

Weight loss by ketogenic diet among overweight and obese Kurds-Kurdistan region of Iraq

Perda de peso com dieta cetogênica entre curdos com sobrepeso e obesos na região do Curdistão, Iraque

Pérdida de peso mediante la dieta cetogénica entre kurdos con sobrepeso y obesidad en la región del Kurdistan Iraquí

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Abstract

Objective: This study aims to ascertain the impact of a Ketogenic (keto) Diet (KD) on weight loss. **Material and Methods:** The study uses questionnaires and surveys to collect data in the Kurdistan region of Iraq between October 2024 and February 2025 and uses keto-diet stores, and in-person encounters to evaluate body mass index, obesity levels, and perceptions of the KD. **Results:** For the individuals' sociodemographic characteristics, frequency and percentage were employed. The consistency of weight loss, weeks of keto diet, and blood glucose and cholesterol levels for each group of men and women were calculated using an unpaired T-test (independent) with a P-value of less than 0.05 for the baseline before and after the keto diet for perception. Of the 130 participants, 48% were women and 52% were men, and they ranged in age from 10 to 69. Both sexes were heavily following the KD between the ages of 30 and 39: 34.92% of women and 35.82% of men. 35.82% of men and 38.10% of women were categorized as Class 1 and Class 2 obese, respectively, based on body mass index. In addition, ladies lost 15.3 kg in 33.1 weeks ($p < 0.0001$), while males lost an average of 23.7 kg in 49.2 weeks ($p < 0.001$). **Conclusion:** The utilization of the KD as a therapeutic intervention for obesity, illnesses related to nutrition, and other new treatments may be supported by these findings.

Keywords: Body mass index; Cholesterol profile; Keto-diet foods; Ketosis; Obesity.

Resumo

Objetivo: Este estudo tem como objetivo determinar o impacto de uma Dieta Cetogênica (DC) na perda de peso. **Materiais e Métodos:** O estudo utiliza questionários e pesquisas para coletar dados na região do Curdistão iraquiano entre outubro de 2024 e fevereiro de 2025, e utiliza lojas especializadas em dieta cetogênica e encontros presenciais para avaliar o índice de massa corporal, os níveis de obesidade e as percepções sobre a dieta cetogênica. **Resultados:** Para as características sociodemográficas dos indivíduos, foram utilizadas frequência e porcentagem. A consistência da perda de peso, das semanas de dieta cetogênica e dos níveis de glicose e colesterol no sangue para cada grupo de homens e mulheres foi calculada utilizando um teste t não pareado (independente) com um valor de p inferior a 0,05 para a linha de base antes e depois da dieta cetogênica para a percepção. Dos 130 participantes, 48% eram mulheres e 52% eram homens, com idades variando de 10 a 69 anos. Ambos os sexos seguiram a dieta cetogênica de forma intensa entre os 30 e 39 anos: 34,92% das mulheres e 35,82% dos homens. 35,82% dos homens e 38,10% das mulheres foram classificados como obesos de Classe 1 e Classe 2, respectivamente, com base no índice de massa corporal. Além disso, as mulheres perderam 15,3 kg em 33,1 semanas ($p < 0,0001$), enquanto os homens perderam em

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média 23,7 kg em 49,2 semanas ($p < 0,001$). Conclusão: A utilização da dieta cetogênica como intervenção terapêutica para obesidade, doenças relacionadas à nutrição e outros novos tratamentos pode ser respaldada por esses achados.

Palavras-chave: Índice de massa corporal; Perfil de colesterol; Alimentos da dieta cetogênica; Cetose; Obesidade.

