

# Comparison of Face-To-Face and Telephone Interviews in the Dietary Intake Assessment by The 24-Hour Recall in Patients With Type 2 Diabetes.

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## Research Article

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## **Abstract**

## **Background**

We sought to compare the means energy, energy contribution from macronutrients, and selected nutrients intakes of patients with type 2 Diabetes mellitus (T2DM) between telephone interviews and a face-to-face interview in the dietary intake assessment by the 24-hour recall.

## **Methods**

Sixty-eight females with T2DM aged 50–55 years enrolled randomly in a descriptive-analytic cross-sectional study from the diabetic clinic of Shahid Bahonar. The patients completed three consecutive 24-hour dietary recalls. The first interview was face-to-face, and the subsequent 2 recalls were conducted by telephone.

## **Results**

There were significant differences between the mean intakes energy and 18 selected nutrients calculated using two telephone interviews together versus all three interviews ( $P$ . values from 0.027 until < 0.001). There were significant differences between the mean intakes energy and 18 selected nutrients calculated using a face-to-face interview versus all three interviews ( $P$ . values from 0.027 until < 0.001). There were no significant differences between the mean intakes energy and 18 selected nutrients calculated using two telephone interviews. However, there were significant differences between the mean intakes energy and 18 selected nutrients calculated using face-to-face interview versus two telephone interviews together ( $P$ . values from 0.031 until < 0.001).

## **Conclusions**

We concluded that the telephone approach could not be considered as an alternative to the face-to-face approach for collecting dietary data by the 24-hour dietary recall method as an open-ended assessment. Each of the telephone interviews versus face-to-face interview underreporting and underestimate the total energy and nutrients intakes in the 24-hour dietary recall.

## **Introduction**

Nutrition and diet therapy for people with diabetes should be individualized, with consideration given to the individual's common food pattern and eating behaviors, metabolic parameters, treatment goals, and preferred consequences. Monitoring of metabolic parameters, lifestyle, as well as food pattern, is necessary to assess the need for modifications in diet therapy and to ensure efficacious outcomes [1]. The 24-hour recall is a subjective measure using open-ended questionnaires administered by a trained

and skilled interviewer in the clinic settings and epidemiologic studies. Although, food frequency questionnaire is also used to assess individual dietary intake; however, these methods have their own strengths and limitations [2]. The 24-hour recall of food intake could be accomplished with two face to face and telephone interviews, and these two approaches could be compared to the difference in mean of receiving different nutrients [3]. Whereas, collecting 24-hour dietary recall through telephone was a practical and valid data collection tool for use in national food consumption surveys [3]. Therefore, the most common methods of individual dietary intake assessment used are the 24-hour recall and the food frequency questionnaire [4]. The advantages of telephone survey as one of the interview approach for assessing usual dietary intakes were the ability data gathering from a large number of individuals even in geographic areas with widely scattered populations and cost-effective method [4, 5]. The quantitative food frequency questionnaire to estimate usual dietary intakes as one of collecting methods of dietary intake data could be completed satisfactorily by telephone if interviews were conducted by expert and trained dietetic interviewers [5]. Against these advantages, this interview approach had a few disadvantages. Underreporting of energy intake was widespread in the studied samples [6–8]. Underreporting of energy intake was highest in women and persons who were older, overweight, or trying to lose weight. Smoking status, level of education, physical activity, and the day of the week were variables that influence the underreporting of data [8].

Janssen and colleagues revealed that telephone assessment with a structured interview was reliable and had a good agreement with face to face assessment and could thus be used in the clinical practice and in future trials [9]. In general, the accuracy of reporting food amounts was not significantly different for the different types of portion-size aids or for the interview technique [10]. On the other hand, in a survey, the face to face interview resulted in higher item responses to retrospective questions about parents' education level than a telephone interview. Although the response rate for food items in the face to face interview is greater and there are more data being deleted or missing data in the telephone interview [11].

Despite the inconsistencies in some articles and the lack of comparison between two interviews, this study aimed to determine and to compare the means intakes energy, energy contribution from macronutrients, and selected nutrients of patients with type 2 Diabetes mellitus (T2DM) between telephone interviews and face-to-face interview in the dietary intake assessment by the 24-hour recall. Finally, by obtaining the results of these comparisons between different interview approaches for dietary intake assessment, which interview approach could reasonably and satisfactorily provide more accurate and comprehensive results for applying in epidemiological studies and clinic settings.

