



Body Composition Changes Following Lenten fasting: A Study in Ethiopia

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ARTICLE INFO

Article type:
Research Paper

Article History:
Received: 04 May 2019
Accepted: 21 Jul 2019
Published: 22 Aug 2019

Keywords:
Body Composition
Lenten Fasting
Vegan Diet
Anthropometric
Non-vegetarian Diet

ABSTRACT

Introduction: The Ethiopian Orthodox Church (EOC) Lenten fasting (Abiy Tsom) is a seven-week period of fasting before Easter. It is a religious fasting practice, which has been less documented in the scientific literature. The present study aimed to investigate effect of EOC fasting with vegan diet practices on body composition parameters.

Methods: This prospective study was conducted on 98 subjects (40 females and 58 males) aged 18-40 years, who were willing for Lenten fasting for seven weeks. Several parameters were evaluated and measured, including body weight, height, waist circumference, hip circumference, body mass index (BMI), and waist-to-hip ratio (WHR). In addition, body fat percentage (BF %) was determined based on skinfold thickness at three sites, including the abdomen, triceps, and suprailiac using a caliper (Holtian Ltd., UK).

Results: Weight, BMI, BF%, and fat mass significantly decreased ($P < 0.05$) during eight weeks of Lenten fasting compared to eight weeks after fasting. The male subjects experienced a more significant reduction in this regard compared to the female subjects.

Conclusion: According to the results, adherence to the Lenten diet (vegan diet) decreased anthropometric and body composition parameters more significantly compared to regular mixed diets, which could be potentially associated with improved cardiometabolic health.

► Please cite this paper as:

Sisay T, Chala G, Teshome Y, Edae CK. Body Composition Changes Following Lenten fasting: A Study in Ethiopia. J Nutrition Fasting Health. 2019; 7(3): 170-174. DOI: 10.22038/jnfh.2019.40077.1194

Introduction

Although food is considered important in religious observance in various religions, not all the believers of a religion are able to follow the same food practices. Based on religious dietary norms and instructions, the major religions in the world that promote vegetarian diets as part of their basic teachings include Buddhism, Jainism, Hinduism, and the Seventh-Day Adventist [1]. The majority of Hindus and Buddhists consume no meat, fish, seafood, eggs, and dairy products (with the exception of milk), while the followers of Judaism are forbidden to consume pork, its products, and all carnivorous animals if not slaughtered and prepared in an appropriate manner. On the other hand, the Seventh-Day Adventists abstain from all animal products, with the exception of dairy products and eggs (lacto-ovo vegetarianism) [2].

In Greek-orthodox Christianity, the followers adhere to the diets that are completely free of animal products (with the exception of fish and

seafood) for 180-200 days of fasting per year, which includes the three major fasting periods of Nativity Fast, Easter Lenten, and the Assumption [3]. In the past, the Catholic Church used prohibited the consumption of meat on Fridays. In contrast, the Ethiopian Orthodox Church recommends a number of fasting periods, during which all foods of animal origin are eliminated from the routine diet, including dairy products, eggs, poultry, and fish. These fasting practices are performed on Wednesdays, Fridays, and the entire Lenten season [4]. Therefore, the followers of the Ethiopian orthodox adhere to a vegan diet in these periods.

Although the term vegetarian is often used to describe a whole range of diets practiced with variable degrees of restriction, studies have generally indicated that vegetarian diets are associated with potential health benefits [5, 6]. Traditionally, vegetarianism is defined as the avoidance of meat [7], while there are various types of vegetarian diets. For instance, the lacto-

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ovo vegetarian diet is characterized by the avoidance of meat, poultry, and fish, while dairy products and eggs are allowed. Among the other subsets of vegetarian religious groups are pescatarians (those who do not consume meat but use fish) and vegans (those who abstain from all foods of animal origin, including dairy products and eggs, in addition to meat, poultry, and fish) [8].

With this background, the wide variety of dietary habits in certain religious groups and their difference with the eating habits of the general population has resulted in the challenging comparison of the health benefits of various vegetarian diets. In the studies conducted in this regard, vegetarians and non-vegetarians have been reported to gain or lose weight with variable patterns, and the health benefits associated with the vegetarian lifestyle have not been thoroughly clarified.

The present study aimed to assess effect of EOC fasting with vegan diet practices on body composition parameters.

Materials and Methods

This prospective study was conducted on 98 generally healthy orthodox Christian fasting individuals (58 males and 40 females) in Ethiopia, East Africa. A random sample of the orthodox Christians who were willing to fast during Lenten were recruited from the College of Health Sciences at Tikur-Anbesa Medical School, Addis Ababa University.

The inclusion criteria of the study were healthy adults aged ≥ 18 years, who were planning to fast for eight weeks of Lenten and provided their consent for participation. The individuals with acute and chronic diseases or those receiving medications were excluded from the study. The study was conducted in accordance with the Declaration of Helsinki, and all the procedures involving human subjects were approved by the Ethics Committee of the College of Health Sciences at Tikur-Anbesa Medical School, Addis Ababa University. Written informed consent was obtained from all the subjects prior to participation.

