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# Nutritional profile of cereal-fruited pasta-food for ageing society

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**Abstract**

**Fresh flours of ragi viz., whole, fermented and puffed were incorporated to whole wheat flour at 10.0, 20.0 and 30.0 per cent levels along with 5.0 per cent bael pulp to prepare noodles/ vermicelli. The prepared samples were analyzed for water absorption capacity, fibre, NDF, ADF, protein and also for Equilibrium Relative Humidity. Water absorption capacity was found to be highest with puffed flour and minimum with fermented flour. A good amount of fibre and protein was found in the complemented sample as compared to whole wheat sample. As far as Equilibrium relative Humidity is concerned a range of 12.38-16.87 per cent was obtained.**

**Keywords:** Cereals, bael, ragi, fingermillet, nutritional value.

## Introduction

Coarse grains form a staple food for a large chunk of population living below the poverty line in the semi-arid parts of country. Millets are small sized grains containing large proportion of husk and bran. They are comparable to rice and wheat in their nutritive value and some higher proportions of micro nutrients. The non-availability of refined and processed millets in ready-to-use form has limited their wider use and acceptability. Therefore, an effort was made to process ragi into three types of flours-whole, fermented and puffed to find out their effect on nutritional value. These flours were incorporated to whole wheat with bael pulp. Bael is highly nutritious having therapeutic value for dyspepsia, diarrhoea and dysentery. It acts as a sweet cooling tonic for heart and brain. Products like noodles/vermicelli prepared from this combination can be good for geriatrics as well as for health conscious subjects, since it is a fast-to-cook and ready-to-eat food.

## Material and Methods

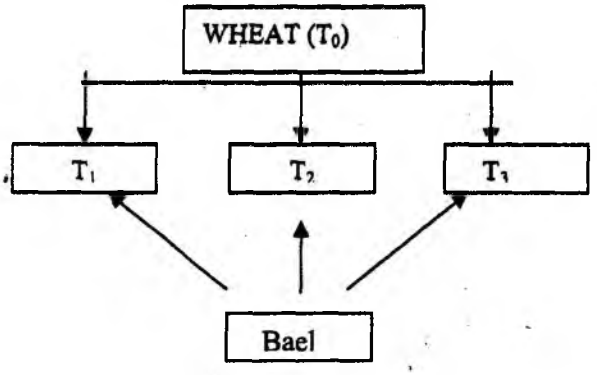
Whole wheat flour and bael was procured from local market. Fresh and ripe fruits free from blemishes were sorted out; pulp was prepared according to method standardized by Roy and Singh (1979). Thereafter, discarded the seeds and filled into sterilized jars. Ragi seeds were procured from the Department of Plant breeding and Genetics of CSK HPKV, Palampur. The seeds were washed to remove filth, dust, dried in sun and stored in airtight containers. One lot was made to flour as such. The other was soaked in 1:3 parts of water for 2 days. Discarded the water and residue was made into paste. The supernatant liquid was decanted and solid starch was allowed to settle down, out of which small balls were made and dried in air drier for 4 hours at 50$^0$C. After drying, balls were ground to flour and obtained the fermented flour. The third lot was popped in a hot pan and popped seeds were ground to a flour.

The preparation of pasta involved the mixing of ragi flours with wheat flour and fruit pulp at their respective levels by adding optimum water. All these ingredients were mixed properly to get a desirable consistency of dough. The dough was then extruded by the hand extruder through suitable shaped dies. The product so obtained was dried in air dryer for six hours at 50-55$^0$C. After drying they were cooled and packed in polyethylene bags and stored under ambient temperature.

**Table 1. Ragi flour (whole, fermented and puffed) and bael pulp proportion**

| Ragi flours (%) | Bael (%) |
|---|---|
| $T_1$ = 10.0 | 5.0 |
| $T_2$ = 20.0 | 5.0 |
| $T_3$ = 30.0 | 5.0 |

**Interactions**




Thereafter, ground to a fine powder for analysis. Protein and crude fibre were estimated by standard AOAC 1990. Neutral Detergent Fibre (NDF) and Acid Detergent Fibre (ADF) were estimated by the method as described by Van Soest and Wine (1967). Equilibrium Relative Humidity was calculated by the method suggested by Ranganna (1995).

