Training According To Pro-Split System And Its Effect On Some Biochemical Indicators, Maximum Strength, And Clean And Jerk Performance For Advanced Weightlifters

Wissam Yasseen Burhan[1], Majid Abdul Hameed Rasheed[2]

[1]Open Education College, Iraq.

[2]Faculty of Physical Education and Sports Sciences, Al-Qadisiyah University, Iraq.

Wisamyaseen1980@gmail.com

Abstract
This study aimed to identify the changes caused by Pro-Split training in certain biochemical indicators, maximum strength, and clean and jerk performance among advanced weightlifters. The researchers employed an experimental design with two equivalent groups using pre- and post-testing. The study population consisted of ten advanced weightlifters from Al-Rafidain Sports Club. After ensuring homogeneity and equivalence of variables to eliminate any external influence on the independent variable, the participants were divided into two groups: a control group and an experimental group of five weightlifters each. The researchers then implemented the Pro-Split training system to observe its effects on biochemical indicators, maximum strength, and clean and jerk performance. The training program lasted eight weeks, with three training sessions per week. The most significant finding was that Pro-Split training targeted the muscles from all angles and aspects, thereby enhancing coordination and synergy among the muscles involved in the exercise.The study concluded that Pro-Split training targeted the muscles from all angles and aspects, leading to improved coordination and synergy among the muscles involved in the exercise.
Keywords: **Pro-Split, biochemical , Maximum Strength, clean and jerk Lift**

Introduction

The diversity of training methods is of great importance in training various sports. This diversity is a healthy approach to overcoming stagnation in achieving the athletic goals set by coaches. Many training methods and techniques are used, especially in strength training, which is a fundamental component of many physical attributes and skill performances, as many movements rely on muscular strength. One such method is the Pro-Split system, which focuses on training each major muscle

group individually on a single day, unlike training multiple muscles in one day. Therefore, it requires training sessions corresponding to the number of muscle groups targeted for development. For example, the first day might focus on leg muscles only, the second day on shoulder muscles only, the third day on back muscles only, and so on. The researchers believe this method is suitable for weightlifters.

Since weightlifting is a sport that relies heavily on muscular strength, especially maximum strength in lifting heavy weights, the clean and jerk is one of the two lifts in the weightlifting routine (the snatch and the clean and jerk). The clean and jerk is performed in two parts: the clean, which is done by bending the legs (squat), and the jerk, in which the weight is lifted from the chest to the top in one continuous motion with the legs extended (Jamil Hanna). Therefore, significant muscular strength is required to lift heavy weights. This necessitates improving physical fitness, particularly specific physical attributes. Due to advancements in training methods and techniques that focus on precise details to achieve peak physical and technical performance, the Pro-Split system is considered by many champions to be among the best strength training systems. Both beginners and professionals can use this system, as it works each muscle separately. This allows the brain and nerve cells in the muscles to concentrate on only one muscle at a time. Training Unit (see /https://liftvault.com/programs/bodybuilding/bro-split-workout-routine)

Therefore, the researchers believe that when providing the basic exercise in a training session, it is best to focus on only one muscle group to protect the weightlifter from strain, fatigue, and muscle injuries, given that they are dealing with heavy weights and repetitions. The researchers aim to understand the impact of this system on biochemical indicators to provide a clear picture of the weightlifter's training status and the effect of the Pro-Split method on testosterone, growth hormone, and CPK enzyme concentration. These hormones have a significant impact, reflecting the weightlifter's functional state and physical capabilities, in addition to developing the maximum strength of the muscles involved in the performance. This has a positive impact on performance development. For this reason, the researchers opted to use the Pro-Split method, which focuses on training one muscle group per day, unlike most coaches who train multiple muscles in a single training session, which can cause fatigue or muscle injuries. Hence, the importance of this research lies in using different methods that serve the functional and physical aspects of weightlifting in order to understand the true nature of this method and its impact on biochemical indicators, maximum strength, and the performance of advanced weightlifters in the clean and jerk.

