PREPARATION AND EVALUATION OF SYNTHETIC SQUASHES FOR DIABETIC PATIENTS BY USING SORBITOL AS SWEETENER

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ABSTRACT

Synthetic orange and mango squashes were prepared for diabetic patients by using sorbitol instead of sucrose. The products were compared for physical, chemical and sensory evaluation with corresponding samples of squashes procured from the local market as control, Sorbitol squashes were orally administered to diabetic patients to check the effect of sorbitol on blood sugar level, the average increase was17.9-18 mg/dl, two patients were taken as control and they were given only one glass of water, which showed an increase of 9mg/dl. Net increase of10.3mg/dl in the blood sugar level from normal was observed. This increase in the blood sugar level is insignificant and can be easily ignored. The result of this study showed that sorbitol can be used in the squashes for consumption of diabetic patients.

INTRODUCTION

Ready to drink and concentrated soft drinks contain a specific proportion of juice, but at the same time these drinks are very refreshing and very popular. This is because of the hot season of Pakistan lasting for more than six months, which compel people to resort to these beverages. The production, preservation and sale of these drinks are bound to grip commercial importance in our country (Ismail and Rehman, 1995). A variety of beverages have been developed to exploit new marketing niches. Beverage manufacturers try to add proteins, fat, vitamins and minerals.

Fruit beverages are formulated as products containing pulp or juice and water as well as sweetener, flavoring, coloring and preservatives. Although fruit is often a dominant ingredient providing flavor and overall character, these products differ from fruit juices and are labeled accordingly (Hicks, 1990). Sweetness and mouth feel are important elements of fruit drinks. These factors are associated with the added sweeteners used mainly sucrose. Sucrose provides energy for internal and external work and to maintain body temperature. Sucrose is not ideal sweetener for all purposes as sugar adds calories which if one eat more than needed it will increase weight. Weight gain increases the risk of getting heart disease, diabetes, high blood pressure or even some types of cancer. However, if incase of underweight person sugar can add extra calories to gain weight. If the body doesn't make enough insulin like a diabetic, then the sugar one eats increases the sugar in the blood to unhealthy levels as a consequence alternatives are now available to food industry, particularly glucose syrups when one is taking special note of nutritive sweeteners.

Since diabetic patients cannot consume sucrose because it increases their blood sugar level so the sucrose can be substituted for other sweeteners like sorbitol. The special characteristics of sorbitol, and hydrogenated glucose syrup enable them to find different applications in traditional food products.

The first hydrogenated sugar is sorbitol, which has been manufactured in 1930s. Originally this compound was used for vitamin C synthesis, and subsequently for the manufacture of non-ionic surfactants. For diabetics, sorbitol has the advantage of inducing no significant rise of blood glucose after oral administration. Though D-glucose can be produced during sorbitol metabolism, its appearance is generally delayed, so that no significant hyperglycosaemia can be detected. In diabetics single dose of sorbitol must not exceed 10-20g, while the total daily intake has to be limited to 60-80g. When sorbitol is intravenously administered, a rate of 0.5g/h must not be exceeded. Due to the absence of a kidney transport renal loses can reach 10% of the sorbitol administered (Sicard, 1982).

The metabolic capacity of the human organism for Sorbitol seems rather high, liver being able to transform 30-40g of Sorbitol/h. Such level can not be attained by oral administration, given that the diffusion rate of Sorbitol from the intestinal lumen does not exceed 10-20g/h, which means that osmotic diarrhoea may occur (Foster and Mehnert, 1979).

Pure sorbitol is obtained from pure dextrose by hydrogenation when purity of final product exceeds 99.8%. It has 60% sweetness relative to sucrose, it is a better substitute for sucrose in squashes specially made for diabetic patients.

The objectives of this study were to check the comparative acceptability of synthetic sorbitol squashes against fruit squashes available in market and to check the effect of sorbitol on blood sugar level of diabetic patients by using it in synthetic squashes as sweetener.

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MATERIALS AND METHODS

Selection of Experimental Material

The research work was carried out in Food Technology Section, Agriculture Research Institute (ARI) Tarnab, Peshawar.

Experimental materials used in the synthetic squeezes are:
sorbitol, citric acid, sodium citrate, sodium benzoate, orange red color, mango color, orange flavor, mango flavor, cloudifying agent (Sucrose acetate iso-butyrate) and guar gum.

