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Original Research Article

Effects of lenten fasting on body composition and biochemical parameters

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ABSTRACT

Background: The catholic lenten fasting is the period of 40 days of fasting that precedes Easter. It is one of religious fasting less documented in the scientific literature. Thus the aim of our study was to evaluate the evolution of anthropometric and body composition and biochemical profile during Catholic lenten fasting.
Methods: We conducted a prospective study, which took place during the period between one week before at the end of lenten fasting. Eleven fasters (4 women and 7 men), aged between 18 and 59 years were included in present study. Anthropometric, body composition parameters and biochemical profile were evaluated one week before, at 15th day and at the end of Lenten fasting.
Results: Weight, body mass index (BMI) and visceral fat decreased significantly at the end of Lenten fasting. Lipid profile changed significantly during this fasting period. Total cholesterol (TC), low density lipoprotein – cholesterol (LDL-C) and triglycerides decreased significantly with fasting. High density lipoprotein – cholesterol (HDL-C) was remained unchanged during this fasting period while TC/HDL ratio was significantly decreased at the end of Lent.
Conclusions: Present study showed that the fasting of Lent seems to have beneficial effects on reducing cardiovascular risk factors. Further studies are required to better understand the physiological mechanisms involved for a therapeutic use.

Keywords: Biological parameters, Body composition, Easter, Lenten fasting

INTRODUCTION

Fasting is defined as a partial or total abstention from all foods, or a select abstention from prohibited foods. Several forms of fasting are proposed, but the most common are caloric restriction (CR), alternate-day fasting (ADF), and dietary restriction (DR).[1] Caloric restriction is the reduction of kilocalorie (kcal) intake by a certain percentage (typically 20-40%) of ad libitum consumption.

While alternate day fasting consists of alternating 24-hour periods: during the "feast period," fasters may consume food ad libitum; during the "fast period," food consumption is restricted or halted altogether. Water is allowed ad libitum during all times. The last form, dietary restriction, is a reduction of one or more components of dietary intake (typically macronutrients) with minimal to no reduction in total kcal intake. Recent studies conducted on these different forms of fasting, showed beneficial effects on animal and human health.[2-7]

They appear to delay the onset of the following diseases: autoimmune diseases, atherosclerosis, cardiomyopathies, cancer, diabetes, renal diseases, neurodegenerative diseases, and respiratory diseases.[8,9] These observations could be related to their effects on the cardiovascular system and on carbohydrate metabolism.[10-12].

Religious fast are made to spirutual purposes, but they also have their impact on health. The most documented in the scientific literature are: 1) Islamic Ramadan; 2) the three principal fasting periods of Greek Orthodox Christianity (Nativity, Lent, and the Assumption); and 3) the Biblical-based Daniel Fast.[1]

Significant decrease in caloric intake has been reported in the Greek Orthodox fasting, while conflicting results have been reported during Ramadan.[13-18] Review on these different fast have shown beneficial effects on cardiovascular health. Indeed, a decrease in the systolic blood pressure and an improvement of lipid profile have been reported.[13,14,18-20]

Contrary to others religious fasting the effects of Catholic fasting are not well studied in scientific literature. During Catholic fasting one intraday mea lis allowed with a frugal diet in the morning and evening. In Senegal, West Africa, many Christian faithful observe this fasting. Thus, our objective was to evaluate changes of anthropometric, body composition parameters and biochemical profile linked to Catholic Lent.

METHODS

We conducted a prospective study at the Laboratory of Physiology and Functional Explorations of the Faculty of Medicine, Pharmacy and Odontology at the University Cheikh Anta Diop of Dakar (UCAD), Senegal, and West Africa. This study took place during the period from 01 March to 20 April 2014. The protocol was designed in accordance with the guidelines set by the Declaration of Helsinki, and approved by the Ethics Committee of Cheikh Anta Diop University. Participants were informed of the procedures and purposes of the study and gave written informed consent to participate.