This is where the importance of this research lies: using different methods that serve the functional and physical aspects of weightlifting to reach a true understanding of this method and its impact on biochemical indicators, maximum strength, and the performance of advanced weightlifters in the clean and jerk.
Research objective is to identify the effect of training according to the Pro-Split system on some biochemical indicators, maximum strength and achievement in the clean and jerk lift for advanced weightlifters.

Method and Procedures

The researchers used the experimental method with two equivalent groups. The research population was defined as weightlifters from Al-Rafidain Sports Club in Al-Diwaniyah Governorate, numbering (10) weightlifters. The mean calculated weight and its deviations were (70.21 ± 12.8), while their biological age was (20.5 ± 3.37), and their training age was (4.25 ± 1.5). To eliminate the effect of weight on the independent variable, since the sample consisted of different weight categories, relative power was used in the statistical treatments. The sample was divided into two groups, a control group and an experimental group, with an equal number of (5) weightlifters in each group. Then, the equivalence of the two research groups was conducted for the study variables, as shown in Table (1). The (Sig.) value was greater than (0.05), which indicates that the two groups are equivalent in the research variables.

Table 1. equivalence of the two groups in the studied variables.

Variables	Measuring unit	Control group		Experimental group		Calculated T value	Level Sig.
		Mean	St.d	Mean	St.d		
TEST	ng/ml	3.334	0.414	3.020	0.344	1.50	0.172
HGH	ng/ml	2.602	0.435	2.740	0.527	1.25	0.248
CPK	U/L	136.800	4.817	138.800	3.834	1.48	0.178
maximum Strength	Relative	1.234	0.059	1.226	0.094	0.23	0.828
	kg	86.400	4.159	85.800	6.573		
Achievement	Relative	1.320	0.073	1.306	0.071	0.94	0.374
	kg	92.400	5.128	91.400	4.980		

Table (1) shows the equivalence between the control and experimental groups in the study variables (testosterone, growth hormone, creatine phosphokinase, maximum strength, and performance), where the p-value (Sig) was greater than the margin of error (0.05), indicating the equivalence of the two groups in the dependent variables.

Measurements Observed

1- Method for Measuring Biochemical Variables: A blood sample of (5 ml) was taken from each weightlifter after the required measurements were performed with the assistance of a chemist specializing in this field, working at the Gulf Laboratory in Diwaniyah. The samples were collected in individual tubes for each weightlifter, labeled with all relevant information. The samples were then analyzed to extract the following biochemical variables:

- Testosterone (TEST)

- Growth Hormone (HGH)
- Creatine Phosphokinase (CPK)

2- Method for Measuring Maximum Strength (Stationary Clean and Lift): The barbell is placed in the last quadrant of the thigh so that it touches the thigh. The weightlifter then begins to pull the barbell until it reaches its maximum range of motion. Afterward, the elbows are rotated rapidly so that the barbell rests on the clavicles and shoulders. (Ahmed Munim Ajami)

3- Performing the Clean and Jerk: The performance is performed in a seated clean and jerk with the knees fully bent, then standing and lifting the barbell with arms extended and legs apart, followed by full extension of the body until a signal is heard. The ruling is to lower the weight without throwing it. Each player is given only three attempts, and the highest successful lift is counted for him in the evaluation (Mansour Jamil Al-Anbaki et al. 1990), as shown in the following figure:

Figure (1) Show the kinetic sequence of the clean and jerk lift.

