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Formulation, texture and sensory characteristics of little millet based RTC (*Ready-to-cook*) soup mix

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Abstract
Millets are a group of small-seeded grasses, widely grown around the world as cereal crops/ grains. Ready to cook (RTC), and instant foods have become very common largely due to today's life style and the demand for quick-to-serve foods. The millet was collected and pre-processing done to develop the ready to cook mixes. The millet powder analysed for physical and nutritional properties. The formulations of millet at (60%, 70%, 80%) level the recipe such as soup mix were prepared and the physical, nutrient, textural, sensory properties of the developed product were determined. The result concluded that form the nutrient analysis of millet and soup mix it is well nutritious, especially fibre content and texture of soup is good and for sensory analysis RTC soup 80%level well accepted by panel members. The finding studies are good nutritious product and recommend the nutritious food.

Keywords: millet, RTC, readymix, soup mix and organoleptic, texture

1. Introduction
Little millet is well known for its drought tolerance and is considered as one of the least water demanding crops. Being the first crop to be harvested in the season, it produces the much needed food grain among the tribal and is staple food for millions in many parts of the world. It is a good source of protein (7.7g/ 100 g), very rich in carbohydrate (67.0 g/ 100 g), fat (4.79 g/100 g), minerals and vitamins and should be considered as essential food for nutritional security (Nirmalakumari *et al*, 2010). Little millet has fat (4.7 g), crude fiber (7.7 g), iron (9.3 mg) and phosphorus (220 mg) per 100 g which is comparable to cereals and other millets (Gopalan *et al*,,,,. 2010) [1]. Dietary fiber content of little millet is the contributing factor for its low glycaemic index and a recent study conducted on little millet indicated that it exhibits hypoglycaemic effect due to its higher proportion of dietary fiber (Itagi *et al*, 2013) [5].

Dietary fiber content of little millet is the contributing factor for its low glycaemic index and a recent study conducted on little millet indicated that it exhibits hypoglycaemic effect due to its higher proportion of dietary fiber (Itagi *et al*, 2013) [5]. It has a significant role in providing significant amounts of antioxidants and phytochemicals in the diet (Ushakumari and Malleshi 2007) [6] considering the growing awareness among the consumers regarding the health benefits of millet, there is a need to meet the diversified demands for millet based food products. The Indian "*Ready to Eat*" (RTE) and "*Ready to Cook*" (RTC) food segment has emerged from its early days of being a fringe alternative to home cooked meal or to eating out. A fast-paced urban lifestyle, increasing prevalence of nuclear family structure, rising disposable income, increasingly larger number of globe-trotting Indians with an experimentative palate are all favorable demographic factors spurring the adoption of RTE and RTC foods in India. Further, the growth of modern retail has provided unprecedented brand and category visibility to convenience foods. (Rahman Tazyn, 2012) [3], (Henry C.J.K, 1993) [4] in his article stated that Convenience foods can be broadly defined as "Foods that have undergone major processing by the manufacturer such that they require little or no secondary processing and cooking before consumption". This means, apart form warming, thawing, cooking, frying, diluting and reconstitution, the food is ready-to-eat. Soup mix had no added preservative, flavour enhancers and colouring matters. Similar observations are by in pearl millet products and opined that millet based products have good self-life hence, processing and value addition of traditional products with millet in general and little millet in particular through ready-to prepare and ready- to- eat products is needed, which will reach different strata of consumers. (Dod *et al*, 2003).

2. Material and Methods
2.1 Collection of samples
The selected millet namely little millet, were procured from local market Salem, Tamil Nadu, India. The millets were cleaned properly and stored in sealed containers till their use in different processing methods. The remaining raw ingredients such as carrot, beans, peas, pepper, corn flour, salt were purchased from local market for the preparation of convenience food mixes.

2.2 Analysis of functional, chemical, anti-nutritional properties of selected little millet flours
2.2.1 Physical characterization of selected little millet
Physical appearance of grain is an important characteristic which determines consumer acceptability and hence the study of physical characteristics of the grains becomes a basic step in any research. Physical characteristics such as thousand

grain weight, thousand grain volumes, hydration capacity and index, swelling capacity and index, cooking quantity/characteristics were analyzed using standard procedures in triplicates.

2.2.2 Functional properties of little millet
The functional properties such as bulk density, water absorption capacity, oil absorption capacity, swelling power, solubility, solid loss was analyzed using little millet.