A random sample of Christians who indicated their intention to fast during Lenten fasting was realized and 11 subjects were recruited from the general population of Dakar City. Inclusion criteria were: healthy adults of both sexes, aged 18 to 59 years, who were planning to fast during this Lenten fasting. Subjects who had acute or chronic disease or medication were excluded from participation. Volunteers with pacemakers or other electronic medical implants were also excluded because these are contraindicated in balance impedancemeter measurements.

All measurements (anthropometrics, biochemical and body composition parameters) were performed at the morning of the experimental day (i.e., 8:00 h) and at 3 times: one week before the beginning of Lent, the 15th day and the last week of Lenten fasting after 8 hours of fasting condition. Blood was drawn into fluoride tubes (5mL) for glucose measurement, heparin tubes (5mL) for lipid measurement.

Anthropometric measurements

Body composition measurements were taken from each subject the week before the start of Lenten fasting, 15th day and the last week of lenten fasting between 08.00 h and 14.00 hours. Weight was measured without shoes and wearing only light clothing using an balance impedancemeter (OMRON, BF511). Height was measured once at baseline without shoes with the subject stretching to the maximum height and the head positioned in the Frankfort plane using a portable stadiometer Tanita® and was recorded to the nearest 0.1 cm. Body mass index (BMI) was also calculated (kg/m^2).

Body composition parameters such as percentages of fat mass and skeletal muscle mass, and levels of visceral fat were determined using a balance. Fat free mass (FFM) was calculated using the following formula FFM (kg) = Weight*(1-%BF) and skeletal muscle mass by SMM (kg) = Weight*%SMM. Then fat free mass index (FFMI) and skeletal muscle mass index (SMMI) was calculated respectively by the following formulas: FFMI (kg / m²) = FFM / hieght² and SMMI (kg/m²) = SMM / height². All measurements (except height measurement) were repeated at 15th day and the last week of Lenten fasting for each subject by the same person.

Biochemical parameters

Serum glucose was determined by using a glucose oxidase method.

Plasma total cholesterol (TC) and high density lipoprotein (HDL) were measured by an enzymatic colorimetric method using cholesterol esterase, cholesterol oxidase, peroxidase and the chromagen 4-aminophenazone/phenol.[21] Plasma triglyceride (TG) levels were determined by an enzymatic colorimetric method using lipoprotein lipase glycerokinase, glycerophosphate oxidase and the chromagen 4-aminophenazone/ N-ethyl-N- (3-sulphopropyl)-nramisidine.[22] Low density lipoprotein (LDL) was calculated using the Friedewald et al equation.[23]

Following parameters were calculated: TG/HDL, LDL/HDL and TC/HDL.

Statistical analysis

Statistical analysis was performed with R software. Descriptive statistics were used to describe the sample characteristics. Paired t-test was used to compare the different variables before versus during Lenten fasting in body composition and biological parameters. The ANOVA was used for and comparison of means of the parameters between different periods of study. When it is significant, a Tukey test has been realized. The differences were considered statistically significant at $p < 0.05$.

RESULTS

Anthropometric and body composition data (Table 1)

The mean age was 27.91±5.85 years, ranging from 21 to 42 years and the average size was 167.8±9.68 cm.

Analysis of results showed that weight and BMI decreased significantly between the beginning and the end of Lent, and between the 15th and the end. Concerning parameters of body composition, only the visceral fat decreased significantly between the beginning and the end of Lent, but also between the 15th and the end. The fat mass tended poorly to decrease at the end of Lent.

Biochemical parameters (Table 2)

Results showed a significant decrease in blood glucose and total cholesterol in all subjects from the 15th and this until the end of Lent. LDL-C decreased significantly between the beginning and the end of study. This decrease is more significant between the 15th and the end of Lent. Triglycerides and LDL / HDL and TC / HDL ratios decreased significantly at the end of study. However, the HDL cholesterol did not significantly increase during Lent. Comparing averages of different biological parameters showed a significant difference between periods for triglycerides and results are shown in Figure 1.

Present data showed that triglyceride levels decreased significantly between the beginning and the end of Lent, and between the 15th day and the end of Lent. However, no significant difference was found between the start and the 15th day of Lent for this parameter.

Table 1: Evolution of anthropometric parameters and body composition during the fasting of lent.

