. | 32.400 | 1.140 | 31.600 | 2.074 | -1.064 | 0.287 |
| | Clean pull | Kg. | 178.000 | 54.955 | 113.000 | 28.636 | -1.681 | 0.093 |
| | Jerk push | Kg. | 70.000 | 15.588 | 56.200 | 8.585 | -1.152 | 0.249 |
| | Good Morning | Kg. | 99.600 | 27.970 | 73.200 | 14.822 | -1.567 | 0.117 |
| | Snatch balance | Kg. | 138.000 | 28.522 | 107.000 | 11.979 | -1.786 | 0.074 |
| Pull phase 11. | T | Sec. | 0.732 | 0.098 | 0.784 | 0.083 | -0.946 | 0.344 |
| | HR | cm. | 72.518 | 1.307 | 75.518 | 2.745 | -1.676 | 0.094 |
| | HL | cm. | 75.792 | 2.685 | 76.068 | 3.311 | -0.522 | 0.602 |
| | HCG | cm. | 75.558 | 2.867 | 76.080 | 3.416 | -0.419 | 0.675 |
| | WR | n.m. | 316.711 | 67.624 | 251.501 | 34.027 | -1.358 | 0.175 |
| | WL | n.m. | 337.394 | 73.231 | 254.930 | 41.045 | -1.567 | 0.117 |
| | WCG | n.m. | 757.158 | 115.291 | 649.682 | 96.038 | -1.567 | 0.117 |
| Squat | T | Sec. | 0.696 | 0.083 | 0.712 | 0.052 | -1.006 | 0.314 |
| | HR | cm. | 60.542 | 4.443 | 56.524 | 4.351 | -1.358 | 0.175 |
| | HL | cm. | 64.660 | 2.917 | 64.042 | 3.314 | -0.104 | 0.917 |
| | HCG | cm. | 24.790 | 3.880 | 24.190 | 4.265 | -0.105 | 0.916 |
| | WR | n.m. | 74.251 | 22.167 | 89.027 | 12.856 | -1.358 | 0.175 |
| | WL | n.m. | 68.544 | 19.809 | 57.898 | 21.881 | -0.940 | 0.347 |
| | WCG | n.m. | 975.450 | 128.192 | 843.960 | 82.857 | -1.567 | 0.117 |
| Standing up clean | T | Sec. | 1.296 | 0.151 | 1.316 | 0.127 | -0.541 | 0.589 |
| | HR | cm. | 132.736 | 0.853 | 134.134 | 1.826 | -1.358 | 0.175 |
| | HL | cm. | 133.752 | 1.010 | 133.792 | 0.921 | -0.104 | 0.917 |
| | HCG | cm. | 74.408 | 2.945 | 73.418 | 2.974 | -0.838 | 0.402 |
| | WR | n.m. | 454.397 | 85.149 | 368.377 | 52.805 | -1.776 | 0.076 |
| | WL | n.m. | 434.845 | 78.409 | 332.016 | 55.996 | -1.776 | 0.076 |
| | WCG | n.m. | 961.118 | 174.338 | 809.285 | 137.565 | -1.358 | 0.175 |
| Jerk | T | Sec. | 1.088 | 0.125 | 1.120 | 0.110 | -0.632 | 0.527 |
| | HR | cm. | 164.174 | 3.976 | 160.644 | 5.370 | -1.358 | 0.175 |
| | HL | cm. | 165.122 | 6.702 | 161.322 | 5.022 | -1.358 | 0.175 |
| | HCG | cm. | 67.304 | 3.130 | 65.304 | 1.581 | -0.946 | 0.344 |
| | WR | n.m. | 201.884 | 59.207 | 127.595 | 34.584 | -1.776 | 0.076 |
| | WL | n.m. | 200.511 | 67.539 | 131.220 | 34.399 | -1.776 | 0.076 |
| | WCG | n.m. | 146.395 | 124.222 | 140.002 | 84.258 | -0.522 | 0.602 |
| Standing up | T | Sec. | 1.168 | 0.222 | 1.120 | 0.251 | -0.961 | 0.337 |
| | HR | cm. | 183.210 | 3.640 | 179.410 | 5.731 | -1.149 | 0.251 |



| | | | | | | | | |
|--------------------|--------------|------|---------|---------|---------|---------|--------|-------|
| | HL | cm. | 185.872 | 3.831 | 181.710 | 5.187 | -1.149 | 0.251 |
| | HCG | cm. | 81.002 | 3.991 | 79.802 | 4.752 | -0.731 | 0.465 |
| | WR | n.m. | 119.995 | 23.117 | 89.053 | 12.203 | -1.776 | 0.076 |
| | WL | n.m. | 131.383 | 42.970 | 105.150 | 30.786 | -0.522 | 0.602 |
| | WCG | n.m. | 277.596 | 155.045 | 244.679 | 103.105 | -0.104 | 0.917 |
| Performance | Clean & Jerk | Kg. | 129.000 | 26.192 | 97.000 | 14.036 | -1.567 | 0.117 |

