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Article

Dietary Habits, Meal-Timing, and Meal Frequency in Kuwaiti Adults: Analysis of the Kuwait National Nutrition Surveillance Data

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Abstract: Dietary habits, including meal frequency, meal timing, and skipping meals, have been extensively studied due to their association with the development of non-communicable diseases (NCDs). This study describes dietary habits, meal timing, meal frequency, skipping meals, and late-night eating in Kuwaiti adults. The Kuwait National Nutrition Surveillance System data was utilized to reach the objectives of this study. The findings reveal that approximately 50% of the adults in Kuwait eat after 10 p.m., 29% skip breakfast, and 9.8% skip dinner. Furthermore, adults in Kuwait consume 4.4 meals per day on average. Women skip breakfast more often and have extended night fasting than men ($p < 0.001$). Married adults skip breakfast and dinner less than unmarried adults ($p < 0.001$). In conclusion, this descriptive study provides valuable insights into the dietary habits of Kuwaiti adults, emphasizing the importance of further investigating the association between meal timing, meal frequency, and the prevalence of NCDs in Kuwait.

Keywords: dietary habits; meal timing; meal frequency; late night dinner; skipping meals; Kuwait

1. Introduction

The impact of dietary habits, such as meal frequency, meal timing, and skipping meals, have been studied extensively in the last decade because of their association with the development of non-communicable diseases [1,2]. As of 2019, non-communicable diseases have been responsible for 74% of deaths worldwide [3]. The role of macro and micronutrients is essential in understanding the rise in the rates of non-communicable diseases; nonetheless, epidemiological studies have demonstrated the significance of dietary habits on health [1,4].

The number and the timing of daily meals have been associated with diabetes [5], obesity [6], and metabolic syndrome [7]. Skipping meals has been associated with obesity [8], low intake of recommended nutrients [9], and an increase in odds of metabolic syndrome [10]. Moreover, night-time eating has been associated with a higher prevalence of metabolic syndrome [11] and an increased rate of obesity [12]. Dietary habits such as meal timing, frequency, skipping meals, and fasting impact metabolic outcomes [2].

Skipping breakfast and eating late-night dinners are associated with an increased risk of insulin resistance and cardiovascular disease [12,13]. This was demonstrated in a cross-over study in which individuals were given a diet with the same macronutrient composition but at different times on different dates, a dinner at 6 p.m. and a late dinner at 10 p.m [14]. The study showed that eating late dinner is associated with glucose intolerance and reduces fatty acid oxidation and mobilization, especially in early sleepers. Another prospective cohort study assessed the association between meal

frequency and type 2 diabetes among community-dwelling adults aged 45 years and older [5]. The study demonstrated that eating four meals a day, compared to eating three meals a day, was associated with a lower risk of type 2 diabetes, especially among normal-weight individuals (BMI < 25 kg/m²).

Most published studies on meal timing and frequency were conducted in the United States, Europe, or Asia. As there is a need for more research in this area in the Middle East, the data from Kuwait National Nutrition Surveillance System provided an opportunity to describe meal timing and frequency in Kuwait. Seventy-two percent of deaths in Kuwait have been attributed to non-communicable diseases [15], and the prevalence of metabolic syndrome is about 36% [16]. Studies demonstrate that non-communicable diseases and metabolic syndrome are associated with dietary habits. Thus, it is essential to examine how dietary habits affect the Kuwaiti population to better understand the country's high prevalence of chronic diseases. This paper aimed to describe dietary habits, including meal timing, meal frequency, skipping meals, and late-night eating in Kuwaiti adults.

2. Materials and Methods

Study sample

The study population comprises a nationally representative sample of the Kuwait National Nutrition Surveillance System (KNNSS). The study followed a stratified cluster sampling strategy obtained from 545 individual households from Kuwait's six governorates. To sample the households, the governorates were divided into 82 clusters, and 20 households were selected from each cluster. From each household, subjects over 20 years of age were randomly selected. Of the 1824 individuals that participated in the KNNSS, 757 adults were included in this study. In total, 722 individuals were not included because they were less than 20 years of age. Those younger than 20 years were assessed in KNNSS differently as adolescents and children. Another 345 individuals were excluded because they were taking diabetes, blood pressure, or cholesterol medication.

