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The Impact of a ketogenic diet (KD) vs. a Low-Fat Diet (LFD) on weight loss in overweight and obese women: A Randomized Crossover Trial

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Abstract

Background: The worldwide predominance of obesity and overweight is a dominant community health concern, linked to raised risks of cardiovascular morbidity and metabolic disorders. Dietary interventions, such as the ketogenic diet (KD) and low-fat diet (LFD), are common weight management strategies. However, their comparative effectiveness, particularly in certain populations, such as women in Yemen, remains underexplored.
Objective: This study proposed to reveal the influence of a KD and an LFD on body weight reduction, body composition, and key biochemical indicators in overweight and obese women over 12 weeks.
Methods: We carried out a 12-week randomized crossover trial among 20 overweight and obese females in Sana'a, Yemen. Participants were randomized to either a KD (65% fat, 25% protein, 10% carbs) or an LFD (30% fat, 15% protein, 55% carbs), with both diets being isocaloric (1650 calories). We measured anthropometric parameters (body weight, BMI, waist circumference, and hip circumference), body composition (fat-free mass and fat mass), and a range of biochemical markers (blood glucose, lipid profile, urea, creatinine, calcium, vitamin D, and ketone bodies) at baseline and weekly intervals.
Results: Both diets led to marked reduction ($p < 0.001$) in body weight, body mass index, and percentage of body fat, and an increase in muscle mass. The KD group, however, experienced more rapid weight loss (averaging 2 kg/week) than the LFD group (1 kg/week). KD also resulted in more favorable changes in lipid indices, including a decrease in total cholesterol, low-density lipoprotein (LDL-C), and TG levels, but not significantly, and an increase in high-density lipoprotein (HDL-C) levels. Both diets maintained stable creatinine and urea levels in the rats. A key finding was the significant decrease in Vitamin D and calcium levels in the KD group, whereas the LFD group maintained these levels. The KD successfully induced nutritional ketosis, as evidenced by a significant and sustained increase in ketone body levels.
Conclusion: Both a KD and an LFD are effective for weight loss and improving cardiovascular outcomes in overweight and obese women. The ketogenic diet demonstrated a greater and more rapid impact on weight loss and lipid profile improvements, whereas the low-fat diet was more effective at preserving vitamin D and calcium. These findings highlight the importance of both caloric restriction and macronutrient composition in managing obesity.

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INTRODUCTION

The worldwide spread of overweight and obesity is a of health concern which can

increases the risk of cardiovascular disability and various cancers [1, 2]. This is also a major reason for the elevated morbidity and mortality rates of metabolic diseases [3]. According to the World Health Organization (obesity has tripled since 1975 [4]. In 2022, more than 2.5 billion adults aged 18 years and older were overweight, and 890 million were obese (43% of men and 44% of women) [5]. Various strategies, including dietary modifications, increased physical activity, medication, and surgical interventions, have been suggested to address this public health issue. Although there are specific approaches to weight loss strategies, such as diet plans, exercise routines, and medications, they can vary [6]. Today, the KD has gained popularity as an effective weight-loss method [2]. The KD is a high-fat, adequate-protein, low-carbohydrate plan in which total carbohydrate is typically restricted to a maximum of 50 g/day, or 5–10% of the daily energy intake. Macronutrient proportions are prescribed with no restrictions, although protein and fat represent 10–30% and 60–80% of daily energy intake, respectively [7, 8]. This diet results in a metabolic state called ketosis, in which the body changes from using glucose as its main source of energy to ketones, which are produced from the catabolism of fats [9]. This change occurs because a low carbohydrate intake markedly decreases blood glucose and insulin levels, causing the body to use stored fat for energy [10].

