

## Chemical composition and functional properties of wheat bread containing wheat and legumes bran

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### Abstract

The study aimed to enrich the conventional wheat based bread with high fiber leguminous bran. Wheat bran, faba bean bran, chick pea bran, pigeon pea bran and soya bean bran were used to enrich whole wheat flour. The wheat/ legume bran composite flours and bread based on them were examined for functional, rheological and proximate composition. The proximate composition of composite flour reflected significant increase ( $p \leq 0.05$ ) in fiber, ash and oil contents compared to the control whole wheat flour system. The gluten level was significantly reduced ( $p \leq 0.05$ ) by increasing level of bran in whole wheat flour (35.8-26.5%). In addition, high fiber composite flour showed significant ( $P \leq 0.05$ ) high falling number (381.3-644 sec). Bread volume and specific volume showed obvious depression by addition of bran to whole wheat flour (WWF), while was noticeable when higher level of bran were added to WWF. Incorporation of bran in WWF caused significant ( $P \leq 0.05$ ) increase in moisture, fat, protein, fiber and ash content compared to the control bread.

**Keywords:** wheat bran, legumes bran, high fiber bread, proximate composition

### 1. Introduction

Fortification of bread plays a major role in dietetic purpose to solve many nutritional disorders and upgrading the health of population. The diets rich in fiber such as cereals, nuts, fruits and vegetables have a positive effect on health as their consumption has been related to decreased incidence of several diseases (Dhingra *et al*, 2012).

Recently, the recommendation for the daily fiber intake is about 25 g but the average intake of fiber in the United States is about 10–15 g (Gelroth and Ranhotra 2011). The actual data on average dietary fiber intake among the Sudanese population are not available. Nowadays the decortications of cereals reduce the fiber intake by the Sudanese as whole grains are replaced with refined grain flours.

Fiber is added to foods to increase the fiber content for health promotion and to improve functional properties such as water and oil retention, viscosity, texture, and feel of mouth. Among foods which are enriched in fiber, breakfast cereals and bakery products are the most known and consumed; bread (Gómez *et al* 2003), fermented milk (Sendra *et al* 2008), yoghurt (Staffolo *et al* 2004), meat products (Verma and Banerjee 2010) and, drinks and beverages (Hashim *et al* 2009).

Around the globe, white bread is the commonly consumed bread. Thus, for meeting the dietary fiber requirement, the enrichment of bread with a higher dietary fiber content is the best way to increase the fiber daily intake (Wang *et al* 2002). Bran is one of the excellent sources of dietary fiber. Bread can be enriched with dietary fiber, such as wheat bran (Sidhu *et al* 1999) gums (Pomeranz *et al* 1977), and b-glucans (Knuckles *et al* 1997). Furthermore, literature also reports the potential use of defatted rice bran as a source of dietary fiber in bread making (Abdul-Hamid and Luan 2000). However, the

addition of these fibers causes a neglected effect on the final bread quality. Addition of too much fiber produces bread of poor quality in terms of texture, loaf volume, and appearance (Gómez *et al* 2003; Wang *et al* 2002). High levels of fiber dilute gluten lowers gas retention thus causing a decrease in loaf volume.

Therefore, the aim of the present study was to test the functional properties of wheat and legume fibers in conventional bread containing bran extracted from wheat and different legumes. In addition, the study aimed to determine the influence of several fibers on the rheological properties of bread dough and the final quality of the resulting breads. The chemical composition and nutritional value of these high fiber breads were also evaluated.

### 2. Materials and Methods

#### Materials

Wheat bran was obtained from the Food Research Centre, Shabbat, Sudan. Faba bean (*Vicia faba*), chick pea (*Cicer arietinum*), pigeon pea (*Cajanus cajan*), wheat flour, salt and dry yeast were obtained from the local market. Soya bean (*Glycine max*) was obtained from Arab Corporation for Investment and Agricultural Development, Khartoum, Sudan. The chemicals of analytical grade were obtained from Food Research Centre, Faculty of Agriculture, and University of Khartoum, Sudan.

#### Methods

##### Preparation of raw materials and products

##### Preparation of wheat and legumes bran

Legume seeds were cleaned by aspiration, sieving and manual separation of impurities. For obtaining high fiber bran, legume

seeds were first decorticated. Wheat and legume bran's were milled at one degree by using junior mill (mode falling number A.BN71849). The mixture was finally sieved at 355mesh screen, mixed well and stored for further analysis and usage.

