International Journal of Food Science and Nutrition
www.foodsciencejournal.com
ISSN: 2455-4898
Received: 27-07-2021, Accepted: 11-08-2021, Published: 27-08-2021
Volume 6, Issue 4, 2021, Page No. 134-137

A review formulation and development of weaning food for infant

Rushikesh S Jadhavar, Swapnil G Jaiswal, Deepak T Bornare
Food Engineering Laboratory, Department of Agricultural Engineering, Maharashtra Institute of Technology, Aurangabad, Maharashtra, India

Abstract
The objective of this study was incorporation of Rice Green gram and Finger millet flour in weaning food formulation and evaluating nutritional quality and sensory quality of the products. The premix is prepared using germination process, and the blend formulation involving incorporation of Rice, Green gram and Finger millet, flour. The analysis undertaken in this study was infant food proximate composition and functional properties of the product such as protein, fat, moisture, ash content and mineral concentration. The results show that the ratio of Rice: Green gram: Finger millet flour respectively is the optimal incorporation. Sensory analysis and proximate analysis showed that incorporation of Rice, Green gram and Finger millet, flour significantly improved all nutritional characteristics and sensory qualities. The moisture is slightly increased compared with the change in the storage period, study on the shelf life of the product is revealed that Compared with low-density polyethylene, high-density polyethylene is the best barrier to air, moisture and microorganisms because the Compared with low-density polyethylene, the fat content and ash content of high-density polyethylene are significantly reduced, and significant increase in moisture was lesser in High density polyethylene.

Keywords: finger millet, rice, green gram, germination, weaning food

Introduction
Functional foods are becoming more and more popular worldwide in view of their inherent health benefits. Today's consumers are more health-conscious and very picky their eating habits. Consumers are looking for food that can not only supplement nutrition balanced nutrition can also increase their health and well-being. Weaning is the most important and critical stage of children's growth and development. Therefore, it is necessary to attach great importance to developing weaning food. The commercial weaning food manufacturers have focused much on supplementing the balanced nutrition to various age groups of children but less emphasis has been given on health and well-being of children. In this direction, it is necessary to develop functional weaning foods to meet the needs of weaned children. Weaning is the stage in which a baby changes from a diet composed entirely of breast milk to a diet similar to that of a community adult. It is a process of introducing semi-solid food into the infant diet. The American Academy of Pediatrics and the World Health Organization recommended waiting until 6 months to introduce baby food. (Nwaigbo, B.I. *et al* 2014) [1] Weaning food is specially formulated for the transition from breastfeeding or bottle feeding to normal intake of solid foods for infants between 3 and 9 months of age. Complementary food plays a vital role in the growth and development of children, because when breast milk alone is no longer sufficient, it can supplement the baby's nutritional and developmental needs (Temesgen, 2013) [2].

Weaning food
Breast milk is the best food for newborns and the most suitable food. Although most Indian babies are breastfed during the first 6 to 8 months of life, not everyone has a healthy mother who can provide adequate nutrition, which in turn increases the demand for weaning food. Breast milk is the best food for newborns and the most suitable food. Although most Indian babies breastfeed during the first 6 to 8 months of life, not everyone has a healthy mother who can provide adequate nutrition, which in turn increases the demand for weaning food. (Mishra *et al* 2014) [3] The semi-solid food given to the child at this stage is usually defined as weaning food it is prepared by processing ingredients to improve digestibility and nutritional quality. It is classified as a ready-to-eat food. Its preparation is simple, convenient, easy and fast. Weaning food supplements with high protein content, high digestibility and high energy density must be prepared from readily available low-cost raw materials. This weaning food can be used to meet the needs of growing children, thereby reducing malnutrition in developing countries (Satter *et al* 2013) [4]. Processing techniques used for formulating complementary foods, roasting, soaking, fermentation and sprouting these techniques enhance the bioavailability of micronutrients by decreasing the antinutritional factors and improving overall digestibility and absorption of nutrients also reduce the high bulk of complementary food with reducing the viscosity (Rasane *et al*., 2015) [5].

Weaning food is eaten
- In the first year of life, babies will experience a period of rapid growth, at which time good nutrition is essential.
- Actually, Nutrition in early life is the main determinant of healthy growth throughout childhood and health in adulthood.
- In the first six months of life, the baby is almost completely breastfed. Usually exhibits satisfactory

growth and development.
- In developing countries, child malnutrition is common because infants at this stage of development need higher energy and protein to meet their increasing metabolic needs.

Children need to consume 14.5 grams of protein, 30-40 grams of fat, 250 grams of carbohydrates, 25 grams of fiber, 5.0 mg of iron, 400 mg of calcium, 800 mg of potassium, and 485 KJ/Kg of calories during childhood.

