



E-ISSN: 2278-4136
P-ISSN: 2349-8234
JPP 2017; 6(6): 2359-2362
Received: 12-09-2017
Accepted: 14-10-2017

S Chandrabhabha

M Sc Community Science (Food Science & Nutrition),
Department of Community Science, College of Horticulture, Kerala Agricultural University, Vellanikkara, Kerala, India

Dr. Sharon CL

Assistant Professor, Department of Community Science, College of Horticulture, Kerala Agricultural University, Vellanikkara, Kerala, India

Dr. Seeja Thomachan Panjikkar

Assistant Professor, Department of Community Science, College of Horticulture, Kerala Agricultural University, Vellanikkara, Kerala, India

Dr. Aneena ER

Assistant Professor, Department of Community Science, College of Horticulture, Kerala Agricultural University, Vellanikkara, Kerala, India

Beena C

Professor, AICRP of Medicinal and Aromatic Plants, College of Horticulture, Kerala, Agricultural University, Vellanikkara, Kerala, India

Correspondence**S Chandrabhabha**

M Sc Community Science (Food Science & Nutrition),
Department of Community Science, College of Horticulture, Kerala Agricultural University, Vellanikkara, Kerala, India

Development and nutritional qualities of vermicelli prepared from barnyard millet and *Ekanayakam* root bark

S Chandrabhabha, Dr. Sharon CL, Dr. Seeja Thomachan Panjikkar, Dr. Aneena ER and Beena C

Abstract

The present study was conducted to develop *Ekanayakam* vermicelli and *uppuma* with barnyard millet. Based on sensory evaluation, the vermicelli and *uppuma* prepared with 40% barnyard millet flour, 58% whole wheat flour and 2% *Ekanayakam* root bark powder was highly acceptable with a mean score of 7.75 and 7.73 respectively. The *Ekanayakam* incorporated barnyard millet vermicelli contains moisture (7.78%), protein (8.09g 100g⁻¹), fat (1.91g 100g⁻¹), fibre (3.45g 100g⁻¹) carbohydrate (50.47g 100g⁻¹) and energy (263.44Kcal 100g⁻¹). The formulated vermicelli was rich in calcium (67.90 mg 100g⁻¹), iron (13.99 mg 100g⁻¹), magnesium (101.72 mg 100g⁻¹) and potassium (228.76 mg 100g⁻¹). Development of novel products with barnyard millet may help the consumers to add variety to their diet and improve human health. Hence, there is ample scope for the development of various designer foods from barnyard millet.

Keywords: *Ekanayakam*, Barnyard millet, Vermicelli, *Uppuma*, Functional foods

Introduction

Millet is the underutilised cereal grains that can grow in adverse agro climatic condition. They are famine reserves which play a major role in the food and nutritional security of millions of people to reduce malnutrition in poor sections of Indian community. Among them, barnyard millet (*Echinochloa frumentacea*) is one of the hardiest millets which can withstand extreme weather conditions. They are short duration crops and grow within six weeks. Barnyard millet is commonly known as Japanese barnyard millet, *sanwan*, *sawa*, *shama*, *samu*, *shamula*, *sanwa*, *kuthiravaali* and *kavadapullu* (Lohani and Pandey, 2008) [10]. Barnyard millet is highly nutritious compared to other cereals due to the fair amounts of protein (12%) that is highly digestible (81.13%) coupled with low carbohydrate content (58.56%) of slow digestibility (25.88%) (Veena, 2003) [18]. Barnyard millet is a nature's gift to recover from diabetes as it has a low carbohydrate of slow digestibility and also well suited for acidity and celiac disease due to the presence of all essential amino acids. Barnyard millet can be considered as a functional food which has a beneficial effect towards human health.

Functional foods are defined as ingredients that provide an additional physiological benefit beyond their basic nutrition (IFIC, 2006) [6]. The functional foods are foods prepared with functional ingredients in addition to common ingredients to maintain good nutritional status. The consumption of functional food in our diet improves immune system, prevent from lifestyle diseases and maintain good physical and mental health (Chaturvedi, 2001) [3]. The market demand of functional food products have increased in 21st century (Hilliam, 2000) [5].

