

Could Craving for Certain Kind of Foods be a Predictor of HbA1c Level in Diabetes Type 2 Patients?

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Abstract

For diabetes mellitus type 2 patients and prediabetes patients healthy food choices is one of the most important factor to maintain recommended metabolic outcomes but this also requires strong willingness to change. As food cravings are common for the majority of healthy adults, rigid dietary control and the deprivation from some foods that are not allowed, can trigger the craving for some categories of foods in diabetic patients. In this study, diabetes type 2 patients and prediabetes patients were asked to share their current HbA1c levels and to self-report their daily experiences with food cravings. The aim of the study was to investigate if cravings for a certain kind of foods is strongly related to higher HbA1c levels in diabetic patients. Methods: Due to the pandemic situation, the study used online-based surveys on diabetes type 2 and prediabetes patients living in West Romania. The questionnaire was distributed through public social media groups with diabetic health condition specific. The collected data were analyzed using inferential and descriptive statistics. Conclusion: The most selected categories of food cravings by all respondents were white bread and sweets. Although men and women tend to crave different kinds of foods, results does not differ significantly between the genders. Personal preferences and cultural determined eating habits seems to influence the food choices and the craving for a certain kind of food. The deprivation from white bread, a Romanian dietary staple showed an increase in cravings for the deprived food. Craving for pastries, alcohol and refined sugar sweets was associated with the highest HbA1c levels in the sample. The study results may help diabetic patients increase the awareness about their medical condition and improve self-management and self-care habits in order to obtain a better blood sugar monitoring and prevent diabetes associated complications.

Keywords: diabetes mellitus; diabetes type 2; food cravings; glycated hemoglobin; HbA1c.

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1. Introduction

As the prevalence of diabetes in adults increases worldwide [1], maintaining normal blood sugar levels is important with the purpose of preventing the disease in healthy population [2, 3]. For prediabetes or T2D patients, controlling the blood glucose levels helps avoiding chronic complications such as vascular damage, nerve damage, skin disorders, diabetic retinopathy or hypertension [4]. In order to prevent acute situations and to reduce long-term complications caused by their medical condition, patients with T2D or prediabetes [5] need to improve self-management and follow strength medical recommendations [6, 7]. The self-care management includes the adherence to medications, daily physical activity, stress reduction, the reduction of overweight, blood glucose monitoring and healthy eating habits [8-11]. The objective of this study was to identify food-craving patterns among prediabetes and T2D patients. As food craving in adults is common [12] and studies shows that there are craving differences between genders [13, 14], the participants were asked to self-report the cravings only for the categories of foods that usually should be avoided or only a small amount is allowed for consumption, in order to help manage their blood sugar levels. Studies suggest that deprivation or reducing the amount of foods can lead to higher craving for deprived foods [15].

2. Materials and methods

An online survey on diabetes type 2 patients and patients diagnosed with prediabetes living in West Romania was conducted during a three month period, from September to December 2021. The questionnaire was distributed on open social media groups with diabetes or diabetes-related topics. The questionnaire contains 3 sections, divided into a demographic section, a sections containing items about the diagnosed form of the disease, items about last glycated hemoglobin level not older than 4 months, items about medication, and a section containing questions about the daily food cravings. Glycosylated hemoglobin (HbA1c) was analyzed as an indicator of metabolic control [16, 17]. The food categories were: staple food (white bread), sugar confectionery such as candy or chocolate (sweets), alcoholic drinks (alcohol), fruits - as the consumption amount of fruits with high glycemic index such as banana or grapes should be reduced (fruits), pastries, rice, polenta, pasta (pastries/starchy foods). The design of eligibility criteria includes T2D patients on dietary control and oral medication and/or Insulin and patients diagnosed with prediabetes on dietary control, as the most frequently treatment includes lifestyle modification counseling [18]. From the total number of 201 responses received, 23 responses were excluded as they were incomplete or contained inaccurate data, as for example levels of HbA1c of 20 and over. The remaining 178 responses were analyzed using SPSS® version 28. For the categorical variables, frequency and percentage were measured. For numerical variables were used descriptive statistics. The statistical parameters for the sample were determined using different inferential statistical measures.

3. Results

In the sample, 73.0% were female participants and 27.0 % were male participants. The majority of the respondents live in urban areas (75.8%) compared to 24.2% living in rural areas. The most of the participants are diagnosed with T2D and are on diet and medication (87.0%) while 13% of respondents are diagnosed with

prediabetes and only following a diet plan. 74.7% of the participants were diagnosed with T2D or prediabetes for over 1 year, 25.3% receive a diagnosis in the last 12 months.

Table 1: Frequency and percentage of the categorical variables.