Resumen

Objetivo: Este estudio tiene como objetivo determinar el impacto de una Dieta Cetogénica (DC) en la pérdida de peso. **Material y métodos:** El estudio utiliza cuestionarios y encuestas para recopilar datos en la región del Kurdistan iraquí entre octubre de 2024 y febrero de 2025, y utiliza tiendas de dieta cetogénica y encuentros personales para evaluar el índice de masa corporal, los niveles de obesidad y las percepciones de la dieta cetogénica. **Resultados:** Para las características sociodemográficas de los individuos, se emplearon frecuencia y porcentaje. La consistencia de la pérdida de peso, semanas de dieta keto y niveles de glucosa y colesterol en sangre para cada grupo de hombres y mujeres se calculó utilizando una prueba T no pareada (independiente) con un valor P menor a 0,05 para la línea base antes y después de la dieta keto para la percepción. De los 130 participantes, el 48% eran mujeres y el 52% eran hombres, y su edad oscilaba entre los 10 y los 69 años. Ambos sexos seguían intensamente la dieta keto entre los 30 y los 39 años: el 34,92% de las mujeres y el 35,82% de los hombres. El 35,82% de los hombres y el 38,10% de las mujeres se clasificaron como obesos de Clase 1 y Clase 2, respectivamente, según el índice de masa corporal. Además, las mujeres perdieron 15,3 kg en 33,1 semanas ($p < 0,0001$), mientras que los hombres perdieron una media de 23,7 kg en 49,2 semanas ($p < 0,001$). **Conclusión:** Estos hallazgos pueden respaldar la utilización de la DC como intervención terapéutica para la obesidad, enfermedades relacionadas con la nutrición y otros tratamientos nuevos.

Palabras clave: Índice de masa corporal; Perfil de colesterol; Alimentos de la dieta cetogénica; Cetosis; Obesidad.

1. Introduction

The Ketogenic Diet (KD) also known as the "keto-diet," promotes high fat 75% and 20% protein content while reducing 5% carbohydrates intake, leading to a metabolic condition called "ketosis," where the body uses fat as primary energy (Alharbi et al., 2020). The standard KD, which was developed in the 1920s, The KD has experienced a reemergence in recent years and modern clinical studies have established the treatment as significantly effective (Alharbi et al., 2020). Recently, the KD has gained popularity and shown effective results in clinical studies, becoming available in over 45 countries (Wheless, 2008; Kossoff and McGrogan, 2005). Limiting carbohydrate intake reduces insulin secretion, promoting gluconeogenesis and ketogenesis (Dhamija et al., 2013). Ketosis produces ketone molecules like acetone, acetoacetate, and β -hydroxybutyrate, which the body uses for energy and signaling, potentially aiding in weight loss and reducing glucose in type 2 diabetes patients (Dhamija et al., 2013). In mice with metastatic cancer, the KD dramatically lowered blood glucose levels; it inhibited tumor growth in lung Xenograft tumor and increased survival time by 56.7% (Allen et al., 2013; Poff et al., 2013). According to the World Health Organization (2025) non-communicable diseases (NCDs) estimated that 5 million deaths in 2019 among adults with a body mass index (BMI) was higher than optimum. Of these, obesity-related NCDs account for 70% (Ahmed and Konje, 2023). By 2035, over 4 billion may be overweight or obese, with nearly 2 billion, or 1 in 4 people, classified as obese (Ng et al., 2025). Obesity is a significant contributor to malnutrition, with high rates in middle-income countries. In the Eastern Mediterranean, prevalence ranges from 25% to 81.9% (Templin et al., 2019). According to the Global Obesity Observatory (2022) 41.41% of Iraqi men and women were obese. The $(\text{BMI}) \geq 30 \text{ kg/m}^2$ affects 33.35% of men and 48.50% of women in the world's adult population. The Kurdistan region has a 74.3% overall prevalence of overweight and obesity, which is similar to any other region in the world (33.4% overweight and 40.9% obese) (Shabu, 2019). Obesity is a major public health concern, with medical costs estimated at \$147 billion in 2008 (Çakmur, 2017). The economic impact of obesity is expected to rise from 2.19% to 3.3% of gross domestic product in 161 countries by 2060 according World Obesity Federation (2022). The countries expected to have the largest economic cost of overweight and obesity is China (over \$10 trillion), the United States (over \$2.5 trillion) and India (nearly \$850 billion) (World Obesity Federation, 2022). Obesity did not exist when humans first appeared as hunter-gatherers; meat is also high in protein and has zero carbs (Dhillon and Gupta, 2023). High-fat diets can improve lipid profiles, and ketone molecules are used by the body for energy. The globe has become obese due to advancements in

agriculture, food processing, marketing, planning, and low physical activity. Body weight is controlled by various physiological processes that maintain energy balance (Dhillon and Gupta, 2023). Foods that are high in carbohydrates should be avoided, including bread, pasta, rice, potatoes, corn, beans, lentils, bananas, grapes, sweet snacks, sodas, and most fruit juices. The study examines the prevalence of excess weight in Kurdistan, Iraq, and the environmental risk factors contributing to it. It limits carbohydrate intake to 20 grams daily to improve health and prevent obesity without drugs or medications. The aim of the present study was to assess role of the kitogenic (keto) diet in the overweight/ obese and diabetic people in Kurdistan region of Iraq.

