



Awareness and Knowledge of Artificial Sweeteners Among Diabetic Patients in Kashmir

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Abstract: Diabetes mellitus is a chronic metabolic disease mainly attributable to unhealthy, untimely food habits and lack of physical activity. Good glycemic control is one of chief aspects of preventing complications related to diabetes. This has led to shift in replacing sugar with artificial sweeteners amongst diabetic population. Past studies have indicated that there is lack of awareness of type and long-term side effects of artificial sweeteners among people with diabetes. This study was thus conducted to assess awareness and knowledge of usage of artificial sweeteners among adults with type 2 diabetes mellitus. The study population involved 200 adults (≥ 18 years) with type 2 diabetes in Kashmir valley. Results revealed that patients didn't know the content of artificial sweetener they consumed, and were also unaware of health benefits and health hazards of artificial sweeteners. The study findings highlight high rate of unawareness amongst subjects regarding the side effects of long-term consumption of artificial sweeteners.

Keywords: Sweeteners, diabetes, nutrition, awareness, diet, obesity

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I. INTRODUCTION

Diabetes is a chronic metabolic disorder that results in hyperglycemia which when uncontrolled can lead to complications. Good glycemic control can be achieved by a healthy balanced diet that focuses on the choice of carbohydrates, portion control and wholesome fibre rich foods along with regular physical activity which helps in regulating the blood glucose levels. Diabetic patients are demanding a greater variety of low-calorie products as they strive to make healthier food choices. Artificial sweeteners are increasingly popular especially among diabetic patients as an alternative to sugar. Increased incidence of diseases such as obesity, diabetes, and metabolic syndrome, coupled with heightened consumer awareness, has led to a steady paradigm shift toward the use of low-calorie artificial sweeteners [1].

Low-calorie sweeteners provide a sweet taste with-

out calories, or with very few calories. Most low-calorie sweetener are not digested by the body and provide no calories. An exception is aspartame, which is metabolised naturally. But since aspartame is approximately 200 times sweeter than sucrose, only a tiny amount of aspartame (1/10 of a kilocalorie) is needed to equal the sweetness of a teaspoon of sugar (16 kilocalories). Low-calorie sweeteners are also called non-nutritive sweeteners, "intense sweeteners", "high intensity sweeteners", "high potency sweeteners or "alternative sweeteners" [2]. Artificial NNS when consumed in daily acceptable limit can help in limiting carbohydrate and energy intake as a tool to manage weight or blood glucose [3]. The FDA has established an acceptable daily intake limit (expressed in mg/kg body weight) for each NNS, and this value is usually set at 1/100 of the no observed adverse effect level (maximum level at which no adverse effects were seen

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in animal studies [4]. The consumption of low-calorie sweeteners continues to increase. And consumer demand for low-calorie foods and beverages has been the major force behind this growth. The increasing interest in a health-conscious lifestyle and advances in food technology are pushing the development of more and better tasting low-calorie foods and beverages. Extensive studies are being conducted and established regarding the ill effects of artificial sweeteners, yet there is a lingering unawareness among a significant proportion of the population. Hence, a study was designed to assess the awareness and knowledge of artificial sweeteners among the adult diabetic patients in tertiary hospital in Srinagar, India.

II. RELATED WORK

A study on 260 diabetic patients to investigate the use and awareness of sweeteners and how this links to demographics and potential co-morbidities showed that daily artificial sweetener consumption is significantly associated with hypertension but not other co-morbidities such as kidney disease or obesity. It further demonstrated that there is limited checking of artificial sweeteners in food or drink products by participants. Thus it was concluded from the findings of this study that there is a need to increase the awareness of artificial sweetener use in diabetic patients, these findings suggested that there is potential to improve outcomes for diabetic patients by improving this awareness [5].

