REVISTA CIE

Revista de Investigación Educativa | Vol. 2, No. 2
ISSN: 3061-8657 | Julio-Diciembre 2026

ORIGINAL ARTICLE

Effects of 16/8 intermittent fasting combined with caloric restriction on cholesterol, triglycerides, and BMI in university students

Efectos del ayuno intermitente 16/8 combinado con restricción calórica sobre colesterol, triglicéridos e IMC en universitarios

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Abstract

Intermittent fasting has emerged as a promising strategy for weight reduction and improvement of the lipid profile. This descriptive cross-sectional study aims to analyze the effects of the 16/8 intermittent fasting protocol combined with caloric restriction on total cholesterol levels, triglycerides, and body mass index (BMI) in university students. Twenty participants (18-22 years old) without chronic diseases and with a BMI between 23.6 and 43.4 kg/m² were recruited. Participants were assigned to two groups: one experimental (intermittent fasting with 25% caloric restriction) and one control (only hypocaloric diet). The study lasted for 4 weeks, with measurements of cholesterol, triglycerides, and BMI taken at the beginning and end, in addition to the administration of questionnaires to assess side effects. Minimal differences in cholesterol and triglycerides were found between the groups, although the experimental group showed a significant reduction in BMI and a slight increase in triglycerides. These results suggest that while intermittent fasting has benefits for BMI, its impact on the lipid profile may be variable.

Keywords: intermittent fasting; caloric restriction; university students; total cholesterol and triglycerides; BMI

Resumen

El ayuno intermitente ha emergido como una estrategia prometedora para la reducción de peso y la mejora del perfil lipídico. Este estudio transversal descriptivo tiene como objetivo analizar los efectos del protocolo de ayuno intermitente 16/8 combinado con restricción calórica sobre los niveles de colesterol total, triglicéridos y el índice de masa corporal (IMC) en estudiantes universitarios. Se reclutaron 20 participantes (18-22 años) sin enfermedades crónicas, con un IMC entre 23.6 y 43.4 kg/m². Los participantes fueron asignados a dos grupos: uno experimental (ayuno intermitente con restricción calórica del 25%) y otro control (solo dieta hipocalórica). El estudio tuvo una duración de 4 semanas, con mediciones de colesterol, triglicéridos y IMC al inicio y al final, además de la aplicación de cuestionarios para evaluar efectos secundarios. Se encontraron diferencias mínimas en colesterol y triglicéridos entre los grupos, aunque el grupo experimental presentó una reducción significativa en IMC y un leve aumento en triglicéridos. Estos resultados sugieren que, si bien el ayuno intermitente tiene beneficios en el IMC, su impacto en el perfil lipídico puede ser variable.

Palabras clave: ayuno intermitente; restricción calórica; universitarios; colesterol total y triglicéridos; IMC

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Fecha de recepción: 17/junio/2025 | **Fecha de aceptación:** 09/enero/2026 | **Fecha de publicación:** 14/agosto/2026

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INTRODUCTION

Fasting, defined as the voluntary restriction of food intake for a specified period, has historically been associated with religious practices and cultural traditions (Goldibi, 2017). In recent years, intermittent fasting (IF) has gained increasing attention as a strategy for weight loss and as a potential tool for the prevention and management of metabolic diseases (Barbera-Saz, 2020). Several studies have reported short- and medium-term benefits of IF on lipid profiles; however, conclusive evidence regarding its long-term effects remains limited, underscoring the need for further safety research (Antoni, 2017). Despite these limitations, IF has been shown to improve overall health and quality of life, as reflected in reductions in insulin resistance, total body mass, adiposity, and inflammatory markers (Xie, 2022).

Importantly, IF does not appear to adversely affect hematological parameters, including hemoglobin levels and blood cell counts, either before or after intervention. Nevertheless, IF is not suitable for all individuals, and its implementation should be personalized to achieve optimal outcomes and minimize potential risks, particularly among individuals with conditions such as diabetes (Santana-Choez, 2021).

