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The Effect of Ethiopian Orthodox Christians 'AbiyTsom' (Lent fasting) on Metabolic Syndrome Indices and Serum Electrolytes

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ABSTRACT

Introduction: Fasting, the voluntary abstention from all restricted foods, is a feature of many religions, and the putative health benefits have attracted both scientific and popular interest. There is no clear understanding that religious fasting has great effects on metabolic syndrome. There is little data available that provides information concerning Ethiopian Orthodox Christians fasting influence on metabolic syndrome indices and serum electrolytes to date. To determine the effect of 'Abiy tsom' (lent fasting) of Ethiopian Orthodox Christians on metabolic syndrome indices and serum electrolytes in Addis Ababa, Ethiopia.

Methods: 88 Study subjects were included conveniently who were followers of Ethiopian Orthodox Christianity faith and fasting "lent" and longitudinal cross-sectional study design was employed. Data were collected twice, the first during last week of the fasting months and the second during the last week of two months' time after returning to usual diet. The data and sample were collected, analyzed, interpreted and was displayed by using descriptive and analytical statistical methods.

Results: Our study found that Ethiopian Orthodox lent fasting had clear and significant effects on Anthropometric measurements, systolic blood pressure, lipid profiles, and Urea. It was also found that this fasting decreased the levels of Calcium and Chloride ions while Serum sodium and potassium were influenced insignificantly.

Conclusion: Ethiopian Orthodox Christians lent fasting is beneficial for weight loss and fighting metabolic syndrome.

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Introduction

Metabolic syndrome constitutes a gathering of clinical and research center symptomatic test variations from the norm, which are related with the expanded danger of cardiovascular infections (CVDs) and diabetes mellitus. Metabolic syndrome is not an illness without anyone else's input, but instead an arrangement of undesirable conditions, established in one's poor way of life; it is additionally connected with the expanded predominance of weight (1).

The regular side effects of metabolic syndrome incorporate unreasonable amassing of fat, particularly in the stomach area, hypertension, and large amounts of triglyceride (TG), blood glucose, and low-thickness lipoprotein-cholesterol (LDL-C), which can build the danger of CVDs and diabetes mellitus. American Heart Affiliation and the National Heart, Lung, and Blood Organization have

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characterized metabolic disorder as comprising of no less than three of the previously mentioned conditions (2, 3). It is among the main sources of bleakness and mortality around the world (48). The predominance of interminable infections when all is said in done and metabolic syndrome specifically is expanding in disturbing rate in Ethiopia (49). Unfortunate dietary practices like utilization of calorie-thick sustenance are among the dependable hazard factors for the expanded pervasiveness of metabolic disorder (17).

Fasting, the willful abstention from nourishment is an element of numerous religions, and the putative medical advantages have pulled in both logical and prevalent intrigue. Generally, the believers are not allowed to eat any animal or dairy source foods unless exempted from these fasts because of serious sickness, breastfeeding mothers, and children less than seven years of age (4). Religious fasting because of their immediate impact on nourishment propensities and way of life of the concerned populace, they are found to have consequences for their wellbeing. Be that as it may, a moderately little extent of research considers led to date have investigated the impact of religious fasting (39). Among religions those have been examined with respect to their connection to wellbeing, Judaism (40-41), Islam (42-45), Seventh-Day-Adventists (46, 47), and Greek Conventional Christians (5).

Not at all like the Greek, Ethiopian Orthodox Christians (EOC) notwithstanding creature source nourishments remedy, calorie limitation has additionally been polished by the vast majority of the devotees and the span of loaned fasting period is delayed by one week; in any case, to the best of the analyst's learning, there is no examination directed on the part Ethiopian Orthodox Christians' fasting practice in connection to metabolic syndrome records and level of serum electrolytes (50, 51)

The aim of this study is to assess the effects of Ethiopian Orthodox Christians Abiy tsom (lent fasting) on metabolic syndrome indices and level of serum electrolytes.

Material and methods

Study setting and population

Study was conducted at Addis Ababa University, college of health sciences, from March 15 to June 15, 2017. It is located in the City of Addis Ababa, capital city of Federal Republic of Ethiopia and Head Quarter of Africa Union. According to the Ethiopian National Population and Housing Census of 2007 (53), Addis Ababa has a total population of 2,737,551. About 23% of the total urban population of Ethiopia lives in Addis Ababa and with respect to religion 74.7% are Orthodox Christians, 16.2% are Muslims and 7.8% are Protestants (53).

