**Evaluation of Nutritional and Sensory Quality of Weaning Food Prepared from Wheat Malt and Pearl Millet Flour**

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**ABSTRACT**

Malnutrition among infants in developing countries is a critical issue, especially during the weaning phase. Nutrient-rich, cost-effective supplementary foods are essential to address protein-energy malnutrition. This study aimed to develop and evaluate a weaning food using wheat malt and pearl millet to enhance protein, energy, iron, calcium, and amylase content. Two formulations and a control were prepared and assessed for physical, physico-chemical, and sensory properties. The most accepted formulation underwent nutritional analysis. Sample 2 received the highest sensory acceptability. Nutritional analysis confirmed improved protein, energy, iron, and calcium levels, along with better digestibility. The optimized wheat malt–pearl millet formulation was nutrient-dense, cost-effective, and well-accepted, making it a promising supplementary food to combat malnutrition in infants.

**Keywords: - Weaning malnutrition, pearl millet wheat malt.**

**INTRODUCTION**

Adequate nutrition during infancy is crucial for healthy development and growth. The infancy period (0-2 years) is a "critical window" for promoting optimal growth, health, and behavioral development (Onoja US et al., 2014). Nutritionally balanced, energy-dense, and easily digestible foods with functional benefits are essential (Murugkar DA et al., 2013). Malnutrition among infants and young children remains a major public health issue, particularly in developing countries, where protein-energy malnutrition is common during the weaning phase. This transitional period from liquid to semi-solid or solid foods often results in inadequate nutrient intake, impacting proper growth and development (Black et al., 2008).Wheat malt, produced by germinating wheat, is rich in B-complex vitamins, carbohydrates, and essential minerals like phosphorus, magnesium, calcium, and iron. It also contains high levels of amylase, an enzyme that aids in starch digestion (Dharmaraj et al., 2012). Pearl millet is another nutritious grain, known for its high energy content and as an excellent source of iron, making it particularly beneficial for infants needing iron-rich foods (Yadava et al., 2009). This study aims to develop and evaluate a weaning food made from wheat malt and pearl millet flour, assessing its physical, physicochemical, and sensory properties to determine the most acceptable formulation.

**METHODOLOGY**

The study was conducted in the Food and Nutrition Laboratory of the Home Science Department at Dayalbagh Educational Institute, Agra. Wheat and pearl millet were purchased from local markets in Agra.

**Sample Preparation**

The wheat and pearl millet grains were cleaned, soaked for 48 hours, dried, and ground into fine flour. The prepared flours were mixed with sugar candy powder and sealed for storage. The wheat malt preparation involved sorting, soaking, germinating, drying, and grinding, while pearl millet flour was prepared by drying and grinding the grains into fine flour. The composite mixtures were formulated in different ratios to optimize nutritional value and sensory appeal. The final products were stored in airtight containers to maintain quality.

 **Development of weaning food**

**Preparation of wheat malt Preparation of pearl millet flour**

 Wheat (cereal) Pearl millet

Sorting and washing sorting and washing

Soaking in water for overnight spread in trays

Trying in a muslin cloth for sprouting Drying in oven70oc for a hour

Appearance of sprouts Dehydrate

Germination Grinding to a fine cereal

Taking germinated cereal flour

 Spread in trays

Drying in oven at 130C for a hour

Repeating the process till moisture disappear

Dehydration

Taking dehydrated cereal

Grinding to a fine powder

 Flours.

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**Nutritional Analysis**

Whole wheat flour and pearl millet weaning food was analysed for nutritional properties in which moisture, ash, protein, fat, fibre, iron and calcium assessed by the method given by (AOAC, 2000).

**Physical Properties**

The physical property of pearl millet and wheat flour was checked by the method given by (prakash et al., 2000).

**Sensory Evaluation**

The sensory evaluation was conducted to assess the acceptability of the weaning foods developed from wheat malt and pearl millet flour. A total of 20 untrained panellists, aged 18-50 years, participated in the sensory evaluation. The panellists were selected to represent the target consumer group for the weaning food. A 9-point Hedonic scale (1 = ‘dislike extremely’ to 9 = ‘like extremely’) was used to rate the sensory attributes. Panellists were asked to rate each sample in terms of Appearance colour, flavour, texture, consistency and overall acceptability

**Statistical Analysis**

The data were analysed using one-way Analysis of Variance (ANOVA) to determine significant differences in the sensory ratings between the different samples. Turkey’s HSD tests were applied to check difference.

**RESULTS AND DISCUSSION**

**Preparation of composite mixture**

The complementary food sample was reconstituted with milk in a bowl and stirred for 2 to 5 minutes to obtain a smooth gruel. The proximate and sensory properties of the weaning food were evaluated after formulation from different blends. The flours were mixed in varying proportions, as shown in Table 1, with wheat flour used as the control. Two treatments, S1 and S2, were formulated using these blends.

**Table 1. Formulation of weaning food**

|  |  |  |
| --- | --- | --- |
| **Samples** | **Wheat flour %** | **Pearl millet flour %** |
| Control | 100 | - |
| S1 |  50 | 50 |
| S2 | - | 100 |

**Table 2. Physical properties of raw material**

|  |  |  |  |
| --- | --- | --- | --- |
| **Sample** | **Bulk density g/ml** | **1000 kernel weight (g)** |  **Dimension(mm)** |
| **Length** | **Width** | **Diameter(mm)** |
| Wheat  | 0.89$\pm 0.93$ | $$44.00\pm 3.00$$ | 06.71$\pm 0.34$ | 3.38$\pm 0.34$ | - |
| Pearl millet | 0.79$\pm 0.03$ | $$11.00\pm 1.00$$ | - | - | 3.41$\pm 0.20$ |
| CD at 5% | 0.02 | 0.18 | 0.67 | 0.45 | 0.34 |

Data represent mean $\pm $SD value followed by letter significant (p < 0.05) determined by Duncan.