Assessment of dietary data

The participants completed a 24-hour dietary recall. Meal frequency was estimated based on the number of eating episodes. An eating episode was consuming any food or beverage of more than 1 Kcal. Skipping breakfast was defined as not eating a meal from 5 a.m. to 10 a.m. Skipping dinner was defined as not eating a meal from 6 p.m. to 10 a.m. Late-night eating was defined as eating a meal between 10 p.m. and 3 a.m. Fasting was calculated by subtracting the time of the last meal from the time of the first meal.

Covariate assessment

Interviewer-administered questionnaires were used to collect data on demographic background, physical status, and lifestyle factors. Body measurements, such as body weight, height, and waist circumference were obtained during the household visit through standard protocol by trained personnel. All biomarkers were measured by collecting blood samples during the house visits after an overnight fast. Two measurements were taken for blood pressure, waist circumference, body weight, and height. Body mass index (BMI) was calculated as weight in kilograms divided by height in meters squared. Age was defined into two categories for adults: 20-49 years and 50 years and older. Smoking was defined as ever smoking a cigarette (Yes/No). Physical activity was defined as being physically active or having a sedentary lifestyle (Active/ Sedentary). Marriage was defined as those who are married and those who are not married, including divorced and widowed (Yes/No). Education was classified into six categories (less than middle school, middle school, high school, diploma, Bachelor's, and postgraduate).

Statistical Analysis

The data were analyzed using SAS 9.4 software. Continuous variables were presented as means \pm standard error of the mean and all categorical variables were presented as frequency (n) and/or percentiles (%). For meal frequency, individuals were divided into those who consume three meals or less, four meals, five meals, and six meals or more. An analysis of variance (ANOVA) was conducted between the four groups of meal frequency to determine if there was at least one different group in the mean or frequency. A t-test was conducted to identify if there was a difference in dietary habits between the two groups. A significance level of $p < 0.05$ was used for all statistical tests.

3. Results

Table 1 shows the general characteristics of participants in the study (n=757). The study included only adults over 20 years, of which 623 (82.3%) were 20 to 49 years and 134 (17.7%) were 50 years and older. There were 341 (45.05%) males and 416 (54.95%) females. The majority of the participants, 217 (28.67%), had a bachelor's degree. Late-night eating was the most popular eating habit among participants in the study (53.9%), followed by skipping breakfast (29%) and skipping dinner (9.8%). The average duration of night fasting was 9.8 ± 3.3 hours. The average BMI for males and females was 28.3 ± 5.9 kg/m² and 29.9 ± 6.7 kg/m², respectively. The mean waist circumference was 93.34 ± 16.3 cm. An estimated 33% (251) of the adults were smokers, while 41% (310) followed an active lifestyle. The mean blood pressure was 124.9/80.47 mmHg in this study. The mean HbA1c was 5.7 ± 0.88 , while the mean triglycerides were 1.3 ± 0.74 mmol/L.

Table 1. Characteristics of the participants included in the study.

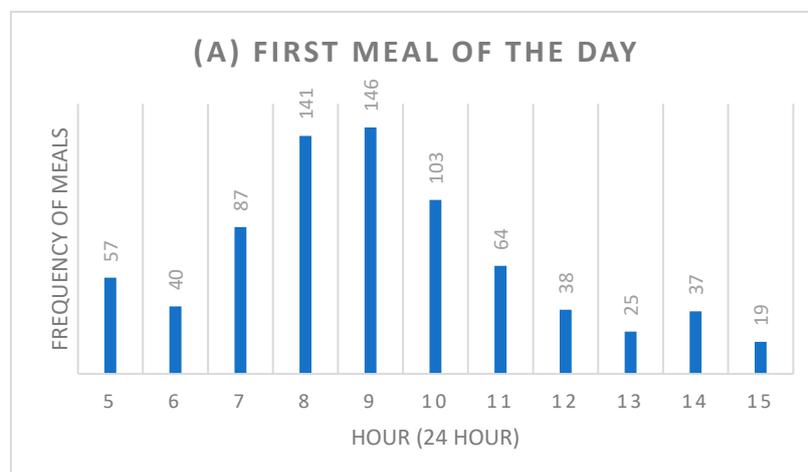
Characteristic	N (%) or Mean \pm SD
Age, n (%)	
20-49 years	623 (82.3)
50 years and greater	134 (17.7)
Gender n (%)	
Male	341 (45.05)
Female	416 (54.95)
Education n (%)	
Less than middle school	39 (5.15)
Middle school	129 (17.04)
High school	155 (20.48)
Diploma	186 (24.57)
Bachelor degree	217 (28.67)
Postgraduate	31 (4.1)
Married, n (%)	
Yes	554 (73.2)
No	203 (26.8)
BMI, mean \pm SD	
Male	28.3 ± 5.9
Female	29.9 ± 6.7
Waist circumference, mean \pm SD	
	93.34 ± 16.30
Smoking (ever), n (%)	
	251 (33.29)
Skipping breakfast, n (%)	
	227 (29.0)
Skipping dinner, n (%)	
	74 (9.8)
Late night eaters, n (%)	
	408 (53.9)

