

FORMULATION OF INSTANT HERBAL PORRIDGE MIXTURES FROM RANAWARA (*Cassia auriculata* Linn) LEAVES

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Abstract

Cassia auriculata Linn, leaves based herbal porridge is a well reputed dietary remedy for treating diabetes in Sri Lanka. However there are no any commercial instant porridge mixtures containing *C. auriculata* leaves. This study was conducted to develop acceptable *C. auriculata* based instant herbal porridge by using a dehydration method. Each ingredient was separately dehydrated to 6% moisture content, ground, sifted and blended according to an Ayurvedic formula for diabetics. The recipe was slightly modified based on a preliminary sensory analysis. Two formulations were prepared with and without coconut powder and packed in packed in metalized polyethylene (12 micron metalized PET layer + 30 micron LDPE layer). Formulated products were evaluated for physic-chemical, antioxidant, sensory properties. Changes in water activity, moisture content, peroxide value and free fatty acid value within two months storage periods were observed to determine the keeping quality of the product. Formulated recipe without coconut powder contains *C. auriculata* leaves 38.86%, crushed rice 45.97%, garlic 9.45%, onion 4.09% and pepper 1.64%. Similarly, formulated recipe with coconut powder contained 46.84% coconut powder in dry weight base. The products without coconut powder contains moisture 4.28±0.04%, fat 4.83±0.12%, ash 3.07±0.04%, protein 10.80±0.03%, fiber 6.39±0.05% and carbohydrate 74.91±1.66%. Total phenolic content and total antioxidant capacity of without coconut powder product were 476.24GAE mg/g and 715.52AAE mg/g respectively, whereas the phenolic content and antioxidant capacity of the product with coconut powder were 240.14 GAE mg/g and 452.30 AAE mg/g respectively. Sensory results indicated there were no significant differences among homemade, commercial and formulated products in terms of overall acceptability. Within two months period both products did not exceed safe peroxide level (20 mEq/kg) and FFA level (1.2%). In conclusion, an organoleptically acceptable instant herbal porridge mixture from Ranawara leaves was obtained.

Key words: *Cassia auriculata*, Herbal Porridge, Dehydration, Antioxidant, Proximate compositions

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1. INTRODUCTION

Herbal porridge is a traditional semi solid food which normally Sri Lankans took it on an empty stomach before solid foods are taken for breakfast. This wonder food is indigenous to Sri Lanka and is made up of green leaves, semi-liquid, nutritionally wholesome food-preparation, which is less in fat but rich in micro nutrients and phytochemicals (Maddumage, 1990). It increases the immunity system of the humans and makes them physically and mentally healthier. Herbal porridge was also used as a remedy for many diseases (Yapa, 2000). Daily practice of drinking herbal porridge is one of the best habits had with the early generation who had

an immense efficiency and a long life in their life patterns (Rupasinghe, 2013). People in modern world have great awareness with their personal health and wellbeing so traditional healthy food items such as herbal porridge have been showing good demand. Therefore instant herbal porridge made up of medicinally important green leaves having demanded by the modern society mainly because of the nutritional and medicinal values as well as for the convenience. In commercial production of instant food items extrusion cooking and drum drying are feasible advanced technologies (Gunathilake & Gamlath, 2002).

Diabetes mellitus is a non communicable disease but it is one of the five leading causes of deaths in the world. Most of the people in