## **Subjects & Methods**

### **Eligibility of participants and Study Design:**

Seventy women with T2DM aged 50–55 years enrolled randomly in a descriptive-analytic cross-sectional study from the diabetic clinic of Shahid Bahonar on Kerman province. Kerman province is one of the 31 provinces of Iran. Kerman is in the southeast of Iran with its administrative center in the city of Kerman. It

is the first largest province of Iran that encompasses nearly 11 percent of the land area of Iran. The population of the province is about 3 million (9th in the country) [12]. Before patients participate in the study, each participant completed a written informed consent form. Sequential sampling was carried out at the first visit. Sixty-eight patients participated in each interview and accomplished the study. The inclusion criteria for eligibility were fasting blood sugar equal to or more than 126 mg/dl, the disease duration at least 1 year, consumption of glucose-lowering agents, and diabetes onset of  $\geq 40$  years of age. The exclusion criteria were pregnancy during the study, suffering from a combination of two metabolic diseases, and severe metabolic failure. The funding organization did not contribute to the protocol of the project. It should be noted that the study protocol was reviewed and approved by the Research Ethics Committee of the Kerman University of Medical Sciences (Approval ID: IR.KMU.REC.1398.014).

## **Dietary Intake Assessment:**

The patients completed three consecutive 24-hour dietary recalls. The first interview in the dietary intake assessment by the 24-hour recall in patients with T2DM was face-to-face. However, the second and third interviews in the dietary intake assessment in these patients were telephone approaches. This was due to patients' familiarity with dietary intake assessment in the first interview. The dietary intake assessment was repeated in three consecutive days. All face-to-face interviews were accomplished on the morning of working days. We interviewed seven patients every day. The other day, the other seven patients were interviewed. In order to increase recall precision and decrease the bias in data gathering, the only one trained interviewer completed the dietary intake assessment with the use of Food Album for estimating and measuring amounts eaten by participants in a face-to-face interview. Patients were asked to recall dietary intake in main meals and snacks in the previous 24 hours. Afterward, all food substances collected in the 24-hour recall questionnaire were encoded and turned into grams and then entered to analyze through the Nutritionist IV database. Energy, energy contribution from macronutrients, and selected nutrients intake of 24-hour dietary recall were analyzed and determined by using the modified Nutritionist IV database [13]. The results of the Draft section the Nutritionist IV database were entered into the SPSS software and the relevant statistical analysis was performed. To prevent the increase in data volume, a number of common nutrients that were analyzed by the software were selected.

## **Food Album:**

Food Album is a book that helps the interviewer and the interviewee to determine the exact amount of different consumed foods in meals and snacks. This book consists of 400 pages and on each page, food substances have been offered as colored illustrated different quantities. This book is the result of two years of efforts by four faculty members of the National Nutrition and Food Technology Research Institute. Each food image has a code. The weight of the food is specified for each image code. Food Album was applied only for a face-to-face interview and was offered to the interviewee.

## **Statistical Analysis:**

Statistical analysis was performed using SPSS 21 software (IBM Corp. Released 2012. IBM SPSS Statistics for Windows, Version 21.0. Armonk, NY: IBM Corp.). The Kolmogorov-Smirnov test was applied in order to determine the normal distribution of nutrients. We applied one-way repeated-measures analysis of variance to determine significant mean differences in total Energy, energy contribution from macronutrients, and selected nutrients intakes of participants between face-to-face interview and two telephone interviews. The paired t-test was applied to determine significant mean differences in total Energy, energy contribution from macronutrients, and selected nutrients intakes of participants between two telephone interviews as well as between face-to-face interview and two telephone interviews together in the dietary intake assessment by the 24-hour recall in patients with T2DM. Comparison of mean differences all three interviews and two telephone interviews together and between all three interviews and face-to-face interview were analyzed by paired t-test. Significance was assumed at  $P < 0.05$ .

## Results

### **Patients Characteristics**

The rate of response among all participants was 97% (68 participants from 70 patients with T2DM). Two were excluded due to incomplete interviews. The mean ( $\pm$  SD) age of participants was  $53.97 \pm 2.14$  years. Baseline characteristics of patients with T2DM are shown in table 1. The cardiovascular biomarkers and metabolic syndrome components are shown in table 1. Table 1 indicates that one third of patients had not any family history of diabetes and more than of two third of patients had not any family history of myocardial infarction.

