

## Whey protein: How does it affect the increase in muscle mass of untrained athletes post weight training?

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### ABSTRACT

Weight training is a type of exercise that can provide many benefits for the body. Apart from exercise programs, the nutritional intake consumed also influences the success of building muscle through weight training. Protein is the main element that influences muscle growth and development after doing weight training. This experimental study used a pretest-posttest control group design to examine the effect of whey protein on muscle hypertrophy. It involved 60 male student athletes from Padang, Indonesia, aged 18-25 with a BMI of 25-29, physically healthy, and willing to follow research guidelines. The experimental group (n = 30) was given whey protein 30 minutes after weight training as much as  $\pm 45$  grams while the control group (n = 30) was only given mineral water after weight training. Muscle hypertrophy was measured using a measuring tape and skinfold calipers. Muscle circumference was calculated using the formula:  $MTC = (3.14 \times TSF)$ , where MTC is the muscle circumference and TSF is the triceps skinfold thickness. The results indicated that the group consuming whey protein experienced a significantly greater increase in muscle circumference compared to the control group ( $p < 0.05$ ). Based on research findings, planned and structured weight training combined with whey protein supplementation can maximize muscle hypertrophy compared to training without whey protein.

### KEYWORDS

Weight Training; Whey Protein; Hypertrophy; Muscle Mass

## **1. INTRODUCTION**

Weight training is one type of exercise that can provide many benefits to the body. Some of the benefits that will be obtained in weight training are increased muscle mass, muscle strength and increased physical fitness (McQuilliam et al., 2020). To achieve success in weight training, of course, it must be carried out with the correct training program and refer to several basic principles of training that are applied (Giechaskiel, 2020). Recent studies have revealed that the popularity of weight training has been designed to increase the optimization of its efficiency and benefits for sportsmen (García-López et al., 2016).

The exercise program used must consider several important elements such as; intensity, training volume, frequency, number of sets and number of repetitions. Some of these elements have an interrelated relationship such as intensity has an inverse relationship with training volume, because the amount of weight lifted is negatively correlated with the number of repetitions performed. A good training program should be outlined in a training periodization. Periodization is a logical method of organizing training into sequential phases to increase the potential for achieving specific performance while minimizing the potential for overtraining (DeWeese et al., 2013), so exercise periodization is considered an integral part of the training process and provides a conceptual framework for designing training programs (DeWeese et al., 2015). Periodization introduces variation through cyclical phases and time periods, whereas programming consists of the gradual structuring of training variables (loads, sets, repetitions, and exercises) to enhance training effects (DeWeese et al., 2015).

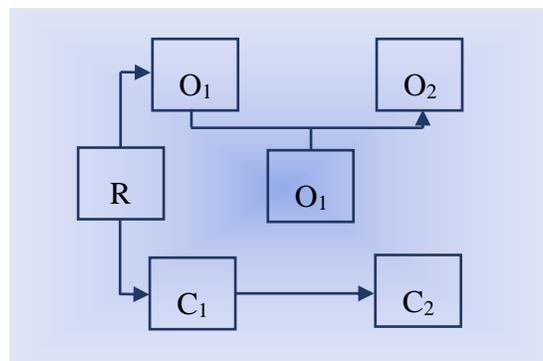
In addition to the exercise program, the nutritional intake consumed also affects the success in building muscle through weight training (Mitchell et al., 2015). Protein is the main element that affects the growth and development of muscles after carrying out weight training (Visiedo et al., 2021). To meet the body's protein needs after weight training can be done by consuming high-protein foods and supplements (Churchward-Venne et al., 2012). High-protein foods and high-protein supplements have the same function in fulfilling nutrients, but both have different ways of meeting the body's nutritional needs. Food fulfills nutritional needs along with other components, while supplements fulfill the body's nutritional needs depending on their content. On food packaging there is information on the nutritional value contained therein, while on supplements there is label information on the composition of the supplement (Mitchell et al., 2015).

Whey protein is one type of supplement that is a source of high-quality protein, rich in essential amino acids that can increase muscle protein synthesis and post-exercise (Davies et al., 2018). Several studies have proven that whey protein can stimulate muscle protein synthesis when compared to other proteins at a dose of 20-25 g of protein (Monteyne et al., 2018) and increase muscle thickness during periods of weight training (Babault et al., 2015). Other studies have also revealed that consuming whey protein post-exercise can reduce the effects of delayed onset of muscle soreness (DOMS) (Nieman et al., 2020). So it can be concluded that consuming whey protein after weight training can cause muscle hypertrophy and reduce the effects of delayed onset of muscle soreness (DOMS). Therefore, this study aims to see how whey protein can have an impact on muscle hypertrophy.

## 2. METHODS

### 2.1. Design and participants

This study was an experimental research with a pretest-posttest control group design (Figure 1). The experimental group was given whey protein 30 minutes after weight training as much as  $\pm 45$  grams while the control group was only given mineral water after weight training. This study involved 60 male student athletes from Padang, Indonesia, aged 18-25 with a BMI of 25-29, physically healthy, and willing to follow research guidelines.



