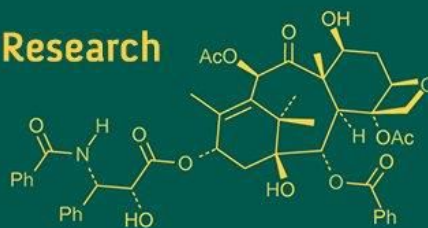
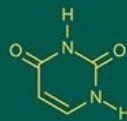
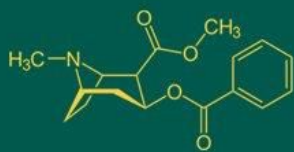


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Nutritional properties of browntop millet (*Brachiaria ramosa*) based ribbons

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Abstract

Browntop millet (*Brachiaria ramosa*) is called as "Korale" in Kannada, its cultivation is found in various regions of Karnataka, Andhra Pradesh, and Tamil Nadu in southern India. It is a good source of protein, dietary fiber, minerals and is gluten free. Exploring the nutritional properties of browntop millet enables its incorporation in various value-added products. Realizing this, brown top millet was incorporated in preparation of *ribbons* in current study. It is thin, crispy, crunchy, nutritious and spicy snack made from browntop millet flour (60%) combined with rice flour (20%) and puffed Bengal gram flour (20%) along with spices by using *ribbon* maker. The present study found that the browntop millet ribbons is a rich source of crude protein with 13.61 g/100g, crude fibre with 7.20 g/100 g, dietary fibre with 12.43 g/100 g and minerals (calcium - 88.71 mg, iron - 4.88 mg, zinc - 2.16 mg, copper -0.61 mg, manganese - 1.33 mg, and magnesium 143.51mg/100 g) which helps in the overall health and development.

Keywords: Browntop millet ribbons, proximate composition, carbohydrate total dietary fibre, antioxidant properties and minerals

Introduction

Millets are an excellent dietary option for individuals with diabetes, as they contain substantial amounts of dietary fiber and non-starchy polysaccharides. These components assist in regulating weight by facilitating the gradual release of glucose from millets (Dayakar Rao *et al.*, 2017) [9].

Millets serve as an excellent source of fiber and slow-digesting starch, promoting gut health by supporting the diverse ecosystem of bacteria residing within it, including rhamnosus GG, actinobacteria, lactobacillus acidophilus and bifido species. Non-starchy polysaccharides found in millets constitute a substantial portion of dietary fiber and act as effective prebiotics by fermenting resistant starch, leading to the production of short-chain fatty acids (ASSOCHAM-2022) [4].

India, being the largest consumer of millets globally, aims to boost millet production to 30-35 million tonnes by 2023 through the 'International Millet Year, 2023' initiative. This effort involves adopting superior varieties, implementing effective agronomic practices, conducting robust extension activities and enacting supportive policy measures (Dayakar *et al.*, 2017) [9]. Browntop millet (*Brachiaria ramosa*) is an annual grass originally from South-East Asia that has been introduced to various regions, including Africa, Arabia, China and Australia. Initially brought to the United States from India in 1915, this millet, known as "korale" in Kannada, is specifically cultivated in rainfed areas of Tumakuru, Chitradurga and Chikkaballapura districts in Karnataka state, where it enjoys widespread cultivation and consumption.

Convenience food has become a widespread dietary trend in both developed and developing countries. There are various reasons for the popularity of convenience foods today. They enable consumers to minimize the time and effort invested in food-related tasks such as meal preparation, shopping, cooking and post-meal cleanup (Brunner *et al.*, 2010) [7].

The previous concept of convenience foods was over shadowed by the changing definition. Over time, consumers are focusing on the healthy aspects of convenience foods. This could be due to the increasing prevalence of several lifestyle diseases like obesity, hypertension and other illnesses linked to convenience food consumption.

The majority of the most recent innovations and advancements in convenience food products are connected to healthy options containing minimal salt, sugar, low calorie and other therapeutic foods (Raj *et al.*, 2021) [13].

Ready-To-Use (RTU) and Ready-To-Eat (RTE) value added and convenient products from millets will not only help the producer in improving their socio-economic status but also help in improving the health of the nation (Begum *et al.*, 2017) [6]. Many fried foods trace their origins back to traditional preservation methods, where they have naturally emerged as favoured options due to their extended shelf life (Kumari and Prakash, 2009) [11]. Snacks contribute to higher percentage of daily nutrient and calorie intake in many consumers (Chakraborty *et al.*, 2011) [8]. The application of ultraviolet-C (UV-C) radiation, known for its germicidal properties, has been extensively studied for its effectiveness in eliminating pathogenic fungi, including aflatoxins and other fungal by products that can contaminate food. Several in-vitro studies have demonstrated the efficacy of UV-C

radiation in inhibiting microbial growth. Research has shown that toxins can be degraded when exposed to UV radiation at a wavelength of 365nm (Ghangro *et al.*, 2016) [10].

Materials and Methods

The present investigation was conducted at the Department of Food Science and Nutrition, College of Community Science, University of Agricultural Sciences Dharwad, Karnataka. Dehusked browntop millet grains were procured from Green Organics.

