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STUDY ON THE ACCEPTABILITY AND FUNCTIONAL PROPERTIES OF MILLETS INCORPORATED FRYUMS

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ABSTRACT: Millets are called nutri-cereals, highly nutritious, and are known to have high nutrient content, which includes protein, essential fatty acids, dietary fiber, B-Vitamins, minerals such as calcium, iron, zinc, potassium, and magnesium. They help render health benefits like reducing blood sugar level (diabetes), blood pressure regulation, thyroid, cardiovascular and celiac diseases. The present study was carried out to develop millet-based fryums and to assess their acceptability and functional properties. Rice, finger millet, pearl millet, foxtail millet, sorghum, sago and other materials required were procured from the market, cleaned, milled and further used for the development of fryums in different proportions. All the developed millet fryums were evaluated for acceptability and functional properties. The results revealed that sensory scores for sorghum millet fryums had high scores for all the parameters (5.1±1.06, 5.06 ± 1.12, 5.3 ± 1.02, 5.1 ± 1.1 and 5.2 ± 0.9 for appearance, texture, colour, aroma, taste, and overall acceptability, respectively) compared to control and other millet fryums.

INTRODUCTION: Millets are a traditional staple food of the dryland regions of the world. According to the Indian Institute of Millet Research, in India, millets are grown on about 17 million hectares with annual production of 18 million tonnes and contribute 10 percent to the country's food grain basket. They are nutri-cereals that are highly nutritious and have high nutrient content that includes protein, essential fatty acids, dietary fibre, B-Vitamins, and minerals such as calcium, iron, zinc, potassium, and magnesium. These grains are the main source of energy in Indian diets contributing 70-80 percent of the daily energy intake of the majority of Indians.

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Since cereals and millets are the cheapest, widely available energy source, the contribution to energy intake is the highest among the poor-income families and decreases with increased income [1]. Millet is an essential underutilized food that sustains well in adverse conditions. Millets, as compared to other cereals, have several desirable nutritional attributes. Nutritionally they are superior to rice and wheat and therefore provides proteins, minerals and vitamins to the poor dependent on such grains [2].

New advanced techniques applied for post-harvest technology and value addition are giving out more products of wide acceptance in rural as well as urban areas. Many food processing technologies have been developed in relation to the nutritional quality, convenience of food uptake, and other sensory properties. Along with nutrition, millets offer health benefits in the daily diet and help manage disorders like diabetes mellitus, obesity, hyperlipidemia, *etc.* [3, 4].

Millets are important crops in the semiarid tropical regions end add indigenous do many parts of the world. Millets have served AS important staple foods for centuries, especially in parts of Asia and Africa. The crop has been cultivated for at least 10,000 years in East Asia [5]. Value addition to food products is considered an important aspect of diverse socio-economic conditions, urbanization, and globalization. Millets are available in the form of pearled and hulled. Consumption of millets has declined over the years, and the major reasons include lack of awareness of nutritional benefits, inconveniences in food preparation, and lack of processing technologies. Suppose the millet is made available to the community in convenient ready-to-eat and ready-to-cook forms. In that case, the nutritional and nutraceutical benefits of the millet could reach both the farming communities and also health-conscious consumers[1]. Hence, in order to increase consumption and make them popular, millets can be utilized in the development of value-based products such as traditional and convenience foods, including ready-to-eat (RTE) foods. Fryums are deep-fried or roasted or baked and served as an accompaniment along with meals. They are generally prepared with rice flour, which is mainly starch-based. Hence, in order to promote their consumption, a study was carried out to develop millet-based fryums and to assess their acceptability.

MATERIALS AND METHOD:

Procurement of Raw Materials: Rice, finger millet, pearl millet, foxtail millet, sorghum, sago, and other materials were purchased from the local market of Mysore, Karnataka, India.

Processing of Raw Millet Flour: All the millets were cleaned, sun-dried and milled into flours. Millet flours were packed in air-tight containers and stored in ambient conditions until further use.

Standard Recipe of Fryums: Standard recipe was prepared using ingredients given in **Table 1** with the combination with millets in different proportions. A flow chart of the fryums preparation is given in **Fig. 1.**

Processing of Fryums: The standard and millets incorporated fryums were puffed in hot oil and in a microwave oven.