The Z= value $\pm 1,96$ at the level of 0.05 (double sided)

Table 1. Significant statistical differences of Mann-Whitney test in the pretest of muscular balance, dynamic parameters and the level of achievement for clean and jerk skill between the experimental and control groups. Where the value of P < 0.05 in all variables indicating the absence of significant differences between the two groups points to the equal sample before executing experiment.

Table 2. Statistics-test for the Muscular balance and dynamic parameters of Wilcoxon between pre-and post-test to the experimental group.

| Variables | | | Pre-test | | Post-test | | z. | p. |
|--------------------------|-----------------------|------|----------|---------|-----------|---------|--------|--------|
| | | | Average | SD. | Average | SD. | | |
| Muscular balance | Right grip | Kg. | 34.000 | 1.732 | 40.600 | 2.408 | -2.032 | 0.042* |
| | Left grip | Kg. | 32.400 | 1.140 | 39.600 | 1.817 | -2.060 | 0.039* |
| | Clean pull | Kg. | 178.000 | 54.955 | 189.000 | 56.613 | -2.121 | 0.034* |
| | Jerk push | Kg. | 70.000 | 15.588 | 79.000 | 15.166 | -2.060 | 0.039* |
| | Good Morning | Kg. | 99.600 | 27.970 | 106.000 | 27.019 | -2.032 | 0.042* |
| | Snatch balance | Kg. | 138.000 | 28.522 | 147.000 | 28.636 | -2.041 | 0.041* |
| | Pull phase 11. | T | Sec. | 0.732 | 0.098 | 0.656 | 0.062 | -1.633 |
| HR | | cm. | 72.518 | 1.307 | 85.374 | 2.287 | -1.214 | 0.043* |
| HL | | cm. | 75.792 | 2.685 | 87.606 | 2.292 | -1.753 | 0.043* |
| HCG | | cm. | 75.558 | 2.867 | 87.412 | 1.527 | -1.753 | 0.043* |
| WR | | n.m. | 316.711 | 67.624 | 410.264 | 95.167 | -2.023 | 0.043* |
| WL | | n.m. | 337.394 | 73.231 | 433.561 | 102.709 | -2.023 | 0.043* |
| WCG | | n.m. | 757.158 | 115.291 | 940.043 | 178.845 | -2.023 | 0.043* |
| Squat | T | Sec. | 0.696 | 0.083 | 0.760 | 0.075 | -1.841 | 0.039* |
| | HR | cm. | 60.542 | 4.443 | 66.618 | 3.212 | -1.214 | 0.043* |
| | HL | cm. | 64.660 | 2.917 | 67.606 | 2.573 | -1.753 | 0.043* |
| | HCG | cm. | 24.790 | 3.880 | 33.406 | 5.539 | -1.483 | 0.043* |
| | WR | n.m. | 74.251 | 22.167 | 124.887 | 18.187 | -0.674 | 0.043* |
| | WL | n.m. | 68.544 | 19.809 | 132.794 | 16.360 | -2.023 | 0.043* |
| | WCG | n.m. | 975.450 | 128.192 | 1082.566 | 124.243 | -2.023 | 0.043* |
| Standing up clean | T | Sec. | 1.296 | 0.151 | 1.008 | 0.168 | -2.060 | 0.043* |
| | HR | cm. | 132.736 | 0.853 | 134.574 | 1.006 | -1.753 | 0.043* |
| | HL | cm. | 133.752 | 1.010 | 134.666 | 0.830 | -1.225 | 0.043* |
| | HCG | cm. | 74.408 | 2.945 | 83.034 | 1.604 | -1.753 | 0.043* |
| | WR | n.m. | 454.397 | 85.149 | 457.196 | 75.393 | -2.023 | 0.686 |
| | WL | n.m. | 434.845 | 78.409 | 451.412 | 75.069 | -2.023 | 0.043* |
| | WCG | n.m. | 961.118 | 174.338 | 995.063 | 109.214 | -2.023 | 0.345 |
| Jerk | T | Sec. | 1.088 | 0.125 | 0.944 | 0.096 | -0.816 | 0.042* |
| | HR | cm. | 164.174 | 3.976 | 172.088 | 3.216 | -2.023 | 0.043* |
| | HL | cm. | 165.122 | 6.702 | 171.038 | 3.986 | -2.023 | 0.080 |
| | HCG | cm. | 67.304 | 3.130 | 69.768 | 2.332 | -2.023 | 0.043* |
| | WR | n.m. | 201.884 | 59.207 | 256.628 | 67.509 | -2.023 | 0.043* |
| | WL | n.m. | 200.511 | 67.539 | 248.596 | 65.591 | -2.023 | 0.043* |
| | WCG | n.m. | 146.395 | 124.222 | 272.723 | 101.595 | -1.753 | 0.043* |
| Standing up jerk | T | Sec. | 1.168 | 0.222 | 1.040 | 0.228 | -1.841 | 0.039* |
| | HR | cm. | 183.210 | 3.640 | 192.810 | 3.282 | -1.483 | 0.043* |
| | HL | cm. | 185.872 | 3.831 | 192.966 | 3.377 | -2.023 | 0.043* |
| | HCG | cm. | 81.002 | 3.991 | 84.028 | 3.487 | -2.023 | 0.043* |
| | WR | n.m. | 119.995 | 23.117 | 139.458 | 23.765 | -0.405 | 0.043* |
| | WL | n.m. | 131.383 | 42.970 | 147.260 | 24.564 | -0.405 | 0.138 |
| | WCG | n.m. | 277.596 | 155.045 | 300.799 | 150.663 | -1.753 | 0.043* |
| Performance | Clean & Jerk | Kg. | 129.000 | 26.192 | 138.000 | 26.589 | -2.121 | 0.039* |



