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# EFFECTIVENESS OF WHEY PROTEIN AND SOYMILK ON MUSCLE MASS AND HEMATOCRIT LEVELS OF VOLLEYBALL ATHLETES

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*Abstract*

*Volleyball is one of the team sports that requires robust muscle mass for exceptional performance and endurance. Protein intake contributes to the formation of muscle mass and red blood cells that are tightly linked to hematocrit levels. The objective of this study was to determine the effectiveness of whey protein and soymilk on muscle mass and hematocrit levels in volleyball athletes. The study was a true experiment with a randomized pre-test and post-test design, involving 20 adolescent, male volleyball athletes divided into 2 groups: whey protein and the soymilk group selected by purposive sampling. The research variables were muscle mass and hematocrit levels. Statistical analysis used independent t-test and paired t-test. The results showed increased muscle mass in the whey protein group (3.50 ± 15.04), but the opposite was found in the soymilk (-1.82 ± 6.46), resulting in significant difference in muscle mass changes between groups (p=0.020). Both groups exhibited reduced hematocrit levels (whey protein group = -3.50±7.69; soymilk group= -1.20±6.30), with a significantly higher decrease shown in the whey protein group (p=0.019).*

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## INTRODUCTION

Volleyball is a very popular team sport in Indonesia because volleyball is a fun sport and can be a place to channel talent (Oktaviany, 2017). Volleyball athletes need good muscle strength to provide a high-quality play (Fauzan, 2019). Muscle tissue makes up 40-50% of total body weight. Adequate muscle mass is required in volleyball games to reduce risks of joint injury during training. The more muscle mass in the body, the better the muscle capacity is (Harahap, 2014). Optimal muscle mass is achieved from a combination of intense training and sufficient protein intake (Azhar, 2013).

Protein plays a major role in muscle building (Harahap, 2014). Protein contains essential branched-chain amino acids (BCAA)—leucine, isoleucine, and valine—which are metabolized in skeletal muscle. Setiowati (2013) reported that increased protein intake led to elevated muscle mass of 3.8%. Accordingly, Morton (2017) stated that increasing daily protein intake, along with regular exercise training, will cause changes in muscle mass. In addition, protein promotes blood cell formation (hemopoiesis), particularly erythrocytes (Andarina and Sumarni, 2006).

An athlete's $VO_2$max can be influenced by nutrient intake, particularly protein (Kameswara P.S, 2014). $VO_2$max is the amount of oxygen available to exercising muscles to produce energy (Hariyanti et al, 2020). Chai et al (2019) found a simple but significant correlation between $VO_2$max and hematocrit levels. The volume of red blood cells in 100 ml of blood is expressed as hematocrit (Rahmatillah, 2019). Hematocrit reflects the ratio of red blood cells compared to total blood volume (Lita et al, 2016). Physical activity incites elevated lung capacity and overall blood circulation, implying increased number of circulating red blood cells which transports oxygen to cells and tissues (Norwidianti et al, 2022).

Whey protein is the protein component in whey milk (Hutama, 2019). It has a high concentration of BCAA (26%) and has been proven to be beneficial for muscle building (Mardiana et al, 2022). However, the high product cost makes it unfit for athletes that would require regular consumption. As an alternative, soybeans may be a more affordable and accessible option.

Soybean (Glycine max) is known for its high protein content complemented with the complete essential amino acids and excellent digestibility. Lynch et all (2020) discovered that consuming soybeans positively affected muscle mass. Soy protein (Glycine max) contains isoflavones (sub-class of flavonoids) which function as antioxidants to prevent muscle damage (Fitriana et al, 2014). One of the processed soybean products is soy milk. Soy milk according to SNI 01-3830-1995 is a product derived from soy bean seed extract with water or a solution of soy flour in water, with or without the addition of other permitted food ingredients (Adawiyah et al, 2018). This study aims to determine the effectiveness of whey protein and soymilk on muscle mass gain and hematocrit levels in volleyball athletes.