Study populations were Orthodox Christians living in Addis Ababa and were chosen using convenience sampling technique on the basis of their willingness to participate and satisfying the inclusion criteria of the study. Employees and students of College of Health Sciences, Addis Ababa University and who are Ethiopian orthodox Christians believers and fasting '*Abiy tsom*'(lent) were selected as study subjects purposively for they are easily available around for the data and sample collection.

Study design

Community based Longitudinal comparative cross sectional study was employed.

Sample size determination

A total of 88 individuals met eligibility criteria during study period were included.

Eligibility criteria

All employees of College of Health Sciences, Addis Ababa University and who were Ethiopian orthodox Christians believers and fasting '*Abiy tsom*'(lent) and had no physical deformity, pregnancy during study period and were not seriously ill or diagnosed of any chronic diseases.

Data collection and instruments of data collection

The instruments used for data collection were adapted mainly from the stepwise (STEPs) approach for non-communicable disease surveillance and partly from Sarri *and their colleagues*. STEPs is the WHO-recommended surveillance tool for chronic disease risk factors and chronic disease-specific morbidity and

mortality which is intended to serve as an entry point for low and middle-income countries into surveillance of chronic diseases and their risk factors. This approach is characterized by the use of questionnaires to gain information on risk factors, simple physical measurements (anthropometric and blood pressure measurements) and biochemical measurements (lipid profile and glucose level).

Data and Samples were collected twice, one at the last week of two months fasting period and the second at the end week of the second month after fasters returned to usual diet. After overnight fasting, samples were collected in the morning between 8 AM and 10 AM.

Anthropometric measurements

Body weight was measured twice at pre-stage and end of fasting by a digital scale (Seca, Hamburg, Germany) to the nearest 100g, placed in flat surface. Waist circumference was measured at the midpoint between the lower margin of the least palpable rib and the top of the hip or minimal waist using stretch-resistant tape. Hip circumference was measured around the widest portion of the buttocks, with the tape parallel to the floor. The cut-off points for waist to hip ratio above 0.90 for males and above 0.85 for females used to indicate CVD risk.

Physical/ Clinical examination

Blood pressure was measured digitally (Micro life BP A50, Micro life AG, Switzerland) The BP was taken using a mercury sphygmomanometer from the right upper arm after the subject was seated quietly for 5 min. Pulse rate was counted from radial artery and the count per minute was registered.

Biochemical tests

10ml of blood was drawn from fasting individuals using serum separator tube. The drawn sample stayed for 30 minutes and then centrifuged at a speed of 4000 rpm for 10 minutes. Then serum was taken and stored under -800C till the time of biochemical analysis. The serum levels of glucose, TC, HDL-c, LDL-c and TG were measured using COBAS INTEGRA 400 (Roche Diagnostics GmbH, Sandhofer Strasse 116, D-68305 Mannheim Germany) random access full automated auto analyzer. Level of Urea was determined by colorimetric method in the presence of Nitroprusside and Electrolytes were analyzed based on the ion selective electrode.

Data Analysis

Data obtained from laboratory results and anthropometry measurements were entered to Epi data version 3.1 and exported to SPSS version 21 for statistical analysis. Normality of continuous variables was checked by using graphic methods (Histograms with normality curves and QQ plots). Models were selected based on the type of variables and to compare the data during fasting period and non-fasting period, Paired sample t test was used and P value $\leq$ 0.05 was considered statistically significant.

Results

Socio demographic Characteristics of the Study participants

A total of 88 study subjects were enrolled and 3 of them were absent during second phase of data and sample collection (non- fasting period) and they were excluded from the study. From total of 88 study subjects, 40 were female and 48 were male. According to Age distribution most of them are found in age group of21-30(61.3%). Regarding Educational status, most of them fall under the category of above secondary education (79.7%). None of them responded yes for Chat chewing, alcohol use and cigarette smoking (Table 1).