Table 2. Shows the results of significant statistical differences to Wilcoxon test the experimental group between pre and post measurements in tests of muscular balance, dynamic parameters and the level of achievement for clean and jerk skill. Where the value of $P < 0.05$ to all variables search which shows statistically significant differences between pre and post measurement for post measurement.

Table 3. Statistics-test for the Muscular balance and dynamic parameters of Wilcoxon between pre- and post-test to control group.

| Variables | | | Pre-test | | Post-test | | z | p. |
|-------------------|----------------|------|----------|---------|-----------|---------|--------|--------|
| | | | Average | SD. | Average | SD. | | |
| Muscular balance | Right grip | Kg. | 32.600 | 2.191 | 35.400 | 2.302 | -2.121 | 0.034* |
| | Left grip | Kg. | 31.600 | 2.074 | 34.600 | 2.074 | 2.060- | 0.039* |
| | Clean pull | Kg. | 113.000 | 28.636 | 116.800 | 28.969 | -2.121 | 0.034* |
| | Jerk push | Kg. | 56.200 | 8.585 | 59.800 | 8.843 | -2.070 | 0.038* |
| | Good Morning | Kg. | 73.200 | 14.822 | 76.600 | 15.060 | -2.070 | 0.038* |
| | Snatch balance | Kg. | 107.000 | 11.979 | 111.000 | 12.942 | -2.041 | 0.041* |
| Pull phase 11. | T | Sec. | 0.784 | 0.083 | 0.764 | 0.064 | -1.633 | 0.102 |
| | HR | cm. | 75.518 | 2.745 | 76.174 | 3.674 | -1.214 | 0.225 |
| | HL | cm. | 76.068 | 3.311 | 77.944 | 3.409 | -1.753 | 0.080 |
| | HCG | cm. | 76.080 | 3.416 | 77.612 | 3.476 | -1.753 | 0.080 |
| | WR | n.m. | 251.501 | 34.027 | 262.839 | 34.933 | -2.023 | 0.043* |
| | WL | n.m. | 254.930 | 41.045 | 272.296 | 40.947 | -2.023 | 0.043* |
| | WCG | n.m. | 649.682 | 96.038 | 689.743 | 104.515 | -2.023 | 0.043* |
| Squat | T | Sec. | 0.712 | 0.052 | 0.668 | 0.069 | -1.841 | 0.660 |
| | HR | cm. | 56.524 | 4.351 | 57.134 | 4.743 | -1.214 | 0.225 |
| | HL | cm. | 64.042 | 3.314 | 64.784 | 3.240 | -2.023 | 0.043* |
| | HCG | cm. | 24.190 | 4.265 | 24.806 | 5.095 | -1.483 | 0.138 |
| | WR | n.m. | 89.027 | 12.856 | 92.258 | 19.549 | -0.674 | 0.500 |
| | WL | n.m. | 57.898 | 21.881 | 65.066 | 20.310 | -1.753 | 0.080 |
| | WCG | n.m. | 843.960 | 82.857 | 874.992 | 86.857 | -2.023 | 0.043* |
| Standing up clean | T | Sec. | 1.316 | 0.127 | 1.244 | 0.078 | 2.060- | 0.039* |
| | HR | cm. | 134.134 | 1.826 | 135.044 | 2.286 | -1.753 | 0.080 |
| | HL | cm. | 133.792 | 0.921 | 134.320 | 1.251 | -1.225 | 0.221 |
