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Sensory acceptability, nutrient composition and cost of multigrain muffins

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Abstract
To complete a healthy diet plan one should consider the nutrition of multigrain. Multigrain flour from Oat, Pearl Millet, Maize, Ragi and Bengal Gram are a best way to found the nutrient. The objective to assess the organoleptic attributes nutritive value and cost of the prepared healthy food product. The value added product was prepared in four different combinations by replacing the amount of refined flour with the multigrain flour i.e. T_1 85:15, T_2 70:30, T_3 55:45 and T_4 40:60. Sensory evaluations of the muffins were done by the 9 point hedonic scale based score card. The nutritive of the prepared product was calculated using food composition table. The experiment was replicated three times and the data obtained during investigation were statistically analyzed using analysis of variance (ANOVA) and critical difference (CD) techniques. Sensory evaluation of prepared product T_4 was highly acceptable on the basis of overall acceptability for *Muffins*. The treatment T_4 was found to have the highest nutritive value with increase in protein (13.22g), fat (4.52g), calcium(100.8mg), iron(5.58mg) and fibre (2.4g) and also with highest cost though acceptable and reasonable as compared to market price. So it was concluded from the results that the value addition of incorporation of Multigrain flour at different level can improve the nutritional quality of food products thereby enhancing the nutritive value of the product as well as provide variety in the diet for the improvement of health related issues.

Keywords: multigrain flour, nutritive value, cost and healthy food

Introduction
In modern life stage people preferred fast food. Fast food prepared from refined flour. Refined flour is not good for health. The multigrain flour products feature a combination of grains such as Oat, Pearl Millets, Maize, Bengal Gram, Ragi etc. with a beneficial nutritional profile and can contribute to weight management, reduce the risk of diabetes, heart disorder and bowel cancer. Muffins are a type of semi –sweet cake or quick bread that is baked in appropriate portion. Oat (Jau), can be a good source of vitamins, especially vitamin E and pantothenic acid. In addition to β-glucans benefits; products derived from oat have a significant content of phenolic compounds and other antioxidants (Inglett *et al.* 2011; or Inglett and Chen 2012) [3]. Pearl millet (Bajra) is the most widely grown type of millet. Pearl millet grain is the staple diet for farm households in the world's poorest countries and among the poorest people. The presence of all the required nutrients in pearl millet makes it suitable for large-scale utilization in the manufacture of food products such as health foods, dietary foods, baby foods, snack foods, and others (Liu 2012) [7]. Maize (Makka) it is the major source of energy and protein in the diet of many people. Estimated annual production of maize is about 5.6 million tons**.** Maize contains about 72% starch, 10% protein, and 4% fat, supplying an energy density of 365Kcal/100g, as compared to rice and wheat, but has lower protein content (Nuss, E.T. and S.A. Tanumihardjo 2010) [9]. Finger millet (Ragi) is an important staple food in the eastern and central Africa as well as some parts of India.Finger millet is good source of nutrients especially of calcium, other minerals and fibre (Jones and Engleson 2010) [4]. Utilization will be one of the successful potential approaches for improving the human health specifically in financially weaker population. Dietary quality should be taken into consideration for solving the problems related to deep rooted malnutrition and health problems (Singh and Raghuvanshi, 2012) [10]. Incorporation of finger millets into the diets has preventive potential from chronic disease (Kannan 2010) [5]. Bengal gram (Desi Chana) is a good source of minerals, protein and trace elements. Bengal gram is widely appreciated as health food. Its anti- nutritional factor is the lowest of all legumes. It is widely appreciated as healthy food. The antibacterial activities of the extracts obtained from Cicer arietinum L. varieties (Kan A, *et. al.*, 2015) [6].

Materials and Methods
The present Study was conducted in the research laboratory of Foods Nutrition and Public Health department, ECHs, SHUATS, Allahabad. All the required raw materials was purchased from the local market of Allahabad.

Multigrain flour was prepared by using some processing technique such as maize and pearl millet grain were soaked overnight then these grain was dehydrated at 115^0c for 12-24 hours and Bengal gram was roasted in hot air oven at 115^0c for 10-15 Minute. After dehydration and roasting grain were grinded into fine powder and utilized in the development of multi-grain flour. The other grains like Ragi flour and Oats flour were purchased from the local market of Allahabad for the development of multi-grain flour. After processing 20% of each flour i.e. Pearl millet, Oat, Maize, Ragi and Bengal gram was taken for prepare of multigrain flour.

The control T_0 and four different treatments were prepared in which control (T_0) was prepared by using 100% refined flour while four other treatment were prepared by utilization of refined flour and multigrain flour like T_1 85:15, T_2 70:30, T_3 55:45 and T_4 60:40. The experiment was replicated 3 times to get an average value. Sensory evaluation of the muffins for their acceptability was done by a panel of judges. The score card based on the 9 point Hedonic Scale (Srilakshmi, 2007) [11].The nutritive value of prepared products was calculated by using the value of per 100 grams of each raw ingredient. (Gopalan *et al.,* 2015) [2]. Costs of the prepared muffins were calculated taking into account the cost of individual raw ingredients used in the preparation of food products as the prevailing market price. The data was statistically analyzed by using analysis of variance (two way classification) and critical difference technique. A significant difference between the treatments was determined by using CD (Critical difference) test. Gacula and Singh (2008) [1].