Table 1. Socio demographic characteristic of the study participants

s.n	Characteristics	Frequency	Percent
1	Sex		
	Male	48	45.5
	Female	40	45.5
2	Marital status		
	Single	62	70.4
	Married	26	29.6
	Divorce		
	Widow		
3	Age		
	21-30	54	61.3
	31-40	30	34
	>40	4	4.7
4	Educational status		
	Cannot read and write		
	Primary Education	8	9
	Secondary Education	10	11.3
	Above secondary education	70	79.7
5	Smoking cigarette		
	Yes	0	0
	No	88	100

6	Alcohol use		
	Yes	0	0
	No	88	100
7	Chat chewing		
	Yes	0	0
	No	88	100

Fasting type of study participants

Fasting of Ethiopian Orthodox church may vary per individuals, so that type of the fasting study participants was assessed. Accordingly, most of our study subjects fast all animal source foods up to 3:00 PM (42 persons, 48%). 14 of them (16%) fast all animal source foods up to lunch (1:00PM) while 8 persons (9%) fast all animal source foods but not fish plus all foods up to 3:00 PM. Eleven of them (12%) fast all animal source foods only and 9 (10%) of them fast all animal sources except fish only (Fig. 1).

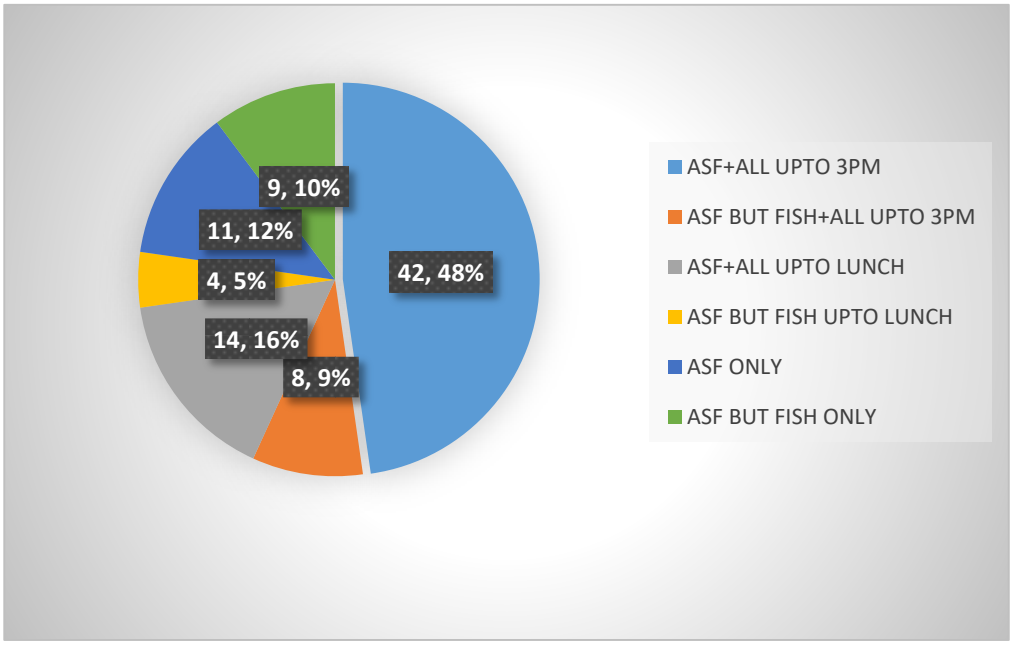

Figure 1. Fasting type of study participants

Comparison of Anthropometric Measurements During fasting and Non- Fasting

Anthropometric measurements of our study participants were taken twice, one during fasting period and the other non-fasting period, and comparison of the two measurements was done. The mean Weight of the study participants was increased from 60.39kg to 61.36kg after they returned to usual diet and their BMI was decreased from 21.6 kg/m^2 to 20.04kg/m2. Waist circumference was increased from 67.76cm to 74.63cm; Hip circumference from 84.65cm to 92cm and Waist to Hip ratio from 0.796 to 0.816 after they returned to their usual diet (Fig. 2).