| | HCG | cm. | 73.418 | 2.974 | 77.408 | 4.674 | -1.753 | 0.080 |
| | WR | n.m. | 368.377 | 52.805 | 382.051 | 53.134 | -2.023 | 0.043* |
| | WL | n.m. | 332.016 | 55.996 | 354.389 | 48.295 | -2.023 | 0.043* |
| | WCG | n.m. | 809.285 | 137.565 | 879.612 | 141.924 | -2.023 | 0.043* |
| Jerk | T | Sec. | 1.120 | 0.110 | 1.136 | 0.083 | -0.816 | 0.414 |
| | HR | cm. | 160.644 | 5.370 | 164.088 | 5.581 | -2.023 | 0.043* |
| | HL | cm. | 161.322 | 5.022 | 162.638 | 4.750 | -2.023 | 0.043* |
| | HCG | cm. | 65.304 | 1.581 | 66.568 | 2.124 | -1.753 | 0.080 |
| | WR | n.m. | 127.595 | 34.584 | 144.481 | 37.546 | -2.023 | 0.043* |
| | WL | n.m. | 123.968 | 30.979 | 139.506 | 37.048 | -2.023 | 0.043* |
| | WCG | n.m. | 140.002 | 84.258 | 188.124 | 111.835 | -2.023 | 0.043* |
| Standing up | T | Sec. | 1.120 | 0.251 | 1.076 | 0.239 | -1.841 | 0.660 |
| | HR | cm. | 179.410 | 5.731 | 182.010 | 3.153 | -1.483 | 0.138 |
| | HL | cm. | 181.710 | 5.187 | 183.566 | 4.479 | -2.023 | 0.043* |
| | HCG | cm. | 79.802 | 4.752 | 82.428 | 4.439 | -2.023 | 0.043* |
| | WR | n.m. | 89.053 | 12.203 | 86.813 | 11.781 | -0.405 | 0.686 |
| | WL | n.m. | 105.150 | 30.786 | 103.555 | 23.293 | -0.405 | 0.686 |
| | WCG | n.m. | 244.679 | 103.105 | 276.310 | 109.596 | -1.753 | 0.080 |
| Performance | Clean & Jerk | Kg. | 97.000 | 14.036 | 100.200 | 14.096 | -2.121 | 0.034* |

Table 3. Shows the results of significant statistical differences to Wilcoxon test the control group between pre and post measurements in tests of muscular balance, dynamic parameters and the level of achievement for clean and jerk skill. Where the value of $P < 0.05$ in all variables search which shows statistically significant differences between pre and post measurement for post measurement.

Table 4. Statistics-test for the Muscular balance and dynamic parameters of Mann-Whitney between Experimental and Control group to post-test.

| Variables | | | Experimental group | | Control group | | z | p. |
|------------------|------------|-----|--------------------|--------|---------------|--------|--------|--------|
| | | | Average | SD. | Average | SD. | | |
| Muscular balance | Right grip | Kg. | 40.600 | 2.408 | 35.400 | 2.302 | -2.305 | 0.021* |
| | Left grip | Kg. | 39.600 | 1.816 | 34.600 | 2.074 | -2.417 | 0.016* |
| | Clean pull | Kg. | 189.000 | 56.613 | 116.800 | 28.969 | -1.991 | 0.047* |