**Results and Discussions**

As is clear from table 2 the water absorption capacity of the control sample ($T_0$) was 65.0 and was found to decrease significantly with the addition of ragi flours. The texture of the raw ingredients is mostly responsible for water absorption capacity. Within each treatment, however, no much difference was observed but among the treatments, fermented ragi had least water absorption of 54.0 per cent followed by whole (55.3) and puffed (60.0) treatment.

**Table 2. Nutritional value of wheat-ragi-bael based noodles / vermicelli**

| Treatments | Protein | Fibre | NDF | ADF |
|---|---|---|---|---|
| $T_0$ | 11.56 | 2.24 | 10.15 | 3.16 |
| **Whole** | | | | |
| $T_1$ | 12.23 | 2.73 | 12.33 | 4.45 |
| $T_2$ | 11.64 | 2.89 | 12.78 | 4.72 |
| $T_3$ | 10.28 | 3.09 | 13.76 | 4.94 |
| Mean | 11.38 | 2.90 | 12.96 | 4.70 |
| **Fermented** | | | | |
| $T_1$ | 11.89 | 2.55 | 10.67 | 4.21 |
| $T_2$ | 12.99 | 2.69 | 9.76 | 3.97 |
| $T_3$ | 13.76 | 2.76 | 9.33 | 3.92 |
| Mean | 12.88 | 2.67 | 9.93 | 4.03 |
| **Puffed** | | | | |
| $T_1$ | 13.38 | 2.64 | 15.71 | 4.87 |
| $T_2$ | 13.34 | 2.82 | 20.06 | 5.15 |
| $T_3$ | 13.10 | 3.02 | 24.35 | 5.72 |
| Mean | 13.27 | 2.83 | 20.04 | 5.25 |
| CD (P=0.05) | | | | |
| A | 0.11 | 0.03 | 0.61 | 0.26 |
| A x T | 0.20 | 0.06 | 1.07 | 0.39 |
| Control vs Others | 0.24 | 0.07 | 0.80 | 0.29 |

A= Ragi flours AxT = Interaction

Highest water absorption in case of puffed flour can be attributed to the incorporation of puffed ragi flour having least moisture due to expansion during popping. Mandoza and Bressani (1987) stated that the increased water absorption during popping is the result of damaged starch. table 3 illustrates the nutritional profile of wheat-ragi-bael based noodles/vermicelli. The protein, fibre, NDF and ADF content of whole wheat sample was found to be 11.56, 2.24, 10.15 and 3.16 per cent respectively which increased significantly after the addition of ragi flours and bael pulp. The mean values for protein content in whole, fermented and puffed treatments were 11.38, 12.88 and 13.27 per cent respectively. A significant decease in protein with increasing level of whole ragi flours was observed which might be due to reductions in the amount of whole wheat flour containing higher protein

content than ragi and bael pulp. As far as fermented and puffed treatments are concerned, a good improvement was observed. Achinewhu (1983) observed improved protein content after fermentation which can be attributed to the present increased content in the samples. An improved protein in the puffed samples has also been reported by Deloist-Lewis *et al.* (1992).

Whole ragi flour samples contained the highest amount of fibre with 2.90 per cent followed by puffed (2.83 per cent) and fermented (2.67 per cent) flour samples. The higher value obtained in case of whole ragi treatment is due to the presence of bran in whole ragi flour. Reductions in case of fermented samples can be due to refining of fingermillet flour during fermentation. Such findings have also been reported by Desikachar (1977). Deloist-Lewis *et al.* (1992) also reported lower content of crude fibre in puffed products.