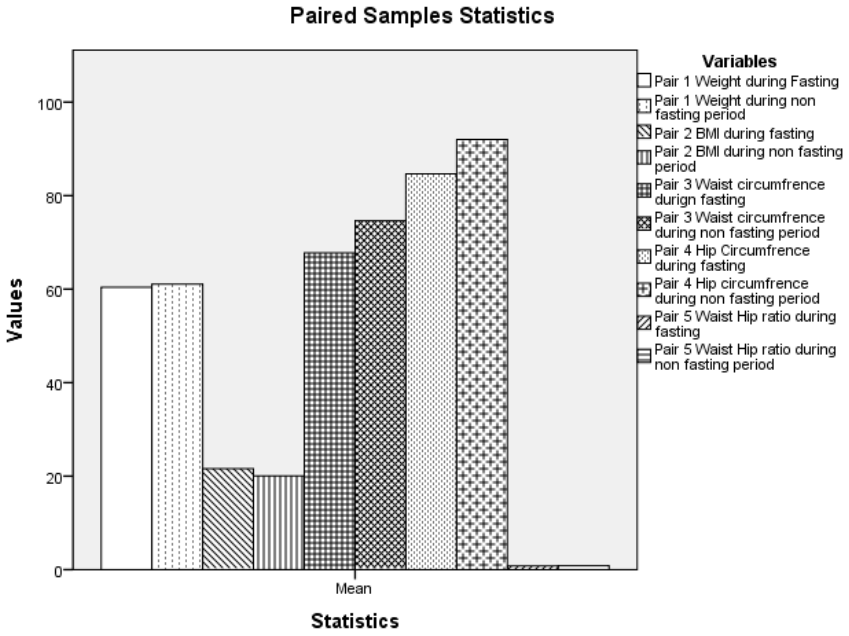

Figure 2. Comparison of anthropometric means during fasting and non-fasting periods

Accordingly, the weight, Body Mass Index, Waist and Hip Circumference were significantly increased during non-fasting period with P value of 0.037, 0.022, 0.001, and 0.001 respectively by paired sample t test. Hip to Waist ratio was found to be increased with non-significant change with p value of greater than 0.05(0.225) (Table 2).

Table 2. Paired sample t test Comparison of means of Anthropometric measurements of the study participants

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
1	Wt	-.675	2.79700	.31875	-1.31017	-.04048	-2.11	76	.037
2	BMI	1.555	6.08211	.66361	.23510	2.87490	2.343	83	.022
3	WC	-6.86	17.87491	1.99848	-10.84037	-2.88463	-3.43	79	.001
4	HC	-7.35	18.49263	2.06754	-11.46533	-3.23467	-3.55	79	.001
5	WHR	-.020	.15213	355.38 ± 0.71[a]	-.05467	.01304	-1.22	79	.225

Comparison of Systolic/Diastolic blood pressure and Pulse rate of the study participants

Paired sample t test analysis of comparison of means of systolic blood pressure, diastolic blood pressure and pulse rate indicated that systolic blood pressure was significantly changed with P value of 0.001 while the rest were not affected (Table 3).

Table 3. Paired sample t test Comparison of means of Blood pressure and pulse rate of the study participants

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% CI				
					Lower	Upper			
Pair 1	SBP	-17.98485	43.24	5.3	-28.61	-7.35	-3.379	65	.001
Pair 2	DBP	.75926	12.2	1.6	-2.59	4.108	.455	53	.651
Pair 3	PR	.77215	11.91	1.34	-1.89	3.440	.576	78	.566

Comparison of Lipid Profile of the study subjects

Means of Lipid profiles were compared and changes were observed. Total cholesterol was decreased from 156.8mg/dl during fasting period to 144.4mg/dl after returning to usual diet. Triglyceride level was increased from 104.4mg/dl during fasting period to 105.1mg/dl after returning to usual meal. LDL cholesterol level was increased from 107.9mg/dl during fasting to 109.9mg/dl during non-fasting and HDL cholesterol level increased to 42.22mg/dl to 45.36mg/dl after fasting gone (Fig. 3).

