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Effect of intermittent Islamic fasting in management of metabolic syndrome: a randomized control trial

Hanaa A. Nofal^{1*}, Abdellatif Abd-El Rahman Elmor¹, Amany M. AbdAllah², Nermeen A. Zaitoun³, Shaherah Yousef Andargeery⁴, Mahmoud A. Sharafeddin⁵, Radwa Ibrahim Ali Hassan^{6†} and Lamiaa Lotfy Elhawry^{1†}

Abstract

Background Metabolic syndrome doubles the risk of developing cardiovascular diseases and type II diabetes mellitus. Intermittent Islamic fasting is an effective health strategy associated with various benefits.

Objectives to compare effect of intermittent Islamic fasting with lifestyle modification versus lifestyle modification only on weight management, blood pressure, blood glucose and lipid profile among a group of metabolic syndrome patients.

Methods A Randomized control trial was conducted on (54 patients) with metabolic syndrome, their ages range from (30–45 years) attending the clinical nutrition outpatient clinic in the Zagazig University hospital from 1st of August (2023) to the end of February (2024). Intervention group (27 patients) followed Islamic fasting with lifestyle modification (Islamic fasting means: fasting two days per week (Monday and Thursday) with fasting (13, 14, 15) middle of lunar months) and control group (27 patients) followed lifestyle modification only.

Results There is statistically non-significant difference between groups regarding healthy lifestyle score, clinical or laboratory parameters. There is statistically significant difference between the studied groups regarding percent of change in weight ($p\text{-value} < 0.001$), waist circumference ($P\text{-value} < 0.001$), systolic ($p\text{-value} = 0.042$), diastolic blood pressure ($P < 0.001$), Fasting blood glucose ($p\text{-value} < 0.001$), triglycerides ($p\text{-value} < 0.001$), HDL ($p\text{-value} < 0.001$) and total cholesterol ($p\text{-value} = 0.023$) with better improvement in intervention group, although no significant difference between them regarding lifestyle before or after intervention but both groups showed significant improvement after intervention.

Conclusion Intermittent Islamic fasting (ISF) demonstrated a statistically significant enhancement in weight regulation, systolic blood pressure, triglyceride levels, total cholesterol, and HDL concentrations when compared to lifestyle modification alone.

Trial registration Retrospectively registered on ClinicalTrials.gov, registered at 22/1/ 2025, Identifier NCT06805526.

[†]Radwa Ibrahim Ali Hassan and Lamiaa Lotfy Elhawry contributed equally to this work.

*Correspondence:
Hanaa A. Nofal
HANofal@medicine.zu.edu.eg

Full list of author information is available at the end of the article



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Keywords Intermittent Islamic fasting, Lifestyle modification and metabolic syndrome

Introduction

Metabolic Syndrome (MetS), also called “Syndrome X” or “insulin resistance syndrome” describes a common condition characterized by high blood pressure, elevated triglycerides, central obesity, and low HDL cholesterol levels [1]–[2]. Having metabolic syndrome doubles the risk of developing cardiovascular diseases and type II diabetes mellitus [3]. The prevalence of Metabolic Syndrome (MetS) is globally increasing due to the widespread adoption of the Western lifestyle [4]. Between 2011 and 2018 the prevalence of Metabolic Syndrome (MetS) in the USA significantly increased from 37.6% in 2011–2012 to 41.8% in 2017–2018. This trend may be indicative of the rising epidemic of type II diabetes there [5]. In Egypt, an estimated 10.9 million people currently have diabetes. This number is projected to rise to 13 million by 2030 and to 20 million by 2045 [6]–[7]. Recent studies report Egypt’s MetS prevalence at 55%, the high prevalence of MetS among middle-aged and elderly Egyptians, these findings call for a nationwide screening program to detect MetS and tackle preventive strategies to face the epidemic of obesity and outcomes of MetS, particularly cardiovascular diseases [8].

Unhealthy eating habits, physical inactivity, and lack of fitness are associated with all components of metabolic syndrome [9]. Adopting a healthy diet and engaging in regular exercise can reduce the risk of MetS [5]. Individuals with metabolic syndrome are advised to lose 5–10% of their body weight to help control blood glucose levels, reduce dyslipidemia, and lower blood pressure [10]. For obese individuals, managing weight requires consuming fewer calories than expended [11]. Lifestyle modifications can improve metabolic parameters such as insulin resistance, blood pressure and blood lipid profiles [12].

Fasting involves abstaining from food and drinks for varying periods of time and is primarily practiced as a health-promoting dietary behavior [13]. It is a common religious practice observed in nearly all religious traditions including Christianity and Islam [14]. Religious fasting entails abstaining from food and drink as a religious obligation at specific times of the year across various regions worldwide [15]. In Islam, intermittent fasting is observed year-round, including weekly fasts on Mondays and Thursdays, along with an additional six days of fasting during the Shawwal month and three days on half of each middle of lunar months. This practice typically involves a pre-dawn meal and a full meal after sunset [16].

