

Influence of debranning on starch content and paste properties of millet (*Pennisetum Glaucum* (L.) R. BR.)

Influência da desbranqueamento no teor de amido e nas propriedades da pasta de milheto (*Pennisetum Glaucum* (L.) R. BR.)

Influencia del descascarado en el contenido de almidón y las propiedades de la pasta de mijo (*Pennisetum Glaucum* (L.) R. BR.)

DOI: 10.55905/oelv22n9-140

Receipt of originals: 08/16/2024

Acceptance for publication: 09/06/2024

André Leonardo dos Santos

PhD in Food Science and Technology

Institution: Universidade Federal Rural do Rio de Janeiro

Address: Rio de Janeiro, Rio de Janeiro, Brazil

E-mail: anddreleo@gmail.com

Monique Barreto Santos

PhD in Food Science and Technology

Institution: Embrapa Agroindústria de Alimentos

Address: Rio de Janeiro, Rio de Janeiro, Brazil

E-mail: moniquebarretomedvet@yahoo.com.br

Luiz Henrique Fasolin

PhD in Food Engineering

Institution: Universidade Estadual de Campinas

Address: Campinas, São Paulo, Brazil

E-mail: lfasolin@unicamp.br

Carlos Wanderlei Piler de Carvalho

PhD in Food Science

Institution: Embrapa Agroindústria de Alimentos

Address: Rio de Janeiro, Rio de Janeiro, Brazil

E-mail: carlos.piler@embrapa.br

ABSTRACT

Pearl millet is largely cultivated in Brazil, but poorly known as food. From their grains, bran can be extracted which a great source of minerals, phitochemicals (bioactives) and dietraty fiber. This work investigated the effect of debranning time on starch content and paste properties. Millet grain debranning for 20 min showed the highest percentages of bran (15.5%) and dehulling (30.7%). Starch granules were found in all treatments, but the

lowest content was found after 5 min debranning (7.23%). As expected, all brans obtained at varied debranning time did not show any peak viscosity as the amount of starch did not account for the viscosity along with the insoluble fibers that are known for not increase viscosity under heat in excess of water.

Keywords: Bran, Starch, Paste Properties, Millet, Decortification.

RESUMO

O milho é amplamente cultivado no Brasil, mas pouco conhecido como alimento. De seus grãos, pode-se extrair farelo, que é uma grande fonte de minerais, fitoquímicos (bioativos) e fibras dietéticas. Este trabalho investigou o efeito do tempo de desbranqueamento no teor de amido e nas propriedades da pasta. O desbranqueamento do grão de milho por 20 min apresentou as maiores porcentagens de farelo (15,5%) e descasque (30,7%). Grânulos de amido foram encontrados em todos os tratamentos, mas o menor teor foi encontrado após 5 min de desbranqueamento (7,23%). Como esperado, todos os farelos obtidos em tempos variados de desbranqueamento não apresentaram nenhum pico de viscosidade, pois a quantidade de amido não foi responsável pela viscosidade, juntamente com as fibras insolúveis que são conhecidas por não aumentar a viscosidade sob calor em excesso de água.

Palavras-chave: Farelo, Amido, Propriedades da pasta, Milho, Decortificação.

RESUMEN

El mijo perla se cultiva ampliamente en Brasil, pero no es muy conocido como alimento. De sus granos se puede extraer el salvado, que es una gran fuente de minerales, fitoquímicos (bioactivos) y fibra dietética. Este trabajo investigó el efecto del tiempo de descascarillado sobre el contenido de almidón y las propiedades de la pasta. El descascarillado del grano de mijo durante 20 minutos mostró los porcentajes más altos de salvado (15,5%) y descascarillado (30,7%). Se encontraron gránulos de almidón en todos los tratamientos, pero el contenido más bajo se encontró después de 5 minutos de descascarillado (7,23%). Como se esperaba, todos los salvados obtenidos en diferentes tiempos de descascarillado no mostraron ninguna viscosidad máxima, ya que la cantidad de almidón no explicaba la viscosidad junto con las fibras insolubles que son conocidas por no aumentar la viscosidad con el calor en exceso de agua.

Palabras clave: Salvado, Almidón, Propiedades de la pasta, Mijo, Decortificación.

