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Effect of directed strength Exercises in Terms of balance indicators on the Snatch Catching and Clean Receiving for Youth Women weightlifters

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Abstract:

This research aims to investigate the effectiveness of guiding strength training based on balance indicators (body inclination towards the four spatial directions and balance degree) during performance. **Methodology**, the experimental approach due to its suitability for the nature and idea of the study **Sample**, consist of 23 female of weightlifters youth, with an average age of 13.62±1.5 selected purposively. The sample was divided into two groups according to the inclination index while receiving the weight as follows: First Group consisted of ١٣ players (inclination towards the positive side on the x axis) and the Second Group consisted of ١٠ players (inclination towards the negative side on the x axis). All participants had an overall balance score below 6/10 of the general balance index, Both groups underwent a 12-week training program consisting of three training units per week, with each unit lasting 90 minutes. Statics (Mean – ST.devision - SKEW – T.test- Change Rate) were utilized using the SPSS program. **Results**, there is an improvement in the percentage of general balance, which was 89.80% for group 1 and 68.21% for group 2, and the rate of successful attempts in clean was 20.52% for group 1 and 21% for group 2 ,snatch was 30.51% for group 1 and 35.96% for group 2. **Recommendations** We advise the need to pay attention to balance indicators when developing both balance and muscle strength because of their association and influence on each other during performance and improve the records level.

Keywords. Balance indicators, Snatch Catch, Clean Receiving.

تأثير توجية تدريبات القوة بدلالة مؤشرات التوازن على استقبال الكلين وتثبيت الخطف للاعبات الناشئات فى رفع الاثقال

المستخلص:

يهدف البحث الى التعرف على فاعلية توجية تدريبات القوة العضلية بدلالة مؤشرات الاتزان (مؤشرات ميل الجسم الى الاتجاهات الفراغية الاربعة ودرجة الاتزان) اثناء الاداء. **منهج البحث،** تم استخدام المنهج التجريبي نظرا لملائمته لطبيعة وفكرة البحث. **العينة،** تم اختيار العينة بالطريقة العمدية لعدد ٢٣ لاعبة (شابات) فى رياضة رفع الاثقال بمتوسط عمر (13.62±1.5)، وتم تقسيم العينة الى مجموعتين، المجموعة الاولى ١٣ لاعبات (ذات الميل للجانب الموجب على المحور x) والمجموعة الثانية ١٠ لاعبة (ذات الميل للجانب السالب على المحور x) وحصلو جميعا على معدل اقل من ١٠/٦ لدرجة الاتزان العام، وخضعت كلا المجموعتين لبرنامج تدريبي موجه لمدة ١٢ اسبوع بواقع (٣ وحدات) تدريبية اسبوعيا زمن الوحدة (٩٠ دقيقة). **المعادلات الاحصائية،** تم استخدام (المتوسط – الانحراف المعيارى – معامل الالتواء – اختبار ت – معدل التغير) وذلك باستخدام برنامج SPSS. **أهم النتائج،** تشير النتائج الى تحسن فى نسبة الاتزان العام كانت 89.80% للمجموعة الاولى و68.21% للمجموعة الثانية ومعدل المحاولات الناجحة فى الكلين كان 20.52% للمجموعة الاولى و21% للمجموعة الثانية ، وللخطف كان 30.51% للمجموعة الاولى و35.96% للمجموعة الثانية. **التوصيات،** ننصح بضرورة الاهتمام بمؤشرات التوازن عند تنمية كلا من التوزان والقوة العضلية لارتباطهما وتاثير كلا منهم فى الاخر أثناء الاداء وتحسن المستوى الرقمى.

الكلمات الافتتاحية: مؤشرات التوازن، تثبيت الخطف، استقبال الكلين

Effect of directed strength Exercises in Terms of balance indicators on the Snatch Catching and Clean Receiving for Youth Women weightlifters

Introduction

The weightlifting competitions consist of two primary lifts: the snatch and the clean and jerk. In the snatch lift, the athlete aims to lift the weight rapidly from the platform to achieve full extension of the arms

above the head in one continuous motion (Ebada, K. et al., 2015).Without pausing. On the other hand, the clean and jerk lift is divided into two distinct phases. The first phase is the clean, where the athlete lifts the weight from the platform and settles it on the shoulders above the chest. The second phase is the jerk, in which the athlete forcefully pushes the weight from the shoulders to achieve maximum extension of the arms above the head. Each athlete is granted three attempts for each lift, and the highest successful lift in each category is considered for scoring purposes.
(Awed, A., 2019)

The attainment of optimal technical performance is recognized as one of the pivotal factors contributing to an athlete's success in achieving the best results. Both the snatch and the clean lifts exhibit significant similarities in terms of performance stages and physical demands. The execution begins with the starting position, the initial stance adopted by the athlete while gripping the bar in preparation for lifting the weight. Subsequently, the first pull stage ensues, during which the athlete raises the weight from the platform to knee level. This is followed by the second pull, wherein the athlete elevates the weight from knee level to an upright position. Next, the full extension stage occurs, where the athlete maximally extends all joints in an upward direction to achieve the highest possible elevation with the weight (Storey, A., & Smith, H. K., 2012). Ultimately, the flying phase and weight reception occur, wherein the athlete briefly lifts off the ground and slightly propels the weight forward, allowing it to settle on the shoulders in the clean lift or the upper arms in the snatch lift. Meticulous attention to these technical stages contributes to optimal performance and improved weightlifting outcomes.
(Garhammer, J., & Taylor, L., 1984)