**Table 1.** Baseline Characteristics of Patients with type 2 Diabetes.

<b>Variables</b>	<b>Mean ± SD/ n (%)</b>
<b>Age (year)</b>	53.97 ± 2.14
<b>Duration of diabetes affected (year)</b>	8.48 ± 5.28
<b>Weight (Kg)</b>	69.98 ± 12.00
<b>Height (cm)</b>	154.40 ± 5.34
<b>Body Mass Index (Kg/m<sup>2</sup>)</b>	29.35 ± 4.83
<b>Waist (cm)</b>	99.27 ± 10.86
<b>Hip (cm)</b>	100.83 ± 8.29
<b>Systolic BP (mmHg)</b>	127.62 ± 19.61
<b>Diastolic BP (mmHg)</b>	76.41 ± 8.60
<b>Fasting Plasma Glucose (mg/dl)</b>	178.45 ± 56.41
<b>Insulin Concentration (mU/L)</b>	8.97 ± 4.95
<b>HOMA-IR</b>	3.95 ± 2.45
<b>Glycosylated Hemoglobin (%)</b>	9.88 ± 1.44
<b>Family history of diabetes</b>	
<b>Without family history</b>	23 (%33.8)
<b>Father</b>	7 (%10.3)
<b>Mother</b>	7 (%10.3)
<b>Both father &amp; mother</b>	2 (%2.9)
<b>Parents and brother &amp;/or sister</b>	29 (%42.7)
<b>Family history of myocardial infarction</b>	
<b>Without family history</b>	49 (%72.1)
<b>Father</b>	10 (%14.7)
<b>Mother</b>	5 (%7.3)
<b>Both father &amp; mother</b>	1 (%1.5)
<b>Parents and brother &amp;/or sister</b>	3 (%4.4)
<b>Lowering blood pressure drugs</b>	
<b>Without prescription</b>	46 (%67.6)
<b>With prescription</b>	22 (%32.4)

Lowering lipid drugs	
Without prescription	44 (%64.7)
With prescription	24 (%35.3)

## Interview Approaches

Sixty-eight T2DM females participated in our study to compare dietary intakes measured by 3 x 24-hour dietary recalls. The first recall was a face-to-face interview in the clinic, and the subsequent 2 recalls were conducted by telephone.

There were significant differences between the mean intakes energy and 18 selected nutrients calculated using two telephone interviews together versus all three interviews (P. values from 0.047 until < 0.001) (Table 2).

**Table 2.** Comparison of between the Mean Intakes Energy, Energy Contribution from Macronutrients and Selected Nutrients of Patients with type 2 Diabetes Calculated Using three Interview approaches.