Another study was conducted on Artificial Sweeteners consumption, discomforts, and health consequences of chronic consumption as well as the opinion of dieticians (n= 53) on Artificial Sweeteners using a pretested questionnaire. Results showed that the study subjects consumed Artificial sweeteners in the form of table top sweeteners (86.3%), sweets (35.3%), and beverages (31.4%). Saccharin (29.5%), sucralose (27.3%), and aspartame (27.3%) were the major table top sweeteners consumed. 77% of subjects consumed AS from 1-3 years, while others from 4-5 years. 59% of participants consumed Artificial Sweeteners without consultation, and only 5.9% expressed discomfort after consumption. However, a significant association was noticed between is comfort and beverage consumption. 58.8% were unaware of the health consequences. The survey among dieticians revealed that 73.6% were not recommending Artificial Sweeteners, mainly due to less reliable information, particularly regarding safety issues, and ambiguity on the use of Artificial Sweeteners in dietetic practice [6].

A study conducted on population involving 297 adults (≥ 18 years) with type 2 diabetes attending a tertiary dia-

betes institute revealed that Sucralose was most popular sugar substitute amongst the subjects (45%) followed by Aspartame (32%). However 13% of them were completely not aware of the type of artificial sweetener that they consumed. A significant number of subjects (81.5%) were unaware of long-term side effects of artificial sweeteners. Thus it was concluded the study findings highlight high rate of unawareness amongst subjects regarding the side effects of long-term consumption of artificial sweeteners [7].

An online questionnaire-based survey was carried out on a sample size comprising of 607 individuals of Indian nationality. Results showed that while majority of respondents declared that they added sugar in their food/beverages regularly, 51.65% of respondents preferred 'Diet/Low calorie' products containing LCS in the market over sugar added products. Sucralose was found to be most popular amongst various commercially available artificial sweeteners.. Thus it was concluded although artificial sweeteners are presently being marketed widely as health substitutes, data regarding the possible adverse effects associated with their frequent use is still limited [8].

A descriptive-analytical study conducted in 2020 was done on 400 diabetic patients admitted to the diabetes clinic of Bu-Ali hospital in Zahedan.. Results showed that the knowledge and attitude of the study population were 39% and 34.8%, respectively at the 'poor' level, 58% and 58.3% at the 'moderate' level, and 3% and 7% at the 'good' level. Thus it was concluded the findings showed that half of the diabetic patients had knowledge and attitude concerning the consumption of artificial sweeteners. They had limited information about low-calorie sweeteners, which affected their nutritional behaviours so that almost half of the subjects did not consume any sweeteners. It has been suggested that appropriate educational programs be designed and implemented to overcome this information gap [9].

A study was conducted on a total of 536 diabetic patients who were interviewed in the hospital for a period of 3 months. Results showed that Analysis of knowledge of patients showed that 97% patients don't know the content of artificial sweetener they consume, 78.5% patients are unaware of health benefits and health hazards of artificial sweeteners and 99.5% patients don't know for how long these products should be consumed. Analysis of attitude of patients showed that 68.7% patients thinks that they would not prefer to use normal sugar instead of artificial sweetener. Thus it was concluded maximum no of well educated type 2 diabetes patients prefer to use artificial sweeteners in their diet to control blood sugar

level without complete awareness on the content & proper consumption of sweeteners, different types of sugar substitutes, health benefits and hazards of sweeteners. Hence, there is a dire need to promote awareness about artificial sweeteners among diabetic patients in order to prevent any long term complications related to the consumption of these sweeteners [10].

A. *Aims and Objectives of the Study*

- To find out the knowledge of respondents regarding low calorie sweeteners.
- To assess the consumption and usage pattern of low calorie sweeteners by diabetic patients.

III. MATERIALS AND METHODS

A cross sectional, survey – based study was conducted from May 15, 2024 to Sep 15, 2024 targeting 200 diabetic patients (40 - 60 years old) with the help of self-administrated questionnaire supplemented with a face to face interview. A door-to-door survey was conducted in three areas of Srinagar district namely Hazratbal, Zakura and Gulab bagh (Northern Srinagar) so that we could reach a diverse range of patients suffering from grade 2 diabetes. Households were drawn from the Register of Quarters maintained by the Census and Statistics Department by systematic replicated sampling. A face-to-face interaction helped clarify questions and provided immediate assistance which enhanced the quality of the data collected. The selection process involved the use of simple random sampling, ensuring that each patient within the defined age group (40-60 years) had an equal chance of being included in the study. Data was collected with the help of Study-specific questionnaire that was reviewed by a renowned endocrinologist of the valley for content validity and was modified accordingly. It was further reviewed by non- content experts to assess the