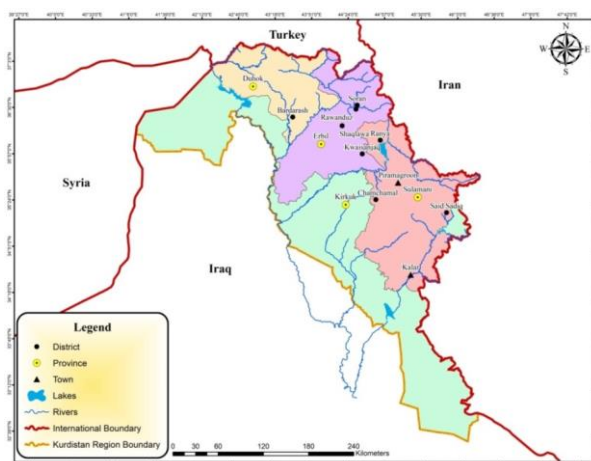
2. Methodology

A mixed-methods study was conducted, partly social with groups of people and partly epidemiological with measurements on individuals (Toassi & Petry, 2021), in a quantitative study (Pereira et al., 2018) using simple descriptive statistics with data classes by age group, mean and standard deviation values, absolute frequency in number of individuals and relative percentage frequency (Pereira et al., 2018) and using statistical analysis (Vieira, 2021; Costa Neto & Bekman, 2009).

2.1 Description of the study area

The data collection procedure is conducted in the Kurdistan region, a semi-autonomous federal area in northern Iraq. The region is divided into three governorates (Kurdish: پارێزگا, Parêzga): Erbil, Sulaymaniyah, and Duhok, which share borders with Iran, Syria, and Turkey. As shown in Figure 1. The period of study was between October 2024 to February 2025. There were 130 participants in total, representing cities, districts, sub-districts, and towns; they were all on the KD and resided in various Kurdistan regions of Iraq.

Figure 1. Map of the study area of people who followed KD.



Source: Research data (2025).

2.2 Data collection

The study involved sharing information on the KD through Facebook groups and local stores or shop (Keto-diet staff). The study collected data from acquaintances that had followed a KD, using a questionnaire divided into socio-demographic factors and body measurements. The socio-demographic factors were: age, gender, education level, socioeconomic status. The age groups categorized into six groups: 10–19, 20–29, 30–39, 40–49, 50–59, 60–69 and ≥ 70 years. Most individuals follow the KD to lose weight, but few use it to cure diabetes. This study measured the number of weeks spent following the KD in order to lose weight. Consequently, not much information was gathered to compare blood glucose and before and after the KD.

Blood glucose measured by glucometer and cholesterol levels are detected by a simple blood test called a lipid panel or lipid profile. The General Sciences Department review board of the Faculty Education, Soran University approved this study (No. 71/5/10/2024).

2.3 Body mass index

The BMI was calculated using the formula (kg/m^2) and defined as weight in kilograms (kg) divided by height (m) squared. Consistent with established criteria, "overweight" was defined as a BMI of 25–29.9 kg/m^2 and "obesity" was defined as a BMI of ≥ 30 (Dhillon and Gupta, 2023).

2.4 Foods to eat on a ketogenic diet

The KDs primary tenets are a higher fat intake, moderate protein intake and a reduced carbohydrate intake, as shown in Figure 2.

Figure 2. Foods can be consumed by people on KD. A. Fats and oils, B. Proteins, C. Vegetable, D. Dairies, E. Fruits, F. Beverages, G. Seeds.



Source: Clarke & Jospe (2025).

2.5 Statistical analysis

Data were analyzed using Graph Pad Prism, version 9. Descriptive characteristic of the respondents were obtained as frequency, percentage, maximum and minimum. Statistical differences between body weights, lose weight, number of weeks, blood sugar, and cholesterol levels before and after the administration of KD were analyzed using a Unpaired T test (independent). All parameters are expresses as mean±SD. The level of significance used for the above analysis was 0.05.