1 INTRODUCTION

Millet, botanical specie *Pennisetum glaucum* (L.) R. Br, is the sixth most widely produced cereal crop, after corn, rice, wheat and sorghum, with a production of 27.8

million tons, of which 96% is made in semi-arid tropical environments in Asia and Africa. Millet grains have excellent nutritional quality comparable or superior to some frequently consumed cereals, such as rice and wheat (Srivastava; Saini; Singh, 2020).

The most important anatomical parts of a cereal grain are endosperm, bran, and germ. The bran represents about 14-19% of the grain's weight and is a rich source of vitamins, minerals, phytochemicals, and dietary fiber (Agil; Hosseinian, 2014). However, the bran and bran-rich fractions (aleurone layer, forehead, pericarp) are usually discarded during primary processes such as dehulling, milling, and polishing (Patel, 2015). The literature reports few works using millet bran. In this context, the objective of this study was to extract millet bran at different burnishing times and relate it to starch content and paste properties.

2 MATERIALS AND METHODS

2.1 SAMPLES PREPARATION

The millet grains, hibrid ADRg9070, kindly donated by Atto Sementes (Rondonópolis, MS). Debranning was performed in a MT-97 rice mill, no. 3788-5 (Suzuki, Brazil) at a flow rate of 150 g at variable time of 5 (FM5), 10 (FM10) and 25 min (FM25). The bran was then milled in a hammer mill 3100 (Perten Instruments AB, Huddinge, Sweden) fitted with aperture of 0.8 mm. The whole grain was ground in the same mill and used as a control sample (MI0). The samples were stored at -15 °C in polyethylene bags and protected from light until the day of the analyses.

2.2 DEBRANNING CHARACTERISTICS AND BRAN EXTRACTION

The bran recovered (%) and debranning (%) was calculated using the following Equation 1 e 2.

$$\text{Bran recovered (\%)} = \frac{\text{Weight of bran obtained}}{\text{Weight of initial sample taken}} \times 100 \quad (1)$$

$$\text{Debranning (\%)} = \frac{\text{Weight of debranned grain}}{\text{Weight of initial sample taken}} \times 100 \quad (2)$$

2.3 TOTAL STARCH

Total starch was determined using a Megazyme© Assay kit (Megazyme Intl. Ireland Ltd., Wicklow, Ireland), according to 79-13 method (AACC, 2000).

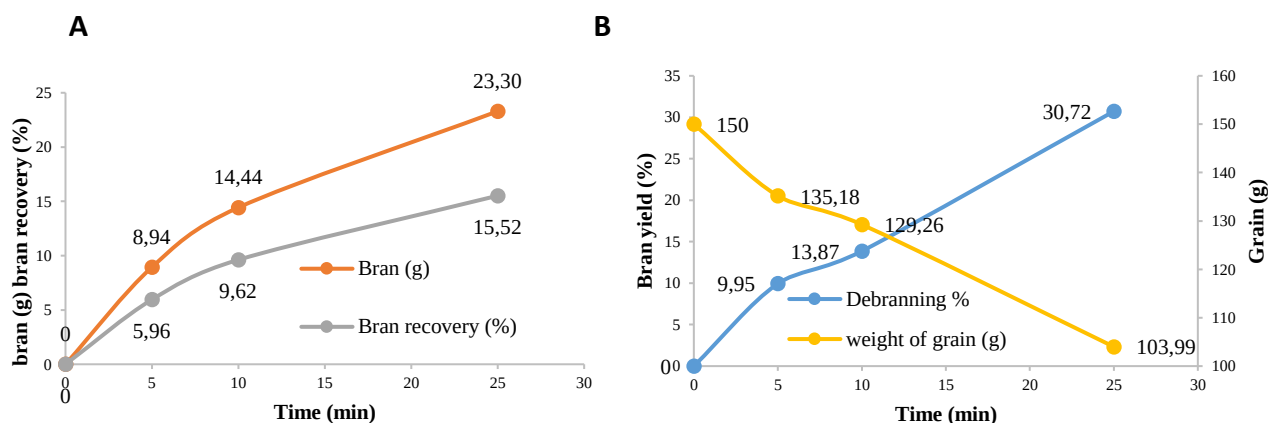
2.4 PAST PROPERTIES

The paste viscosity was determined using a Rapid Visco Analyzer series 4 RVA (Newport Scientific Pty Ltd., Warriewood, Australia) was used following method 76-21 (AACC, 2000)

