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Nutrient composition of value added eggless muffins incorporating 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 eggless muffins incorporating defatted rice bran, mixed nuts and sesame seeds in the Department of Foods and Nutrition, CCSHAU, Hisar. Value added Type I and Type II eggless muffins contained 10 and 20 per cent defatted rice bran, respectively while both had 10 per cent mixed nuts and sesame seeds. The control eggless muffins had 10 per cent mixed nuts and sesame seeds but were without rice bran. Control eggless muffins had moisture (2.23%), crude protein (6.90 %), crude fat (19.10%), crude fibre (0.94%), ash (1.10%) and total carbohydrates (71.96%). Upon supplementation of 10 and 20 per cent defatted rice bran, the contents of moisture, crude protein, fat, crude fiber, ash and total carbohydrate in Type I and Type II eggless muffins were 3.30, 3.80; 7.80, 8.70; 17.60, 15.80; 2.30, 3.01; 2,20, 3.41 and 70.10, 69.08 per cent, respectively. It was found that moisture, crude protein, crude fat, crude fiber and ash content increased significantly but total carbohydrates and fat contents decreased significantly in Type II eggless muffins over the control. Total calcium contents of control, Type I and II eggless muffins were 86.9, 93.9, 100.9 mg/100g, respectively; a significant ($p<0.05$) difference was observed in total calcium content of eggless muffins. The values of total calcium in Type II eggless muffins were found to be higher than those in control and Type I eggless muffins. Type II eggless muffins had 8.12 mg of total iron per 100g, which was significantly ($P<0.05$) higher than that of Type I (5.14 mg/100g) and control (2.20 mg/100g) eggless muffins. The entire nutrients were higher in Type II eggless muffins except carbohydrate.

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

Introduction
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 contributing factors for the popularity of bakery products are urbanization resulting in increased demand for ready to eat convenient products, availability at reasonable cost, greater nutritional quality, availability of varieties with different textural and taste profiles and better taste. The bakery products such as breads and muffins have become popular among all cross section of population irrespective of age group, and economic conditions (Saranraj *et al*., 2012).

The general formula for muffins consists of refined flour, condensed milk, butter, sugar and other additives. It is well documented that most of the ingredients used in such commercial bakery goods lack important nutrients. The refined flour lacks in dietary fiber and micronutrients which are important health promoting components. There is a growing awareness among the consumers regarding the constituents that affect health both positively and negatively. The number of such health conscious consumers is fast increasing and so is the health food industry.

As bakery products viz., breads and muffins are being widely consumed and therefore, can act as an ideal vehicle for nutraceutical delivery. Rice bran, soy flour, flax seeds, sesame seeds and inulin are some of the nutraceutical ingredients that may be incorporated into bread and muffins to provide health benefits. New foods with new health claims such as multigrain bread/muffins, brown bread, garlic bread, rye bread, barley bread etc are flooding the market to meet the diverse demands of consumers. However, still there is an ample scope to enhance the nutritional value of breads and muffins both quantitatively and qualitatively using nutritious food ingredients.

In this regard, there are several food ingredients with exceptional nutritional qualities because of their nutraceutical and /or nutritional components, such as millets, oil seeds, nuts, condiments, rice bran and other novel ingredients. Value addition to existing foods with such ingredients is a simple and feasible way of enhancing nutritional value of foods and in turn the health benefits.

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 value added muffins the required ingredients namely, refined flour, condensed milk, vegetable oil, sesame seeds, almonds and cashew nuts were purchased in a single lot from the local market of Hisar.

Defatting of full fat rice bran

Full fat rice bran (FRB) was extracted with petroleum ether (boiling point, 60-80ºC). The extraction was carried out for one hour at 90ºC in a soxhlet apparatus to obtain laboratory defatted rice bran LDRB (AOAC, 2012) [1].