Method of preparation of synthetic Sorbitol squashes

Orange Squash Preparation by Sorbitol

Citric acid 7.5g was dissolve in 700 ml of sorbitol. Then sodium citrate 1g, cloudifying agent 1ml, orange flavor 1ml, orange color 0.25g was added. Finally the preservative i.e. sodium benzoate 1g was added.

Mango Squash Preparation by Sorbitol

Guar gum 8g was added to 700 ml sorbitol in an electric blender, then in the above blended material 3.75g citric acid was added finally sodium citrate 1g, cloudifying agent 1ml, mango flavor 1ml, mango color 0.25g was added. Finally the preservative i.e. sodium benzoate 1g was added.

Comparison between synthetic Sorbitol squashes and fruit squashes Procured from local market

Orange and mango squashes made by sorbitol were compared for physical, chemical and sensory evaluation with corresponding samples of squashes procured from the local market. These fruit squashes procured from local market were taken as control.

Product Analysis

Physicochemical Analysis

***pH*:** pH was measured by pH meter as reported by AOAC (1984).

***Total soluble solids*:** Total soluble solids were measured by hand refractometer as recommended by AOAC (1984).

Sensory Evaluation

Samples were evaluated by panel of 10 judges for the flavor, color, taste and overall acceptability as described by Larmond (1977).

Administration of Synthetic Sorbitol Squashes to Diabetic Patients

Synthetic sorbitol squashes were orally administered to diabetic patients to check the effect of Sorbitol on blood sugar level.

Statistical Analysis

The means in Table II were compared applying DMRT test as recommended by Steel and Torrie (1980).

RESULTS AND DISCUSSION

In present study two sorbitol squashes were made for diabetic patients. Table-1 shows the pH and total soluble solids (TSS) of market sucrose squashes and laboratory prepared Sorbitol squashes.

Table II shows the sensory evaluation grading given by taste panel for color, flavor, taste to the products of market surcorse squashes and laboratory prepared Sorbitol squashes.

Effect of Sorbitol on Blood Sugar Level of Diabetic Patients

Sorbitol squashes were orally administered to 8 diabetic patients of Khyber Teaching Hospital Peshawar. Their blood sugar level was tested at fasting and two hours after administration of squashes. Table III shows that the level of blood sugar content of eight patients at fasting and two hours after oral administration of sorbitol squashes. Each patient was given one glass of squash containing 35g of sorbitol. After consumption of 35g of Sorbitol each patient showed a slight increase in blood sugar level. The maximum increase was 25mg/dl and minimum increase was 15mg/dl. The average increase was 17.9-18 mg/dl.

Two patients were taken as control and they were given only one glass of water. Their blood sugar was also tested at fasting and two hours after the consumption of water. They showed an increase of 9mg/dl. If we subtract this normal increase from maximum, minimum and average value, we get 16mg/dl, 6mg/dl and 9mg/dl respectively. The average of these three quantities which is 10.3mg/dl gave the net increase in the blood sugar level. This slight increase appeared due to the sweetening agent which was used in the preparation of these squashes. According to Sicard (1982) D-glucose can be produce during sorbitol metabolism. So, the consumption of this sweetener slightly increases the blood sugar level.

This increase in the blood sugar level is insignificant and can be easily ignored. The result of this study showed that sorbitol can be used in the squashes for consumption of diabetic patients.

Table I ***Comparison of pH and TSS of samples and market product***

Treatments	pH	TSS
Market product (orange)	2.32	20.5
Sorbitol squash (Orange)	3.05	13.5
Market product (Mango)	2.85	20
Sorbitol squash (Mango)	3.6	12

Table II ***Comparative sensory evaluation***.

Treatments	Color	Flavor	Taste	Overall acceptability
Market product (orange)	6.6ns	4.8c	4.6c	4.8c
Sorbitol squash (Orange)	6.8ns	6.8b	7.0b	6.8b
Market product (Mango)	6.6ns	5.0c	4.8a	5.2a
Sorbitol squash (Mango)	6.8ns	7.0c	7.2b	7.2c

Treatments sharing the same letter in each parameter are statistically non-significant.
DMR ($P<0.05$)
ns = non-significant.

Table III ***Comparison of blood sugar level at fasting and after administration of Sorbitol squashes***

Patients	Blood sugar mg/dl(Fasting)	Blood sugar after squash administration mg/dl	Difference
1	105	130	25
2	225	240	15
3	250	265	15
4	90	105	15
5	105	125	20
6	230	245	15
7	90	110	20
8	250	268	18
Mean	--	--	17.9

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