The weight receiving stage in the clean and the catching phase in the snatch are crucial components of successful execution. While many athletes possess the strength to lift the weight and elevate it to its maximum height, challenges arise during the moment of receiving the weight. Undesirable rebounds or an inability to stabilize the weight often occur. This inadequacy can be attributed to the player's compromised balance and their inability to reposition the center of gravity within the base of support. Consequently, the athlete struggles to attain the optimal position for stabilizing the weight effectively. Understanding and addressing these balance deficiencies can significantly contribute to enhanced weightlifting performance. By developing the athlete's balance capabilities and facilitating the return of the body's center of gravity to its base of support,

athletes can achieve improved stability and mastery of weightlifting techniques.(Hassan, A. A., 2020)

Physical activity is a direct consequence of the forces generated by the skeletal muscles (Khaled, E., 2013). The classification of physical fitness encompasses two primary conceptual perspectives. The first perspective defines physical fitness as a comprehensive state of well-being, enabling individuals to effectively meet the diverse physical challenges encountered in daily activities. This includes components such as cardiorespiratory endurance, muscular endurance, muscular strength, and flexibility. These attributes are essential for performing common activities such as walking, climbing, and lifting weights (Lane, C. L., et al, 2019).

The second perspective highlights the integration of both aerobic and anaerobic fitness, which manifests as a combination of attributes crucial for athletic performance. This encompasses flexibility, agility, speed, balance, and strength. These components collectively play a fundamental role in determining the success of sports movements. For instance, flexibility enhances the range of motion, allowing athletes to execute movements with greater efficiency. Agility enables rapid changes in direction and precise coordination. Speed contributes to swift execution and competitive advantage. Balance ensures stability and control during dynamic actions. Strength enables the generation of optimal force output, facilitating powerful and explosive movements.
(McKelvie, R. S., & McCartney, N., 1990)

The amalgamation of these physical fitness components is paramount in achieving peak performance levels. The successful execution of physical activities and sports movements, including weightlifting, heavily relies on these foundational attributes. Weightlifting, specifically, requires a harmonious integration of various physical fitness components.(Stone, M. H., et al, 2006) Muscular strength, both maximum and explosive, is essential for effectively handling heavy loads and executing powerful lifts. Flexibility aids in achieving proper lifting form and optimizing range of motion (Stone, M. H., et al, 2005). Agility enables quick transitions and precise adjustments during complex lifting maneuvers. Speed contributes to swift barbell acceleration and successful lift completion. Balance ensures stability and control throughout the lifting process. The combination of these physical fitness components is pivotal for optimizing weightlifting performance and achieving desired outcomes.(Ebada, K et al, 2016)

Muscular strength plays a critical role in weightlifting, starting from the initiation of the lift. It enables athletes to exert the necessary force to overcome resistance and effectively control the weight throughout the various stages of performance. Additionally, muscular strength influences the ability to guide the barbell along a specific movement path, ensuring its successful completion and stabilization at the end of the lift. According to Kirhard Carl (1976), advancements in weightlifting records are consistently achieved through the continuous development of physical characteristics. (Carlock, J. M., et al, 2004)

This is because weightlifting stands as a demanding sport that necessitates a high level of physical fitness to master the technical intricacies involved in executing both the snatch and the clean and jerk lifts. By enhancing muscular strength, athletes can enhance their performance and strive towards reaching new heights in weightlifting achievements.(Ahmed, A. W. A. D., 2017)

Balance in weightlifting refers to an athlete's capacity to maintain their body's center of gravity within the base of support (Adelsberger, R., & Tröster, G., 2014).Thereby achieving a state of stability and exerting control over the weight during the lift. This balance manifests in two distinct forms throughout the performance. Firstly, dynamic balance is observed at the completion of the pull-up and during full extension. At this stage, the athlete momentarily lifts off the ground, creating a slight backward swing of the back to allow the barbell to move past the body's frontal plane and reach a point of stability. In the clean lift, this stability is achieved on the shoulders, while in the snatch lift, it is attained on the upper arms (Christ, F. L., et al, 1995). Secondly static balance becomes apparent as the athlete demonstrates the ability to maintain control over the weight and achieve stability in the final position, such as the squatting position, before rising from the lift. Developing both dynamic and static balance capabilities is crucial for weightlifters to enhance their performance and achieve optimal results (Awad, A., 2020). By honing their balance skills, athletes can ensure precise control, stability, and mastery throughout the entire lifting process.(Kang, S. H., et al.2013)

The research problem arises from an observation of young female players under 17 years old participating in the national project for Talented in Damietta Governorate. It was noted that a significant number of failed attempts occurred during the stage of receiving weight in the clean and catching snatch (squatting position). This prompted the need to investigate

the underlying reasons behind these failures. Two main factors were hypothesized: a possible weakness in either flexibility or balance.

