RESEARCH PAPER

Effect of Early Breakfast Consumption on Anthropometric Measures and Lipid Profile among Overweight and Obese Female Employees: A Two-Phase Interventional Study

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ABSTRACT

Background: Breakfast timing has been increasingly recognized as an important factor influencing metabolic health and body weight regulation. However, delayed breakfast consumption and irregular lifestyle behaviors are common among working adults and may contribute to obesity and metabolic disturbances.

Aim of the study: This study aimed to assess breakfast consumption patterns and lifestyle behaviors among female employees and to evaluate the effect of early breakfast consumption on anthropometric measurements and lipid profile among overweight and obese participants.

Methods: A two-phase study was conducted among female employees. Phase I was a cross-sectional study including 100 female participants to assess sociodemographic characteristics, anthropometric measurements, breakfast habits, and lifestyle behaviors. Phase II was a one-month intervention involving 30 overweight and obese participants from the initial sample who approved to participate in the study. Participants received an educational session promoting early breakfast consumption before 8:00 a.m. Anthropometric measurements and lipid profile parameters (total cholesterol, HDL-cholesterol, and triglycerides) were assessed before and after the intervention.

Results: Phase I revealed a high prevalence of overweight and obesity, accompanied by delayed breakfast timing and unfavorable lifestyle behaviors, including physical inactivity, short sleep duration, and irregular meal patterns. Despite most participants reported regular breakfast consumption, the average breakfast time was markedly delayed. Following the intervention, significant reductions were observed in body weight, body mass index, waist circumference and hip circumference ($p < 0.01$). Total cholesterol and triglyceride levels also decreased significantly ($p < 0.001$), while HDL-cholesterol remained unchanged.

Conclusion: Early breakfast consumption may represent a simple and practical nutritional strategy for improving body composition and lipid profile among overweight and obese women. Incorporating meal timing education into workplace health programs may contribute to obesity prevention and metabolic health improvement.

Keywords: Early breakfast, obesity, lipid profile, meal timing, female employees

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Introduction:

The obesity pandemic is a worldwide public health issue marked by excessive fat accumulation and an elevated risk of chronic diseases, such as cardiovascular disease, diabetes mellitus, and dyslipidemia. It is the second most prevalent preventable cause of mortality following smoking. The incidence of obesity has surged significantly on a global scale, impacting both

industrialized and developing countries (Chooi et al, 2019). The World Health Organization reports that Egypt is one of the countries with the highest global obesity rates, with non-communicable diseases responsible for almost 71% of overall mortality. (World Health Organization, 2021). National surveys indicate elevated rates of overweight and obesity among Egyptian adults, with prevalence exceeding 60% for overweight and approximately 36–40% for obesity. Women disproportionately affected, with significantly higher obesity rates compared to men. These findings underscore the significant burden of obesity in Egypt and stress the immediate necessity for effective prevention and therapeutic efforts (Aboulghate et al., 2021).

Lifestyle modification is a principal approach for obesity management, primarily focusing on calorie consumption and physical exercise. However, growing data indicates that meal timing significantly influences metabolic regulation. The circadian rhythm regulates metabolic functions, such as glucose and lipid metabolism in addition to hormone production. Alteration of normal circadian patterns due to irregular or postponed meal timing may adversely affect metabolic health (Ruddick-Collins et al., 2022).

Breakfast is considered as an essential meal that affects daily metabolic processes. Delayed breakfast intake may result in compromised lipid metabolism, elevated triglyceride levels in addition to weight gain. Consuming breakfast early may improve circadian alignment, increase insulin sensitivity, and optimize lipid metabolism (Leng et al., 2017). Despite increasing interest in meal timing, few interventional studies have assessed the impact of early breakfast eating on weight reduction in addition to improving lipid profiles in overweight and obese women in Egypt.

Aim of the study: This study aims to assess the impact of early breakfast intervention on anthropometric measurements and lipid profiles in overweight and obese female employees.