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

Moisture, crude protein, crude fat, crude fiber and ash were estimated by employing the standard methods of analysis (AOAC, 2012) [1]. 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 (1981) [3]. Total calcium, iron, potassium and magnesium in acid digested samples were determined by Atomic Absorption Spectrophotometer according to the method of Lindsey and Norwell (1969) [6]. Phosphorus was determined calorimetrically by the method of Chen *et al.* (1956) [2]. Available calcium was extracted by the method of Kim and Zemel (1986) [5] and determined by atomic absorption spectrophotometer. Ionizable iron in the samples was extracted according to the procedure of Rao and Prabhavati (1978) [8]. *In vitro* protein digestibility was carried out by using the modified method of Mertz *et al.* (1983) [7].

Results

Value added eggless muffins incorporating defatted rice bran (10 and 20%) and mixed nuts and sesame seeds (10%)

Value added Type I and Type II eggless muffins contained 10 and 20 per cent defatted rice bran, respectively while both had 10 per cent mixed nuts and sesame seeds. The control eggless muffins had 10 per cent mixed nuts and sesame seeds but were without rice bran.

Control eggless muffins had moisture (2.23%), crude protein (6.90 %), crude fat (19.10%), crude fibre (0.94%), ash (1.10%) and total carbohydrates (71.96%). Upon supplementation of 10 and 20 per cent defatted rice bran, the contents of moisture, crude protein, fat, crude fiber, ash and total carbohydrate in Type I and Type II eggless muffins were 3.30, 3.80; 7.80, 8.70; 17.60, 15.80; 2.30, 3.01; 2,20, 3.41 and 70.10, 69.08 per cent, respectively. It was found that moisture, crude protein, crude fat, crude fiber and ash content increased significantly but total carbohydrates and fat contents decreased significantly in Type II eggless muffins over the control (Table 4.57).

Table 1: Proximate composition of value added eggless muffins incorporating defatted rice bran (10 and 20 %) and mixed nuts and sesame seeds (@ 10 %) and (%, on dry weight basis)

Levels of defatted rice bran in eggless muffins containing mixed nuts sesame seeds	Moisture	Crude protein	Crude fat	Crude fiber	Ash	Total Carbohydrates
Control (90:10: RF: MN& SS)	2.23±0.07	6.90±0.03	19.10±0.06	0.94±0.03	1.10±0.06	71.96±0.13
Type I (80:10:10: RF:RB:MN& SS)	3.30±0.09	7.80±0.03	17.60±0.05	2.30±0.06	2.20±0.07	70.10±0.11
Type II (70:20:10: RF:RB: MN& SS)	3.80±0.12	8.70±0.04	15.80±0.04	3.01±0.07	3.41±0.08	69.08±0.10
CD (P=0.05)	0.14	0.07	0.12	0.02	0.17	0.19

Values are mean ± SE of three independent determinations.
RF: Refined flour, RB: Rice bran, MN&SS: Mixed nuts and sesame seeds

Total dietary fiber contents of control, Type I and Type II eggless muffins were 2.10, 4.50 and 7.00 g/100g, respectively; a significant (P<0.05) difference was observed in their total dietary fiber contents. Highest amount of total dietary fiber content was present in Type II eggless muffins containing 20 per cent defatted rice bran and mixed nuts and

sesame seeds (10 %) while it was the lowest in control. Type II eggless muffins had maximum value of soluble dietary fiber content (1.23 g/100g) while control eggless muffins had the lowest (0.54 g/100g). Insoluble dietary fiber contents of control, Type I and Type II eggless muffins were 1.56, 3.55, 5.78 g/100g, respectively; differences were significant (P<0.05) (Table 4.58).