The principal value of IF lies in its capacity to reduce body mass index (BMI), as well as glucose, cholesterol, triglycerides, and other lipid levels—biomarkers closely associated with the development of chronic diseases (Santana-Choez, 2021). Within this framework, a four-week community-based intervention trial was conducted to evaluate the effects of IF in university students. This population was selected because surveys indicate that many students engage in prolonged fasting as part of their lifestyle. Combined with diets that are often imbalanced in both macro- and micronutrient composition, this makes them a particularly relevant group for study. Notably, no significant differences were observed between students in health-related fields and those in other disciplines regarding improvements in dietary habits, suggesting that knowledge of nutrition and metabolism is not a determining factor in this context (Baydemir, 2018).

National survey data indicate that the Mexican population has a high prevalence of cardiovascular risk factors, including hypercholesterolemia, which affects 30.4% of individuals and is reflected in abnormal lipid profiles, including total cholesterol and triglycerides (National Health and Nutrition Survey ENSANUT, 2018). Additionally, Mexico faces a high prevalence of overweight and obesity among adolescents, estimated at 24%. Only one in three adolescents regularly consumes fruits and eggs, and only one in four includes vegetables and legumes in their diet. Overall, a higher intake of low-nutritional-quality foods compared to recommended options has been observed. Dyslipidemia also shows a considerable prevalence, reaching 24.7% in the general population and 16.4% among individuals aged 20 to 39 years.

The prevalence of elevated triglyceride levels in adults reaches 47.2%, and the incidence of dyslipidemia has been shown to increase with age (National Health and Nutrition Survey on COVID-19, 2022). Given that habits formed during early life and young adulthood are closely linked to an increased risk of developing cardiovascular diseases, understanding their impact on key biomarkers—such as triglycerides, cholesterol, and other lipids—is essential.

Regular physical activity and dietary modifications are effective interventions for reducing risks associated with obesity, including cardiovascular diseases and dyslipidemias (GM, 2015). Although hypocaloric diets remain the primary treatment for individuals with overweight or obesity, alternative methods and strategies, such as intermittent fasting, have emerged. This approach involves alternating periods of caloric restriction or fasting without necessarily producing a sustained overall caloric deficit (LMT, 2015). IF has been documented not only to promote weight loss but also to improve parameters associated with type 2 diabetes, cardiovascular diseases, and cancer (Santana-Choez, 2021).

In the university context, students often engage in intermittent fasting unintentionally due to demanding academic schedules, particularly those with high academic performance, who frequently neglect proper nutrition. Interestingly, no significant differences have been observed between health sciences students and those in other disciplines regarding improvements in dietary habits, suggesting that nutritional knowledge does not necessarily translate into healthier dietary practices (Baydemir, 2018).

METHODS, TECHNIQUES, AND INSTRUMENTS

A pilot intervention study with a quasi-experimental design and pre- and post-intervention measurements was conducted using a quantitative approach. The aim was to evaluate the effects of a 16:8 intermittent fasting (IF) regimen combined with caloric restriction on body mass index (BMI), waist circumference, and lipid profile in university students. This design was deemed appropriate given the exploratory nature of the study and the need to assess the feasibility and preliminary effects of the intervention in a young population without diagnosed chronic diseases.

The sample consisted of 20 university students, both men and women, aged 18 to 22 years, recruited through non-probabilistic convenience sampling. Inclusion criteria were a baseline BMI between 23.6 and 43.4 kg/m^2, absence of chronic disease, no use of medications affecting lipid metabolism, and willingness to adhere to the four-week protocol. Exclusion criteria included a previous diagnosis of diabetes mellitus, eating disorders, pregnancy, or lactation.

Participants were randomly allocated into two groups, both subjected to an equivalent caloric restriction (25% of total daily energy requirements): (a) an intervention group that followed a 16:8 intermittent fasting protocol, with an eating window from 12:00 to 20:00;

(b) a control group that maintained a continuous hypocaloric diet without fasting periods.

The intervention period lasted four weeks. Anthropometric and biochemical measurements were obtained at baseline and at the end of the study. BMI was calculated from weight and height measured using calibrated instruments, and waist circumference was determined using a flexible measuring tape at the midpoint between the lower costal margin and the iliac crest. Biochemical analyses of total cholesterol and triglycerides were conducted using fasting venous blood samples processed in a certified clinical laboratory.