#### Preparation of wheat flour

Whole wheat flour was used as base for making conventional bread containing bran extracted from wheat and different legumes.

#### Preparation of composite flour by additional of bran to wheat flour

For preparing composite flour containing 4% fiber, Pearson square was used to calculate the amount of fiber in the form of bran to be added to wheat flour.

#### Preparation of bread samples

The various bran/wheat flour blends were made into bread according to the procedure described by (Badi *et al.*, 1978), using the following formula:

Flour=250gms, Dry yeast=2.5gms, Salt=2.5gms, Ascorbic acid=80ppm and water according to the type of bread.

The loaves were cooled, sliced with an electric knife and some slices were dried in single layers on trays at room temperature ( $38 \pm 2^\circ\text{C}$ ) for 48 hr, ground into powder form, kept in glass jars and stored at room temperature until further use.

#### Analytical work

##### Proximate composition

Moisture content, total fat, ash and crude fiber were determined according to the Association of Official Analytical Chemistry Method (AOAC, 2000). Nitrogen content was determined by the Micro-Kjeldahl technique following (AOAC, 2000). Nitrogen was converted to protein by using factor of 6.25. The total carbohydrates were calculated by difference.

##### Rheological properties

##### Determination of gluten content

The gluten content (wet gluten) and the gluten index were performed according to the American Association of Cereal Chemists (AACC2001) approved method no. 38-12.

##### Falling number for $\alpha$ -amylase activity

Falling number was determined according to the ICC international standard (FN) method no. 107/1 according to ICC (1995). Using (Falling number 1500, Perten).

##### Evaluation of bread quality

The different types of bread were cooled at room temperature for an hour after baking and quality measures were made on triplicate loaves as follows:

##### Bread volume and weight

The loaf volume expressed in cubic centimeters was determined by seed displacement; while weight of bread was taken in gram. The specific volume was calculated by dividing volume/weight (cc/g).

#### Statistical analysis

Replicates of each sample were analyzed using statistical analysis system. The analysis of variance was performed to examine the significant effect in all parameters measured by using complete randomized design. Duncan's multiple range tests was used to separate the means with all data collected.

### 3. Results and Discussion

#### Proximate composition of wheat and legume bran

Table I shows the chemical composition of wheat bran (WB), faba bean bran (FBB), chick pea bran (CPB), pigeon pea bran (PPB) and soya bean bran (SBB), that were used as sources of fiber for making high fiber bread. The moisture contents of legume bran's were found to be in the range of 6.4 - 7.2% which were significantly ( $p \leq 0.05$ ) lower than the moisture content of wheat bran (7.8%) which was lower than 7.56% as reported (Almeida *et al* 2010) and 10.4% as reported by (Rendleman 1982).

The fat content of legume bran's ranged between 1.9-8.8% (Table 1). The PPB contained the lowest level of fat (1.9%) and this may be attributed to the low fat content in the seed while SBB contained the highest level of fat (8.8%) attributable to the soya bean seed being high in oil. The fat content of WB was 5.6% almost higher than the ranges 2.3-4.0% for fat content of WB obtained by (Sidhu *et al* 1999).

The crude protein content of legumes bran ranged between 11.1 and 18.4% (Table I). The SBB contained the highest level of protein (18.4%) while CPB contained the lowest level of protein (11.1%) which was lower than 12.1% reported by (Dalgetty and Baik 2006). This was expected since soya bean contains high level of protein (38.2%) which is extremely higher than that of other legumes (McCarthy *et al* 1977). The protein content of WB was 19.9% and was higher than 13.3-15.7 % for protein content of WB (Sidhu *et al* 1999).

The fiber content of legumes bran was in the range of 19.7 to 29.4% (Table I). The FBB contained the highest level of crude fiber (29.4%) followed by CPB (28.5%), PPB (24.6%) and finally SBB (19.7 %). The WB recorded 9.6% fiber content which lied in the range of 8.9 and 13.6% for WB fiber content mentioned by (Rendleman 1982).

The ash content of legumes bran was found to be in the range of 3.2 and 4.5% (Table I). The lowest level of ash was for FBB (3.2%). The ash content of SBB was 4.5% which was lower than that reported by (Chaudhary and Weber 1990). The ash content of CPB was 4.4% which was lower than 5.7% reported by (Dalgetty and Baik 2006). The ash content of WB was 5.4% which higher than the range of 3.0-5.2% for ash content of WB reported by (Sidhu *et al* 1999).