Sensory Evaluation of Developed Products: All the puffed fryums were evaluated by a panel of semi-trained judges (n=20). The products were evaluated for Appearance, Texture, Aroma, Taste, and Overall acceptability using scorecard **Table 2.**

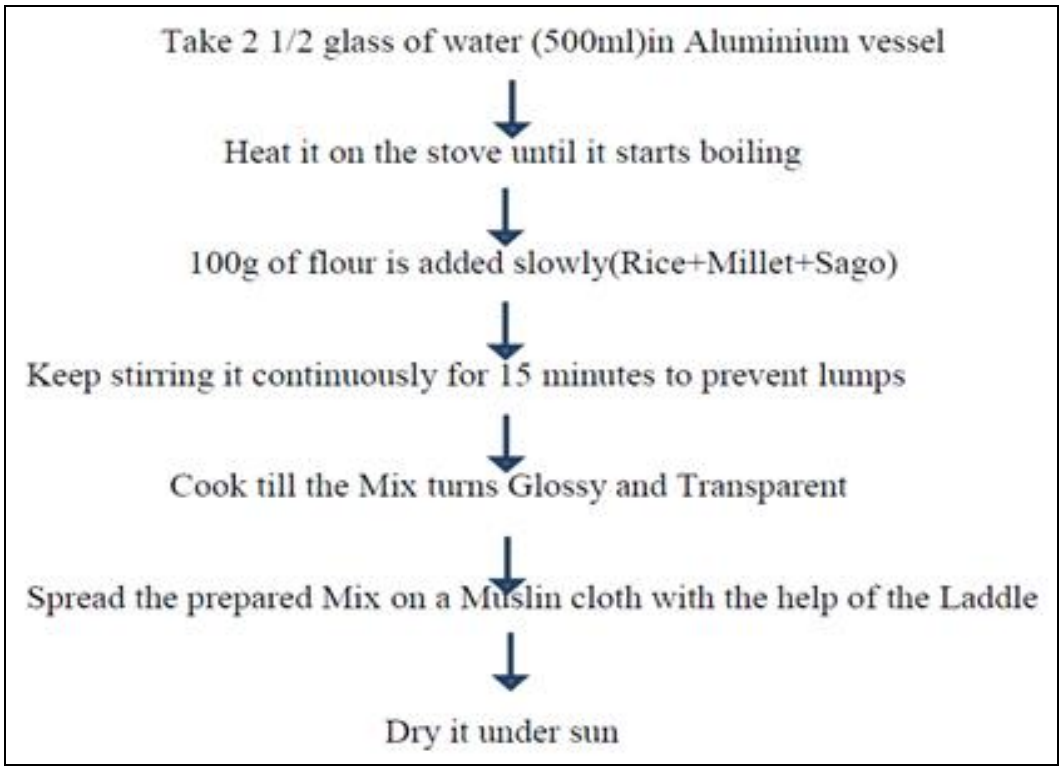

FIG. 1: FLOW CHART FOR THE PREPARATION OF FRYUMS

TABLE 1: STANDARD RECIPE AND MILLET COMPOSITION OF THE FRYUMS

Percent	Rice flour	Sago	Millet flour
Control (Rice)	90	10	NA
Finger Millet Fryums	60	10	30
Pearl Millet Fryums	60	10	30
Foxtail Millet Fryums	60	10	30
Sorghum Millet Fryums	60	10	30
Other common ingredients (gms) for 100gms in all variations			
Salt		1.5	
Jeera		2	
Water (ml)		500	

TABLE 2: SENSORY PARAMETERS EVALUATED IN DEEP-FRIED MILLETS INCORPORATED FRYUMS

Attributes	A	B	C	D	E	F
Appearance						
Texture						
Aroma/flavour						
Taste						
Overall acceptability						

Note: Not acceptable=0; Acceptable=2; Good=4; Excellent=6

Functional Properties of the Fryums: The flour mixture of each millet variation was analyzed for the functional properties - water and oil absorption capacity.

Water and Oil Absorption Capacity: One gram sample was mixed with 10 ml of either distilled water or in 15 ml oil for 30 min. The contents were allowed to stand at 30 ºC in a water bath for 30 min and then centrifuged at 3000-5000 rpm for 20-30 min. After centrifuging, the volume of the supernatant was recorded and used for the determination of water and oil absorption, and the results were expressed as g/g sample [6].