| | | | | | | | | |
|--------------------------|----------------|------|----------|---------|---------|---------|--------|--------|
| | Jerk push | Kg. | 79.000 | 15.166 | 59.800 | 8.843 | -2.009 | 0.045* |
| | Good Morning | Kg. | 106.000 | 27.019 | 76.600 | 15.060 | -1.984 | 0.047* |
| | Snatch balance | Kg. | 147.000 | 28.636 | 111.000 | 12.942 | -2.015 | 0.044* |
| Pull phase 11. | T | Sec. | 0.656 | 0.062 | 0.764 | 0.064 | -2.095 | 0.036* |
| | HR | cm. | 85.374 | 2.287 | 76.174 | 3.674 | -2.611 | 0.009* |
| | HL | cm. | 87.606 | 2.292 | 77.944 | 3.409 | -2.611 | 0.009* |
| | HCG | cm. | 87.412 | 1.527 | 77.612 | 3.476 | -2.611 | 0.009* |
| | WR | n.m. | 410.264 | 95.167 | 262.839 | 34.933 | -2.402 | 0.016* |
| | WL | n.m. | 433.561 | 102.709 | 272.296 | 40.947 | -2.402 | 0.016* |
| | WCG | n.m. | 940.043 | 178.845 | 689.743 | 104.515 | -2.193 | 0.028* |
| Squat | T | Sec. | 0.760 | 0.075 | 0.668 | 0.069 | -1.687 | 0.092 |
| | HR | cm. | 66.618 | 3.212 | 57.134 | 4.744 | -2.611 | 0.009* |
| | HL | cm. | 67.606 | 2.573 | 64.784 | 3.240 | -1.776 | 0.076 |
| | HCG | cm. | 33.406 | 5.539 | 24.806 | 5.095 | -1.984 | 0.047* |
| | WR | n.m. | 124.887 | 18.187 | 92.258 | 19.549 | -2.193 | 0.028* |
| | WL | n.m. | 132.794 | 16.360 | 77.816 | 15.692 | -2.611 | 0.009* |
| | WCG | n.m. | 1082.566 | 124.243 | 874.992 | 86.857 | -2.193 | 0.028* |
| Standing up clean | T | Sec. | 1.008 | 0.168 | 1.244 | 0.078 | -2.305 | 0.021* |
| | HR | cm. | 134.574 | 1.006 | 135.044 | 2.286 | -2.193 | 0.028* |
| | HL | cm. | 134.666 | 0.830 | 134.320 | 1.251 | -2.193 | 0.028* |
| | HCG | cm. | 83.034 | 1.604 | 77.408 | 4.674 | -1.776 | 0.076 |
| | WR | n.m. | 457.196 | 75.393 | 382.051 | 53.134 | -2.402 | 0.016* |
| | WL | n.m. | 451.412 | 75.069 | 354.389 | 48.295 | -2.402 | 0.016* |
| | WCG | n.m. | 995.063 | 109.214 | 879.612 | 141.924 | -1.776 | 0.076 |
| Jerk | T | Sec. | 0.944 | 0.096 | 1.136 | 0.083 | -2.371 | 0.018* |
| | HR | cm. | 172.088 | 3.216 | 164.088 | 5.581 | -0.104 | 0.917 |
| | HL | cm. | 171.038 | 3.986 | 162.638 | 4.750 | -0.313 | 0.754 |
| | HCG | cm. | 69.768 | 2.332 | 66.568 | 2.124 | -1.984 | 0.047* |
| | WR | n.m. | 256.628 | 67.509 | 144.481 | 37.546 | -1.567 | 0.117 |
| | WL | n.m. | 248.596 | 65.591 | 139.506 | 37.048 | -1.776 | 0.076 |
| | WCG | n.m. | 272.723 | 101.595 | 188.124 | 111.835 | -1.776 | 0.076 |
| Standing up jerk | T | Sec. | 1.040 | 0.228 | 1.076 | 0.239 | -0.745 | 0.456 |
| | HR | cm. | 192.810 | 3.282 | 182.010 | 3.153 | -2.611 | 0.009* |
| | HL | cm. | 192.966 | 3.377 | 183.566 | 4.479 | -2.402 | 0.016* |
| | HCG | cm. | 84.028 | 3.487 | 82.428 | 4.439 | -0.731 | 0.465 |
| | WR | n.m. | 139.458 | 23.765 | 86.813 | 11.781 | -2.611 | 0.009* |
| | WL | n.m. | 147.260 | 24.564 | 103.555 | 23.293 | -2.193 | 0.028* |
| | WCG | n.m. | 300.799 | 150.663 | 276.310 | 109.596 | -0.313 | 0.754 |
| Performance | Clean & Jerk | Kg. | 138.000 | 26.589 | 100.200 | 14.096 | -2.095 | 0.036* |

Table 4. Significant statistical differences of Mann-Whitney test in the post measurement of muscular balance, dynamic measurements and the level of achievement for clean and jerk skill between the control and experimental groups. Where the value of $P < 0.05$ in all research variables indicating that there are statistically significant differences between the control and the experimental group for the experimental group.