To explore this further, an exploratory study was conducted involving 10 players. The study aimed to measure the level of flexibility and balance among the participants. The flexibility level was assessed through tests such as forward downward torso bending and side leg opening. The results showed an average flexibility level of 11 ± 5 centimeters for torso bending and 17 ± 8 centimeters for leg opening. These values indicated acceptable levels of flexibility for weightlifters. Additionally, balance was assessed using a standing test on the edge of a hard disk with a metatarsal support for each foot individually. The results showed balance average duration of 7 ± 6 seconds. However, inconsistencies were observed between the right and left foot, suggesting an imbalance in balance capabilities.

Upon surveying the opinions of coaches and weightlifting experts, a consensus emerged that the imbalance in strength ratios between the right and left sides of the players could be a contributing factor. This imbalance potentially leads to a tendency to favor one side while bearing the weight. To investigate this further, the players were taken to Alexandria University, where balance testing was conducted using a specialized balance device. The results confirmed deviations, with four players showing deviations to the right and forward, two players to the right and backward, three players to the left and forward, and one player to the left and backward. These deviations indicated an imbalance in muscular strength, particularly in the abdominal and back muscles.

Based on these findings, the research team decided to develop a training program specifically targeting muscular strength, guided by the identified imbalances in balance and muscle strength. The goal of this program is to address the identified issues and enhance the players' overall performance in weightlifting.

Methods

The experimental approach was selected as the most appropriate research method for this study, considering its alignment with the research objectives and the nature of the investigation

Sample

The sample was purposefully selected from the participants of the National Project for Talented in Damietta, who were registered in the Egyptian Weightlifting Federation for the season 2021/2022. A total of 33 girls were included in the sample. The sample was divided into two main groups: an exploratory sample consisting of 10 players and an experimental sample consisting of 23 players who would be subjected to the research intervention (the experimental sample was divided into two groups using a balance measuring device. The first group, consisting of 13 players, was categorized as the "A group," representing individuals leaning towards the right side. Conversely, the second group, comprising 10 players, was designated as the "B group," comprising individuals leaning towards the left side.

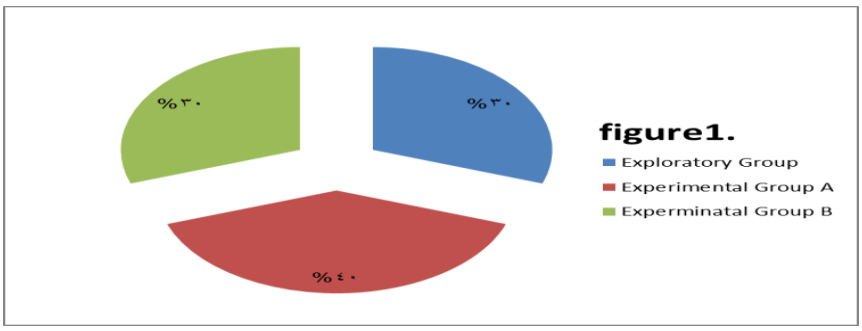

Figure1. expermintal sample, exploratory sample

Research aims

The research aims to investigate the effectiveness of using balance indicators (body inclination in the four spatial directions) to guide strength training exercises in improving the stability level and Record numbers of snatch and clean.

Hypotheses

1. There are statistically significant differences between the pre-test and post-test results for the first group in balance indicators, clean receiving and snatch catching, in favor of the post-test measurements.
2. There are statistically significant differences between the pre-test and post-test results for the second group in balance indicators clean receiving and snatch catching in favor of the post-test measurements.

Executive steps for research:

1- The importance of this study was initially verified through the researchers's personal observation of female players during local and experimental competitions, additionally, the researchers

conducted personal interviews with coaches to further ascertain the significance of the study.

2- To ensure comprehensive understanding of the research variables, including theoretical information and measurement tools, the researchers collected necessary and sufficient information by referring to previous studies related to the topic.

3- The researchers selected specific measurement tools, including the following methods:

First: Balance Assessment:

- By measuring the quadriceps' ability to maintain balance in the four spatial directions using the N-Balance Device. (Attachment 1)

Second: Clean Receiving:

- Clean Classic Test. (Attachment 2)

Third: Snatch Catching:

- Snatch Classic Test. (Attachment 2)

N-Balance Device, to assess the ability to maintain balance in the four spatial directions. In addition, classic clean and snatch tests were employed as measurement tools.

4- The research sample was carefully determined, comprising female weightlifters who met the essential criteria of biological age and registration in the 2021/2022 season of the National Project for Talented Individuals in Damietta.

5- To minimize potential confounding factors, the researchers ensured the homogeneity of the sample across various study variables, such as weight, biological age, training age, N index of balance, average right inclination, maximum right inclination, average left inclination, maximum left inclination, average forward inclination, maximum forward inclination, average backward inclination, and maximum backward inclination.

6- An exploratory study was conducted involving ten female weightlifters enrolled in the federation to further strengthen the research idea and enhance its credibility.

In this exploratory study, a group of 10 players participated to assess their flexibility and balance levels. Flexibility was measured by conducting tests, including forward downward torso bending and side leg opening. The study revealed that the participants had an average flexibility level of 11 ± 5 centimeters for torso bending and 17 ± 8 centimeters for leg opening. These values indicated that the weightlifters possessed acceptable levels of flexibility.