Development of Weaning Foods

Solomon Mariam (2005) [6] three composite blends were prepared from maize, Acha grains, soyabeans, groundnut, Bambaranut, benniseed, carrot, garden eggand crayfish based on protein basis of food commodities used.The proximate nutrient composition are compared with proprietary formula (Nestle Cerelac) and observed that Most of the local grains and legume blends have high nutritional value than Cerelac product and all minerals values lower than values in cerelac product. Rashmi Kumkum, Chikke Gowda, Anjum Khanam And Bhagya Swamylingappa (2010) [7] Developed two instant weaning food formulas by using oilseed, Wheat, green gram Dhal, sugar and cereal malt. And evaluated physico-chemical, functional and nutritional characteristics of formulas during his sensory research he confirms that under normal storage conditions, products with a shelf life of one year. V.I.E. Ajiwe and B.I. Nwaigbo (2014) [1] Weaning Foods Formulated from maize, sorghum, wheat, African yam bean, Bambara groundnut, Pigeon Pea and Soybean.20 kinds of compound mixtures are prepared in different proportions(Cereals: legumes). The chemical analysis is in compare their nutritional value with the nutritional value of commercial formulas (Cerelac and Nutrend). The proximate composition, vitamins, minerals and sensory evaluation were evaluated. Result shows that the whole-tested weaning food can be used to replace more expensive commercialproduct.

Shipra Srivastava, Neerubala, Shikha Singh and Mohammad Zaki Shamim (2015) [8] prepared sweet porridge from Three flour based combination of wheat flour, Bajra and whole moong flour. The sensory evaluation of the developed products was evaluated by nine-point hedonic scale scorecard to evaluate sensory attributes such as color, appearance, texture, flavor, taste and overall acceptability.

S. Patel & Veenu Verma (2015) [9] prepared malted weaning food from finger millet, green gram and bengal gram.Malted weaning food is mixed with powdered sugar, milk powder or whole milk and flavoring agents to make milk-based beverages. i.e. ragi malt. Shelly Jain, R.S. Dabur, S. Bishnoi and Jitender (2016) [10] prepared two milk based ragi porridge by using milk, and ragi. And observe the nutrient composition, mineral and sensory characteristics of formula weaning food. Laxmi Pandey and Vishakha Singh (2018) [11] Two weaning formulas were prepared from (mixed grains and nuts; banana, apple and rice paste) Sensory evaluation and close composition research were carried out on the prepared weaning food. Prepared weaning foods were investigated for organoleptic evaluation and proximate composition he observed that weaning food formulas belong to the category of "liked very much" in terms of sensory, and have good potential for use as infant weaning food in terms of nutrition. A. Poshadri, Y. Praveen Kumar, G. Shiva Charan, M. Raghuveer, M. Sunil Kumar and A. Rama Devi (2019) [12] prepared energy rich composite millet and soybean based malted weaning mix from Sorghum, Wheat, Ragi, Soybean, Green Gram and observed that superior nutritional quality with acceptable sensory properties of prepared weaning mix

Effect of Processing on nutritional composition

Table 1

Rice		
Soaking, Drying, Milling	In soaking process break down anti nutritional factors. And soaked rice is rich in vitamin B6, B12, also increase in calcium, magnesium and iron content.	Sharma & Gaytri (2018) [13]
Green Gram		
Germination	After 24 hours of germination the bioavailability of iron has increased significantly by 38% (green grams).48hours after germination, the bioavailability of iron obtained from millet increased by 20%.And the tannin content decreased within 48 hours after germination.	S Hemalatha *et al* (2007) [14]
Drying	Reported that compared with dry seeds, the content of amino acids and protein is significantly increased. It was found that they had slightly higher carbohydrate content after germination. The nutrient content and quality of mung bean seeds improved after germination.	Gideon I. Ogu (2017) [15]
Roasting	Reported that the increase of water TDS will adversely affect the germination of mung bean and the production of bean sprouts. It is recommended to use water with a TDS of less than 100 ppm or distilled water to germinate mung beans at a temperature of 30°C to obtain high-quality mung bean sprouts.	Muhammad hanif *et al* (2019) [16]
milling	Improve the bioavailability, digestibility and utilization of nutrients, nutrition and medicinal quality. Sprouting and then drying (controlled germination) results in malt production which helps to transform the sprouts into a more digestible form.	Dattatray *et al* (2019) [17]
Finger Millet		
Germination	Malting of finger millet improves its digestibility, sensory and nutritional quality as well as significantly reduces anti-nutrients.and during the germination and roasting process desirable aroma is produced.	(Desai *et al*., 2010) [18].
Drying	Sprouted and cooked samples have a higher crude protein content of Ragi, and the total fat content of raw and processed Ragi is 1.0% to 1.8%. Fat content in the raw sample was the highest, and the total fiber content in all samples was between 2.02% and 3.66%, reduction of phytic acid in roasted Ragi and significant reduction of tannins was found in soaking.	B. S. Gunashree *et al* (2014) [19]
Roasting	Protein ash, fat and crude fiber content in ragi porridge increased during germination.	Shelly Jain *et al* (2016) [10]
Milling	Suggest Processing operations such as dehulling, milling, fermentation, malting, extrusion, popping, and baking operations to improve their nutritive value and consumer acceptability.	Kulkarni *et al* (2018) [20]

