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Nutrition analysis and cooking quality of finger millet (*Eleusine coracana*) vermicelli with hypoglycaemic foods

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ABSTRACT

An experiment was conducted to formulate the diabetic vermicelli and to analyse nutritional composition and cooking quality of finger millet vermicelli blended with different hypoglycaemic foods. Vermicelli was extruded by mixing finger millet flour (45%), defatted soyflour (10%) and whole wheat flour (32.5-40%) with different levels of hypoglycaemic foods viz Madhunasini (5%), Amruthballi (3%), Ashwagandha (5%), Jamun fruit seed powder (5%) and fenugreek seed powder (12.5%) each in different formulations. The cooking quality such as cooked weight of diabetic vermicelli with hypoglycaemic foods ranged from 258.0 to 292.4 g. Maximum cooked weight was found for vermicelli with Amruthballi and minimum with Madhunasini. The mean cooking loss of 9.6 per cent was recorded. Vermicelli with germinated fenugreek seeds showed highest protein content whereas vermicelli with Amruthballi showed highest amount of calcium and iron. The statistical data with respect to cooking quality and nutrient composition showed significant difference at 5 per cent level.

Keywords: Finger millet; medicinal plants; cooking quality; nutritional composition; diabetics

INTRODUCTION

Finger millet is an important millet crop of Karnataka and is a major source of energy and proteins in the diet of rural population. It is nutritionally superior to wheat and rice with respect to protective nutrients such as dietary fibre, calcium and protein and has well balanced amino acid profile and a good source of methionine, cystine and lysine (Rai 2000). Relatively higher proportion of carbohydrate which is in the form of non-starchy polysaccharides and dietary fibre along with low fat provide several nutritional and physiological benefits namely hypocholestrolaemic and hypoglycaemic effects by slow release of glucose to the blood stream during digestion and reduce transit time. The fat from finger millet contains higher proportion of unsaturated fatty acids and supply essential fatty acids. Finger millet is especially rich in calcium containing as much as 344 mg per 100 g. Millet grains are also rich in important

vitamins such as thiamine, riboflavin and niacin besides minerals like iron and phosphorus. Hence products prepared from finger millet are known for their health benefits, special type of starch, fibre and other unique properties.

As people are becoming very health conscious and would like to consume foods containing high fiber, low fat and other protective nutrients. Vermicelli made from millet contains high fiber and low fat and is expected to find place among health foods. To extend the benefits to diabetics by blending of different medicinal plants like Madhunasini (*Gymnema sylvestre*), Amruthballi (*Tinospora cardifolia*), Ashwagandha (*Withania somnifera*) and other hypoglycaemic foods like Jamun seed powder (*Syzigium cumini* L) and fenugreek (*Trigonella foenum graecum*) seeds powder with finger millet for the formulation of diabetic vermicelli. On account of these the present investigations were done on formulation of diabetic vermicelli. Cooking quality and nutritional composition of diabetic vermicelli products from finger millet with medicinal plants were analysed.

MATERIAL AND METHODS

Processing of ingredients

Finger millet and wheat were thoroughly cleaned and ground in laboratory mini mill to obtain wholegrain flour and sieved using 60 mm mesh. Madhunashini and Amruthballi leaves were soaked in 2 per cent salt water for 10 minutes and thoroughly washed in tap water. Leaves were dried in an oven till moisture free. Dried leaves were powdered and sieved using 60 mm mesh. The Ashwagandha roots and Jamun fruit seeds were broken into small pieces and powdered. Fenugreek seeds were soaked in water for 12 h. Excess water was discarded and the soaked seeds were tied in muslin cloth and kept in closed container for germination at room temperature for 10-12 h. The germinated seeds were dried for 6 h at 60^0C, powdered and sieved using 60 mesh.

Formulation of finger millet vermicelli with defatted soy flour

The basic finger millet vermicelli with defatted soy flour was prepared using 45 per cent of finger millet flour, 45 per cent of wheat flour and 10 per cent of defatted soy flour that were premixed for 2 minutes in a laboratory model (Dolly pasta machine) cold extruder. Further mixing was continued for 9-10 minutes using hot water at 75^0C. Water used for the dough was at 36 per cent level. The dough was extruded using a brass die with 1 mm holes spread over the entire surface at 2 mm apart. Cutter was attached to the extruder and the extruded vermicelli was cut to 3 cm long.