7- To evaluate balance, the participants underwent a standing test on the edge of a hard disk with metatarsal support for each foot individually. The results showed average balance duration of 7 ± 6 seconds. However, disparities were observed between the right and left foot, indicating an imbalance in their balance capabilities.
8- Based on the research goals, the researchers designed a proposed training program. This program included targeted exercises aimed at developing muscle strength on the side opposite to the direction of inclination, as well as stretching exercises for the side to which the player tended.
9- Pre-measurements were carried out on the two experimental groups, consisting 23 players, According to the following schedule:
   - Balance assessment on Wednesday, 3/11/2022.
   - Snatch Catching and Clean Receiving conducted on Thursday, 4/11/2022.
10- The training program was implemented over a 12-week period, commencing from Saturday, 6/11/2021, and concluding on Wednesday, 26/1/2022. The participants underwent three training units per week, each lasting 90 minutes. (attachment 3)
11- Post-measurements were conducted to assess the relevant study variables after the completion of the training program, According to the following schedule:
   - Balance assessment on Saturday, 29/1/2022.
   - Snatch Catching and Clean Receiving conducted on Sunday, 30/1/2022.
12- Appropriate statistical analyses were performed to determine the statistical significance of the applied training program.
13- Finally, the research findings were compiled and presented in the written form.

N-Balance Device

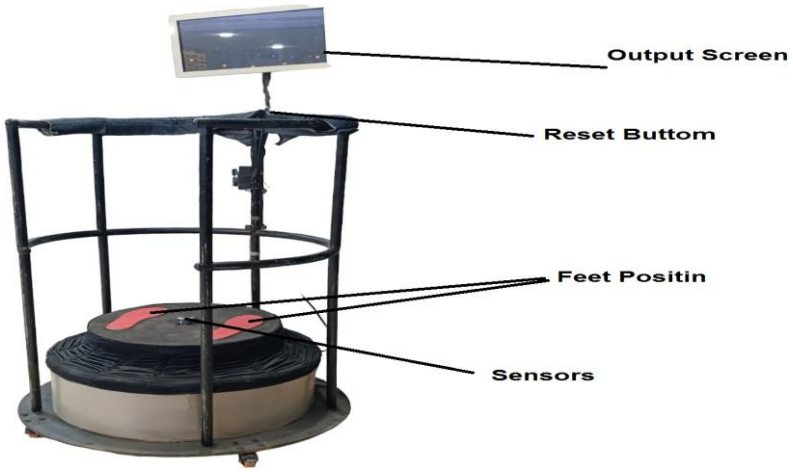

Figure2.Contents of N-Balance device

The N-Balance Device, utilized in this study, is composed of three primary components. Firstly, the device includes a base that serves as the central platform for the player while assuming the required positions for balance measurement. This base is equipped with marked foot placements, allowing the player to align their body's center of gravity directly above the sensor. Once the balance measurement begins, the base becomes unencumbered and moves freely in the four spatial directions, contingent upon the player's ability to maintain their body's center of gravity on the middle of the base or their inclination towards a particular direction.

The second component of the device is the sensor, responsible for quantifying the degrees of inclination exhibited by the base in each of the four directions. This sensor records and provides measurements such as the average inclination and the maximum degree of inclination for each direction.

The third component comprises a reset button, which facilitates the adjustment and preparation of the device for subsequent attempts. This button enables the device to be reset to its initial state, ensuring accurate and reliable measurements for each new trial.

Finally, the device incorporates an output screen, which immediately displays the results of each balance attempt. This screen provides real-time feedback, allowing for prompt assessment and analysis of the recorded data.

Note that the device is new, and it has been designed and its intellectual property rights have been proven by Alexandria University. (Attachment 1)

Homogeneity of the research sample:

The homogeneity of the two main research groups was verified as follows:

Table1. Baseline Characteristics

Characteristics	Group 1 (n=13)	SKEW.	Group 2 (n=1٠)	SKEW.
Weight ±SD	64.38±8.33	0.03	80.46±7.90	-0.36
Age ±SD	13.62±1.5	1.08	14.54±2.09	-1.14
Training age ±SD	1.77±0.57	0.07	2.09±0.51	0.15
N index ±SD	4.35±0.81	0.71	5.02±0.52	-0.85
average right inclination ±SD	10.62±2.02	-0.16	٠٠	-
maximum right inclination ±SD	12.85±1.91	-1.35	٠٠	-
average left inclination ±SD	٠٠	-	8.91±1.73	-0.94
maximum left inclination ±SD	٠٠	-	13.45±1.62	-0.58
average forward inclination ±SD	8.46±1.22	-0.48	9.73±1.64	0.27
maximum forward inclination ±SD	12.69±1.81	0.09	13.64±1.34	-0.21
average backward inclination ±SD	٠٠	-	٠٠	-
maximum backward inclination ±SD	٠٠	-	٠٠	-
Classic Clean ±SD	59.62±7.71	0.29	72.73±8.09	-0.32
Classic Snatch ±SD	38.08±6.37	0.34	49.55±7.82	0.67

Table 1 presents compelling evidence of the complete homogeneity of the sample used in the research across various variables. These variables include weight, biological age, training age, N index of balance, average right inclination, maximum right inclination, average left inclination, maximum left inclination, average forward inclination, maximum forward inclination, average backward inclination, and maximum backward

inclination. Additionally, the record variables of classic clean and classic snatch were considered.

