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EFFECT OF DRIED BOTTLE GOURD PULP SUPPLEMENTED SNACKS ON GLYCEMIC STATUS OF SUBJECTS IN NORMAL HEALTH

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ABSTRACT

Vegetable nutrition and its verified health benefits have caught the attention of both the fitness conscious people and food experts. They are important foods and highly beneficial for the maintenance of health and prevention of diseases. Dietary fiber, the indigestible component in vegetables, is considered to play an important role in human diet and health. In the present study an attempt has been made to formulate a fiber enriched snack Namkeen Sev which is a popular North Indian preparation and was further evaluated for its acceptability, Glycemic Index (GI) and effect on glycemic status of normal healthy subjects so that several other fiber enriched formulations could be worked out and advocated to be consumed for their beneficial effect. Results of the study indicated that addition of dried bottle gourd pulp powder which was used as a source of fiber in development of fiber enriched snack was acceptable and reduced GI of the preparation and there was significant difference ($p < 0.001$) in Increment Area Under Curve of glucose and fiber enriched Namkeen Sev.

Key words: Dietary fiber, glycemic response, glycemic index.

INTRODUCTION

Vegetables are the fresh and edible portions of herbaceous plants. They are important food and highly beneficial for the maintenance of health and prevention of diseases. Many researchers have paid attention towards the Cucurbitaceous family because the fruits, seeds and vegetables are traditionally consumed in various Ayurvedic preparations. *Lagenaria siceraria* (Bottle gourd) is a commonly consumed in India, generally used as a vegetable and for preparation of sweets and pickles, while the wild variety is bitter and is preferred for the medicinal use (Sivarajan and Balchandra, 1994). Dietary fiber, the indigestible cell wall component of plant material, is considered to play an important role in human diet and health (Cummings et.al., 2004).

Dietary fiber is not only used for its nutritional properties, but also for its functional and technological properties. Among many bioactive substances to be found in food such as antioxidants, plant sterols, pro and prebiotics and vitamins – a crucial role is played by dietary fiber. Fiber-rich foods generally have a low glycemic index (GI), although not all foods with a low GI necessarily have high fiber content. Several beneficial effects of low-GI, high-fiber diets have been shown, including lower postprandial glucose and insulin responses, an improved lipid profile, and, possibly, reduced insulin resistance (Riccardi et.al., 2008). The aim of this study was to examine the sensory attributes of the breakfast item developed with addition of dietary fiber obtained in the form of dried bottle gourd pulp powder (DBPP) which generally is a byproduct of bottle gourd juice extraction and to evaluate glycemic response of these fiber supplemented products in normal healthy subjects.

MATERIALS AND METHODS

PREPARATION AND SENSORY EVALUATION OF DBPP SUPPLEMENTED FOOD PRODUCTS

Two samples of Namkeen Sev were prepared with Bengal gram flour, kidney bean Flour, Mint, Garlic, Ginger and Green Chilly. In one sample DBPP (20%) was added and another sample was kept without DBPP. The preparations were then subjected to organoleptic evaluation for various attributes like appearance, texture, colour, taste, flavor and crispiness. A 9 point hedonic scale (Shrilaxmi, 2010) determined organoleptic quality of both the varieties of Namkeen Sev i.e. Namkeen Sev without DBPP and Namkeen Sev with DBPP. These preparations were tasted by the panel of 10 judges. The judges were requested to taste products and award a score with reference to a number of attributes viz. appearance, texture, taste, colour, flavour and crispiness during the tasting session. This procedure was repeated two more times on different days. The samples obtaining nearest similar scores in both replications were considered acceptable.

SELECTION OF SAMPLE

To determine Glycemic Index of individual food items subjects in normal health were contacted. 10 well informed and motivated normal healthy volunteers in the age group of 25-45 years, who were willing to participate in the study, were enrolled to carry out the study.

COLLECTION OF BASELINE DATA & DETERMINATION OF GLYCEMIC INDEX

All the subjects were asked to attend the testing session after a 10-12 hour overnight fast on the day test

was performed, having been instructed not to consume unusually large meals, drink alcohol or exercise vigorously on the previous day, and to avoid cycling or walking to the laboratory. On the first day subjects were given the standard or reference carbohydrate i.e. 50 g glucose dissolved in 300 ml of water. Blood glucose level was measured in capillary whole blood obtained by finger prick (Accu-Chek Roche Diagnostics India Pvt Ltd, Mumbai) in the fasted state at 0 and after 30, 60, 90 and 120 minutes on consumption of the reference (glucose) food. Blood glucose curves were constructed and the incremental area under the curve (IAUC) was calculated for reference food (glucose) by the trapezoidal rule (Gibaldi and Perrier, 1982). Equicarbohydrate quantity of both Namkeen Sev with DBPP and Namkeen Sev without DBPP (containing 50g carbohydrate which was calculated on the basis of carbohydrate content of different food items given in Nutritive value of Indian foods by ICMR (Gopalan et al., 2004) were administered keeping interval of 3 days between administration of reference food as well as each test food.

CALCULATION OF GLYCEMIC

The Glycemic Index (GI) values were calculated by the method of Wolever (1990). The glycemic index was calculated by dividing the IAUC for the test food by the IAUC for the reference food and multiplying by 100 for each individual. The following formula was used:

$$GI = \frac{\text{IAUC for tested Food}}{\text{IAUC for Reference Food}} \times 100$$

IAUC – Incremental Area Under the blood glucose response Curve.

The final glycemic index for each test food was calculated as the mean of the respective GI's of the ten individuals.