Intermittent Islamic fasting is an effective health strategy, associated with various benefits including reduced hypertension, enhanced insulin sensitivity, weight loss,

increased endorphin levels, immune cell regeneration, decreased inflammation, detoxification and improved management of rheumatoid arthritis [15]. It also positively affects metabolic metrics and overall quality of life [17]. Fasting on Monday and Thursday specifically can lead to reduction in body weight and blood glucose levels [18].

A sedentary lifestyle combined with the consumption of high-caloric diets has significantly contributed to the rising prevalence of metabolic syndrome (MetS) in recent decades, making it a pressing concern for healthcare systems worldwide [19]–[20]. Although dietary interventions such as the Mediterranean diet and the Dietary Approaches to Stop Hypertension (DASH) have demonstrated effectiveness in managing MetS components [21], these diets often rely on high-quality foods such as fresh fruits, vegetables, and fish which can be financially and geographically inaccessible for many individuals [22]–[23].

Intermittent fasting, particularly Islamic intermittent fasting in contrast to other diet regimen represents a potentially cost-effective and culturally relevant intervention that does not necessarily require changes in dietary content or the consumption of expensive food items. Despite its growing popularity, there remains limited research on the effects of intermittent fasting in individuals with diagnosed MetS. Therefore, this study aims to evaluate and compare the effects of intermittent Islamic fasting combined with lifestyle modification versus lifestyle modification alone on weight management, blood pressure, blood glucose levels, and lipid profiles among a group of patients with metabolic syndrome.

Research question

Does intermittent Islamic fasting with lifestyle modification have beneficial effect on metabolic syndrome better than lifestyle modification only?

Hypothesis

Intermittent Islamic fasting with lifestyle modification has beneficial effect on metabolic syndrome better than lifestyle modification only.

Methodology

Study design, setting and duration A randomized controlled open-label trial was conducted to compare the effects of intermittent Islamic fasting combined with lifestyle modification versus lifestyle modification alone on weight management, blood pressure, blood glucose, and lipid profile among patients with metabolic syndrome, aged 30 to 45 years. Participants were recruited from the

Clinical Nutrition Outpatient Clinic at Zagazig University Hospital between August 1, 2023, and February 29, 2024. The study was conducted in accordance with CONSORT guidelines, and a flowchart was used to illustrate the participant selection and allocation process.

Sample size The mean reduction in body weights (kg) in fasting with lifestyle modification group vs. lifestyle modification group were deemed as (4.1 ± 3.65 vs. 1.7 ± 1.49 respectively) [24] with Confidence level of 95%, power of study 80% and With 20% potential dropout, the sample size calculated with open epi program was **54 participants (27 patients in each group)**.

Method of sample selection

At first, 54 participants were picked from patients attending clinical nutrition outpatient clinic of Zagazig University hospital using systematic random technique. The sample was classified randomly according to intervention type into two groups (27 each group) by block randomization using sealed Envelope website. The participants was classified into 6 blocks (3 block in each group) each block size 9 list length with allocation ratio 1:1, Study was open-label [25].

The study contains two groups (intervention group and control group).

- a) Group I: intervention group (27 patients) followed Islamic fasting with lifestyle modification; (Islamic fasting means: fasting two days per week (Monday and Thursday) with fasting (13, 14, 15) middle of lunar months).
- b) Group II: control group (27 patients) followed lifestyle modification only.

Inclusion criteria Egyptian adults with metabolic syndrome, Adults (30–45 years old) and providing consent.

Exclusion criteria: patients had any chronic disease or pregnant females.

Study methods the study was carried out through 3 phases.

Phase I (pre-intervention): consisted of 3 sections

Section I: a semi-structured questionnaire An interviewing questionnaire was designed to collect data; including:

Sociodemographic characteristics: such as age, gender, residence, marital status, education and working status.

Questions about healthy lifestyle behavior were measured by **The Simple Lifestyle Indicator Questionnaire**: The five components of SLIQ are diet, exercise, alcohol consumption, smoking status, stress. Because alcohol

is prohibited in Islam, it was not included in the questionnaire, each lifestyle dimension on the SLIQ is given a raw score; a higher raw score denotes healthier behavior. According to the scoring guidelines, the raw score are converted into category scores ranging from 0 to 2, where diet category score (0 if diet score 0–5, 1 if diet score 6–10, 2 if diet score 10–15), Activity category score (0 if light exercise only, 1 if any moderate activity, 2 if any vigorous activity), stress category score (0 if life stress 1 or 2, 1 if life stress 3 or 4, 2 if life stress 5, 6), 0 denotes a low score in that dimension, 1 an intermediate score, and 2 a healthy score. The category scores are summed to determine the overall score on a scale of zero to 8, after removal alcohol score ($SLIQ = \text{Diet category score} + \text{activity category score} + \text{smoking category score} + \text{stress category score}$), which is also classified into three categories: unhealthy (score 0–2), intermediate (score 3–5), and healthy (score 6–8) [26]. Before starting the study the questionnaires were translated into Arabic and retranslated through a specialized Bi-linguist, submitting the questionnaire to a board of public medicine experts to judge tool items with relevance and appropriateness. A reliability test was done using the reliability coefficients, which was high and suitable for scientific purposes (Cronbach's alpha ranged from 0.78 to 0.90).