third world countries cannot bear cost of the drugs, these types of medicinal plant gives healthy alternative for drugs without side effects as drugs (Joy, *et al.*, 2012). Consumption of some types of herbal leafy porridges is well reputed dietary remedy among Sri Lankans in treating diabetes (Senadheera and Ekanayaka, 2013). In traditional Ayurveda which practices in Sri Lanka, herbal porridge made up of Ranawara (*Cassia auriculata* Linn) has been recommended for those suffering from diabetes and many more diseases (Yapa, 2000). *C. auriculata* is commonly used from earliest period to treat diabetes mellitus (Gupta *et al.*, 2011). The leaves of *Cassia auriculata* are having potential in the development of medication for diabetes due to its anti-hyperglycemic and lipid-lowering action (Gupta, *et al.*, 2009). *C. auriculata* have shown very good antioxidant properties and they are rich in phenolics and carotenoids (Gunathilake & Ranaweera, 2016) and also possess anti-inflammatory properties too (Gunathilake *et al.*, 2018a). Further, fatty acid esters, fatty acid amide, triterpene, diterpene alcohols and phytol are the phytoconstituents which are isolated from leaf of this leaves (Joy, *et al.*, 2012). Furthermore, antioxidants present in porridge made with *C. leaves* exceeds the phenolic in green or black tea and antioxidants reduce oxidative damage to tissues by reacting with free radicals, chelating catalytic pro-oxidant metals and by scavenging reactive oxygen species. In addition to the antioxidant effects, these phytochemicals also have other functions which contribute to attenuate complications related to diabetes (Senadheera *et al.*, 2013). There are few types of instant herbal porridge mixtures, which are prepared from common green leaves already commercially available in the market, but products formulated with *C. auriculata* leaves are not available in the current market. So it has great potential to catch the consumer demand. Therefore, this study was carried out to develop Instant herbal porridge mixtures and to evaluate nutritional,

physicochemical, sensory properties and shelf life quality.

2. MATERIALS AND METHOD

2.1 Material

Cassia auriculata leaves and other raw materials for the herbal porridge were collected in Makandura, Sri Lanka. All the chemicals used were of analytical grade.

2.2. Recipe Formulation

Formulation was based on a recipe described by an indigenous medical practitioner and the recipe was slightly modified according to the preliminary sensory evaluation to optimize the ingredients amount for the formulation. All ingredients except coconut milk were separately dehydrated and reduced moisture content up to 6%. For coconut milk, commercially available spray dried coconut powder (brand: Nestle) was added. Dehydrated ingredients were ground; sifted and powdered and blended according to the recipe obtained. Two types of instant porridge mixtures were prepared with commercial coconut powder and without adding commercial coconut powder. Blanched *C. auriculata* leaves was dried at 55°C for 12 hours and ground and sifted and 92% - 95% particle sizes remain less than 250 microns and 4% - 6% remain 425 microns. Rice was dried in the oven at 80°C for 3 to 4 hours. Garlic and onion powder was prepared according to the method described in Gunathilake and Gamlath (2002). Black pepper powder was prepared according to Peter (2007). All ingredients were blended according to the recipe. Two types of instant porridge mixtures were prepared with or without adding commercial coconut powder (Table 1). For reconstitution of the dried mixture, 950 mL of water or coconut milk were added and boiled for 5-10 minutes. Dehydrated mixture was packed in metalized polyethylene (12 micron metalized PET layer + 30 micron LDPE layer) with vacuumed sealing for storage.

Table 1. Blending ratio of dehydrated ingredients both mixtures and reconstitution methods

	Mixture which prepared with coconut powder contains	Mixture which prepared without coconut powder
Leaves powder *	20.66 %	38.86 %
Crushed rice *	24.44 %	45.97 %
Garlic powder *	5.02 %	9.45 %
Onion powder *	2.17 %	4.09 %
Pepper powder *	0.87 %	1.64 %
Spray dried coconut powder	46.84 %	---
Reconstitution of porridge mixtures	Added in to 950 ml hot water and boiled for 5 to 10 minutes (for 6 servings)	Added in to 600 ml hot water and 350 ml of first extract of coconut milk (70 g scraped coconut + 350 ml water) then boiled for 5 to 10 minutes (for 6 servings)

* Dry weight base

2.3. Determination of water activity and pH value

Water activity was measured using water activity meter (model Novasina ms1 – aw). The pH of the water phase of the herbal porridge sample was measure using a calibrated pH meter (model ST 3000/ USA).