Ekanayakam (*Salacia reticulata*) is a medicinal plant native to Sri Lanka. Traditionally people of India, Sri Lanka and Thailand utilised the roots and stems of *Ekanayakam* to cure diabetes and reduce weight. Now a days, *Ekanayakam* is used effectively as food supplements. *Salacia reticulata* extract were consumed to reduce fasting blood glucose and glycated haemoglobin level in diabetic patients (Jayawardena *et al.*, 2005) [8].

Vermicelli can be prepared by adding a variety of functional ingredients and such a food product can be used as potential vehicle to carry nutraceutical properties (Naik, 2004) [11]. Development of functional product with nutritional and sensory properties may be beneficial to improve human health. Hence, the present study aims to develop barnyard millet based vermicelli incorporated with *Ekanayakam* root barks with improved nutritional and organoleptic qualities.

Materials and methods

Procurement of the raw materials

The barnyard millet was purchased from the farmers of Pollachi in Tamil Nadu. The other ingredient like whole wheat flour was collected from local market of Thrissur. *Ekanayakam* root barks were collected from local dealers of medicinal plants, Thrissur.

Preparation of raw materials

Barnyard millet was cleaned, washed, soaked in water for 10 hours with intermittent change in water for period of 4 hours. The excess water has been drained out and allowed to germinate under a wet cloth for a period of 24 hours. The germinated barnyard millet was de-vegetated, powdered and sieved to acquire uniform flour. The *Ekanayakam* root barks was powdered and sieved to obtain a uniform fine powder.

Preparation of *Ekanayakam* root barks incorporated barnyard millet vermicelli

Ekanayakam root barks incorporated barnyard millet vermicelli was prepared as per the procedure of Ranganna *et al.* (2014) [15]. Vermicelli prepared with different combination of barnyard millet flour, whole wheat flour and *Ekanayakam* root barks whereas treatment T₀ were served as control (Table 1) The ingredients were mixed thoroughly and the dough was prepared with water and the prepared dough was extruded through manual extruder. The extruded vermicelli was dried in a cabinet drier for 4 to 5 hours. The dried vermicelli was packed in a polyethylene pouches.

Table 1: Treatments for the preparation of *Ekanayakam* root barks incorporated barnyard millet vermicelli.

Treatments	Combinations
T ₀	Control (100% Refined wheat flour)
T ₁	80% BM + 15% WWF + 5% E
T ₂	80% BM + 18% WWF + 2% E
T ₃	70% BM + 25% WWF + 5% E
T ₄	70% BM + 28% WWF + 2% E
T ₅	60% BM + 35% WWF + 5% E
T ₆	60% BM + 38% WWF + 2% E
T ₇	50% BM + 45% WWF + 5% E
T ₈	50% BM + 48% WWF + 2% E
T ₉	40% BM + 55% WWF + 5% E
T ₁₀	40% BM + 58% WWF + 2% E

(BM – Germinated Barnyard millet flour, WWF – Whole Wheat Flour, E – *Ekanayakam* root barks)

Preparation of *uppuma*

Uppuma was prepared from all the combination of *Ekanayakam* root barks incorporated barnyard millet vermicelli. For the preparation of *uppuma* 25gm of the vermicelli were roasted, cooked with 90ml of the water and 5g of the other ingredients (mustard, onion, green chilli and curry leaves).

Organoleptic evaluation

The sensory evaluation was carried out for the prepared vermicelli and *uppuma* using a nine point hedonic scale with a panel of 15 judges considering the 6 sensory parameters (appearance, colour, flavor, texture, taste and overall acceptability).

Nutritional qualities

The nutritional qualities of best selected *Ekanayakam* root barks incorporated barnyard millet vermicelli was analysed as per standard procedure in Table 2.

Table 2: Nutritional qualities of *Ekanayakam* root barks incorporated barnyard millet vermicelli.

Nutritional qualities	Methods
Moisture	A.O.A.C (1980) [11]
Protein fat and fibre	Sadasivam and Manickam (1997) [16]
Energy	Gopalan <i>et al.</i> (1989) [4]
Calcium, iron, and magnesium	Perkin – Elmer (1982) [13]
Potassium	Jackson (1973) [7]

Statistical analysis of the data

The statistical analysis was carried out for the mean scores obtained for organoleptic evaluation were evaluated by Kendall's Coefficient of Concordance (W).