3. Results

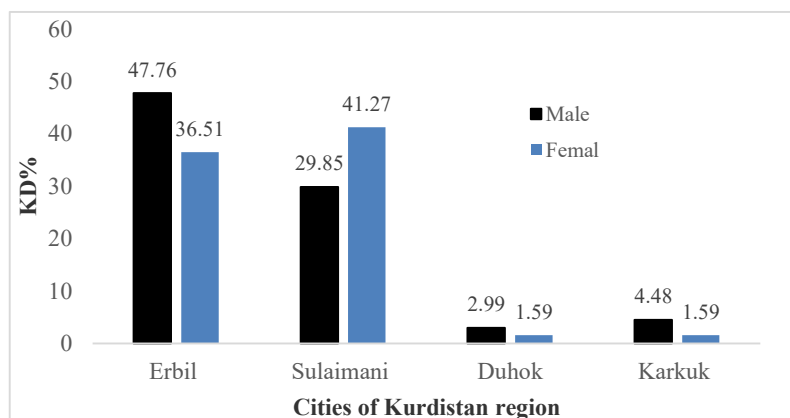
Table 1 Socio-demographic characteristics of the participants: 130 individuals from the Kurdistan Region, including males and females 67 (52%) vs. 63 (48%) respectively. Males and females who adopted the KD with the majority being between the ages of 30 and 39, according to Table 1. Then, among graduates who persevered with the KD, the proportions of females and males were 39 (61.9%) vs. 25 (37.31%), respectively, which was higher than in elementary, secondary, and post-education. Geographically, the biggest percentage of men and women following the KD were reported in Erbil city, with 32 (47.76%) and 23 (36.51%) individuals, respectively. According to Figure 3, Sulimanyia then came in second for both females and males.

Table 1. Socio-demographic properties of the participants.

Characteristic	Frequency (%)	Frequency (%)
Gender	Male	Female
	67 (52%)	63 (48%)
Age group		
10-19	1 (1.5%)	0
20-29	16 (23.88%)	20 (31.75%)
30-39	24 (35.82%)	22 (34.92%)
40-49	18 (26.85%)	15 (23.81%)
50-59	7 (10.45%)	6 (9.52%)
60-69	1 (1.5%)	0
Education		
Primary	20 (29.85%)	11 (17.45%)
Secondary	15 (22.4%)	9 (14.3%)
Graduated	25 (37.31%)	39 (61.9%)
Post	7 (10.44%)	4 (6.35%)

Frequency and percentage of the sample. Source: Research data (2025).

Figure 3. Men and femal followed KD indifferent citeis.



KD=Ketogenic diet. Source: Research data (2025).

In the current study, as illustrated in Table 2, the average BMI for males and females which was statistically non-significant ($p=0.45$) based on the unpaired t test (nonparametric test). Participants were divided into different classes based on their BMI as indicated in Table 3, BMI class 2 women had a higher than class 1 men, with 24 (38.10%) vs. 24 (35.82%), respectively.

Table 2. Male and female sample characteristic.

	Number	Age	Height (m)	Weight (Kg)	BMI(Kg/m ²)
Male	67	37.7±10.2 (16, 66)	1.74±8.01 (1.55, 1.94)	110±21.4 (75, 180)	36.3±7.06 (26.6, 64.5)
Female	63	35.3±8.89 (21,52)	1.61±7.08 (1.45, 1.82)	92.7±14.9 (62, 150)	35.5±4.83 (25.5, 50.1)
p-value		0.07	0.3	0.004	0.45

All data are mean± SD with minimum and maximum value. Source: Research data (2025).

Table 3. The BMI category and their range across male and female in Kurdistan -region.

	Rang (kg/m ²)	Male Frequency (%)	Female Frequency (%)
Overweight	25-29	7 (10.45)	4 (6.35)
Obesity			
Class 1 obesity	30 -34	24 (35.82)	23 (36.51)
Class 2 obesity	35-39	18 (26.87)	24 (38.10)
Class 3 Obesity	40 -44 and above	18 (26.87)	12 (19.05)
Severe obesity			

Frequency and percentage of the sample. Source: Research data (2025).

Table 4 showed that the average body weight of males and females before and after the KD decreased showed statistically significant ($p=0.001$ and $p<0.0001$). The average days followed a KD and weight loss for males and females were statistically significant using an unpaired t-test (nonparametric test) ($p<0.001$, 0.001) respectively. In Table 5, baseline

cholesterol level decreased significantly after the KD in the male (p-0.04) and female (p-0.002) respectively. Unpaired t-test (nonparametric test) showed a significantly decreased blood glucose level after KD in male and female.

Table 4. Effects of KD on weight cross Kurdish male and female.