RESULTS AND DISCUSSION: The fryums prepared by incorporating millets are given in **Fig. 2.**

Sensory Evaluation of the Fryums: Acceptability of the deep-fried millets incorporated fryums is given in **Table 3.** Sensory evaluation of the fryum developed was conducted in the following variations.

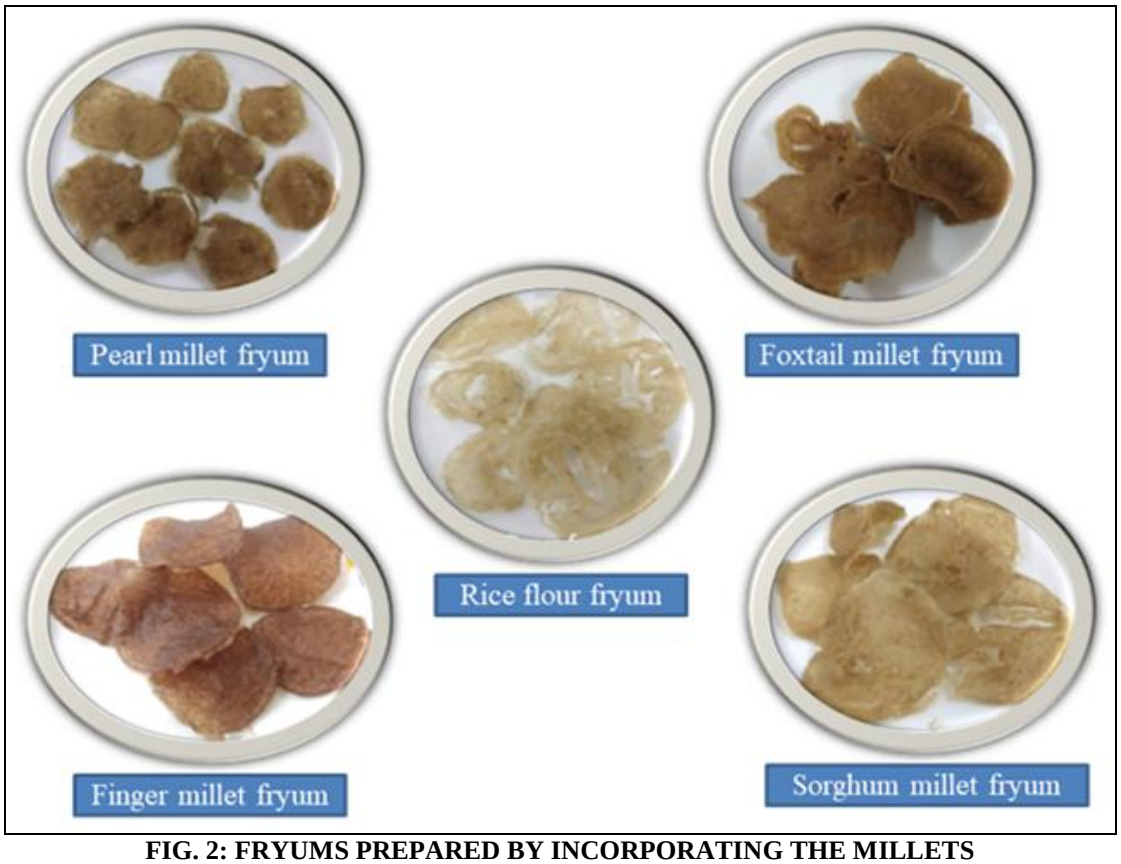

FIG. 2: FRYUMS PREPARED BY INCORPORATING THE MILLETS

TABLE 3: MEAN SENSORY SCORES OF DEEP-FRIED AND MICROWAVE PUFFED MILLET INCORPORATED FRYUMS

Product	Appearance	Flavour	Texture	Taste	Overall Acceptability
	RF	FMF	PMf	FtMF	SMF
Deep-fried	4.1±1.50	3.7±1.3	3.84±1.37	4.2±1.5	5.1±1.06
Microwave	4.5±1.13	4.2±1.4	4.2±1.4	4.3±1.30	4.4±1.5
Deep-fried	4.1±1.6	3.8±1.43	4.08±1.5	4.2±1.6	5.06±1.12
Microwave	4.6±1.3	4.4±1.5	4.3±1.5	4.5±1.32	4.2±1.3
Deep-fried	4.3±1.40	4±1.32	4.7±1.5	4.7±1.5	5.3±1.02
Microwave	4.7±1.25	4.4±1.3	4.5±1.20	4.5±1.3	4.4±1.3
Deep-fried	4.2±1.5	4.1±1.5	4±1.15	4.08±1.7	5.1±1.1
Microwave	4.7±1.2	4.3±1.4	4.5±1.5	4.7±1.3	4.4±1.5
Deep-fried	4.3±1.50	4±1.33	4±1.37	4.4±1.5	5.2±0.9
Microwave	4.8±1.2	4.7±1.2	4.7±1.20	4.8±.98	4.6±1.3

Rice Fryums (control) -RF; Finger Millet Fryums -FMF; Pearl Millet Fryums -PMF; Foxtail Millet Fryums-FtMF; Sorghum Millet Fryums-SMF.

Mean sensory scores of deep-fried and microwave puffed millets incorporated fryums is presented in **Table 3**. The results revealed that sensory scores for deep-fried sorghum millet fryums were more acceptable than the standard fryums, in all the parameters. Sensory evaluation of papad sorghum genotype RPASV-3 was compared with finger millet and black gram papads [7].

They found that finger millet papad was overall accepted at rank 1 in accordance with colour and appearance, texture, flavour and taste followed by sorghum papad prepared from the genotype RPASV-3 and black gram papad. Whereas the mean sensory scores of both deep fried and microwave puffed, fryums were almost equally accepted in all the parameters. Especially, microwave puffed foxtail millet fryums were best acceptable in terms of scores compared with other millet fryums puffed by both deep-fried and microwave and was on par with the control. Prabhakar *et al. reported that incorporating* level of 40% of finger millet in sorghum flour in the development of papad was acceptable without any change in sensory, textural and quality parameters and also showed a significant increase in mineral content of sorghum-finger millet papad [8].