2.2.3 Nutritional properties of little millet
The Nutritional properties of millet such as pH, total titratable acidity, Moisture, Carbohydrate and Energy value, crude protein,, Ash, total starch, Amylose content, soluble amylose, total sugar, dietary fibre and mineral composition were determined using standard procedures.

2.2 Standardization and development of millet based RTC (*Ready-to-cook*) soup mix
Convenience also decides to a greater extent when, where, what and how to eat foods the dry milling process started with the cleaning of grains. The millet undergone certain process as Millet grains (little millet) were Cleaned and washed under running water and Soaked millet grains were Parboiled. The Parboiled grains were dried to14% moisture and Milling into Millet grits.

2.3 Preparation of RTC soup mix from processed little millet grits
Three variations of soup mix were prepared by incorporating little millet and corn flour at different levels. corn flour in the ratios 0:100 (standard), other three variations of soup mix at 60%, 70%, 80% level of millet grits and other ingredients such as carrot, beans, peas, pepper, corn flour is taken in required quantity. The samples were cooled, packed in containers and stored at normal condition.

Table 1: Variations for the preparation of RTC soup mix

S. No	Ingredients	Control	V1	V2	V3
1.	Rice /corn flour (g)	100	40	30	20
2.	Little millet grits (g)	-	60	70	80
3.	Peas (g)	2	2	2	2
4.	Carrot (g)	2	2	2	2
5.	Corn (g)	2	2	2	2
6.	Pepper powder (tsp)	¼	¼	¼	¼
7.	Salt (g)	3	3	3	3

2.4 Preparation method for millets RTC (*Ready-to-cook*) soup mix
Roasted millet grits and Add Dried vegetables, salt, pepper powder to taste, Packed and sealed polyethylene pouches as Soup mix (RTC).

Method to cook
Boil 300ml of water and add 40 g of soup mix and stir well for 5minutes and Serve it hot

2.5 Nutrient composition of the developed millet based RTC (*Ready-to-cook*) soup mix
The developed millet based dry soup mix were analysed for its nutrient profile. The major nutrients such as Moisture, protein, carbohydrates, fat, fibre, soluble and insoluble fibre were calculated for all the developed recipes using the standard procedures (Gopalan *et al*, 2011).

2.6 Organoleptic evaluation of the developed millet based RTC (*Ready-to-cook*) noodles
Organoleptic quality evaluation of the product plays an important role in the acceptance and preference of foods. The sensory evaluation is done in the all the variation. The sensory quality is the different senses of preparation of prepared soup. All the developed RTC foods were evaluated for their acceptability by a semi trained panel of ten judges. Products were evaluated for sensory quality on the basis of appearance, colour, flavour, taste, texture and overall acceptability using a 9 point Hedonic scale by a panel of 10 judges (Larmond, 1977) score card with scores ranging from 9 to 1, where 1 = dislike extremely, 5= neither like nor dislike and 9= like extremely was used. Samples were coded and presented in a random sequence to the panellists.

2.7 Texture evaluation of developed millet based RTC (*Ready-to-cook*) soup
Texture is a very important quality characteristic which makes a significant contribution to the overall quality acceptance of food products. It was one of the three main acceptability factors used by consumers to evaluate food, the other two being appearance and flavour (Bourne, 1990). All the variations of noodles will be subjected to texture analysis using a Texture Analyzer (TVT-300XP, Perten Instruments, Sweden) after the preparation. The parameter such as stickiness, Resilience, Adhesiveness will be measured from the Texture Profile Analysis (TPA) according to the software provided by the company. All measurements for the texture analyses for each sample were performed more than three times, and the mean values were obtained.

2.8 Statistical Analysis
The data are compiled and analysed using statistical methods such as mean, SD, ANOVA. All these are performed and the results separated, using the Multiple Range Duncan Test ($P < 0.05$) and using the statistical software of SPSS 16.

3. Result and Discussion
3.1 Physical properties of little millet
Physical characteristics such as thousand grain weight, thousand grain volume, hydration capacity and index, swelling capacity and index, cooking quantity/characteristics were discussed bellow:

Table 2: Physical properties of little millet

Physical Parameter	Little millet
Thousand grain weight (g)	2.59±0.005
Thousand grain Volume (ml)	3.06±0.1
Hydration Capacity (g/1000 seeds)	1.61±0.02
Hydration Index (%)	61.5±0.05
Swelling Capacity (ml/1000 seeds)	0.21±0.01
Swelling Index (%)	6.71±0.02
Cooking Quantity	193.3±11.9

Values are mean ± standard deviations.