Assessment nutritional status through 24 h recall. Follow a multi-pass method, typically in 3 to 5 passes: Quick list: All foods and beverages consumed, detailed description (Time, type, and portion sizes), review for forgotten foods (e.g., drinks, sauces, supplements) [27], Final check to Clarify and confirm accuracy. After that analysis all foods in main food groups. To avoid recall bias repeat 24 h recalls (2–3 times).

Section II Physical examination including three repeated measurement of blood pressure, Anthropometric measurement as (weight, height, BMI, waist circumference). Weight was measured to the nearest 0.1 kg while putting on light clothes. Height was measured bare-footed and recorded to the nearest 0.1 cm with a calibrated stadiometer. All the measurements were obtained by a single investigator.

Section III Under conventional laboratory circumstances, fasting blood samples were collected to measure glycemic and lipid profile with the assistance of an expert technician.

In this study, we applied the NCEP ATP III criteria (National Cholesterol Education Program– Adult Treatment Panel III) to define metabolic syndrome (MetS). MetS is diagnosed when three or more of the following conditions are met: waist circumference of ≥ 102 cm in men and ≥ 88 cm in women; blood pressure of $\geq 130/85$ mmHg or the use of blood pressure medication; fasting

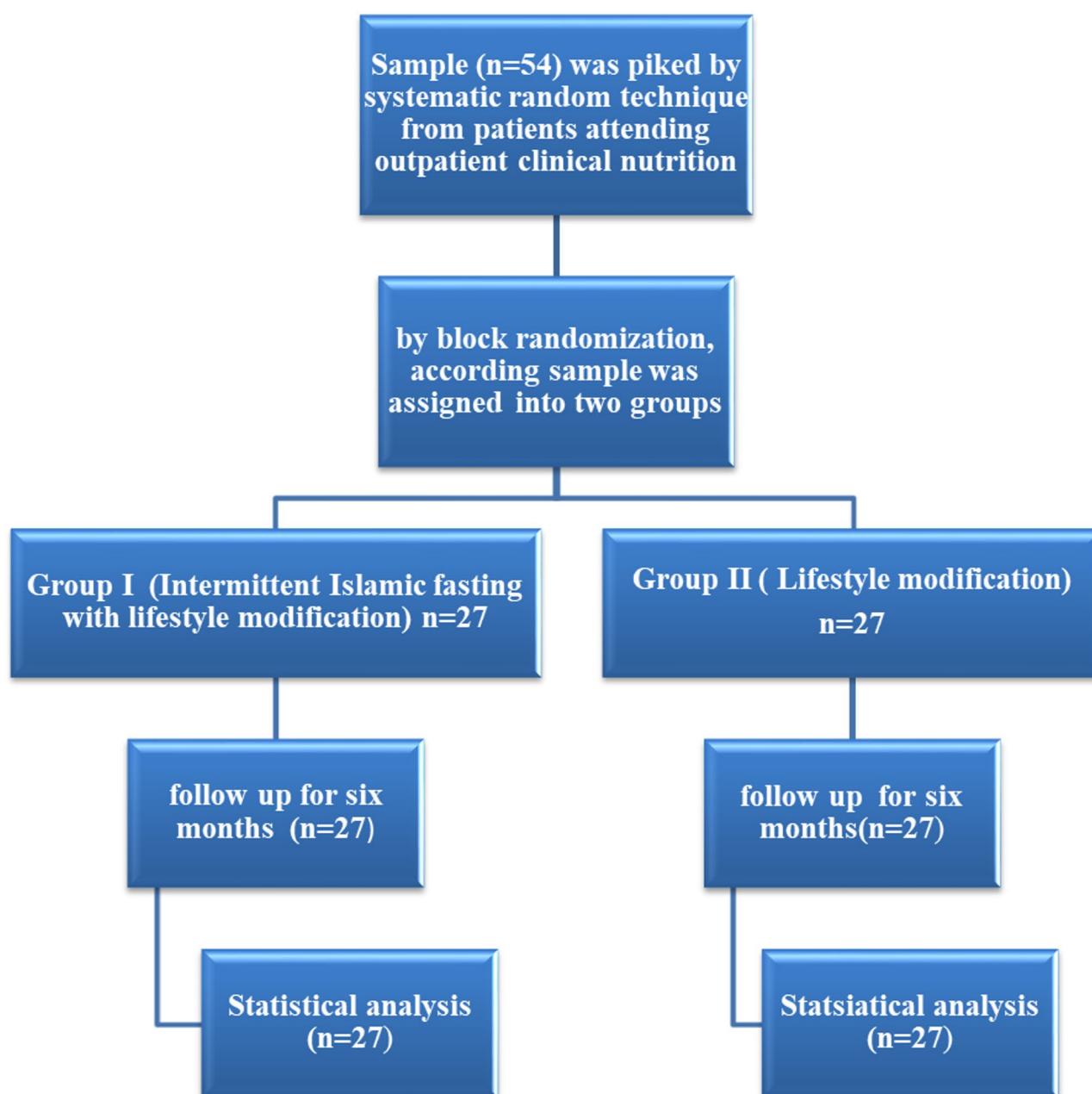


Fig. 1 Flow chart showing sampling technique

triglycerides (TG) levels of ≥ 150 mg/dL or the use of cholesterol-lowering medication; fasting high-density lipoprotein (HDL) cholesterol levels of < 40 mg/dL in men, < 50 mg/dL in women, or the use of cholesterol-lowering medication; and fasting blood glucose (FBG) levels of ≥ 100 mg/dL [28].