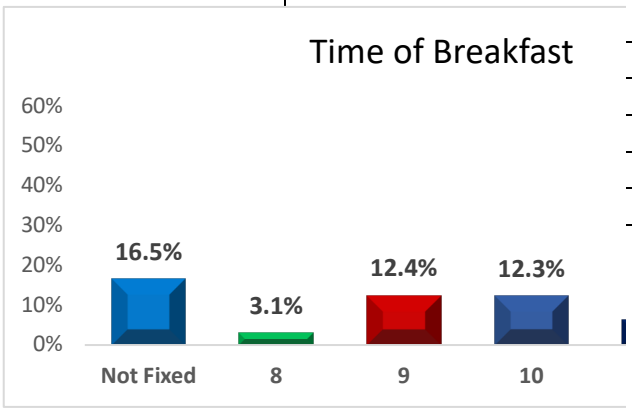
Subjects and Methods: Study Design: This study was conducted in two phases at October 6 University. Phase I was a cross-sectional study aimed at evaluating sociodemographic variables, anthropometric measurements, dietary habits (including breakfast intake patterns), and lifestyle behaviors among female employees. This phase aimed to identify individuals who are overweight or obese who were qualified for the intervention phase. Phase II was an interventional study assessing the impact of early breakfast eating on anthropometric measurements and lipid profiles in overweight and obese participants identified in Phase I and accepted to participate in the interventional phase.

Study Population: The study included female administrative employees working at October 6 University. A convenience sample of 100 participants was included in Phase I. From this group, 30 overweight and obese participants (BMI $\geq$ 25 kg/m^2) accepted to participate in Phase II. **Inclusion Criteria for participants in the intervention phase:** Female employees, BMI $\geq$ 25 kg/m^2, late breakfast consumption and willingness to participate. **Exclusion Criteria:** pregnancy or lactation, chronic metabolic diseases and participation in weight-loss programs. **Intervention Protocol:** Participants attended an educational session explaining the importance of breakfast consumption, early breakfast timing and strategies to overcome common barriers that may influence their adherence to the intervention. Participants were instructed to consume breakfast before 8:00 AM daily for one month. Weekly follow-up sessions were conducted to monitor adherence and reinforce behavioral change. **Anthropometric Measurements:** Measurements included body weight, height, waist circumference, and hip circumference. The BMI was calculated as weight divided by height squared (kg/m^2). **Laboratory Measurements:** Blood samples were collected to measure total cholesterol, HDL cholesterol, and triglycerides. Samples were collected before and after the intervention and analyzed using standard laboratory methods. **Statistical Analysis:** Data were coded, entered, and analyzed using the Statistical Package for the Social Sciences (SPSS), version 25. Quantitative variables were expressed as mean ± standard deviation (SD), while qualitative variables were presented as frequencies and percentages. Comparisons between pre- and post-intervention measurements were performed using the **p**aired t-test. A p-value of less than 0.05 was considered statistically significant. **Ethical Considerations:** The study was reviewed and approved by the Ethical Committee of October 6 University, Egypt (PMC-Me-2209026). All participants were informed about the objectives and procedures of the study, and written informed consent was obtained prior to participation. Participation was voluntary, and participants had the right to withdraw from the study at any time. Confidentiality of all participant data was strictly maintained throughout the study.

Results:

The study started with 100 middle-aged female participants working as employees in October 6 University in jobs with no medical knowledge background. The mean age of participants was (40.59 ± 8.33 years), 80% of them were residents inside October city and 53% of them had university education. Regarding their social life, only 6 % of them were never married, the rest of them, who either currently married or divorced with 68% of them had one or two children reflecting generally small family sizes among the participants. Anthropometric assessment of all participants indicated a generally elevated level of adiposity within the study population. The mean BMI was (30.02 ± 5.40 kg/m²), placing the average participant within the obese category. In addition, the mean waist circumference was (85.71 ± 14.64 cm), suggesting increased central adiposity among a substantial proportion of the participants. Although 84% of them were keen on consuming breakfast, the average breakfast time was delayed (11.03 ± 1.31 a.m), with 49.5% of the participants eating breakfast close to midday. Breakfast was commonly consumed at the workplace (73.2%), frequently with workmates (47.4%), and consisted mainly of traditional Egyptian foods such as fava beans and falafel (49.5%), followed by cheese and tea or coffee. Breakfast choices were primarily influenced by personal preference (59.8%) and cost considerations (27.8%). Overall, the findings indicate a pattern of delayed breakfast timing despite regular breakfast consumption among the participants.