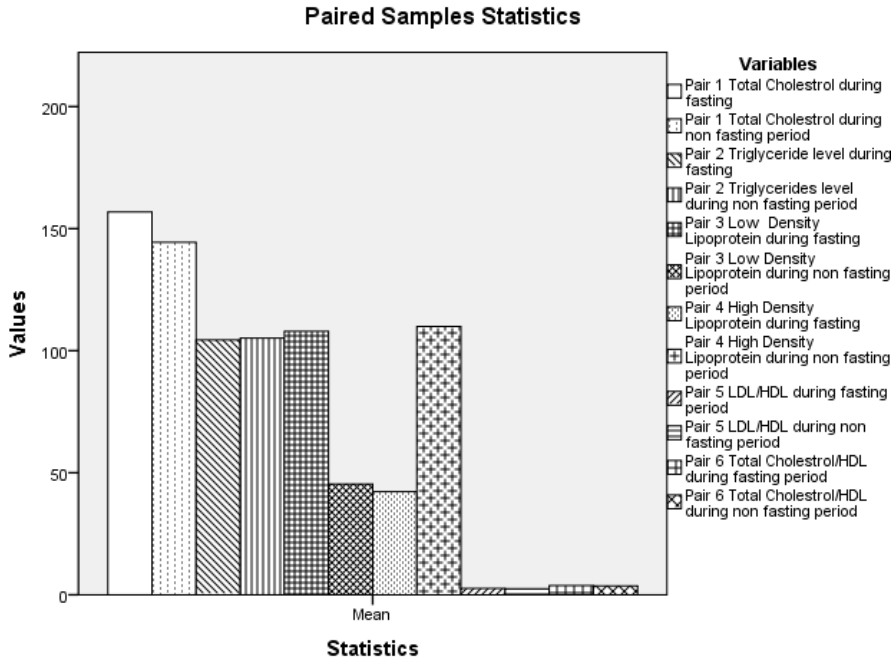

Figure 3. Comparison of means of lipid profiles during fasting and non-fasting period

Statistical Analysis of lipid profiles of the study participants by paired sample test indicates that, Total cholesterol, High Density Lipoprotein, LDL to HDL ratio and Total Cholesterol to HDL ratio were significantly changed with P value of 0.044, 0.0001, 0.015 and 0.035 respectively. Low density lipoprotein and Triglycerides level were not significantly affected (Table 4).

Table 4. Paired sample t test comparison of means of lipid profiles of the study participants

	Paired Differences					t	df	Sig. (2-tailed)
	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
				Lower	Upper			
TC	12.45238	60.71073	6.62408	-.72266	25.6274	1.88	83	.044
TRI	-.77027	57.63740	6.70021	-14.123	12.5832	.115	73	.909
LDL	-2.00000000	25.584134	2.97409	-7.9273	3.92736	-.67	73	.503
HDL	-3.14865	6.68403	.77700	-4.6972	-1.60008	-4.0	73	.0001
LDL/HDL	.14338	.49512	.05756	.02867	.25809	2.49	73	.015
TC/HDL	.14885	.59559	.06924	.01087	.28684	2.15	73	.035

Comparison of Urea level and total protein of the study participants

As the table below clearly shows, Urea level of the study subjects was significantly affected during two periods with P value of 0.028 while Total Protein remained unaffected (Table 5).

Table 5. Paired sample t test comparison of means of Total protein and Urea level of study participants

	Paired Differences					t	df	Sig. (2-tailed)
	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
				Lower	Upper			
UREA	-1.4	5.45971	.63468	-2.6838	-.15401	-2.2	73	.028
TOTAL PRTOTEIN	.07	.74168	.03622	.09616	.24751	.878	73	.383

Comparison of Fasting blood glucose level of study participants

As shown below, the analysis made, revealed that Blood glucose level was not significantly affected after the fasting ceased for two months (Table 6).

Table 6. Paired sample t test comparison of blood glucose of participants

	Paired Differences					t	df	Sig. (2-tailed)
	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
				Lower	Upper			
FBS	-1.5	16.1093	1.87267	-5.2862	2.17818	-.83	73	.409

The effect of Ethiopian Orthodox Christians fasting on the levels of serum electrolytes (Na^{+}, K^{+}, Ca^{+2} and Cl^{-})

The analysis made to determine the effect of fasting on the levels of serum electrolytes indicated that, the average means of Sodium and Potassium ions were slightly higher during fasting period than the non- fasting period (142 mmol/L, 141 mmol/L) and (4.508 mmol/L, 4.426 mmol/L). However, it was found that serum calcium and chloride ions were sharply decreased after the study participants ceased the fasting and returned to usual diet (1.510 mmol/L,1.047 mmol/L) and (107.7 mmol/L, 105.9 mmol/L) (Fig. 4).

