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A Study on Isolation of Fibre from Red Cabbage to Enhance Athletic Performance

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Abstract

Achieving peak performance in sports is a multifaceted process that goes beyond training and skill development. Nutrition, particularly dietary fiber, is a crucial aspect often overlooked in this pursuit. Fiber, a complex carbohydrate found in plant-based foods, is essential for the overall health and performance of sports people. Red cabbage, also known as purple cabbage, is a nutritious vegetable with antioxidant properties. It is rich in vitamins C and K, dietary fiber, and supports gut health by nourishing gut bacteria, enhancing digestion, and reducing inflammation. Two samples of red cabbage were dried: one sample was sun-dried for 3 days, and the other sample was dried in a cabinet dryer at 9 ° C for 8 hours. The results indicated that the sample dried in the cabinet dryer showed high fiber content, and the isolation of fiber was done in this sample. This study contributes valuable insights into maximizing the nutritional benefits of red cabbage and finger millet to enhance sports performance of the sports person.

Keywords : Finger Millet, Red Cabbage, Isolation of Fibre, Nutritive Analysis, Fibre Rich Snacks.

Introduction

Millet was a staple diet for our ancestors. Their livelihood is significantly impacted by millets. Finger millet (Ragi, Eleusine coracana), is the principal food grain of the rural population in India, especially in South India. It is very nutritious with respect to minerals, dietary fiber and essential amino acids. Amongst cereals, Ragi provides highest level of calcium including antioxidants and phytochemicals. The total dietary fiber of finger millet grain is relatively higher than that of most of other cereal grains, which helps to control blood glucose levels in diabetic patients. It is usually converted into flour and a variety of preparations. Several methods of processing of ragi have been developed to make the final product more attractive in flavour, appearance, taste, and consistency. [Paschapur, A. U., Joshi, D., Mishra, K. K., Kant, L., Kumar, V., & Kumar, A., 2021)

Anthocyanins are naturally occurring plant compounds found in red cabbage that offer a number of health benefits. They are antioxidants that fight harmful free radicals, which have been connected, among

other chronic ailments, to cancer and cardiovascular disease. They also possess anti-inflammatory qualities that could help regulate inflammatory responses. Anthocyanin consumption can enhance heart health. They may also help prevent some types of cancer by stopping the growth of cancer cells. They may also improve brain health by improving cognitive function and reducing the risk of age-related cognitive decline. They may also help regulate blood sugar, strengthen immunity, and protect against oxidative damage and inflammation. However, adopting a balanced diet is the key to achieving these health benefits. [M. Dekker et al.,2000]

The isolation process of nutrients refers to the methods used to extract or separate specific nutrients from a food source. This process is often employed in the food industry, research laboratories, and pharmaceutical settings to obtain pure compounds for various purposes, including nutritional supplements, research studies, or the development of functional foods. [I.F.F. Benzie et al.,2006]

Eating dietary fiber is crucial for promoting gut health and has been associated with various benefits for the digestive system. For maximum fiber advantages and to enhance overall health and athletic performance, it's crucial to gradually increase fiber consumption and be well-hydrated. Glucosinolates are a group of naturally occurring compounds found in plants of the Brassicaceae family. Consuming a diet rich in cruciferous vegetables provides a natural source of glucosinolates and their breakdown products, which may contribute to overall health. A diet rich in vegetables and fruits is beneficial for human health, but the specific constituents responsible for these effects are not well understood. Vitamins, flavonoids, and glucosinolates (GLS) are particularly important. Flavonoids can reduce the risk of cardiovascular diseases and inhibit enzymes in the metabolism of xenobiotics. GLS degradation products have been linked to reduced cancer risk. [K. Oerlemans et al.,2006]

Hence, the present study was aimed to enhance the physical abilities of sports persons by isolating fiber from red cabbage and incorporating it into food products.

Objectives of the Study

The objectives set forth for the present study entitled “A Study on Isolation of Fibre From Red Cabbage to Enhance the Athletic Performance”

- To compare the sun dried and cabinet dried red cabbage for optimal fibre isolation
- To isolate the fibre from red cabbage and test its efficiency
- To incorporate the isolated fibre in the food products
- To analyse the certain nutrients and phytochemicals of the powder samples

Materials and Methods

Collection of Ingredients

Red cabbage was purchased from Mattuthavani, Madurai.

Drying of Red Cabbage Using Different Methods

Red cabbage was dried under sun drying and cabinet drying. Sun drying is done for three days and Cabinet drying is done for 8 hours.