A study confirmed that ketogenic diets can cause marked decreases in body weight, BMI, and waist circumference and improve lipid indices, including a decrease in triglyceride levels and an increase in HDL cholesterol [11]. These changes are important because abdominal obesity is a major risk factor for CV disability [11]. In a randomized controlled clinical trial where individuals were randomized to a 6 6-month KD or a high-carb, low-fat diet under controlled variables, the results revealed that the KD group lost weight faster and shed more weight throughout the study, without cardiovascular risks within the 6 months [1]. The present study aimed to evaluate the effects of a ketogenic diet (KD) and a low-fat diet (LFD) on weight reduction and lipid indices in overweight and obese females.

MATERIALS AND METHODOLOGY:

Study Design:

A cross-sectional randomized trial of the ketogenic diet versus a low-fat diet in women with obesity or overweight status for a duration of 12 weeks.

Sample Size:

The sample size was determined based on the availability of participants, with a sample size of 20 volunteers.

Random Assignment:

Participants were randomly assigned to one of two dietary groups: ketogenic diet (KD) or standard diet for 12 weeks.

Participants:

The participants were selected from women suffering from overweight or obesity voluntarily through social media. The participants were aged $\geq$ 18 years and had a Body Mass Index (BMI; in kg/m²) >25 to be included in the study. The number of participating women was 20, and they were directly interviewed to gather initial data through direct questioning. Assessments of the participants were conducted at the consultation clinic of Dr. Nashwan Al-Malaki, Al Andaluz Toward Medical Center, Al-Satin Street. This was done to determine weights, BMI, and the presence of diseases. The inclusion criteria were females aged $\geq$18 years with a Body Mass Index (BMI; in kg/m²)$\geq$ 30. The exclusion criteria included women with certain diseases or those taking medications that lower blood sugar (such as insulin). They were also required to have a stable dietary history, defined as not adding or removing major food groups from their diet. The participants (20 in total) were then randomly divided by age, weight, and body mass index into 10 participants for each dietary regimen.

DIET INTERVENTIONS:

Participants in the HFKD group (n = 10) were placed on an HFD consisting of (65%) fat, (10%) carbohydrates, and (25%) protein of total energy intake (according to their daily caloric needs) for a duration of 12 weeks. The LFD group (n = 10) was designed to follow a low-fat diet consisting of (30%) fat, (55%) carbohydrates, and (15%) protein of the total daily energy intake for 12 weeks [**10**]. Both diets had equal total energy intakes but differed in terms of macronutrient content (fats, carbohydrates, and proteins). The two dietary groups consumed a variety of carbohydrates in their daily meals while avoiding sugary foods. Saturated fats were kept below 10% in both diets, and no supplements, artificial sweeteners, or any other nutritional items or beverages were allowed in either group. All participants received weekly meal plans that included “breakfast, lunch, dinner, snacks” and consultation sessions with the researcher for advice during the 12 weeks. The nutrition session on meal planning and support was presented by the researcher to all the participants. A uniform total energy intake was established for all participants in both groups to assess the differences between the two diets in terms of weight loss, as both diets were equal in total energy content and within each diet (1650 calories/day) [9].

MEASUREMENTS:

Anthropometrics Measurements

Anthropometric Measurements: (Height) was measured to the nearest millimeter using a wall-mounted stadiometer. (Waist and hip circumference) were measured to the nearest millimeter using "standard procedures with a 150 cm anthropometric tape measure. (Body weight, body fat percentage), (percentage of total weight) for all participants were obtained weekly using the "Omron Body Composition Monitor BF511". Anthropometric measurements were performed before and during the experiment.

Biochemical assays:

Blood samples were collected after a 12-hour overnight fast initially and every week during the experimental period to measure plasma glucose, total cholesterol, LDL, HDL, triglyceride, urea, vitamin D, calcium, and ketone body levels.

Follow up:

The dietary plans of the participants were monitored, and various measurements were taken from the start date of the experiment until week 12, and the results were recorded.

Ethical Considerations:

Approval was obtained from the Sana'a University. All participants provided informed written consent during the 12-week nutrition trial. Data were anonymized to protect confidentiality, and the participants were free to withdraw at any stage.