Result and discussion

Organoleptic evaluation

Ekanayakam root barks incorporated barnyard millet vermicelli and *uppuma* were subjected to sensory evaluation and results are represented in Table 2 and 3.

The Table 3 showed that treatment T₁₀ (40 per cent barnyard millet, 58 per cent whole wheat flour and 2 per cent *Ekanayakam* root barks) had the mean score and mean rank score for appearance (7.77 and 9.00), colour (7.91 and 9.23), flavour (7.80 and 8.07), texture (7.73 and 8.87), and taste (7.81 and 9.40) and the overall acceptability (7.75 and 9.67).

Table 3: Mean score for organoleptic evaluation of *Ekanayakam* root barks incorporated barnyard millet vermicelli.

Treatments	Sensory Attributes					
	Appearance	Colour	Flavour	Texture	Taste	Overall acceptability
T ₀	8.84 (10.93)	8.86 (10.80)	8.71 (10.53)	8.84 (10.67)	8.77 (10.71)	8.82 (10.53)
T ₁	5.16 (3.13)	5.46 (3.17)	6.28 (3.10)	5.98 (3.37)	5.51 (3.50)	5.55 (2.60)
T ₂	5.31 (3.30)	5.35 (4.13)	6.15 (3.17)	5.98 (3.53)	5.71 (3.60)	5.71 (3.37)
T ₃	5.44 (4.40)	5.57 (3.83)	6.20 (4.17)	6.04 (4.17)	5.88 (3.90)	5.82 (3.37)
T ₄	5.75 (4.10)	5.91 (3.27)	6.51 (4.63)	6.11 (4.13)	6.02 (4.00)	6.24 (4.50)
T ₅	6.13 (4.63)	6.08 (3.57)	6.57 (4.93)	6.22 (4.87)	6.64 (4.17)	6.11 (4.33)
T ₆	6.86 (6.08)	6.48 (5.60)	6.91 (6.30)	6.67 (4.90)	6.77 (6.20)	6.60 (5.93)
T ₇	6.44 (5.23)	6.57 (6.07)	6.93 (6.40)	6.88 (5.77)	7.22 (5.03)	6.84 (5.67)
T ₈	7.28 (6.70)	7.08 (7.77)	7.33 (6.97)	7.15 (6.90)	7.48 (7.20)	7.02 (7.73)
T ₉	7.71 (8.53)	7.64 (8.57)	7.46 (7.73)	7.62 (8.83)	7.66 (8.83)	7.44 (8.70)
T ₁₀	7.77 (9.00)	7.91 (9.23)	7.80 (8.07)	7.73 (8.87)	7.81 (9.40)	7.75 (9.67)
Kendalls W	.630**	.729**	.520**	.613**	.612**	.724**

Value in parentheses is mean rank score based on Kendall's W

** Significant at 1% level

Table 4: Mean score for organoleptic evaluation of *Ekanayakam* root barks incorporated barnyard millet *uppuma*.

Treatments	Sensory Attributes					
	Appearance	Colour	Flavour	Texture	Taste	Overall acceptability
T ₀	8.22 (10.97)	8.86 (10.67)	8.71 (10.60)	8.82 (10.73)	8.77 (10.70)	8.22 (10.80)
T ₁	5.11 (2.13)	5.40 (2.80)	6.15 (3.63)	6.08 (3.60)	5.51 (2.33)	5.55 (2.07)
T ₂	5.17 (2.27)	5.42 (3.07)	6.02 (3.03)	6.00 (2.73)	5.71 (2.50)	5.71 (2.60)
T ₃	5.37 (2.27)	5.44 (3.37)	6.06 (3.23)	6.06 (3.37)	5.88 (3.37)	5.82 (3.07)
T ₄	5.68 (3.63)	5.77 (3.77)	6.37 (4.07)	6.08 (3.30)	6.02 (4.23)	6.24 (4.60)
T ₅	6.06 (4.93)	6.02 (4.77)	6.44 (4.53)	6.15 (3.70)	6.08 (3.87)	6.11 (4.00)
T ₆	6.62 (6.47)	6.42 (5.77)	6.91 (6.60)	6.60 (6.13)	6.64 (6.30)	6.60 (6.43)
T ₇	6.51 (6.03)	6.57 (6.30)	6.86 (6.17)	6.84 (6.70)	6.77 (6.47)	6.84 (6.80)
T ₈	7.22 (7.81)	7.06 (7.17)	7.20 (7.13)	7.11 (7.60)	7.22 (7.90)	7.02 (7.27)
T ₉	7.64 (9.17)	7.60 (9.07)	7.40 (8.20)	7.57 (8.90)	7.48 (8.97)	7.42 (8.97)
T ₁₀	7.71 (9.27)	7.84 (9.27)	7.67 (8.80)	7.71 (9.23)	7.06 (9.37)	7.73 (9.40)
Kendalls W	.863**	.729**	.628**	.728**	.809**	.829**