**Table 3. Water absorption capacity of wheat-ragi-bael based noodles/vermicelli**

| Treatments | Water absorption |
|---|---|
| $T_0$ | 65.0 |
| Whole | |
| $T_1$ | 54.0 |
| $T_2$ | 56.0 |
| $T_3$ | 56.0 |
| Mean | 55.0 |
| Fermented | |
| $T_1$ | 50.0 |
| $T_2$ | 56.0 |
| $T_3$ | 56.0 |
| Mean | 54.0 |
| Puffed | |
| $T_1$ | 56.0 |
| $T_2$ | 58.0 |
| $T_3$ | 66.0 |
| Mean | 60.0 |

When fermented flour was added at 10, 20 and 30 per cent along with 5 per cent bael pulp, the NDF content was found to decrease with the minimum value of 9.93 per cent. Whereas, whole and puffed recorded an increased amount of NDF content with the mean values of 12.96 and 20.04 per cent. Among the treatments, puffed treatment recorded the highest range of 15.71-24.35 per cent, which can be attributed to the formation of residue resistant to chemical detergents. Same was also observed by Pedersen *et al.* (1987). Whereas, the fermented flour at 10.0 per cent recorded 10.67 per cent NDF somewhat similar to the control sample but decreased beyond this level. This reduction might be due to degradation of hemicellulose during fermentation. Morrison *et al.* (1989) also had similar observations, thus giving credence to the present findings.

**Table 4. Equilibrium Relative Humidity/$a_w$ of wheat-ragi-bael based noodles/ vermicelli**

| Treatments | Whole | | Fermented | | Puffed | |
|---|---|---|---|---|---|---|
| | ERH (%) | $a_w$ | ERH (%) | $a_w$ | ERH (%) | $a_w$ |
| $T_0$ | 74.5 | 0.75 | 70.0 | 0.70 | 60.0 | 0.60 |
| $T_1$ | 73.5 | 074 | 73.5 | 0.74 | 54.0 | 0.54 |
| $T_2$ | 70.0 | 0.70 | 74.0 | 0.74 | 52.5 | 0.53 |
| $T_3$ | 70.0 | 0.70 | 72.5 | 0.73 | 53.5 | 0.54 |
| Mean | 71.2 | 0.71 | 73.3 | 0.73 | 53.3 | 0.53 |

ADF content also increased to a mean value of 4.70, 4.03 and 5.25 per cent by substituting whole, fermented and puffed ragi flour at 10, 20 and 30 per cent with 5 per cent bael pulp. Within the treatments the ADF contents were found to increase significantly with the addition of ragi flours. Among the treatments, puffed recorded the highest content due to insolubilization of the residue in acid hydrolysis. Whereas, the least content of fermented treatment might be due to reduction in the cellulose content during fermentation. As ADF includes cellulose, reductions in cellulose caused reductions in ADF. Similar observations were also reported earlier by Jones *et al.* (1992) which supports the findings. The data in Table 4 shows the ERH/$a_w$ of the prepared samples. The ERH values recorded were higher in fermented samples (73.3 %) as compared to control. The values recorded in whole and puffed treatment were 71.2 per cent and 53.3 per cent, respectively. The high $a_w$ observed in fermented treatment is due to the increased moisture during soaking of the grains thus providing higher values. Shreedhar *et al.* (1996) indicated that water activity of product is apparently controlled by the relative proportion of moisture binding components. Whole ragi treatment also indicated higher water activity due to the presence of high amount of starch. Since it was stated by Chinachoti and Steinberg (1986) that the

presence of any impurity of other food ingredient such as starch could be responsible for incomplete crystallization within the equilibration time thereby, resulting in relatively high moisture content in the sample. This also makes clear for low values of puffed treatment since there is breakdown of starch during popping.

## Conclusion

Ragi flours can successfully be utilized for the preparation of several high protein, fibre and high dietary fibre products mostly suitable for old aged. Moreover, high protein and fibre content can be recommended for cardiac, diabetes and other health conscious subjects. People living below the poverty line can easily rely on these products for their body needs as these products are easy to prepare.

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