The table-II shows the thousand grain weights of little millet were 2.59 g respectively. The thousand grain volume of little millet was 3.06 ml. Grain volumes change significantly and most often, regularly at varying moisture contents. The hydration capacities of the little millet were 1.61 g/1000 seeds with the hydration index of 61.5% respectively. The little millet grain was found to have swelling capacity of 0.21 ml/1000 seeds (Phattanakulkaewmorie, 2011) [7] stated that the presence of high protein, lipid, fiber and larger amount of amylose-lipid complex in flour could inhibit the swelling of starch granules.

3.2 Functional properties of little millet

The functional properties such as bulk density, water absorption capacity, oil absorption capacity, swelling power, solubility, and solid loss discussed bellow table-3.

Table 3: Functional properties of little millet

Functional Parameter	Little millet
Bulk Density (g/ml)	0.44±0.005
Water Absorption Capacity (g/g)	0.94±0.02
Oil Absorption Capacity (g/g)	1.09±0.02
Swelling Power (g/g)	5.5±0.45
Solubility Per gram (%)	6.4±0.95
Solid Loss Per gram (%)	30.8±1.05

Water absorption capacity is important in the development of ready to eat foods, and high absorption capacity may assure product cohesiveness (Housson P, 2002) [8]. Water absorption capacity is about 0.94g and oil absorption capacity is1. 09g.Variation in fat absorption may be due to the variation in protein concentration, degree of interaction with water and oil and conformational characteristics (Butt MS, 2010) [9]. Swelling power, solubility, solid loss is 5.5g, 6.4g, 30.8 g respectively.

3.3 Nutritional properties of little millet

The Nutritional properties of developed recipes were discussed bellow table-4.

Table 4: Nutritional properties of little millet

S:NO:	Parameters	Little millet
1.	pH	6.9±0.1
2.	Ash(g)	6.9± 0.1
3.	Total titrable Acidity	24.6±0.20
4.	Moisture(g)	9.8±0.20
5.	Crude Protein(g)	13.6±0.1
6.	Crude Fibre(g)	5.0±0.1
7.	Carbohydrates(g)	65±1.0
8.	Fat(g)	1.9±0.1
9.	Energy (Kcals)	331.5±0.58
10.	Total Starch(g)	18.5±0.15
11.	Amylose content(g)	28.4±0.1
12.	Sodium(mg)	16±1.0
13.	Potassium(mg)	347±1.0
14.	Iron (mg)	9.2±0.1
15.	Calcium(mg)	43±1.00
16.	Phosphorus(mg)	265±1.00

The table-4 shows that the nutrient content such as protein (13.6g), high fibre content (5.0), and calcium (43). The iron content is 9.2 g, amylose content is 28.4 g. The highest amount of energy source was noticed in little millet (331.5kcals) The process of germination greatly attributed protein increase to protein synthesis due to inclusion of microbial cells in to the flour. (Srichuwong *et al*, 2005) [10]

3.4 Nutrient Analysis of developed Dry soup mix

The Nutrient Analysis of the developed Dry soup mix is given in the table-5.

Table 5: Nutrient analysis of little millet based convenience Dry Soup mixes

Nutrients	Standard soup mix	V1 (60%)	V2 (70%)	V3 (80%)
Moisture	5.2	3.5	3.8	4.0
Carbohydrate	78.2	72.3	70.5	69.1
Protein	5.0	7.5	7.6	7.6
Fat	9.8	9.6	9.5	9.3
Total fibre	5.2	6.4	6.2	6.8

Soluble fibre	0.4	1.2	2.0	2.5
Insoluble fibre	1.6	2.0	2.9	3.0

Values are mean ± standard deviations.

As can be seen from table-5 that available carbohydrate content and the High protein content (7.6 g) and the high fibre content. The soluble and insoluble fibre content in standard is high. Nutritional evaluation of the selected fibre rich food items revealed that the fibre rich product have good nutritional value and found to be a good source of minerals (Bora and kulshrestha, 2014) [11].

3.5 Organoleptic evaluation of RTC soup

Table 6: Mean organoleptic scores of RTC soup

Type of variation	Appearance	Colour	Flavour	Taste	Overall acceptability
Standard	8.9000±.6500^{a}	8.9000±.9000^{a}	8.3000±.3000^{a}	8.0500±.0500^{a}	8.2000±.2000^{a}
V_1	8.6500±.9000^{b}	9.0000±.9000^{a}	8.0000±.8.000^{a}	8.5000±.5000^{b}	8.8000±.5000^{b}
V_2	9.0000±.9.000^{b}	8.9000±.0000^{a}	8.2000±.8.200^{a}	8.5000±.5000^{b}	8.5500±.5500^{c}
V_3	9.0000±9.000^{b}	8.9000±.9000^{a}	8.8500±.2112^{a}	8.9000±.9000^{c}	8.9500±.9500^{c}

Values are the means ± standard errors of means (SEM) of four (3) determinants. Means with same superscript are not significantly
different using Duncan's Multiple Range Test ($P < 0.05$).