	Interview approaches*			<b>P value</b>
	Face-to-Face (n=68)	Telephone (1 <sup>st</sup> ) (n=68)	Telephone (2 <sup>nd</sup> ) (n=68)	
<b>Energy (Kcal)</b>	1414.9 ± 55.0 <sup>a</sup>	1154.3 ± 49.2	1197.2 ± 66.6	<0.001
<b>Energy from Protein (%)</b>	15.2 ± 0.5	16.5 ± 0.8	16.3 ± 0.6	0.263
<b>Energy from Carbohydrate (%)</b>	58.8 ± 1.2	57.7 ± 1.3	58.6 ± 1.3	0.736
<b>Energy from Fat (%)</b>	25.9 ± 1.2	25.6 ± 1.2	24.9 ± 1.1	0.797
<b>Protein (g)</b>	54.2 ± 2.4 <sup>a</sup>	46.8 ± 2.3	47.1 ± 2.7	0.042
<b>Carbohydrate (g)</b>	210.9 ± 8.6 <sup>a</sup>	168.5 ± 7.6	176.9 ± 10.1	<0.001
<b>Total fat (g)</b>	43.4 ± 3.0 <sup>b</sup>	34.9 ± 2.6	35.4 ± 3.3	0.027
<b>Saturated fatty acids (g)</b>	10.6 ± 0.7	9.4 ± 0.6	9.6 ± 0.7	0.293
<b>Mono unsaturated fatty acids (g)</b>	12.2 ± 0.9	9.7 ± 0.8	11.1 ± 1.7	0.291 <sup>¶</sup>
<b>Poly unsaturated fatty acids (g)</b>	14.7 ± 1.5 <sup>a</sup>	10.8 ± 1.3	10.2 ± 1.1	0.006
<b>Linoleic acid (g)</b>	13.04 ± 1.49 <sup>a</sup>	9.42 ± 1.25	8.70 ± 1.15	0.007
<b>Linolenic acid (g)</b>	0.14 ± 0.02	0.22 ± 0.06	0.13 ± 0.02	0.146 <sup>¶</sup>
<b>Cholesterol (mg)</b>	124 ± 12	128 ± 14	117 ± 11	0.796 <sup>¶</sup>
<b>Fiber (g)</b>	14.3 ± 1.0 <sup>b</sup>	11.1 ± 0.8	11.8 ± 0.7	0.007
<b>Soluble fiber (g)</b>	0.55 ± 0.06 <sup>a</sup>	0.37 ± 0.04	0.33 ± 0.03	0.003 <sup>¶</sup>
<b>Insoluble fiber (g)</b>	2.66 ± 0.30 <sup>b</sup>	1.87 ± 0.17	1.95 ± 0.16	0.012 <sup>¶</sup>
<b>Calcium (mg)</b>	633 ± 40	599 ± 43	583 ± 41	0.502
<b>Iron (mg)</b>	13.1 ± 0.7 <sup>b</sup>	10.5 ± 0.7	11.1 ± 0.7	0.005
<b>Zinc (mg)</b>	6.2 ± 0.3 <sup>a</sup>	5.3 ± 0.3	5.3 ± 0.3	0.047
<b>Potassium (mg)</b>	2457 ± 116 <sup>a</sup>	1923 ± 103	1911 ± 91	<0.001
<b>Thiamin (mg)</b>	1.43 ± 0.06 <sup>a</sup>	1.21 ± 0.06	1.21 ± 0.07	0.003 <sup>¶</sup>
<b>Riboflavin (mg)</b>	5.25 ± 3.89	1.17 ± 0.06	1.19 ± 0.07	0.300 <sup>¶</sup>
<b>Folate (μg)</b>	198 ± 17	154 ± 16	169 ± 12	0.077

<b>Vitamin A (RE)</b>	687 ± 60	562 ± 83	480 ± 46	0.071 ¶
<b>Vitamin D (µg)</b>	0.6 ± 0.2	0.7 ± 0.1	0.6 ± 0.2	0.962
<b>α-Tocopherol (mg)</b>	6.4 ± 0.8 <sup>a</sup>	4.3 ± 0.4	4.4 ± 0.4	0.011 ¶
<b>Vitamin C (mg)</b>	104 ± 7 <sup>a</sup>	66 ± 5	68 ± 5	<0.001

\* Repeated measure ANOVA analyzed the differences (M±SE) between the mean intakes total energy, energy contribution from macronutrients and selected nutrients of 68 patients calculated using three interview approaches.

a There are statistically significant differences between the mean intakes calculated using face to face interview versus the other interview approaches.

b There are statistically significant differences between the mean intakes calculated using face to face interview versus the first telephone interview.

c There are statistically significant differences between the mean intakes calculated using face to face interview versus the second telephone interview.

¶ When Mauchly's test had been significant and the assumption of compound symmetry had not been met in order to clarifying individual differences, we applied the Greenhouse, Geisser test.

Table 3 shows two comparisons separately. There were significant differences between the mean intakes energy and 18 selected nutrients calculated using two telephone interviews together versus all three interviews (P. values from 0.027 until < 0.001) (Table 3). There were significant differences between the mean intakes energy and 18 selected nutrients calculated using a face-to-face interview versus all three interviews (P. values from 0.027 until < 0.001) (Table 3) with a similar pattern in the same nutrients.

Table 3

Comparison of between the Mean Intakes Energy, Energy Contribution from Macronutrients and Selected Nutrients of Patients with type 2 Diabetes Calculated Using All of Three Interviews<sup>§</sup> versus two Telephone Interviews together and All of Three Interviews<sup>§</sup> versus Face-to-Face Interview.