Extrusion of finger millet vermicelli with hypoglycaemic foods

The composite flour with different hypoglycaemic foods was premixed for 2

Table 1. Formulation of finger millet vermicelli with hypoglycaemic foods

Type	Ingredients			
	Finger millet flour (%)	Whole wheat flour (%)	Defatted soy flour (%)	Hypoglycaemic flour (%)
FMV(control)	45	45	10	-
FMV with Ashwagandha Powder	45	40	10	5
FMV with Madhunasini leaf powder	45	40	10	5
FMV with Jamun fruit seed Powder	45	40	10	5
FMV with germinated fenugreek seed powder	45	32.5	10	12.5
FMV with Amruthballi leaf powder	45	42	10	3

FMV: Finger millet vermicelli

minutes in a laboratory model (Dolly pasta machine) cold extruder. Further mixing was continued for 9-10 minutes using hot water at 75^{0}C. Water used for the dough was at 36 per cent level. The dough was extruded as mentioned above.

Drying of finger millet vermicelli with hypoglycaemic foods

The extruded vermicelli was dried till it reached 9 per cent moisture. The samples were brought to room temperature and packed in polyethylene pouches.

Cooking qualities of diabetic vermicelli

A 50 g sample was cooked in 500 ml boiling water for 10 minutes each in duplicate and the cooked vermicelli was drained over a screen to separate the liquid portion and weighed. Results were expressed as g/100 g of dry vermicelli. Hydrated volume was measured by using measuring cylinder and expressed as ml/ 100 g of dry vermicelli sample. The total solids or cooking loss in the liquid portion was determined by evaporating a known

quantity of drained liquid over water bath followed by drying in an oven at $105^0C \pm 1$ for 3 h. The weighed solid was expressed in percentage (Anon 1993).

Analysis of nutritional composition

Finger millet vermicelli with hypoglycaemic foods was powdered and sieved through 40 mesh and stored in air tight sample containers. Analysis was done for the nutrients namely moisture, protein, fat, energy, fat, crude fiber, ash, calcium and iron by using standard procedures (Anon 1980). Analysis was done in duplicates. Chemicals used for analysis were of analytical grade. Results were expressed on dry weight basis.

Statistical analysis

Two-way analysis of variance was applied on the means of two replications for different nutrient components of finger millet vermicelli with different hypoglycaemic foods and for cooking quality. Formulations of finger millet vermicelli with hypoglycaemic foods are give in Table 1.

RESULTS AND DISCUSSION

The mean cooked weight, cooking loss, water uptake and water remained for finger millet vermicelli with different hypoglycaemic foods were 278.9 g, 9.6 per cent, 690.3 ml and 309.7 ml respectively (Table 2). The highest cooked weight of 292.4 g was recorded for finger millet vermicelli with Amruthballi leaf powder with water uptake of 731.5 ml. However lowest cooked weight and highest water uptake with minimum water remained was for finger millet vermicelli with Madhunasini leaf powder. Cooked weight of finger millet vermicelli with Ashwagandha and Jamun fruit seed powder and also control were found to be same with respect to water uptake and water remained. The finger millet vermicelli with germinated fenugreek seed powder comparably showed minimum water uptake and maximum water remained and the cooked weight being 263.5 g.

Finger millet vermicelli blended with Ashwagandha showed minimum cooking loss however cooking loss was found almost similar in finger millet vermicelli with Amruthballi, Jamun fruit seed powder and Madhunasini with a mean cooking loss of 9.6 per cent. Sowbhagya and Ali (2001) reported that vermicelli with less than 10 per cent solid loss had better overall acceptability and better appearance, texture and flavour. Statistically significant differences at 5 per cent were found with respect to cooked weight, cooking loss, water uptake and water remained.

