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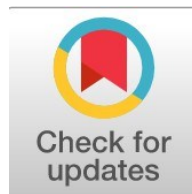
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Whey Protein Group Shows Higher Muscle Coordination Scores During Bodybuilding Training

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Abstract

General Background: Bodybuilding development depends on structured resistance exercise and appropriate nutritional intake tailored to athletes' physical characteristics and training experience. **Specific Background:** Nutritional supplements are widely incorporated into bodybuilding programs, but their use must correspond with body weight, physical capacity, and training age to support targeted muscular development. **Knowledge Gap:** Comparative evidence remains limited regarding muscular development produced by selected exercises combined with whey protein or amino acid supplementation among young bodybuilders. **Aims:** This study develops a selected exercise program incorporating two supplements and compares muscular development between two experimental groups. **Results:** An experimental equivalent-group pretest–post-test design was applied to 20 randomly selected male bodybuilders aged 18–21 years from a population of 60 athletes in Najaf Governorate. Participants completed 30 sessions over five training days per week. One group received whey protein, whereas the other received amino acids, with quantities adjusted to athletes' characteristics and administered around training sessions. Both groups demonstrated post-test development in assessed body regions. The amino acid group recorded significant pretest–post-test differences in the pectoralis major, lateral deltoid, and biceps brachii. Comparative post-test findings indicated superior values for the group receiving whey protein across the targeted regions, including the chest, shoulder, arm, oblique, and abdominal areas. **Novelty:** The study combines a structured exercise schedule with a direct comparison of two supplement protocols using judge-rated muscular coordination. **Implications:** Supplement programs should be designed according to individual needs and implemented under qualified professional supervision to reduce inappropriate use and support balanced muscular development.

Highlights:

- Both experimental groups improved after thirty structured training sessions.
- The first supplement group achieved superior post-test scores across targeted body regions.
- Dosages should correspond with athletes' weight, capacity, and training experience.

Keywords: Integration, Exercises, Nutrition, Supplements

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1. Introduction

The rapid revolution in information and technology that our world is witnessing, especially in individual and team sports since their inception, continues to drive research into various methods and techniques for achieving the highest level of performance and keeping pace with developments to attain first place. This comes from continuous training, professional development, and raising the level of physical fitness.

Painting a picture on paper or a wall, or engraving on stone, is not the same as painting or engraving a picture on a living, moving body with feelings and emotions the human body. This requires extreme precision and extensive training expertise. Bodybuilding is one of the individual sports that has kept pace with progress and development compared to other individual sports in terms of changes in the form and rules of the game. It is well known that bodybuilding depends, in addition to exercise, on the type and nature of food [1]. Therefore, most bodybuilders resort to taking nutritional supplements with relatively high protein content to meet muscle needs and achieve the required growth [2]. The importance of this research lies in attempting to. The selected exercises were made more effective when combined with two types of nutritional supplements. The study also investigated which of the two supplements was more effective in developing muscle growth in the targeted muscles, especially since supplements have become an integral part of modern bodybuilding training programs.

Research Problem

As a bodybuilder with continuous experience in gyms, fitness centers, and bodybuilding studios, and through his direct supervision of elite young athletes, the researcher observed a weakness in the effectiveness of nutritional supplements as an aid to muscle growth. This weakness stemmed from the athletes' efforts in performing the exercises according to the appropriate dosages (scoops) of the supplements, taking into account the athletes' physical capabilities, weight, and training duration. The goal was to achieve optimal benefit from the supplements.

Research Objectives

1. To develop selected exercises using the two nutritional supplements to enhance muscle growth in specific muscles among young athletes in the two experimental groups of the research sample.
2. To determine the extent to which the selected exercises, based on the use of the two nutritional supplements, affect the development of muscle

growth in certain muscles among young athletes in both experimental groups.

Research Hypotheses

1. The selected exercises, based on the use of the two nutritional supplements, have a positive effect on the development of muscle growth in certain muscles among the young athletes in the research sample in both experimental groups.
2. There is a higher statistical significance for one of the nutritional supplements in developing muscle growth among the young athletes in one of the experimental groups.

