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A study of diabetic subjects: Common symptoms, treatment, artificial sweeteners and snack consumption

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Abstract
A total random sample size of 351 diabetic subjects in the age group of ≥20 years representing rural and urban area of Ludhiana district were selected to determine the symptoms experienced by them, treatment undertaken to manage diabetes, artificial sweetener and frequency of snack consumption by them. It was found that significantly ($p \leq 0.01$) higher number of rural diabetic subjects were suffering from symptoms of diabetes. Significantly ($p \leq 0.01$) higher percentage of rural diabetic subjects were not taking medicine for managing diabetes. It was also observed that use of artificial sweeteners was significantly ($p \leq 0.01$) higher among urban women. Frequency of snack consumption was found higher among urban diabetic subjects. It was observed that majority of the subjects rural (59 per cent men, 67 per cent women) as well as urban (68 per cent men, 78 per cent women) did not have any kind of diet restriction of sweet, sugary products or refined flour products in everyday life so they were eating everything without any restriction.

Keywords: Symptoms diabetes, artificial sweeteners, snack consumption, treatment diabetes

Introduction
Diabetes mellitus is fastest growing non communicable disease. Diabetes is associated with many severe complications which in turn affect individual's health and quality of life. Around 50% diabetic patients die of cardiovascular conditions and diabetes is also a cause of end stage renal disease. It is also a cause of blindness due to diabetic retinopathy. (Sami *et al.* 2017) [18]. Type 2 diabetic patients are also at risk of lower limb amputations. Diabetes has caused 4.6 million deaths in 2011(Rizkalla 2014) [17]. There are many factors which contribute to diabetes. Socio-economic status of subjects also affects health of individuals. Diabetic patients with low socio-economic status are more prone to diabetic complications. Dietary factors have role in management and prevention of type 2 diabetes (Forouhi *et al.* 2018) [4]. Diet contribute to morbidity and mortality globally reported by the Global Burden of Disease Study carried out in 188 countries. (Forouzanfar *et al.* 2015) [5]. Physicians are also not trained in providing nutrition interventions and counseling to diabetic patients (Lianov and Johnson 2010) [11], (Kahan and Manson 2017) [8]. Following a eating pattern for diabetes is challenging for many people (Forouhi *et al.* 2018) [4]. Present study was conducted to assess data regarding common symptoms experienced by diabetic subjects, treatment undertaken to manage diabetes, consumption of artificial sweeteners and frequency of snack consumption by diabetic patients.

Material and Methods
The present study was planned to assess data regarding common symptoms experienced by diabetic subjects, treatment undertaken to manage diabetes and artificial sweeteners and snack consumption among diabetic subjects in rural and urban areas of Ludhiana district. The study was carried out in 12 blocks of Ludhiana district (Punjab). The sampling design used for the study was 30 cluster multi-stage sampling. A total of 30 locations from Ludhiana district were selected targeting adult men and women. In the next stage of sampling 12 blocks of Ludhiana district were selected. From each block two villages (total of 24 villages) and 6 locations from the urban area were selected in order to have a total random sample size of 880 subjects in the age group ≥ 20 years, representing the rural and urban areas of Ludhiana. A well-structured questionnaire with interview schedule was prepared to obtain information from rural and urban diabetic subjects regarding food habits, symptoms experienced, treatment undertaken to manage diabetes, consumption of artificial sweetners and frequency of snack consumption.

The preliminary interview schedule was pre-tested to make sure of the validity of questionnaire. Necessary modifications were included after pre-testing the questionnaire and this modified questionnaire was then used for the study. Participants were approached via door to door survey as well as the health camps approach. Local panchayats and village heads were consulted and permission was obtained to carry out the research study. An informed verbal consent was taken from all research participants before enrolment.

Statistical Analysis

Mean, standard errors, percentages and z- test were calculated. Data was analysed using Microsoft excel and SPSS 23.0 statistical softwares.

Results and Discussion

Symptoms of diabetes experienced by the diabetic subjects

The symptoms of diabetes experienced by the diabetic subjects are presented in the Table 1. Data has revealed that significantly higher percentage of rural diabetic subjects had experienced the classic triad of diabetes that is excessive thirst, excessive urination and excessive hunger as compared to urban diabetic subjects. Besides this majority of diabetic subjects had experienced one of the major complications of diabetes that is blurred vision.