clarity of the questions, and a final version was adopted thereafter. Before the actual administering of questionnaire, the pilot study was conducted to see the reliability of the questionnaire to the whole population. Its purpose was to see whether there was any difficulty in language and other aspects of questionnaire. The questionnaire included various sections to extract information about the awareness and knowledge of respondents on various kinds of artificial sweeteners and also to find out its consumption pattern. The data obtained were analyzed using the Statistical Package for the Social Sciences (SPSS) version 26 (IBM Corp., Armonk, NY). Categorical variables are presented as frequencies and percentages and the chi-square test (χ^2) was used to compare them. All p-values < 0.05 were considered statistically significant.

IV. RESULTS

The demographics were collected (Table 1) and the study population consisted of a total of 200 diabetic patients with 112 males (56%) and 88 females (44%). Patients from a range of age groups responded to the survey with the majority within the 40–50 years range (46%). Respondents belonged mainly to nuclear families (58%) with majority falling in the income group range of Rs. 30,000- 60,000 per month. Moreover 34% were Post graduates, 56% belonged to teaching profession. Majority of respondents (62%) belonged to Married category. As evident from the table, the majority of patients had been diagnosed with diabetes for the last 1-5 years (44%) with nearly a third diagnosed more than 10 years ago (34%). Nutritional status of the respondents (Table 2) revealed that 52% of the respondents were falling in obese category (BMI 25 kg/m² and above) as per WHO's Asian classification of BMI. Only 26% belonged to overweight category. (BMI 25- 29.9 kg/m²)

TABLE 1
SOCIO DEMOGRAPHIC CHARACTERISTICS

		No	%
Age (in yrs)	40 -50	92	46
	50 – 60	48	24
	60 – 70	60	30
Gender	Male	112	56
	Female	88	44
Educational qualification	Graduate	20	10
	Post graduate	72	36
	Ph.D	48	24
	Others	60	30
Occupation	Teaching staff	112	56
	Non teaching staff	36	18
	Student	44	22
Family type	Others	8	4
	Nuclear	116	58
Income (in Rs)	Joint	84	42
	Rs. <10,000	36	18
	Rs. 10,000 – 30,000	60	30
	Rs. 30,000 – 60,000	64	32
Marital status	Rs.60,000 – or above	44	22
	Married	124	62
	Unmarried	16	8
	Divorced	24	12
Time since Diabetes diagnosed	Widowhood	36	18
	1 -5 years	88	44
	5 to10 years	44	22
	10 to 15 years	40	20
	15 years	28	14
	Total	200	100

TABLE 2
NUTRITIONAL STATUS OF THE RESPONDENTS

Nutritional status	No	%
Under weight(BMI<18.5 kg/m ²)	28	14
Normal (BMI 18.5-24.9 kg/m ²)	16	8
Over weight (BMI 25- 29.9 kg/m ²)	52	26
Obese (BMI 25 kg/m ² and above)	52	52
Total	200	100

Source : WHO Body Mass Index (BMI Kg/m²) for Asian population (Lancet, 2004)

We next sought to understand the consumption of sweeteners by participants (Table 3) and their awareness of the health impacts of sweeteners (Table 3). The frequency of consumption, type of sweeteners and mode of consumption in the diet, as reported by participants, showed that Zero-Cal was the most commonly consumed sweetener among all the sweeteners. Among those who preferred taking artificial sweeteners in their daily diet,

majority used to take it on daily basis (745). It was also worth noting that 42% were not used to taking any artificial sweeteners in their daily diet. Moreover there was an even distribution of sweetener consumption in tea and coffee (52% & 42% respectively) The self-reported awareness of sweeteners in the participants (Table 4) showed that 32% were aware of the fact that artificial sweeteners are harmful for health Similarly, most of the participants

(54% & 56%) were not aware of effect of AS on blood sugar levels and blood pressure. As far as side effects experienced after consumption of AS is concerned, 54% reported that they gained weight after the usage of AS.