Data were collected using a questionnaire that was completed by the participants and included data on the name, age, gender, type of diet, alcohol consumption, and smoking habits of the subjects. The measurements were performed during the last week of Lenten fasting and seven weeks after Lenten fasting at 8-10 AM.

Anthropometric Measurements

Both body weight (kg) was measured without shoes and with light clothing using a beam balance (Seca, GmbH, Germany). Height was taken at standing position with heads, backs and buttocks vertically aligned to the height gauge and the result was rounded to the nearest 0.5 cm, and weight was recorded and rounded to the nearest 0.5 kg. BMI (kg/m^2) was calculated by dividing the body weight in kilograms by height in square meters. Waist circumference was measured using a measuring tape at the navel point, and hip circumference was measured at the widest portion of the buttocks in order to calculate the waist-to-hip ratio (WHR). Body fat percentage (BF%) was determined with the skinfold thickness at three sites, including the abdomen, triceps, and suprailiac, using a caliper (Holtain Ltd., UK). A trained individual carried out the skinfold measurements. The values obtained from the skinfold thickness were directly applied to predict BF% based on the formula proposed by Jackson and Pollock [10]. Based on the BF%, the fat-free mass (FFM) and fat mass (FM) were calculated, as follows:

$$FM (kg) = [BW (kg) \times BF\%] \div 100$$
$$FFM (kg) = BW (kg) - FM (kg)$$

Statistical Analysis

Data analysis was performed in SPSS version 21.0 using descriptive statistics to describe the characteristics of the subjects. Two ANOVA with Post hoc pairwise comparisons were performed as necessary with Bonferroni adjustment. In all the statistical analyses, P-value of less than 0.05 was considered significant, and the data were expressed as mean and standard deviation (SD).

Results

In total, 101 subjects were approached and provided with the data checklists, and three subjects did not complete the study due to the lack willingness or unavailability. The final samples size included 98 subjects who completed the study (58 males and 40 females), with the mean age of 27.1 ± 0.4 years.

The analysis of the results indicated that body weight (kg), BMI (kg/m^2), BF%, and FM (kg) decreased significantly at baseline compared to after Lenten fasting ($P < 0.05$), while they returned to the baseline levels seven weeks after the end of fasting (Table 1). In addition, body weight (kg) and BMI (kg/m^2) significantly reduced at the end of Lenten fasting compared to

seven weeks after the end of Lenten fasting (54.69 ± 8.92 and 57.57 ± 8.58 , respectively; $P=0.018$ versus 21.73 ± 2.16 and 19.96 ± 2.13 kg/m^2 , respectively; $P=0.023$). With regard to the parameters of body composition, BF% ($8.43 \pm 5.90\%$ versus $16.67 \pm 6.11\%$; $P=0.002$) and FM (9.33 ± 3.36 versus 10.55 ± 3.52 kg ; $P=0.001$) significantly decreased at the end of Lenten fasting compared to seven weeks after the end of Lenten fasting (Table 1).

Comparison of the male and female subjects was indicative of significantly lower body weight, BMI, and BF% in men compared to women (Table 2).

Discussion

The Ethiopian Orthodox Church prohibits all foods of animal origin, including dairy products and eggs, poultry, and fish, during Lenten, which encompasses seven weeks of fasting before Easter [4]. However, after the break of lent, the followers eat all foods of animal origin for another eight weeks, including on Wednesdays and Fridays. This prospective study aimed to compare the changes in anthropometric and body composition parameters before, at the end, and after Lenten fasting in Ethiopian orthodox individuals.

According to the results of the present study, adherence to the Ethiopian orthodox diet (vegan diet) for Lenten fasting had beneficial health effects on the fasting men and women. Furthermore, the obtained results indicated that all the subjects experienced significant reduction in the body weight, BMI, BF%, and FM during Lenten compared to baseline. However, body weight, BMI, BF%, and FM significantly increased to higher levels seven weeks after the Lenten fasting compared to during Lenten fasting. These findings are of great significance since Lenten fasting is a key practice in the Ethiopian orthodox religion. Such vegan diets have a low fat content and mostly contain large proportions of carbohydrates and fibers [11].

In the current research, the daily activities of all the participants were considered to be minimal as they maintained a sedentary lifestyle without

involvement in formal physical activities, mostly spending their time learning (e.g., university students), teaching (e.g., university lecturers), and providing health care to patients in hospitals (e.g., healthcare professionals). Therefore, we believe that the changes in the physical activity of the subjects had no impact on the obtained results.

A study in this regard investigated fasting in Seventh-Day Adventists (lacto-ovo-vegetarians) [13, 14], Greek Orthodox Christians (pesco-vegetarian) [14, 15], and Ramadan [16, 17], reporting a significant reduction in the body weight and BMI of the subjects. Other similar studies have also denoted that differences in body composition parameters decrease during Lenten fasting [19] and Ramadan [20, 21], while other findings have demonstrated no such effects [18].