Table 2: Dietary fiber content of value added eggless muffins incorporating defatted rice bran (10 and 20 %) and mixed nuts and sesame seeds (@ 10 %) and (g/100g, on dry weight basis)

Levels of defatted rice bran in eggless muffins containing mixed nuts and sesame seeds	Total dietary fiber	Insoluble dietary fiber	Soluble dietary fiber
Control (90:10::RF: MN& SS)	2.10±0.06	1.56±0.02	0.54±0.04
Type I (80:10:10::RF:RB:MN& SS)	4.50±0.01	3.55±0.01	0.95±0.02
Type II (70:20:10::RF:RB: MN& SS)	7.00±0.02	5.77±0.01	1.23±0.01
CD (P=0.05)	0.12	0.03	0.09

Values are mean ± SE of three independent determinations.
RF: Refined flour, RB: Rice bran, MN&SS: Mixed nuts and sesame seeds

Protein digestibility (*in vitro*) of control, Type I and Type II eggless muffins were 73.35, 71.98 and 70.87 per cent, respectively. The highest value was found in control and the lowest in Type II eggless muffins incorporating 20 per cent defatted rice bran. Protein digestibility (*in vitro*) was decreased upon increasing the level of defatted rice bran in eggless muffins (Table 4.59).

Table 3: Protein digestibility (*in vitro*) of value added eggless muffins incorporating defatted rice bran (10 and 20 %) and (mixed nuts and sesame seeds @ 10 %) (%, on dry weight basis)

Levels of defatted rice bran in eggless muffins containing mixed nuts and sesame seeds	Protein digestibility (*in vitro*)
Control (90:10::RF: MN& SS)	73.35±0.02
Type I (80:10:10::RF:RB:MN& SS)	71.98±0.02
Type II (70:20:10::RF:RB: MN& SS)	70.87±0.03
CD (P=0.05)	0.08

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

Total calcium contents of control, Type I and II eggless muffins were 86.9, 93.9, 100.9 mg/100g, respectively; a significant (p<0.05) difference was observed in total calcium content of eggless muffins. The values of total calcium in Type II eggless muffins were found to be higher than those in control and Type I eggless muffins (Table 4.60).
Type II eggless muffins had 8.12 mg of total iron per 100g, which was significantly (P<0.05) higher than that of Type I (5.14 mg/100g) and control (2.20 mg/100g) eggless muffins.
Total phosphorus, magnesium and potassium contents were significantly (P<0.05) higher in Type II eggless muffins incorporating 20 per cent defatted rice bran followed by Type I eggless muffins containing 10 per cent level of defatted rice bran and control i.e. without rice bran in descending order and differences were significant (p<0.05) (Table 4.60).

Table 4: Total mineral contents of value added eggless muffins incorporating defatted rice bran (10 and 20 %) and mixed nuts and sesame seeds (@ 10 %) (Mg/100g, on dry weight basis)

Levels of defatted rice bran in eggless muffins containing mixed nuts and sesame seeds	Calcium	Phosphorus	Iron	Potassium	Magnesium
Control(90:10::RF: MN& SS)	86.90±0.07	88.90±0.09	2.20±0.03	89.60±0.10	57.10±0.06
Type I(80:10:10::RF:RB:MN& SS)	93.90±0.09	235.20±0.17	5.14±0.04	136.90±0.13	136.90±0.11
Type II(70:20:10::RF:RB: MN& SS)	100.90±0.11	380.80±0.21	8.12±0.07	216.70±0.22	216.70±0.12
CD (P=0.05)	0.15	0.19	0.21	0.27	0.22

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

No doubt Type I and Type II eggless muffins had significantly (P<0.05) higher available calcium and iron contents than the control but the per cent calcium and iron availability were less from them. Availability of calcium and iron were observed to be maximum from control and minimum from Type II eggless muffins (Table 4.61).

Table 5: Availability of calcium and iron of value added eggless muffins incorporating defatted rice bran (10 and 20 %) and mixed nuts and sesame seeds (@ 10 %) (mg/100g, on dry weight basis

Levels of defatted rice bran in eggless muffins containing mixed nuts and sesame seeds	Total calcium	Available calcium	Total iron	Available iron
Control(90:10::RF: MN& SS)	86.90±0.06	38.90±0.04(44.76%)	2.20±0.02	0.83±0.01(38.18%)
Type I(80:10:10::RF:RB:MN& SS)	93.90±0.09	42.68±0.05(40.82%)	5.02±0.03	1.35±0.02(26.47%)
Type II(70:20:10::RF:RB: MN& SS)	100.90±0.11	42.40±0.07(38.75%)	8.02±0.04	1.90±0.04(23.75%)
CD (P=0.05)	0.26	0.21	0.15	0.17

