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Value addition, nutritional status and shelf-life of cocoa, cardamom and sugar free dietary fiber supplement

MEENAKSHI TRILOKIA[1], ANURADHA GANDHOTRA[2], RAKESH KUMAR[3] and PARSHANT BAKSHI[4]

Post Graduate Department of Food Science & Technology, Government College for Women, Gandhi Nagar, Jammu; and
Sher-e-Kashmir University of Agricultural Sciences & Technology of Jammu; and
Faculty of Agriculture, Main Campus, Chatha, Jammu 180 009

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ABSTRACT

At present, supplementation of food is of great interest because of increasing nutritional awareness among the consumers. Supplementation with bengal gram is one way to meet the needs of dietary fiber particularly in convenient foods. Hence, an attempt has been made to develop value added dietary fiber supplement with acceptable sensory attributes. Three types of dietary fiber supplements, viz. cardamom flavor, cocoa flavor and sugar free flavor were developed. Cardamom flavor dietary fiber supplement was developed by the addition of bengal gram, fox nut, almonds, powdered sugar and cardamom powder at different levels. Cocoa flavor dietary fiber supplement was developed by the addition of cocoa powder with same ingredients whereas, the sugar free dietary fiber supplement was prepared without the addition of sugar with same ingredients. The nutritional and storage quality evaluation of the best accepted dietary fiber supplement were estimated. The findings indicated that cocoa flavor dietary fiber supplement prepared with bengal gram (25.6 g), fox nut (25.6 g), almonds (12 g) powdered sugar (28 g) and cocoa powder (8.8 g), cardamom flavor dietary fiber supplement with same ingredients at same ratio was best accepted, as compared to the sugar free dietary fiber supplement. Among the various types of dietary fiber supplements, cocoa flavor dietary fiber supplement was most accepted. There were significant increases in appearance, flavor, taste, over all acceptability and moisture; whereas, fat, total ash, crude fiber found to be constant. The developed dietary fiber supplement has a shelf-life of two and half months.

Key words: Cardamom flavor, Cocoa flavor, Dietary fiber

Dietary fiber is the edible part of the plants, or similar carbohydrates, that are resistant to digestion and absorption in the small intestine (James and Mark 2010). However, research during the past few years has shown that fiber in food act as a bulking agent. It affects the metabolic rate of lipids and sugar, control body weight (Slavin 2008), blood sugar and insulin level (Nazare 2011). Recent trend in the market is to introduce a range of products containing high dietary fiber level to the consumer for all age groups. Products such as bread, breakfast cereals, etc. are available in the markets with high dietary fiber contents. Most nutritionists recommend 12 g of fiber/1 000 Kcal (i.e. 30 g of fiber/day) and the proportion of soluble to insoluble should be 1:2 through varied sources (Prosky and De Vires 1992). American Diabetes Association (1994) has recommended 25-38 g of dietary fiber per day for person suffering from diabetes.

The Food and Drug Administration [FDA] has approved two health claims for dietary fiber. The first claims that on decreasing the consumption of fats (<30% of calories) along with an increase in consumption of dietary fiber from fruits, vegetables and whole grains may reduce some types of cancer (FDA Health claims, 1993). A diet having high insoluble fiber in it also decreases the risk of diabetes. It is mostly found in whole grains, nuts, wheat bran and vegetables. Eating high fiber food is not only important but also a healthy diet (Gjenero 2012).

In this study, an attempt was made to prepare "dietary fiber supplement" by the addition of bengal gram, almonds and fox nut. Bengal gram is an important pulse which ranks the highest both in production and consumption in India (Bhama and Sadana 2002). Secondary processing like soaking, cooking, sprouting and fermentation improves the bio-availability of nutrients by partly and wholly removing some of the anti-nutritional factors and toxic constituents (Singh *et al*. 1989, Bishnoi and Khetrapal 1994 and Singh

[1]Junior Research Fellow (e mail: ocidmeenakshi@gmail.com), RRSS, Raya, SKUAST-J, [2]Associate Professor and Head (e mail: ocidmeenakshi@gmail.com), P G Department of Food Science and Technology, G.C.W, Gandhi Nagar, Jammu, [3]Junior Scientist (e mail: rakesh_sangwal@yahoo.com), Division of Fruit Science, RRSS, Raya, [4]Associate Professor, Fruit Science, SKUAST-J