Research Scope

1. Human Scope: Young bodybuilders in Najaf Governorate.
2. Time Scope: From November 1, 2025, to March 15, 2026.
3. Spatial Scope: Al-Mustaqbal Institute for Fitness and Bodybuilding and the Fitness Hall of the College of Physical Education and Sports Sciences at the University of Kufa.

2. Research Methodology and Field Procedures

Research Methodology

The nature of the problem the researcher intends to study is one of the most important determinants of the research methodology used. The aim is to arrive at the best results based on scientific principles that contribute to achieving the objectives. Therefore, the researcher chose the experimental method with a two-group equivalent design using pre- and post-tests, as it is suitable for the nature of the research problem.

Research Population and Sample

The population in this research was defined as young male bodybuilders aged 18-21 years in the Najaf Governorate, totaling (60) athletes.

As for the sample, since it is "the group that is examined or monitored and on which the experiment is conducted, and it may consist of one or more individuals" [3, p. 114], the researcher selected the sample randomly by drawing lots from the original research population, which consists of (20) athletes. All members of the sample will undergo the tests that the researcher will conduct as part of the research procedures.

Sample Homogeneity and Equivalence of the Research Groups

To control variables affecting the research results, and before conducting the tests, the researcher verified the homogeneity of the groups for all members of the research sample using certain variables related to anthropometric measurements such as (height, weight, and training age), as shown in the table below:

Table 1. Show variables Unit of Measurement Mean Standard Deviation
Median Skewness Coefficient

Variables	Units	Mean	Std	Median	Skewness
Length	Cm	166.8	2.7	165.6	0.85
Weight	Kg	67.13	4.3	65.75	0.95
Training age	Months	24.6	5.92	23.12	0.314

From observing the results of the data in the previous table, it becomes clear to us that the values of the skewness coefficient are specified between (+1, -1), which indicates the homogeneity of the research sample of young players with those variables that were measured, which are influential in one way or another on the physical capabilities of those players [4].

Research Methods, Equipment, and Tools

The methods used by the researcher to collect data and information can be summarized as follows:

- Observation.
- Personal interviews.
- Tests and measurements.
- Arabic sources and the internet.
- Dell laptop.
- Canon video cameras (1).
- Electrical medical scale (1).
- Multigym (1).
- Shift (2).
- Smith scale (1).
- Level platform (1).
- Back platform (1).
- Abdominal platform (1).
- Weights in the form of 5 kg, 10 kg, and 15 kg discs.

Field Research Procedures

How to Assess Muscle Coordination

By utilizing the expertise of four judges, the researcher was able to assess the level of muscle coordination among the players in all the tests administered to the research sample in both groups. Muscle coordination here refers to the players' execution of a series of body positions that highlight the coordination of the muscles targeted in this study. This performance was recorded on video to allow the judges to assign an appropriate score to each player based on their assessment of the coordination achieved [5]. The researcher notes that the evaluation form contains 10 points, divided from 1 to 10. The four scores are then added together and divided by 4 to obtain the mean (average score) [6].

Pre-Test

After familiarizing the players with the body positions that highlight the muscles targeted in the study, the researcher conducted a pre-test to assess their level of muscle coordination. This involved recording all participants and presenting the results to a panel of judges to determine the appropriate score for evaluating the level of coordination of the muscles under study. This will take place at 4:00 PM on Friday, December 4, 2025, at the Future Institute for Fitness and Bodybuilding.

Application for Selected Exercises

The total number of training sessions is (30), with (5) training sessions per week. Training takes place on Saturdays, Sundays, and Mondays, with Tuesdays designated as active rest days for working other muscle groups. Training then resumes on Wednesdays and Thursdays, with Fridays designated as passive rest days. This pattern continues for the remaining weeks.

The selected exercises were developed by the researcher after receiving feedback and suggestions from experts, specialists, and coaches who were interviewed. It was also taken into consideration that these exercises are suitable for the abilities and weights of the athletes in the research sample [7].