	Interview approaches *		<i>P</i> value	Interview approaches *		<i>P</i> value
	Face-to-Face & Telephone (1st & 2nd ) (n = 68)	Telephone (1st & 2nd ) (n = 68)		Face-to-Face & Telephone (1st & 2nd ) (n = 68)	Face-to-Face (n = 68)	
Energy (Kcal)	1256.5 ± 43.5	1168.2 ± 48.3	< 0.001	1256.5 ± 43.5	1414.9 ± 55.0	< 0.001
Energy from Protein (%)	15.9 ± 0.4	16.5 ± 0.5	0.059	15.9 ± 0.4	15.2 ± 0.5	0.108
Energy from Carbohydrate (%)	58.2 ± 0.9	57.6 ± 1.0	0.319	58.2 ± 0.9	58.8 ± 1.2	0.404
Energy from Fat (%)	25.9 ± 0.8	25.8 ± 0.9	0.776	25.9 ± 0.8	25.9 ± 1.2	0.983
Protein (g)	50.0 ± 1.6	47.6 ± 2.0	0.016	50.0 ± 1.6	54.2 ± 2.4	0.031
Carbohydrate (g)	185.7 ± 6.7	171.9 ± 7.7	< 0.001	185.7 ± 6.7	210.9 ± 8.6	< 0.001
Total fat (g)	37.9 ± 2.2	34.8 ± 2.1	0.002	37.9 ± 2.2	43.4 ± 3.0	0.003
Saturated fatty acids (g)	9.9 ± 0.5	9.5 ± 0.5	0.076	9.9 ± 0.5	10.6 ± 0.7	0.107
Mono unsaturated fatty acids (g)	11.0 ± 0.8	10.3 ± 0.9	0.065	11.0 ± 0.8	12.2 ± 0.9	0.086
Poly unsaturated fatty acids (g)	11.9 ± 1.0	10.3 ± 0.9	0.002	11.9 ± 1.0	14.7 ± 1.5	0.001
Linoleic acid (g)	10.37 ± 1.00	8.84 ± 0.85	0.002	10.37 ± 1.00	13.04 ± 1.49	0.002
Linolenic acid (g)	0.15 ± 0.01	0.15 ± 0.02	0.441	0.15 ± 0.01	0.14 ± 0.02	0.433

\* Paired t-test analyzed the differences (Mean ± SE) between the mean intakes energy and selected nutrients in interview approaches.

§ The mean intakes energy and selected nutrients calculated using all of three interviews in 68 patients with T2DM.

	Interview approaches *		Interview approaches *			
	Face-to-Face & Telephone (1st & 2nd ) (n = 68)	Telephone (1st & 2nd ) (n = 68)	P value	Face-to-Face & Telephone (1st & 2nd ) (n = 68)	Face-to-Face (n = 68)	P value
Cholesterol (mg)	123.7 ± 8.0	123.1 ± 9.7	0.907	123.7 ± 8.0	124.5 ± 12.4	0.935
Fiber (g)	12.4 ± 0.6	11.4 ± 0.6	0.003	12.4 ± 0.6	14.3 ± 1.0	0.005
Soluble fiber (g)	0.41 ± 0.03	0.34 ± 0.03	0.002	0.41 ± 0.03	0.55 ± 0.06	0.002
Insoluble fiber (g)	2.16 ± 0.16	1.91 ± 0.14	0.011	2.16 ± 0.16	2.66 ± 0.30	0.011
Calcium (mg)	606.1 ± 33.3	590.0 ± 36.0	0.194	606.1 ± 33.3	633.3 ± 40.6	0.264
Iron (mg)	11.6 ± 0.5	10.7 ± 0.6	0.002	11.6 ± 0.5	13.1 ± 0.7	0.005
Zinc (mg)	5.6 ± 0.2	5.3 ± 0.2	0.007	5.6 ± 0.2	6.2 ± 0.3	0.011
Potassium (mg)	2103 ± 77	1919 ± 79	< 0.001	2103 ± 77	2457 ± 117	< 0.001
Thiamin (mg)	1.28 ± 0.05	1.20 ± 0.05	0.001	1.28 ± 0.05	1.43 ± 0.06	0.002
Riboflavin (mg)	1.23 ± 0.05	1.18 ± 0.05	0.016	1.23 ± 0.05	1.34 ± 0.07	0.022
Folate (µg)	174.0 ± 11.0	161.3 ± 11.1	0.027	174.0 ± 11.0	198.4 ± 17.4	0.033
Vitamin A (RE)	556.0 ± 39.1	488.3 ± 39.9	0.001	556.0 ± 39.1	687.4 ± 60.9	0.001
Vitamin D (µg)	0.6 ± 0.1	0.6 ± 0.1	0.837	0.6 ± 0.1	0.6 ± 0.1	0.843
α-Tocopherol (mg)	5.0 ± 0.4	4.2 ± 0.3	0.004	5.0 ± 0.4	6.4 ± 0.8	0.010
Vitamin C (mg)	79.6 ± 4.3	67.2 ± 4.4	< 0.001	79.6 ± 4.3	104.1 ± 7.6	< 0.001

\* Paired t-test analyzed the differences (Mean ± SE) between the mean intakes energy and selected nutrients in interview approaches.

