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Development of minor millets based lavish and its quality evaluation

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Abstract
Lavish is a crispy version of snacks, it is usually a cracker that is handmade and roasted to provide crunchiness and it is also a healthy snack. *Lavish* when prepared by using minor millets as a major ingredient provides a much more nutrition in terms of protein, carbohydrates, minerals and dietary fibers in comparison with the traditional *Lavish* that is made of wheat flour. Since over consumption of wheat or its products are known for improper health condition such as celiac disorder may overcome by substituting it with minor millets which is rich in several minerals such as calcium and iron. Finally obtained product is kept for sensory evaluation by using nine point hedonic scale. *Lavish* was prepared by incorporating minor millets flour replacing wheat flour at different proportions. Nutritional composition was analyzed by using standard protocols. Results revealed that, developed product was acceptable up to 70 percent minor millets flour incorporation. Developed product had 11.23 g protein, 0.92 g fat, 74.27 g carbohydrate, 2.76 g crude Fibre and 345 K. calories of energy.

Keywords: Minor millets, organoleptic analysis, nutritional analysis

Introduction
Millet is a collective term referring to a number of small-seeded annual grasses. Millets belong to various genera in the subfamily 'Panicoideae', that are a part of the grass family 'Poaceae'. They possess remarkable ability to survive under severe drought conditions. Millets have been food commodities since ancient times. Because of their important nutritional qualities, there is a need to revive their usage in daily diet. Millets can substitute major cereals for better health benefits.

Supplementation of cereal based products with millets has become increasingly popular due to nutritional and economic advantages. With proper preparation, 30 percent of minor millets can be gainfully substituted for value added foods such as bakery products, extruded foods, ready-to-eat and allied mixes for the convenient preparation by rural and town folk at low cost. Thus, the minor millets with high yielding capacity, disease resistant, tolerant to adverse conditions and with better nutritive value in terms of complex carbohydrate and high dietary fibre render their suitability for the development of convenience, therapeutic and ready-to-eat (RTE) products Kanchana *et al.* (2018) [7]. Further, in the present existing situation of the society, it is the need of the day to exploit the positive nutritional benefits of millets and popularize them among all sectors of the society for achieving nutritional and therapeutic food security. Thus, for the health conscious in the present world, minor millet is perhaps one more addition to the existing list of healthy foods, owing to its nutritional superiority. Apart from this, the grain has high utilization potential owing to its excellent capacity to blend with other food grains without imparting any off flavour or after taste. Thus, the millets can be incorporated in traditional foods and valorized to novel food uses (Veena, 2003) [11]. Hence, the present investigation was undertaken to develop value added *lavish* from minor millets and to evaluate for consumer acceptability and nutritional efficiency. Thus, in view of this, the present study made an effort to diversify the utilization of millets and wholegrain based composite flour in the production of *lavish*, which were nutritionally rich and possessed health promoting properties.

Materials and Methodology
The present research work was carried out in Department of Food Science and Nutrition, University of Agricultural Sciences, Bengaluru.

Materials

Ingredients for the production of millet based lavish such as minor millets, wheat flour, oil, sesame and chilli powder were procured from the more super market, Bengaluru, Karnataka India. Unpolished and unhusked small millet samples namely finger millet (*Eleusine coracana*), little millet (*Panicum sumatrense*), foxtail millet (*Setaria italica*), Proso millet (*Panicum miliaceum*), kodo millet (*Paspalum scrobiculatum*), barnyard millet (*Echinochloa corona*) which were procured from All India Co Ordinated Research Project on Small Millets (AICRPSM), Gandhi Krishi Vigyan Kendra, Bengaluru-65. All the required chemicals and reagents of analytical grade were procured from the well reputed chemical distributer companies and used for the chemical analysis as such. Glass wares used during research work obtained from Department of Food Science and Nutrition, University of Agricultural Sciences, Bengaluru Karnataka India.

Processing methods and preparation of millet based *lavish*

Preparation of millets based *lavish* was carried out as per the formulation given in Table 1. The good quality of ingredients was selected and cleaning was carried out to remove the extraneous matter. Weighing was done as per the recipe formulation. Selected grains were washed two-three times under the running tap water and flow chart for the preparation of minor millets *lavish* was presented in Fig. 1.

Table 1: Formulation of minor millets *lavish*

Sl. No.	Ingredients (g)	Control	Variations		
			MLT1	MLT2	MLT3
1	Minor millets	0	70	80	90
2	Wheat flour	93	23	13	3
3	Oil	3	3	3	3
4	Salt	1	1	1	1
5	Sesame	2	2	2	2
6	Chilli powder	1	1	1	1

MLT1-Minor millets *lavish* treatment 1.
MLT2-Minor millets *lavish* treatment 2.
MLT3-Minor millets *lavish* treatment 3.

