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Avaliação da qualidade de três marcas de farinha de trigo tipo 1 comercializadas em Belém, Pará, Brasil

Quality evaluation of three brands of type 1 wheat flour commercialized in Belém, Pará, Brazil

Evaluación de calidad de tres marcas de harina de trigo tipo 1 comercializadas en Belém, Pará, Brasil

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Resumo

O trigo é uma cultura rica em nutrientes. No Brasil, cerca de 130 mil propriedades produzem o cereal, envolvendo 800 mil pessoas. Devido as suas propriedades reológicas, ou seja, a capacidade de extensibilidade desse cereal se destaca na fabricação de pães, além do crescente uso da farinha na indústria alimentícia. Assim, o presente trabalho tem o intuito de vislumbrar através de análises físico-químicas a qualidade de três três variedades de farinha do trigo, seguindo a instrução normativa de n°8/2005 do Ministério da Agricultura, Pecuária e Abastecimento (MAPA). Para a pesquisa laboratorial, as amostras de farinha de trigo do tipo 1 (A, B e C) foram adquiridas em um supermercado localizado no município de Belém/PA, consequentemente conduzidas ao Centro de Tecnologia Agropecuária – CTA na Universidade Federal Rural da Amazônia (UFRA), para determinação dos parâmetros granulometria, acidez graxa, proteína, umidade e cinzas. No que tange à análise de granulometria, as amostras A e C se mostraram acima dos valores de tolerância proposto pelo Ministério da Agricultura e Pecuária – MAPA. Os parâmetros de acidez graxa e umidade se mostraram dentro dos padrões detolerância do MAPApara todas as amostras. Na determinação de cinzas, os valores mostraram que as três amostras estão fora do padrão de qualidade, além disso, no que se refere ao teor de proteína, as amostras também foram caracterizadas como fora do tipo. Portanto, se faz necessário melhor fiscalização pelas autoridades responsáveis desde as condições de cultivo, até ao controle final de qualidade do produto.

Palavras-chave: Tecnologia de alimentos; Alimentos de origem vegetal; Regulamento técnico de alimentos.

Abstract

Wheat is a crop rich in nutrients. In Brazil, about 130,000 properties produce the cereal, involving 800,000 people. Due to its rheological properties, that is, the extensibility capacity of this cereal stands out in the manufacture of breads, in addition to the increasing use of flour in the food industry. Thus, the use of some physical-chemical analysis to determine the quality of wheat flour according to the normative instruction from Agriculture, Livestock and Storage Ministry (MAPA) document nº 8/2005. Wheat flour samples of type 1 (A, B and C) were acquired in a supermarket located in the city of Belém / PA, posteriorly sent to the Centro de Tecnologia Agropecuária - CTA at the Universidade Federal Rural da Amazônia (UFRA), to determine granulometry, grease acid, protein, humidity and ashes. Regarding to granulometry analysis, samples A and C were above the tolerance values proposed by the Ministry of Agriculture and Livestock - MAPA. Grease acid and humidity were inside to

MAPA tolerance standards for all samples. In ashes determining, the values showed that all three samples were out of the quality standard, in addition, about protein content, the samples were also characterized as out of type. Therefore, there is a need for better inspection by the responsible authorities, since cultivation conditions until the final quality control of the product.
Keywords: Food technology; Food of plant origin; Technical food regulations.