Figure (1): The Breakfast time in The Studied Group



Lifestyle behaviors also reflect suboptimal health patterns. Physical inactivity was highly prevalent (87%), and the average sleep duration was (6.44 ± 1.27 hours), with 68% of participants sleeping less than the recommended seven hours per night. In addition, 50% of the participants reported irregular eating patterns, with 74% reporting consumption of their last meal after 8:00 p.m. Overall, the findings from phase I revealed a high prevalence of obesity, delayed breakfast timing, and unfavorable lifestyle behaviors among female employees. Based on these findings, a subgroup of overweight and obese participants reported delayed breakfast consumption, only 30 of them approved to participate in the intervention phase.

Regarding participants in Phase II: their mean age was (42.63 ± 7.03 years), most of them had secondary education 66.7%, versus 33.3% had university education. The majority were married 83.3%, and 37% of participants reported having two children. Following the one-month early breakfast intervention, during which participants were instructed to consume breakfast before 8:00 a.m. As shown in (table 1) significant improvements were observed in several anthropometric measurements. As the mean body weight decreased from 88.05 kg to 87.30 kg (mean change = −0.75 kg), while BMI decreased from 33.95 to 33.56 kg/m² (mean change = −0.39 kg/m²). Waist circumference decreased from 95.5 cm to 94.5 cm (mean change = −1.0 cm), and hip circumference decreased from 121.0 cm to 120.0 cm (mean change = −1.0 cm). A slight reduction in waist–hip ratio was also observed. Statistical analysis demonstrated that reductions in body weight, BMI, waist circumference and hip circumference were statistically significant ($p < 0.01$).

Table (1): Pre- and Post-Intervention Changes in Anthropometric Measurements (N = 30)

	Pre-intervention mean ±SD	Post-intervention mean ±SD	
	86.11 ± 11.44	85.14 ± 11.37	
	95.87 ± 12.30	94.70 ± 12.38	
	120.80 ± 13.88	118.58 ± 15.37	
	0.80 ± 0.07	0.80 ± 0.09	
	33.90 ± 5.08	33.52 ± 5.04	

[a]. Paired t-test **P-value<0.01

Regarding the lipid profile (total cholesterol, HDL-cholesterol, and triglycerides), were assessed before and after the intervention (as shown in Table 2).

Table (2): Pre- and Post-Intervention Changes in lipid profile Measurements (N = 30)

Parameter	Pre-intervention mean ±SD	Po
Total cholesterol (mg/dl)	170.74 ± 19.95	1
HDL-Cholesterol (mg/dl)	84.61 ± 5.90	

Triglycerides (mg/dl)	243.40± 24.56	237.04 ± 25.15	<0.001[a]**

[a]. Paired t-test **P-value<0.01

The mean total cholesterol level decreased from (170.74 ± 19.95 mg/dL) to (166.09 ± 20.05) mg/dL (mean change = −4.65 mg/dL), while triglyceride levels decreased from (243.40 ± 24.56 mg/dL) to (237.04 ± 25.15 mg/dL) (mean change = −6.36 mg/dL). These reductions were statistically significant ($p < 0.001$). In contrast, HDL-cholesterol levels remained unchanged following the intervention.

Discussion:

The present study evaluated the effect of early breakfast consumption on anthropometric measurements and lipid profile among overweight and obese female employees. Baseline findings indicated a high prevalence of obesity, with the average BMI falling within the obese category. This may be attributed to factors such as the predominance of middle-aged participants, high levels of physical inactivity, insufficient sleep, and irregular eating patterns, including late-night eating (Hurtado et al., 2024; Booth et al., 2012; Chaput et al., 2020; Dashti et al., 2021 and Lopez-Minguez et al., 2019). Although most participants reported regular breakfast consumption, breakfast timing was notably delayed, often close to midday. This suggests that the issue was related to delayed meal timing rather than breakfast skipping, which may disrupt metabolic regulation and appetite control (Lopez-Minguez et al., 2019). Based on the study objective, 30 overweight and obese women agreed to participate in a one-month intervention promoting early breakfast consumption before 8:00 a.m., supported by nutritional education, follow-up, and strategies to overcome common work- and family-related barriers that may influence adherence.