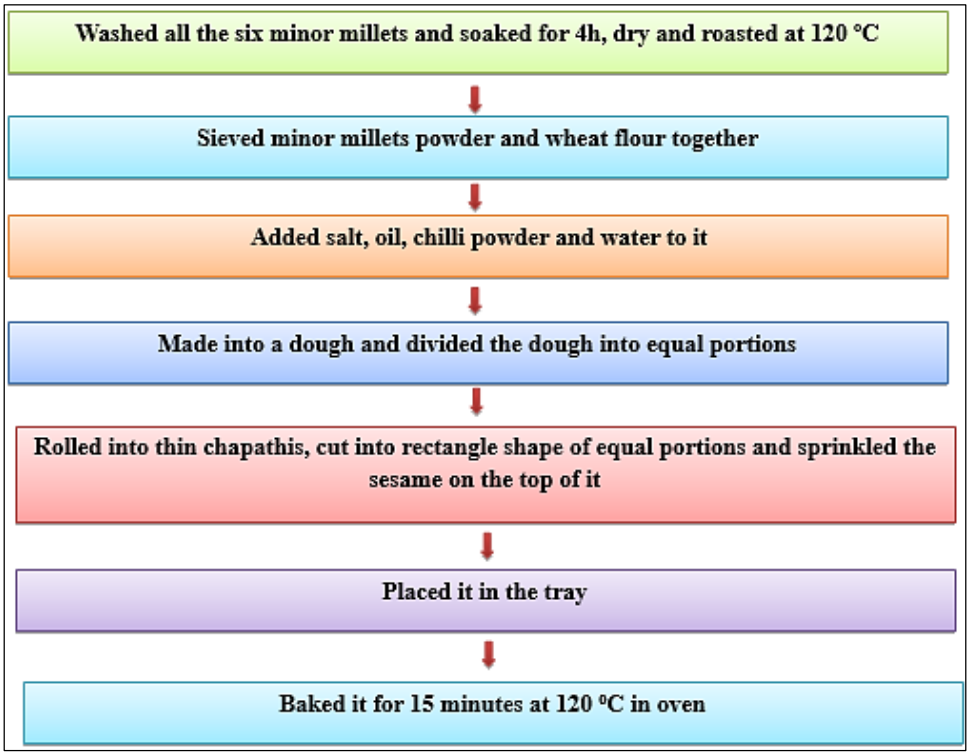

Fig 1: Flow chart for the preparation of minor millets *lavis*

Organoleptic analysis

Organoleptic evaluations of all samples (control and T1-T3) were carried out for the acceptability based on 9 points Hedonic scale. Samples were evaluated on the basis of appearance, color, taste, flavour, texture and overall acceptability. Scores were given on Hedonic scale represent 9 for like extremely while 1 for dislike extremely. Evaluation was carried out with the help of trained and semi trained panellists by providing respective evaluation sheet to individual member. Average score was selected for the selection of standardised product formulation.

Nutrient analysis

Analysis was carried out to determine the proximate composition of the selected (MLT1-70%) and control. Moisture content of the product was determined by dry oven method (AOAC, 2005) [1]. The dry moisture free sample further used for the analysis of proximate constituents like fat, protein, crude fibre, and ash content (AOAC, 2005) [1]. Carbohydrate content was calculated by difference method. Total energy was calculated using conversion formula by multiplying carbohydrate, fat and protein by 4, 9 and 4 respectively. Mineral solution prepared by digesting the ash sample and minerals such as calcium (Ca), magnesium (Mg), phosphorus (P), zinc (Zn), iron (Fe) and copper (Cu) were determined by the standard process. All proximate constituents were analysed in triplicate and mean score was considered.

Antinutrient analysis

Anti-nutrients are natural or synthetic compounds that when present in foods reduce the availability of the nutrients. The antinutritional parameters such as phytic acid, tannin and polyphenols were determined using standard procedures as described by Gao *et al*., 2007 [4] and AOAC, 2005 [1].

Statistical analysis

The analysis of variance (ANOVA) was used to find out significant differences between the variations for different sensory characters, and nutrient content.

Result and Discussion

Mean sensory scores of minor millets *lavish*

Lavish was developed by incorporation of minor millets flour at 70% (MLT1), 80% (MLT2), 90% (MLT3) and control 100% wheat flour. *Lavish* without minor millets flour incorporation was used as control. The sensory evaluation of *lavish* prepared from millets was presented in Table 2 and Fig. 2. The control *lavish* had higher mean scores 8.63, 8.69, 8.65, 8.67, 8.68 and 8.66 for appearance, colour, texture, aroma, taste and overall acceptability as compared to minor millets incorporated *lavish*. The minor millets incorporated *lavish* was best accepted at 70 percent with mean appearance (8.46), colour (8.43), texture (8.48), aroma (8.42), taste (8.47) and overall acceptability (8.49). The 90 percent level of incorporation showed lowest sensory scores 8.01, 8.03, 8.10, 8.06, 8.09 and 8.05 for appearance, colour, texture, aroma, taste and overall acceptability respectively. As the incorporation level of millets increased the sensory scores are found to be decreased due to the hardening of texture and dark colour. When statistically analyzed, the mean sensory scores were found to be significant at 5 percent level.