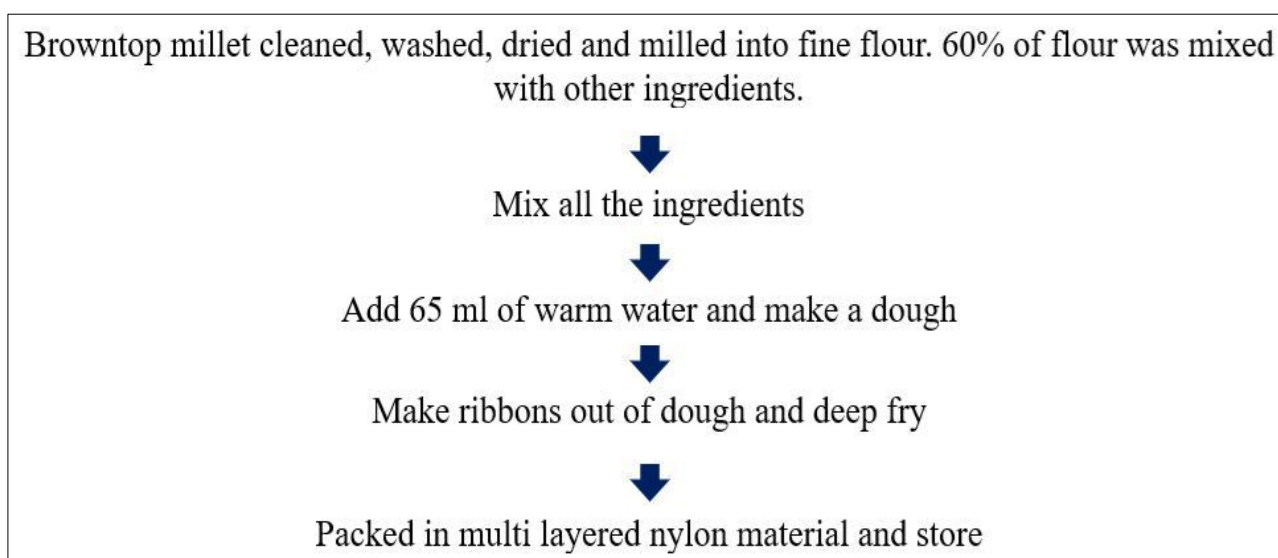
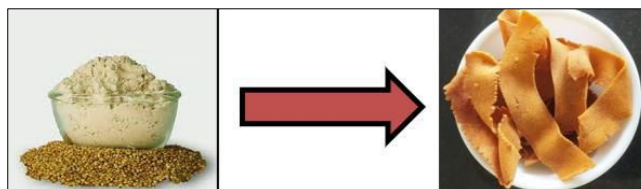


Fig 1: Flowchart for preparation of browntop millet ribbons

The proximate of browntop millet ribbons: The proximate properties like moisture, protein, crude fat, total ash, crude fibre, carbohydrates, energy of browntop millet ribbons were analysed according to Anon, 2019 [1].

Dietary fibre (%) of browntop millet ribbons: The soluble, insoluble and total dietary fibre of browntop millet ribbons was estimated by using α -amyl glucosidase method (Asp *et al.*, 1983) [3].

Antioxidant properties of browntop millet ribbons: The antioxidant properties like antioxidants-tannin, total phenolics content and DPPH radical scavenging activity, antinutrients- phytic acid and oxalic acid.

The mineral content of browntop millet ribbons

Minerals (mg/100 g): The minerals (calcium, iron, zinc, copper, manganese and magnesium) were estimated by wet digestion using triacid mixture. A known aliquot of browntop millet sample was diluted and micro minerals in the test sample (Ca, Cu, Mn, Mg, Zn and Fe) were determined using atomic absorption spectrophotometer (Anon., 2019) [1]. Calibration of measurements was performed using commercial standards.

Results and Discussion

Table 1: Nutrient composition of browntop millet ribbons

Parameters	Mean $\pm$ SD
Moisture (%)	1.98 $\pm$ 0.05
Fat (%)	13.17 $\pm$ 0.32
Crude protein (%)	13.61 $\pm$ 0.09
Ash (%)	1.95 $\pm$ 0.03
Crude fibre (%)	7.20 $\pm$ 0.13
Carbohydrate (%)	62.09 $\pm$ 2.49
Energy (Kcal)	422 $\pm$ 14

Note: Values are expressed as mean $\pm$ standard deviation of three replications

Table 2: Total dietary fibre of browntop millet ribbons

Total dietary fibre (g/100g)		Mean $\pm$ SD
Dietary fibre	Total dietary fibre	16.79
	Soluble dietary fibre	2.55
	Insoluble dietary fibre	14.24

Note: Values are displayed as mean $\pm$ standard deviation of three replications.