The reason could be that health care facilities are less available to rural people and they are not much aware of the disease management, monitoring and treatment. Many of them were not taking medicine regularly.

It was observed that significantly higher number of rural subjects (40 per cent men, 44 per cent women) had experienced excessive thirst as compared to urban subjects (23 per cent men, 19 per cent women). Excessive urination had also been observed significantly more in rural (47 per cent men, 51 per cent women) subjects as compared to the urban (23 per cent men, 27 per cent women) subjects. Similarly significantly higher number of subjects had experienced excessive hunger in rural (24 per cent men, 26 per cent women) area when compared with the urban (2 per cent men, 11 per cent women) subjects. Blurred vision has been reported by 43 and 31 per cent rural men and women, respectivley while 29 and 27 per cent urban men and women, respectively. Data on the prevalence of diabetic complications is scarce in India (Mohan *et al.* 2013) [12]. Ramachandran 2014 [16] has suggested that awareness about the signs and symptoms, warning signs of diabetes can help in preventing new cases of diabetes at an early stage. Vishwanathan and Rao (2013) [21] has reported that type 2 diabetes in India remain undetected for years and diagnosis is usually made from associated complications. It results in more than half of the diabetic population being undetected (IDF 2010).

Table 1: Symptoms experienced by the diabetic subjects

Symptoms	Men (n=159)		Z value	Women (n=192)		Z value	Total (n = 351)		Z-value
	Rural (n=101)	Urban (n=58)		Rural (n=153)	Urban (n=39)		Rural (n=254)	Urban (n=97)	
Excessive thirst	40(40)	13(23)	2.21**	67(44)	7(19)	3.22***	107(42)	20(21)	3.75***
Excessive urination	47(47)	14(23)	2.80***	78(51)	11(27)	2.77***	125(49)	25(26)	3.97***
Excessive hunger	24(24)	1(2)	3.67***	40(26)	4(11)	2.29**	64(25)	5(5)	4.23***
Giddiness	0(0)	0(0)	-	2(1)	1(3)	0.62 NS	2(1)	1(1)	0.22 NS
Skin irritation	0(0)	0(0)	-	2(1)	2(5)	1.62 NS	2(1)	2(2)	1.01 NS
Tiredness	4(4)	2(4)	0.16NS	9(6)	6(16)	2.15**	13(5)	8(8)	1.11 NS
Weight loss	4(4)	1(2)	0.78 NS	8(5)	4(11)	1.26 NS	12(5)	5(5)	0.17 NS
Blurred vision	43(43)	17(29)	1.66*	47(31)	11(27)	0.33 NS	90(35)	28(29)	1.16 NS
Slow healing	0(0)	0(0)	-	0(0)	1(3)	2.16**	0(0)	1(1)	1.62 NS

Figures in the parenthesis represent percentages.

*Significant at 10% level; **Significant at 5% level; *** Significant at 1% level; NS-Non Significant

Table 2: Type of treatment undertaken to manage diabetes mellitus by the diabetic subjects

Type of treatment used by the subjects	Men		Z-value	Women (n=192)		Z-value	Total (n=351)		Z-value
	Rural(n=101)	Urban (n=58)		Rural(n=153)	Urban(n=39)		Rural(n=254)	Urban(n=97)	
Only medicine	58(57)	25(43)	1.74*	78(51)	19(49)	0.27 NS	136(54)	44(45)	1.37NS
Only diet	7(7)	3(6)	0.44NS	28(18)	1(3)	2.67***	35(14)	4(4)	2.57**
Medicine and diet	30(30)	22(38)	1.06 NS	44(29)	16(41)	1.61 NS	74(29)	38(39)	1.80*
Medicine and exercise	1(1)	1(2)	0.40 NS	0(0)	1(3)	2.16**	1(0.39)	2(2)	1.52 NS
Medicine, diet and exercise	4(4)	6(11)	1.60 NS	3(2)	2(5)	1.21 NS	7(3)	8(8)	2.27**

Figures in the parenthesis represent percentages.

*Significant at 10% level; **Significant at 5% level; *** Significant at 1% level; NS-Non Significant

Type of treatment undertaken to manage diabetes mellitus

It is evident from the Table 2 that majority of the subjects depended only on medicine and medicine with diet for their treatment. Majority of the subjects i.e. 54 and 45 per cent rural and urban subjects depended only on medicine whereas significantly higher number of urban subjects (39 per cent) were depending on medicine with diet as compared to rural diabetic subjects (29 per cent) for the management of the disease. At the same time significantly higher number (14 per cent) of rural subjects were relying on only diet as a treatment of disease as compared to rural diabetic subjects (4 per cent). Significantly higher number of urban subjects (8%) were depending on medicine, diet and exercise when compared with rural diabetic subjects (3%).