The total carbohydrate of legumes brans ranged between 61.9 to 75.0%. The PPB showed highest level of carbohydrates (75.0%) while SBB contained the lowest level of carbohydrates (61.9%), since carbohydrate content of soya bean seed is lower than that of other legumes and this is due to the high protein and oil contents in the soya bean seeds.

**Table 1:** Proximate composition of wheat and legumes bran used in bread making \*

Bran	Moisture	Fat	Crude	Crude	Ash	Total
Source**	(%)	(%)	Protein (%)	Fiber (%)	(%)	CHO***
WB	7.8 <sup>a</sup>	5.6 <sup>b</sup>	19.9 <sup>a</sup>	9.6 <sup>c</sup>	5.4 <sup>a</sup>	61.3 <sup>d</sup>
FBB	6.9 <sup>c</sup>	2.6 <sup>c</sup>	14.9 <sup>c</sup>	29.4 <sup>a</sup>	3.2 <sup>d</sup>	72.4 <sup>b</sup>
CPB	7.2 <sup>b</sup>	2.6 <sup>c</sup>	11.1 <sup>e</sup>	28.5 <sup>b</sup>	4.4 <sup>b</sup>	74.7 <sup>a</sup>
PPB	6.9 <sup>c</sup>	1.9 <sup>d</sup>	12.4 <sup>d</sup>	24.6 <sup>c</sup>	3.8 <sup>c</sup>	75.0 <sup>a</sup>
SBB	6.4 <sup>d</sup>	8.8 <sup>a</sup>	18.4 <sup>b</sup>	19.7 <sup>d</sup>	4.5 <sup>b</sup>	61.9 <sup>c</sup>

\* Mean values having different superscript letters in each column differ significantly ( $p \leq 0.05$ )

\*\*WB=wheat bran, FBB=faba bean bran, CPB=chickpea bran, PPB=pigeon pea bran, SBB=soya bean bran

\*\*\*Carbohydrate by difference

### Proximate composition of cereal/legume brans composite flour

Table (2) shows the proximate composition of cereal/legume bran composite flour. The moisture content of whole wheat flour (WWF) was found to be 10.4%, which lied in the range of 10 - 11% as reported by (Badi *et al* 1978) for moisture content of WWF (Badi *et al* 1978). The high bran wheat flour (WF/HB) showed no significant difference in the moisture content as compared to legumes bran composite flour which was in the range of 7.7 and 8.2%. The moisture content of W/SBB/CF was 7.8% almost similar to 7.88% reported by Anjum *et al* (2006) for composite flour of soya bran and wheat flour (Anjum *et al* 2006).

The fat content of WWF was 1.0% (Table 2) which was lower than 1.91% as reported (Anjum *et al* 2006). The fat content of legume bran composite flours ranged between 1.5 to 2.9%. Addition of bran caused significant ( $p \leq 0.05$ ) increase in fat compared to the control. The fat content of wheat/soya bean bran composite flour (W/SBB/CF) and WF/HB was slightly higher (2.9 and 2.4%) respectively.

The protein content of WWF was 12.4% (Table 2) a value was higher than 11.85% obtained by (Anjum *et al* 2006). The protein content of wheat/chick pea bran composite flour (W/CPB/CF) and wheat / pigeon pea bean bran composite flour (W/PPB/CF) was not affected by addition of bran. The addition

of soya bean bran, faba bean bran and wheat bran resulted in significant ( $p \leq 0.05$ ) increase in protein contents of the blends compared to the control.

The WWF contained 2% crude fiber (Table 2) which almost similar to 2.11% reported by Anjum *et al* (2006). The fiber content of cereal /legume bran composite flour ranged between 3.7 and 3.9%. In general, addition of bran to the blends showed significantly ( $p \leq 0.05$ ) increase in crude fiber compared to the control. Soya bean is an excellent source of fiber, which is often separated in preparation of various soy foods. It is then used as an additive to enhance the fiber content of other foods, such as enthrall nutrition products (Anjum *et al* 2006).

The ash content of WWF was found to be 0.7% (Table 2) was less than 1.92% for ash content of WWW (Anjum *et al* 2006). The ash content of cereal/legume bran composite flour ranged between 0.8 and 2.3%. The W/FBB/CF contained the lowest level of ash (0.8%) while WF/HB contained the highest level of ash (2.3%) and this was due to the different amounts of bran added to the flour because of their different fiber contents. The WWF contained 75.5% of total carbohydrates (Table 2). The carbohydrates content of composite flour blends ranged between 69.6 and 77.3%. The HF/WB contains the lowest level of carbohydrates (69.6%) while W/CPB/CF contains the highest level of carbohydrates (77.3%).