	Male	Female
Baseline weight (Kg)	110±21.4 (75, 180)	92.7±14.9 62, 150
Weight after keto-diet (Kg)	86.3±14.2 (3, 87)	77.3±13.8 (58,125)
p-value	0.001	<0.0001
Weight loss (kg)	23.7±15 (3, 87)	15.3±9.2 (0, 34)
Days of keto-diet	344±412 (7, 1636)	231 ± 312 (5, 1456)
p- value	<0.001	0.001

Unpaired t test (anonparametric test). All data are mean± SD with minimum and maximum value. Mean with same column P<0.05 was significantly different. Source: Research data (2025).

Table 5. Impact KD on blood glucose and cholesterols level.

	Male	Female
Baseline cholesterol level(mg/dL)	247±99.9 (150, 430)	182±161 (46.7, 400)
Cholesterol level after keto-diet (mg/dL)	178±53 (77, 264)	79.7±38.1 (33.9, 120)
p-value	0.03	0.04
Baseline blood sugar level (mg/dL)	191± 108 (96, 350)	118±16.1 (109, 150)
Blood sugar level after keto-diet (mg/dL)	97.9±26 (80, 160)	90.3±14.2 (70, 110)
p-value	0.016	0.01

Unpaired t test (nonparametric test). All data are mean± SD, with minimum and maximum value. Mean with same column p<0.05 was significantly different. Source: Research data (2025).

4. Discussion

The KD low in carbohydrates have regained popularity as a means of treating obesity and type 2 diabetes and these diets lower insulin resistance, enhance glycemic management, and encourage weight loss. It is debatable, nevertheless, whether the gains in insulin sensitivity and glycemic control are a direct consequence of hyperketonemia or are a byproduct of weight loss (Merovci et al., 2024). Socio-demographic characteristics of the participants: 130 individuals from the Kurdistan Region, including males and females 67 (52%) vs. 63 (48%) respectively as shown in Table 1. Men are more likely to respond online surveys in Middle Eastern societies, because they have greater access to technology. This digital which is particularly pronounced in conservative or rural areas, affects women's engagement (Abdulwahid-Kurdi, 2020). In addition, most of the females who were interviewed from an area were against the collection of their personal data for social, cultural, and gender-related reasons. In Italy, men have higher obesity prevalence than women, with 51% vs 34%, suggesting socio-economic factors may also contribute to gender differences in obesity prevalence. Studies show higher prevalence among women in

countries with lower gross domestic product per capita and income inequality (Wells et al., 2012).

Males and females in the Kurdistan region of Iraq who adopted the KD with age groups 30-39, according to Table 1. This age group often seeks methods to improve their overall health, boost their energy levels, and reduce weight, all of which the KD is said to support (Solhi et al., 2022).

Among graduates who persevered with the KD, the proportions of females were higher than males, some women feel a stronger sense of responsibility to "care" about health or nurture those around them after graduation. Of the participants in primary-level education due to social media platforms greatly increasing their reach, connecting people worldwide. In order to meet the specific health care demands of both literate and illiterate communities, KD techniques are required (Hruska and Maresova, 2020). Men and women in cities show the highest engagement with the KD likely due to greater availability of keto-friendly foods (Hruska and Maresova, 2020). Residents in Kurdistan and Baghdad are particularly diet-conscious. Social media platforms like Instagram and TikTok provide useful insights into the KD through success stories, recipe lessons, and clarifying misconceptions (Hruska and Maresova, 2020).

The burden of high BMI has doubled in more than 70 nations and is predicted to continue rising, despite the fact that it was high for both sexes and somewhat higher for Kurdish men than women (Zhou et al., 2024). Similarly, Stewart (2024) found that men in England had an average BMI of 29 kg/m², which was higher than women's BMI of 28.8 kg/m². Sex hormones may influence body composition, with females showing a favorable effect on insulin sensitivity despite higher adiposity (Stewart, 2024). The BMI is a useful screening tool, but it may not accurately represent all populations and does not directly assess body fat percentage, requiring careful evaluation (Callahan, 2023). Participants were divided into different classes based on their-BMI. The second classes, women had a higher than class 1 men, in line with these, according to Skogberg et al. (2018) a Norwegian study found that women from Turkey and Iran were more likely than men from the same groups to be overweight or obese. The observed sex disparities in overweight and obesity may be partially explained by cultural variables, social norms, and a lack of awareness about health-promoting behaviors (Skogberg et al., 2018). Men's higher muscle mass and lower body fat percentages may be the cause of the noticeable disparities in average BMI between men and women, whereas women's accumulation of fat in specific areas may increase their BMI values (Bond et al., 2021). Menopause leads to reduced insulin sensitivity, which can improve with estrogen therapy. Additionally, androgens impact insulin resistance and fat tissue variably based on gender (Muscogiuri et al., 2024).