Resumen

El trigo es un cultivo rico en nutrientes. En Brasil, alrededor de 130 mil propiedades producen el cereal, involucrando 800 mil personas. Debido a sus propiedades reológicas, es decir, la capacidad de extensibilidad de este cereal se destaca en la fabricación de panes, además del uso creciente de la harina en la industria alimentaria. Así, el presente trabajo pretende predecir acerca análisis físicos y químicos de calidad, la calidad de tres variedades de harina de trigo, siguiendo las instrucciones normativas nº 8/2005 del Ministerio de Agricultura, Ganadería y Abastecimiento (MAPA). Se adquirieron muestras de harina de trigo de tipo 1 (A, B y C) en un supermercado en la ciudad de Belém / PA, y llevado al Centro de Tecnología Agrícola - CTA en la Universidad Federal Rural del Amazonas (UFRA), para determinar los parámetros de granulometría, acidez de grasas, proteínas, humedad y cenizas. Acerca de análisis de partícula, las muestras A y C estaban por encima de los valores de tolerancia propuestos por el Ministerio de Agricultura y Ganadería - MAPA. Los parámetros de acidez y humedad de la grasa estaban dentro de los estándares de tolerancia MAPA para todas las muestras. Al determinar la ceniza, los valores mostraron que las tres muestras están fuera del estándar de calidad, además, con respecto al contenido de proteína, las muestras también se caracterizaron como fuera de tipo. Así, es necesario que las autoridades responsables realicen una mejor inspección desde las condiciones de cultivo hasta el control de calidad final del producto.
Palabras clave: Tecnología de alimentos; Alimentos de origen vegetal; Normativa técnica alimentaria.

1. Introduction

Wheat (*Triticum aestivum*) is a C3 cycle grass, which is considered a highly nutritious food because its derivates provides carbohydrates, vitamin B, proteins, zinc, and fiber. It is known as a winter crop, as it is more typically cultivated in southern Brazil, specifically in the states of Paraná and Rio Grande do Sul, although it, is also cultivated in other states as a rotation crop with soy in the summer (Lin, Gu, Bian & Surface, 2019; Camargo, Ferreira-Filho & Salomom 2004; Emilia & Zarebelni, 2015). The powder used to make wheat flour is obtained by passing it through a crushing unit. Nationally, about 130,000 rural properties produce wheat-based cereal in a system tha involves 800,000 workers (Emilia & Zarebelni, 2015; Marques, 2012). In recent years, Brazil has become the world's major wheat importer, overcoming countries that traditionally occupied privileged spots between the majors buyers in the international market, like Egypt, Japan and Iran.

For being an important cereal in the human diet, wheat occupies the first place in volume of international production, and for that, researches are being more encouraged as a result of this market importance. Wheat is the base of a wide variety of foods consumed daily. Its physical and chemical composition, with structural properties and microbiologic population, defines the quality of wheat flour (Scheuer et al, 2011). It has been observed that wheat consumption in tropical countries has been increasing at a rate of 2 to 5 % per year. At the same time, tropical countries are the major importers, since their internal production does not attend to the consumptive demand (Camargo, Ferreira-Filho &Salomom 2004; El-dash & Miranda, 2002).

Wheat is an essential ingredient in breads, cakes, cookies and other dough-based foods (Cerqueira, Dias & Freitas, 2016). It is one of the key cereal grains in Bread production for its elastic and extensibility capacities, also known as its rheological properties. Both the production and commercialization of this grain are growing increasingly, mainly due to the use of flour in the food industry (Cerqueira, Dias & Freitas, 2016). As for wheat flour, the quality of this product directly affects the appearance, flavor, and texture of the food.

Wheat flour can be classified according to some chemical parameters found in the normative instructions from Agriculture Ministry document nº 8/2005. Concerning type 1 wheat flour, the reference parameters are ashes content (maximum of 0,8%), granulometry where 95% of the product has to pass through the 250 μm sieve, protein content with a 7,5% minimum, grease acid 100 mg of KOH/100 g of the product. Besides that, the humidity content must be 15% at maximum (Brasil, 2018).

Moreover, the quality of cereal grains and flours is recognized for a variety of characteristics that assume different meanings with respect to the types and uses of the product (Smanhotto et al, 2006; Scheuer et al, 2011). The technological quality of the flour depends of wheat quality, which relates to the management conditions of field crop, crop operations, as well as drying and grain storage (Gutkoski et al, 2007). To that end, a knowledge of wheat properties is necessary for optimizing results.