Fasting duration, mean \pm SD	9.8 \pm 3.3
Frequency of meals, mean \pm SD	4.4 \pm 1.3
Physical activity, n (%)	
Sedentary	446 (59)
Active	310 (41)
Glucose	5.6 \pm 1.6
Triglycerides	1.3 \pm 0.74
Blood pressure, mean \pm SD	
Systolic	124.90 \pm 17.13
Diastolic	80.47 \pm 11.35

The mean number of meals consumed per day was 4.4 meals (Table 2). The majority of the participants consumed four meals (29.9 %) daily, followed by five meals (27.3%), three meals (20%), six meals (12.3%), and two meals (5%). Furthermore, most of the participants (19.3%) consumed their first meal of the day at either 9 a.m. (19.3%) or 8 a.m. (18.6%) (Figure 1). On the other hand, 22.6% of the participants consumed their last meal of the day at 10 p.m., followed by 21.1% at 9 p.m. (Figure 1).

Table 2. Frequency of meals consumed by the participants.

Frequency of meals	N (%) , Mean \pm SD
One meal	4 (0.5)
Two meals	38 (5.0)
Three meals	148 (19.6)
Four meals	226 (29.9)
Five meals	208 (27.5)
Six meals	93 (12.3)
Seven meals	28 (3.7)
Eight meals	9 (1.2)
Nine meals	1 (0.1)
Ten meals	2 (0.3)
Average number of meals	4.4 \pm 1.04



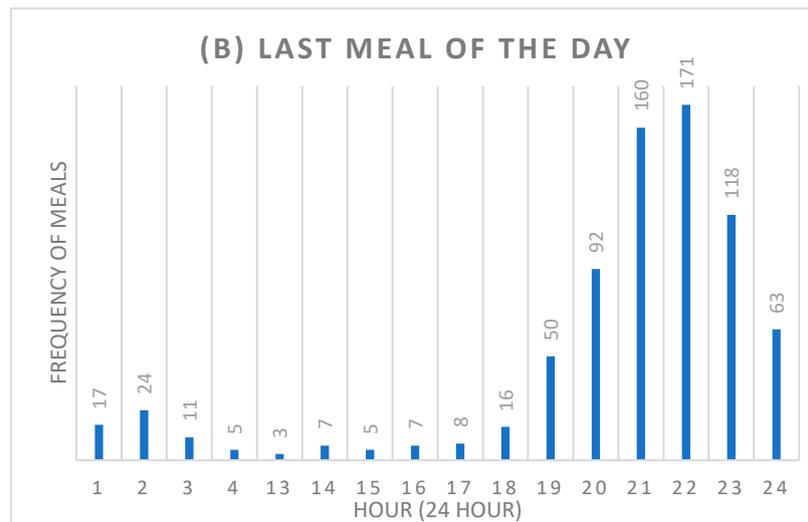


Figure 1. Frequency of the first meal and last meal of the day by the hour. (A) A bar graph showing the number of participants who consumed the first meal of the day at each hour. (B) A bar graph showing the number of participants who consumed the last meal of the day at each hour.

The general characteristics of the men and women in the study according to their meal frequency are shown in Table 3. Compared with individuals who ate three or fewer meals per day, individuals who ate six meals or more per day were more likely to be men, married, consume meals after 10 p.m., have higher serum triglyceride, and fast for a shorter duration ($p < 0.05$). Furthermore, individuals who ate six or more meals per day were less likely to skip breakfast and dinner compared to individuals who ate three or fewer meals per day ($p < 0.0001$). Marital status, smoking, activity level, BMI, waist circumference, systolic and diastolic blood pressure, fasting glucose, HbA1c, total serum cholesterol, and HDL cholesterol did not significantly differ based on meal frequency among the participants.

