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BIOAVAILABILITY OF NUTRACEUTICALS AND PHYTOCOMPONENTS IN THE ROASTED AND GERMINATED FORM OF SELECTED MILLETS

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ABSTRACT: Millets contain major and minor nutrients such as carbohydrate, protein, fat, dietary fibre, vitamins, minerals, antioxidants and phytochemicals. The acceptability, digestibility and bioavailability of nutrients in millets can be enhanced by the traditional processing methods like roasting and germination. These processing methods improve the nutrients of millets for nourishing the health. The present study was aimed to study the impact of the roasting and germinating process in the selected millets. It was observed that among the selected millets, germinated ragi was found to contain maximum digestibility and bioavailability of nutrients which might be due to its phytocomponents residing in the germinating plumule.

KEYWORDS: Millets, roasted form, germinated millets, nutrients, phytocomponents.

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1.INTRODUCTION

Millets are nutritionally rich and occupy an important place in the diet of people in many regions of the world. Millet grains are now receiving specific attention from the developing countries in terms of utilization as food as well as from some developed countries in terms of its good potential. Millets are rich sources of phytochemicals and micronutrients, play many roles in the body immune system. Millets have nutraceutical properties in the form of antioxidants which prevent deterioration of human health such as lowering blood pressure, risk of heart disease, prevention of cancer and diabetes (Hassan et al 2006: Pradeep SR and Guha M, 2011). In this context, millets must be accepted as functional food and nutraceuticals. Millets are consumed by processing them. ie., roasting and the germination process. The processing techniques aim to increase the

physicochemical accessibility of micronutrients, decrease the content of antinutrients and increase the content of compounds that improve bioavailability. Hence, the study emphasizes on the impact of the traditional processing methods such as roasting and germinating with respect to their nutritional and phytocomponents.

2. MATERIAL AND METHODS

Millets selected for the study:

1. *Eleucine corocana* (Ragi), 2. *Paspalum scrobiculatum* (Varagu), 3. *Panicum miliaceum* (Panai varagu), 4. *Pennisetum glaucum* (Kambu), 5. *Sorghum bicolor* (Sorghum)

Processing Of The Millets: The selected millets were first cleaned thoroughly and made free from dust, dirt, and foreign matter. Any seeds which were spoiled or with cracked hull were discarded and the remaining seeds were surface sterilized with 0.1% (w/v) potassium permanganate solution. Millets are roasted in a open dry pan at 60o C for 3 mins till a pleasant aroma develops. For sprouting, seeds were soaked in distilled water for 4h at room temperature (RT). The excess water was drained, sample further rinsed with distilled water, seeds placed in a single layer on filter paper in sterile petri dishes and placed in the muslin cloth at the room temperature, 90% RH for 24h. After sprouting the seeds were dried in an oven overnight at 60°C. They were then cooled in a desiccator. The processed millets were then powdered using a electric blender at moderate speed (5,000 rpm) and sieved through mesh size of 600 microns.

Analysis: The processed and unprocessed millet were analysed for the total carbohydrate (Anthrone method), Protein (Lowry's method), Fat (AOAC method) and dietary fibre (AOAC method). The qualitative analysis of phytochemicals viz. phenolics, flavonoids, alkaloids and saponins present in the millets was done by the Method of Treese and Evans(1989).

3. RESULTS AND DISCUSSION

Millets are the store houses of many chemical components including nutrients, phytochemicals, and non-nutritive plant protective functional constituents. The results of the nutrient profile in the millets are shown in fig 1.