Findings regarding the effects of Ramadan fasting on body weight, BMI, and body composition are not conclusive. Some studies have denoted that body weight and body composition are not affected by Ramadan fasting [22-24], while other findings have indicated that Ramadan fasting leads to the reduction of body weight and BMI [15, 16]. This inconsistency could be attributed to the variations in calorie intake during Ramadan or variations in the duration of fasting and physical activity.

In the present study, the effects of age-matched gender differences were assessed in the female ($n=40$) and male subjects ($n=58$) before, at the end, and after eight weeks of Lenten fasting. According to the obtained results, the male subjects experienced a significant reduction in the body weight, BMI, BF%, and FM during Lenten fasting compared to the baseline level. However, these values significantly increased again and became higher than the values during Lenten fasting when compared to seven weeks after Lenten in men. Despite the need for further investigation in this regard, the differences between the genders could be due to the variations in nutrient oxidation and changes in energy expenditure during the fasting period.

Table 1. Anthropometric and Body Composition Parameters before, at End, and Seven-Weeks after Lenten Fasting (n=98; values expressed as mean±SD)

Variable	Pre-Lenten	Lenten	Post-Lenten	P
Weight (kg)	55.59±7.56	54.69±8.92	57.57±8.58	0.018
HC (cm)	88.45±4.34	89.95±6.24	88.92±6.31	0.064
WC (cm)	68.12±6.0	70.72±7.16	70.69±7.175	0.095
WHR	0.74±0.02	0.78±0.05	0.79±0.07	0.101
BMI (kg/m ²)	20.67±1.45	21.73±2.16	19.96±2.13	0.023
BF%	16.10±4.86	18.43±5.90	16.67±6.11	0.002
FM (kg)	6.98±2.09	9.33±3.36	10.55±3.52	0.001
FFM (kg)	47.00±6.90	49.28±8.70	49.59±8.49	0.120

Independent and paired *t*-test used for comparisons; HC: hip circumference; WC: waist circumference; BF%: percentage of body fat; FM: fat mass; FFM: fat-free mass; WHR: waist-to-hip ratio; P: comparison of means by time

Table 2. Anthropometric and Body Composition by sex (values expressed as mean±SD)

Independent and paired *t*-test used for comparison of male and female subjects; BF%: percentage of body fat; FM: fat mass; FFM: fat-free

Variable	Sex	Before Lenten	During Lenten	After Lenten	P
Weight (kg)	Male (n=58)	23.02±3.74	22.34±3.86	23.12±2.98	0.045
	Female (n=40)	24.43±7.52	23.71±7.02	24.09±8.05	
BMI (kg/m ²)	Male (n=58)	21.34±3.45	20.40±2.34	21.33±1.62	0.002
	Female (n=40)	20.19±1.23	19.66±1.95	20.32±2.55	
BF%	Male (n=58)	13.96±1.42	12.76±3.12	14.97±3.64	0.032
	Female (n=40)	22.12±3.79	21.57±4.98	22.94±4.89	
FFM (kg)	Male (n=58)	57.61±4.46	54.65±5.56	53.67±5.49	0.054
	Female (n=40)	40.73±5.37	40.31±6.17	39.75±4.84	
FM (kg)	Male (n=58)	5.92±3.02	5.67±3.17	8.08±2.90	0.154
	Female (n=40)	8.45±2.33	7.45±3.43	11.00±3.06	

mass; BMI: body mass index; P₁: comparison of means before and at end of Lenten;

According to the results of the present study, the Ethiopian Orthodox Christian individuals who adhered to a vegan diet during Lenten fasting had a slight reduction in their systolic and diastolic blood pressure compared to after fasting, which is consistent with the previous findings in this regard [3]. This could be due to the fact that the Orthodox Christian Church prohibits the consumption of meat, dairy products, fats, and olive oil on almost all fasting days. Such restrictions may lead to the reduction of the total energy, total fat, and saturated fat intakes, which in turn leads to the reduction of the body weight and blood pressure. In a similar research, Chiu et al. [23] stated that vegetarian diet is high in potassium and fibers, which are known to reduce blood pressure.

One of the limitations of the present study was the limited age range of the subjects, and since the majority of the participants were city dwellers, the obtained results cannot be generalized to wider populations. Moreover, dietary intakes were not assessed in our research, while it was confirmed that the subjects

adhered to a vegan diet in accordance with the doctrine of the Ethiopian Orthodox Church regarding dietary recommendations. In order to validate our findings, it is suggested that a properly designed, population-based study encompassing various socioeconomic and geographical areas be conducted in developing countries.

Conclusion

According to the results, the subjects experienced a significant reduction in their body weight, BMI, BF%, and FM with adherence to a vegan diet for Lenten fasting, and the reduction was considered to be more significant in men compared to women.

Acknowledgments

Hereby, we extend our gratitude to the College of Health Sciences at Addis Ababa University for the financial support of this study. We would also like to thank all the participants for assisting us in this research project. Lastly, but not list, we

thank Ms. Roza Wami, for her unlimited assistance through this study.

Conflicts of interest

None declared.

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