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Gender Differences in Dietary Practices among People with Type 2 Diabetes. A Study from South India

Research Article

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Abstract

Background: Evidence on food intake among people with diabetes in India is limited. Aim was to assess gender differences in the dietary practices, food frequency, calorie distribution and nutrient composition among people with type2 diabetes(T2DM).

Methods: A total of 454 participants were included and their sociodemographic, anthropometric, biochemical, 24hours dietary-recall were recorded. Food frequency of different food items and nutrient composition such as total calorie, Carbohydrate, Protein and Fat were calculated. Recommended Dietary Allowance (RDA) for Indian population was used.

Results: The total calorie intake was higher in males (1410kcals) than females (1303kcals). Consumption of carbohydrate(gms) (M: F 220 vs 201) (P<0.001), Protein(gms) (M: F 49 vs 46) (p=0.006) was significantly higher in males than females. The fat consumption was similar in both genders. The percentage of carbohydrate intake was higher (M: F 63.7 vs 63.2%) and protein intake (M: F 13.9 vs 14%) was lesser in both genders as compared to RDA of Indian population. Green leafy vegetables and consumption of other vegetables was also lesser.

Conclusion: The level of protein, green leafy vegetables and other vegetables consumption was lesser than recommendations among people with T2DM. Intensive diet counselling should be focused on recommendation of protein rich foods to meet the requirements.

Keywords: Food Frequency, 24hrs Dietary Recall, Calorie Distribution, Nutrient Composition

Abbreviations

Recommended Dietary Allowance (RDA); Type2 Diabetes Mellitus (T2DM)

Introduction

Around 537 million adults are living with diabetes worldwide and this number is predicted to rise to 643million by 2030 and 783million by 2045 [1]. According to ICMR INDIAB study, the prevalence of diabetes and prediabetes in India is reported as 101million and 136 million respectively [2]. Diet plays a major role in type 2 diabetes(T2DM) coupled with physical activity(PA). Dietary guidance helps in prevention of T2DM and also helps in initial management of the condition prior to pharmological treatment [3-6]. It involves the avoidance of rapidly absorbed simple carbohydrates, a reduction in fat intake, an increase in high fiber (HF) foods and a balanced distribution of complex carbohydrates [3,5-9]. HF diet have been shown to control hyperglycaemia, modifying meal frequency and size altered nutrient uptake afford better glycemic control(GC) [8]. GC can also be achieved by calorie restriction and weight reduction [10].

Healthy dietary practice can improve various factors which include obesity, insulin release, hypertension. Absence of healthy

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dietary practice is crucial declining factor in attaining GC in T2DM. Individuals with diabetes are generally not aware of its value in assuring better GC [11,12]. Diet related self-care practices, individual preferences, availability of food substitute at affordable level, knowledge about ideal diet and PA plays an important role in self-care dietary practice [13]. A greater knowledge of the dietary practices among people with T2DM is important for healthcare professionals for better treatment outcomes. A systematic review of studies modelling dietary pattern of general population in India was reported in 2016. A large variations in dietary pattern was evident in the above review but the literature available on dietary practices followed by people with T2DM is limited in Indian context [14]. Hence, the study was aimed to assess the gender differences in the dietary practices, food frequency, calorie distribution and nutrient composition among people with T2DM.

Materials and Methods

This cross-sectional study was conducted among people with T2DM, between Nov2020-Oct2022 attending a tertiary care centre in Chennai, South India. A total of 454 participants (Male: Female 289:165) were included and participants who are following ketogenic diet, paleo diet and restricted diet and people with gestational diabetes, type 1 diabetes, chronic illness were excluded.

Sociodemographic details such as education, occupation, family income, location, marital status, habits, medication details, PA were recorded. Standardized protocols were used to collect the anthropometric measurements such as weight measured in light clothing without shoes. BMI was calculated as kg/m^2. Blood pressure(BP), clinical and biochemical measurements were also recorded. Glycated haemoglobin(HbA1c) was estimated by immunoturbidimetric method using fully automated Roche c311 analyzer. Presence of co-morbid conditions and diabetic complications were recorded. The Study protocol was approved by the institution's ethical committee (Ref IEC/N-003/11/2020). Informed consent was obtained from all the participants.

24hours dietary recall was taken to evaluate their dietary habits and nutrient composition such as total calories, Carbohydrate(CHO), Protein and Fat% were calculated. Food frequency of different food items, consumption of different types of oils was identified and whether the participants consumed these items daily, alternative days, twice a week, once a week, rarely or never was recorded. The Recommended Dietary Allowance (RDA) and Indian Food Composition Table (IFCT) for Indian population was used for reference [15,16]. Details on PA, timing of consumption of food, meal schedule and composition were recorded.