Under the direct supervision of the researcher, the selected exercises were implemented on the two experimental groups within the specified timeframe. Regarding the dosage of the two nutritional supplements used, they were administered in specific amounts designed by the researcher based on his experience in determining their suitability for the athletes' weights and fitness levels. The same quantity of each supplement was used, but each supplement was administered to a specific experimental group. One amount was given before exercise and another after [8]. On rest days, a smaller amount was

given only once. This design allowed the researcher to determine which supplement resulted in a clearer and more balanced development of the muscles under study.

Post-Test

To assess the levels achieved by the research sample after completing the selected exercises, the researcher conducted post-tests of muscle coordination at 4:00 PM on Friday, February 5, 2026, at the Future Institute for Fitness and Bodybuilding. The researcher ensured that the same conditions and body positions were maintained for the pre-test, and that the same judging panel was used.

The same panel of judges used in the pre-test was also employed.

Statistical Methods Used in Research

The researcher used the SPSS statistical package with the following statistical methods:

1. Mean.
2. Standard Deviation.
3. Media.
4. Credit Coefficient.
5. T-test for paired samples.
6. T-test for independent samples.

3. Results

Presentation, Analysis, and Discussion of Results

Presentation and Discussion of Results for the Muscle Coordination Test of the Two Experimental Groups in the Pretest.

Table 2. Shows the means, standard deviations, and calculated and tabulated t-values for the muscle coordination test of the two experimental groups in the pretest

Muscles	First experiment al group (pre-test)	Second experiment al group (pre-test)	T value (independent)	Type of indicati on
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	Mean	Std	Mean	Std	Calculated	Tabulation at a significance level of 0.05
Pectoral muscle	4.5	0.41	4.2	0.33	0.772	Non-Sig.
Lateral deltoid of the shoulder	4.6	0.3	4.7	0.31	0.657	Non-Sig.
Biceps brachii	4.4	0.37	4.6	0.35	0.665	2.1 Non-Sig.
Three-headed	4.6	0.34	4.5	0.32	0.723	Non-Sig.
Square oblique	4.7	0.31	4.6	0.3	0.655	Non-Sig.
Abdominal muscles	4.5	0.33	4.6	0.36	0.633	Non-Sig.

By observing the results of the previous table of means and standard deviations obtained in the pre-test, we find that the individuals in the research sample in the two experimental groups are equivalent in these variables [9].

Presentation and discussion of the results of the muscle coordination test for the two experimental groups in the pretest.

Table 3. The following table shows the means, standard deviations, and calculated and tabulated t-values for the muscle coordination test of the two experimental groups in the pre-test. Experimental Group 1 (post-test) $\Delta\epsilon$ Experimental Group 2 (post-test) $\Delta\epsilon$ the calculated (independent) t-value is tabulated at a significance level of 0.05

Muscles	First experiment al group (post-test)	Second experiment al group (post-test)	T value (independent)	Type of indication
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	Mean	Std	Mean	Std	Calculated	Tabulation at a significance level of 0.05
Pectoral muscle	4.7	0.43	4.5	0.35	0.775	Non-Sig.
Lateral deltoid of the shoulder	4.6	0.3	4.7	0.31	0.657	Non-Sig.
Biceps brachii	4.8	0.41	4.9	0.39	0.669	2.1 Non-Sig.
Three-headed	4.6	0.34	4.5	0.32	0.723	Non-Sig.
Square oblique	4.8	0.32	4.7	0.4	0.656	Non-Sig.
Abdominal muscles	4.5	0.33	4.6	0.36	0.633	Non-Sig.

By observing the results of the previous table of values of means, standard deviations and the calculated and tabulated (t) value obtained in the pre- and post-tests, we find that the members of the research sample in the first experimental group have achieved remarkable development through the significant function shown in the previous table [3]. The researcher attributes the reason for this to the positive effect of the selected exercises that the players in this group practiced according to what they took of nutritional supplements of the type (whey protein), which contributed with those exercises to raising their capabilities and abilities in terms of muscle growth in general and the targeted muscles in particular, which enabled those players to perform the test in muscle coordination in a way that resulted in them obtaining better scores [10].

