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Nutrient composition of value added toast breads incorporating full fat/defatted rice bran, mixed nuts and sesame seeds

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Abstract
The present investigation was conducted to evaluate the nutrient composition of value added toast breads incorporating full fat/defatted rice bran, mixed nuts and sesame seeds. Control toast bread had 17.70 percent moisture, 11.80 percent crude protein, 12.20 percent crude fat, 0.82 percent crude fiber, 1.80 percent ash and 73.38 percent total carbohydrates. In value added Type I toast bread incorporating 10 percent full fat rice bran, mixed nuts and sesame seeds, the moisture, crude protein, fat, crude fiber, ash and total carbohydrates contents were 18.10, 11.90, 14.10, 1.91, 2.68 and 69.41 percent, respectively. Similarly, value added Type I toast bread incorporating 10 percent defatted rice bran, mixed nuts and sesame seeds had the moisture, crude protein, fat, crude fiber, ash and total carbohydrates as 18.20, 13.10, 12.22, 2.13, 2.90 and 69.60 percent. It was found that all nutrient significantly higher in toast bread containing defatted rice bran.

Keywords: Rice bran, proximate composition, fiber, mineral and protein digestibility

Introduction
Bakery industry in India is the largest of the food industries with an annual turnover of about Rs. 3000 crores. The bakery industry comprises mainly of bakery products manufacturing units. Bakery products once considered as a sick man's diet have now become essential food items of vast majority of population in India. They are becoming popular even in places where rice has been the staple food. The bakery products such as breads and muffins have become popular among all cross section of population irrespective of age group, and economic [1]. The addition of rice bran into the refined wheat flour can further increase the protein quality and dietary fiber contents in bread and cookies. But due to its naturally occurring enzymatic activity (lipases) and subsequent hydrolytic rancidity, it is better to stabilize rice bran by defatting so as to control these undesirable [2].

The problems of malnutrition in India, although different in magnitude and severity among different groups, are due to protein, vitamins and mineral deficiencies [3]. Therefore, there is a need for strategic use of inexpensive high protein and micronutrient rich novel and underutilized food sources that will increase the protein and mineral contents of the staple food in order to enhance their nutritive value. Recently, the focus of interest and significant effort has been in the development of food products including bread from by- products or wastes and under-utilized agricultural products such as rice bran [4].

A variety of wheat flour substitutes such as rice bran can be tried in bread formulation. Rice bran, the brown outer layer of rice kernel is mainly composed of pericarp, aleurone/sub-aleurone layers and germ accounting for approximately 10% of the weight of the rice grain [5]. Currently, it is discarded as a waste product during the process of rice milling in India. However, it is an excellent source of total dietary fiber ranging from 20% - 51%. It is also a good source of proteins, lipids, vitamins and minerals. Chemically, it contains 11% - 17% protein, 11% - 18% fat, 10% fiber and 9% ash [6]. It is a rich source of B-vitamins and minerals such as potassium, calcium, magnesium and iron. The amino acid profile of rice bran has been generally reported to be superior to cereal grain proteins [7]. Defatted rice bran is also rich in proteins, minerals, and vitamins. Proteins are more concentrated in the rice bran and are unique in their nutritional value, which is quite comparable with that of its endosperm protein or protein from any other cereal or legume. The protein of rice bran is highly digestible and hypoallergenic food ingredient [8].

It is important to know its nutrients composition of value added toast bread incorporating full fat/defatted rice bran and mixed nuts and sesame seeds which has been presented in this study. The addition of rice bran and mixed nuts and sesame seeds into the refined wheat flour can further increase the protein quality and dietary fiber contents in toast bread. Keeping it in view, the present study was conducted and these findings have been reported in this paper.

Materials and Methods

This study was carried out in Department of Foods and Nutrition, I.C College of Home Science, Chaudhary Charan Singh Haryana Agricultural University, Hisar.

Procurement of material

Rice bran was procured in a single lot from the rice mill located at Yamunanagar. For the preparation of breads the required ingredients namely, refined flour, vegetable oil, fat, sugar, compressed yeast, salt, gluten, milk powder, sesame seeds, almonds and cashew nuts were purchased in a single lot from the local market of Hisar.