Phase (II) intervention

Both groups followed a healthy lifestyle for 6 months including:

Diet The participants' habitual total energy expenditure was estimated using the standard Harris-Benedict equation. For men, the formula is: $BMR = 66.4730 + 13.7516 \times \text{weight (kg)} + 5.0033 \times \text{height (cm)} - 6.7550 \times \text{age (years)}$. For women, the formula is: $BMR = 655.0955 + 9.5634 \times \text{weight (kg)} + 1.8496 \times \text{height (cm)} - 4.6756 \times \text{age (years)}$ [29]. To achieve a reduction of over 500 kcal/day, a daily intake of 1,200 to 1,500 kcal is typically recommended for women and 1,500 to 1,800 kcal for men [30].

Physical activity Moderate physical activity is advised. This includes engaging in exercise for 30 to 60 min, five

days a week. Additionally, incorporating resistance training is recommended twice a week [31].

- stress management How to cope with stress, relaxation technique, quality and quantity of sleep,
- Drinking enough water 30–40 ml/kg/day.

For Group I (intervention group) only, Followed Intermittent Islamic fasting which meant fasting two days per week (Monday and Thursday) with fasting (13, 14, 15) middle of lunar months, (During Intermittent Islamic fasting caloric requirement was distributed as 30–40% of total caloric requirement in suhoor, 10–20% Iftar snack, 40–50% Iftar and 10–20% healthy snack) [32].

All sessions carried out face to face every 10 days for each patient personally, the first session took about (30–45 mins) the next ones took about (15–20 mins). Each patient had his own plan according to his preferable food, waking up or sleeping time and his ability to do suitable exercise. There was WhatsApp's group for each group for any questions and proper follow up daily, for example what the food exchange list is, how to use it and to be ensured that the control group did not engage in any fasting behaviors during the study period.

Phase (III) post intervention Reassessment after 6 months, Primary outcome: medical examination, including measurement of blood pressure, Anthropometric measurement as (weight, height, BMI, waist circumference) and **Secondary Outcome:** Lab investigation to measure glycemic and lipid profile.

Data analysis Data analysis was conducted using SPSS (Statistical Package for the Social Sciences) version 28. Categorical variables were reported as absolute frequencies and compared using the chi-square test. The chi-square for trend test was applied to compare ordinal data between two groups. The Shapiro-Wilk test was used to assess the assumptions for parametric tests. Quantitative variables were summarized using means and standard deviations or median and interquartile range according to normality of data distribution. To compare quantitative data between two groups, an independent samples t-test and Mann Whitney test were used. For assessing changes

in a variable over two time points within the same group, a paired samples t-test (for normally distributed data) or Wilcoxon signed-rank test (for non-normally distributed data) was applied. Statistical significance was considered at a $p < 0.05$, with a highly significant difference defined as $p \leq 0.001$.

Results

Comparison of baseline characteristics between the two studied groups

There is statistically non-significant difference between the studied groups regarding gender ($\chi^2 1.187$, $p\text{-value} = 0.276$), age ($t = 0.116$, $p\text{-value} = 0.908$) and height ($t = 1.111$, $p\text{-value} = 0.272$) (Table 1).

There is statistically non-significant difference between both groups regarding healthy lifestyle score for each domain and total score pre or post intervention. Within each group, there is significant improvement in healthy lifestyle score for each and total score post intervention when compared to baseline ($p\text{-value} < 0.001$) (Table 2).

Primary outcome: change in medical examination (blood pressure and anthropometric measurements)

There was statistically non-significant difference between both groups regarding pre-intervention waist circumference ($t = -0.621$, $p\text{-value} = 0.537$), weight ($t = -0.515$, $p\text{-value} = 0.609$), systolic blood pressure ($t = -1.221$, $p\text{-value} = 0.22$). There is statistically non-significant difference between both groups regarding diastolic blood pressure or BMI pre- or post-intervention (Table 3).

After intervention, there is **significant** difference between them regarding waist circumference ($t = -2.15$, $p\text{-value} = 0.036$), weight ($t = -2.089$, $p\text{-value} = 0.042$), systolic blood pressure ($t = -2.131$, $p\text{-value} = 0.038$) (all were significantly lower among intervention group) (Table 3).

Within each group, there is significant change in weight, waist circumference, BMI ($p\text{-value} < 0.001$). Systolic and diastolic blood pressure significantly decreased within intervention group ($p\text{-value} < 0.001$) while control group showed non-significant decrease ($p\text{-value} = 0.161$ for SBP and $p\text{-value} = 0.537$ for DBP) (Table 3).