Table 3: Antioxidant properties of browntop millet ribbons

Antioxidants		Mean±SD
Antioxidants	Tannin (mg TAE/100g)	942.86±19.54
	Total phenolics content (mg GAE/100g)	217.78±6.48
	DPPH radical scavenging activity (%)	57.23±0.01

Note: Values are expressed as Mean± standard deviation of three replications.

Table 4: The mineral content of browntop millet ribbons

Mineral (mg/100g)	Mean±SD
Calcium	88.71
Iron	4.88
Zinc	2.16
Manganese	1.33
Copper	0.61
Magnesium	143.51

Note: Values are expressed as Mean± standard deviation of three replications.

Table 1 presented the nutrient composition of browntop millet ribbons. The moisture content was determined to be 1.98%. The fat content was measured at 13.17%, while the crude protein content was reported as 13.61%. The ash content was found to be 1.95%, and the crude fiber content was recorded at 7.20%. The carbohydrate content constituted 62.09%, and the energy value of the ribbons was noted to be 422 Kcal.

The dietary fiber content of browntop millet ribbons was analyzed and the results are presented in Table 2. The total dietary fiber content was found to be 16.79 g per 100g of the sample. Of this, 2.55 g per 100g was soluble dietary fiber, while the remaining 14.24 g per 100g was insoluble dietary fiber.

Table 3. presented the antioxidant properties of browntop millet ribbons, detailing the antioxidants content. The amount of tannins was recorded at 942.86 mg TAE/100 g, while the total phenolic content was measured at 217.78 mg GAE per 100 grams. The DPPH radical scavenging activity, an indicator of antioxidant potential, was found to be 57.23%.

The mineral composition of browntop millet ribbons, including calcium, iron, zinc, manganese, copper, and magnesium, was analyzed and presented in Table 4. The concentrations of these minerals were found to be 88.71 mg of calcium, 4.88 mg of iron, 2.16 mg of zinc, 1.33 mg of manganese, 0.61 mg of copper and 143.51 mg of magnesium per 100g of the sample.

Discussion

Table 1. present the study browntop millet ribbons revealed that the product is energy-dense, with a moisture content of 1.98%, fat content of 13.17%, protein content of 13.61%, ash content of 1.95%, crude fiber content of 7.20%, carbohydrate content of 62.09% and an energy value of 422 Kcal per 100g. This makes it a suitable snack option that is not only nutritious but also convenient for travel. In comparison, Sarojani *et al.* (2021) [15] reported that a similar fried product, proso millet chakli, had an energy content of 513 Kcal, with a higher protein content of 9.51%. On the other hand, a study by Namitha *et al.* (2019) [12] found that foxtail millet chakli had a significantly higher fat content (18.40%) and protein content (11.38%) than the browntop millet ribbons, which could be attributed to variations in the ingredients and the nutritional composition of foxtail millet.

In the present study, the dietary fiber components of browntop millet ribbons (Table 2) were analyzed, revealing that the soluble dietary fiber content was 2.55 g per 100g, which was lower compared to the insoluble dietary fiber content of 14.24 g per 100g. The total dietary fiber content was found to be 16.79 g per 100g. Similarly, Roopa and Premavalli (2008) [14] reported that foxtail millet papad contained 1.1% soluble dietary fiber, 11.1% insoluble fiber, and 12.2% total dietary fiber. In comparison, foxtail millet papad had a higher total dietary fiber content than the browntop millet ribbons, which could be attributed to the higher dietary fiber content in foxtail millet and the fact that the papad preparation used 100% foxtail millet.

Table 3 presented the investigation of the antioxidant properties of browntop millet ribbons, which contained 942.86 mg TAE/100g of tannins, 217.78 mg GAE/100g of phenols, and exhibited 57.23% DPPH radical scavenging activity. Balasubramanian *et al.* (2014) [15] reported that polyphenolic compounds may help reduce the free fatty acid content in pearl millet. Based on this, the phenol content in the present study's browntop millet ribbons may contribute to reducing free fatty acid levels.

The mineral composition of browntop millet ribbons was analyzed and the results showed in the table 4. Ribbons contained 88.71 mg of calcium, 4.88 mg of iron, 2.16 mg of zinc, 0.61 mg of copper, 1.33 mg of manganese, and 143.51 mg of magnesium per 100g. These findings were similar to those reported by Sarojani *et al.* (2021) [15], who analyzed proso millet chakli and found that it contained 4.1 mg of iron, 2.1 mg of zinc and 26.3 mg of calcium per 100g. The mineral composition of browntop millet ribbons was comparable to that of other millet-based products, although the levels of calcium and magnesium were notably higher in the browntop millet ribbons.

Conclusion

In the present study, analysis was conducted on the proximate composition, dietary fibre, antioxidant and minerals properties of browntop millet ribbons. The results revealed that browntop millet ribbons were rich in crude fibre, dietary fibre, and ash content. These findings highlight the potential of browntop millet as a valuable nutri-cereal. Given its high fibre content, it can be utilized for value-added products aimed at improving overall health. The inclusion of browntop millet ribbons in the diet may play a significant role in the prevention and management of various lifestyle-related diseases, such as diabetes, obesity, and cardiovascular diseases.

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