Thus, flour quality (which is crucial in baking) is determined through several analyses, such as, humidity content and ashes content analyses, which determine the quantity of minerals through organic matter burn, until the classification concerning to the content of that parameter, featuring the physical and chemical analysis (Goesaert et al, 2005; Cerqueira, Dias & Freitas, 2016). Due to the huge diversity of wheat genotypes, it is necessary to analyze these parameters to determine physical-chemical and rheological characteristics. As a feedstock, wheat can be considered as responsible to quality of its flour (Costa et al, 2008), besides other factors.

Regarding genetic enhancement, which is achieved every year, changes in wheat cultivation with soil types, drying and storage, are inevitable so as not to obtain a wheat variety with different properties. Without these laboratory analyses, it becomes difficult to maintain a product quality standard (Lanzarini, 2015) for being processed from the feedstock in a gross state.

Wheat flour is considered na alimentary product that can suffer alterations in nutritional and technological quality during transport operation, including during the importation process. Thus, this article aims to determine, through physical-chemical analysis, the quality of three varieties of wheat flour commercialized in a market place in the city of Belém/PA.

2. Methodology

2.1 Sampling and laboratory analysis location

Type 1 wheat flour samples were acquired in a supermarket located in the city of Belém/PA, on July 2018. After that, the samples of type A, B and C were sent to the Centro de Tecnologia Agropecuária – CTA – at the Universidade Federal Rural da Amazônia (UFRA) for analysis of the physical-chemical parameters (e.g., granulometry, grease acid, protein, humidity and ashes), for laboratory research of qualitative purpose (Pereira et al, 2018). All analyses were conducted three times to obtain more precise results.

2.2 Physical-chemical analysis

To determine the granulometry of wheat flour, it was necessary to weight 100 g of the sample in a beaker (600 ml) on analytical balance (Adventure brand, model AR2140). After this, it was transferred to a sieve with lid and bottom through circular horizontal agitation for 1 minute, thus obtaining the mass in grams of the residues in the sieve (SOLOTEST brand) with leaked and lost content in this process (Brasil, 2018).

To determine the level of grease acid, about 5 g of sample was weighed in a beaker on an analytical balance, which was then transferred to the gas fume hood (QUIMIS brand) where 12,5 ml of toluene solution was added. The sample was agitated for 2 minutes and then filtered into a funnel and quantitative filter, while 25 ml of the filtered sample was pipetted to an Erlenmeyer. After that, 3,3 ml of phenolphtalein solution 0,04% was added to perform the titration with potassium hydroxide solution (KOH) 0,0356 N, until a pink color appeared (Brasil, 2018). Figure 1 demonstrates the analytical balance and the sieve shaker used in the process.

Figure 1: Equipments used in the process, Analytical balance (A) and Sieve shaker (B).

Source: Authors.

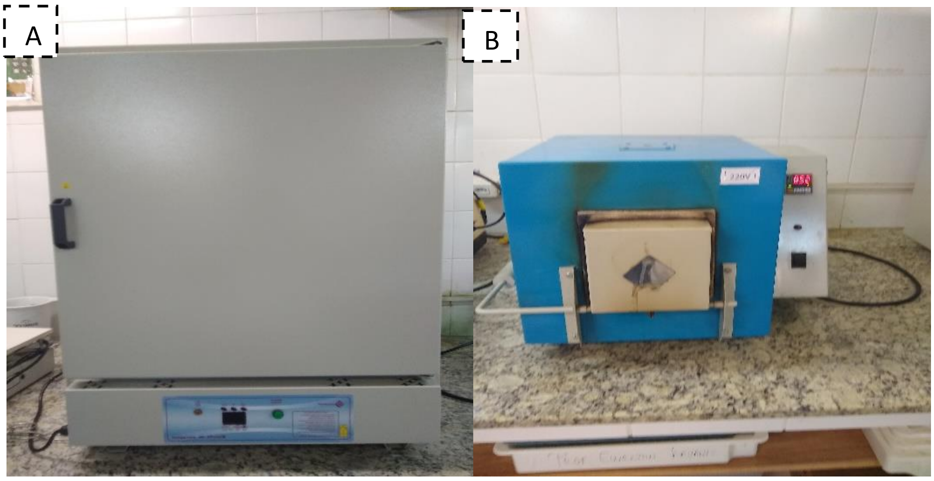
The equipment in Figure 1A has its importance in reagents weighing, solutions preparation, and samples weighing. The sieve shaker is essential for granulometric separation (Figure 1B).