2.4. Evaluation of antioxidant properties

a) Extract Preparation

Exactly 0.25 g of porridge sample was weighed and taken in to a centrifuge tube containing 10 ml of methanol. Centrifuge tube was mixed properly with a vortex meter for 5 minutes. Then the sample was centrifuged at 4500 rpm for 10 minutes. Supernatant solution was collected in to a labeled amber coloured bottle and stored in a freezer until the tests are performed.

b) Determination of Total Phenolic Content (TPC)

The total phenolic content was determined using Folin–Ciocalteu assay as described by Gunathilake (2012).

c) Determination of total antioxidant capacity

The total antioxidant capacity was determined as described by Gunathilake et al. (2018b).

2.5. Sensory evaluation

Sensory evaluation of the products was conducted through 9-point hedonic scale with 4 types of products; dehydrated product reconstituted with water; dehydrated product reconstituted with coconut milk; homemade

product and commercially available products. All products were evaluated by 15 semi trained panel according to the appearance, aroma, taste, consistence and overall acceptability.

2.6. Shelf life determination

While packaging material evaluation also shelf life of the product was determined by evaluating peroxide and free fatty acid increment. Shelf life determination data was shown only for selected packaging method. Chloroform extract was prepared for the analysis of peroxide and free fatty acid values during storage. Briefly, five grams of sample was added in to clean dry 100.00 mL volumetric flask. Exactly 50.0 mL of chloroform was added into the flask and the flask was shaken for five minutes. Then, another 50.0 mL of chloroform was added in to the flask and shake for one minute to extract fat in sample. The peroxide value of the sample in dry basis was analysed using the method described in Gunathilake (2005). Free fatty acid content was analyzed using the method of Gunathilake (2005).

2.7. Statistical analysis

The results of tests conducted with three replications were statistically Minitab 15 software at 95% confidence level ($P < 0.05$) and the results were presented as mean \pm standard deviation.

3. RESULTS AND DISCUSSION

3.1. Recipe formulation

This study was based on formulation of instant herbal porridge mixtures with medicinally important leafy vegetables, *C. auriculata* leaves. Recipe was formulated basically based on knowledge of traditional Ayurvedic medicine. According to the literature *C. auriculata* contains antioxidant (Gunathilake and Ranaweera, 2016) and anti-inflammatory properties (Gunathilake et al., 2018c). For the formulation of instant herbal porridge mixture ingredients were dehydrated and the fresh ingredient contain somewhat higher amount of moisture, dehydration time-temperature combinations were selected based on previous findings. Moisture content and the water activity of all dried ingredients are shown in Table 2. All dehydrated ingredient contain less than 6% moisture content and lower water activity levels and therefore, the mixture has higher shelf life. Rice having large particle size than other ingredients, so it induce consumer acceptance due to its mouth feel. Porridge with large rice particle have showed lower glycemic index (GI) than porridge with fine particles

(Senadheera & Ekanayake, 2013). This porridge mixture is mainly targeted for people who are suffering from diabetes.

3.2. Proximate compositions of the herbal porridge mixtures

Table 2 summarizes data on proximate analysis of the both types of porridge mixtures and *C. auriculata* leaves. It has shown that with and without coconut contained $7.68 \pm 0.068\%$ and $10.80 \pm 0.090\%$ crude protein respectively. Red raw rice was selected for the formulation because rice bran contains more protein than milled rice (Houston and Kohler, 1972). As shown in Table 3, porridge mixture with coconut contains significantly more energy.

3.3. Antioxidant properties of the final products

Instant herbal porridge mixtures with coconut contains about 240.14 GAE mg/g phenolic content and 452.30 AAE mg/g antioxidant capacities, whereas the porridge mixture without coconut contains higher phenolic content (476.24 GAE mg/g) and antioxidant capacity (715.52 AAE mg/g), because of dilution of antioxidant in the mixture with coconut powder.