3 RESULTS AND DISCUSSION

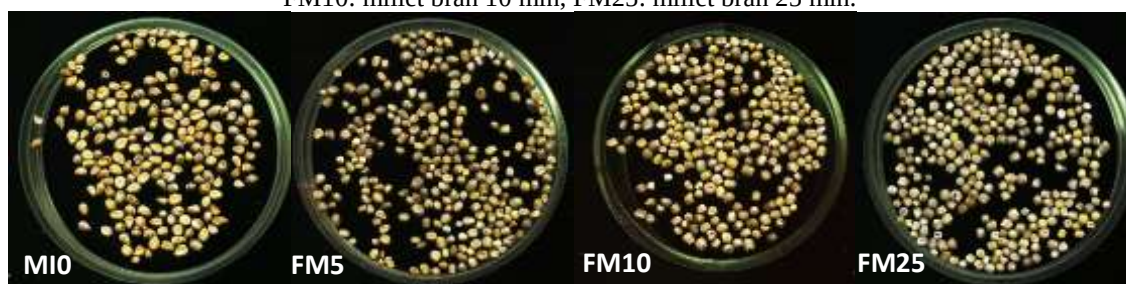
The yield of recovered bran and honing are shown in Figure 1. The initial weight of millet grain at time 0 min (150 g) was reduced to 103.99g at time 25 min. The highest percentage of debranning and bran was 30.7 % and 15.22%, respectively, at time 25 min. The debranning time influenced the bran yield and these results are in agreement with Barbhai and Hymavathi, (2022) . In Figure 2, the images of the grains before and after the debranning process are presented. In the Figure, there is a slight color change between grains MI0 and FM25 as a result of bran extraction.

Figure 1: Bran recovery, debranning and weight of millet grains as a function of processing time



Source: Authors

Figure 2: Grains of millet debranned at different times. MIO: Whole millet, FM5: millet bran 5 min, FM10: millet bran 10 min, FM25: millet bran 25 min.



Source: Authors

The paste properties and total starch contents of the whole flour and bran are presented in Table 1. The debranning time directly influenced the starch content, which varied between 7.23 (5 min) and 22.16 (25 min). Higher values (26.33 g/100 g) were found by Cukelj Mustač et al., (2020) in their study with millet bran (*Panicum miliaceum* L.).

Table 1: Paste properties and total starch for whole millet and millet bran

	TP (°C)	VMa (cP)	VMi (cP)	BDV	VmiF (cP)	SBV (cP)	VF (cP)	Total Starch (%)
MI0	86.7	825.5	516	309.5	1439	923	1439	63.1
FM05	-	71.5	56	15.5	68.5	12.5	75	7.2
FM10	-	88.5	67	21.5	82	15	78.5	11.8
FM25	-	82	65	17	84.5	19.5	78.5	22.2

MI0: Whole millet, FM5: Millet bran 5 min, FM10: Millet bran 10 min, FM25: Millet bran 25 min TP:

Paste temperature. VMa: Maximum viscosity. VMi: Minimum viscosity. BDV: Breakdown viscosity.

VMinF: Minimum cold viscosity. SBV: *Setback viscosity*. VF: Final Viscosity.

Source: Authors

As for the paste properties, the TP of whole millet was 86.7 °C, VMa was 825.5 cP and VF was 1439 cP, showing a behavior compatible with starchy flours. Different behaviors were observed in the bran (FM05, FM10 and FM25), as the temperature was raised, no increase in viscosity was observed. This behavior is typical of materials with high fiber content (Nascimento *et al.*, 2022).

4 CONCLUSION

The results of this study showed the direct relationship of debranning time on bran yield, starch content and paste properties in millet bran, confirmed from total starch and paste viscosity readings.

ACKNOWLEDGEMENTS

The authors would like to thank Universidade Federal Rural do Rio de Janeiro - UFRRJ, Universidade Estadual de Campinas – UNICAMP, Empresa Brasileira de Pesquisa Agropecuária - EMBRAPA, Fundação Carlos Chagas Filho de Amparo à Pesquisa do Estado do Rio de Janeiro – FAPERJ and Conselho Nacional de Desenvolvimento Científico e Tecnológico - CNPq

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