Functional Properties of the Fryums: Functional properties are essential physicochemical properties of foods that reflect the complex interactions between the structures, molecular conformation, compositions and physicochemical properties of food components with nature of the environment and conditions in which these are measured and associated [9]. Functional properties are those parameters that determine the application and use of food material for various food products [10]. Water and oil absorption capacity of fryums is presented in **Fig. 2** and **3**. Sorghum millet fryum showed the highest water capacity (385 ml/100 g) followed by control (380 ml/100 g), whereas the highest oil absorption was observed in finger millet fryums (100 ml/100 gm). The water absorption capacity of sorghum-wheat composite flour ranged from 96.8 to 92.5 percent.

WAC improves the reconstitution ability and textural properties of dough. High WAC is also attributed to lose structure of starch polymers, while low value indicates the compactness of the structure [10]. Indicating present formulation has better compactness of the structure. WAC of millets decreases significantly upon milling, possibly due to loss of fibre, which has the ability to bind and hold water. WAC is an important property of protein and other components of flour in viscous foods, *e.g.*, soups, dough, custards, and baked products, because these are supposed to imbibe water without dissolution of protein, thereby providing body, thickening and viscosity. The oil absorption capacity-OAC of the formulation depends on the presence of a non-polar side chain, which binds the hydrocarbon side chain of the oil among the flours.

OAC is potentially useful in structural interaction in food, especially in flavor retention, improvement in palatability and extension of shelf life, particularly in bakery and meat products where fat absorption is desired. The major chemical component affecting OAC is a protein that is composed of both hydrophilic and hydrophobic parts. Non-polar amino acid side chains form

hydrophobic interaction with hydrocarbon chains of lipids [11]. In the present study, the oil and water absorption capacity of sorgum flour was better than compared to all other millet fours.