Values are mean ± SE of three independent determinations.
RF: Refined flour, RB: Rice bran**,** MN&SS: Mixed nuts and sesame seeds
Values in parenthesis indicate per cent availability of the mineral

Discussion

Control eggless muffins had moisture 2.23, crude protein 6.90, crude fat 19.10, crude fibre 0.94, ash 1.10 and total carbohydrates 71.96 per cent. Upon supplementation of 10 and 20 per cent defatted rice bran, the contents of moisture, crude protein, fat, crude fiber, ash and total carbohydrate in Type I and Type II eggless muffins were 3.30, 3.80; 7.80, 8.70; 17.60, 15.80; 2.30, 3.01; 2,20, 3.41 and 70.10, 69.08 per cent, respectively. It was found that moisture, crude protein, crude fat, crude fiber and ash content increased significantly but total carbohydrates and fat contents decreased significantly in Type II eggless muffins over the control. Total calcium contents of control, Type I and II eggless muffins were 86.9, 93.9, 100.9 mg/100g, respectively; a significant ($p<0.05$) difference was observed in total calcium content of eggless muffins. The values of total calcium in Type II eggless muffins were found to be higher than those in control and Type I eggless muffins. Type II eggless muffins had 8.12 mg of total iron per 100g, which was significantly ($P<0.05$) higher than that of Type I (5.14 mg/100g) and control (2.20 mg/100g) eggless muffins. The entire nutrients were higher in Type II eggless muffins except carbohydrate. It was found that moisture, protein, crude fat, crude fiber and ash contents increased significantly but total carbohydrates were decreased significantly over the control in Type II eggless muffins containing 20 per cent defatted rice bran. And total minerals were also increased in Type I and Type II eggless muffins as compared to control while the protein digestibility was decreased in Type I and Type II eggless muffins which might be due to high phytate content. All nutrients were increased on increasing the levels of rice bran as compared to that of control. Similar findings have been reported by previous workers also. The addition of defatted rice bran and flaxseeds improved the proximate composition, dietary fiber contents of breads (Ajmal *et al.* 2006) [12]. Dietary fiber contents of breads, muffins and cookies improved due to the supplementation with flaxseed and rice bran in wheat flour. The flaxseed was rich in insoluble, soluble and total dietary fibres, and the addition of flaxseeds resulted in the improvement of dietary fiber contents of products in which it was present. Similar findings were supported by Ameh *et al.* (2013) [13]. Moisture, crude protein, crude fat, crude fiber and ash in breads prepared from the composite flour of refined flour and rice bran were 21.07 to 23.67 per cent, 12.04-13.14 per cent, 1.57-3.77 per cent, 1.76-2.91 per cent and 1.46-2.41 per cent, respectively.

Conclusion

Control eggless muffins had moisture (2.23%), crude protein (6.90 %), crude fat (19.10 %), crude fiber (0.94 %), ash (1.10 %) and total carbohydrates (71.96 %). Upon supplementation of 10 and 20 per cent of full fat rice bran in Type I and Type II eggless muffins, the contents of moisture, crude protein, crude fat, crude fiber, ash and total carbohydrate were 3.20, 3.60; 7.50, 7.70; 21.10, 22.90; 2.04, 2.98; 2.10, 3.20 and 67.26, 63.60 per cent, respectively. It was found that moisture, protein, crude fat, crude fiber and ash contents increased significantly but total carbohydrates were decreased significantly over the control in Type II eggless muffins containing 20 per cent full fat rice bran. And total minerals were also increased in Type I and II eggless muffins incorporating full fat rice bran when compared to that of control. Protein digestibility of Type I (71.90) eggless muffins and Type II (70.80) eggless muffins was less than that of the control (73.35) eggless muffins.

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