**Table 2:** Proximate composition of cereal/legume bran composite flours\*

Sample	Moisture	Fat	Crude	Crude	Ash	Total
	(%)	(%)	Protein (%)	Fiber (%)	(%)	CHO**
WWF	10.4 <sup>a</sup>	1.0 <sup>c</sup>	12.4 <sup>d</sup>	2.0 <sup>c</sup>	0.7 <sup>e</sup>	75.5 <sup>c</sup>
WF/HB	7.4 <sup>b</sup>	2.4 <sup>b</sup>	18.3 <sup>a</sup>	3.9 <sup>a</sup>	2.3 <sup>a</sup>	69.6 <sup>c</sup>
W/FBB/CF	8.2 <sup>b</sup>	1.8 <sup>c</sup>	12.9 <sup>c</sup>	3.8 <sup>ab</sup>	0.8 <sup>d</sup>	76.3 <sup>b</sup>
W/CPB/CF	7.9 <sup>b</sup>	1.5 <sup>d</sup>	12.3 <sup>d</sup>	3.7 <sup>b</sup>	1.0 <sup>c</sup>	77.3 <sup>a</sup>
W/PPB/CF	7.7 <sup>b</sup>	1.6 <sup>d</sup>	12.5 <sup>d</sup>	3.7 <sup>b</sup>	1.0 <sup>c</sup>	77.2 <sup>a</sup>
W/SBB/CF	7.8 <sup>b</sup>	2.9 <sup>a</sup>	14.2 <sup>b</sup>	3.7 <sup>b</sup>	1.2 <sup>b</sup>	73.9 <sup>d</sup>

\* Mean values having different superscript letters in each column differ significantly ( $p \leq 0.05$ )

\*\*Carbohydrate by difference

### Gluten properties and falling number of cereal/legume brans composite flours

Table (3) shows the gluten properties of cereal/legume brans composite flours. The WWF recorded significant ( $p \leq 0.05$ ) high value of gluten (35.8%), which was slightly lower than value obtained by MacRitchie (1980). The gluten level was significantly ( $p \leq 0.05$ ) reduced by increasing level of bran in WWF. Addition of bran to wheat flour was reported to cause decrease in gluten content and hence affect baking quality of the flour (Pomeranz *et al* 1977). The  $\alpha$ -amylase activity of bran enriched flour was estimated as falling number (Table 3). The

WWF gave a falling number of 307.7 sec. The high fiber composite flour showed significantly ( $p \leq 0.05$ ) high values in the range of 381.3 to 644 sec. Falling number was defined as the time in seconds required to stir and to allow a viscometer stirrer to fall a measured distance through aqueous flour gel under-going liquefaction. The principle of the FN method is to determine  $\alpha$ -amylase activity using the starch in the sample as substrate. Perten (1964) recommended an optimum  $\alpha$ -amylase activity of 250 to 300 for good quality bread flours (Perten 1964).

**Table 3:** Gluten properties and falling number of cereal/legume bran composite flours\*

Sample	Wet gluten (%)	Dry gluten (%)	Falling number (sec)
WWF	35.8 <sup>a</sup>	13.7 <sup>a</sup>	307.7 <sup>d</sup>
WF/HB	24.3 <sup>f</sup>	8.4 <sup>d</sup>	470.7 <sup>b</sup>
W/FBB/CF	34.4 <sup>b</sup>	13.5 <sup>a</sup>	484.7 <sup>b</sup>
W/CPB/CF	28.8 <sup>d</sup>	10.5 <sup>b</sup>	644.0 <sup>a</sup>
W/PPB/CF	30.5 <sup>c</sup>	10.8 <sup>b</sup>	401.0 <sup>c</sup>
W/SBB/CF	26.5 <sup>e</sup>	9.4 <sup>c</sup>	381.3 <sup>c</sup>

\* Mean values having different superscript letters in each column differ significantly ( $p \leq 0.05$ )

### Characteristics of high fiber bread containing no improver

Table (4) shows the characteristics of high fiber bread containing no improver. Loaf weight and volume were measured within 10 min after the bread was removed from the oven. The weight of loaf of bread prepared from WWF was found to be 103.6 g and the weight of loaf high fiber bread ranged between 107.0 and 108.9 g.