Discussion

The results of this study showed that there are statistically significant differences at the level of 0.50, where the value of $P < 0.05$ in tests of muscular strength and maximum some dynamic parameters of study and the level of achievement of the clean and jerk skill between two measurements pre- and post-test control group and in favor of post measure, researchers find the improvement of the control group mainly due

to attend the training and the application of the program, which includes exercises to help applied to the control group. This is consistent with the results of studies (Ebada, 2008, Ebada, 2011), which indicated the superiority of measuring post measurement control group in tests of muscle strength and maximum power explosive and the level of achievement of the clean and jerk skill due to the effect of exercise help to improve the level of achievement of the clean and jerk skill.



The results also showed that there are statistically significant differences at the 0.05 level, where the value of $P < 0.05$ in muscular balance tests and dynamic parameters and the level of achievement for clean and jerk skill between pre and post measurements of the experimental group in favor of the post measurement. The researchers attributed this progress to the impact of the training program for muscular balance applied to the experimental group.

Where results showed low time motor performance in measuring post-test with increased mechanical work on both sides of the bar left and right and center of gravity body mass during the stages of various performance is an indicator of increased mechanical power for the weightlifters, as the ability = work / time, the researchers due to the impact of the training program, which includes maximum strength training of balanced muscular groups and working in the motor performance of the skill that led to increased muscular strength and balance of the weightlifters and then increase to the level of achievement (Hall, 2005, Andras, 2011), that with the increase of mechanical work and decrease time mechanical power is increased, as noted increased time performance stage squat in measuring post-test for measurement pre- test where the value of $P < 0.05$, an indicator of the strength of the player and the ability to control raised weight during descent to put squat The researcher due that to the program, which includes the training muscular balance which contributed to the harmonious development of muscular strength of weightlifter.

The results also showed the experimental group are statistically significant differences where the value of $P < 0.05$ in the height sides of the bar right and left the ground in measuring post-test for pre-test, as well as the approaching averages rise the left and right sides of the bar, an indicator of the balance of motor performance of the players as well as to improve the potential energy stored body and gained player as a result placed by the player's ability to stretch the muscles, which evolved after the training program, and with the increase of weight raised led to the improvement of potential energy (Hall, 2005, Ibrahim, 2006, Whiting, Zernicke, 2008), potential energy = $(m * g * h)$, where m = mass, g = gravitational acceleration, h = height in meters above the reference which is what has been achieved in the post test measurement of an increase in the height of both sides of the bar as well as raised weight, which led to increased potential energy of squat.

The results showed that there statistically significant differences between the post measurements between experimental and control groups and in favor of the experimental group as the value of $P < 0.05$ in tests muscular balance parameters dynamic stages performance to stage clean and jerk in increasing mechanical work effort on both sides of the bar left and right and center of gravity body mass during

performance stages (Pull phase 11., squat, Standing up clean, Standing up clean, Jerk, Standing up jerk), an indicator of increasing the mechanical power of weightlifting player, which leads to improvement in the level of achievement for clean and jerk skill (Whiting, Zernicke, 2008) and that is due to the training program for muscular balance applied on the experimental group. If the common center of gravity will be lifted vertically we can minimize the energy requirement for the lift, and minimize also the negative effect on the performance of the lifter. So weightlifter will produce a better result. Plus another advantage: having an optimum technique from dynamic parameters, as point of view, the risk of injury is also much less. This fact is because of the good balanced lift, minimizing the unnecessary load on the joints of the body of weightlifters (Andras, 2011).

Compatibility between muscle groups holding and extensor help increase muscular strength in performance, and that by keeping in true balance with a maximal strength increase, is the first, requirement for the development of muscular strength (David, John, 1997).