An estimated 35.3% of the females and 23.5% of the males skipped breakfast (Table 4), which was significantly different ($p = 0.0004$). There was no difference in the proportion of males and females who skipped dinner. There was a significant difference ($p = 0.0373$) between the genders in which 58.1% of the males and 50.5% of the females ate late at night. Duration of fasting was significantly ($p < 0.0001$) different between the genders; men fast at night on average for a period of 10.1 ± 2.8 hours, and women fast on average for 10.9 ± 2.9 hours.

Table 3. Characteristics of the study participants based on meal frequency.

	≤ Three Meals N=190	Four meals N=226	Five meals N=208	≥ Six Meals N=133	P^a
Age (20- 49 yrs), %	81.1	84.5	80.8	82.7	0.727
Men, %	37.4	42.5	47.6	56.4	.005*
Married, %	66.3	71.7	77.4	79.0	0.023*
College degree or higher, %	57.4	57.5	54.3	61.1	0.216
Ever Smoked, %	29.0	30.9	36.7	38.4	0.183
Active, %	39.5	37.8	43.3	45.1	0.473
BMI (kg/m ²), Mean ± SD	29.0 ± 6.8	29.2 ± 6.0	29.5 ± 6.5	28.8 ± 6.4	0.81
Body Fat %, Mean ± SD	24.9 ± 14.9	25.3 ± 12.2	26.3 ± 13.0	23.8 ± 14.7	0.415

Waist (cm), Mean ± SD	92.3 ± 16.7	92.4 ± 15.8	94.7 ± 16.8	94.4 ± 15.7	0.331
Systolic bp (mmHg), Mean ± SD	124.5 ± 17.7	124.5 ± 16.0	124.1 ± 17.5	127.3 ± 17.4	0.359
Diastolic bp (mmHg), Mean ± SD	79.5 ± 11.7	81.1 ± 11.2	80.3 ± 11.2	81.0 ± 11.4	0.554
Skipped Breakfast, %	51.6	32.7	17.8	13.5	<.0001
Skipped Dinner, %	23.7	6.6	5.3	2.26	<.0001
Late night Eater, %	44.2	45.1	60.0	73.7	<.0001
Fasting, Mean ± SD	11.0 ± 4.1	10.4 ± 3.1	9.0 ± 2.7	8.2 ± 2.3	<.0001
Glucose, Mean ± SD	5.4 ± 1.2	5.6 ± 1.6	5.6 ± 1.9	5.7 ± 1.8	0.303
HbA1C, Mean ± SD	5.6 ± 0.9	5.7 ± 0.8	5.7 ± 0.8	5.9 ± 1.1	0.114
Triglyceride, Mean ± SD	1.1 ± 0.6	1.3 ± 0.7	1.4 ± 0.8	1.3 ± 0.8	0.017*
Total cholesterol, Mean ± SD	4.9 ± 1.0	5.1 ± 1.1	5.0 ± 1.0	5.1 ± 1.0	0.079
HDL cholesterol, Mean ± SD	1.3 ± 0.3	1.3 ± 0.3	1.2 ± 0.3	1.3 ± 0.3	0.082

a) *p*-value for ANOVA F-statistics.

Dietary habits differed based on the participants' marital status (Table 4). A significant difference was found in the proportion of participants who skipped breakfast, as more unmarried participants skipped breakfast (36.5%) than married participants (27.6%). Similarly, a significantly higher proportion of the unmarried participants (13.8%) skipped dinner than the married participants (8.3%). Furthermore, the unmarried participants were fasting during the night than married participants, and the fasting durations were 10.9 and 10.4 hours, respectively.

Table 4. Dietary habits based on gender and marriage status.

	Male	Female	<i>p</i>-Value^a	Married	Not Married	<i>p</i>-Value^a
Skipping Breakfast, %	23.5	35.3	0.0004	27.6	36.5	0.0235
Skipping Dinner, %	9.7	9.9	0.9345	8.3	13.8	0.0425
Late night Eater, %	58.1	50.5	0.0373	52.7	57.1	0.2775
Fasting, mean ± SD	10.1 ± 2.8	10.9 ± 2.9	<.0001	10.4 ± 1.9	10.9 ± 3.3	0.0432

a) *p*-value for T-test.