Value in parentheses is mean rank score based on Kendall's W

** Significant at 1% level

Based on organoleptic evaluation of *Ekanayakam uppuma*, treatment T₁₀ was highly acceptable with a mean score of 7.71 for appearance and texture, 7.84 for colour, 7.67 for flavor, 7.06 for taste and 7.73 for overall acceptability. The mean rank score was also found to be highest in T₁₀ of 9.27 for appearance and colour, 8.80 for flavour, 9.23 for texture, 9.37 for taste and 9.40 for overall acceptability. The statistical analysis revealed that there was a significant agreement among the judges for all the sensory attributes of the prepared vermicelli and *uppuma* with a combination of barnyard millet flour, whole wheat flour and *Ekanayakam*.

Li *et al.* (2008) reported that *Ekanayakam (Salacia reticulata)* root and stem was effective medicinal herb with functional properties to treat diabetes and obesity. Radha and Amrithaveni (2009) [14] carried out a study on *Salacia reticulata*. They proved that consumption of 2gm of *Salacia reticulata* powder per day for 3 months helps to manage diabetes.

Nutritive value

The nutritive value of formulated *Ekanayakam* root barks incorporated barnyard millet vermicelli is presented in Table 5. The *Ekanayakam* root barks incorporated barnyard millet vermicelli was observed to have a moisture content of 7.78%, protein of 8.09g 100g⁻¹, fat of 1.91g 100g⁻¹, fibre of 3.45g 100g⁻¹ and energy of 263.44 Kcal 100g⁻¹. The *Ekanayakam* root barks incorporated barnyard millet vermicelli was rich in calcium (67.90 mg 100g⁻¹), iron (13.99 mg 100g⁻¹), magnesium (101.72 mg 100g⁻¹) and potassium (228.76 mg 100g⁻¹).

Table 5: Nutritive value of *Ekanayakam* root barks incorporated barnyard millet vermicelli.

Nutritional qualities	<i>Ekanayakam</i> root barks incorporated barnyard millet vermicelli (100 g ⁻¹)
Moisture (%)	7.78
Protein (g)	8.09
Fat (g)	1.91
Fibre (g)	3.45
Energy (Kcal)	263.44
Calcium (mg)	67.90
Iron (mg)	13.99
Magnesium (mg)	102.50
Potassium (mg)	228.76

The results are in agreement with the findings of Ranganna *et al.* (2014) [15], who formulated foxtail millet, barnyard millet and refined wheat flour based vermicelli and observed a

moisture content of 6.88 per cent, 8.85 per cent and 9.74 per cent respectively. Begum *et al.* (2017) [2] showed that finger millet based vermicelli was a good source of protein (13 per cent) and negligible amount of fat (1.4g 100g⁻¹). They also reported that vermicelli and *uppuma* prepared with finger millet observed to have a low calorific value of 214 Kcal 100g⁻¹ and 221.8 Kcal 100g⁻¹. Nousheen (2013) [2] reported a similar study on the pasta product developed with millet flour, cassava modified starch and green gram dhal with a crude fibre content of 5.21 to 6.92 g 100 g⁻¹ and the pasta with wheat flour had a fibre content of 2.00 g 100 g⁻¹. Thilagavathi (2015) [17] reported that noodles prepared with a combination of millets, soya bean, horse gram and egg albumin had a calcium content ranging from 51.70 to 180.65mg 100 g⁻¹, iron content varying from 5.86 to 7.82mg 100 g⁻¹, magnesium ranging from 125.97 to 137.45mg 100 g⁻¹, and potassium varied from 238.31 to 290.60mg 100 g⁻¹.