Table 1. Moisture content, water activity and particle size of dehydrated ingredients

Ingredient	Moisture content	Water activity (at 32°C)	Particle size
Ranawara leaves	5.14± 0.04 %	0.395 – 0.398	92 – 95 % (< 250 microns)
Red rice	5.05± 0.07 %	0.256 – 0.312	95 – 97 % (< 1180 microns)
Garlic	5.38 ±0.05 %	0.274	94 – 95 % (< 850 microns)
Onion	5.18 ±0.06 %	0.232	92 – 94 % (< 850 microns)
Black pepper	4.92 ±0.08 %	0.215	96 % (< 850 microns)

Table 3. Proximate compositions of instant herbal porridge mixtures and *C. auriculata* leaves

Porridge mixtures	Moisture	Protein*	Fat*	Fiber*	Ash*	Carbohydrate
1. Instant herbal porridge with coconut	4.80%	7.68%	32.84%	3.47%	2.53%	53.48%
2. Instant herbal porridge without coconut	4.28%	10.80%	4.83%	6.39%	3.07%	74.91%
3. <i>C. auriculata</i> leaves	78.45%	5.63%	3.14%	12.87%	8.16%	70.20%

Table 0. Antioxidant properties of porridge mixtures and Ranawara leaves

	Porridge with spry dried coconut	Porridge without spry dried coconut
Total phenolic (GAE mg/g)	240.14	476.24
Total antioxidant capacity (AAE mg/g)	452.30	715.52

GAE - Gallic Acid Equivalent, AAE - Ascorbic Acid Equivalent

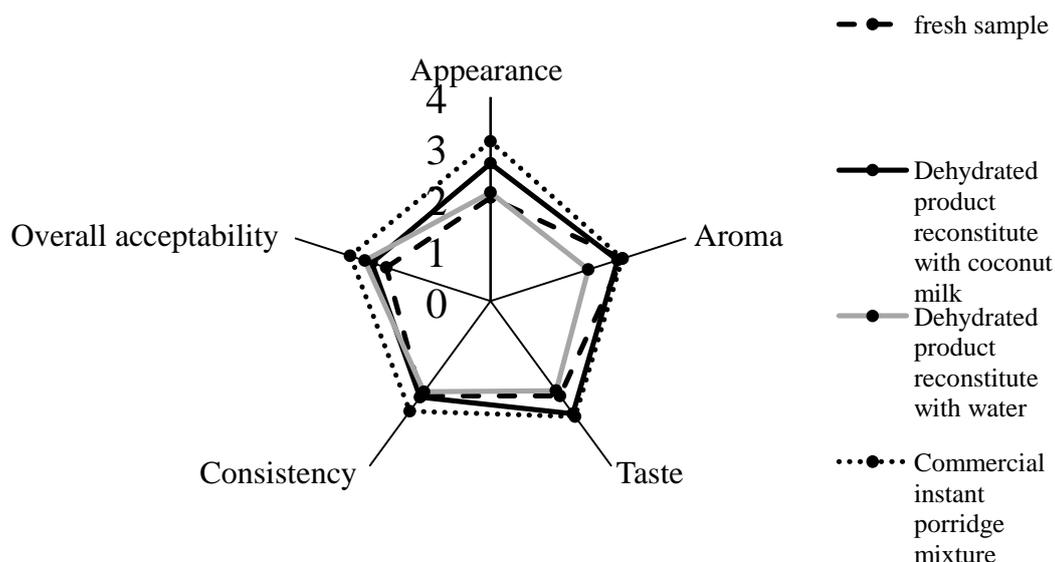


Fig.1. Mean score for sensory properties of porridge mixtures

3.4. Sensory evaluation

There was significant differences ($p < 0.05$) in aroma, taste, consistency and overall acceptability of 4 products evaluated in sensory properties; dehydrated product reconstituted with water, dehydrated product reconstituted with coconut milk, homemade product and commercially available products. As shown in the Figure 1, homemade product (herbal porridge prepared with fresh ingredients) obtained highest acceptance in overall acceptability. However, both herbal mixtures with and without coconut have showed higher acceptability for all sensory attributes compared with the commercial product.