Statistical Analysis

The normality of the data was checked and median values are reported for continuous variables which showed skewed distribution. Number and percentages are reported for categorical variables. Mann-Whitney U and chi-square tests were used to see the statistical significance in clinical profile and dietary intake among male and female participants. A p-value of <0.05 was considered as statistically significant. Statistical analysis was performed using IBM SPSS version 28.0.

Results

(Table1) shows the socio demographic details of the study participants. The median age was 60 and 58years respectively in males and females. Majority of them were males (64%) and females were 36%. Around 93.4% of males and females were educated and only 6.6% were found to be illiterates. Majority of the female participants(86.6%) were homemakers. Most of the males (49.4%) were involved in private jobs by occupation. Family income showed that 25.6% of males and 33% females were earning monthly income of 20000-40000INR. Around 92.3% of males and 51.2% of females were living in a urban location whereas 7.6% of males and 5.8% of females were from rural areas. [Table1].

Table 1: shows the socio demographic details of the study participants.

Variables	Males n=289	Females n=165	P value
Age(years)*	60(18,86)	58(28,78)	0.02
Educational status			
Illiterate	11(3.8)	19(11.5)	0.001
Primary	13(4.4)	12(7.1)	0.211
Secondary	115(39.7)	94(60)	0.004
Higher Secondary	41(14.1)	14(8.4)	0.733
Diploma/college Professional	109(37.7)	26(15.7)	<0.001
Occupational status			
Home makers	-	143(86.6)	-
Farming and Agriculture	13(4.4)	-	-
Retired	21(23.5)	8(4.8)	<0.001
Business	48(16.6)	9(5.45)	0.310
Private Jobs	143(49.4)	2(1.2)	<0.001
Government Jobs	47(16.2)	3(1.8)	<0.001
Professional	17(5.8)	-	-
Monthly Family income (in INR)			
<10000	95(32.8)	58(34.3)	0.244
10,000-20,000	90(31.1)	46(27.8)	0.465
21,000-40,000	74(25.6)	55(33)	0.790
>40,000	30(10.3)	6(3.6)	0.010
Location			
Urban	267(92.3)	148(51.2)	0.325
Rural	22(7.6)	17(5.8)	
Marital status			
Married	285(98.6)	158(95.7)	0.056
Unmarried	2(0.6)	6(3.6)	0.021
Widow	1(0.3)	1(0.6)	0.687
Divorced			

Values are n (%)

(Table2) shows the anthropometric, blood pressure, clinical and biochemical details of the study participants. Median weight of male participants(70) was significantly higher than female participants(66)(P=0.004). BMI was significantly higher in females than males(P=0.001). Nearly 75% of females were overweight and obese which was higher compared to males (68%). The median duration of diabetes was similar in both gender. BP and GC was also similar between males and females. Medication profile shows that, 47% of the males and 42.4% of the females were on oral hypoglycaemic agents (OHAs) respectively. 46.7% of the

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Table 2: shows the anthropometric,blood pressure, biochemical and clinical profile of the study participants.

Variables	Males n=289	Females n=165	P value
Weight(kg)	70(43,120)	66(42-100)	0.004
BMI(kg/m^2)	26.5(18.5,47.7)	28.5(20.5,45.2)	0.001
Diastolic BP(mmHg)	80(0,150)	165(0,151)	0.574
Systolic BP(mmHg)	120(0,206)	120(0,210)	0.377
Duration of diabetes(years)	12(1,20)	11(1,32)	0.277
Plasma fasting glucose (mg/dl)	138(25,426)	147(70,334)	0.157
Post prandial	227(101,587)	228(105,461)	0.517
HbA1c(%)	7.9 (5.4,16.3)	8.3(5.3,16.1)	0.791
Medication details* OHA Insulin Insulin+OHA	 138(47) 16(5.5) 135(46.7)	 70(42.4) 6(3.6) 89(53.9)	 0.273 0.364 0.138
Complications* Neuropathy Retinopathy	 28(9.6) 6(2)	 15(9) 3(1.8)	 0.834 0.849

Values are *n (%), median (min, max), BMI- Body mass index, HbA1c-Glycosylated hemoglobin, BP-Blood pressure.

males and 53.9% of the females were on combination of insulin and OHAs. Out of all, 9.6% and 2% of the males and 9% and 1.8% of the females were having diabetic complications such as neuropathy and retinopathy respectively. [Table2]

(Table 3) shows the genderwise comparison of diet intake among the participants. The total calorie intake was significantly higher in males (1410kcals) as compared to females (1303kcals) (p<0.001). The consumption of complex carbohydrates(gms) (M:F;220:201) (p<0.001), protein (gms) (M:F;49:46) (P=0.006) was significantly higher in males than females. The fat consumption was similar in both the gender (M: F; 31:30gms) (P=0.272). [Table3]

Table 3: Shows the comparison of diet intake among male and female participants.

