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# PARTICLE SIZE DISTRIBUTION IS AN INDICATION OF WHEAT BRAN QUALITY ATTRIBUTES FOR DAIRY FARMERS IN TIGRAY REGION, NORTHERN ETHIOPIA

## Introduction



Wheat bran is not a standardised product with defined quality and chemical composition. The composition of commercial bran depends upon many factors. Dairy farmers in northern Ethiopia particularly rely on particle size distribution to assess wheat bran quality on the market.

Previous research focused on characterizing the relationship between particle size of wheat bran and its hydration properties (Jacobs *et al.*, 2015; Onipe *et al.*, 2017). The present study was conducted to evaluate the relationship between farmers' preference and laboratory analysis as wheat bran quality parameters.

## Material and methods

A total of 30 smallholder dairy farmers were involved in the study. Five types of wheat bran were collected from five major wheat flour processing factories found in Tigray (Ethiopia).

Farmers scored the studied wheat bran types on a scale of 1 (not preferred) to 4 (highly preferred) for quality attributes including water holding capacity (WHC), swelling capacity (SC) and nutritive value.

The laboratory analysis of wheat bran samples were conducted for physical parameters [geometric mean particle size (D50), WHC, SC, water retention capacity (WRC) and bulk density (BD)], proximate and fibre components as well as in vitro digestibility.



Fig 1. Sieving of wheat bran with shaker for determination of particle size distribution



Fig 2. Determination of water holding capacity

## Results

**Table 1.** Chemical composition (g/kg DM, unless stated otherwise) and effective rumen dry matter and protein degradability of wheat bran produced from five flour processing factories in Tigray region, northern Ethiopia

Parameters	Wheat bran producing factories				
	A	B	C	D	E
DM (g/kg)	906	901	908	906	898
Crude protein	144	133	161	152	163
Crude fat	39	40	51	43	52
aNDFom	347	368	476	409	436
NFC	436	422	265	358	307
ERDD (g/g DM)	0.712	0.675	0.568	0.662	0.582
ERPD (g/g CP)	0.747	0.732	0.730	0.793	0.734

DM = Dry matter; aNDFom = Neutral detergent fibre assayed with heat stable amylase and expressed exclusive of residual ash; NFC = non fibre carbohydrates; ERDD = Effective rumen dry matter degradability; ERPD = Effective rumen protein degradability

**Table 2.** Physical parameters of wheat bran produced from different flour factories in Tigray region

Parameters	Wheat bran producing factories					SEM	P-value
	A	B	C	D	E		
D50 (µm)	1103 <sup>a</sup>	1011 <sup>ab</sup>	1046 <sup>a</sup>	909 <sup>b</sup>	977 <sup>ab</sup>	28.2	0.0067
BD (g/ml)	0.36 <sup>a</sup>	0.36 <sup>a</sup>	0.27 <sup>b</sup>	0.36 <sup>a</sup>	0.35 <sup>a</sup>	0.014	0.0036
WHC (g/g)	2.28 <sup>bc</sup>	2.49 <sup>b</sup>	2.90 <sup>a</sup>	2.14 <sup>c</sup>	2.49 <sup>b</sup>	0.053	0.0001
SC (g/g)	2.00 <sup>b</sup>	2.13 <sup>ab</sup>	2.80 <sup>a</sup>	2.13 <sup>ab</sup>	2.00 <sup>b</sup>	0.169	0.0371
WRC (g/g)	2.40 <sup>ab</sup>	1.90 <sup>c</sup>	2.84 <sup>a</sup>	2.22 <sup>bc</sup>	2.07 <sup>bc</sup>	0.097	0.0004

abc = Means in a row with different superscripts are significantly different (P<0.05);

D50 = geometric median particle size; BD = bulk density; WHC = water holding capacity; SC = swelling capacity; WRC = water retention capacity

**Table 3.** Spearman's rank correlation of farmers preference scores with laboratory parameters for wheat bran quality assessment (\* P < 0,05)

Laboratory parameters	Farmers preference score for wheat bran quality attributes	
	Nutritive value	Water holding capacity
D50 (µm)	-0.553*	0.526*
WHC (g/g)	-0.196*	0.367*
CP (g/kg DM)	0.347*	-0.377*
aNDFom (g/kg DM)	0.092	-0.040
NFC (g/kg DM)	-0.092	0.040
ERDD (g/g DM)	-0.092	0.040
ERPD (g/g CP)	0.291*	-0.477*

## Results

Wheat bran types with coarse particle size were scored high for the quality attributes of WHC and SC, while wheat bran types with fine particle size distribution were generally better scored for their nutritive value.

Particle size distribution showed the highest negative correlation with nutritive value and the greatest positive correlation with water holding capacity.

## Conclusion

Particle size distribution is the predominant qualitative selection criteria for farmers to assess wheat bran quality (e.g. on the market) and this qualitative appreciation is to some extent related to chemical characteristics and rumen degradability.

The observed variation in physical and nutritive value attributes of the wheat bran produced by the flour processing factories calls for a standardization of this by-product.

## References

Jacobs, P.J., Hemdane, S., Dornez, E., Delcour, J.A. and Courtin, C.M. 2015. Study of hydration properties of wheat bran as a function of particle size. *Food Chemistry*, 179: 296–304.  
Onipe, O.O., Beswa, D. and Jideani, A.I. 2017. Effect of size reduction on colour, hydration and rheological properties of wheat bran. *Food Sci. Technol, Campinas*, 37: 389-396.

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