§ The mean intakes energy and selected nutrients calculated using all of three interviews in 68 patients with T2DM.

Table 4 shows two comparisons separately as well. The first comparison in Table 4 is a comparison between the mean intakes energy, energy contribution from macronutrients, and selected nutrients of participants calculated using two telephone interviews. There were no significant differences between the mean intakes energy and 18 selected nutrients calculated using two telephone interviews. However, there were significant differences between the mean intakes energy and 18 selected nutrients calculated using face-to-face interview versus two telephone interviews together in Table 4 (P. values from 0.031 until < 0.001) with a similar pattern in the previous same nutrients.

Table 4

Comparison of between the Mean Intakes Energy, Energy Contribution from Macronutrients and Selected Nutrients of Patients with type 2 Diabetes Calculated Using two Telephone Interviews and Face-to-Face Interview versus two Telephone Interviews together.

	Interview approaches *		Interview approaches *			
	Telephone (1st) (n = 68)	Telephone (2nd) (n = 68)	P value	Face-to-Face (n = 68)	Telephone (1st & 2nd) (n = 68)	P value
	1154.3 ± 49.2	1197.2 ± 66.6	0.497	1414.9 ± 55.0	1168.2 ± 48.3	< 0.001
Energy (Kcal)						
Energy from Protein (%)	16.5 ± 0.8	16.3 ± 0.6	0.809	15.2 ± 0.5	16.5 ± 0.5	0.076
Energy from Carbohydrate (%)	57.7 ± 1.3	58.6 ± 1.2	0.576	58.8 ± 1.2	57.6 ± 1.0	0.356
Energy from Fat (%)	25.6 ± 1.2	24.9 ± 1.1	0.703	25.9 ± 1.2	25.8 ± 0.9	0.897
Protein (g)	46.8 ± 2.3	47.1 ± 2.7	0.930	54.2 ± 2.4	47.6 ± 2.0	0.024
Carbohydrate (g)	168.5 ± 7.6	176.9 ± 10.1	0.332	210.9 ± 8.6	171.9 ± 7.7	< 0.001
Total fat (g)	34.9 ± 2.6	35.4 ± 3.3	0.885	43.4 ± 3.0	34.8 ± 2.1	0.002
Saturated fatty acids (g)	9.4 ± 0.6	9.6 ± 0.7	0.874	10.6 ± 0.7	9.5 ± 0.5	0.093
Mono unsaturated fatty acids (g)	9.7 ± 0.8	11.1 ± 1.7	0.482	12.2 ± 0.9	10.3 ± 0.9	0.077
Poly unsaturated fatty acids (g)	10.8 ± 1.3	10.2 ± 1.2	0.689	14.7 ± 1.5	10.3 ± 0.9	0.001
Linoleic acid (g)	9.42 ± 1.25	8.70 ± 1.15	0.629	13.04 ± 1.49	8.84 ± 0.85	0.001
Linolenic acid (g)	0.22 ± 0.06	0.13 ± 0.02	0.130	0.14 ± 0.02	0.15 ± 0.02	0.436
Cholesterol (mg)	128.8 ± 14.7	117.8 ± 11.8	0.551	124.5 ± 12.4	123.1 ± 9.7	0.926
Fiber (g)	11.1 ± 0.8	11.8 ± 0.7	0.449	14.3 ± 1.0	11.4 ± 0.6	0.005
Soluble fiber (g)	0.37 ± 0.04	0.33 ± 0.03	0.479	0.55 ± 0.06	0.34 ± 0.03	0.002
Insoluble fiber (g)	1.87 ± 0.17	1.95 ± 0.16	0.677	2.66 ± 0.30	1.91 ± 0.14	0.011

\* Paired t-test analyzed the differences (Mean ± SE) between the mean intakes energy and selected nutrient intake in interview approaches.