Nutritional properties of weaning food

Mathanghi S.K and K. Sudha. (2012) [21] He studied the functions and phytochemical properties of finger millet. It has beneficial health effects, such as anti-diabetic, anti-tumor, atherosclerotic effects and antioxidant and antibacterial properties. Pragya Singh and Rita Singh Raghuvanshi (2012) [22] studied finger millet and concluded that It is non-acidic food, easy to digest It is considered one of the least allergic and most digestible grains Finger millet is rich in nutrients, rich in protein, fat and minerals, especially calcium and iron. Amir Gull, Romee Jan, Gulzar, Ahmad Nayik, Kamlesh Prasad and Pradyuman Kumar (2014) [23] studied that Significance of Finger Millet in Nutrition, Health and Value added Products. It contains protein (6-8%) and fat (1-2%), and is superior to rice and wheat in terms of mineral and micronutrient, high calcium content (344 mg/100 g), dietary fiber (15-20%) and phenolic compounds (0.3–3%).Contains important amino acids, namely isoleucine, leucine, methionine and phenylalanine. Health benefits, such as anti-diabetics, anti-tumor, atherosclerogenic effect, antioxidant, Flour used to prepare porridge, pudding, Pancakes, biscuits, bread, roti, noodles and other snacks. In addition, it can also be used as a nutritional food for babies Rohman, A, Siti Helmiyati, Mirza Hapsari and Dwi Larasati Setyaningrum (2014) [24] studied nutrition of rice and its health beniefits. Suggest that the nutrient content of rice varies with the variety of rice soil and its growth conditions. Rice is good source of thiamine (vit B1) riboflavin (B2) and niacin (vitamin B3), major amino acid present in rice are glutamic and aspartic acids. P. K. Dahiyaa, A. R. Linnemann, M. A. J. S. Van Boekel, N. Khetarpaul, R. B. Grewal & M. J. R. Nout (2015) [25] studies on technological and nutritional potential of green gram, andobseved Mung beans are rich in protein (14.6–33.0 g/100 g) and iron (5.9–7.6 mg/100 g). The color of grains is related to compounds such as polyphenols, Carotenoids, and grain hardness is related to fiber content. Ishwar Patel, Komal Patel, Suneeta Pinto, Sunil Patel (2016) [26] are reported that, Millet has a particularly high content of minerals, such as magnesium, iron, potassium and phosphorus. Ragi is rich in minerals, dietary fiber and essential amino acids. Ragi provides the highest calcium content (about 10 times that of wheat), including antioxidants and rich in Phytochemicals include phytic acid (considered to lower cholesterol) and phytate (associated with lowering the risk of cancer).Iron and calcium are important minerals necessary for the normal functioning of the human body. The total dietary fiber of cereals is relatively higher than other cereals, which helps to control the blood sugar level of diabetic patients. Research has linked magnesium and phosphorus is important for the development of body tissue and energy metabolism. Health benefits of finger millet the hypoglycemic properties and antibacterial and antioxidant activities, vitamins B1 and B2 and prevents malnutrition. The amino acid called tryptophan present in ragiis an excellent natural relaxant that helps fight anxiety, insomnia and depression. This amino acid also helps treat migraines headaches. Phytate, polyphenols and tannins contribute to antioxidant activity Prabha R Chaudhari, Nishesh Tamrakar, Laxmi Singh, Ambika Tandon, Deepak Sharma (2018) [27] Reported that Rice is an great source of complex carbohydrates. Carbohydrates are broken down into glucose, most of which are used as energy for sports and essential fuel for the brain. Rice is also an important source of protein (7-8%). The lysine and protein digestibility are high. Rice contains 3% fiber. Rice has no fat, cholesterol and sodium free. Rice is also a source of potassium (K), which is an important mineral required for the body's normal metabolism, cell, tissue and organ function, muscle growth, and normal heart activity. Rice also contains traces of manganese (Mn) and copper (Cu). The normal function of the brain and nerves requires manganese, and copper is needed for enzyme production for normal body function. Aniket S. Bhosale, Dr. Heena V. Sanghani, Suchita S. Bhosale (2020) [28] He studied Finger millet samples collected from the Nashik and Kolhapur Maharashtra regions. The nutrients in the samples collected from Nashik area were better than those in the Kolhapur area. He also says that millet is rich in calcium and phosphorus. These can be used as calcium supplement foods, and compound flour can be effectively used as a supplementary feeding program.