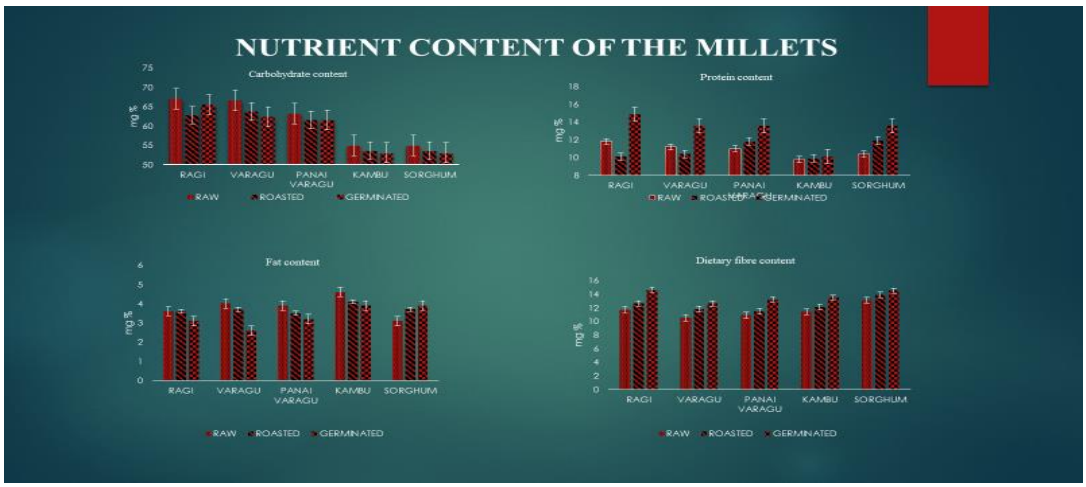

Fig-1: Nutrient content in processed and unprocessed millets

Phytochemical Analysis Of The Millets

Phytochemical testing to detect for the presence of different chemical group of phytocompounds alkaloid, tannin, terpenoids, phenolic compound and flavonoids are depicted in table-1.

Phytochemicals	Ragi			Varagu			Panaivaragu			Kambu			Cholam		
	C	R	G	C	R	G	C	R	G	C	R	G	C	R	G
Alkaloids	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Glycosides	--	--	+	+	+	+	+	+	+	-	-	-	-	-	-
Tannins	+	+	+	+	+	+	+	+	+	+	+	-	+	+	+
Phytosterol	+	--	+	+	+	+	+	+	+	-	-	-	+	+	+
Terpenoids	+	+	+	-	-	-	-	-	-	+	+	+	+	+	+
Steroids	--	--	+	+	+	+	+	+	+	-	-	-	-	-	-
Phenolic compound	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Flavonoids	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+

C- Raw control, R- Roasted, G – Germinated, + indicates presence, - indicates absence

From our results, it is observed that the levels of carbohydrate- the energy yielding component is high in all the selected raw millets. In the assessment of nutritional status of the processed millets a decline was noted in roasted as well as in germinated millets. The decline was very predominant in ragi, varagu and panaivaragu. It was also observed that the levels of total carbohydrate was found to be decreased in germinated when compared to roasted forms. The reduction in carbohydrate content could be attributed to increased activity of alpha-amylase which hydrolyses starch to simple sugar. Total fat content in the processed millets were observed to be low when compared to unprocessed selected raw millets except sorghum. which may be attributed to the breakdown of fats to fatty acid and glycerol. This is in accordance with the studies of Anthony and Babatunde (2014). The levels of protein and dietary fibre were observed to be increased in all the selected germinated millets. Increased protein levels reflect the activation of the proteolytic enzymes during germination. The observed decline levels in the roasted form is due to the denaturation induced by the impact of temperature during the roasting process. The germinated millets showed an appreciable fibre content compared to the unprocessed samples. Germination increased the crude fibre content in all the selected millets. Among the selected millets the nutraceutical profile was found to be in appreciable levels in the germinated ragi. Millets is a good source of phytochemicals. The antinutrient tannin and phytosterols were found to be in decreased amount after processing methods such as germination and roasting. Phenolics are known to impart antioxidant properties and serve as radical scavengers thereby imparting several health benefits like reducing the risk of cancer, diabetes, cardiovascular diseases etc, they also contribute to improving colour and sensory attributes of food. (Troszynska et al., 2006., Cevallos-Casals and Cisneros-Zevallos, 2010). Among the selected millets

the phytoconstituents were found to be appreciable levels in the germinated ragi. Germination is a biochemical process which involves transition of a seed from dormant state to vital active state. It has been reported to improve the nutritive value of foods. Several studies on the effect of germination on legumes have found that germination can increase protein content and dietary fibre bioavailability (Rao and Prabhavathi, 1982; Hussein and Ghanem, 1999; and Ghavidel and Prakash, 2007). This is in accordance to the present study. as germination is economical and more effective in improving nutritional value it can be accepted as functional food and nutraceuticals because they provide adequate dietary fibres, proteins and energy required for human health. In our earlier studies we have observed germination of ragi enriches its potent bioavailability and digestibility (ChandraPrabha et al 2018)

4. CONCLUSION

Among the different processing techniques, consumption of germinated millets was found to be efficient in their nutritional profile and levels of phytocomponents thereby enhancing the bioavailability. It is therefore suggested to educate about the potential health benefits among all groups of people and promote millet by increasing its consumption and cultivation. Creating an awareness regarding the consumption of millets in germinated form helps the public to get rid off from the lifestyle diseases.

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