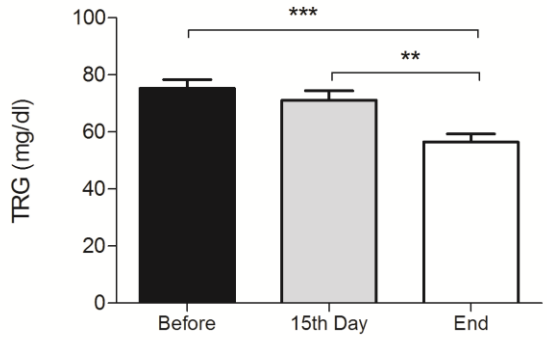
	Before	15th Day	End	p1	p2	p3
Weight (kg)	60.75±8.38 [47.3;71]	60.17±8.7 [46.7;73.8]	59.19±8.25 [45.9;70.1]	0.08	0.003	0.02
BMI (kg/m²)	21.56±2 [18.1;23.7]	21.42±2.37 [18.1;24]	21.01±1.99 [18.3;23.6	0.23	0.01	0.04
% SMM	35.94±7.35 [22.8;44.3]	35.64±8.05 [22.9;45.7]	36.2±7.96 [23.2;46.9]	0.26	0.39	0.27
% FM	22.34±8.51 [10.5;37.8]	21.86±5.11 [9.1;39.9]	21.12±9.35 [7.2;37.8]	0.21	0.15	0.2
% FFM	77.66±8.51 [62.2;89.5]	78.14±9.32 [60.1;90.9]	78.88±9.35 [62.2;92.8]	0.21	0.15	0.2
FFM (kg)	47.38±9.25 [34.08;57.2]	47.23±9.78 [34.22;58.3]	46.91±9.59 [34.02;59.37]	0.38	0.29	0.28
FM (Kg)	13.37±4.74 [5.76;21.85]	12.94±5.11 [4.98;22.74]	12.28±5.03 [1.12;20.68]	0.11	0.07	0.15
SMM (kg)	22.14±6.35 [13.18;28.5]	21.78±6.74 [12.51;28.87]	21.75±6.59 [12.69;29.51]	0.18	0.29	0.47
SMMI (kg/m²)	7.69±1.53 [5.45;9.35]	7.55±1.66 [5.07;9.75]	7.55±1.61 [5.35;9.73]	0.14	0.26	0.48
FFMI (kg/m²)	16.64±1.68 [13.83;16.68]	16.56±1.81 [13.88;19.1]	16.45±1.72 [14.23;19]	0.32	0.26	0.28
% VF	4.27±1.79 [1;7]	3.9±1.57 [1;6]	3.36±1.5 [1;6]	0.05	<0.001	0.01

BMI: Body mass index, FM: Fat mass, FFM: Fat free mass, SMM: Skeletal muscle mass, FFMI: Fat free mass index, SMMI: Skeletal muscle mass index, p1: Before versuss 15th day, p2: Before versus End and p3 : 15th versus End

Table 2: Evolution of the biological profile during Lent.

	Before	15th Day	End	p1	p2	p3
Gl (g/L)	0.94±0.08 [0.77;1.07]	0.85±0.07 [0.76;0.96]	0.88±0.1 [0.76;1.05]	0.01	0.08	0.21
TC (mg/dl)	204.5±55.42 [91;265]	215.5±53.87 [103;279]	179.4±44.7 [101;224]	0.01	0.003	<0.001
HDL-C (mg/dl)	54.56±21.85 [26.4;103.9]	62.58±21.21 [30.4;90.9]	61.07±14.27 [40.4;86.3]	0.17	0.15	0.37
LDL-C (mg/dl)	134.8±51 [40.2;212]	138.7±39.12 [62;200.1]	106.98 ±39.86 [35.6;156.9]	0.3	0.01	<0.001
TRG (mg/dl)	75.27±10.16 [60;90]	71.09 ±11.26 [53;90]	56.55 ±9.02 [40;70]	0.14	<0.001	0.005
TRG/HDL	0.66±0.33 [0.31;1.49]	0.56±0.2 [0.31;0.89]	0.62 ±0.32 [0.37;1.32]	0.07	0.27	0.18
LDL/HDL	2.89±2 [1.04;7.27]	2.31±0.61 [1.45;3.48]	1.81±0.78 [0.64;2.88]	0.19	0.05	0.01
TC/HDL	4.21±2.1 [2.35;8.9]	3.57±0.64 [2.62;4.7]	3±0.8 [1.8;4.09]	0.18	0.04	0.01