	Interview approaches *			Interview approaches *		
	Telephone (1st)  (n = 68)	Telephone (2nd)  (n = 68)	P value	Face-to-Face (n = 68)	Telephone (1st & 2nd)  (n = 68)	P value
Calcium (mg)	599.2 ± 43.1	583.1 ± 41.3	0.723	633.3 ± 40.6	590.0 ± 36.0	0.237
Iron (mg)	10.5 ± 0.7	11.1 ± 0.7	0.393	13.1 ± 0.7	10.7 ± 0.6	0.003
Zinc (mg)	5.3 ± 0.3	5.3 ± 0.3	0.946	6.2 ± 0.3	5.3 ± 0.2	0.009
Potassium (mg)	1924 ± 104	1911 ± 92	0.916	2457 ± 117	1919 ± 79	< 0.001
Thiamin (mg)	1.21 ± 0.06	1.21 ± 0.07	0.990	1.43 ± 0.06	1.20 ± 0.05	0.001
Riboflavin (mg)	1.17 ± 0.06	1.19 ± 0.07	0.797	1.34 ± 0.07	1.18 ± 0.05	0.020
Folate (µg)	154.1 ± 17.0	169.5 ± 12.6	0.446	198.4 ± 17.4	161.3 ± 11.1	0.031
Vitamin A (RE)	562.7 ± 83.6	480.3 ± 46.9	0.383	687.4 ± 60.9	488.3 ± 39.9	0.001
Vitamin D (µg)	0.7 ± 0.1	0.6 ± 0.2	0.920	0.6 ± 0.1	0.6 ± 0.1	0.841
α-Tocopherol (mg)	4.3 ± 0.4	4.4 ± 0.4	0.864	6.4 ± 0.8	4.2 ± 0.3	0.007
Vitamin C (mg)	66.4 ± 5.7	68.3 ± 5.5	0.789	104.1 ± 7.6	67.2 ± 4.4	< 0.001

\* Paired t-test analyzed the differences (Mean ± SE) between the mean intakes energy and selected nutrient intake in interview approaches.

## Discussion

We sought to compare between the mean intakes total energy, energy contribution from macronutrients, and selected nutrients of patients with T2DM calculated using telephone interviews and a face-to-face interview in the dietary intake assessment by the 24-hour recall due to the lack of comparison between two interviews in this dietary intake assessment method. There were significant differences between the mean intakes in majority energy and selected nutrients intakes calculated using face-to-face interview versus the other interview approaches; all of three interviews versus two telephone interviews together; and all of three interviews versus a face-to-face interview with a similar pattern in the same nutrients. These comparisons were done between the mean intakes calculated using two telephone interviews and the mean intakes calculated using a face-to-face interview versus two telephone interviews together. Interestingly, no significant difference was found between the mean intakes calculated using two

telephone interviews. However, some significant differences were revealed between the mean intakes calculated using a face-to-face interview and two telephone interviews together with a similar pattern in the previous same nutrients. In our study, the number of energy and selected nutrients intakes were important to be significant when two approaches compare with each other. First, our goal was to distinguish the feasibility of interviewing approaches which could reasonably provide more comprehensive and accurate results. In the same way, the literature review of previous limited studies showed the advantages and the disadvantages of applying these two approaches; however, in general, this conflict was evident in studies.

A few studies demonstrated that telephone approaches were a preferable option. They supposed that collecting 24-hour dietary recall data through telephone interviews was a practical and valid data collection tool. They indicated that one of the advantages of telephone assessment as one of the interview approaches for assessing usual dietary intake was cost-effectiveness this method as well as the ability data gathering from a large number of individuals [3, 5]. While, quantitative food frequency questionnaire as one of collecting methods of dietary intake data can be completed satisfactorily by telephone if interviews were conducted by expert and trained dietetic interviewers [5]. On the other hand, some researchers revealed that the telephone interview was comparable with a face-to-face interview. They believed that both telephone and face-to-face interviews generated similar information and the data collected by telephone interview appeared to be interchangeable with dietary data collected by face-to-face interview [9, 10, 14, 15]. A necessary condition for this consistency and reliability was a structured interview or closed-ended questionnaire [9]. The interviewer effect was the other limitation that leads to the vulnerability of the 24-hour dietary recall method [15]. The most important issue is that the mean energy requirement of our patients might be higher than the calculated mean energy intake of patients through 24-hour recall assessment. The lower the calculated mean energy intake, the lower the calculated mean intake of the macronutrients and the micronutrients through 24-hour recall assessment. Therefore, our data in determining the mean intakes energy and selected nutrients in gathering data period might be underreported. However, the aim of this study was to compare the findings of the mean intakes calculated using face-to-face interviews with telephone interviews. The goal was the superiority and dominance of one method against another or the equality of one method with another.