In case of women, 50 and 49 per cent of the rural and urban women were relying on medicine only for the management of diabetes. Further 29 and 41 per cent rural and urban women were depending on medicine as well as diet. A significantly large number of rural women (18%) were trying to manage the disease with only diet. They were not taking medicine nor performing any exercise which could be the reason that majority of them were experiencing symptoms of diabetes like excessive thirst, excessive urination and excessive hunger and blurred vision of course which are the complication of

diabetes. There is a variation in the use of diet modification to manage type 2 diabetes, less than 5-10% type 2 diabetic patients in India. (Mohan *et al.* 2014) [13] Patients lack knowledge about diabetes which hinder their ability to manage their condition (Viswanathan and Rao 2013) [21]. CURES (Chennai Urban Rural Epidemiology Study) have reported that nearly 25% population was unaware of diabetes mellitus and only 22.2% of the population and 41% of known diabetic subjects felt that diabetes could be prevented (Deepa *et al.* 2005) [2]. A study based on sales of antidiabetic pharmaceutical agents showed that, on an average, only 10–12% people with diabetes received modern pharmacological treatment in India.(Kapur *et al.* 1997) [10]

Use of artificial sweetener by the diabetic subjects

The use of artificial sweeteners among the diabetic subjects is presented in Fig. 1. It was found that the use of artificial sweeteners was very less among both rural and urban men. But the use of artificial sweeteners was significantly ($p \leq 0.01$) higher among urban women (16%) as compared to rural diabetic women (4%).

Artificial Sweeteners are sweeter than sugar containing few to no or zero calories (www.fda.gov). Recent research has shown that consumption of artificial sweeteners for a long time can lead to an altered glucose metabolism (Young *et al.* 2011) [22]. It has also been reported that consumption of artificial sweeteners is associated with increased risk of weight gain and type 2 diabetes (Swithers 2013) [20]. Since Artificial Sweeteners has been associated with an increased risk of weight gain, obesity and type 2 diabetes, there is the need to monitor the impact of consumption of artificial sweeteners on consumer health. (Sanyaolu *et al.* 2018) [19]

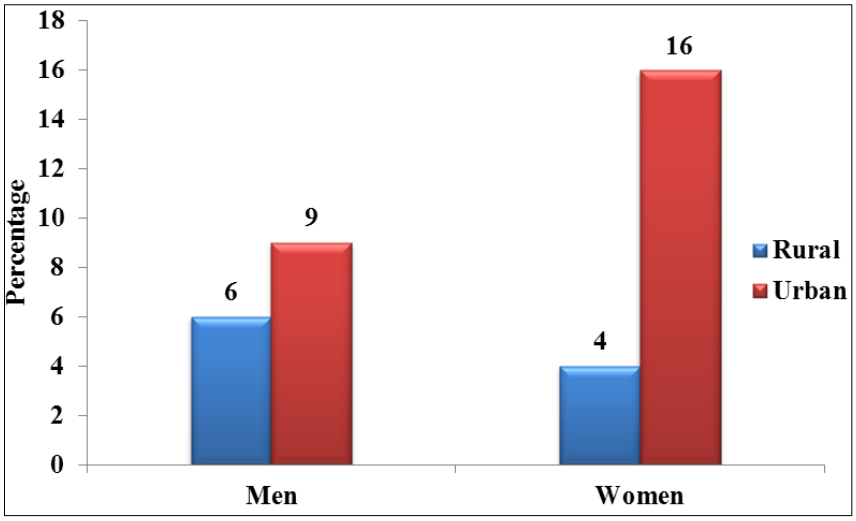

Fig 1: Consumption of artificial sweeteners by the diabetic subjects

Frequency of snack consumption among diabetic subjects

Snack consumption frequency by the diabetic subjects is given in Table 3. Among men, non-significant difference was found for the consumption of snacks whereas, among women significantly higher number of urban women (24 per cent) were eating snacks once in a week as compared to rural diabetic women (9%). Studies reported that majority of the subjects i.e., 57-80 per cent subjects used to eat out rarely. Further 20-40 per cent subjects used to go fortnightly for eating out. It was seen that 16.7-46.7 per cent subjects used to eat out once in a month (Kapoor 2010) [10]. It has been reported by Zong *et al.* 2016 [23] reported that frequent consumption of Meals prepared at home is associated with a lower risk of developing type 2 diabetes.