Table 1 Baseline data of studied groups

	Intervention group N = 27 (%)	Control group N = 27 (%)	Test of significance	P-value
Gender				
Female	11 (40.7%)	15 (55.6%)	1.187#	0.276
Male	16 (59.3%)	12 (44.4%)		
Age (year) [mean $\pm$ SD]	31.58 $\pm$ 3.25	31.44 $\pm$ 4.85	0.116*	0.908
Height (cm) [mean $\pm$ SD]	167.33 $\pm$ 6.47	169.41 $\pm$ 7.23	-1.111*	0.272

*Independent sample t test # χ^2 Chi square test

Table 2 Comparison between the studied groups regarding lifestyle before and after intervention

		Intervention group N= 27 (%)	Control group N= 27 (%)	Test of significance	P-value
Diet	Pre				
	Unhealthy	16 (59.3%)	18 (66.7%)	0.318 [#]	0.573
	Intermediate	11 (40.7%)	9 (33.3%)		
	Healthy	0 (0%)	0 (0%)		
	Post				
	Unhealthy	1 (3.7%)	1 (3.7%)	0.906 [§]	0.341
Exercise	Intermediate	11 (40.7%)	15 (55.6%)		
	Healthy	15 (55.6%)	10 (40.7%)		
	P-value[§]	< 0.001**	< 0.001**		
	Pre				
	Unhealthy	13 (48.1%)	12 (44.4%)	0.074 [#]	0.785
	Intermediate	14 (51.9%)	15 (55.6%)		
Smoking	Healthy	0 (0%)	0 (0%)		
	Post				
	Unhealthy	0 (0%)	2 (7.4%)	0.517 [§]	0.474
	Intermediate	14 (51.9%)	13 (48.1%)		
	Healthy	13 (48.1%)	12 (44.4%)		
	P-value[§]	< 0.001**	< 0.001**		
Stress	Pre				
	Unhealthy	5 (18.5%)	8 (29.6%)	0.652 [#]	0.419
	Intermediate	6 (22.2%)	5 (18.5%)		
	Healthy	16 (59.3%)	14 (51.9%)		
	Post				
	Unhealthy	1 (3.7%)	2 (7.4%)	0.203 [§]	0.652
Total score	Intermediate	9 (33.3%)	9 (33.3%)		
	Healthy	17 (63%)	16 (59.3%)		
	P-value[§]	0.025*	0.011*		
	Pre				
	Unhealthy	13 (48.1%)	11 (40.7%)	0.3 [#]	0.584
	Intermediate	14 (51.9%)	16 (59.3%)		
Stress	Healthy	0 (0%)	0 (0%)		
	Post				
	Unhealthy	0 (3.7%)	1 (3.7%)	0.256 [§]	0.613
	Intermediate	16 (59.3%)	12 (44.4%)		
	Healthy	11 (40.7%)	14 (51.9%)		
	P-value[§]	< 0.001**	< 0.001**		
Total score	Pre				
	Unhealthy	12 (44.4%)	11 (40.7%)	0.076 [#]	0.783
	Intermediate	15 (55.6%)	16 (59.3%)		
	Healthy	0 (0%)	0 (0%)		
	Post				
	Unhealthy	0 (0%)	0 (0%)	0.078 [#]	0.78
Total score	Intermediate	10 (37%)	11 (44.4%)		
	Healthy	17 (63%)	16 (51.9%)		
	P-value[§]	< 0.001**	< 0.001**		

[#]χ²Chi square test [§]Chi square for trend test *p-value ≤ 0.05 is statistically significant **p-value < 0.001 is statistically highly significant [§] p for Wilcoxon signed rank test

Secondary outcome: laboratory investigations (change in glycemic and lipid profile)

There is statistically non-significant difference between both groups regarding pre-intervention fasting blood glucose, triglycerides. There is statistically non-significant difference between both groups regarding total cholesterol, HDL pre- or post-intervention (Table 4).

After intervention, there is **significant** difference between them regarding fasting blood glucose ($t = -2.141$, $p\text{-value} = 0.037$) and triglycerides ($t = -2.085$, $p\text{-value} = 0.042$) (all were significantly lower among intervention group). Within each group, there is significant change in fasting blood glucose, triglycerides, total and HDL cholesterol (Table 4).