The loaf volume of bread prepared with WWF was 401.7 cc (Table 4). The depression in loaf volume observed with high fiber bread containing WB and high fiber bread containing SBB. In spite of the fact that materials caused reduction in loaf volume (Dalgetty and Baik 2006; Gómez *et al* 2003), it was noticed that high fiber bread containing FBB, CPB and PPB recorded significantly ( $p \leq 0.05$ ) high loaf volume compared to control bread because they contain small amounts of bran and high gluten. This was found in agreement with reports which show that a positive correlation was found between gluten content and loaf volume of flours (McCarthy *et al* 1977). Also a decrease in cake volume and symmetry was observed with an increased substitution of chickpea flour as fiber rich legume in wheat flour products. (Gómez *et al* 2008). Moreover, Cai *et al* (2014 a) observed that the loaf volume of whole wheat flour bread was affected by bran particle size. Also the Loaf volume of bread incorporated roasted legume flour was better than that of cooked one.

The specific volume (cc/g) of bread was calculated from the average loaf weight and volume (Table 4). The specific volume of bread fortified with chick pea and pigeon pea brans (4.1 and 4.2 cc/g) did not differ significantly ( $p \leq 0.05$ ) from that of the control bread (3.9 cc/g). The specific volume of bread containing FBB showed significantly ( $p \leq 0.05$ ) high value i.e. 4.8 cc/g as compared to other types of bread including the control. The specific volume remained unchanged by incorporation of small amounts of bran in WWF. The same observation was noticed by Wang *et al* (2002) and Gomez *et al* (2003) who stated that the specific volume always decreased as consequence of fibre addition (Gómez *et al* 2003; Wang *et al* 2002).

Taking the specific volume as one of the main quality attributes of bread, it was obvious that wheat flour can accept low levels of cereal and legume bran without significant alternation in end product quality. Increasing levels of bran in bread may be carried out for specific objectives provided that the quality of bread should be improved some additives are used to counteract the deleterious effect of fibre addition on the dough handling characteristics, loaf volume reduction and acceptability of the bread (Gómez *et al* 2003). Nowadays, there is a growing demand for a new generation of healthier food products which at the same time have excellent sensory qualities (Ang 2001).

**Table 4:** Characteristics of high fiber bread containing no improver\*

Bread Source	Loaf Weight (g)	Loaf volume (cc)	Specific volume (cc/g)
WWFBD	103.6 <sup>b</sup>	401.7 <sup>c</sup>	3.9 <sup>b</sup>
WBD	108.4 <sup>d</sup>	238.3 <sup>e</sup>	2.2 <sup>d</sup>
FBD	107.0 <sup>a</sup>	518.3 <sup>a</sup>	4.8 <sup>a</sup>
CPBD	107.0 <sup>a</sup>	443.3 <sup>b</sup>	4.1 <sup>b</sup>
PPBD	107.1 <sup>a</sup>	448.3 <sup>b</sup>	4.2 <sup>b</sup>
SBBBD	108.9 <sup>a</sup>	321.7 <sup>d</sup>	3.0 <sup>e</sup>

\* Mean values having different superscript letters in each column differ significantly ( $p \leq 0.05$ )

### Characteristics of high fiber bread containing improver

Main characteristics of bread samples prepared from cereal/legume brans composite flours containing a commercial improver (Megamix) are presented in Table 5. Addition of improver to high fiber composite flours resulted in significant ( $p \leq 0.05$ ) increase in loaf volume of bread for both WWF and FBB. Similar observation was noticed by Hartikainen *et al* (2014) who stated that fermentation and enzyme treatment of bran compensated for the increased hardness and the volume-decreasing effect observed with untreated bran. Other blends recorded reduction in loaf volume in spite of addition of the improver.

The specific volume of WWFBD was significantly ( $p \leq 0.05$ ) increased by addition of improver compared to the other bread samples (5.6 cc/g), also the specific volume of high fiber bread containing FBB was significantly ( $P \leq 0.05$ ) increased as a result of adding megamix (5.2 cc/g). Other high fiber breads recorded low specific volume; hence they were not affected by addition of megamix. This could be attributed to quality and quantity of the bran added to whole wheat flour. Cai *et al* (2014 b) observed that the variations in physical and compositional bran characteristics among different sources and classes of wheat were associated with bread-baking quality of whole grain wheat flour.