Statistical Analysis

Data were analyzed using repeated measures "ANOVA" to assess within-subject effects (i.e., change over time), between-subject effects (i.e., differences between groups), and interaction effects (i.e., differential change over time between groups). Effect sizes were reported using partial eta-squared (η^2). Sphericity assumptions were evaluated using Mauchly's Test, and the Greenhouse-Geisser correction was applied where violations occurred. The statistical software used for data analysis was SPSS 28, with statistical significance set at P<.05.

RESULTS

All 20 overweight and obese women were enrolled in this study, with 10 participants assigned to the Ketogenic Diet (**KD**) group and 10 to the Low-Fat Diet (**LFD**) group. The tables below present the participants' baseline and follow-up characteristics.

The study revealed statistically significant changes in both anthropometric and body composition measurements in both groups. Both groups showed a remarkable decrease in body weight and Body Mass Index (BMI) during the study period. The effect was highly statistically significant (p < 0.001), confirming that the changes were not random and that the pattern of weight loss differed significantly between the two groups. The KD group achieved a greater reduction in weight, with participants' average weight decreasing from 96.11 kg to 74.32 kg, whereas participants in the LFD group saw their weight decrease from 98.59 kg to 84.90 kg. Both groups experienced a significant decrease in waist and hip circumferences. This reduction was more pronounced in the KD group, where the waist circumference decreased from 105.87 cm to 81.86 cm and the hip circumference from 118.75 cm to 90.71 cm. The statistical results indicated that this decrease was significant and that its pattern differed between the two groups (waist circumference: p = 0.002; hip circumference: p <0 .001). Regarding the effect on fat mass and fat-free mass, the percentage of fat mass decreased significantly in both groups (p <0.001), although there was no major statistical difference in the amount of reduction between the two groups (p = 0.523). Regarding Fat-Free Mass (FFM), significant changes were observed over time (p = 0.001), but without a major statistical difference between the two groups (p = 0.118). Regarding the effect on muscle mass and waist-to-hip ratio, muscle mass increased over time in both groups (p < 0.001), although the increase was statistically similar between them (p=0.137). Furthermore, the waist-to-hip ratio showed no significant statistical changes (p = 0.313), indicating that the reduction in waist and hip circumferences was proportional in both groups.

Biochemical Measurements:

The study results revealed significant changes in the participants' biochemical markers over 12 weeks, as detailed in Table 2. Both the **ketogenic (KD)** and **low-fat diet (LFD)** groups showed a notable decrease in **blood sugar (BS)** levels.

The overall effect of time was statistically significant (p =0 .045); however, since the time-by-group interaction was not significant (p = 0.347), this suggests similar trends in blood sugar reduction between the two diets. The lipid profiles showed more distinct patterns. The KD group showed a clear trend of improvement, with HDL levels increasing from 52.30 to 70.25, while LDL and triglyceride (TG) levels decreased from 185.70 to 139.40 and 105.62 to 77.90, respectively. Although these changes were not always statistically significant, they indicated a marked improvement. In contrast, the lipid levels in the LFD group remained relatively stable. The cholesterol ratio (CR) did not significantly change in either group. The results also tracked the markers of kidney function and micronutrient levels. While Urea levels showed a slight but statistically significant increase in the KD group (p =0 .041), Creatinine and Hemoglobin levels remained stable in both groups. A significant finding was the decrease in calcium (CA) and Vitamin D (VD) levels in the KD group. The reduction in Vitamin D was