Table 3 Comparison between the studied groups regarding anthropometric and clinical data before and after intervention

	Intervention group Mean $\pm$ SD	Control group Mean $\pm$ SD	t test	P-value	Reference value
Waist circumference (cm)					Females $\leq$ 80 cm, males $\leq$ 94 cm
Pre	104.33 $\pm$ 8.83	106.19 $\pm$ 12.74	-0.621	0.537	
Post	96.85 $\pm$ 12.74	103.15 $\pm$ 12.71	-2.15	0.036*	
P-value[€]	$< 0.001^{**}$	$< 0.001^{**}$			
Weight (kg)					
Pre	88.3 $\pm$ 9.14	89.67 $\pm$ 10.37	-0.515	0.609	
Post	81.67 $\pm$ 9.61	87.19 $\pm$ 9.81	-2.089	0.042*	
P-value[€]	$< 0.001^{**}$	$< 0.001^{**}$			
BMI (Kg/m²)					Underweight < 18.5 kg/m ² Normal 18.5- $\leq$ 24.9 Overweight 25- $\leq$ 29.9 Obese $\geq$ 30.0
Pre	31.58 $\pm$ 3.25	31.44 $\pm$ 3.47	0.116	0.908	
Post	29.21 $\pm$ 3.47	30.56 $\pm$ 4.54	-1.229	0.224	
P-value[€]	$< 0.001^{**}$	$< 0.001^{**}$			
Systolic blood pressure					
pre	132.04 $\pm$ 10.85	135.56 $\pm$ 10.32	-1.221	0.228	< 120 mmHg
post	128.33 $\pm$ 9.81	134.44 $\pm$ 11.21	-2.132	0.038*	
P-value[€]	$< 0.001^{**}$	0.161			
Diastolic blood pressure					
pre	82.22 $\pm$ 10.68	83.52 $\pm$ 12.62	-0.407	0.685	< 80 mmHg
post	77.41 $\pm$ 9.24	83.15 $\pm$ 12.49	-1.92	0.06	
P-value[€]	$< 0.001^{**}$	0.537			

t independent sample t test * $p \leq 0.05$ is statistically significant [€]p for paired sample t test ** p -value < 0.001 is statistically highly significant

Table 4 Comparison between the studied groups regarding laboratory data before and after intervention

	Intervention group Mean $\pm$ SD	Control group Mean $\pm$ SD	t test	P-value	Reference value
FBG (mg/dl)					70–100 mg/dl
Pre	115.19 $\pm$ 7.95	113.19 $\pm$ 7.62	0.944	0.349	
Post	104.59 $\pm$ 9.64	109.78 $\pm$ 8.09	-2.141	0.037*	
P-value[€]	$< 0.001^{**}$	$< 0.001^{**}$			
TG(mg/dl)					< 150 mg/dl
Pre	170.85 $\pm$ 12.96	167.37 $\pm$ 11.36	1.049	0.299	
Post	148.07 $\pm$ 13.26	155.56 $\pm$ 13.11	-2.085	0.042*	
P-value[€]	$< 0.001^{**}$	$< 0.001^{**}$			
HDL (mg/dl)					> 40 mg/dl in men > 50 mg /dl in women
Pre	39.81 $\pm$ 5.41	38.89 $\pm$ 5.75	0.609	0.545	
Post	42.26 $\pm$ 5.36	39.41 $\pm$ 5.71	1.892	0.064	
P-value[€]	$< 0.001^{**}$	$< 0.001^{**}$			
Total cholesterol (mg/dl)					< 200 mg/dl
Pre	199.15 $\pm$ 30.27	205.22 $\pm$ 40.06	-0.629	0.532	
Post	190.3 $\pm$ 28.81	200.3 $\pm$ 38.59	-1.079	0.286	
P-value[€]	$< 0.001^{**}$	0.004*			

t independent sample t test * p -value ≤ 0.05 is statistically significant [€]p for paired sample t test ** p -value < 0.001 is statistically highly significant

There is statistically significant difference between the studied groups regarding percent change in weight, waist circumference, systolic, diastolic blood pressure, triglycerides, HDL and total cholesterol (better improvement in intervention group) ($Z = -2.049$, p -value = 0.042 for SBP, $Z = -2.272$, p -value = 0.023 for total cholesterol and < 0.001 for each other parameter). Percent decrease in all parameters was significantly higher among intervention group (Table 5).

Discussion

Religious fasting has a beneficial impact on blood sugar, cholesterol, and body weight. It also has antioxidative properties, lengthens life and strengthens the immune system and kidneys [15]. The current study investigated the effect of Intermittent Islamic Fasting with lifestyle modification, compared to that of lifestyle modification only on weight management, blood pressure, blood glucose and lipid profile among a group of metabolic

Table 5 Comparison between the studied groups regarding percent of change in outcome parameters

% increase	Intervention group Median (IQR)	Control group Median (IQR)	Z	P-value
Weight	-8(-10.11, -5.56%)	-2.91(-4.04, -1.15)	-5.278	< 0.001**
Waist circumference	-8.16(-9.17, -4.55%)	-2.44(-4, 0%)	-4.291	< 0.001**
Systolic blood pressure	-3.33(-4, 0%)	0(-3.45, 0%)	-2.029	0.042*
Diastolic blood pressure	-5.56(-10.53, 0%)	0(0, 0%)	-3.562	< 0.001**
Fasting blood glucose	-9.84(-13.46, -4.07%)	-1.65(-3.7, -0.83%)	-3.876	< 0.001**
Triglycerides	-14(-15.95, -10%)	-6.06(-9.38, -5.03%)	-4.265	< 0.001**
Total cholesterol	-3.85(-5.56, -2%)	-2.86(-3.53, 0%)	-2.272	0.023*
HDL cholesterol	6.52(4.76–8.57%)	2.17(0–2.94%)	-4.657	< 0.001**

*p-value < 0.05 is statistically significant IQR interquartile range Z Mann Whitney test **p-value ≤ 0.001 is statistically highly significant

syndrome patients. While intermittent fasting regimes like the 5:2 diets have been widely studied in Western contexts, the specific health impacts of fasting two days per week according to Islamic tradition remain largely unexplored in the scientific literature. Research on this form of fasting could offer valuable insights into its potential physiological benefits, metabolic effects, and comparisons to other intermittent fasting protocols.