Variables	Categories	N	Percentage
Gender	Female	130	73.0%
	Male	48	27.0%
Residential area	Urban Areas	135	75.8%
	Rural Areas	43	24.2%
Stadium of disease	Prediabetes, diet only	23	13.0%
	T2D, diet and medication and/or Insulin	155	87.0%
Time from the first diagnostic	≥ 1 Year	133	74.7%
	< 1 Year	45	25.3%

Table 2: Age characteristics by gender.

Gender	Age (min)	Age (max)	Age (mean)
Female (N=130)	26	74	49.7
Male (N=48)	30	69	51.3

The five food categories were designed as multiple response variables. The analysis of the results indicate that white bread cravings, as staple food, got the highest percentage of responses (37.5%), followed by sweets cravings (21.8%), craving for fruits (16.8%) and craving for starchy foods (15.1%). Craving for alcohol got the lowest rate (8.8%).

The variables Age and HbA1c level were analyzed using descriptive statistics. The results indicated that the youngest participant was 26 years old and the oldest 74 years. The age mean of the total sample was 50.11 (SD = 12.36). The lowest level for HbA1c was 4.8, the highest level was 13.5 with a mean of 7.90 (SD = 2.07).

Table 3: Age and HbA1c level characteristics of the sample.

Variables	Min	Max	Mean	SD	Skewness		Kurtosis	
					Statistic	Std. Error	Statistic	Std. Error
Age	26	74	50.11	12.36	-.196	.182	-.897	.362
HbA1c	3	4	7.90	2.07	.849	.182	-.229	.362

We used inferential statistics to investigate the relationship between HbA1c level and food cravings. The food categories were coded as dichotomous / dummy explanatory variables. The results of the multiple regression analyses shows that the presence of craving for starchy foods, alcohol, sweets and white bread (staple food) may be expected to shift higher HbA1c level. In this model, no statistically significant association was found

between fruit cravings and HbA1c level.

Table 4: ANOVA^a Test Results.

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	350.025	5	70.005	28.988	<.001 ^b
	Residual	415.381	172	2.415		
	Total	765.407	177			

a. Dependent Variable: HbA1c

b. Predictors: (Constant), white bread, alcohol, sweets, fruits, pastries/starchy foods

Table 5: Coefficients^a

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95.0% Confidence Interval for β	
		β	Std. Error	Beta			Lower Bound	Upper Bound
1	(Constant)	6.002	.291		20,657	<.001	5.428	6.575
	white bread	.742	.262	.169	2.832	.005	.225	1.260
	sweets	1.289	.257	.303	5.008	<.001	.781	1.797
	alcohol	1.614	.331	.283	4.882	<.001	.961	2.266
	fruits	.359	.275	.079	1.308	.193	-.183	.901
	pastries/starchy foods	2.058	.280	.437	7.356	<.001	1.506	2.610

a. Dependent Variable: HbA1c

The group statistic shows a gender difference in HbA1c level, male participants registered a higher HbA1c level mean (Mean = 7.95, SD = 2.17) than women (Mean = 7.88, SD = 2.05). However, the difference was not statistically significant.

Table 6: HbA1c level by gender.

	Gender	N	Mean	Std. Deviation	Std. Error Mean	t
HbA1c	m	48	7,9546	2,17057	,31329	.203
	f	130	7,8829	2,05315	,18007	

Cross-tabulation was used to study the effects of the duration of the disease (T2D or prediabetes diagnosed < 1 year or ≥ 1 year) on food cravings. The results shows that all patients regardless of the duration of the disease craved at most for white bread (N=31 Patients diagnosed <1 year; N=88 Patients diagnosed ≥ 1 year) followed by craving for sweets (N=25 Patients diagnosed <1 year; N=44 Patients diagnosed ≥ 1 year). The responders diagnosed with T2D or prediabetes for less than one year shows low craving for fruits, while responders with diabetes health condition diagnosed for one year or longer shows low craving for alcohol. The effects of disease stadium on HbA1c level was analyzed using independent samples t-test. The patients with diabetes medical condition for longer than a year showed lower HbA1c levels (M= 7.6986, SD = 1.8906) than patients that were diagnosed for less than a year (M = 8.5042, SD = 2.4851). The difference between the groups was statistically significant at $p < 0.001$.

Table 7: Independent sample t-test for the effect of disease stadium on HbA1c level.