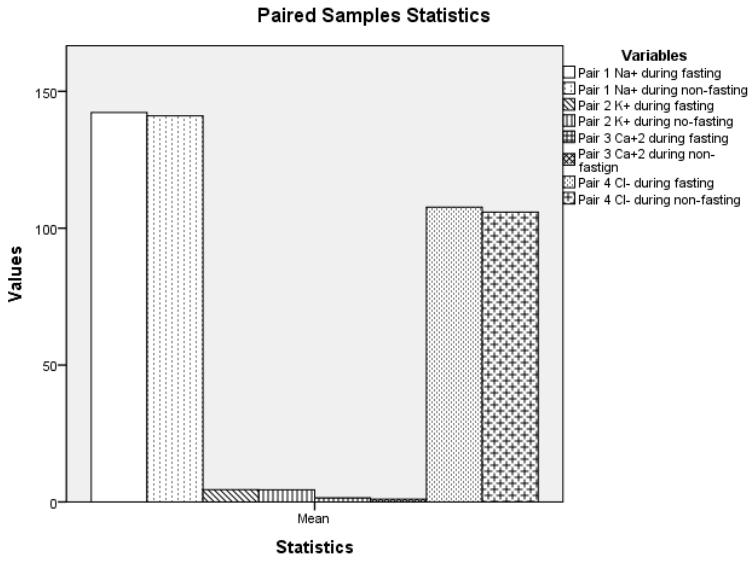

Figure 4. Comparison of mean levels of serum electrolytes during fasting and non-fasting

Paired samples t test was done to check whether this effect was significant and showed that the effect on calcium and chloride ions were significant with P value 0.015 and 0.033 respectively (Table 7).

Table 7. Paired samples t test comparison of levels of serum electrolytes of study participants

	Paired Differences					t	df	Sig. (2-tailed)
	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
				Lower	Upper			

1	NA^{+}	1.2037	7.0137	.779	-.3	2.754	1.5	80	.126
2	K+	.08160	.43757	.048	-.0	.1783	1.6	80	.097
3	Ca^{+2}	.46346	1.6832	.187	.09	.8356	2.4	80	.015
4	Cl^{-}	1.8555	7.7150	.857	.14	3.561	2.1	80	.033

Discussion

This study found that Ethiopian orthodox Christian fasting significantly decreased anthropometric measurements like weight, Body mass Index, Waist and hip circumference. These findings are supported by various studies. A study undergone to assess effects of Greek Orthodox Christian church fasting revealed that Body mass index was decreased during fasting period (5). Another interventional study conducted on a strict vegetarian diet for five weeks on 35 women found significantly decreased Body Mass Index (30). Other researchers that investigated seventh day Adventist who were strict vegetarians, found decreased weight, Body mass index and Waist to Hip ratio of the subjects (28, 32). Another study on a group of vegans and non-vegetarians found lower Anthropometric measurements in vegan group (33). Other research that was conducted on the effect of intermittent fasting on anthropometric measurements showed decreased weight gain whereas no significant change on BMI, WC and HC (21). This significant change of Weight, Body Mass Index, Waist circumference and Hip circumference in our study can be attributed to decrease protein intake and caloric restriction of Ethiopian Orthodox Christians fasters and insignificant influence on Waist and Hip ratio may be due to increment of both waist and Hip circumferences simultaneously keeping the ratio almost constant.

Regarding the effect of Ethiopian orthodox Christian fasting on systolic blood pressure, diastolic blood pressure and pulse rate, we found that the fasting significantly affected systolic blood pressure while diastolic blood pressure and Pulse rate remain unchanged. A literature reported that Ramadan fasting had no significant effect on all of these three parameters (22). The results from studies conducted on Greek Orthodox Christians are conflicting. A study found that systolic blood pressure increased during fasting periods (19), while another study found no change in blood pressure when fasters were compared with non-fasters (5). One study reported that non-fasters' diastolic blood pressure decreased significantly during fasting periods when compared to the changes in fasters' diastolic blood pressure (5), while another study reported that fasters' diastolic blood pressure did not change during fasting periods (19). But all of them revealed that Pulse rate at rest was not affected significantly.

The comparison of the lipid profile of the fasters during period of two months fasting and non-fasting period indicates that most of the parameters were affected significantly. Specifically, our study showed that Total cholesterol, High density lipoprotein, Total cholesterol to HDL ratio and LDL to HDL ratio were significantly influenced by fasting with P value 0.044, 0.001, 0.015 and 0.035 respectively. However, the level of Low density lipoprotein and triglycerides were not decreased significantly during the fasting period.