Variables	Males n=289	Females n=165	P value
Total calories(kcals)	1410 (810,2730)	1303(835,2520)	<0.001
Carbohydrates(g)	220(114,506)	201(105,506)	<0.001
Protein(g)	49(30,96)	46(28,98)	0.006
Fat(g)	31(15,56)	30(11.8,72)	0.272

Values are median (min, max), g-grams.

(Table 4) shows the comparison of gender wise macronutrient distribution with recommended dietary allowances (RDA 2020) among the study participants. The percentage of carbohydrate intake was 63.7% in males and 63.2% in females. As per the RDA recommendation it should be 60% but the percentage of the carbohydrate intake was higher in both males and females (M: F:63.7:63.2%). The percentage of protein intake was 13.9% in males and 14% in females. RDA recommends 15%, however the protein intake was lesser in both genders. The percentage of fat was 19.9% in males and 20.6% in females. There was no difference found in the percentage of fat consumption. [Table 4]

Table 4: shows the comparison of gender wise macronutrient distribution with recommended dietary allowances (RDA 2020) among the study participants.

Variables	RDA 2020	Males n=289	Females n=165	P value (Males vs Females)
Carbohydrates (%)	60	63.7 (34.2,80.8)	63.2 (44.8,78.4)	0.420
Protein (%)	15	13.9 (8.7,22)	14 (8.2,25)	0.521
Fat (%)	20-35	19.9 (10,35)	20.6 (9.5,39.4)	0.114

Values are median (min, max).

Table 5) shows the lifestyle and dietary habits of the study participants. Dietary habits showed that majority of the participants were non-vegetarians (males-87.5%, females-90%). Most of the males(62.6%) and females(56.3%) were doing regular exercise as advised whereas 37.3% of the males and 43.6% of the female participants were physically inactive. It was noticed that 68% of the male participants do not consume food at regular timing whereas 83% of female participants were taking food at regular timing which was statistically significant (P<0.001). A minor proportion of participants (2.4%) only skip meals in both gender. Around 88.2% of the males and 75.7% of the females follow appropriate meal schedule which was statistically significant (P=0.005). Among all the participants, 85.8% of the males and 86.6% of the females were taking adequate meal composition [Table 5].

Table 5: shows the lifestyle and dietary habits of the study participants.

Variables	Male(n=289)	Female(n=165)	P value
Diet Habit			
Vegetarian	36(12.4)	16(9.6)	0.374
Non vegetarian	253(87.5)	149(90)	
Physical activity **Do you exercise regularly**			
Yes	181(62.6)	93(56.3)	
No	108(37.3)	72(43.6)	0.189
Do you consume food at regular timing			
Yes	92(31.8)	137(83)	
No	197(68)	28(16.9)	<0.001
Do you skip meals			
Yes	7(2.4)	4(2.4)	
No	282(97.5)	161(97.5)	0.812
Meal schedule			
Appropriate	255(88.2)	125(75.7)	
Inappropriate	34(11.7)	40(24.2)	0.005
Meal composition			
Adequate	248(85.8)	143(86.6)	
Inadequate	41(14.1)	22(13.3)	0.800

Values are in n (%)

(Figure 1) -shows the gender-wise comparison of cereal intake among the study participants. Assessment of food frequency showed that, majority of males (83.7%) and females (78%) consume rice daily while only few of them (8.3 vs.7.2%) consumes millets. Figure2-shows that, majority of the male participants were taking milk daily than females (91.6 vs.80%;P=0.003). A majority of the male participants were consuming pulses everyday than females (67.8 vs.60%;P<0.001). Only 15.2% of males and 16.9% of females were observed to consume green leafy vegetables everyday. 41% of

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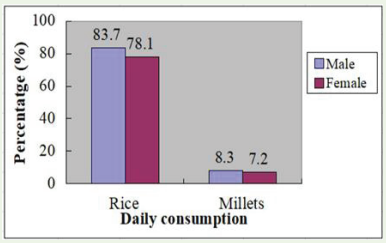

Figure 1: Shows the gender wise comparison of cereal intake among the study participant

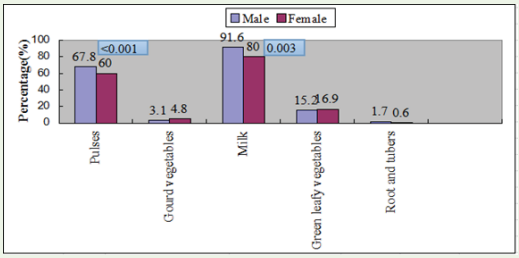

Figure 2: Gender wise comparison of daily consumption of pulses, vegetables and milk.

the male and 33.9% of the female participants were consuming nuts daily. Majority of them were consuming sunflower oil (M: F 58.8 vs.53.3%) than any other source of oils in both the gender. The non-vegetarian food consumption especially chicken without skin or fish was consumed either once a week or twice a week. Daily egg white consumption among the males was 17.9% whereas it was 19.3% in females. Around 11.7% of males and 12.1% of females consumes simple sugars every day.