The interventional phase demonstrated significant improvements in anthropometric measurements, including body weight, body mass index, waist circumference, and hip circumference. Although the magnitude of weight reduction was modest, the changes were statistically significant despite the short duration of the intervention, suggesting that modifying breakfast timing may contribute to improvements in body composition. The observed reduction in waist circumference is particularly important, as it reflects a decrease in central adiposity, which is closely associated with cardiometabolic risk. These findings are consistent with previous studies indicating that earlier meal timing and alignment with circadian rhythms may improve metabolic outcomes (Wicherski et al., 2021). Regarding lipid profile, intervention resulted in significant reductions in total cholesterol and triglyceride levels, while HDL-cholesterol remained unchanged. The reduction in triglycerides is particularly notable, as triglycerides are highly responsive to meal timing and postprandial metabolic regulation. The lack of change in HDL may be attributed to the short duration of the intervention, as HDL typically requires longer periods of sustained lifestyle modification to demonstrate measurable improvement. (Sun et al., 2020 and Kodama et al., 2007). The observed effects may be explained by several physiological mechanisms. Early food intake aligns with the body's circadian rhythm, optimizing metabolic processes. Insulin sensitivity is higher in the morning, allowing for more efficient glucose and lipid utilization (Manoogian et al., 2024). In addition, earlier meals reduce prolonged fasting periods and enhance triglyceride clearance, while also contributing to better appetite regulation and reduced late-night eating, which collectively support improved metabolic outcomes (Chen et al., 2026).

These findings are consistent with previous intervention studies showing that early time-restricted eating improves lipid profile and cardiometabolic risk factors (Chen et al., 2026). Early breakfast consumption may enhance postprandial fat clearance and improve metabolic efficiency, supporting the role of meal timing in metabolic regulation. However, evidence from randomized controlled trials has reported no significant effect of breakfast consumption or skipping on body weight, highlighting ongoing controversy in the literature (Dhurandhar et al., 2014 and Sievert et al., 2019). This discrepancy may be explained by differences in study design, particularly the focus on breakfast consumption rather than meal timing. Also, previous interventional studies on time-restricted or early time-restricted eating have reported improvements in body weight and metabolic outcomes. Notably, many of these improvements have been closely associated with reductions in total caloric intake and prolonged fasting duration, suggesting that energy restriction and fasting periods may play a substantial role alongside meal timing. (Jamshed et al., 2022; Pavlou et al., 2023; Chang et al., 2024).

The previous findings highlight the importance of examining meal timing independently of caloric restriction, as addressed in the present study. So, our study focused on a simple and practical approach that can be easily implemented in daily life, examining the effect

of early breakfast timing as an isolated behavioral intervention, rather than modifying the entire daily eating window. In addition, the study targeted working women with real-life occupational and household responsibilities, addressing common barriers that may influence adherence to dietary behaviors. Furthermore, the two-phase design, which first explored lifestyle patterns and then applied a targeted intervention, adds strength to the study by linking observed behaviors with a feasible and context-specific intervention strategy.

Conclusion

Early breakfast consumption was associated with significant improvements in anthropometric measures, including body weight, body mass index, and waist circumference, as well as favorable changes in lipid profile, particularly reductions in total cholesterol and triglycerides, among overweight and obese women. These findings highlight the potential role of meal timing as an important component of metabolic regulation. Accordingly, meal timing interventions, such as promoting early breakfast consumption aligned with circadian rhythm, may represent a practical, low-cost, and effective strategy for improving metabolic health and supporting obesity management, particularly among working women.

Limitations:

Despite these strengths, several limitations should be acknowledged. The relatively short duration of the intervention may have limited the magnitude of observed changes, particularly for HDL-cholesterol. In addition, the small sample size in the intervention phase may limit generalizability. Using BMI as primary indicator of body composition (not distinguish between fat and lean mass) and absence of advanced body composition assessment methods may limit detailed interpretation.

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