Presentation and discussion of the results of the muscle coordination test for the second experimental group in the pre- and post-tests.

Table 4. Shows the means, standard deviations, and calculated and tabulated t-values for the muscle coordination test for the second experimental group in the pre- and post-tests. Muscles, Experimental Group 2

(Pre-test), Experimental Group 2 (Post-test), T-value (correlated), Type of significance

Muscles	Second experimental group (pre-test)		The second experimental group (post-test)		T value		Type of indication
	Mean	Std	Mean	Std	Calculated	Tabulation at a significance level of 0.05	
Pectoralis major muscle	4.2	0.33	4.5	0.52	3.18	2.26	Sig.
Lateral deltoid muscle of the shoulder	4.7	0.31	4.9	0.43	2.84	2.26	Sig.
Biceps brachii	4.6	0.35	4.7	0.44	2.47	2.26	Sig.

By observing the results of the previous table of the values of the means, standard deviations, and the calculated and tabulated (t) value obtained in the pre- and post-tests, we find that the members of the research sample in the second experimental group achieved a slight improvement through the significant function shown in the previous table [11]. The researcher attributes the reason for this to the effect resulting from practicing the exercises in conjunction with the use of the nutritional supplement (amino acids) practiced by the players in this group, which contributed to raising their capabilities and potential in terms of muscle growth in general, which enabled those players to perform the coordination test better than they were at the beginning of their performance [12].

Presentation and discussion of the results of the post-test for the muscle coordination test for the two experimental groups.

Table 5. shows the means, standard deviations, and calculated and tabulated t-values for the post-test for the muscle coordination test for the two experimental groups

Muscles	Posttest		Trace test		T value		Type of indication
	Mean	Std	Mean	Std	Calculated	Tabulation at a significance level of 0.05	
Pectoral muscle	4.5	0.52	5.7	0.17	7.2		Sig.
Lateral deltoid of the shoulder	4.9	0.43	5.8	0.19	6.9		Sig.
Biceps brachii	4.7	0.44	5.8	0.26	7.0	2.1	Sig.
Three-headed	4.8	0.65	6.0	0.44	8.7		Sig.
Square oblique	4.8	0.43	5.9	0.18	8.3		Sig.
Abdominal muscles	4.7	0.53	5.6	0.22	6.3		Sig.

By observing the results in the table above, which shows the means, standard deviations, and calculated and tabulated t-values obtained in the post-test, we find that the participants in both experimental groups demonstrated significant improvement, as indicated by the statistical significance shown in the table [13].

It is worth noting that the group with the higher means showed greater statistical significance [14]. The researcher attributes this to the positive impact of the selected exercises performed by the athletes in this group, in conjunction with their whey protein supplement. This protein, combined with the exercises, contributed to enhancing their overall muscle growth potential, particularly in the targeted muscles [15]. This improvement surpassed that achieved by the amino acid supplement alone, indicating a marked improvement in muscle tone within the first experimental group.

4. Conclusions

- a. The selected exercises used by the two experimental groups resulted in varying degrees of improvement in the post-test, indicating the superiority of the protein supplement over the amino acid supplement.
- b. The first experimental group showed greater progress compared to the second experimental group in tests assessing muscle coordination.
- c. There is a clear effect from the use of nutritional supplements, provided that the quantities are within the limits of the athletes' weights, capabilities, and training ages.
- d. Nutritional supplements are an effective tool for improving the physical, psychological, and training condition of athletes.

Recommendations

1. Those involved in education and training should familiarize themselves with the correct principles and foundations for using supplements as an effective tool in enhancing the training process, enabling them to utilize this knowledge to discover the best methods for achieving ideal physique.
2. Exercises should be designed and prepared according to the use of nutritional supplements, in line with the athlete's actual needs.
3. Conducting similar studies to explore the potential use of other supplements for different weight classes and categories of athletes.
4. The necessity of educating young people about the importance of not using dietary supplements without sufficient knowledge and expertise, and only under the supervision of qualified professionals, to avoid any potential negative consequences.

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