Giridhar (2019) [5] reported that control *khakhra* sample showed highest scores for appearance (8.20), colour (8.20), flavor (8.32), consistency (8.66), mouth feel (8.23) and overall acceptability (8.20) compared to other treatments. The percent incorporation of finger millet *khakhra* had highest sensory scores of 8.12, 8.12, 8.23, 8.28, 8.12 and 8.14 for colour, appearance, flavor, consistency, mouth feel and overall acceptability. The lowest scores for colour, appearance, flavor, consistency, mouth feel and overall acceptability were 8.02, 8.02, 8.15, 8.35, 8.01 and 8.12 was observed by 20 percent incorporation of finger millet *khakhra*. Significant difference was observed between the treatments for all sensory attributes at five percent level.

Bhavya *et al*. (2020) [2] reported that control pizza base showed highest scores of 8.46, 8.40, 8.66, 8.66, 8.60 and 8.33 for appearance, crust colour, aroma, texture, taste and overall acceptability compared to other treatments. The 70 percent incorporation of proso millet flour had highest sensory scores for appearance (7.53), crust colour (8.00), aroma (7.80), texture (7.86), taste (8.0) and overall acceptability. The lowest scores for appearance, crust colour, aroma, texture, taste and overall acceptability were 7.06, 7.20, 7.13, 7.26, 7.46 and 6.93 was observed by 60 percent incorporated proso millet flour pizza base. However, significant difference (p<0.05) exists between proso millet pizza base for appearance, crust colour, aroma, texture, taste and overall acceptability.

Table 2: Mean sensory scores of minor millets *lavish*

Products	Appearance	Colour	Texture	Aroma	Taste	Overall acceptability
Control	8.63	8.69	8.65	8.67	8.68	8.66
MLT1 (70%)	8.46	8.43	8.48	8.42	8.47	8.49
MLT2 (80%)	8.23	8.25	8.27	8.26	8.21	8.24
MLT3 (90%)	8.01	8.03	8.10	8.06	8.09	8.05
F-value	*	*	*	*	*	*
SEm±	0.03	0.06	0.09	0.05	0.12	0.07
CD @5%	0.09	0.18	0.27	0.15	0.36	0.21

*Significant at 5%.

MLT1 (70%)-Minor millets*lavish*treatment 1.

MLT2 (80%)-Minor millets *lavish* treatment 2.

MLT3 (90%)-Minor millets *lavish* treatment 3.

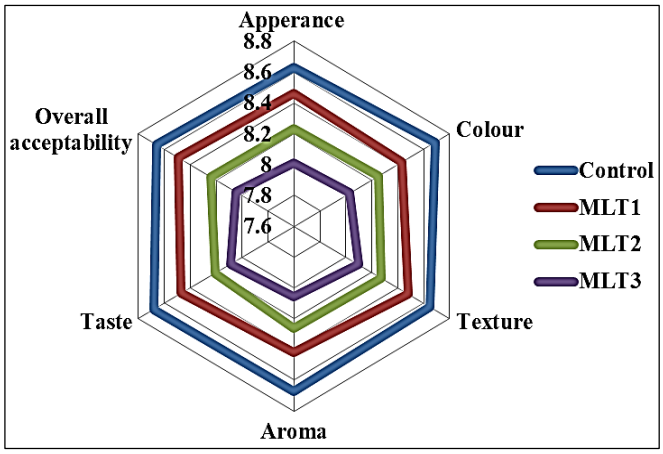

Fig 2: Mean sensory scores of minor millets *lavish*

Proximate composition of minor millets *lavish*

The proximate of *lavish* is depicted in the Table 3. The control and 70 percent incorporated millets lavish contains moisture (11.34 and 9.62 g), protein (10.36 and 11.23 g), ash (0.51 and 1.25 g), fat (0.76 and 0.92 g), fibre (2.76 and 3.85 g), carbohydrate (74.27 and 73.13 g) and energy (345 and 345 kcal) respectively. The incorporation of 70 percent millets *lavish* have high nutrient contents when compared to control which may be due to the incorporation of minor millets where the millets are good source of nutrients. When statistically analyzed they are significant at 5 percent level.