4. Discussion

This study demonstrated that 757 participants aged 20 and older consumed 4.4 meals daily. Most of the study participants consumed four meals (29.9%) or five meals (27.5%) daily. Moreover, 29% of the participants skipped breakfast, 53.9% ate meals later than 10 p.m., and only 9.8% skipped dinner. Dietary habits, including meal frequency, meal timing, skipping meals, and fasting, have been shown to be as vital as nutrients in influencing health outcomes [1]. Thus, understanding and tracking the dietary habits of a community is essential to overcome chronic health conditions [2].

The results of this study are unique to adults in Kuwait, yet it is important to see how they compare to other studies. The average number of meals consumed daily by the study participants (4.4 meals) is lower than the average of 5.7 meals and snacks consumed daily by US adults based on the NHANES survey (1971-2010) [17]. Although the NHANES survey calculated meals and snacks separately, this study assessed all eating events as meals, whether a snack or a heavy meal. Higher meal consumption is linked to a healthier lifestyle and better health outcomes [18]. Nonetheless, factors other than meal frequency, such as meal timing, play into the benefit of the meal to the individual.

Skipping breakfast is associated with an increased risk of overweight and obesity [19]. In this study, 29% of the participants skipped breakfast or did not eat a meal until 11 a.m. The results are similar to a recent study on breakfast consumption in Kuwait among adolescents which illustrated that 21.7% of the adolescents never consumed breakfast or consumed it only once per week [20]. However, the habit of skipping breakfast differs in each country as a study of Korean adults revealed that 41.2% skipped breakfast [21]. Another cohort study in Japan revealed that 38.8% of the participants skipped dinner [22]. In contrast, a cross-sectional study in Saudi Arabia revealed that 42% of medical students skipped breakfast [23]. A study of US adults shows that only 5.1% never consumed breakfast, while 10.9% rarely consumed breakfast [24].

Dinner is as essential as breakfast in determining health outcomes. Eating a late dinner or bedtime snack and skipping dinner have been associated with an increased risk of obesity and overweight [25,26]. In this study, 9.8% skipped dinner and 53.9% had a meal later than 10 p.m. The number of participants who ate late at night is comparable with other studies. A cohort study in Japan demonstrated that 57.1% had a late night dinner [22], while 49.7% of medical students in Saudi Arabia reported having a late night dinner [23]. The proportion of the population who skipped dinner (9.8%) was low compared to those who skipped breakfast (29%). However, it is relatively high compared to a cohort study in Japan, where 2.4% of university students skipped or ate dinner occasionally [26].

The frequency and timing of meals are associated with increased blood glucose levels and triglycerides [5,27]. This study demonstrated significant differences in serum triglycerides between individuals who ate different amount of meals. As the frequency of meals increases, serum triglycerides increase. This finding was similar to an Australian study evaluating the association of meal frequency with the risk of metabolic syndrome that illustrated that higher meal frequency was associated with elevated triglyceride levels among men [28].

There are some potential limitations to this study. First, the study extracted meal timing and frequency from the 24-hour dietary recall. There were no specific questions on skipping meals and the number of snacks or meals consumed daily in the questionnaire administered during the study. Instead, the data collected in 2010 in Kuwait's National Nutrition Surveillance System was utilized as secondary data to calculate meal timing and frequency. Second, since this was collected from a 24-hour food recall, all eating events were treated as meals without differentiating between snacks and meals. Thus, comparing this study to studies that reported meals and snacks is challenging.

5. Conclusions

Adults in Kuwait who are 20 years and older demonstrate dietary habits unique to Kuwait's culture. Around 54% of the study participants eat a meal after 10 p.m., while only 29% skip breakfast and 9.8% skip dinner. The high proportions of late-night eaters and breakfast skippers could be attributed to cultural practices in Kuwait. However, it is crucial to investigate the implications of those dietary habits on health in future research.

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Informed Consent Statement: Informed consent was obtained from all subjects involved in the study.

Data Availability Statement: We encourage all authors of articles published in MDPI journals to share their research data. In this section, please provide details regarding where data supporting reported results can be found, including links to publicly archived datasets analyzed or generated during the study. Where no new data were created, or where data is unavailable due to privacy or ethical restrictions, a statement is still required. Suggested Data Availability Statements are available in section “MDPI Research Data Policies” at <https://www.mdpi.com/ethics>.

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