The soup formulation (V3) prepared from 80% little millet grits, scored highest scores for all the sensory characters viz., colour and appearance (9.00), taste (8.90), flavour (8.85), texture (8.90), after taste (8.90) and overall acceptability (8.95) as compared to other modified combinations. This might be due to addition of fine foxtail millet flour in appropriate combination resulting good colour, nice taste of soup. In appearance there is significance difference between the group and for other parameter such as flavour, colour, and taste and overall acceptability their is non-significance difference between the group.

3.6 Textural characteristics of RTC soup

Textural characteristics of little millet incorporated RTC soup is shown in table -7.

Table 7: Textural characteristics of RTC Noodle

S. No	Sample	Stickiness (N)	Resilience	Adhesiveness
1	Standard	-4.0	-3.0	-2.0
2.	Varation-1(60%)	-2.0	0.40	0.08
3.	Varation-2(70%)	0.05	3.10	0.26
4	Varation-3(80%)	0.34	4.64	0.19

(Shown in figure 1). apart from its energy contribution, starch content is the major factor which governs the texture of noodle and as a result, to the organoleptic properties of food.

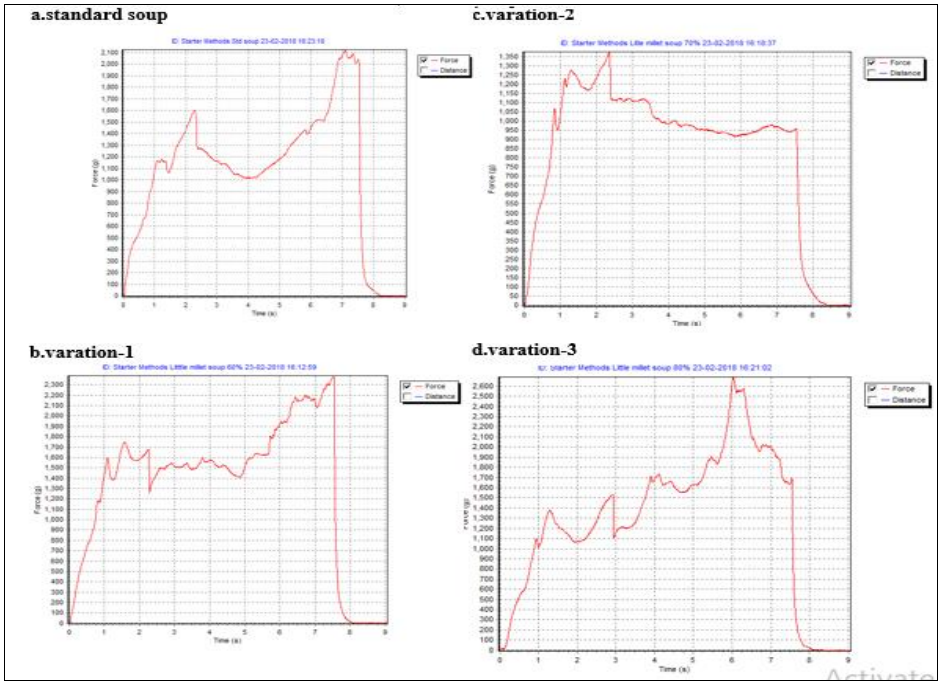

Fig 1: Texture evaluation of RTC soup

4. Conclusion

To increase little millet utilization and add to diversification in the market, which is mostly dependent on products from wheat and rice. Therefore, an attempt was made to develop Ready-to-cook recipe from little millet by incorporating different levels of raw little millet (*Panicum Miliare* L.). A developed soup is best substitutes for people who seek varieties and want foods with high fibre and low fat for good health. The increasing participation of women in working force and the interest of consumers in health foods has increased the demand for instant foods, ready-to eat snacks and ready-to-cook products with good nutritional profile. The millet is highly nutritious and rich in fibre content. The prepared ready-to-cook soup is more nutritious and highly accepted by panel members. The texture is excellent for all variations of soup. The mix is well nutritious because of the presence of fiber content in soup mix. The findings of this study were useful and easy to carry journey food.

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