Results and Discussion

A. Organoleptic Evaluation of the Prepared Multigrain Flour muffins

Table 1: Average of different treatments of sensory score of Multigrain Muffins

Control and Treatments	Colour and Appearance	Body and Texture	Taste and Flavour	Overall Acceptability
T_0	7.6	7.73	7.66	7.74
T_1	8.2	7.76	8	8.16
T_2	8	8.13	8	8.02
T_3	8.53	8.5	8.53	8.53
T_4	8.86	8.9	8.93	8.85
Result	S	S	S	S
C.D.	0.09	0.17	0.07	0.08

Table 1 shows that the sensory attributes in the multigrain Muffins illustrated that the according to overall acceptability of product treatment T4 is more acceptable by the panel followed by Colour and Appearance, Body and Texture and Taste and Flavour using nine point hedonic scale. The sensory evaluation of the multigrain flour muffins illustrated that the according to overall acceptability mean score of Muffins indicates that the treatment T4 (8.85) scored maximum followed by treatment T0 (7.74), T1 (8.16), T2 (8.02) & T3 (8.53) respectively so T4 is more acceptable by the panel of judges followed by different parameters of sensory, Color and Appearance, Body and Texture and Taste and Flavour. Hence From the ANOVA table of all three products that, it is evident that the calculated value of F is greater than the table value on 4,8 (d.f.) at 5% probability level so there was significant difference between treatments regarding all sensory Attributes of the product. The findings of Limbachiya and Amin (2015) [8] Texture score of the Sample T_1 ratio (50:20:30) of Soybean: Ragi: Maize Muffin was8.35 whereas for the sample T_2 (40:20:40) Soybean: Ragi: Maize Muffin and Sample T_3 (30:20:50) Soybean: Ragi: Maize Muffin the score were8.7 and 8.3 respectively. In these which show sample T_2 (40:20:40) Soybean: Ragi: Maize Muffin and Sample T_3 (30:20:50) Soybean: Ragi: Maize Muffin was non- significant difference compared to the T_1 ratio (50:20:30) of Soybean: Ragi: Maize Muffin.

Table 2: Average percentage of nutrients in control and treatment sample of Muffins

Treatments	Energy (kcal)	Protein (g)	Fat (g)	CHO (g)	Calcium (mg)	Iron (mg)	Fiber (g)
T_0	407.23	4.78	15.78	63.51	19.58	1.76	2.65
T_1	408.16	4.93	15.78	63.31	23.44	1.91	2.76
T_2	408.95	5.04	15.78	62.88	27.42	2.06	2.86
T_3	409.29	5.15	15.78	62.45	31.37	2.20	2.97
T_4	409.63	5.26	15.78	62.02	35.20	2.35	3.07

The range of energy content was 407.23 to 409.63Kcal/100g which was higher than control. The maximum value 409.63kcl/100g was observed in Treatment T4. Fiber content of the Muffins product varied from 2.85to 3.07g/100g. The highest value 3.07g/100g was observed in treatment T4. Protein content of the muffins was found to be in the range of 4.78 to 5.26 g/100g. The maximum value 5.28 g/100g was observed in Treatment T4. Results showed that fat content of the muffins was in range of 15.78 to 15.78 g/100g. The constant fat value was found in Treatment with addition of Multigrain. CHO content of the muffins was found to be in the range of 63.51 to 63.02 g/100g. The maximum value 63.31 g/100g was observed in Treatment T1. iron content of the muffins was in range of 1.76 to 2.35mg/100g. The maximum value 2.35mg/ 100g.was found in Treatment T4. Calcium content of the muffins was found to be in the range of 19.58 to

35.20 mg/100g. The maximum value 35.20 mg/100g was observed in Treatment T4. Summarizes the average nutritive value of energy, fiber, protein, iron, and calcium content in the muffins of T4 was greater than other treatments, the fat was constant in all treatments and carbohydrate was higher in T1 compare to T2, T3, and T4.

Cost of the Muffins Based On the Raw Materials

The total cost of *Muffins* per 100g of dry ingredients at the prevailing cost of the raw materials was T_0 is Rs. 18.98 for treatment, T_1 is Rs. 19.59, T_2 is Rs. 20.2T_3 is Rs. 20.81 and T_4 is 21.42. It is therefore concluded that the control T_4 has the highest cost and T0, T2, T3, T4 has the lowest cost because the incorporation level of Multigrain flour did Increase the cost of the prepared products marginally.

Conclusion

It is concluded that the Multigrain Flour (Oat, Pearl Millet, Maize, Ragi and Bengal Gram) enhance the nutritive value of Muffins. Most of the Indian Snacks like muffins can be successfully incorporated with Multigrain Flour to enhance the sensory properties of the products. Sensory evaluated of prepared products T_4 (40:60) was highly acceptable on the basis of overall acceptability for Muffins. Cost was increased marginally in all treatment of prepared products comparatively control.

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