Conclusion

The study concluded that barnyard millet vermicelli and *uppuma* formulated with 40 per cent of barnyard millet flour, 58 per cent of whole wheat flour and 2 per cent of *Ekanayakam* root barks was highly acceptable in terms of all the sensory attributes like appearance, colour, flavour, texture, taste and overall acceptability. The formulated vermicelli was also found to be highly nutritious which may improve human health. Hence, there is ample scope for the development of various designer foods from barnyard millet.

Acknowledgement

College of Horticulture, Kerala Agricultural University

References

1. AOAC. Official and Tentative Methods of Analysis. Edn 13, Association of Official Analytical Chemists, Washington. D. C, 1980, 1018.
2. Begum JM, Begum. SS, Pandey A. Development of finger millet vermicelli and sensory evaluation of finger millet vermicelli based value added products contemporary Research in India, 2017; 7(2):1-7.
3. Chaturvedi A. Designer foods for the health conscious consumer. In: Devi NL, Kader, V and Sumathi S (eds), Emerging Trends in Functional Foods. Acharya Ranga Agricultural University, Hyderabad, 2001, 269-277.
4. Gopalan C, Sastri BVR, Balasubramanian SC. Nutritive Value of Indian Foods. Indian Council of Medical Research, Hyderabad, 1989, 114.
5. Hilliam M. Functional food: how is the market? World

- Food Ingredients, 2000; 12:50-53.
6. IFIC. [International Food Information Council]. 2006. Functional Foods. Accessed from <http://www.foodinsight.org>. Accessed on 1 March, 2017.
 7. Jackson ML. Soil Chemical Analysis. Prentice Hall of India Private Ltd, New Delhi, 1973, 299.
 8. Jayawardena MHS, Alwis NMW, Hettigoda V, Fernando DJS. A double blind randomised placebo controlled cross over study of a herbal preparation containing *Salacia reticulata* in the treatment of type 2 diabetes. Journal of Ethnopharmacology. 2005; 97:215-218.
 9. Li Y, Huang THW, Yamahara J. *Salacia* root, a unique ayurvedic medicine, meets multiple targets in diabetes and obesity. Life Science. 2008; 82:1045-1049.
 10. Lohani UC, Pandey JP. Effect of moisture content on physical properties of barnyard millet. Pantnagar Journal of Research. 2008; 6(1):148-154.
 11. Naik R. Value addition of underutilised foods. Annual Report No. 106, Nutrition Society of India, Hyderabad, 2004, 117.
 12. Nousheen I. Development of low glycemic functional pasta products. Ph.D. thesis Tamil Nadu Agricultural University, 2013, 301.
 13. Perkin-Elmer. Analytical Methods for Atomic Absorption Spectrophotometry. Perkin- Elmer Corporation, USA, 1982, 114.
 14. Radha R, Amrithaveni M. Role of medicinal plant *Salacia reticulata* in the management of type II diabetic subjects. Ancient Science of Life, 2009; 29(1):14-16.
 15. Ranganna B, Ramya KG, Kalpana B. Development of small millet cold extruded products (vermicelli and pasta). Mysore Journal of Agricultural Science. 2014; 46(2):300-305.
 16. Sadasivam S, Manickam A. Biochemical Methods for Agricultural Sciences. Edn 8, Wiley Eastern Ltd, New Delhi, 1997, 223.
 17. Thilagavathi T. Optimization of technology for millet and pulse blended low glycemic functional pasta foods for metabolic disorders. Ph.D. thesis, Tamil Nadu Agricultural University, Coimbatore, 2015, 315.
 18. Veena B. Nutritional, functional and utilisation studies on barnyard millet. M.Sc. (Thesis). University of Agricultural Science. Dharwad. 2003, 72.