The average body weight of males and females before and after the KD was decreased. According to Kosinski and Jornayvaz (2017) suggested that KDs in humans can effectively aid in weight loss, with an average of 5% body weight loss at 6 months. A study involving 17 obese men found that a 4-weeks KD reduced hunger, led to lower food intake, and resulted in greater weight loss, including both fat mass and fat-free mass (Johnstone et al., 2008). A study found that ketogenic diets (KDs) led to fat loss in overweight women, while not causing significant changes in lean mass (Jabekk et al., 2010).

A low-carbohydrate diet led to significant weight loss in obese non-diabetic participants after 6 months, but no significant difference at one year (Foster et al., 2003). The effects of a calorie-restricted low-fat diet and a Mediterranean KD on weight loss; both models were based on a mobile app. In terms of weight reduction, there was a notable difference in favor of the KD at week 12 (an average of -5.6 kg compared to -2.5 kg in the low-fat diet group). At week 24, the effect persisted (the KD group lost 8.4 kg, while the low-fat group lost 2.9 kg (Falkenhain et al., 2021). Although these changes were not statistically significant, the authors discovered that after two months, the average body weight in the KD group dropped from 86.39 ± 15.42 kg to 85.51 ± 13.62 kg, whereas in the Western diet group it increased from 89.04 ± 11.73 kg to 90.37 ± 9.91 kg. The KD also markedly decreased inflammatory cytokines, insulin, glucose, and triglycerides (Paoli et al., 2021). Men are more likely to follow a weekly KD due to weight loss, compared to women who typically adhere to specific diets, take diet

pills, and consume vegetables (Muscogiuri et al., 2024).

The KD in humans has been linked to significant reductions in total cholesterol, increased high density lipoprotein (HDL) cholesterol levels, decreased triglycerides, and reduced low density lipoprotein (LDL) cholesterol levels (Dashti et al., 2006). Short-term KD can improve lipid disorders like atherogenic dyslipidemia (Sharman et al., 2002). The KD meal lowers glucose and insulin levels compared to a Mediterranean diet (Battezzati et al., 2023). Sugary drinks decrease vitamin E levels, reducing antioxidants (Mohanty et al., 2000). Disrupting antioxidant status can lead to various diseases. Sugar consumption is positively associated with cancer in humans and animals (Kaaks, 2001). Researchers examined the relationship between coffee consumption and body fat percentage in the National Health and Nutrition Examination Survey (Carson et al., 1994). In rodents, short term (14 days) studies showed no change in fatty acids and triglycerides levels in mice fed a KD. The duration and the KD feeding are very important (Murata et al., 2013). A study found mice fed a KD for 6 weeks had lower cholesterol and triglycerides levels, possibly due to reduced insulin levels and decreased liver fatty acids and cholesterol biosynthesis pathways. However, saturated fat-rich diets may have detrimental effects (Holland et al., 2016). KD in humans has been linked to significant improve lipid profile. A study found no significant difference in total and LDL cholesterol levels after 12 months of a low-carbohydrate diet compared to a conventional diet, suggesting weight loss doesn't typically decrease LDL cholesterol (Foster et al., 2003). Interestingly, the effect of a KD on lipid profile may be associated with ethnicity: in a study, white subjects lost more weight and had a bigger decrease in triglycerides levels than black subjects (Samaha et al., 2003).

5. Conclusion and Recommendation

Intermittent fasting and a KD can speed up ketosis, helping with weight loss and improving insulin sensitivity. Body mass index estimates show men have a higher average than women. The KD is a safe option for long-term weight loss and health improvement without typical medication side effects. A high-fat, low-carb diet influences lipid metabolism. Suggested strategies include a 16:8 fasting window (16 hours fasting, 8-hour eating window), drink more water, get (7–9 hours) of sleep and temporary carb increases for hormone reset. Seasonal breaks, like a 1-2 week break, recharge after 3-4 months. Eating protein and vegetables before carbs due to decrease insulin and post-meal glucose levels in obese and type 2 diabetes. Last but not least, the human should not overfill beyond the stomach, consuming enough to sustain himself. Ideally, one-third should be for food, one-third for drink, and one-third for breath.

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