**Figure 1.** Experimental Design

*Note: R: Random; X: Whey Protein Consumption after Weight Training; O<sub>1</sub>: Pretest data of experimental group muscle hypertrophy; O<sub>2</sub>: Posttest data of experimental group muscle hypertrophy; C<sub>1</sub>: Pretest data of Control group muscle hypertrophy; C<sub>2</sub>: Posttest data of control group muscle hypertrophy*

## 2.2. Procedures

The sample was divided into a control group and a treatment group, each with 30 participants. Initially, daily protein intake was calculated, and daily protein requirements were set at 1.5 grams per kilogram of body weight. Participants underwent 12 weeks of weight training (4 sessions per week, 48 total), with training intensity between 75%-90%. After training, the treatment group was given 45 grams of whey protein. Skinfold thickness was measured before and after the intervention to assess muscle mass growth, focusing on the arms and thighs.

## 2.3. Statistical Analyses

Data analysis was performed using SPSS and a T-test to compare pretest and posttest results for both groups. The study ensured validity by measuring muscle mass changes attributed to whey protein and maintained reliability through a well-controlled design, adequate sample size, and consistent measurement methods. The research aimed to assess the effectiveness of whey protein supplementation on muscle growth in athletes following a structured weight training program.

## 3. RESULTS

The description of the data presented in this study is data on increasing the hypertrophy of 60 students of the Faculty of Sports Science, Padang State University (the whey protein group and the control group). More details are presented in Table 1.

**Table 1.** Description of hypertrophy

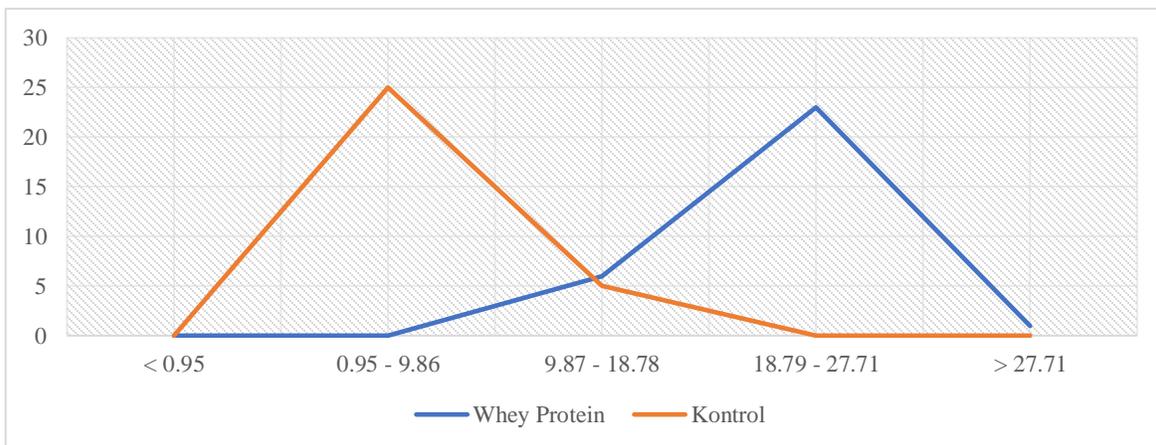
<b>Research Group</b>	<b>n</b>	<b>Minimum</b>	<b>Maximum</b>	<b>Mean</b>	<b>Std. Deviation</b>
Whey Protein Group	30	11.28	28.42	22.23	3.94
Control Group	30	1.00	16.28	6.43	4.13
Total	60	1.00	28.42	14.32	0.13

Based on Table 1 above, from 30 samples in the whey protein group, the minimum value was 11.28, the maximum value was 28.42, the average was 22.23, and the standard deviation was 3.94. Furthermore, in the control group, the minimum value was 1.00, the maximum value was 16.28, the average was 6.43, and the standard deviation was 4.13. Based on the description of the research data, the whey protein group had a higher average than the control group. For further explanation regarding the distribution and comparison of hypertrophy data for research samples, see on Table 2.

**Table 2.** Frequency distribution of hypertrophy

Scale	Whey Protein Group		Control Group	
	fa	fr%	fa	fr%
> 27.71	1	3.33	0	0.00
18.79 - 27.71	23	76.67	0	0.00
9.87 - 18.78	6	20.00	5	16.67
0.95 - 9.86	0	0.00	25	83.33
< 0.95	0	0.00	0	0.00
	30	100%	30	100%

Based on Table 2 above, from the whey protein group and the control group with a sample size of 30 people each, in the interval class above 27.71 there was 1 person from the whey protein group (3.33%) and 0 people from the control group (0.00%). In the class interval 18.27 – 27.71 there were 23 people from the whey protein group (76.67%) and 0 people from the control group (0.00%). In the interval class 9.87 – 9.86 there were 6 people from the whey protein group (20.00%) and there were 5 people from the control group (16.67%). In the interval class 0.95 – 9.86 there were 0 people from the whey protein group (0.00%) and 25 people from the control group (83.33%). Finally, in the interval class below 0.95 there were 0 people from the whey protein group (0.00%) and 0 people from the control group (0.00%). The histogram of sample hypertrophy data can be seen in figure 1.