Table 1. changes in (body weight) and (body composition) over 12 weeks

Group	Baseline	3rd Week	6th Week	9th Week	12th Week	(Time)	Time × Group)
Weight (kg)							
(KD)	96.11 ± 7.65	89.34 ± 10.01	83.63 ± 10.06	79.06 ± 10.76	74.32 ± 10.10	<0 .001	<0 .001
(LFD)	98.59 ± 5.33	95.07 ± 4.97	91.82 ± 3.65	89.34 ± 3.61	84.90 ± 2.76		
BMI							
(KD)	38.490 ± 1.45	36.09 ± 2.28	34.04 ± 2.86	31.72 ± 3.50	29.70 ± 3.48	<0.001	<0.001
(LFD)	39.18 ± 1.87	37.80 ± 1.83	36.53 ± 1.42	35.54 ± 1.41	33.96 ± 1.25		
Waist Circumference (cm)							
(KD)	105.87± 14.96	99.39 ± 14.53	93.93 ± 14.97	88.18 ± 14.48	81.86 ± 10.93	<0 .001	0.002
(LFD)	99.23 ± 8.50	96.19 ± 7.66	92.17 ± 6.79	89.35 ± 6.68	86.21 ± 6.47		
Hip Circumference (cm)							
(KD)	118.75 ± 16.81	111.53 ± 15.98	104.53 ± 18.66	97.63 ± 19.15	90.71 ± 16.53	<0 .001	<0 .001
(LFD)	114.80 ± 12.45	111.15 ± 11.78	107.82 ± 12.29	104.29 ± 12.44	100.05 ± 12.43		
Fat Mass (%)							
(KD)	38.10 ± 4.02	36.03 ± 3.86	34.21 ± 3.45	31.57 ± 3.81	29.57 ± 4.39	<0 .001	0.523
(LFD)	36.35 ± 3.37	34.31 ± 2.07	33.16 ± 2.83	31.29 ± 2.20	28.82 ± 2.94		
FFM							
(KD)	59.50± 6.92	58.200±7.33	56.32±6.95	56.300±7.05	62.100± 6.22	<0 .001	0.118
(LFD)	62.57±2.66	62.500±3.74	60.54 ± 2.97	60.1002.131	63.100±3.17		
Muscle Mass(kg)							
(KD)	26.04 ± 3.49	25.91 ± 3.32	25.85 ± 3.53	26.94 ± 3.46	27.86 ± 3.85	<0 .001	0.137
(LFD)	22.53 ± 1.79	23.23 ± 2.47	24.38 ± 2.67	25.37 ± 2.88	27.53 ± 3.14		
Waist-to-Hip Ratio							
(KD)	88.53 ± 7.86	89.22 ± 7.25	90.46 ± 9.84	91.09 ± 9.74	91.56 ± 8.03	0.313	0.432
(LFD)	86.61 ± 5.64	86.08 ± 6.06	85.86 ± 6.78	86.76 ± 7.72	86.70 ± 7.14		

Body weight (BMI) and body fat of participants before and after following the ketogenic diet (KD) (n=10) and low-fat diet (LFD) (n=10). Values are presented as mean ± SD. Data were analyzed using a paired-samples t-test, with *p < 0.05 significance. Indicating statistical participants who followed either the (KD) or the (LFD).

Table 2. Biochemical Markers of Participants Following Ketogenic vs. Standard Diets over 12 Weeks