Gl: Glycemia, TC: Total Cholesterol, TRG: Triglyceride, p1: Before vs 15th day, p2: Before vs End and p3: 15th vs End.



*: Significant difference between conditions. **: p<0.01; ***: p<0.001; TRG: Triglyceride.

Figure 1: Evolution of triglycerides during Lent.

DISCUSSION

During the period between the weeks before the fasting of Lent Catholic to an end, we conducted a prospective study whose purpose was to assess the evolution of anthropometric, body composition and biological parameters. This is a fast not or no documented compared to other forms of religious fasting.

It approaches to one of three main periods of fasting Greek Orthodox Christian, which is that of the 40 days of fasting before Easter. During our study, we found a significant decrease in weight, BMI and visceral fat at the end of Lent. Total cholesterol, LDL-C, triglycerides as well as the TC / HDL and LDL / HDL ratios decreased also significantly during the period of fasting.

Present results corroborated those of other studies on religious fast. Papadaki et al, and Sarri et al have all found a significant decrease in body weight in studies performed on fasting Greek Orthodox Christian.[13,14] For Ramadan, Hallak et al, also found a significant decrease in weight at the end of this holy month.[17] In present study weight tend to decrease since the 15th day of fasting. However, a study conducted during Ramadan found a significant decrease in weight after two weeks of fasting.[24]

Concerning, BMI significant decrease was found in our study. During Ramadan this aspect was found by some authors.[25-27] However, other authors did not find any decrease in BMI during Ramadan.[28,29] We found no significant decrease in body fat, but visceral fat decreased significantly after the fasting of Lent. A significant decrease in fat mass was found at the end of Ramadan by Trabelsi et al.[30] In present study the decrease in body weight is accompanied by non-significant decreases in fat free mass and fat mass. The results found on the parameters of body composition could be related to diet. Indeed, present subjects take only one meal per 24 hours. It was a light meal, but with a predominance in animal fat. Sundays were not fasting day and ate food ad libitum. All these elements could explain this effect on visceral fat is considered as a cardiovascular risk factor.

Biological profile has changed significantly. Blood glucose, total cholesterol, LDL-C and triglycerides decreased significantly during Lent. However, HDL-C did not significantly increase during the study period. Certain authors have found a significant decrease in TC and LDL-C during Ramadan, Greek Orthodox fasting and Daniel fasting.[13,14,20,31,32] In scientific literature, results are conflicting for triglycerides and HDL-C.[13,14,17,20,33] LDL / HDL and TC / HDL ratio decreased significantly at the end of the study.

Papadaki et al have found a significant decrease in TC / HDL ratio in the Orthodox fasting, while Aksungar during Ramadan and Sarri during Orthodox fasting did not find significant differences.[13,14,34] These aspects could be explained by the differences between forms of religious fast or the diet during fasting.

During Ramadan, the faithful do dietary restriction between sunrise and sunset. But after the break of fasting no food restrictions exist. The Orthodox fasting is characterized by three main periods of fasting covering 180 to 200 days in the year. The diet is predominantly vegetarian. During the fasting of Lent, catholics have only one meal a day and eat ad libitum once a week, on Sundays and solemnity days. Their diet is for the majority of our subjects composed of animal milk with sugars. This type of diet could explain the significant decrease in lipid parameters have a beneficial effect on cardiovascular health.

CONCLUSION

In conclusion, present results showed undoubtedly the potential impact of this fasting on heart health and glycemic control in normal subjects, but also patients with cardiovascular disease or diabetes. Further studies with a significant number would be necessary to try to understand the mechanisms by which it influences fasting physiological parameters to therapeutic use.

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