Discussion

The present study highlights the gender differences of dietary practices followed by people with T_2DM. The majority of the participants were educated and duration of diabetes was similar in both gender. Half of the participants were on combination therapy of OHA and insulin. The total calorie consumption was higher in males than females. The carbohydrate and protein intake was higher in males as compared to females but the fat intake was similar in both the gender.

The dietary recommendations by ICMR, NIN [15] allow (55-60%)carbohydrate, (15%) protein and (20-35%)fat to keep diabetes under good control. Our study findings revealed that percentage of carbohydrate intake was higher in both males and females (M:F 63.7:63.2%) and protein intake was lesser in both gender(M:F 13.9:14%). The consumption of recommended level of good quality protein was only 5% among rural and 18% in urban region. Similarly, the consumption of carbohydrate percentage by individuals with T_2DM was higher and the protein percentage was lesser in the study. In general, it was reported that proportion of population consuming more than recommended intake of cereals was 97.1% in rural and 68.8% in urban region [15].

There was a strong relationship between dietary pattern and body size. Hypertension, diabetes and cholesterol levels were found to be significantly related to dietary patterns [17]. In our study, nearly 75% of females were overweight and obese as compared to 68% of males. The median BMI was significantly higher in females than males. Contrary to our finding, there was no difference in the mean WHR and BMI of male and female respondents in a study conducted in Madhya pradesh, India [18].

Another finding of the present study revealed that around 83.7% of males and 78% of females consume rice daily while only few of them (male-8.3%,female-7.2%) consume millets. Similarly, a India multicenter screening including a large sample size proved that, consumption of rice is more across India as compared with millets. The report also showed that staple food has significant effect on blood glucose levels and anthropometric measurements [19]. The present study revealed that daily consumption of pulses among the male was 67.8% and among females it was 60% but the quantity to be taken as per the RDA recommendation was (pulses-90g/day) so that the protein needs will be met as per the requirement. Similarly, shrivastav etal [20] reported that majority of respondents consume pulses every day.

Lodha etal [18] reported that intake of green leafy vegetables was less. Our study also showed that only 15.2% of males and 16.9% of females consume green leafy vegetables every day which seems to be very less when compared with RDA [15]. As per ICMR NIN [15] guidelines, a person should include 350g of vegetables per day or to consume 3-5 serving of vegetables but in our study there was less consumption of vegetables on daily basis among both the gender.

Overall, 91.6% of males and 80% of females consume milk every day in our study. Similar to our finding lodha etal [18] also revealed that majority of respondents consumed milk every day. NIN guidelines recommend usage of different varieties of cooking oils to obtain a variety of phytonutrients [15] but the present study revealed that majority of them consume sunflower oil than any other source of oil.

The lodha etal [18] revealed that 27 participants used sugars daily whereas in our study 34 male and 20 female participants consume sugars every day. In general, a varied diet with HF fruits, vegetables, pulses and nuts was associated with better health outcomes. Inspite of imparting education on dietary practices and dietary recommendation at every follow-up visit to the clinic, there was an imbalance in their nutrient intake in our participants. Only 32% of our male participants reported that they consume food at regular timing whereas 83% of female participants consume food on time. The level of PA was lesser in females than males (56.3% vs.62.6%), only 2.4% of them skip meals in both gender. Majority of them follow appropriate meal schedule (males-88.2%,females-75%) and meal composition (males-85.8% ,females-86.6%).

Limitation

In this study, only 24hour diet recall was used to assess the dietary pattern and proximate principles of calorie, carbohydrate,

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protein and fat was calculated, but not fiber, vitamins and minerals intake which has to be focused in future studies. This study was conducted in a tertiary care centre, thus we cannot generalize the findings.

Conclusion

The level of protein consumption was lesser than required amount among people with T_2DM as per recommended dietary allowance. Green leafy vegetables and other vegetables consumption was lesser among the participants. Intensive diet counselling should be focused on the amount of green leafy vegetables and other vegetables to be taken per day and protein rich foods to meet the requirements.

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