Nutritional evaluation of value added toast bread incorporating full fat/defatted rice bran, mixed nuts and sesame seeds

Moisture, crude protein, crude fat, crude fiber and ash were estimated by employing the standard methods of analysis [9]. The total carbohydrate was calculated by the difference method. Total carbohydrate (%) = 100 – [crude protein (%) + crude fat (%) + crude fiber (%) + total ash (%)]. Total, soluble and insoluble dietary fiber constituents were determined by the enzymatic method given by Furda [10]. Total calcium, iron, potassium and magnesium in acid digested samples were determined by Atomic Absorption Spectrophotometer according to the method of [11]. Phosphorus was determined calorimetrically by the method of [12]. Available calcium was extracted by the method of [13] and determined by atomic absorption spectrophotometer. Ionizable iron in the samples was extracted according to the procedure of [14] *In vitro* protein digestibility was carried out by using the modified method of [15].

Results

Value added toast bread containing full fat/defatted rice bran and mixed nuts and sesame seeds

Control toast bread containing mixed nuts and sesame seeds had 17.70 percent moisture, 11.80 percent crude protein, 12.20 percent crude fat, 0.82 percent crude fibre, 1.80 percent ash and 73.38 percent total carbohydrates. In value added Type I toast bread incorporating 10 percent full fat rice bran and mixed nuts and sesame seeds, the moisture, crude protein, fat, crude fiber, ash and total carbohydrates contents were 18.10, 11.90, 14.10, 1.91, 2.68 and 69.41 percent, respectively. Similarly, value added Type I toast bread incorporating 10 percent defatted rice bran and mixed nuts and sesame seeds had the moisture, crude protein, fat, crude fiber, ash and total carbohydrates as 18.20, 13.10, 12.22, 2.13, 2.90 and 69.60 percent, respectively (Table 1).

Table 1: Proximate composition of value added toast bread incorporating rice bran (10%) and mixed nuts and sesame seed (@ 10%) (%, on dry weight basis)

Nutrients	Control (90:10:: RF:MN&SS)	Rice bran 10%			
		Full fat		Defatted	
		Type I (80:10:10:: RF:RB:MN&SS)	t- value	Type I (80:10:10:: RF:RB:MN&SS	t- value
Moisture	17.70±0.07	18.10±0.09	6.57**	18.20±0.09	8.22**
Crude protein	11.80±0.06	11.90±0.06	2.97*	13.10±0.03	4.87**
Crude fat	12.20±0.10	14.10±0.05	6.45**	12.22±0.05	0.61
Crude fiber	0.82±0.08	1.91±0.09	2.21*	2.13±0.07	8.41**
Ash	1.80±0.04	2.68±0.06	3.49*	2.90±0.07	7.36**
Total carbohydrates	73.38±0.10	69.41±0.09	7.07**	69.60±0.08	6.41**

Values are mean ± SE of three independent determinations.
*Significant at 5% level
**Significant at 1% level
RF: Refined flour RB: Rice bran MN&SS: Mixed nuts and sesame seeds

It was found that moisture, protein, fat, crude fiber and ash contents increased significantly in value added Type I toast bread incorporating 10 percent defatted rice bran and mixed nuts and sesame seeds when compared to those of value added Type I toast bread incorporating 10 percent full fat rice bran and mixed nuts and sesame seeds. On the other hand, total carbohydrates decreased significantly in both the value added Type I toast breads incorporating 10 percent full fat/defatted rice bran over the control bread.

A significant (P<0.05) difference was observed in total and insoluble dietary fiber contents of control and value added toast breads incorporating 10 percent full fat as well as defatted rice bran. Highest amounts of total and insoluble dietary fiber contents were present in value added Type I toast bread incorporating 10 percent level of defatted rice bran with mixed nuts and sesame seeds while the lowest in control. Upon supplementation of defatted/full fat rice bran, total and insoluble dietary fiber contents increased significantly over the control but addition of full fat or defatted rice bran did not cause significant change in the soluble dietary fiber contents of various breads over the control (Table 2). Insoluble dietary fiber contents of control and Type I toast breads incorporating 10 percent full fat/defatted rice bran and mixed nuts and sesame seeds were observed as 3.05, 5.41, 5.51 g/100g, respectively. Control and Type I toast bread incorporating 10 percent full fat/defatted rice bran containing mixed nuts and sesame seeds showed a significant (P<0.05) difference for insoluble dietary fiber contents.