Unhealthy behavior was prominent among the study participants which was almost 65%. This extensively matched the literature [33] and highlighted the real need for interventions to improve the lifestyle and consequently health.

The results revealed significant changes in weight between the intervention and control groups and also significant pre- post changes within each group with more reduction among the intervention group's participants. Such finding was heavily described in the literature as a positive impact of Intermittent Islamic Fasting on weight reduction which was proved to occur through various mechanisms [15, 33, 34]. A systematic review and meta-analysis done by Sadeghirad et al. demonstrated that fasting could result in weight loss, yet it should be supported by other lifestyle modifications to have long lasting effects [35]. However, the effect of intermittent Islamic fasting on the body composition are not conclusive as some studies revealed reduction in the body weight while other failed to present in significant changes [36]– [37].

Weight reduction after intermittent Islamic fasting can be attributed to several physiological mechanisms; with prolonged fasting hours, glycogen stores in the liver deplete, causing the body to shift to fat oxidation for energy from the adipose tissue and protein stores, leading to weight loss. The metabolism of triglyceride deposits in adipose tissue is the main factor behind the significant alteration in metabolism that occurs after glycogen depletion. During periods of fasting, protein catabolism occurs concurrently with fat catabolism through the process of gluconeogenesis. The body's tissues eventually become less dependent on glucose once glycogen

stores are exhausted because ketone bodies are easier to metabolize [38].

Similar changes were detected in systolic blood pressure, with significant differences among both groups and within each group pre-post intervention as well. However, this was not applied to diastolic blood pressure. This finding was in line with a previous study by Parvaresh et al. who detected the effect of fasting on the systolic blood pressure after 8 weeks, among the participants of the interventional group with no changes in diastolic blood pressure [24]. Other meta-analyses of over 30 studies revealed that while some studies reported no changes, others reported a decrease in both systolic and diastolic blood pressure following alternate-day Islamic fasting. These changes imply that the intervention of fasting was not the same in the studies due to many factors. The duration of daylight hours, which varied according to the latitude of geographical area, had longer days in regions with the long daylight hours. This extended fasting period can lead to dehydration and changes in hormonal balance and a hot climate can exacerbate dehydration more than a cold climate. In addition to other factors related to cultural factors, pre-existing conditions, and dietary habits during non-fasting hours [39].

Regarding FBG and TG, Intermittent Islamic Fasting had a more beneficial effect on improving their levels, as it was obvious due to significant changes between the study groups and also within each group before and after fasting. This agreed with what was shown in a meta-analysis by Kul et al., who included 30 publications with a total of 1476 subjects in their study and showed that fasting can effectively impact some biochemical parameters. However, the results ranged between minimal to high changes across their studies and across the studied groups as well [40]. The most immediate organ affected by Islamic fasting is pancreas. IF often leads to lose weight, through reduction in visceral fat which helps improve insulin sensitivity and reduces work load on the pancreas in addition to the improvement in the lipid profile (triglycerides) can indirectly support better pancreatic health by reducing metabolic strain [41].

The breakdown of TGs started by activation of hormone-sensitive lipase (HSL) which worked on adipose TGs lipase converted them into diglyceride. Three distinct fatty acids and one glycerol molecule remain after the other two FA are broken off by HSL and monoacylglycerol lipase. Glycerol kinase and glycerol-3-phosphate dehydrogenase, respectively, transform glycerol into glycerol-3-phosphate and subsequently dihydroxyacetone (DHAP). The glycolysis route is then used to metabolize DHAP. This breakdown of triglycerides is essential for maintaining energy balance, especially during periods of fasting when glucose availability is limited [42].

The present study demonstrated that there was improvement in lifestyle in both group which indicate that no superior impact of lifestyle modification with ISF over lifestyle modification only, with regards to changes in participants' lifestyle. This was in favor of the study results suggesting the contribution of ISF in improving the outcome in spite of the changes in the lifestyle domain within each group. However, the role of lifestyle modifications is highlighted in the literature to be highly necessary to have a long-lasting effect by Islamic fasting [35].