A study conducted on Greek orthodox Christians fasting also found the decreased level of LDL and LDL to HDL ratio. But in this study after the fasters returned to usual diet, sharp increment in LDL and Total Cholesterol was witnessed. The reduction in HDL we found is the common finding with low fat and vegetarian diet. Conflicting with our study, a study reported the ratio of Total cholesterol to HDL and LDL to HDL were remain unchanged (30).The disparity may be due to different study setting, where they studied by intervention diet and also the population samples differ with possible genetic variation.

Concerning total cholesterol, a group of researchers reported decreased level during Greek Orthodox fasting and also in catholic Christian during lent. The difference may be due to the fasting style of Catholics which is different from that of orthodoxies. Catholics lent fasters abstain from meat sources only on Wednesday and Friday while Orthodox fasters abstain from it for 55 days (5, 20). In various literatures, results for Triglycerides are conflicting (31). In our case, there was no significant change. This may be because during fasting the body may synthesize Triglycerides from carbon skeletons of amino acids and metabolites from

carbohydrate metabolism.

The other crucial effect we observed is that urea level which was significantly increased during Fasting period. This is well supported by a study carried out in district of Maharashtra, India that underwent among Judo athletes (25, 26).Many dietitians consider the diet of plant origin consumed by vegans to be "lighter" and "more healthful" for the kidneys than the diet of both plant and animal origin consumed by omnivores (25). This is because of the lower dietary protein intake (particularly meat), which decreases urea level (23). The present findings agree with these conclusions.

Additionally, significant changes of Total protein and blood glucose were not detected. This is also similar finding of various studies among different fasting season of religious groups during Ramadan fasting and in Greek orthodox Christian church fasting (5, 27). Normally this is expected result because Ethiopian Orthodox Christian fasters do not restrict protein from plant sources and in the same way the carbohydrates, except that of animal sources.

This study observed the effect of Ethiopian Orthodox Christians fasting on serum electrolytes and found that, Serum Sodium and Potassium ions were insignificantly increased while Calcium and Chloride ions were significantly raised during fasting season with P value of 0.015 and 0.035 respectively.

Studies underwent among Greek Orthodox and Coptic Christians lent fasters reported conflicting results for Serum Sodium level i.e., some showed normal, and others decreased value of total Na^+ excretion throughout the fasting and reasoned decreased intake of food. The results for K^+ were also conflicting. Some of the studies showed normal level while others studies increased value during fasting and reasoned that common practice of drinking large volumes of fruit juices, eating dates and dried fruits as well as reduced potassium excretion. These literatures indicated increased level for Ca^{+2} and Cl^- which is similar to our findings (6, 19).

In Greek Orthodox Christians decreased level of Ca^{+2} and unchanged level of Cl^- during fasting was reported. This may be due to study setting (interventional) and genetic difference of the study subjects. In line with our findings, the level of Na^+ and K^+ were not affected significantly (36)

Generally, lent fasting of Ethiopian Orthodox Christians affected several parameters significantly. The variation of our findings from previous studies conducted among Greek Christians fasting, Ramadan fasting, Adventists fasting and catholic fasting may be attributed to differences in study setting, the type and period of fasting, type of food avoided during fasting period, environmental and genetic variations.

Conclusion

This piece of work was an effort to assess effect of Ethiopian orthodox Christians fasting of two months' period on some metabolic syndrome indices. Ethiopian orthodox Christians fasting has a considerable effect on metabolic indices changing various parameters. It is observed that, anthropometric parameters like weight, Body mass index, Waist circumference and Hip circumference were significantly decreased during fasting season indicating that fasting is beneficial for weight loss and combating against metabolic syndrome. Systolic blood pressure was decreased during fasting period which may be hypothesized as a good fighting mechanism against Hypertension which is one of the constituents of disorders in metabolic syndrome. Moreover, the fasting also caused significant change in lipid profiles decreasing multiple biochemical parameters which again shines green light on using fasting as a strategy to fight disorders caused by increased consumption of fats specifically animal fats. Additionally, fasting affected the serum electrolytes which were not significant in Na^+ and K+, while significant in Ca^{+2} and Cl^-.

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Conflict of interest

None declared.

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