Main Experiment

After conducting a pilot study on January 20-21, 2025, at 2:00 PM on a sample of two weightlifters, the aim was to determine the validity of the tests, the time taken, and any potential drawbacks. The second day was dedicated to identifying the maximum intensity of the exercises. Following this, pre-tests were conducted for the weightlifters in the weightlifting hall at Al-Rafidain Sports Club in Al-Diwaniyah Governorate on Tuesday and Wednesday, January 28-29, 2025, at 2:00 PM on the research sample. Subsequently, training was carried out according to the Pro-Split system for the weightlifters' main muscle groups (legs, trunk, and arms) from Saturday, February 1, 2025, to Wednesday, March 26, 2025. The number of training sessions totaled (24) units over (8) weeks, with (3) training sessions per week on Saturdays, Mondays, and Wednesdays for the experimental group, while the control group continued with the coach's program. The training period was during the special preparation and included exercises that were part of the main section of the unit after the technical performance exercises for the clean and jerk. The Pro-Split training was based on strength exercises that target one muscle and focus on it well and develop it from all angles and with an intensity of (70-90%) and the number of exercises ranging from (4-5) exercises in sets of (4) and with repetitions of (8-12) repetitions during one training unit per week to ensure the muscle recovery process and protein synthesis within the muscle to increase strength.

This applies to the targeted muscles (legs, trunk and arms), i.e., three days a week. After the end of the training period, the post-test was conducted with the same variables that were conducted in the pre-test, taking into account the same conditions. It was on Saturday and Sunday, March 29-30, 2025, at two o'clock in the afternoon, on the research sample. This is a model of a training unit for the research sample, the experimental group.

Table 2. model of a training unit for the research sample, the experimental group.

Section	Time	Exercise	Exercise intensity	Training volume		Rest between groups	Rest between exercises
				Rep.	Sets		
Main	60 minutes	Front squat	70%	10	3	3 minutes	5 minutes
		Back squat		10	3		
		Shin curls		12	3		
		Triceps curls		12	3		
		Calf		12	3		

The division of muscle groups is based on the days of the week, and they are trained on a day dedicated to each muscle, with multiple exercises and at different angles, according to the following table (3).

Table 3. division of muscle groups is based on the days of the week, and they are trained on a day dedicated to each muscle

Days of week	Targeted muscle:
Saturday	Legs
Monday	Back
Wednesday	Arms

Results

Table 4. differences in the study variables in pre-test and post-test for control group

Variables	Measuring unit	Pre		Post		Calculated T value	Level Sig.
		Mean	St.d	Mean	St.d		
TEST	ng/ml	3.334	0.414	3.960	0.688	2.89	0.045
HGH	ng/ml	2.602	0.435	2.800	0.453	3.32	0.029
CPK	U/L	136.800	4.817	151.600	5.941	8.00	0.001
Max	Relative	1.234	0.059	1.314	0.039	4.10	0.015

Variables	Measuring unit	Mean	St.d	Mean	St.d		
Strength	kg	86.400	4.159	92.000	2.739		
Achievement	Relative	1.320	0.073	1.389	0.037	3.16	0.034
	kg	92.400	5.128	97.200	2.588		

The significance of the variables is determined when the Sig value is less than (0.05).

Table 5. differences in the study variables in pre-test and post-test for experimental group.

Variables	Measuring unit	Pre		Post		Calculated T value	Level Sig.
		Mean	St.d	Mean	St.d		
TEST	ng/ml	3.020	0.344	5.040	0.365	7.96	0.001
HGH	ng/ml	2.740	0.527	3.500	0.354	2.84	0.047
CPK	U/L	138.800	3.834	160.400	3.647	9.24	0.001
Max Strength	Relative	1.226	0.094	1.371	0.060	3.55	0.024
	kg	85.800	6.573	96.000	4.183		
Achievement	Relative	1.306	0.071	1.457	0.078	10.87	0.000
	kg	91.400	4.980	102.000	5.431		

The significance of variables is determined when the Sig value is less than (0.05).

Table 6. differences in study variables in post-test for control and experimental groups.