To overcome the imbalance muscles resulting from adaptation to performance, it requires some measures to attempt the power equation for this weak side until growth is moderate, and this requires strengthening the muscles interview and this requires strengthen muscles corresponding through exercises affected a direct impact on the strength not only major muscle force during perform clean and jerk skill, but also the corresponding muscles (Frank, et. al., 2012). Muscle balance requires an equivalence between the power of the muscle or group of muscles working in the skill with ability muscle or group muscles corresponding, and requires a balance in the percentage strength in the body of individual and that on both sides of the body and between the parties the upper and lower body and between muscle groups on the same joint, and requires access to this balance training to perform repetitions and appropriate used muscle groups the basic dynamics of movement and muscle anti muscle help (Cochran, House, 2000).

Conclusion

There are statistically significant differences between the experimental and control groups in muscular balance and dynamic performance parameters Clean and jerk skill. The effectiveness of the training program to increase muscular balance, improved dynamic performance and the level of achievement of the weightlifters.

These results must be taken into account by the coaches and weightlifters for the development of muscular balance for improved dynamic performance and the level of achievement for Clean and jerk skill.

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Appendix 1. The training program to the development of the muscular balance for Experimental group for Clean and jerk skill for weightlifters.

| weeks | Day | Exercises | intensity | Repetition | sets | Rest between exercises | Termin al rest |
|--------|----------|---|-----------|------------|------|------------------------|----------------|
| Week 1 | Sunday | Front Squat, Back Squat, Power Clean, clean From Knee, Clean and jerk | 80% | 3 | 2 | 10sec. | 1min |
| | Tuesday | Power jerk, clean from blocks, Back Squat, Clean and jerk, Hang clean | 85% | 3 | 2 | 10sec. | 1min |
| | Thursday | Snatch Balance, high pull of clean, Front Squat, Clean Pull, Clean and jerk | 80% | 3 | 2 | 10sec. | 1min |



| Warm-up : Exercises in unit intensity 40% -3 repetitions- 2 groups from Maximum weight player (1) time lift | | | | | | | |
|--|----------|--|-----|---|---|--------|-------|
| Week 2 | Sunday | Power Clean, dead pull of clean, split jerk, Clean and jerk, half squats | 85% | 2 | 3 | 10sec. | 1 min |
| | Tuesday | Push press, Good morning, Back Squat, Power jerk, Clean and jerk | 85% | 2 | 3 | 10sec. | 1 min |
| | Thursday | Clean pull Snatch Pull, Bench press, Split jerk, Clean and jerk | 85% | 2 | 3 | 10sec. | 1 min |
| Warm-up : Exercises in unit intensity 45% 6repetitions 1groups from Maximum weight player(1)time lift | | | | | | | |
| Week 3 | Sunday | Barbell squats, Power Clean Back Squat, leg press, Clean and jerk | 90% | 1 | 4 | 10sec. | 1 min |
| | Tuesday | Clean Pull, dumbbell barbell lunges, Back Squat, Hang Power Clean pull, Clean and jerk | 85% | 2 | 4 | 10sec. | 1 min |
| | Thursday | Power hang clean, Power jerk, Half squats, Clean Pull, Clean and jerk | 90% | 1 | 4 | 10sec. | 1 min |
| Warm-up : Exercises in unit intensity 50% - 4 repetitions- 1 groups from Maximum weight player (1) time lift | | | | | | | |
| Week 4 | Sunday | Power Snatch, Snatch Pull, Snatch, Power jerk, Clean and jerk | 85% | 2 | 3 | 10sec. | 2 min |
| | Tuesday | Power clean, Clean Pull, Power jerk, Split jerk, Clean and jerk, | 85% | 2 | 3 | 10sec. | 2 min |
| | Thursday | Power clean, Hang clean, Front Squat, Clean Pull, Clean and jerk | 85% | 2 | 3 | 10sec. | 2 min |
| Warm-up : Exercises in unit intensity 40% - 5 repetitions- 2 groups from Maximum weight player (1) time lift | | | | | | | |
| Week 5 | Sunday | Front Squat, Back Squat, Power Clean, clean From Knee, Clean and jerk | 90% | 1 | 5 | 10sec. | 1 min |
| | Tuesday | Power jerk, clean from blocks, Back Squat, Clean and jerk, Hang clean | 90% | 1 | 5 | 10sec. | 1 min |
| | Thursday | Snatch Balance, high pull of clean, Front Squat, Clean Pull, Clean and jerk | 90% | 1 | 5 | 10sec. | 1 min |
| Warm-up : Exercises in unit intensity 45% - 5 repetitions- 1 groups from Maximum weight player (1) time lift | | | | | | | |
| Week 6 | Sunday | Power Clean, dead pull of clean, split jerk, Clean and jerk, half squats | 83% | 3 | 3 | 10sec. | 2 min |
| | Tuesday | Push press, Good morning, Back Squat, Power jerk, Clean and jerk | 85% | 3 | 3 | 10sec. | 2 min |
| | Thursday | Clean pull Snatch Pull, Bench press, Split jerk, Clean and jerk | 83% | 3 | 3 | 10sec. | 2 min |
| Warm-up : Exercises in unit intensity 50% - 2 repetitions- 2 groups from Maximum weight player (1) time lift | | | | | | | |
| Week 7 | Sunday | Barbell squats, Power Clean Back Squat, leg press, Clean and jerk | 85% | 2 | 4 | 10sec. | 2 min |
| | Tuesday | Clean Pull, dumbbell barbell lunges, Back Squat, Hang Power Clean pull, Clean and jerk | 90% | 1 | 5 | 10sec. | 2 min |
| | Thursday | Power hang clean, Power jerk, Half squats, Clean Pull, Clean and jerk | 85% | 2 | 4 | 10sec. | 2 min |