By examining the skewness values calculated for the two groups in each variable, it is evident that they fall within the range of -1.35 (the lowest value observed for the maximum right inclination in the first group) to 1.08 (the highest value observed for the biological age variable in the first group). Notably, all skewness values lie between -3 and +3, which are considered an acceptable range according to statistical norms. This outcome confirms the homogeneity of the sample across the aforementioned variables.

Results

Firstly, the research analysis focused on examining the results of the differences between the pre and post-measurements for the first group. This group was characterized by a tendency to lean towards the right side and forward during their performance

Table2. The significance of the differences between the pre and post measurements of the first group

Characteristics		Group 1 Pre-tests (n=13)	Group 1 Post-tests (n=13)	Change Rate %	T - test
Balance scale	N index ±SD	4.35±0.81	8.24±0.91	89.80	11.272
	average right inclination ±SD	10.62±2.02	1.46±0.76	-86.23	17.71
	maximum right inclination ±SD	12.85±1.91	3.31±0.83	-74.25	19.53
	average left inclination ±SD	٠٠	0.46±05	-	3.21
	maximum left inclination ±SD	٠٠	1.23±1.42	-	2.99
	average forward inclination ±SD	8.46±1.22	2.16±0.95	-74.46	18.18
	maximum forward inclination	12.69±1.81	3.69±1.26	-70.91	15.99

	±SD				
	average backward inclination ±SD	٠٠	0.15±0.36	-	1.48
	maximum backward inclination ±SD	٠٠	0.31±072	-	1.51
Clean Receiving	Classic Clean ±SD	59.62±7.71	71.85±8.40	20.52	21.12
Snatch Catching	Classic Snatch ±SD	38.08±6.37	49.69±7.16	30.51	14.58

T=2.179

Table 2 provides significant evidence of statistically significant differences between all pre and post measurements pertaining to the inclination of female players towards the right side and forward. The calculated t-test values for these measurements ranged from 2.99 (the lowest value observed for the maximum left inclination) to 18.18 (the maximum value observed for the average forward inclination). Importantly, all calculated t-test values exceeded the critical value of T-table, indicating the presence of statistically significant differences.

However, it is worth noting that there were no statistically significant differences observed in the variables of average backward inclination and maximum backward inclination, with respective t-test values of 1.48 and 1.51. These values were both lower than the critical value of T-table, suggesting that these variables were not significantly impacted by the training program. It is important to acknowledge that the focus of the training program did not specifically target improvements in the backward inclination.

Furthermore, the analysis revealed statistically significant differences in the record numbers of clean reception and snatch catching, with corresponding t-test values of 21.12 and 14.58, respectively. These values exceeded the critical value of T-table, confirming the significant impact of the training program on the participants' performance outcomes in these specific weightlifting exercises.

Table3. The significance of the differences between the pre and post measurements of the second group

Characteristics		Group 2 Pre-tests (n=10)	Group 2 Post-tests (n=10)	Change Rate %	T – test
Balance scale	N index ±SD	5.02±0.52	8.45±1.32	68.21	8.761
	average right inclination ±SD	٠٠	0.36±0.48	-	2.390
	maximum right inclination ±SD	٠٠	0.82±1.11	-	2.23
	average left inclination ±SD	8.91±1.73	1.46±0.5	-83.67	11.96
	maximum left inclination ±SD	13.45±1.62	3.45±0.78	-74.32	15.46
	average forward inclination ±SD	9.73±1.64	3.18±2.95	-67.29	8.53
	maximum forward inclination ±SD	13.64±1.34	4.82±3.43	-64.67	8.61
	average backward inclination ±SD	٠٠	0.09±0.57	-	1
	maximum backward inclination ±SD	٠٠	0.18±0.57	-	1.21
Clean receiving	Classic Clean ±SD	72.73±8.09	88±8.94	21	11.10
Snatch Catching	Classic Snatch ±SD	49.55±7.82	67.36±9.49	35.96	9.85

T=2.179

Table 3 presents compelling evidence of statistically significant differences between all pre and post measurements concerning the inclination of female players towards the left side and forward. The calculated t-test values for these measurements ranged from 2.33 (the lowest value observed for the maximum right inclination) to 15.46 (the

maximum value observed for the maximum left inclination). Importantly, all calculated t-test values exceeded the critical value of T-table, indicating the presence of statistically significant differences.

However, it is important to note that there were no statistically significant differences observed in the variables of average backward inclination and maximum backward inclination, with respective t-test values of 1 and 1.21. These values were both lower than the critical value of T-table, suggesting that the training program did not significantly impact these variables. It should be acknowledged that the primary focus of the training program was not specifically on improving the backward inclination.

Furthermore, the analysis revealed statistically significant differences in the record numbers of clean reception and snatch catching, with corresponding t-test values of 11.10 and 9.85, respectively. These values exceeded the critical value of T-table, providing strong evidence for the significant impact of the training program on the participants' performance outcomes in these specific weightlifting exercises.