Variables	Measuring unit	Control group		Experimental group		Calculated T value	Level Sig.
		Mean	St.d	Mean	St.d		
TEST	ng/ml	3.960	0.688	5.040	0.365	2.42	0.042
HGH	ng/ml	2.800	0.453	3.500	0.354	1.80	0.109
CPK	U/L	151.600	5.941	160.400	3.647	2.72	0.026
Max Strength	Relative	1.314	0.039	1.371	0.060	3.04	0.016
	kg	92.000	2.739	96.000	4.183		
Achievement	Relative	1.389	0.037	1.457	0.078	2.72	0.026
	kg	97.200	2.588	102.000	5.431		

The significance of the variables when the Sig value is less than (0.05)
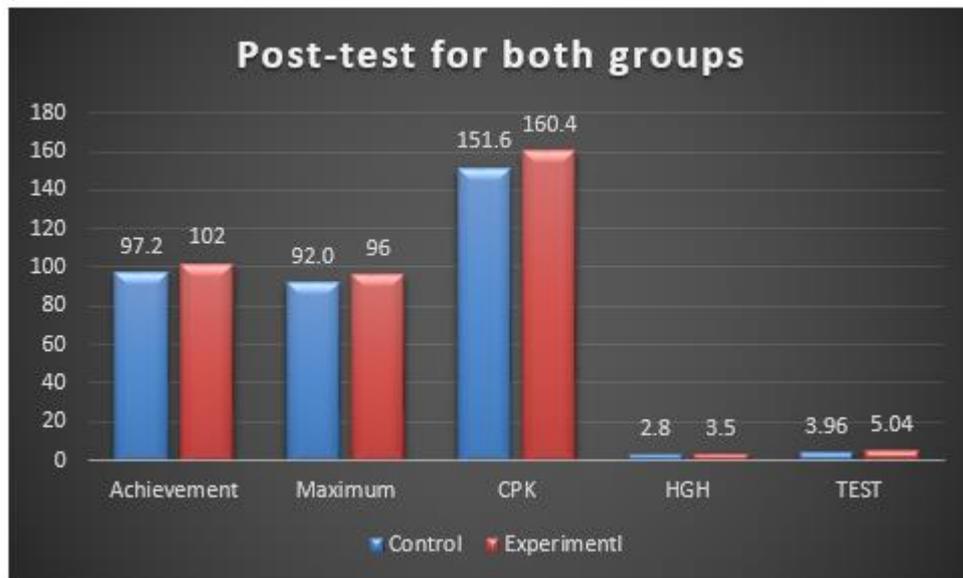
Figure (2) show the differences in the study variables in the post-test for the control and experimental groups.

Discussion

From the above tables (4, 5, 6), it is evident that both the control and experimental groups achieved significant results in all study variables, favoring the post-test. This indicates that the training program developed by the researcher and coach achieved the desired goal of the study. This is attributed to the training loads, the regular training program, and adherence to training times for this age group. This aligns with Fatouh (1992), who stated that "regularity in the training program leads to certain biochemical changes in the body's systems as a manifestation of adaptation to the nature of the activity" (Karima Ahmed Fattouh. 1992). Furthermore, the increase in biochemical indicators is considered a positive indicator of the weightlifters' training status, which positively affected the increase in maximum strength and performance in the clean and jerk. This demonstrates the success of the coach and researcher in developing exercises that target the muscles involved in the performance more extensively, thus increasing the number of active kinetic units.

As "Using exercises whose nature of execution aligns with the general form of performing specialized skills leads to better results in strength gain" (Abu Al-Ala Ahmed Abdel Fattah and Ahmed Nasr El-Din. 1993). Continuity in training is also crucial. Over a period of eight weeks, significant biochemical and physical changes can occur due to practice, repetition, and high training loads. This is because effective weightlifting requires lifting heavy weights to maximize athletic performance. This aligns with statement that "a training program can induce changes and adaptations, especially if it exceeds six weeks" (Abdullah Hussein Al-Lami. 2010).

Table (6) illustrates the differences between the control and experimental groups in the post-test for the study variables. Significant differences were found in all variables, favoring the experimental group, except for the growth hormone (HGH)

variable. The researcher attributes this to the significant role of Pro-Split training, which has a strong effect on increasing muscle strength.