**Table 5:** Characteristics of high fiber bread containing improver\* (Mega mix)

Bread Source**	Loaf Weight (g)	Loaf Volume (cc)	Specific Volume (cc/g)
WWFBD	101.7 <sup>e</sup>	568.3 <sup>a</sup>	5.6 <sup>a</sup>
WBD	106.6 <sup>bc</sup>	216.7 <sup>e</sup>	2.0 <sup>f</sup>
FBD	105.4 <sup>cd</sup>	550.0 <sup>a</sup>	5.2 <sup>b</sup>
CPBD	105.1 <sup>d</sup>	361.7 <sup>c</sup>	3.4 <sup>d</sup>
PPBD	106.9 <sup>b</sup>	421.7 <sup>b</sup>	3.9 <sup>c</sup>
SBBBD	111.3 <sup>a</sup>	305.0 <sup>d</sup>	2.7 <sup>e</sup>

\* Mean values having different superscript letters in each column differ significantly ( $p \leq 0.05$ )



### Proximate composition of high fiber bread

The proximate composition of bread containing high fiber from wheat and different legume bran sources is illustrated in Table 6. Incorporation of wheat and legume brans in WWF caused significant ( $p \leq 0.05$ ) increase in moisture, fat, protein, fiber and ash contents compared to the control bread except the ash of FBBD bread because the bran was added in small amount. The results indicated that the increase in moisture, fat, protein, fiber and ash contents mainly due to addition of bran to WWF and this results in agreement with (Dalgetty and Baik 2006) who stated that breads enriched with pulse hulls and fiber were higher in moisture content than control bread regardless of the type, source, or enrichment level (Johnson *et al* 1985) reported that high fiber bread containing legume bran can be a source of protein, fiber and minerals; hence it has multi physiological functions. The total carbohydrates was observed to be significantly ( $p \leq 0.05$ ) decreased by inclusion of wheat and legume bran. It was noticed that increasing level of bran in WWF decreased its available carbohydrates content; therefore, high fiber bread has been successful as a low calorie food in improving diabetic control (Anderson *et al* 1987). The additives improve the overall quality of fibre-supplemented bread but, in general, there stiller main pronounced differences to white bread (Gómez *et al* 2003). (Rosel *et al* 2006) observed some synergistic effects in wheat dough mixing properties with the addition of commercial pea fibers (hull or cotyledon fibers), chicory root, or sugar beet fibers, singly or in combination). Improvements in dough functionality could be achieved using an optimized combination of fibers in the formulation of fiber-enriched dough (Collar *et al* 2007). The ideal fiber ingredient may not exist, but is probably a blend of various fiber sources.

### 4. Conclusion

Dietary fiber is a common and important ingredient of new generation of healthy food products. The conventional wheat based bread was enriched with bran from wheat and different legumes sources including faba bean, chick pea, pigeon pea and soya bean. Wheat and legumes bran increased the nutritional value of bread but in the same time altered rheological properties of dough causing significant ( $p \leq 0.05$ ) reduction in gluten level and increasing the falling number of the composite flour. Finally, the quality of the high fiber bread was noticeable when higher level of bran were added to the whole wheat flour. However, the improver caused development in wheat and faba bean high fiber breads.

**Table 6:** Proximate composition of high fiber bread\*

Bread Source	Moisture (%)	Fat (%)	Crude Protein (%)	Crude Fiber (%)	Ash (%)	Total CHO**
WWFBD	32.1 <sup>d</sup>	0.3 <sup>d</sup>	8.4 <sup>f</sup>	0.7 <sup>c</sup>	1.2 <sup>bc</sup>	58.0 <sup>a</sup>
WBD	42.2 <sup>a</sup>	1.1 <sup>c</sup>	12.7 <sup>a</sup>	2.5 <sup>a</sup>	1.9 <sup>a</sup>	42.1 <sup>c</sup>
FBBD	37.4 <sup>c</sup>	1.1 <sup>c</sup>	11.9 <sup>c</sup>	2.7 <sup>a</sup>	1.1 <sup>c</sup>	48.5 <sup>b</sup>
CPBD	39.2 <sup>b</sup>	1.2 <sup>b</sup>	10.9 <sup>e</sup>	2.6 <sup>a</sup>	1.2 <sup>bc</sup>	47.5 <sup>b</sup>
PPBD	37.5 <sup>c</sup>	1.2 <sup>b</sup>	11.3 <sup>d</sup>	2.7 <sup>a</sup>	1.2 <sup>bc</sup>	48.8 <sup>b</sup>
SBBD	41.9 <sup>a</sup>	1.7 <sup>a</sup>	12.3 <sup>b</sup>	2.5 <sup>b</sup>	1.4 <sup>b</sup>	42.7 <sup>c</sup>

\* Mean values having different superscript letters in each column differ significantly ( $p \leq 0.05$ )

\*\*Carbohydrate by difference

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