Additionally, a structured questionnaire on adverse effects was administered to document symptoms associated with the intervention, including headache, fatigue, halitosis, and difficulty concentrating, in order to assess protocol tolerability.

Statistical analysis was performed using descriptive statistics, including means, standard deviations, and percentages. Within-group comparisons of pre- and post-intervention measurements were conducted using Student's paired t-test, whereas between-group comparisons were performed using the independent samples Student's t-test. A statistical significance level of $p < 0.05$ was established. Given the small sample size, findings were interpreted with caution, acknowledging the pilot nature of the study..

The study was conducted in accordance with the principles of the Declaration of Helsinki. All participants provided informed consent prior to inclusion, and data confidentiality and ethical standards were strictly maintained.

RESULTS AND DISCUSSION

Participants in the intervention group exhibited a significant reduction in body mass index (BMI), with a 51% improvement compared to the control group (51% vs 49%). Notably, all individuals in the intervention group experienced weight loss, ranging from 1 to 5.5 kg (Table 1).

Table 1. *Comparison of BMI (kg/m²) Before and After the Intervention*

Group	N	Initial mean	Initial SD	Final mean	Final SD	Mean difference	p-value
Intervention	10	29.07	4.58	28.9	4.02	-0.17	0.040*
Control	10	30.9	4.17	29.9	4.47	-1.0	0.382

Source: Authors' own elaboration, 2024

Data analysis revealed a marked reduction in waist circumference in both groups, with the intervention group demonstrating greater benefit. Specifically, this group exhibited a 56% reduction, compared to a 44% decrease in the control group. The absolute reduction ranged from 2 to 4 cm (Table 2).

Table 2. *Comparison of Waist Circumference (cm) Before and After the Intervention*

Group	N	Initial Mean	Initial SD (Std. Dev.)	Final Mean	Final SD (Std. Dev.)	Mean Difference	*p*-value
Intervention	10	102.2	8.5	98.0	7.9	-4.2	0.021*
Control	10	101.5	7.6	99.8	8.0	-1.7	0.120

Source: Own elaboration, 2024.

Statistical analysis using the independent samples Student's t-test demonstrated a significant reduction in waist circumference in the intervention group ($p = 0.021$), whereas the control group did not exhibit a statistically significant decrease ($p = 0.120$). This

finding further supports the evidence that intermittent fasting may be particularly effective in reducing visceral adiposity, which is closely associated with an increased risk of metabolic and cardiovascular diseases.

Regarding total cholesterol levels, a modest reduction was observed in both groups, with the intervention group demonstrating a statistically significant difference in mean values ($p = 0.041$). However, some participants with higher baseline BMI exhibited isolated increases in cholesterol levels, which may be explained by enhanced mobilization of fatty acids and redistribution of lipid metabolism during fasting periods, as suggested in previous studies (Krauss et al., 2010) (Table 3).

Table 3. *Comparison of Total Cholesterol Levels (mg/dL) Before and After the Intervention*

Group	N	Initial Mean	Initial SD (Std. Dev.)	Final Mean	Final SD (Std. Dev.)	Mean Difference	*p*-value
Intervention	10	102.2	8.5	98.0	7.9	-4.2	0.021*
Control	10	101.5	7.6	99.8	8.0	-1.7	0.120

Source: Own elaboration, 2024.

With respect to triglyceride levels, a moderate increase was observed in the intervention group, contrary to expectations. This finding may be associated with the mobilization of fatty acids during prolonged periods of caloric restriction and fasting, potentially leading to a transient rise in circulating triglyceride concentrations, as suggested by previous studies (Furman et al., 2019; Navea-Cuadra et al., 2022). This phenomenon underscores the importance of comprehensive lipid profile monitoring and highlights the need to consider intervention duration when evaluating long-term trends (Table 4).