| | | | | | | | |
|--|----------|--|------|---|---|--------|------|
| Warm-up : Exercises in unit intensity 45% - 5 repetitions- 1 groups from Maximum weight player (1) time lift | | | | | | | |
| Week 8 | Sunday | Power Clean, dead pull of clean, split jerk, Clean and jerk, half squats | 85% | 2 | 4 | 10sec. | 2min |
| | Tuesday | Push press, Good morning, Back Squat, Power jerk, Clean and jerk | 90% | 1 | 5 | 10sec. | 2min |
| | Thursday | Clean pull Snatch Pull, Bench press, Split jerk, Clean and jerk | 85% | 2 | 4 | 10sec. | 2min |
| Warm-up : Exercises in unit intensity 50% - 3 repetitions- 2 groups from Maximum weight player (1) time lift | | | | | | | |
| Week 9 | Sunday | Barbell squats, Power Clean Back Squat, leg press, Clean and jerk | 85% | 3 | 4 | 10sec. | 2min |
| | Tuesday | Clean Pull, dumbbell barbell lunges, Back Squat, Hang Power Clean pull, Clean and jerk | 90% | 1 | 7 | 10sec. | 2min |
| | Thursday | Power hang clean, Power jerk, Half squats, Clean Pull, Clean and jerk | 85% | 3 | 4 | 10sec. | 2min |
| Warm-up : Exercises in unit intensity 40% -5 repetitions- 2 groups from Maximum weight player (1) time lift | | | | | | | |
| Week 10 | Sunday | Front Squat, Back Squat, Power Clean, clean From Knee, Clean and jerk | 85% | 2 | 4 | 10sec. | 2min |
| | Tuesday | Power jerk, clean from blocks, Back Squat, Clean and jerk, Hang clean | 90% | 1 | 5 | 10sec. | 2min |
| | Thursday | Snatch Balance, high pull of clean, Front Squat, Clean Pull, Clean and jerk | 85% | 2 | 4 | 10sec. | 2min |
| Warm-up : Exercises in unit intensity 45% - 5 repetitions- 1 groups from Maximum weight player (1) time lift | | | | | | | |
| Week 11 | Sunday | Power Clean, dead pull of clean, split jerk, Clean and jerk, half squats | 85% | 2 | 4 | 10sec. | 2min |
| | Tuesday | Push press, Good morning, Back Squat, Power jerk, Clean and jerk | 100% | 1 | 6 | 10sec. | 2min |
| | Thursday | Clean pull Snatch Pull, Bench press, Split jerk, Clean and jerk | 90% | 1 | 7 | 10sec. | 2min |
| Warm-up : Exercises in unit intensity 50% - 3 repetitions- 2 groups from Maximum weight player (1) time lift | | | | | | | |
| Week 12 | Sunday | Power jerk, clean from blocks, Back Squat, Clean and jerk, Hang clean | 90% | 2 | 4 | 10sec. | 2min |
| | Tuesday | Front Squat, Back Squat, Power Clean, high pull of clean, Clean and jerk | 100% | 1 | 6 | 10sec. | 2min |
| | Thursday | Barbell squats, Power Clean Back Squat, leg press, Clean and jerk | 90% | 2 | 4 | 10sec. | 2min |
| Warm-up : Exercises in unit intensity 45% - 4 repetitions- 1 groups from Maximum weight player (1) time lift | | | | | | | |

cf.(Ebada, 2011, Ajan, 2006)