**Figure 1.** Arm muscle hypertrophy

In Table 3, the results of the research data were analyzed using comparative statistical analysis of the Independent Sample T-Test. Based on the data analysis of table 3, in the equal variances assumed column,  $F = 0.03$  is obtained with a significant number or (p-value) =  $0.86 > 0.05$ , which means that the data variance from the two groups is the same or homogeneous. In the Equal variances not assumed column, the price is  $t = 15.15$ ,  $df = 57.87$  and sig. (2 tailed) or p-value =  $0.00$

$< 0.055$ , or  $H_0$  is rejected. Thus, the proposed hypothesis has been tested by the data. It can be concluded that consuming whey protein during weight training can provide higher hypertrophy than not consuming whey protein.

**Table 3.** Hypertrophy comparison with and without whey protein

		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Result	Equal variances assumed	0.03	0.86	15.15	58.00	0.00	15.81	1.04	13.72	17.89
	Equal variances not assumed			15.15	57.87	0.00	15.81	1.04	13.72	17.89

#### 4. DISCUSSION

Consuming whey protein as a supplement after weight training will produce maximum hypertrophy. Whey protein can also increase muscle strength and help a person recover after exercise. Whey protein is a supplement that is recommended to support muscle mass gain in humans (Naclerio & Seijo, 2019). Providing protein is important to maximize muscle function during weight training (Park et al., 2019). Whey protein is a valuable source of protein for a person to enhance their recovery (West et al., 2017). Whey protein has benefits for health and fitness which include increasing muscle mass and strength, speeding recovery after exercise, controlling body weight, improving general health, and managing sugar levels. There are several types of whey protein supplements on the market, namely Whey Protein Concentrate (WPC), Whey Protein Isolate (WPI), and Whey Protein Hydrolyzate (WPH) (Naclerio & Seijo, 2019). Whey protein concentrate (WPC) contains around 70-80% protein. The advantage of WPC is that it is more affordable and contains many bioactive nutrients that will be beneficial. Whey Protein Isolate (WPI) contains about 90% or more protein with little lactose and no fat. The advantage of WPI is that it is purer with higher protein content and lower fat, which is better for people who are lactose or fat intolerant. Whey Protein Hydrolyzate (WPH) is a protein that has been partially broken down to speed up absorption. The advantage of WPH is that it is digested more quickly than other types of protein and is often used for recovery after training (Naclerio & Seijo, 2019).

Muscle protein will increase acutely after exercise. By consuming Whey protein, muscle protein will be further increased (Davies et al., 2018). Whey protein is absorbed quickly by the body providing the amino acids necessary for muscle protein synthesis. This process involves several stages starting from digestion in the stomach and small intestine, transportation through the bloodstream, until entering muscle cells where whey protein is used to repair and build muscle. Based on study results, whey protein will increase muscle hypertrophy after 12 weeks of training. Apart from muscle hypertrophy, tendons will also experience hypertrophy (Farup et al., 2013). In accordance with research conducted by Morton et al. (2018) states that whey protein can increase muscle hypertrophy and strength when combined with exercise and that protein supplements are very effective for improving performance and muscle recovery. Consuming whey protein can improve muscle adaptation to strength training, and allow for a more significant increase in muscle mass. In accordance with the results of research conducted by Roberts et al. (2020) that consuming whey protein during weight training will increase greater muscle mass without fat and muscle adaptation compared to not consuming whey protein.

Based on the results of the research that the authors do, consuming whey protein can significantly increase muscle hypertrophy. In accordance with research conducted by Davies et al. (2018) Finding that consuming whey protein can significantly increase strength and muscle hypertrophy in someone who practices compared to not consuming whey protein. Also in accordance with the results of other studies, which hurt that the provision of protein supplements, including whey will increase muscle mass and strength if combined with exercise (Morton et al., 2018). The limitation of this research is that researchers were unable to control aspects that were outside research activities, such as contamination of other high-protein foods consumed by the research sample. In the next stage, future research should investigate the effects of sustainably consuming high-protein supplements on human health.

## **5. CONCLUSIONS**

Based on research findings, planned and structured weight training combined with whey protein supplementation can maximize muscle hypertrophy compared to training without whey protein. Without whey protein, muscle growth from weight training alone may be limited. Therefore, the authors recommend the consumption of whey protein to support optimal hypertrophy.

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## ACKNOWLEDGEMENT

We would like to express our sincere gratitude to all parties who contributed to this research, especially Universitas Negeri Padang (UNP).

## AUTHOR CONTRIBUTIONS

All authors listed have made a substantial, direct and intellectual contribution to the work, and approved it for publication.

## CONFLICTS OF INTEREST

The authors declare no conflict of interest.

## FUNDING

This research received no external funding.

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