TABLE 3
DISTRIBUTION OF RESPONDENTS AS PER TYPE OF ARTIFICIAL SWEETENERS USED

Type of Artificial sweeteners used	N	%
Sugar based	20	10
Zero calories	40	20
Equal sweeteners	36	18
Splenda no calorie sweeteners	20	10
Don't take any artificial sweeteners	84	42
Frequency of consumption of Artificial sweeteners		
Daily	86	74
Occasionally	30	26
Usage of Artificial sweeteners in Beverages		
Tea	105	52
Coffee	95	48
Total	200	100

TABLE 4
KNOWLEDGE REGARDING ARTIFICIAL SWEETENERS BEING HARMFUL FOR HEALTH

Knowledge regarding side effects of artificial sweeteners		
Yes	64	32
No	136	68
Effect of Artificial sweeteners on blood sugar		
Yes	92	46
No	108	54
Side effects experienced		
Obesity	108	54
Eye disease	32	16
Gastro intestinal problems	8	4
Dental problem	24	12
Kidney problem	12	6
Headache	16	8
Effect of Artificial sweeteners on blood pressure		
Yes	88	44
No	112	56
Total	200	100

V. DISCUSSION

Our study investigated whether there was any awareness of respondents about artificial sweeteners and also to

find out its usage pattern. In our study, it was found that Beverages like tea, coffee are the most common mediums where consumers look for sugar replacements. These results were in accordance with the results of the recent assessment of the use of low-calorie sweeteners amongst the Indian population [8]. Among our study population, saccharin (zero calories) was the most popular and commonly used substitute followed by equal sweeteners (Aspartame) which was preferably consumed in beverages. In our study, a good percentage of individuals belonged to obese category. About 26% of the subjects belonged to the overweight category with BMI ranging between 23-29.9kg/m² indicating that obesity is prevalent among study sample and those who aimed at managing weight loss with artificial sweeteners have not shown much promising results. study [11] claims to have shown similar results where consumption of sweeteners (saccharin, cyclamate based, acesulfame-K based, and aspartame) resulted in significantly increased body weight even though the food intake did not change. This questions the effect of non-caloric artificial sweeteners on weight-loss management.

Artificial sweeteners have become a prime component in the food industry that can help to tackle diabetes and obesity. Some of the common foods which contain artificial sweeteners include soft drinks, sweets and desserts, ice creams and chewing gums. However, the safety of artificial sweeteners is questionable as it has been well established that they can cause gastrointestinal issues including bloating and acidity and several other chronic diseases. Studies [12]. indicate that aspartame, sucralose, and saccharin disrupt gut microbiota homeostasis which can lead to long-term digestive diseases like irritable bowel syndrome (IBD). Headache was observed as a regular symptom in individuals consuming artificial sweeteners, especially aspartame [13]; [14]. Which can be attributed to the formation of formic acid when aspartame breaks down resulting in metabolic acidosis. Dental problems, eye problems and headache was observed as the main side effect of the consumption of AS. A good percentage of subjects in our side were not aware about the side effects caused due to the consumption of artificial sweeteners. An increasing trend of unawareness about the side effects of long-term consumption of artificial sweeteners was found among individuals according to several other studies [8]; [15].

Limitations of The Study: The study presents limitations wherein the side effects or weight changes declared by the subjects cannot be entirely attributed to the use of artificial sweeteners only.

VI. CONCLUSION

Our study calls attention to the high rate of unawareness amongst the subjects regarding the side effects of long-term consumption of artificial sweeteners. Some of the subjects with type 2 diabetes do not know the type of artificial sweetener they consumed. Common side effects of artificial sweeteners were eye, dental problems and headache. Nutritional knowledge will have a positive impact on health and can help make wise food choices. Establishing a healthy lifestyle, regular physical activity and judicious consumption of food and artificial sweeteners under the guidance of healthcare professionals should be the focal point.

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