## METHOD

The study was a true experiment with a randomized pre-test post-test design. A total of 16 young, male volleyball athletes were selected by purposive sampling based on the following inclusion criteria: adolescents aged 14 to 18-year-old, have been an athlete for at least a year, not currently taking muscle mass enhancing supplements, and not participating in any programs to build muscle mass. Samples were equally

divided into 2 groups and given a glass of (210 ml) either whey protein milk or soymilk after training for 12 days within 4 weeks. Muscle mass measurements were taken at the beginning and end of the study using a skinfold caliper while hematocrit levels were measured at the beginning and end of the study using For a Kit Test 6 Plus.

Primary data collected were training status, intake, physical activity, and nutritional status. Intake was assessed with 4 x 24-hour recall. Measurements of muscle mass and hematocrit levels were carried out on athletes before and after treatment. Univariate analysis was done to describe the mean, standard deviation, maximum and minimum value of the data. Normality test was done with Shapiro Wilk, then bivariate analysis used Independent Sample T-Test and mean difference was analyzed using Paired t-test.

## RESULT AND DISCUSSION

The result of the research is presented in the form of chart, table, or description. The analysis and intepretation of the result is needed to be elaborated before being discussed. The discussion is focused of elaboirating the data and result of the analysis with the problems of the research or the purpose of the research in a broader theorithical context. In the discussion, also, providing answer of why based on the facts taken from the data. The discussion is written according to the data that is being discussed and supposedly not biased from the data result.

Table 1 Sample characteristics

| Characteristic | Whey Protein | Soymilk | *p* |
|---|---|---|---|
| BMI-for-age (kg/m²) | 0.73±0.45 | 0.63±0.62 | 0.693 |
| Age (year) | 16.50±1.17 | 16.30±1.49 | 0.744 |
| Training status (year) | 3.90±1.66 | 2.30±1.76 | 0.052 |
| | 1.68±0.57 | 1.50±0.18 | 0.051 |
| Physical activity level (PAL) | 102.07±1.50 | 91.25±1.06 | 0.082 |
| Energy intake (%) | 83.14±1.27 | 78.34±1.08 | 0.377 |
| Protein intake (%) | 85.80±1.78 | 75.00±1.71 | 0.185 |
| Fat intake (%) | 110.67±1.74 | 102.00±2.06 | 0.323 |
| Carbohydrate intake (%) | 31.4±1.06 | 21.6±1.33 | 0.084 |
| Calcium intake (%) | 38.4±2.68 | 30. 8±2.45 | 0.516 |
| Vitamin C intake (%) | 78.6±1.17 | 70.21±1.84 | 0.244 |
| Iron intake (%) | | | |

Tabel 2. Muscle mass changes during the intervention

| Muscle mass | Mean±SD | | | $p^a$ |
|---|---|---|---|---|
| | Pre (%) | Post (%) | Δ muscle mass | |
| Whey Protein | 67.87±15.2 | 71.37±10.4 | 3.50±15.04 | 0.048 |
| Sari Kedelai | 66.82±9.52 | 65.00±8.59 | -1.82±6.46 | 0.039 |
| $p^b$ | 0.856 | 0.022 | 0.020 | |

Notes :
$p^a$ : paired t-test
$p^b$ : independent t-test

Tabel 3. Hematocrit level changes during the intervention

| Hematocrit | Mean±SD | | | $p^a$ |
|---|---|---|---|---|
| | Pre (%) | Post (%) | Δ hematokrit | |
| Whey Protein | 39.30±4.62 | 35.80±9.17 | -3.50±7.69 | 0.021 |
| Soymilk | 37.10±3.81 | 35.90±5.85 | -1.20±6.30 | 0.040 |
| $p^b$ | 0.261 | 0.049 | 0.047 | |

Notes :
$p^a$ : paired t-test
$p^b$ : independent t-test

## CONCLUSION

Whey protein has better effects than soymilk in building and increasing muscle mass. Soymilk is better for maintaining hematocrit levels than whey protein.

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