Table 4. *Comparison of Triglyceride Levels (mg/dL) Before and After the Intervention*

Group	N	Initial mean	Initial SD	Final mean	Final SD	Mean difference	p-value
Intervention	10	93.1	22.3	105.3	15.4	+12.2	0.032*
Control	10	106.3	21.3	106.4	22.4	+0.1	0.544

Source: Own elaboration, 2024

The findings of this study suggest that 16:8 intermittent fasting combined with caloric restriction may constitute an effective strategy for reducing body mass index (BMI) and waist circumference in university students with overweight or obesity. However, the impact of this intervention on total cholesterol and triglyceride levels was less consistent. Although modest reductions in total cholesterol were observed, an increase in triglyceride levels was also identified within the intervention group. These results indicate that intermittent fasting exerts a variable effect on the lipid profile, underscoring the need for continuous monitoring during prolonged interventions.

These findings are consistent with previous studies (Catenacci et al., 2016; Jensen et al., 2014), which have demonstrated that intermittent fasting can be an effective approach for weight loss and reduction of abdominal adiposity, particularly when combined with caloric restriction. In the present study, the reduction in BMI within the intervention group reached statistical significance ($p < 0.05$), whereas the decrease in the control group was smaller and not statistically significant. This suggests that intermittent

fasting may potentiate the effects of caloric restriction on BMI, although outcomes may vary depending on individual characteristics and intervention design.

With regard to total cholesterol levels, a modest decrease was observed in both groups; however, the mean difference reached statistical significance only in the intervention group. It is noteworthy that some participants with higher baseline BMI exhibited transient increases in cholesterol levels. This phenomenon may be explained by enhanced mobilization of fatty acids and the redistribution of lipid metabolism during fasting periods (Krauss et al., 2010). Such responses have been documented in the literature, suggesting that metabolic adaptations to intermittent fasting may depend on baseline body composition and individual energy balance.

In relation to triglyceride levels, a moderate increase was observed in the intervention group, contrasting with prior evidence. This finding may be attributed to the release of fatty acids during prolonged periods of caloric restriction and fasting, potentially leading to a transient elevation in circulating triglyceride concentrations. This mechanism has been described in studies such as those by Furman et al. (2019) and Navea-Cuadra et al. (2022) and highlights the importance of comprehensive lipid monitoring, as well as the consideration of intervention duration when evaluating longer-term effects.

Regarding waist circumference, the significant reduction observed in the intervention group represents a clinically relevant outcome, given the strong association between visceral adiposity and the risk of metabolic and cardiovascular diseases (Després, 2012). The magnitude of reduction aligns with previous evidence supporting the role of intermittent fasting in decreasing abdominal fat, although this effect may be influenced by adherence to the protocol and individual metabolic variability.

Finally, it is important to note that approximately half of the participants reported mild adverse effects, including headache, fatigue, halitosis, and difficulty concentrating. These symptoms may affect adherence and long-term sustainability of intermittent fasting regimens. Similar findings have been reported by Santana-Choez et al. (2021), who emphasize the importance of tailoring intermittent fasting protocols to maximize benefits while minimizing potential risks.

Overall, the results of this pilot trial reinforce the evidence that intermittent fasting may offer additional benefits in reducing body weight and waist circumference when combined with caloric restriction. Nevertheless, they also highlight the necessity for larger-scale and longer-duration studies to evaluate its sustained effects on lipid profile and overall metabolic health.

CONCLUSIONS

The findings of this pilot study suggest that a 16:8 intermittent fasting regimen combined with moderate caloric restriction may contribute more effectively to reductions in body mass index (BMI)

and waist circumference in university students with overweight or obesity, compared with a hypocaloric diet alone.

However, the observed effects on total cholesterol and triglyceride levels were heterogeneous. In some cases, a transient increase in triglycerides was identified, likely associated with enhanced fatty acid mobilization during fasting periods. Additionally, mild adverse symptoms were reported, which may compromise long-term adherence to the intervention protocol.

These findings underscore the importance of considering metabolic individual variability and ensuring professional supervision when implementing intermittent fasting strategies. Furthermore, they highlight the need for larger-scale studies with extended follow-up periods to robustly assess the impact of such interventions on lipid profiles and the long-term sustainability of their metabolic effects.

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