Nutritive value of finger millet vermicelli with different hypoglycaemic foods

The mean moisture content of finger millet vermicelli with different hypoglycaemic foods (Table 3) was 2.4 per

Table 2. Cooking quality of finger millet vermicelli with different hypoglycemic foods

Hypoglycemic foods	Cooked weight (g/100g)	Cooking loss (%)	Water uptake (ml/100g)	Water remained (ml/100g)
Finger millet vermicelli (control)	283.8	10.7	686.5	313.5
FMV with Ashwagandha	288.5	8.7	692.0	308.0
FMV with Amruthballi	292.4	9.0	731.5	268.5
FMV with germinated fenugreek seeds	263.5	10.2	631.0	369.0
FMV with Madhunasini	258.0	9.6	749.5	250.5
FMV with Jamun fruit seeds	287.5	9.1	651.5	348.5
Mean	278.9	9.6	690.3	309.7
SEm±	4.096	0.2148	12.57	12.57
F value	121.094*	87.265*	62.702*	62.702*
$CD_{0.05}$	11.353	0.595	34.84	34.84

FMV: Finger millet vermicelli

cent. The highest moisture content of 3.4 per cent was observed in vermicelli with Madhunasini leaves. However lower moisture content (1.1%) was observed in vermicelli with Ashwagandha. The moisture content of other variations was found to be between 1.1 and 3.4 per cent. The average protein content of finger millet vermicelli with hypoglycaemic foods was 18.21 g. The highest protein content of 20.15 per cent was found in finger millet vermicelli with germinated fenugreek seeds. However Saibaba and Raghuram (1997) reported fenugreek seeds to contain more protein content and also found to be proportional to the ingredients used in the finger millet vermicelli.

Fat content of the finger millet vermicelli with hypoglycaemic foods was almost in the same range of 0.88 to 1.18 g with a mean value of 1.04 g. The ash

Table 3. Nutritive value of finger millet vermicelli with different hypoglycaemic foods (per 100 g)

Type	Moisture (%)	Protein (g)	Fat (g)	Ash (g)	Crude fiber (g)	Carbohydrate (g)	Energy (kcal)	Calcium (mg)	Iron (mg)
Finger millet vermicelli (control)	2.9	16.65	1.18	2.3	3.6	73.43	371	223.8	7.53
FMV with Ashwagandha	1.1	17.37	1.11	2.5	6.7	71.26	365	256.6	9.15
FMV with Amruthballi	2.3	18.40	1.14	2.7	4.7	70.83	367	278.3	12.86
FMV with germinated fenugreek seeds	2.0	20.15	0.88	2.5	5.8	68.76	364	200.1	9.55
FMV with Madhunasini	3.4	19.00	1.09	2.8	4.4	69.36	363	222.1	11.52
FMV with Jamun fruit seeds	2.7	17.80	0.88	2.4	6.2	70.57	361	179.3	11.32
Mean	2.4	18.21	1.04	2.5	5.2	70.7	365	226.7	10.32
SEm±	0.22	0.345	3.87	4.97	0.34	0.461	1.018	10.00	0.533
F value	710.46*	60.53*	13.04*	31.06*	29.06*	22.01*	6.99*	129.25*	293.98*
$CD_{0.05}$	0.609	0.956	10.72	13.78	0.942	1.278	2.821	27.71	1.477

FMV: Finger millet vermicelli

contents of finger millet vermicelli with Madhunasini or Amruthballi leaves were found to be higher. However ash contents in finger millet vermicelli with Ashwagandha and germinated fenugreek seed powder were similar. The control finger millet vermicelli had comparatively lower ash content.

The highest crude fiber content was observed in finger millet vermicelli with Ashwagandha followed by Jamun fruit seed blend. This could be due to the presence of higher fiber in roots and seeds. However in vermicelli with germinated fenugreek seeds it was 5.8 per cent. Raghuram et al (2003) reported that seeds of fenugreek are a rich source of fiber. It contains mucilaginous fiber and total fiber to the extent of 20 and 50 per cent respectively. The crude fiber contents of vermicelli with Amruthballi and Madhunasini were similar but were found to be higher than finger millet vermicelli (control).

The carbohydrate and energy contents of control finger millet vermicelli were more than finger millet vermicelli with hypoglycaemic foods. This may be because of substitution of carbohydrate source with hypoglycaemic foods. However finger millet vermicelli with germinated fenugreek seeds had lower carbohydrate and energy than other blends. The reason could be substitution of whole wheat flour with slightly higher proportion of germinated fenugreek seed powder (12.5%).

The calcium and iron contents of finger millet vermicelli with Amruthballi was higher. Lower calcium content was found in finger millet vermicelli with Jamun fruit seed powder. However lower iron content was found in finger millet vermicelli (control). Statistically significant difference at 5 per cent level was found for all the nutrients.

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