Group	Baseline	3rd Week	6th Week	9th Week	12th Week	(Time)	(Time × Group)
BS							
(KD)	142.70 ± 86.07	119.30 ± 45.56	110.90 ± 36.00	104.80± 26.2	102.30 ± 22.20	0.045	0.347
(LFD)	114.90 ± 68.57	103.90 ± 37.31	104.90 ± 38.02	102.20± 29.2	98.00 ± 18.37		
HDL							
(KD)	52.30 ± 9.46	54.80 ± 5.67	57.01 ± 11.72	61.85 ± 18.36	70.25 ± 29.40	0.101	0.119
(LFD)	42.80 ± 2.78	44.00 ± 6.02	44.70 ± 4.11	44.30 ± 4.47	43.80 ± 4.32		
LDL							
(KD)	185.70 ± 137.3	167.20 ± 110.7	157.30 ± 90.81	146.81± 73.7	139.40 ± 62.23	0.072	0.210
(LFD)	141.40 ± 71.49	138.60 ± 63.93	136.05 ± 55.96	134.00± 46.6	133.90 ± 41.55		
TG							
(KD)	105.62 ± 85.86	102.71 ± 78.86	95.65 ± 65.04	85.71 ± 52.34	77.90 ± 36.69	0.080	0.123
(LFD)	60.29 ± 15.46	60.73 ± 14.37	59.16 ± 13.18	59.29 ± 14.13	58.65 ± 9.88		
COL							
(KD)	169.30 ± 93.60	158.80 ± 77.80	150.20 ± 66.34	141.44± 47.8	138.60 ± 38.58	0.093	0.219
(LFD)	112.82 ± 58.12	114.01 ± 52.55	115.58 ± 54.04	110.31± 43.6	107.51 ± 32.71		
CR							
(KD)	0.7750 ± 0.134	0.7940 ± 0.093	0.8020 ± 0.084	0.7720± 0.13	0.7940 ± 0.1201	0.120	0.932
(LFD)	0.8650 ± 0.053	0.8750 ± 0.036	0.8830 ± 0.036	0.8630± 0.06	0.8870 ± 0.0430		
Urea							
(KD)	2.473 ± 1.985	2.596 ± 1.974	2.736 ± 1.881	2.622 ± 1.876	2.681 ± 1.726	0.041	0.476
(LFD)	2.000 ± 0.125	2.030 ± 0.200	2.155 ± 0.243	2.143 ± 0.325	2.025 ± 0.284		
CA							
(KD)	2.330 ± 0.374	2.270 ± 0.464	2.160 ± 0.481	1.980 ± 0.308	2.040 ± 0.201	0.082	0.089
(LFD)	2.630 ± 0.591	2.630 ± 0.609	2.540 ± 0.448	2.610 ± 0.463	2.650 ± 0.508		
VD							
(KD)	22.25 ± 2.42	21.33 ± 2.09	19.76 ± 1.67	19.59 ± 0.92	19.30 ± 2.33	<0 .001	0.036
(LFD)	23.84 ± 5.59	23.79 ± 5.69	23.22 ± 5.36	23.35 ± 5.21	23.37 ± 5.05		
HB							
(KD)	13.70 ± 0.82	13.47 ± 0.73	13.59 ± 0.63	13.76 ± 0.51	13.55 ± 0.76	0.234	0.629
(LFD)	13.71 ± 0.67	13.62 ± 0.51	13.69 ± 0.53	13.75 ± 0.50	13.80 ± 0.32		
KB							
(KD)	1.73 ± 2.59	2.52 ± 2.14	3.70 ± 1.77	4.77 ± 2.15	4.95 ± 2.32		
(LFD)	1.03 ± 1.52	1.25 ± 1.53	1.55 ± 2.19	1.63 ± 2.18	1.40 ± 1.69	< 0.001	0.011

Biomarker (BS) blood sugar, High-density lipoprotein (HDL, Low-density lipoprotein (LDL), Triglyceride (TG), Total cholesterol (COL), cholesterol ratio (CR), Calcium (CA), Vitamin D (VD), Hemoglobin (HB) and ketone bodies (KB) of participants before and after following the ketogenic diet (KD) (n=10) and low-fat diet (LFD) (n=10). Values are presented as means ± SD. Data were analyzed using a paired-samples t-test, with *p < 0.05 significance. Indicating statistical participants who followed either the (KD) or the (LFD).

particularly significant, with both the overall effect of time ($p < 0.001$) and the time-by-group interaction ($p = 0.036$) being statistically significant. This suggests that the ketogenic diet may have a more pronounced impact on vitamin D status than a low-fat diet. The most prominent difference between the two diets was the change in the levels of ketone bodies (KB). The KD group experienced a significant and sustained increase in KB levels, which increased from 1.73 to 4.95. This increase was highly statistically significant ($p < 0.001$) and confirmed that the participants in the KD group successfully entered a state of ketosis. In contrast, ketone body levels in the LFD group remained low and unchanged throughout the study.