Table 2: Dietary fiber content of value added toast bread incorporating rice bran (10%) and mixed nuts and sesame seeds (@ 10%) (g/100g, on dry weight basis)

Nutrients	Control (90:10:: RF:MN&SS)	Rice bran 10%			
		Full fat		Defatted	
		Type I (80:10:10:: RF:RB:MN&SS)	t-value	Type I (80:10:10:: RF:RB:MN&SS)	t-value
Total dietary fiber	4.46±0.31	6.60±0.42	3.67*	6.90±0.44	4.07*
Insoluble dietary fiber	3.05±0.17	5.41±0.23	3.73*	5.51±0.34	2.92*
Soluble dietary fiber	1.41±0.11	1.19±0.13	0.69	1.39±0.18	1.12

Values are mean ± SE of three independent determinations.
*Significant at 5% level
RF: Refined flour RB: Rice bran MN&SS: Mixed nuts and sesame seeds

Table 3 indicated that the protein digestibility of value added toast breads containing full fat (67.70%) or defatted rice bran (68.73%) was almost similar. There was a non-significant difference between the protein digestibility of value added Type I toast bread incorporating 10 percent full fat and Type I toast bread incorporating 10 percent defatted rice bran; but these differences were significantly when compared to that of control. The value added control toast bread i.e. without rice bran had significant (P<0.05) higher (*in vitro*) protein digestibility (70.1%) when compared to those either having 10 percent full fat or 10 percent defatted rice bran.

Table 3: Protein digestibility (*in-vitro*) of value added toast bread incorporating rice bran (10%) and mixed nuts and sesame seeds (@ 10%) (%, on dry weight basis)

Nutrient	Control (90:10:: RF:MN&SS)	Rice bran 10%			
		Full fat		Defatted	
		Type I (80:10:10:: RF:RB:MN&SS)	t-value	Type I (80:10:10:: RF:RB:MN&SS)	t-value
Protein digestibility (*in-vitro*)	70.10±0.35	67.70±0.54	3.10*	68.73±0.56	3.89*

Values are mean ± SE of three independent determinations.
*Significant at 5% level
RF: Refined flour RB: Rice bran MN&SS: Mixed nuts and sesame seeds

Total calcium contents in control, value added Type I toast bread incorporating 10 percent full fat rice bran and value added Type I toast bread incorporating 10 percent defatted rice bran were observed as 106.90, 113.30 and 113.90 mg/100g, respectively. A significant difference was observed in total calcium contents of value added Type I toast bread containing full fat and the other containing 10 percent defatted rice bran. Supplementation of 10 percent rice bran either full fat or defatted, both resulted in significant (P<0.05) increase in calcium content over the control (Table 4).

Table 4: Total mineral contents of value added toast breads incorporating full fat/defatted rice bran (10%) and mixed nuts and sesame seeds (@ 10%) (mg/100g, on dry weight basis)

Nutrients	Control (90:10::RF:MN&SS)	Rice bran (10%)			
		Full fat		Defatted	
		Type I (80:10:10:: RF:RB:MN&SS)	t-value	Type I (80:10:10:: RF:RB:MN&SS)	t- value
Calcium	106.90±0.13	113.30±0.19	8.12**	113.90±0.22	9.13**
Phosphorus	222.80±0.11	356.80±0.15	8.67**	357.30±0.22	8.97**
Iron	7.90±0.19	8.60±0.21	6.78**	9.20±0.23	7.11**
Potassium	72.23±0.07	215.70±0.12	13.01**	217.70±0.16	13.04**
Magnesium	14.10±0.12	14.90±0.11	13.06**	14.97±0.21	13.09**

Values are mean ± SE of three independent determinations.
**Significant at 1% level
RF: Refined flour RB: Rice bran MN&SS: Mixed nuts and sesame seeds

Value added Type I toast bread incorporating 10 percent defatted and full fat rice bran had 9.20 mg total iron per 100g which was significantly (P<0.05) higher than that of value added Type I toast bread incorporating 10 percent full fat rice bran (8.60mg/100g) and control (7.90mg/100g) i.e. without rice bran. Least amount of total iron was found in the control toast bread and both the value added toast breads containing either 10 percent full fat or defatted rice bran had significantly higher amounts of total iron over the control toast bread.

