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ORIGINAL ARTICLE

Effects of Calorie Restriction on Body Composition in Young Adults

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Abstract

Background: This research investigated the effects of caloric and fluid restriction on body fluids, muscle mass, bone mass, and body fat on young adults. **Method:** A pretest–posttest design study was conducted in the village of Kotarindau, Sigi, Central Sulawesi. Thirty-one young adults aged 18–25 years (21.1 ± 1.82) voluntarily assented to join in this research .The total sample were chosen based on inclusion and exclusion criteria. The pretest data were collected the day before fasting, and the subjects then engaged in caloric restriction for 21 days for 12–14 hours each day. After the subjects completed the 21 days of fasting. Body fluids, muscle mass, bone mass, and fat body were measured using a bioelectric impedance analyzer. Statistical analysis was performed using a paired t-test. **Results**: This research showed a mean standard deviation (SD) pretest bone mass of 2.56 ± 0.28 (kg) and a posttest of 2.32 ± 0.28 (kg), with a p-value of 0.001. The mean pretest muscle mass was 47.04 ± 5.57 (kg) and the posttest was 44.2 ± 5.33 (kg), with a p-value of 0.001. The mean pretest body fat was 18.34 ± 14.14 (%) and posttest was 15 ± 10.54 (%), with a p-value of 0.001. The mean pretest body fluids level was 61.3 ± 4.03 (%) and posttest was 58.8 (%). The important differences in body fluids, muscle mass, bone mass and body fat ($p<0.05$). **Conclusion:** There is an effect of caloric restriction on the levels of bone mass, body fluids, muscle mass, and body fat in young adults. Therefore, caloric restriction can be considered as one of several medicinal programs to regulate body composition and promote well-being.

Keywords: caloric restriction, body fluids, muscle mass, bone mass, body fat.

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Introduction

The health of the body can be regulated by maintaining a balance in body composition, which can be regulated in various ways, such as regular exercise, maintaining a lifestyle and a calorie diet.[1,2] Calorie diet can be done by calorie restriction. There are two paradigms of calorie restriction: limited daily feeding and fasting. Both of these paradigms can increase stress resistance, thereby prolonging survival. Caloric restriction can affect the levels of blood glucose, insulin-like growth factor 1 (IGF-1), and â-hydroxybutyrate [3]. In addition to intermittent fasting, caloric restriction can also be achieved by periodic or intermittent fasting [4].

There has been extensive research on calorie restriction. Caloric restriction can provide benefits to the body, including preventing and treating cancer and prolonging life [5-7]. During young adulthood, the body's organs function optimally and have not yet deteriorated. Therefore, the purpose was to conduct analysis on an effect of calorie, fluid restriction on body fluid, muscle mass, bone mass, and body fat levels in young adults.

Methods

This was a quantitative, quasi-experimental study that utilized a pretest–posttest design. The research was conducted in the village of Kotarindau, Sigi, Central Sulawesi. Thirty-one young man aged 18–25 years (21.1 ± 1.82) voluntarily participated in this study. Subjects' inclusion criteria were 18–25 years old and fasting for 21 days by filling out a checklist. The exclusion criteria were suffering from a disease during fasting and an incomplete checklist. The pretest data were collected the day before fasting. The subjects then engaged in caloric restriction for 21 days by fasting for 12–14 hours each day. After the subjects completed the 21 days of fasting, their levels of body fluids, muscle mass, bone mass, and body fat were measured and named posttest data (see Figure 1). Tadulako University's Faculty of Medicine granted ethical clearance for this study under the registration number 2417/UN.28.1.30/KL/2021. Body fluids, muscle mass, bone mass, and body fat can be measured using a bioelectric impedance analyzer [8]. This study used the Tanita Body Composition Analyzer BC-541 bioelectrical impedance analyzer.

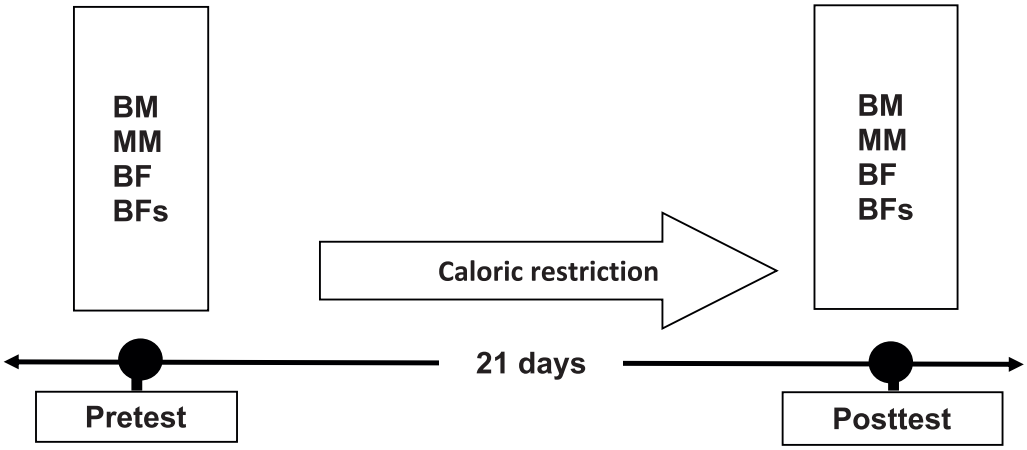

Figure 1: *The flow scheme of the study.*
BM (bone mass), MM (muscle mass), BF (body fat), and BFs (body fluids) were measured using the bioelectric impedance analyzer.