1995). Moreover, its seed have good source of protein, dietary fiber, several essential nutrients and vitamin-C. On sprouting, grains, legumes and seeds converts into super foods by becoming extremely rich source of protein, fiber and vitamin-B (Primal seeds, USDA, www.Primalseeds.org/sprouting.htm). Fox nut is a non-cereal food. It is very popularly known as Makhana used in traditional medicine to cure diseases such as kidney problems, chronic diarrhoea, excessive leucorrhoea, etc. (Das 2006). Fox nut act as a tonic for the treatment of Leucorrhoea (Bakuni *et al*. 1969). The sweet preparation with germinated and roasted crushed bengal gram are usually taken by all the ages but to make the preparation more appetizing, fibred, fox nut and almonds were added. In the diet of hyperlipidemic subjects, almonds significantly reduce coronary heart diseases risk factors because of the non-fat and mono-unsaturated fatty acid components of the nut (Jenkins and Kendall 2002). On other hand, addition of cardamom powder, cocoa powder and powdered sugar is used to add flavor and to ensure the acceptability among the consumer. Cocoa powder is a rich source of iron, fiber and magnesium and also reduces cholesterol level, high blood pressure, cancer and heart diseases (Swami 2012).

MATERIALS AND METHODS

Bengal gram, fox nut and almonds constituted the main ingredients and other ingredients such as powdered sugar, cocoa powder and cardamom powder were added either to add variety and flavor. All the ingredients after suitable processing were stored in laminates for further use.

Preparation of Bengal gram flour: The bengal gram was soaked in sufficient water for overnight. Next day, water was be drained off. The bengal gram was left as such for the germination process. The germinated sprouts were spread evenly on aluminum trays and dried in a hot-air oven at 105°C for 3 hours. The dried bengal gram was roasted on low flame for 3-5 minutes till it changed to light brown colour and developed roasted flavor. The roasted bengal gram was ground in an electric grinder to make fine flour.

Preparation of fox nut flour: The fox nut was roasted on low flame for 2 minutes. The roasted fox nut was ground into flour.

Preparation of almond flour: The almonds were ground in an electric grinder to make fine powder flour.

Three types of dietary fiber supplement were developed namely cardamom flavor, cocoa flavor and sugar free with bengal gram, almonds and fox nut. In all three, amount of cardamom and cocoa flavor were kept constant. Three variations of dietary fiber supplement were developed. The first variation comprised of Bengal gram flour (25.6 g), fox nut flour (25.6 g), almond flour (12.0 g), powdered sugar (28 g) and cocoa powder (8.8 g), the second variation comprised of Bengal gram flour (25.6 g), fox nut flour (25.6 g), almond flour (12.0 g), powdered sugar (28 g) and cardamom powder (8.8 g) and in the third variation Bengal gram flour (33.6 g), fox nut flour (33.6 g), almond flour (24 g), cocoa powder (8.8 g) were taken. After mixing properly, all the ingredients in the required quantity were subjected to sensory as well as nutritional evaluations.

The value added dietary fiber supplement were evaluated for appearance, flavor, taste and overall acceptability using a 9-point hedonic scale by a panel of 10 semi-trained judges of age in between 22–45 yrs. The scores were based on the following criteria: like extremely: 9; like moderately: 7-8; like slightly: 5-6; dislike slightly: 3-4; dislike extremely: 0-2 from Department of Food Science and Technology, Government College for Women, Gandhi Nagar, Jammu, J & K, India.

The proximate principles namely moisture, total ash, fat and crude fiber content of all the three variations of dietary fiber supplement were assessed following the standard methods (Ranganna, 2003). Each selected, developed value added dietary fiber supplement was analyzed in triplicate for moisture, total ash, fat and crude fiber content.

Triplicate samples of value added dietary fiber supplement (100 g) were packed in packaging materials of aluminum laminated pouches and heat sealed and stored at ambient conditions of 28–30°C for two and half months. The storage qualities of cookies were evaluated in terms of visual observations, moisture uptake and sensory attributes at 15 days intervals.

The analysis of variance (ANOVA) was used to find out significant differences between the variations for different sensory quality of developed dietary fiber supplement at intervals. Completely random design (CRD) was applied and data obtained for each parameter was subjected to statistical analysis to determine the level of significance at $P< 0.05$.

RESULTS AND DISCUSSION

Trials for standardization of dietary fiber supplement carried out for inclusion of different ingredients revealed that dietary fiber supplement developed by addition of cocoa flavor and sugar was observed highly acceptable.

Sensory evaluation of dietary fiber supplement

Sensory evaluation is usually performed towards the end of the product development or formulation cycle and is carried out to assess the reaction of judges towards the product and they rate the liking on a scale. Scores for sensory evaluation of dietary fiber supplement (Table 1, 2 and 3) showed that sensoric attributes differed significantly due to variation and storage.