Mitkal *et al*. (2021) [8] analyzed the nutritional composition of kodo millet cookies. The control and kodo millet cookies contain moisture (13.3 and 10.90g), protein (8.30 and 11.0g), fat (0.90 and 1.30g), crude fibre (0.3 and 8.50g) and carbohydrate (73.9 and 65.90g). The high nutrients are found in the kodo millet cookies when compared to the control which may be due to the kodo millet being good source of nutrients. The present study is on par with this study.

The fat content of sugar cookies was high in both control and millet cookies because of added fat and slightly lower fat

content were found in salt cookies (Thejaswini *et al*., 2017) [10]. Hemalatha *et al*. (2007) [6] reported that addition of millets flour resulted in an increase in protein and fibre content in millet incorporated biscuits.

Table 3: Proximate composition of minor millets *lavish*

Proximate	Control	MLT1 (70%)	t value
Moisture (g)	11.34	9.62	4.37*
Protein (g)	10.36	11.23	2.15*
Ash (g)	0.51	1.25	20.72*
Fat (g)	0.76	0.92	5.07*
Fibre(g)	2.76	3.85	8.70*
Carbohydrate (g)	74.27	73.13	0.41 NS
Energy (Kcal)	345	345	0.02 NS

*Significant at 5%, NS-Non significant.
MLT1 (70%)-Minor millets *lavish* treatment 1.

Mineral composition of minor millets *lavish*

The micronutrient value of *lavish* has been presented in Table 4. The control had 20.40 mg 1.54 mg, 148 mg, 1.77 mg, 0.17 mg, 30.69 mg, 0.88 mg, 110 mg, 0.63 for calcium, sodium, potassium, iron, copper, magnesium, zinc, phosphorus and manganese. The 70 percent incorporated millets *lavish* contains calcium (80.32 mg), sodium (14.73 mg), potassium (186.15 mg), iron (3.33 mg), copper (0.42 mg) magnesium (84.67 mg), zinc (2.66 mg), phosphorus (198.70 mg) and magnesium (1.70 mg). The incorporation of minor millets increased the nutrient content of 70 percent incorporated millets *lavish* where the minor millets are rich in minerals which meet the daily requirement.

The present study is on par with the study conducted by (Thejaswini *et al*., 2017) [10] who developed control and millet cookies. The control millet contains calcium (15.43 mg) and iron (2.07 mg). The millets cookies are rich in calcium (70.10 mg) and iron (6.65 mg). Hemalatha *et al*. (2007) [6] also reported a content of 3.30 mg of iron and 23 mg of calcium/100g in the 20 percent little millet incorporated cookies. Shiny and Johm (2014) [9] also reported an improved nutrient profile in the millet incorporated biscuits. Biradar *et al*. (2020) [3] reported that phosphorus content in control cookies were (121.0 mg) and millet cookies (220.0 mg).

Table 4: Mineral composition of minor millets *lavish*

Minerals (mg/100g)	Control	MLT1 (70%)	t value
Calcium	20.40	80.32	27.33*
Sodium	1.54	14.73	33.66*
Potassium	148.00	186.15	6.06*
Iron	1.77	3.33	15.64*
Copper	0.17	0.42	20.85*
Magnesium	30.69	84.67	22.65*
Zinc	0.88	2.66	24.01*
Phosphorus	110.00	198.70	14.76*
Manganese	0.63	1.70	22.31*

*Significant at 5%.
MLT1 (70%)-Minor millets *lavish* treatment 1.

Antinutrient composition of minor millets *lavish*

The antinutrient content of *lavish* is depicted in Table 5. The content of antinutrients reduced significantly from control to millets incorporated *lavish*. The phytic acid content reduced from 462.50 to 212.35 mg, tannin reduced from 155.32 to 87.14 mg and polyphenols content reduced from 209.56 to 108.80 mg. The antinutrient content reduction was significant between the samples. The reduction of antinutrients in the millets *lavish* may be due to processing methods, roasted millet flours are used in making *lavish* preparation.

Table 5: Antinutrient composition of minor millets *lavish*

Antinutrients (mg/100g)	Control	MLT1 (70%)	t value
Phytate	462.50	212.35	18.58*
Tannin	155.32	87.14	14.47*
Polyphenols	209.56	108.80	16.13*

*Significant at 5%.
MLT1 (70%)-Minor millets *lavish* treatment 1.

Conclusion

Thus, from the present investigation it is clear that minor millets could be successfully value added. Hence, it can be concluded that the minor millet is a potential grain with superior nutrient content, could be a worthy addition to one's daily diet. However, further scientific investigations with regard to other novel foods can be carried out. Long term intervention feeding should be carried out to see the clinical efficacy millets based food products. This study has shown that minor millets have good potential for use in convenience food product formulation with the objective to enhance nutritional quality to meet future demand.

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