Table 2: Nutritional composition of Rice, Green gram and Finger millet (Gull *et al* 2014 [23], P.K Dahiya *et al*, Patel *et al* 2016) [26]

Sr. no.	Nutrients as per 100 gm	Rice	Green gram	Finger millet
1	Protein (gm)	6.8	23.8	7.60
2	Fat (gm)	0.5	1.22	1.14
3	Carbohydrate(gm)	78.2	61.0	72.0
4	Fibre(gm)	5.2	4.57	3.63
5	Calcium (mg)	10	113.4	429.8
6	Iron (mg)	0.5	5.9	12.4
7	Potassium (mg)	120	956.6	408
8	Phosphorus (mg)	160	384.4	305.5
9	Energy (kcal)	344	350	345

Conclusion

In recent years, the development and evaluation of functional foods for target populations has considerably increased among food scientists and technicians. Scientists are exploring underutilized crops which are rich source of nutrients. In this study a weaning mix was developed from a combination of germinated Ragi, germinated green gram and Rice flour. These weaning foods contain high protein and energy; have acceptable functional and sensory properties, and excellent nutritional quality. It can be concluded that local resources have great potential in the formulation and preparation of infant weaning foods.

Acknowledgement

The first author would like to thank second and third author of this article for providing their valuable guidance.

References

1. Ajiwe VIE, Nwaigbo BI. Quality Evaluation of Weaning Foods Formulated from Some Local Cereals and Legume Blends. Int. J. Pure App. Biosci,2014:2(4):75-81.
2. Temesgen Melese. Nutritional Status of Ethiopian Weaning and Complementary Foods: A Review,2013:2:621. doi:10.4172/scientificreports.621
3. Mishra Atul Anand, Shukla RN, Guggi Prakash, Chanda Singh Sugandha. Devlopment of banana-soy sesame based weaning food for malnourished children. International journal of agriculture and food science technology,2013:(4):221-226.
4. Satter Mohammed A, Jabin Syeda Absha, Abedin Nusrat, Arzu Taslima, Mitra Kanika, Abdullah AM *et*