Total phosphorus content was significantly (P<0.05) higher in value added toast bread incorporating 10 percent defatted rice bran (357.30 mg/100g) followed by toast bread incorporating 10 percent full fat rice bran (356.80 mg/100g) and control(222.80 mg/100g). And minimum amount of total phosphorus was observed in control toast bread when compared to breads either containing full fat or defatted rice bran and the differences were significant.

Total magnesium contents of control, value added toast breads incorporating 10 percent full fat/ defatted rice bran were observed as 14.10, 14.90, 14.97 mg/100g, respectively and the differences over the control were significant.

Value added toast breads incorporating 10 percent defatted and full fat rice bran had 217.70 and 215.70 mg of total potassium per 100 g, which were significantly (P<0.05) higher than that of control bread (72.23 mg/100g).

Data regarding available calcium and iron contents of control, value added toast breads incorporating 10 percent full fat/defatted rice bran are tabulated in the Table 5. Both the value added toast breads incorporating 10 percent full fat/defatted rice bran had significantly (P<0.05) higher availability of calcium over the control toast bread. There were significant (P<0.05) differences in the availability of iron from the control as well as both the types of value added toast breads containing full fat and defatted rice bran. Availability of iron was observed to be maximum from control toast bread (27.84%) and minimum from the value added toast bread incorporating 10 percent full fat rice bran (22.82%).

Table 5: Availability of calcium and iron of value added toast bread incorporating rice bran (10%) and mixed nuts and sesame seeds (@ 10%) and (mg/100g, on dry weight basis

Available Mineral	Control (90:10:: RF:MN&SS)	Rice bran (10%)			't' value
		Full fat		Defatted	
		Type I (80:10:10:: RF:RB:MN&SS)	t-value	Type I (80:10:10:: RF:RB:MN&SS)	
Total calcium	106.90±0.12	113.30±0.11	9.12**	113.90±0.18	8.13**
Available calcium	51.10±0.16 (47.80%)	54.60±0.11 (48.01%)	6.07**	54.80±0.14 (48.02%)	6.08**
Total iron	7.90±0.11	8.60±0.12	6.78**	9.20±0.15	7.11**
Available iron	2.10±0.10 (27.84%)	2.00±0.13 (22.82%)	1.37	2.10±0.16 (23.25%)	4.21*

Values are mean ± SE of three independent determinations.
*Significant at 5% level **Significant at 1% level
Values in parenthesis indicate percent availability of the mineral.
RF: Refined flour RB: Rice bran MN&SS: Mixed nuts and sesame seeds

Discussion

Table 1 indicated that control toast bread had 11.80 percent crude protein, 12.20 percent fat, 0.82 percent crude fibre, 1.80 percent ash 73.38 percent total carbohydrates, 70.10 percent protein digestibility and 4.46g total dietary fiber per 100g whereas supplemented toast bread contained 11.9 percent crude protein, 14.1 percent fat, 1.91 percent crude fibre, 2.68 percent ash, 67.7 percent protein digestibility and 6.60g total dietary fiber per 100g. The protein digestibility decreased by increasing the levels of rice bran which might be due to its high phytate content. Minerals were also increased in the bread on increasing the level of rice bran but availabilities of Ca and Fe were decreased which might also be due to high phytate content of rice bran. All the changes in nutrient composition were noticed due to supplementation of bread with rice bran (full fat/defatted). Similar findings have been reported by previous workers also. Khan *et al.* [16] reported that sensory quality decreased with increasing the level of rice bran in the bread. Rice bran supplementation to bread at 5, 10, 15, 20, 25, and 30 percent in bread resulted in increase in crude fiber (11.87 to 12.94%), crude fat (3.64 to 8.63%), crude fiber (0.62 to 2.15%) and ash contents (1.52 to 1.18%). Krishnan *et al.* [17] studied that the effects of oat bran supplementation (10-15%) in bread. Dietary fiber and protein contents increased significantly with oat bran supplementation up to 10 percent.

Conclusion

The value added toast breads incorporating full fat rice bran and mixed nuts and sesame seeds contain good amount of protein, crude fat, crude fiber, ash, total carbohydrates and total dietary fiber then value added control toast bread. The total minerals including iron, calcium, phosphorus, potassium and magnesium were present in good quantity. Similarly, value added toast bread incorporating 10 percent defatted rice bran had also increased amounts of the proximate nutrients due to removal of fat, except total carbohydrates over control toast bread.

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