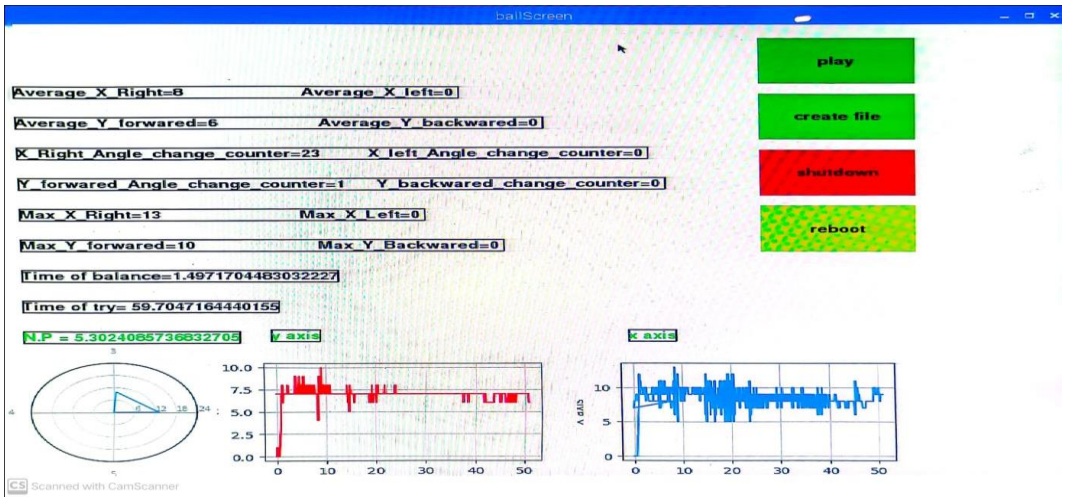

Figure3. An example of one of the primary measurements from the group 1

Figure (3) illustrate, one of the initial measurements of the first group, the main problem of this group was concentrated in the tendency of the players to the right and forward side, explaining that tendency that the player always tends towards the stronger side trying to involve it the performance more, which negatively effects on balance during the performance and then attempts fail.

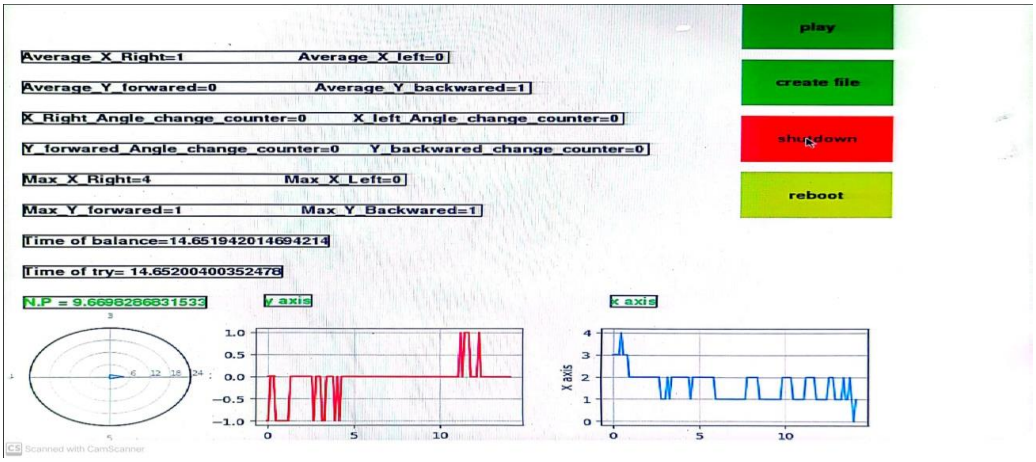

Figure4. An example of one of the post-measurements from the group 1

Figure (4) shows the indicators of the post-measurements for a member of the first group sample, and it shows a significant improvement in the inclination degrees, with an average inclination to the right side of 1 degree and 4 degrees as the maximum inclination degree to the right side, as well as an improvement in the inclination forward and backward, which indicates higher control over weight and greater balance during performance This is reflected in the score of the N indicator of balance, which reached 9.67 degrees.