DISCUSSION

In this interventional study, we tested the hypothesis that a ketogenic diet (KD) would be more effective for weight loss than a low-fat diet (LFD) in overweight and obese women. This study showed significant weight loss and body mass reduction in both groups of patients. This aligns with other studies that have observed similar weight-loss outcomes between high-fat ketogenic diets (HFKD) and low-fat diets (LFD), primarily attributed to a reduction in overall caloric intake [12, 13]. Research comparing different diets in obese adults has also found comparable weight loss across groups [14–16]. While some evidence suggests that HFKD and LFD are equally effective for weight loss [17], other studies indicate that HFKD may lead to greater reductions in body weight [11, 14]. The discrepancies in these results may be due to individual differences in response to diet or variations in the study duration [18]. The statistical outcomes of BMI measurements were consistently positive across multiple studies. Seven separate studies reported a decrease in BMI as a result of a ketogenic diet intervention [16, 19–24]. For instance, [22] conducted a randomized controlled trial over 24 months with 45 obese adults. At the conclusion of the study, the very low-calorie ketogenic (VLCK) group demonstrated significantly greater weight loss (12.8 kg) than the standard low-calorie diet group (4.4 kg). Additionally, the VLCK group had a larger average reduction in waist circumference (11.6 cm) than the standard diet group (4.1 cm).

The results of this study showed a significant decrease in both lean and fat masses, further supporting the notion that ketogenic diets effectively reduce body weight. This is consistent with a recent systematic review by [25] on ketogenic diets and performance in healthy, non-obese individuals. This review reported a decline in body mass, fat mass, and fat-free mass. However, studies comparing ketogenic and low-fat diets have yielded varied results regarding the preservation of fat-free mass. Unlike the findings of [26], the findings of this study indicate that the LFD preserved fat-free mass to a greater extent than the KD. This difference may be partly due to variations in skeletal muscle glycogen content [27, 28] and a significant reduction in fat-free mass among individuals on a ketogenic diet compared to their non-ketogenic counterparts. The authors suggested that ketogenic diets might inhibit the mechanistic target of rapamycin (mTOR) signaling pathway, possibly through heightened AMPK activity, which is a known regulator of muscle mass gains [29]. This study investigated whether a ketogenic diet (KD) is more effective for weight loss than a low-fat diet (LFD) in overweight and obese women. The results of this study showed significant reductions in body weight and fat mass in both groups. This aligns with other studies that found comparable weight loss between high-fat ketogenic and low-fat diets, primarily due to a reduction in caloric intake [12, 13]. However, the results of this study regarding lean body mass differ from those of previous studies. For example, [14, 15] observed that low-carbohydrate diets were more effective in preserving lean body mass than high-carbohydrate diets. A key finding of this study was that while both diets led to significant fat loss, the KD produced a more pronounced reduction. This contradicts the findings of [16], who found that a low-fat diet led to a greater decrease in body fat percentage than a high-fat diet. Proponents of the ketogenic diet often suggest that it is an effective strategy for improving body composition by reducing body fat while preserving muscle mass. These effects are attributed to a metabolic shift in which the body uses fat for energy instead of carbohydrates [30]. The results of this study support this, showing that the KD led to a statistically significant reduction in blood glucose levels. This is consistent with other studies on low-carbohydrate diets [13, 31, 32]. The mechanism underlying this is that the limited carbohydrate intake in the KD directly lowers blood glucose levels. Additionally, the resulting state of ketosis enhances fat oxidation and reduces glucose utilization, leading to lower insulin levels [33, 34].