Commitment towards diet during function/party by the diabetic subjects: Information regarding the strictness on diet during function or party by the diabetic subjects is provided in the Table 4. Majority of the diabetic subjects from rural (77 per cent men, 84 per cent women) and urban area (77 per cent men, 73 per cent women) were not strict with regard to the diet restriction. Only 23 and 16 per cent rural men and women, 23 and 27 per cent urban men and women followed their diet strictly even during function/parties. Information regarding the daily diet restriction of urban and rural women subjects has been given in the Table 4.16. It shows that majority of the subjects rural (59 per cent men, 67 per cent women) as well as urban (68 per cent men, 78 per cent women) did not have any kind of diet restriction of sweet, sugary products or refined flour products in everyday life so they were eating everything like normal people. Around 41 and 33 per cent rural men and women and 32 and 22 per cent urban men and women had diet restriction in their daily routine.

Table 3: Frequency of snack consumption by diabetic subjects

Snack consumption	Men (n=159)			Women (n=192)			Total (n=351)		
	Rural (n=101)	Urban (n=58)	Z-value	Rural (n=153)	Urban (n=39)	Z-value	Rural (n=254)	Urban (n=97)	Z-value
Once a week	34(34)	16(28)	0.79^{NS}	14(9)	9(24)	2.60^{***}	48(19)	25(26)	1.42^{NS}
Once in 2 weeks	4(4)	3(6)	0.36^{NS}	6(4)	1(3)	0.44^{NS}	10(4)	4(4)	0.08^{NS}
Once a month	6(6)	0(0)	1.89^{*}	14(9)	4(11)	0.23^{NS}	20(8)	4(4)	1.24^{NS}
Rarely	14(14)	2(4)	2.10^{**}	23(15)	0(0)	2.81^{***}	37(15)	2(2)	3.33^{***}
Never	41(41)	36(62)	2.61^{***}	96(63)	24(62)	0.15^{NS}	137(54)	60(62)	1.34^{NS}

Figures in the parenthesis represent percentages.

*Significant at 10% level; **Significant at 5% level; *** Significant at 1% level; NS-Non Significant

Table 4: Commitment towards diet during function/party by the diabetic subjects

Commitment towards diet on party/functions	Men (n=159)		Z-value	Women (n=192)		Z-value	Total (n=351)		Z-value
	Rural(n=101)	Urban(n=58)		Rural(n=153)	Urban(n=39)		Rural(n=254)	Urban(n=97)	
Yes	23(23)	13(22)	0.05 ^{NS}	24(16)	10(27)	1.58 ^{NS}	47(19)	23(24)	1.09 ^{NS}
No	78(77)	45(78)	0.05 ^{NS}	129(84)	27(73)	2.35**	207(81)	72(74)	1.51 ^{NS}
Daily diet restriction									
Yes	41(41)	19(33)	0.98 ^{NS}	50(33)	9(22)	1.26 ^{NS}	91(36)	28(29)	1.23 ^{NS}
No	60(59)	39(67)	0.98 ^{NS}	103(67)	30(78)	1.26 ^{NS}	163(64)	69(71)	1.23 ^{NS}

Figures in the parenthesis represent percentages.
*Significant at 10% level; **Significant at 5% level; *** Significant at 1% level; NS-Non Significant

Conclusion

The study concluded that significantly ($p \leq 0.01$) higher number of rural diabetic subjects were suffering from symptoms of diabetes. Significantly ($p \leq 0.01$) higher percentage of rural diabetic subjects were not taking medicine for managing diabetes which will eventually lead to various complications of this disease. It was also observed that use of artificial sweeteners was significantly ($p \leq 0.01$) higher among urban women. Frequency of snack consumption was found higher among urban diabetic subjects. It was observed that majority of the subjects rural (59 per cent men, 67 per cent women) as well as urban (68 per cent men, 78 per cent women) did not have any kind of diet restriction of sweet, sugary products or refined flour products in everyday life so they were eating everything without any restriction. There is urgent need to conduct interventional studies and to make people aware especially in rural area regarding diabetes and how to manage it to prevent its complications.

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