Table - 1 (Ingredients Used for the Preparation of Isolated Fibre Powder Incorporated Ragi Puttu)

Ingredients used	Control Sample	Experimental Sample A	Experimental Sample B	Experimental Sample C
Finger Millet	90	88	86	84
Isolated Fibre Powder	-	2	4	6
Brown Sugar	10	10	10	10

Sensory Evaluation of Puttu

For evaluating the sensory characteristics, the three different formulations of the selected Ragi Puttu were assessed by 10 panel members. The panellist was asked to determine the sensory attributes on the basis of 5 point hedonic scale and they were scored on the basis of sensory qualities such as appearance, colour, taste, texture and odour. The overall acceptability was evaluated by the mean score of all the attributes.

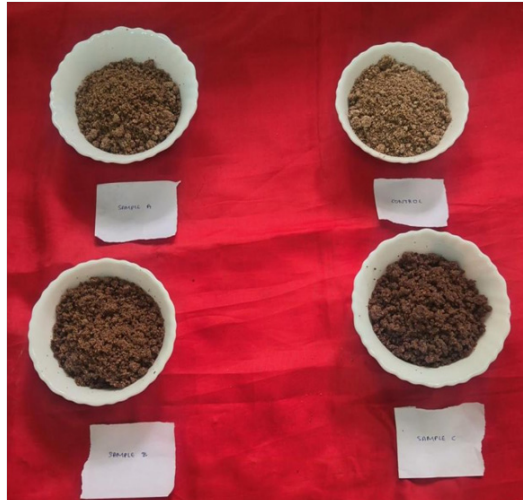


Figure 1 Isolated Fibre Incorporated Puttu

Analysis of Proximate Composition

Estimation of Ascorbic acid

Ascorbic acid reduces the 2, 6 dichlorophenol indophenol dye to a colourless leuco-base. The ascorbic acid gets oxidized to dehydroascorbic acid. Though the dye is a blue colored compound, the end point is the appearance of pink colour. The dye is pink coloured in acid medium. Oxalic acid is used as the titrating medium. In this study, ascorbic acid was determined for the germinated pearl millet flour samples.

Phytochemical Screening Using Different Extractions

Phyto-chemicals are non-essential nutritive plant material that consists of protective and disease preventing materials. The ethanol and methanol extracts of germinated pearl millet flour were subjected to preliminary qualitative phytochemical screening by using the following standard procedure (Ayoola, G.A., 2008)

Test for Alkaloid

1ml of Mayer's reagent was added to 1ml of extract in the test tube. A green colour which indicated the presence of alkaloids appeared. This indicated the presence of alkaloids appeared.

Test for Flavonoid

2N dilute ammonia (5ml) was added to a 1ml portion of sample solution in water. 1 ml concentrated sulphuric acid was added. A yellow colouration that disappeared on standing indicated the presence of flavonoids.

Test for Glycoside

2ml of glacial acetic acid and 5% of FeCl₃ & conc. H₂SO₄ was added to 5ml of extract solution in the test tube. A formation of brown ring which indicated the presence of glycoside appeared.

Test for Saponin

Foam Test: 2ml of extract was treated with 2ml of distilled water shaken vigorously for 2 minutes and adding of 1ml of olive oil to the foam stable foam indicates the presence of saponin.

Test for Coumarin

3 ml of 10% NaOH was added to 2 ml of extract and yellow colour was observed for the presence of coumarin.

Test for Steroid

1 ml of extract was dissolved in 10 ml of chloroform and to it was added an equal amount of Conc. H2SO4 from sides of the test tube. The upper layer turns into red and the sulfuric acid layer showed yellow with green fluorescence indicated the presence of steroid.

Result and Discussion

Estimation of Vitamin C Content of the Fibre Incorporated Ragi Puttu Samples

Table 2 Estimation of Vitamin C content

Variations	Results
Control	26 mg
Sample A [2g]	33 mg
Sample B [4g]	46 mg
Sample C [6g]	60 mg

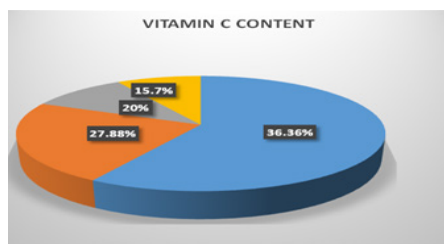


Figure 2 Vitamin C Content of Fibre Incorporated Ragi Puttu

Table 2 and figure 2 shows that the vitamin - C content of fibre incorporated puttu. In this study, it was found that sample C shows high vitamin C value. The results obtained were correlated with the study conducted by Kumar, A., & ChAuhAn, B. (1993).