This study also revealed improvements in blood lipid levels in both groups, supporting the importance of diet type in cardiovascular health [35]. Both diets showed a decreasing trend in total cholesterol, LDL, and triglyceride levels, but these reductions were more pronounced in the KD group. Specifically, HDL levels increased in the KD group but remained stable in the LFD group. This contrasts with previous studies on LFDs, which found significant reductions in LDL cholesterol, possibly due to a lower intake of saturated fats and cholesterol [13, 33]. The findings of this study are consistent with those of other studies showing that carbohydrate-restricted diets effectively lower fasting serum triglyceride concentrations [30]. This is particularly relevant as research has shown that increasing carbohydrate intake while lowering fat intake during weight maintenance can increase serum triglyceride concentrations [30, 36]. Interestingly, the findings of decreased total cholesterol and LDL levels in the KD group are inconsistent with some prior studies [1, 37] that have shown an increase in total cholesterol with ketogenic diets [38, 39]. However, other studies, such as [40], have also demonstrated a decrease in total cholesterol levels in carbohydrate-restricted diets. This variability highlights the complex and sometimes conflicting evidence regarding the effects of different diets on lipid profile. Recent research suggests that the link between LDL and cardiovascular risk varies depending on the particle size [16, 41]. Because low-carbohydrate ketogenic diets tend to increase the size of LDL particles [42], an increase in total LDL may not necessarily lead to a higher cardiovascular risk.

However, the triglyceride-to-HDL ratio, a marker of coronary artery disease, was lower in the low-carbohydrate ketogenic (LCK) group than in the moderate-carbohydrate calorie-restricted (MCCR) group [16, 43]. Although both diets produced positive changes in the blood lipid profiles, the KD group showed more favorable overall results. Urea and creatinine levels remained stable in both the KD and LFD groups. The slight increase in urea levels observed in the KD group was minimal and not statistically significant. Similarly, plasma uric acid and urinary calcium, metabolic markers that often increase with high-protein diets, did not significantly change from baseline, suggesting that these fluctuations were transient [44]. The findings of this study showed that creatinine levels remained stable across the 12 weeks for both groups.

However, there was a significant fluctuation in the creatinine clearance throughout the experiment. Although an elevated creatinine clearance rate is a normal physiological response, it may lead to renal hyperfiltration in individuals with impaired kidney function, which may increase the risk of glomerulosclerosis ([45]. Therefore, individuals at risk of kidney disease should be cautious when adopting LCK diets [38]. A significant finding was that Vitamin D levels decreased significantly in the KD group, whereas they remained stable in the LFD group. This contrasts with a study by [23], which concluded that a one-year ketogenic diet led to significant weight loss and increased vitamin D levels in obese adults. The risk of nutrient deficiency is a concern with any diet that restricts the consumption of certain food groups. If not carefully planned, a ketogenic diet may lead to deficiencies in essential nutrients, vitamins, and minerals [46]. Finally, ketone body levels increased notably in the KD group, reflecting the expected metabolic adaptation to ketosis. This is the defining feature of a ketogenic diet. Shifting metabolism to use fat for energy and produce ketone bodies is only possible after carbohydrate deprivation, which leads to nutritional ketosis (ketone bodies >0.5 mmol/L) with a simultaneous increase in dietary fat intake over several weeks [47, 48]. In this state, ketone bodies replace most of the glucose required by the brain, while liver gluconeogenesis provides the limited energy needed by glucose-dependent tissues, such as red blood cells and the retina [49]. The metabolic state of ketosis also enhances fat oxidation and reduces glucose utilization, which ultimately leads to lower insulin levels [40].

CONCLUSION

This study, the first of its kind in Yemen, compared the effects of a ketogenic diet (KD) and a low-fat diet (LFD) in overweight and obese women. Both diets successfully led to significant weight loss and improved cardiovascular health, but with distinct benefits for each diet. The KD group experienced more rapid weight loss, averaging 2 kg per week, which was double that of the LFD group. KD also significantly improved metabolic markers by lowering cholesterol, triglyceride, and LDL-C levels while increasing HDL-C levels. It also effectively improves blood sugar control and induces ketosis. Importantly, both diets maintained stable creatinine and urea levels, suggesting that they do not harm kidney function. In contrast, the LFD better preserved vitamin D and calcium levels. The results of this study emphasize that both calorie reduction and the specific macronutrient composition of a diet are crucial for managing obesity. They also highlighted the importance of considering individual responses to diet. We recommend future research with larger and more diverse groups and longer study periods to better understand the long-term effects of these diets on the gut microbiome.

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CONFLICT OF INTEREST

The author(s) do not have any conflicts of interest.

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