Wheat has a bulk density of 0.89 g/ml, while pearl millet has a bulk density of 0.79 g/ml. Panda et al. (2020) reported a bulk density of approximately 0.84 g/ml for pearl millet, which closely aligns with findings. The 1000-kernel weight of wheat is 44.00 g; whereas that of pearl millet is 11.00 g. Prakash et al. (2020) reported that the 1000-kernel weight of different pearl millet varieties ranged from 9.11 g to 10.12 g, which is in close agreement with our results. Grain dimensions, wheat has a length of 6.71 mm and a width of 3.38 mm. Pearl millet has a diameter of 3.41 mm. Prakash et al. (2020) observed that pearl millet grains had lengths ranging from 2.997 mm to 3.172 mm and widths from 2.433 mm to 2.609 mm, which are slightly similar to our study.

**Table 3. Sensory evaluation of weaning food**

| **Attribute** | **Control** | **S1WFPMF** | **S2PMF** | **C.D.**  |
| --- | --- | --- | --- | --- |
| Appearance | 6.5 ± 1.14ᵃ | 6.70 ± 0.64ᵃ | 5.60 ± 0.96ᵇ | 1.04 |
| Taste | 6.5 ± 1.00ᵇ | 7.1 ± 1.12ᵃ | 5.4 ± 2.00ᵇ | 1.13 |
| Flavor | 5.60 ± 1.62ᵇ | 6.7 ± 1.10ᵃ | 5.00 ± 1.61ᵇ | 0.78 |
| Consistency | 5.70 ± 1.12ᵇ | 6.40 ± 1.3ᵃ | 6.20 ± 1.33ᵃ | 0.76 |
| Overall Acceptability | 7.59 ± 1.53ᵃ | 7.98 ± 1.28ᵃ | 7.7 ± 1.34ᵃ | 0.89 |

Data represent mean$\pm $SD value same letter (a, b,) within a row indicates no significant difference. Different letters indicate significant differences between the means (p < 0.05) determined by Duncan.

S1 Wheat flour pearl millet flour 50:50 %. S2 Pearl Millet flour 100%.

Weaning food was evaluated by sensory evaluation (appearance colour, flavour texture, taste and overall acceptability by 20 panellists. Mean scores of sensory parameters are given in table no 3.S1 scores better as compare to control Laminu et al., (2016) found that pearl millet, when combined with wheat, cowpea, and groundnut, improved texture and acceptability, similar to S1 formulation Okwunodulu et al., (2020) reported that higher pearl millet content enhanced taste and flavor, aligning with finding that S1 had the best sensory scores. In comparison, the sensory evaluation of formulations indicated that the weaning food prepared from the wheat and pearl millet blend (S1) was preferred for its smooth texture and acceptable sweetness, similar to findings by Sharma et al. (2018), who observed that the addition of sweeteners like sugar candy improved the palatability of weaning foods without compromising nutritional value.

**Table 4. Nutritional quality of weaning food**

| **Nutrients(100g)** | **Pearl Millet Flour**  | **Wheat Flour**  |  |
| --- | --- | --- | --- |
| **Moisture (g)** | 5.98±0.67ᵃᵇ | 5.96±0.77ᵃᵇ |  |
| **Ash (g)** | 2.1±0.61ᵃᵇ | 1.2±0.61ᵃᵇ |  |
| **Protein (g)** | 7.89±0.76ᵃ | 9.18±0.02ᵃ |  |
| **Fat (g)** | 2.67±0.66ᵃᵇ | 3.73±0.42ᵃᵇ |  |
| **Fiber (g)** | 1.9±0.08ᵃᵇ | 2.14±0.56ᵃᵇ |  |
| **Carbohydrate (g)** | 72.3±1.4ᵇ | 68.1±1.3ᵇ\* |  |
| **Calcium (mg)** | 34±1.2ᵇ | 43±1.2ᵇ\* |  |
| **Iron (mg)** | 3.5±0.87ᵃᵇ | 11.5±0.78ᵃᵇ |  |

Data represent mean$\pm $SD value same letter (a, b,) within a row indicates no significant difference. Different letters indicate significant differences between the means (p < 0.05) determined by Duncan.

Significant differences were found in carbohydrate and calcium content. No significance difference was found in moisture ash protein fat and fiber. The findings of this study align with similar research on the development of weaning foods using millet and wheat Pandya et al. (2020) found that weaning foods prepared with millet and wheat blends improved digestibility and provided higher energy, calcium and iron content compared to single cereal-based formulations. Additionally, the proximate analysis of formulations showed an increase in protein content and digestibility, as reported by Kumar et al. (2019), who found that the inclusion of amylase-rich foods like malted wheat enhanced the nutritional profile and digestibility of complementary foods. These findings support the potential of using malted wheat and pearl millet as key ingredients in the formulation of nutritious and digestible weaning foods for infants.

**CONCLUSION**

Homemade weaning diets can provide significant benefits in achieving the status of an ideal weaning food. This study does not endorse the use of commercial feeds but instead stresses to mothers that a homemade diet is not a compromised option. An enriched homemade diet plays a crucial role in supporting not only the child’s immediate health but also their long-term development. One of the key advantages of a homemade diet, as compared to commercial feeds, is the favourable cost-benefit ratio. It offers a more affordable yet effective way to address malnutrition and meet the essential nutritional needs of infants. Therefore, ensuring that infants receive the right food at the right time is critical for fostering optimal growth, development, and health outcomes.

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