There was a declining trend in appearance score during storage. The maximum score (8.5) was assigned to fresh dietary fiber supplement (Variation I, II and III) that decreased to 8.3, 8.3, 8.1, 8.1 after 30, 45, 60, 75 days respectively (Table 1, 2 and 3). The deteoriation of appearance/color was possibly due to the absorption of moisture from the atmosphere and oxidation of fats. It is observed that there is natural trend of color findings with progressive storage that affects the appearance (Manley 2002)

Table 1 Acceptability scores of dietary fiber supplement cocoa flavor (variation I)

Storage period (No. of days)	Appearance	Taste	Flavor	Overall acceptability
0 Day	8.50	8.60	8.60	8.60
15 Days	8.50	8.60	8.60	8.60
30 Days	8.30	8.40	8.40	8.30
45 Days	8.30	8.40	8.40	8.30
60 Days	8.10	8.20	8.20	8.10
75 Days	8.10	8.20	8.20	8.10
CD (P= 0.05)	NS	NS	NS	0.40

Table 2 Acceptability scores of dietary fiber supplement Cardamom flavor (variation II)

Storage period (No. of days)	Appearance	Taste	Flavor	Overall acceptability
0 Day	8.50	8.60	8.50	8.60
15 Days	8.50	8.60	8.50	8.60
30 Days	8.30	8.30	8.30	8.30
45 Days	8.30	8.30	8.30	8.30
60 Days	8.10	8.10	8.00	8.10
75 Days	8.10	8.10	8.00	8.10
CD (P= 0.05)	NS	0.40	NS	0.40

Table 3 Acceptability scores of dietary fiber supplement sugar free (variation III)

Storage period (No. of days)	Appearance	Taste	Flavor	Overall acceptability
0 Day	8.50	7.80	7.80	7.80
15 Days	8.50	7.80	7.80	7.80
30 Days	8.30	7.60	7.60	7.60
45 Days	8.30	7.60	7.60	7.60
60 Days	8.10	7.40	7.40	7.40
75 Days	8.10	7.40	7.40	7.40
CD (P= 0.05)	NS	NS	NS	NS

Perceptions of flavor are synthesis of taste and smell impressions, along with texture and are even influenced by appearance (Sharif *et al*. 2009). Mean scores for flavor of fresh dietary fiber supplement (Table 1, 2 and 3) revealed that variation I and II were liked by the judges obtained maximum scores i.e. (8.6, 8.5) whereas, variation III got minimum score (7.8) which tend to decrease after 30, 45, 60 and 75 days. It has been observed that during storage of cookies, moisture absorption results in deterioration of flavor due to oxidation of fats (Wade 1988, Sharif *et al.* 2005).

The taste is a sensation perceived by the tongue and influenced by texture, flavor and composition of food. Mean for taste revealed that variation I got maximum score (8.6) followed by variation II (8.6) and variation III (7.8), respectively. Maximum scores were assigned (8.6, 8.6 and 7.8, respectively) from 0 day which gradually decreased as 8.4, 8.4, 8.2, 8.2 (variation I) and 8.3, 8.3, 8.1, 8.1 (variation II) and 7.6, 7.6, 7.4, 7.4 (variation III) after 30, 45, 60, 75 days of storage, respectively.

The results pertaining to mean score for the overall acceptability of fresh dietary fiber supplement (variation I, II and III) revealed that from the overall acceptability of dietary fiber supplement variation I and II got highest score (8.6) as compared to variation III (7.8) which tends to decreased as 8.1, 8.1 and 7.4 during 75 days storage (Table 1, 2 and 3). It is evident from the results that variation I and II were more appealing as compared to variation III. Trials for standardization of dietary fiber supplement carried out for inclusion of different ingredient.

Nutrient composition

The nutritional composition of dietary fiber supplement consists of moisture contents (6.5%), fat content (1%), total ash contents (4%) and crude fiber content (32.6%) of all variations. The similar finding has been observed by Wondimu and Malleshi (1996).

Storage quality

The visual observation of stored dietary fiber supplement at the end of 75 days indicated no insect infestation. On the other hand, there was a gradual deterioration in its appearance. The dietary fiber acquired a lighter shade as the storage period increased (variation I, II and III). Packaging materials have a role in determination of shelf-life in terms of moisture uptake and altering the levels of free fatty acid content thereby affecting the acceptability (Surekha *et al*. 2013).

The present investigation showed that moisture content increased from 6-6.5% as storage period progressed; whereas, the ash content, fat content and crude fiber content remained constant from 0 day to 75 days. The dietary fiber supplement possessed good storage graph quality which is an important aspect of consumer acceptability.

In present investigation, efforts were made to develope value added dietary fiber supplement. The nutritional quality was enhanced due to added protein through bengal gram flour. The dietary fiber supplement (variation I) would be highly acceptable as compared to other ones on the basis of above observation, it was concluded that the dietary fiber supplement (variation I) could be considered the best from both the nutritional and sensory point of view.

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