Phytochemical Screening Using Different Extractions

Table 3 Qualitative Screening of Flavonoid

Qualitative Screening of Flavonoid						
Variations	Isolated Fiber Powder Incorporated Puttu					
	Sample A		Sample B		Sample C	
	Ethanol	Methanol	Ethanol	Methanol	Ethanol	Methanol
Sample A	+	+	+	+	+	+
Sample B	+	+	+	+	+	+
Sample C	+	+	+	+	+	+
Control	+	+	+	+	+	+

Table 3 interprets that flavonoid was present in the product which has antioxidant activity and antimicrobial activity, cancer prevention, weight management, diabetes management, weight management. The results were coincided with the study conducted by Purewal, S. S. (2014). Note: (+) indicates the presence.

Table 4 Qualitative Screening of Saponin

Qualitative Screening of Saponin						
Variations	Isolated Fiber Powder Incorporated Puttu					
	Sample A		Sample B		Sample C	
	Ethanol	Methanol	Ethanol	Methanol	Ethanol	Methanol
Sample A	+	+	+	+	+	+
Sample B	+	+	+	+	+	+
Sample C	+	+	+	+	+	+
Control	+	+	+	+	+	+

Table 4 interprets that saponin was present in the product which has hypocholesterolemic effects, cardioprotective effects, immune system modulation, antioxidant properties. The results were coincided with the study conducted by Purewal, S. S. (2014). Note: (+) indicates the presence.

Table 5 Qualitative Screening of Steroids

Qualitative Screening of Steroids						
Variations	Isolated Fiber Powder Incorporated Puttu					
	Sample A		Sample B		Sample C	
	Ethanol	Methanol	Ethanol	Methanol	Ethanol	Methanol
Sample A	+	+	+	+	+	+
Sample B	+	+	+	+	+	+
Sample C	+	+	+	+	+	+
Control	+	+	+	+	+	+

Table 5 interprets that steroid was present in the product which has body building ability, Immunosuppression. The results were coincided with the study conducted by Purewal, S.S. (2014). Note: (+) indicates the presence.

Table 6 Qualitative Screening of Coumarins

Qualitative Screening of Coumarins						
Variations	Isolated Fiber Powder Incorporated Puttu					
	Sample A		Sample B		Sample C	
	Ethanol	Methanol	Ethanol	Methanol	Ethanol	Methanol
Sample A	+	+	+	+	+	+
Sample B	+	+	+	+	+	+
Sample C	+	+	+	+	+	+
Control	+	+	+	+	+	+

Table 6 interprets that coumarin was present in the product which has anti microbial effects and vasodilatory effect. The results were coincided with the study conducted by Purewal, S. S. (2014). Note: (+) indicates the presence.

From the analysis of phytochemicals the flavonoids, saponin, coumarins, steroids were present and alkanoid and glycoside were absent in the product.

Sensory evaluation of the Puttu

The prepared puttu was incorporated with isolated fibre powder in the proportion of 2g, 4g and 6g. They were subjected to sensory evaluation by 10 panel members and then the mean scores were obtained and analysed statistically.

Table 7 [Mean Scores of the Fibre Powder in Corporated with Puttu]

Characteristics	Control	Experimental sample A	Experimental sample B	Experimental sample C
Flavour	4.2±0.3	3.5±0.2	4.2±0.5	4.4±0.8
Taste	4.4±0.4	3.2±0.3	4.8±0.3	4.6±0.3
Colour	4.5±0.4	3.4±0.6	4.8±0.24	4.9±0.24
Texture	4.5±0.5	3.2±0.2	4.9±0.4	4.8±0.4
Overall acceptability	4.5±0.6	3.6±0.6	4.7±0.39	4.6±0.39

Table 7 shows the mean score of the isolated fibre incorporated puttu. Evaluation of organoleptic attributes of the product for colour, texture, flavour, taste and overall acceptability of SAMPLE C [6g] incorporated fibre powder was excellent with the mean score of 4.7±0.39 than the other two variations.

Conclusion

The isolation of fiber from red cabbage and incorporated into finger millet puttu, vitamin C analysis and phytochemical testing, provides valuable insights into the potential enhancement of nutritional and health benefits in the prepared food product. The incorporation accompanied by comprehensive nutritional and phytochemical analyses, highlights the potential for creating a healthier and more nutritionally nourished food products. Fiber is essential for athletes, as it promotes digestive health, blood sugar regulation, weight management, nutrient absorption, gut function, heart health, cholesterol management, and anti-inflammatory effects. A well-balanced diet with fiber supports overall health and performance.

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