3.5. Shelf life determination

Changes in moisture %, water activity, peroxide value and free fatty acid values were monitored during storage period of 48 hours at

room temperature. Figure 2 shows the changes in moisture content (A) and water activity (B) within two months period. Moisture content of the both types of porridge mixtures packed in metalized polyethylene with vacuumed sealing method was observed below 10% and the water activity was below 0.6 within the storage period. According to Jay (1997), water activity below 0.6 is desirable for dried foods as it retard microbial growth during storage. It was found that the changes in peroxide values of the both types of porridge mixture were negligible even after 2 months period. Similarly the free fatty acid values of the instant porridge mixtures remain unchanged during two months period. About 0.2% and 0.4% free fatty acids values were observed in instant herbal porridge mixtures without coconut and with coconut samples respectively.

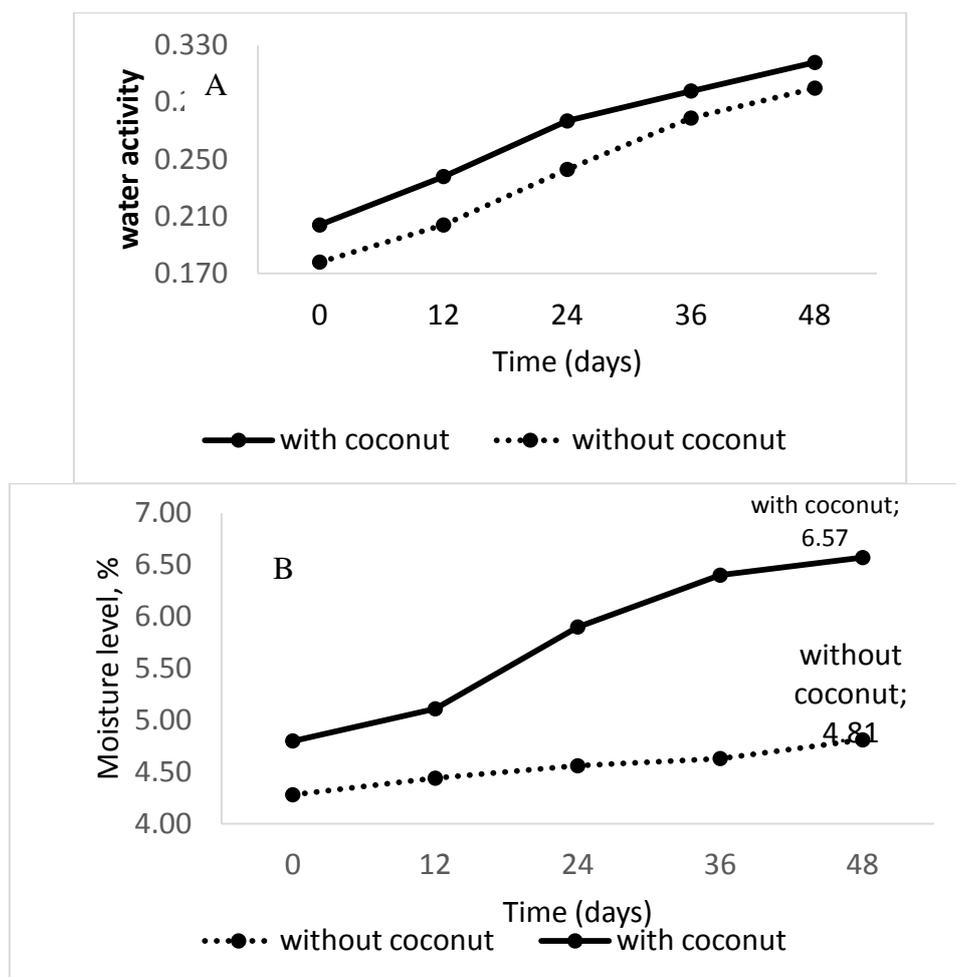


Fig. 2. Changes in water activity (A) and moisture content (B) in instant herbal porridge mixtures during storage

4. CONCLUSION

This study shows that there is a possibility of formulating an instant herbal porridge mixture with *Cassia auriculata* leaves. The product is organoleptically acceptable and possesses antioxidative properties. The product packed in metalized polyethylene (12 micron metalized PET layer + 30 micron LDPE layer) can be stored minimum of 48 days at ambient temperature.