	T2D Diagnostic or prediabetes	N	Mean	Std. Deviation	Std. Error Mean	t
HbA1c	≥ 1 year	133	7.6986	1.89064	.16394	-2.273*
	< 1 year	45	8.5042	2.48516	.37047	

* $p < 0.001$

4. Discussion

Lifestyle changes, particularly a healthy balanced diet is essential to create lasting effects on personal well-being especially in those with prediabetes or type 2 diabetes. As prediabetes patients have an increased risk to develop T2D or cardiovascular diseases, studies shows that lifestyle modification is more effective in preventing the progression to T2D-continuing effect even as metformin medication [19]. Refined, high glycemic index carbohydrates increase the risk of T2D in both men and women [20]. A 2017-conducted systematic review finds that compared to pasta, white bread has a higher postprandial glucose response that can result in an increased metabolic disease risk [21]. Further studies, systematic reviews and meta-analysis studies found that certain food categories can be positively (like fruit, vegetables, whole grains, coffee, low carbohydrate foods) or negatively (like high saturated fat foods, meat, carbohydrates) related to the risk to develop prediabetes or T2D [22-25]. Several other studies have found a relationship between eating patterns, food cravings and HbA1c levels. Mediterranean and DASH diet seems to significantly reduce risk of T2D preeminently in the high-risk population [26]. Systematic reviews shows that vegan, vegetarian or Mediterranean dietary patterns also reduced glycated hemoglobin levels on average of 0.8% [27]. The risk of T2D was directly associated with western dietary pattern and inverse related to the adherence to healthy dietary pattern [28]. A Mexican study found that a Western-style diet and the sweets and dairy diet patterns were associated with HbA1c $\geq 7\%$, whereas a healthy dietary pattern was associated with HbA1c $< 7\%$ [29]. A 2011 study on Caucasian population 40 - 79 years shows higher HbA1c levels of 5.50 and above related to the higher progressively increased risk to T2D [30]. Other findings shows significant associations of food cravings with lower diet quality and poor eating patterns [31]. A study on Brazilian patients found that compared to higher quality diet, lower-quality diet is associated with poorer glycemic control [32]. A British study on persons aged 65 years and over shows undiagnosed with

high HbA1c levels have poorer nutritional status than T2D diagnosed persons [33].

Similarly to the Japanese findings for rice [34], the craving for white bread, a Romanian staple food, indicate a higher craving generated by the restricted intake of foods which leads to a higher blood sugar level. In healthy or overweight adults cravings can also be associated with being bored, emotional or watching TV. Women, overweight persons or persons trying to lose weight seems to more likely to experience cravings, Canadian study founds [35]. A study on young healthy men founds that a high glycemic index meal increase hunger, decrease plasma glucose, and stimulate particular brain regions associated with reward and craving in the late postprandial period [36].

In our study, craving for sugary, high carbohydrate foods was registered both in women and men, both in prediabetes and T2D patients regardless of the time from the first diagnosis. Similarly, in a randomized clinical trial over 24-weeks study in overweight and obese adults with T2D, food cravings decrease in all food categories, except carbohydrates [37]. A 2016 study on craving in Brazilian healthy population finds higher average scores for chocolate in women and for bread in men [38]. A 2014 study on a sample of healthy adults with BMI 27.3 ± 5.5 kg/m² reveals a significant positive associations of cravings for sweets, fats, carbohydrates, and fast-food on respective consumption of these food categories [39].

Consistent with a number of previous researches on this topics, our findings suggest that food cravings, especially on high glycemic index foods may be related to the deprivation from certain foods, cultural influences, and poor self-management of diabetes.

As our study was conducted during the Covid-19 pandemic, the self-reported cravings for foods could be higher compared to the period before. Recent study results on T2D patients reveal an increased consumption of sugary food and snacks and a connection between levels of foods cravings and snack consumption [40].

Further studies are needed. These should include all food categories and a sample of healthy adults as a control group. The effects of physical activity, stress, comorbidities should additionally also be examined.

5. Conclusion

The craving for staple food (white bread) and for sweets registered the highest number of nominations. There was a difference between the self-reported levels of HbA1c on patients newly diagnosed with diabetes (under 1 year) and people with type 2 diabetes diagnosed for one year or longer. The higher HbA1c levels reported from newly diagnosed patients may be associated with impaired health status that led to the medical examination and blood tests resulting in the diagnosis of T2D. Another explanation can be the increased awareness of balanced diet, the adherence to treatment and the education among T2D patients diagnosed from one year or longer. This study has identified new evidence of a significant relationship between HbA1c levels and the craving for some categories of foods. As avoiding hypoglycemia while pushing for lower HbA1c's is a challenge for the most of diabetic patients, increasing awareness of the intense desire for a specific food and satisfying hunger with healthy alternatives may help to keep blood sugar stable.

6. Limitation of the study

As not every T2D or prediabetes patient had the same chances to be included in the study, results may not be generalizable and should be carefully considered. The self-reported HbA1c levels may be inaccurate. Further studies with larger sample sizes and additional factors that can be considered are needed to confirm the findings of this study.

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