This system divides muscle groups according to the days of training, with each muscle being trained on a separate day, focusing on the targeted muscle from all angles and aspects in a scientifically sound manner, taking into account the muscle's anatomical position. Appropriate training intensity, volume, and rest periods are also considered. Table (6) shows an increase in testosterone (TEST) levels because of Pro-Split training. This system stimulates muscle fibers by focusing on one muscle group from different angles each day, which in turn activates the glands responsible for producing testosterone.

This positively increases muscle strength and enhances the weightlifter's masculine characteristics. It was also found that the intensity of the training significantly affects the hormonal response, with high-intensity training having a strong effect on the hormone. Testosterone (B. H. Opaszowski and K. Busko. 2003)

As for growth hormone (HGH), there was a slight improvement in favor of the experimental group, but it did not reach statistical significance, so the differences between the two groups (control and experimental) were not significant. However, the CPK enzyme, which is responsible for energy production according to the phosphagen system that requires the release of a large amount of energy during muscle contractions, increases the concentration of the CPK enzyme.

This occurred more than in the experimental group and this is consistent with, who confirmed that the percentage of CPK in the blood increases by (3-4) times the normal level in athletes during physical exertion (Adirix H. G. Nutthen. 1988). Meanwhile, the variables of strength and performance in the clean and jerk improved significantly in favor of the experimental group in the post-test. The researcher attributes this to the fact that training the muscle from all angles and directions and focusing on it during the training session according to the Pro-Split system greatly increased strength production. This increase in strength gave the experimental group an advantage in lifting heavy weights and achieving performance in the clean and jerk compared to the control group.

The degree of coordination between the muscles involved in the exercise (kinetic, antagonist, and stabilizer) plays a significant role in producing muscle strength. Muscle strength increases when the degree of coordination and synergy between muscle movements increases (Saad Nafie Ali Al-Dulaimi et al. 2024).

Conclusions

Training using the Pro-Split system targeted the muscle from all sides and angles, thus increasing coordination and synergy between the muscles involved in the exercise. High-load training using the Pro-Split system increased the concentrations of biochemical variables, giving the experimental group an advantage over the control group. The increase in muscle strength and the levels of testosterone and CPK

positively affected the ability of the experimental group to lift heavier weights, leading to improved performance.

References:

1- Abu Al-Ala Ahmed Abdel Fattah and Ahmed Nasr El-Din. 1993. Physiology of Physical Fitness, Cairo, Dar Al-Fikr Al-Arabi.

2- Ahmed Munim Ajami: The Effect of Compensatory Acceleration Training (CAT) on Some Forms of Strength, Biochemical Indicators, and Performance of Young Weightlifters, Master's Thesis, University of Wasit, College of Physical Education and Sports Sciences

3- Jamil Hanna: International Laws and Regulations for Weightlifting, Arab Weightlifting Federation (2005-2008)

4- Saad Nafie Ali Al-Dulaimi et al. 2024. The Technical and Mechanical Foundations of Weightlifting, 1st ed., Dar Al-Sadiq Cultural Foundation, Babylon.

5- Abdullah Hussein Al-Lami. 2010. Sports Training, Najaf, Dar Al-Dhiyaa for Printing and Design.

6- Karima Ahmed Fattouh. 1992. The Relationship between Physical Efficiency and Some Physiological Characteristics of Swimming Practices in Kuwait, Journal of Studies and Research Faculty of Physical Education, Helwan University.

7- Mansour Jamil Al-Anbaki et al. 1990. Theoretical and Practical Foundations of Weightlifting, Baghdad.

8- Adirix H. G. Nutthen. 1988. The Dynamic Book of Sport Medicine, (Illustrated, Oxford)

9- B. H. Opaszowski and K. Busko. 2003. Plasma Growth Hormone, Cortisol and Testosterone Responses to Repeated and Intermittent Pedaling Rates.

10- https://liftvault.com/programs/bodybuilding/bro-split-workout-routine