STATISTICAL ANALYSIS

The data was analyzed using sigma stats package (3.5).

RESULTS AND DISCUSSION

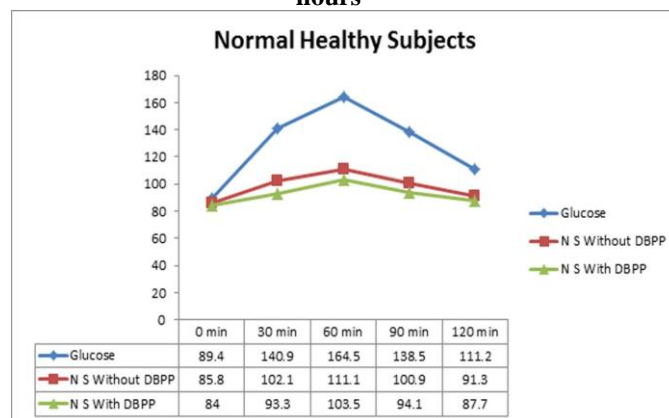
Namkeen Sev is one of the popular North Indian snacks traditionally prepared with Bengal gram flour. In the present study Namkeen Sev was prepared with Bengal gram with an idea to develop a product which is nutritionally improved by addition of kidney bean flour and fiber obtained from bottle gourd. Two varieties were made, one served as control and was prepared without addition of DBPP and other variety was prepared by addition of 20% DBPP making it rich in fiber. The results of sensory attributes indicated that the Namkeen Sev prepared without addition of 20% DBPP obtained highest scores for sensory parameters. Although both the preparations were equally good with reference to taste and flavor but varied with reference to appearance, color, texture and crispiness and overall acceptability of DBPP enriched Sev was good.

Table 1- Mean scores for sensory attributes

Sensory Attributes	Namkeen Sev without DBPP BGF+KBF(50:50)	Namkeen Sev with DBPP BGF+KBF+DBPP(40:40:20)
Appearance	8	6.8
Taste	9	9
Colour	8.2	6.3
Texture	8.8	6.7
Flavour	8.4	8
Crispness	8.6	7.9
Overall acceptability	8.5	7.45

Administration of glucose and both the test foods to normal healthy subjects indicated that after intake of 50 g glucose, blood glucose level increased in the time period of 0 to 60 minutes and reached a peak value at 60 minutes and then decreased progressively till the end of the observation period of 2 hours. The mean plasma glucose responses after the consumption of glucose and the test foods in normal subjects are shown in Figure 1.

Figure 1 -Mean plasma glucose level on consumption of reference and test foods at 30 minute interval for 2 hours



N S: Namkeen Sev

DBPP: Dried Bottle Gourd Pulp Powder

The mean IAUC of glucose was found to be 310.9 mg/dl. Mean IAUC of Namkeen Sev with DBPP and Namkeen Sev without DBPP was noted to be 67.9 mg/dl and 99.0 mg/dl respectively. The mean IAUC of glucose was significantly greater than those of Namkeen Sev with DBPP ($p < 0.001$) and Namkeen Sev without DBPP ($p < 0.001$). On the basis of ability of a food to raise blood glucose level foods may be divided into three groups: foods with low GI (GI= 55 or less), foods with medium GI (GI= 69) and foods with high GI (GI=70 or more) (Foster-Powell *et al.*, 2002).

The present study demonstrated that DBPP added to Namkeen Sev had benefits to its consumers. It increased dietary fiber intake and reduced the glycemic index value of the snack. Bengal gram and kidney beans are main ingredients of NS are reported to have blood glucose lowering effect. According to a study administration of kidney bean extract appeared to be a novel and potentially effective method for reducing the GI of a food without modifying its ingredient profile (Jay *et al.*, 2009). Findings of yet another study corroborate with findings of our study and reported that consumption of Bengal gram dal and

rajmah (kidney beans), when compared with dextrose, showed decline in postprandial plasma glucose levels than wheat and rice (Dilawari et.al., 1981). Similarly a study on

determination of GI of pulses found that Bengal gram and kidney beans had low glycemic index and glycemic load (Imran et.al., 2008).

Table 2- IAUC & GI of food items in normal healthy subjects

Reference & Test food	Time interval in minutes					IAUC	GI
	0	30	60	90	120		
Glucose	89.4	140.9	164.5	138.5	111.2	311	-
Namkeen Sev without DBPP BGF+KBF(50:50)	85.8	102.1	111.1	100.9	91.3	99.08*	32.82
Namkeen Sev with DBPPBGF+KBF+DBPP(40:40:20)	84	93.3	103.5	94.1	87.7	67.96*	21.83

- Blood glucose level after administration of reference and test foods at 30 minute interval
- * P< 0.001

In the present study addition of DBPP to NS further lowered the GI of the snack. Soluble dietary fibers have been shown to alter food texture, structure, and viscosity, and, therefore, the rate of starch degradation and digestion, (Brennan, 2005) which is related to the regulation of postprandial glucose levels. It is possible that decreased glycemic index of such fiber enriched products would lead to smaller increases in blood glucose, and thus reduce blood glucose and HbA1c levels if consumed for longer period of time. Our findings are further supported by a study which links high fiber intake to a decreased risk of diabetes (Meyer et.al., 2000 and Wannamethee et.al., 2009). Intake of pulses and fiber should be emphasized especially today where incidence of diabetes is continuously increasing.

CONCLUSION

Results obtained in the present study indicate that DBPP supplemented Namkeen Sev may serve as health improving snack. Development and consumption of fiber enriched products should be encouraged and masses should be made aware about various ways of incorporation of fiber in their diet.

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