We revealed that there was no significant difference between the two telephone interviews. One patient's intake may change from day to day. However, a nonsignificant change in two consecutive intakes in one method such as telephone interview is not accidental compared to the other approach. While there were significant differences in 18 energy and selected nutrients intakes of participants between a face-to-face interview and two telephone interviews together. Our study demonstrated that the telephone approach could not be considered as an alternative to the face-to-face approach for collecting dietary data by the 24-hour dietary recall method as an open-ended assessment. The total energy and nutrients intakes in face-to-face approaches were higher than two telephone approaches together and each of the telephone interviews. Therefore, each of the telephone interviews underestimates the total energy and nutrients intakes in the 24-hour dietary recall. In fact, this underestimation is due to underreporting total energy and selected nutrients of patients with T2DM in the study.

Our results were paralleled with the other researchers [8, 16, 17]. The response rate for food items in the face-to-face interview was greater; while, there was more data being deleted or missing data in the telephone interview [8]. In another study, in order to compare different sampling methods in wine consumer research, Szolnoki and Hoffmann revealed that the face-to-face approach provided the most representative and realistic results. While, the telephone approach might provide a good alternative in collecting data from a larger sample [16]. More complete population coverage for sampling, item response, completion of the questionnaire, survey response, length of verbal response/amount of information, and respondents' preferences for mode of administration were high for a face-to-face interview; however, these factors were low for a telephone interview. While interviewer bias for both of the interviews were high [17].

Our study had a few strengths. The only noticeable feature of this study was that it was novel in a situation where the researcher was not able to spend extra budget on a face-to-face interview, and especially in the COVID-19 pandemic and similar situations that the researcher will not be able to contact or meet the patient directly. The other strengths include the population used and a large number of patients with T2DM for interview approach implementation. A study of this kind has not been conducted in people with T2DM living in Iran. We have not any special limitations in our study. Limitations include the fact that the order of the recalls was not randomized and the face-to-face recall was always conducted first. However, some factors such as mood, attention, spirit, and intelligence are the integral parts of this kind of dietary intake assessment. On the other hand, in face-to-face interviews, interviewees might explain daily food intake in more detail. Therefore, food intakes were underestimated in telephone interviews. We attempted to adjust these factors in both face-to-face and telephone interviews through the expert interviewer. Our research has provided evidence of the advantage of a face-to-face approach in the dietary intake assessment by the 24-hour recall in patients with T2DM. Therefore, the superiority of an approach to another approach depends on the study design and the tools used.

## Conclusion

We concluded that the telephone approach could not be considered as an alternative to the face-to-face approach for collecting dietary data by the 24-hour dietary recall method as an open-ended assessment. Therefore, telephone and face-to-face interviews could not generate similar information, and the data collected by telephone interviews did not appear to be interchangeable with dietary data collected by a face-to-face interview. The total energy and nutrients intakes in face-to-face approaches were higher than two telephone approaches together and each of the telephone interviews. Then, each of the telephone interviews versus a face-to-face interview underestimates the total energy and nutrients intakes in the 24-hour dietary recall. In fact, this underestimation is due to underreporting total energy and selected nutrients of patients with T2DM in the study.

## Declarations

### Consent for publication and Ethical approval

The Research Ethics Committee of the Kerman University of Medical Sciences approved the study protocol (Approval ID: IR.KMU.REC.1398.014). All methods were performed in accordance with the relevant **guidelines and regulations** of Biomed Central. "Informed" consent was obtained from all participants that took part in the study.

## Consent for Publication

Not applicable.

## Availability of data and material

The data that support the findings of this study are available from the corresponding author, but restrictions apply to the availability of these data, which were used under license for the current study, and so are not publicly available. Data are however available from the authors upon reasonable request.

## Competing interest

No potential conflict of interest relevant to this article was reported.

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## Author's Contributions

MRM contributed to the conception of the original idea, conducting the study design, analysis and interpretation of the data, drafting and revising the draft, and approval of the final version of the manuscript. BK contributed to encode and turn food substances data into grams and then entered to analyze through Nutritionist IV database and enter the results of the Draft section Nutritionist IV database into the SPSS software and preparing the draft, and approval of the final version of the manuscript. SA contributed to the acquisition of random selecting of patients with T2DM, the accomplishment of three consecutive 24-hour dietary recalls, and approval of the final version of the manuscript.

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