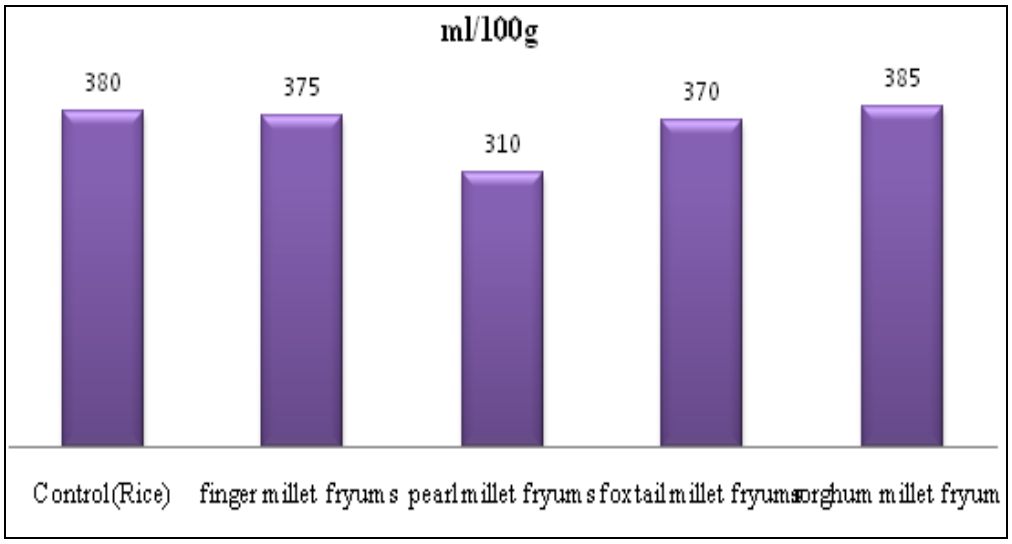

FIG. 3: WATER ABSORPTION CAPACITY OF THE MILLET INCORPORATED FRYUMS FLOUR

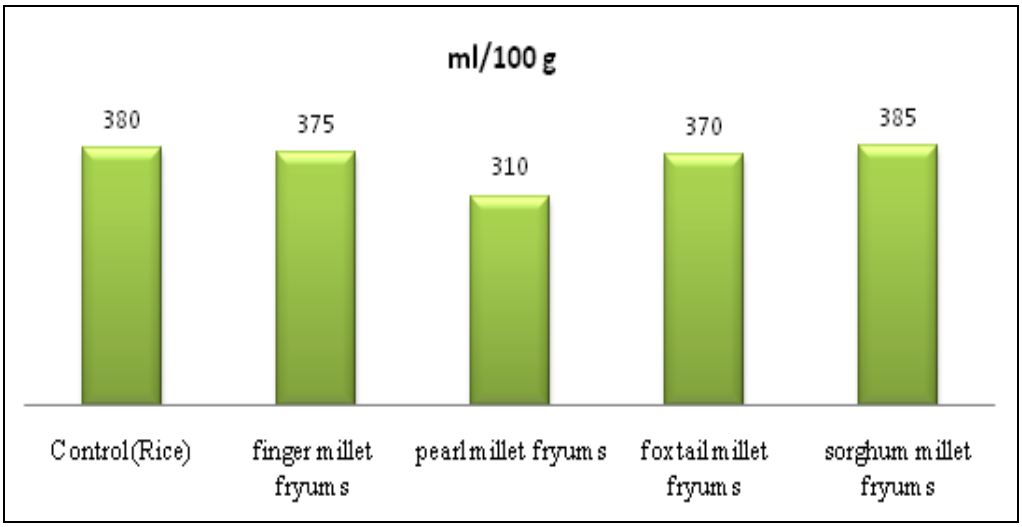

FIG. 4: OIL ABSORPTION CAPACITY OF MILLET INCORPORATED FRYUMS FLOUR

CONCLUSION: In the present study, compared to deep-fried Milletfryums, microwave puffed were equally acceptable, which indicates the consumption of fryums with low-fat content. Millets are referred to SA nutri-cereals that are highly nutritious and have high nutrient content, including protein, essential fatty acids, dietary fibre, B-Vitamins, minerals such as calcium, iron, zinc and potassium and magnesium.

As rich sources of soluble and insoluble dietary fiber, a product developed by incorporating the millets can help reduce the risk of chronic diseases. Hence, it can be used as a part of our daily diet and in the development of traditional products to improve their nutritional profile.

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CONFLICTS OF INTEREST: The authors don't have any conflicts of interest.

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