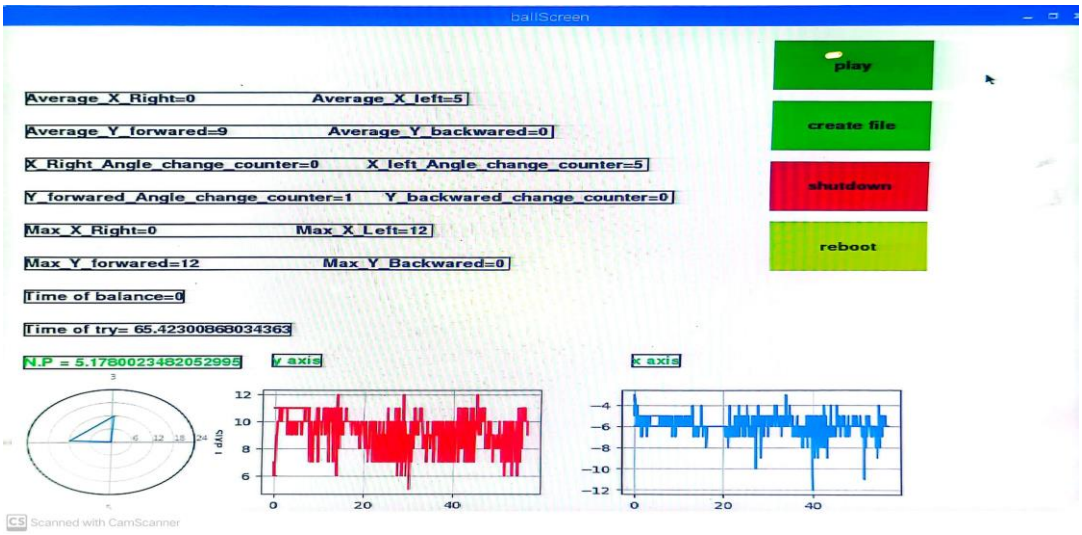

Figure 5. An example of one of the primary measurements from the group 2

Figure (5) shows one of the primary measurements of the second group, which confirms the concentration of the players' inclination to the left side and forward, explaining that tendency that the player always tends towards the stronger side to try to involve it in the performance more,

which negatively affects the balance during the performance and then the failure of the attempts.

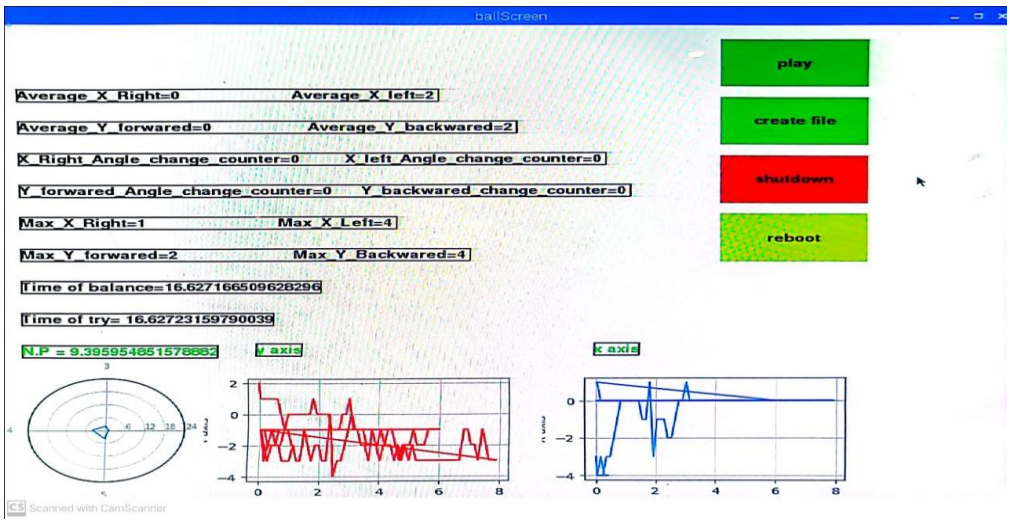

Figure 6. An example of one of the post-measurements from the group 2

Figure (6) shows the indicators of the post-measurements for a member of the second group sample, and it shows a significant improvement in the inclination degrees, with an average inclination to the left side of 2 degrees and 4 degrees as the maximum inclination degree to the left side, as well as an improvement in the angles of inclination forward and backward, which indicates higher control over weight and greater balance during performance This is reflected in the score of the N indicator of balance, which reached 9.39 degrees.

Discussion

Discuss the results of the first group

Table 2 presents compelling evidence regarding the significance of the differences between the pre and post measurements of the first group, characterized by a tendency to lean towards the right side and forward. The table reveals noteworthy changes in the inclination patterns of the participants, indicating the effectiveness of the training program.

Prior to the training program, the average degrees of inclination towards the right side were measured at 10.62 ± 2.02. However, following the implementation of the program, this average significantly decreased to 1.46 ± 0.76. This substantial decrease in the inclination percentage signifies a remarkable improvement in achieving balance between both sides, with a change rate of -86.23%. These findings highlight the successful outcome of

the training program, which focused on enhancing muscular strength exercises specifically for the left leg.

Furthermore, the maximum degrees of inclination towards the right side exhibited notable changes as well. Initially, the measurements indicated an average value of 12.85 ± 1.91. However, after the training program, this average value decreased significantly to 3.31 ± 0.83, resulting in an improvement rate of -74.25%. This improvement in the maximum degrees of inclination towards the right side further supports the notion that the training program effectively targeted and addressed the imbalance observed in the participants' inclination patterns.

The findings presented in Table 3 demonstrate the positive impact of the training program on the first group, leading to a significant reduction in inclination towards the right side and forward. This improvement can be attributed to the emphasis placed on strengthening exercises for the left leg throughout the training program. These results contribute to our understanding of how directed training interventions can effectively address and rectify imbalances in inclination patterns, ultimately promoting better balance, stability, and performance outcomes in weightlifting.

In Table 2, significant changes in inclination patterns and performance outcomes are observed, indicating the effectiveness of the training program. The average inclination to the left side increased from 0 to 0.46 ± 0.05, suggesting that female players who previously lacked focus on the left side started relying on it (the left leg) significantly. This shift towards the left side signifies a restoration of balance in performance, as reflected in the change in the maximum degree of inclination to the left from 0 to 1.23 ± 1.42.