Regarding the percent change in weight, waist circumference, systolic, diastolic blood pressure, triglycerides, HDL, and total cholesterol, there is a statistically significant difference between the studied groups, with better improvement in the intervention group even if the difference post-intervention is non-significant in some parameters yet ISF added extra-benefit for patients. The caloric restriction from fasting combined with a better-quality diet and exercise could enhance fat loss and improve body composition more effectively than lifestyle changes alone, may be attributed to fasting-induced hormonal changes, including reductions in insulin and improvements in lipid oxidation, in addition intermittent Islamic fasting reduce C-reactive protein (CRP), Lowering pro-inflammatory cytokines such as TNF- α , IL-6, and IL-1 β , promoting anti-inflammatory responses via increased autophagy and antioxidant gene expression, these reductions in inflammation enhance insulin sensitivity and reduce cardiovascular risk. Increasing microbial diversity and beneficial strains (*Akkermansia*, *Bacteroidetes*), enhancing production of short-chain fatty acids (SCFAs) like butyrate, which improve gut barrier integrity and regulate immune responses and decrease gut permeability, these microbial changes mediate the anti-inflammatory effects of IF, which in turn enhance metabolic outcomes. These reductions in inflammation enhance insulin sensitivity and reduce cardiovascular risk [43].

Other studies revealed that intermittent Islamic fasting alone cannot induce greater improvement in the body weight and changes in body composition, lipid profile, and blood pressure when compared with another group

of Islamic intermittent fasting with a concurrent training program [44]. However, others reported that Ramadan diurnal intermittent fasting (RDIF) alone resulted in a significant reduction in weight, especially among obese patients [45].

Strengths

The current study is considered a contribution to the literature due to the scarcity of research studies tackling intermittent Islamic Fasting, since most available studies are conducted to investigate the regular Ramadan Fasting. The study methodology and design add to its strength, being a randomized control study with prospective follow up of the participants, which is vital in providing more evidence. The inclusion of potential variables and objective measures is another strength point, adding more parameters to evaluate the study outcomes. Moreover, the sampling technique, the use of control group and randomization allow for generalizability of the study and increase the reliability of the results.

Limitations

Although, the current study investigated many health outcomes related to ISF, several limitations should be addressed. First, the sample could be more representative if collected from a number of health facilities. Second, the time interval was another limitation which needed to be longer as there might be a better opportunity of reaching more significant results. There was change in time of intermittent fasting due to seasonal variation between summer and winter in day time, many interlinked effects of ISF with different pathways of the studied domains, was another challenge faced by this study.

Conclusions

In the light of the present study, it can be concluded that ISF has promising positive effects on weight, systolic blood pressure, and TG levels (total and HDL cholesterol). Although there was reported non-significant changes in the other investigated items. Yet, ISF effects are potential within each of the studied groups. Larger in-depth prospective studies with longer time interval and more focus on the many interlinked health outcomes of ISF will be highly beneficial.

Abbreviations

ISF	Intermittent Islamic fasting
TG	Triglyceride
LDL	Low density lipoprotein
HDL	High density lipoprotein
MetS	Metabolic syndrome
DASH	Dietary approach to stop hypertension
BMI	Body mass index
HSL	Hormone sensitive lipase
SLIQ	Simple lifestyle indicator questionnaire
SPSS	Statistical package for the social sciences
HSL	Hormone-sensitive lipase

NCEP ATP III National cholesterol education program– adult treatment panel III
RDIF Ramadan diurnal intermittent fasting

Supplementary Information

The online version contains supplementary material available at <https://doi.org/10.1186/s12889-025-23493-7>.

Supplementary Material 1

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Author contributions

H.A.N., A.A.E., L.L.E., R.I.A.H. Conceptualization, H.A.N., A.A.E., L.L.E., A.M.A. and R.I.A.H. Data curation, A.M.A. Formal analysis, S.Y.A. Funding acquisition, A. A.E., L.L.E., N.A.Z., M.A.S. Investigation, H.A.N., A.A.E., R.I.A.H., L.L.E. and N.A.Z. Methodology, S.Y.A., M.A.S. Resources, A.A.E., R.I.A.H. Supervision, L.L.E., H.A.N., R.I.A.H. and A.M.A. Validation, all authors Write original draft and review & edit the manuscript.

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Data availability

The datasets generated during and/or analyzed during the current study are available from the corresponding author upon reasonable request.

Declarations

Ethics approval and consent to participate

The study followed the ethical principles of the Declaration of Helsinki, was approved by the Institutional Research Review Board (IRB) of the Zagazig Faculty of Medicine (IRB#: **11296**). The participants were informed about the purpose of the study and Participants' data would be kept confidential. Informed written consent was gained from all study members after simple and clear explanation of the research objectives.

Consent for publication

Not applicable.

Competing interests

The authors declare no competing interests.

Author details

¹Public health and community medicine department, Faculty of Medicine, Zagazig University, Zagazig, Sharkia, Egypt

²Family Medicine department, Faculty of Medicine, Zagazig University, Zagazig, Egypt

³Physiology department, Faculty of Medicine, Zagazig University, Zagazig, Egypt

⁴Nursing Management and Education Department, College of Nursing, Princess Nourah bint Abdulrahman University, P.O. Box 84428, Riyadh 11671, Saudi Arabia

⁵Internal Medicine department, faculty of medicine, Zagazig University, Zagazig, Egypt

⁶Public Health and Community Medicine department, Faculty of Medicine, Faculty of Medicine, Cairo University, Galala University, Cairo, Egypt

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