Results

This research were young adults aged 18–25 years. The subjects had a mean body weight of 58.74 kg and an average height of 166.64 cm.

Table 1: The measurements of the subjects' levels of bone mass, muscle mass, body fat, and body fliuds.

Measurements of Variables	Pre-test	Post-test	P-value
	Mean ± SD	Mean ± SD	
BM	2.56 ± 0.28	2.32 ± 0.28	0.001***
MM	47.04 ± 5.57	44.2 ± 5.33	0.001***
BF	18.34 ± 14. 14	15 ± 10.54	0.001***
BFs	61.3 ± 4.03	58.84 ± 3.95	0.001***

Value means (SD BM = bone mass (kg); MM = muscle mass (kg); BF = body fat (%); BF = body fluid (%); = p-value of 0.05 < by paired t-test

Discussion

Bone Mass

The result of this study showed a mean pretest bone mass of 2.56 ± 0.28 (kg) and a posttest of 2.32 ±0.28 (kg), with a p-value of 0.001 (Table 1). Bone is a composite connective tissue structure composed of bone lining cells, namely osteoblasts, osteocytes, and osteoclasts [8]. Bone mass is affected by physical activity and nutritional intake [9]. The results of this study showed that there was a decrease in bone mass after fasting. This is different from the research conducted by Barnosky (2017), which showed that alternate-day fasting had no effect on bone mineral gratified or bone mineral thickness in humans despite moderate weight loss [10].

The impact of fast on bone breakdown and immunoglobulin levels in blood serum modulate intact parathyroid hormone secretion in a pattern that is beneficial for bone remodeling and bone well-being. Ramadan fasting has been shown to affect the secretion of parathyroid hormone; thus, it is beneficial for bone health [11]. Fasting can also increase serum IGF-1, where IGF-1 plays a role in regulating bone metabolism [3,12]. However, further studies are needed regarding the hazard of bone fractures , osteoporosis due to calorie restriction [13].

Muscle Mass

The result of this study showed a mean pretest muscle mass of 47.04 ± 5.57 (kg) and a posttest of 44.2 ± 5.33 (kg), with a p-value of 0.001. This result indicates that fasting can significantly reduce muscle mass. This is in accordance with previous studies, which have shown that calorie restriction can reduce muscle mass [13]. Fasting can increase levels of IGF-1[3] and IGF-1 inversely regulates muscle atrophy through the phosphatidylinositol 3-kinase-AKT-mammalian target of rapamycin pathway [14].

Body Fat

The result of this study showed a mean pretest body fat of 18.34 ± 14.14 (%) and a posttest of 15± 10.54 (%), with a p-value of 0.001. There was a significant difference in body fat ($p<0.05$). Body fat is a source of energy in the body that consists of several types, such as cholesterol, saturated fatty acids, polyunsaturated fatty acids, and monounsaturated fatty acids. The amount of body fat is affected by the intake of dietary fat and other forms of calories. The results of this study indicate that fasting can significantly reduce body fat, which is in line with previous studies that showed that calorie restriction reduces body fat. Dietary fat restriction results in a greater decrease in body fat compared with carbohydrate restriction [15,16]. Based on its location, there are two types of body fat: visceral and subcutaneous. Caloric restriction can reduce body fat, particularly visceral fat and its derivatives. This process is regulated by leptin and other peptides via central nervous system receptors [17].

Body Fluids

The result of study presented average pretest body liquid level 61.3 ± 4.03 (%) and posttest level was 58.8 (%), with a p-value of 0.001. There was a significant difference in the level of body fluids ($p<0.05$). Body liquids are essential substances and are the major section. It contain salt and minerals that function to maintain the body's homeostasis [18]. The calorie restriction in form of fasting can significantly reduce the level of body fluids. Calorie restriction can reduce body fluids [19]. The effect of calorie restriction on body fluid levels has not been widely studied, so further research is needed. However, researchers suspect that the loss of body fluids in an intermittent fasting state can be compensated for by regulating an antidiuretic hormone (ADH) until rehydration is established. An ADH can regulate body fluid levels by increasing water reabsorption in the renal tubules and producing vasoconstriction in arterioles [20].

Conclusion

In conclusion, caloric restriction effects the levels of bone mass,

body fluids, muscle mass and body fat in young adults. Caloric restriction can be considered as one of several medicinal programs to regulate body composition and promote well-being.

What do you know about the subject?

The subjects are used teenage boys with an age range of 18-25 years who participated voluntarily. Calorie restriction is done by fasting Ramadan (12-14 hours) for 21 days. The body fluids, muscle mass, bone mass, and body fat were measured with a bioelectrical impedance analyzer.

What does the edited study add to the literature?

Calorie restriction during Ramadan's fasting can affect body composition, which consists of body fluids, muscle mass, bone mass, and body fat in young age.

What are the implications of the results obtained?

Fasting can be one of the health programs regulating body composition in young age and can be studied to be applied as a prevention against various diseases related to body composition, such as dyslipidemia.

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Conflict of Interest:	All authors declare no COI
Ethics:	There is no ethical violation as it is based on voluntary anonymous interviews
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