Regarding the average forward inclination during performance, it decreased from 8.46 ± 1.22 to 2.16 ± 0.95, representing a change of -74.46%. This reduction indicates that players initially experienced a lack of muscle strength in the back muscles. However, through targeted training, including exercises such as lying down and extending the torso backward to the maximum degree using the arms, balance and resistance distribution between the front and back sides were achieved (corresponding to straightening the torso under the bar). Similarly, the maximum forward inclination also improved significantly, decreasing from 12.69 ± 1.81 to 3.69 ± 1.26, with an improvement rate of -70.91%. This demonstrates the

program's success in addressing forward inclination and achieving balanced performance.

Analyzing the results of the N index of balance, which incorporates measurements and attempt duration, it is evident that the balance rate increased from 4.35 ± 0.81 to 8.24 ± 0.91, indicating a substantial improvement in maintaining the center of gravity during performance. Notably, the maximum degree representing complete balance increased from 10 degrees to an average of 8.24, with an improvement rate of 89.80%. This enhancement in balance underscores the improved ability of female players to stabilize their bodies on the kicking base, leading to increased overall balance.

Moreover, Table 2 reveals a significant increase in the weight lifted during successful attempts in the clean and snatch. The clean weight improved from 59.62 ± 7.71 to 71.85 ± 8.40, indicating a 20.52% improvement. Similarly, for the snatch, the weight increased from 38.08 ± 6.37 to 49.69 ± 7.16, representing an estimated improvement of 30.51%. These improvements in record levels can be attributed to the players' enhanced balance maintenance during performance and their ability to distribute resistance evenly between the right and left sides (right and left leg) and the front and back (abdomen and back). These findings align with previous research by **Christ, F. L. et al, (1995)** and **Storey, A., & Smith, H. K. (2012),** emphasizing the influence of balance and muscular strength on the technical and numerical performance of classical lifts\

Discuss the results of the second group

In Table 3, the significance of the differences between the pre- and post-measurements of the second group, characterized by leaning to the left side and forward, is demonstrated. The average degrees of inclination to the left side in the pre-measurement were 8.91 ± 1.73, and following the application of the training program, it decreased to 1.65 ± 0.5, indicating a change of -81.48%. This improvement can be attributed to the training program's focus on enhancing muscular strength in the right leg. Similarly, the extreme left inclination decreased from 13.45 ± 1.62 to 2.45 ± 0.78, with an improvement rate of -81.78%.

Furthermore, Table 3 reveals that the average inclination towards the right side changed from 0 to 0.36 ± 0.48. This indicates that certain individuals in the sample shifted their full concentration from the left side to a significant reliance on the right side (the right leg). This change

signifies the restoration of balance in performance, as reflected in the modification of the maximum degree of inclination to the right side from 0 to 0.82 ± 1.11.

Regarding the average forward inclination, it decreased from 9.73 ± 1.64 to 3.18 ± 2.95, at a rate of -67.29%. This suggests that female players initially lacked muscle strength in the back muscles. However, through targeted training, including abdominal stretching exercises such as the bridge exercise, performance balance and resistance distribution between the front and back sides (straightening the torso under the bar) were achieved. Similarly, the maximum forward inclination was also affected, decreasing from 13.64 ± 1.34 to 4.82 ± 3.43, with an improvement rate of -64.67%. This confirms the program's success in improving torso straightening and, consequently, balances.

Remarkable progress is observed in the results of the N balance index, which incorporates measurements and attempt duration. The balance rate increased from 5.02 ± 0.52 to 8.45 ± 1.32 (with a maximum score of 10 degrees), reflecting a 68.21% improvement. This signifies an enhanced ability for female players to maintain balance during performance.

Additionally, Table 3 highlights a significant increase in the weights lifted during successful attempts in the clean and snatch. The clean weight improved from 72.73 ± 8.091 to 88 ± 8.94, with a rate of improvement of 21%. Similarly, for the snatch, the weight increased from 49.55 ± 7.82 to 67.36 ± 9.49, representing an estimated improvement of 35.96%. These improvements in record levels are attributed to the players' enhanced balance maintenance during performance and their ability to distribute resistance evenly between the right and left sides (right and left leg) and the front and back (abdomen and back). These findings align with previous research by **Hassen, A. A. A. (2020)** and **Kang, Knuttgen, H. G. (2007)** on the influence of both balance and muscle strength on the technical performance of lifts and, consequently, the players' record level development.

Conclusions

We can summarize the study's conclusions as follows:

1. Balance plays a significant role in determining the record level of snatch and clean.

2. The findings validate the use of balance semantics as a valuable guide for designing muscular strength exercises. Incorporating balance-focused training can contribute to improved performance outcomes.

Recommendations:

1. Based on the study's results, it is recommended that trainers and coaches consider balance and its associated indicators as a fundamental aspect when designing strength training programs for athletes. By incorporating exercises that enhance balance, athletes can optimize their overall performance.
2. The research outcomes suggest the importance of generalizing the study's findings and assessing their impact on athletes in other sports. Conducting similar investigations across different sporting disciplines would provide valuable insights into the broader applicability and effectiveness of balance-focused training methods.

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