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5. REFERENCES

- [1]. Gunathilake, K. & Gamlath, G., 2002. Development of Instant Herbal Porridge Mixtures from Heenbowitiya (*Osbeckia octandra* L.) Leaves. *Tropical Agricultural Research*, 14(2002), pp. 351 - 356.
- [2]. Gunathilake, K.D.P.P. & Ranaweera, K.K.D.S. (2016). Antioxidative properties of 34 green leafy vegetables. *Journal of Functional Foods*, 26, 176-186.
- [3]. Gunathilake, K.D.P.P. (2005). Application of hurdle technique to preserve fresh scraped coconut at ambient and refrigerated storage. *Journal of the National Science Foundation of Sri Lanka*, 33(4).
- [4]. Gunathilake, K. D. P. P., Ranaweera K. K. D. S. and Rupasinghe, H. P. V. (2018)a. Effect of in vitro gastro-intestinal digestion of selected leafy vegetables on anti-inflammatory

properties. Annals of Food Science and Technology, 19(1)

[5]. Gunathilake, K. D. P. P., Ranaweera K. K. D. S. and Rupasinghe, H. P. V. (2018)b. Change of polyphenols, carotenoids, and antioxidant capacity following simulated gastrointestinal digestion and dialysis of selected edible green leaves: Journal of Food Chemistry, 245.

[6]. Gunathilake, K.D.P.P., Ranaweera, K.K.D.S. and Rupasinghe, H.P.V. (2018)c. Influence of Boiling, Steaming and Frying of Selected Leafy Vegetables on the In Vitro Anti-inflammation Associated Biological Activities. Plants, 7(1), p.22.

[7]. Gunathilake, K.D.P.P. (2012). A fruit based functional beverage designed to reduce the risk of cardiovascular disease. M.Sc. Thesis, Dalhousie University, Canada

[8]. Gupta, S., Sharma, S. B., Bansal, S. K. & Prabhu, K. M., (2009). Antihyperglycemic and hypolipidemic activity of aqueous extract of *Cassia auriculata* L. leaves in experimental diabetes. Journal of Ethnopharmacology, p. 499–503.

[9]. Gupta, S., Sharma, S. B., Singh, U. R. & Bansal, S. K. (2011). Salutory Effect of *Cassia auriculata* L. Leaves on Hyperglycemia Induced Atherosclerotic Environment in Streptozotocin Rats. Cardiovasc Toxicol, 11(2011), pp. 308 - 315.

[10]. Howitz, W.(2000). Official Methods of Analysis of AOAC International. 17th Edition, Vol.1.

[11]. Joy, V., Peter, M. J., Raj, J. Y. & Ramesh, (2012). Medicinal values of *Avaram* (*Cassia auriculata*): A review. International Journal of Current Pharmaceutical Research, 4(2012).

[12]. Maddumage, S., (1990). *Osu Kada* Osu Pan. first ed. Thalawathugoda: Jayaweera .

[13]. Peter, K. V., (2007). Horticulture Science Series - 5. 1 st ed. New Delhi: New India publishing agency.

[14]. Rupasinghe, U., 2013. Ceylontoday. [Online] Available at: <http://www.ceylontoday.lk/18-47352-news-detail-be-green-before-breakfast-a-glassful-of-herbal-gruel.html> [Accessed 30 march 2015].

[15]. Senadheera, S. P. A. S., Ekanayaka, S. & Wanigatunge, C., 2013. Antioxidant potential of green leafy porridges. Ceylon Medical Journal, 59(1), pp. 4-8.

[16]. Senadheera, S. & Ekanayake, S., 2013. Development of a marketable rice based herbal porridge suitable for diabetics from *Scoparia dulcis*. Agricultural Science, 4(2013), pp. 81 - 84.

[17]. Siriwardana, T., Bamunuarachchi, A. & Perera, P., 1998. Application of Extrusion Cooking Technology in the Manufacture of Herbal Porridge and some Observations on Product Composition and Shelf Life. Tropical Agricultural Research, 10(1998), pp. 203 - 213.

[18]. Yapa, P. A., (2000). *Kadata Upan* Thurulatha. First ed. Colombo: Tharangi.