al. Development of nutritionally enriched instant weaning food and its safety aspects. African Journal of Food Science,2013:7(8):238-245.
5. Rasane Prasad, Jha Alok, Sabikhi Latha, Kumar Arvind, Unnikrishnan VS. Nutritional Advantages of Oats and Opportunities For Its Processing As Value Added Foods - A Review. Journal of Food Science and Technology,2013:52(2):662-675.
6. Solomon Mariam. Nutritive value of three potential complementary foods based on cereals and legumes. African Journal of Food and Nutritional Sciences, 2005, 5(2).
7. Kumkum Rashmi, Gowda Chikke, Khanam Anjum, Swamylingappa Bhagya. Chemical, Functional and Nutritional Characteristics of Weaning Food Formulations. J. Food Sci. Technol. Nepal,2010:6:36-42.
8. Srivastava Shipra, Neerubala, Singh Shikha, Shamim Mohammad Zaki. Nutritional composition of weaning food using malted cereal and pulses flour for infants. International Journal of Pure & Applied Bioscience,2015:3(1):171-185.
9. Patel S, Verma Veenu. Ways for Better Utilization of Finger Millet through Processing and Value Addition and Enhance Nutritional Security among Tribals. Global Journal of Medical Research: L Nutrition & Food Science,2015:15(1):1.0.
10. Jain Shelly, Dabur RS, Bishnoi S, Jitender. Development of Milk Based Malted Finger Millet (Ragi) Porridge: Effects of Malting of Finger Millet on Compositional Attributes. Haryana Vet,2016:55(2):155-159.
11. Pandey Laxmi, Singh Vishakha. Development and nutritional evaluation of weaning foods to prevent protein-energy malnutrition in infants. International Journal of Chemical Studies,2019:7(1):05-09.
12. Poshadri A, Kumar Y Praveen, Charan G Shiva, Raghuveer M, Kumar M Sunil, Devi A Rama. Energy Rich Composite Millet and Soybean based Malted Weaning Mix: A Complementary Food in Tribal Areas of Adilabad District, India. Int. J. Curr. Microbiol. App. Sci,2019:8(2):2058-2064.
13. Sharma M Neha, Gayathri R, Priya V Vishnu. Assessment of Nutritional Value of Overnight Soaked Cooked Rice over Unsoaked Cooked Rice. Int. J. Research in Pharmaceutical Science,2018:9(3):616-619.
14. Sreeramalah Hemalatha, Platel Kalpana, Shrinivasan Krishnapura. Influence of germination and fermentation on bio accessibility of zinc and iron from food grains. Influence of germination and fermentation on bio accessibility of zinc and iron from food grains. European Journal of Clinical Nutrition,2007:61:342-348.
15. Madar Inamul Hasan, Asangani Amjad Hussain, Srinivasan Shantkriti, Tayubi Iftikhar Aslam, Ogu Gideon I. Nutritional and Biochemical Alterations in Vigna Radiata (Mung Bean) Seeds by Germination. International Journal of Current Microbiology and Applied Sciences,2017:6(9):3307-3313.
16. Hanif Muhammad, Khan Mansoor, Khattak, Haq Inam Ul, Gul Kausar, Khan Ansa *et al*. Effects of Temperature and Water Purity on Germination and Yield of Mung bean Sprouts. Journal Sains Malaysiana,2019:48(4):711-717.
17. Tilekar Rasika Dattatray, Oswal Monica, Ayenampudi Surendra Babu, Jaganmohan Rangarajan. Effect of Soaking Time on Sprouting and Rheological Properties of Green Gram. Int. J. Pure App. Biosci,2019:7(3):181-188.
18. Desai Anuradha D, Kulkarni Sharduli S, Sahoo AK, Ranveer RC, Dandge PB. Effect of Supplementation of Malted Ragi Flour on the Nutritional and Sensorial Quality Characteristics of Cake. Advance Journal of Food Science and Technology,2010:2(1):67-71.
19. Gunashree BS, Kumar R Selva, Roobini R, Venkateswaran G. Nutrients and Antinutrients of Ragi and Wheat as Influenced by Traditional Processes. Int. J. Curr. Microbiol. App. Sci,2014:3(7):720-736.
20. Kulkarni DB, Sakhale BK, Giri NA. A Potential Review on Millet Grain Processing. International Journal of Nutritional Science,2018:3(1):1018.
21. Mathanghi SK, Sudha K. Functional and phytochemical properties of finger millet (ELEUSINE CORACANAL.) for health. International journal of pharmaceutical, chemical sciences and biological science,2012:2(4):431-438.
22. Singh Pragya, Raghuvanshi Rita Singh. Finger millet for food and nutritional security. African Journal of Food Science,2012:6(4):77-84.
23. Gull Amir, Jan Romee, Nayik Gulzar Ahmad, Prasad Kamlesh, Kumar Pradyuman. Significance of Finger Millet in Nutrition, Health and Value added Products. Journal of Environmental Science, Computer Science and Engineering & Technology,2014:3(3):1601-1608.
24. Rohman A, Siti Helmiyati, Mirza Hapsari, Dwi Larasati Setyaningrum. Rice in health and nutrition. International Food Research Journal,2014:21(1):13-24.
25. Dahiya PK, Linnemann AR, Boekel MA, Van JS, Khetarpaul N, Grewal RB *et al*. Mung Bean Technological and Nutritional Potential. J Food Science and Nutrition,2015:55(5):670-688.
26. Patel Ishwar, Patel Komal, Pinto Suneeta, Patel Sunil. Ragi a powerhouse of nutrients. Journal of Dairy Science and Technology,2016:5(3):36-47.
27. Chaudhari Prabha R, Tamrakar Nishesh, Singh Laxmi, Tandon Ambika, Sharma Deepak. Rice nutritional and medicinal properties. Journal of Pharmacognosy and Phytochemistry,2018:7(2):150-156.
28. Bhosale Aniket S, Dr Sanghani Heena V, Bhosale Suchita S. Proximate Composition of Finger Millet (Eleusinecoracana) in Regional areas of Maharashtra. Int. J. Adv. Res. Biol. Sci,2020:7(3):193-199.
29. Weaning from breast milk to family food, World Health Organization Geneva in collaboration with the United Nations Children's Fund, 1988.
30. Kim Fleischer Michaelsen, Lawrence Weaver, Franscesco Branca, Alieen Robertson. Feeding and nutrition of infants young children: Guidelines for the WHO European Region, With emphasis on the former soviet countries, WHO Rrgional publications, European Series, 87.