For the humidity analysis, an incubator (QUIMIS brand, model Q317M-53) was used at constant temperature of 130º C to dry the empty aluminum capsule for 30 minutes and then subsequently cooled to room temperature. After that, the capsule mass was obtained in analytical balance. This process was also done with a 3 g sample of wheat flour in the incubator for 1 hour. After being cooled in desiccator, the weight of the capsule with the sample was obtained (Brasil, 2018).

To determine the ashes content, a muffle (ZEZIMAQ brand, model 2000B) was used, which had previously been programed to 600º C. Empty porcelain crucibles were placed inside for calcine, after temperature stabilization, for 30 minutes. The next step was cooling in the desiccator and obtaining the weight of the empty crucible.

A sample of 2 g was added in each crucible with different markings and placed in the muffle for 2 hours, after temperature stabilization, to incineration. After this, the crucibles were removed from muffle to cool in the desiccator and, afterward, the weight of crucibles was measured with the incinerated samples (in ashes) (Brasil, 2018). Figure 2 shows the incubator and muffle used in the analysis.

Figure 2: Equipments used in the process, incubator (A) and muffle (B).



Source: Authors.

The protein analysis was conducted using a micro Kjeldahl method (MARCONI brand, model MA036 plus). First, a sample of about 0,2 g was weighed on vegetable paper, in addition to a small amount of silicone grease and, after that, placed in a Kjeldahl tube. Then, 8 ml of concentrated sulfuric acid was added to the tube with the package and then the tubes with samples were placed on digester block (LUCADEMA brand) for thermal treatment of wheat samples.

The distillation process occurred after the removing of samples from thermal treatment. The receiving solution was made by adding 20 ml of boric acid 4 % with 5 drops of methyl red. After the sample was coupled to the distiller, the receiving solution was added.

The solution obtained by distillation (100 ml) was titrated with cloridric acid 0,1 N standardized solution until reaching a reddish color (Brasil, 2018). Figure 3 shows the micro Kjeldahl equipment, which was used in the protein analysis.

Figure 3: Micro Kjeldahl.

Source: Authors.

Still in the micro Kjeldahl, 35 ml of sodium hydroxide 40 % were added to the solution. The distillation continued until the receiving solution reached 100 ml in Erlenmeyer, obtaining a yellow color.

2.3 Statistics tests

For the treatment of the obtained results Microsoft Excel was used to calculate statistics, such as the means and standards of deviation.

3. Results and Discussion

The results of physical-chemical compositions of the type 1 wheat flour was determined as shown in Table 1, where means and standards deviation of obtained data from parameters to the samples are expressed.

Table 1: Mean and standard deviation data of wheat flour physical-chemical analysis and reference values from Law of MAPA.

Parameters	Samples			Law
	A	B	C	
Granulometry (%)	98.86 ±0.20	94.33 ±2.58	97.52 ±0.59	95
Grease acid (mg of KOH/100g)	20.98 ±1.58	11.17 ±4.47	18.38 ±1.99	100
Humidity by incubator (%)	5.92 ±0.27	3.94 ±0.05	5.14 ±1.70	15
Ashes in humid base (%)	0.72 ±0.42	0.77 ±0.32	0.72 ±0.18	0.8
Ashes in dry base(%)	0.82 ±0.48	0.86 ±0.35	1.24 ±0.31	0.8
Protein in humid base (%)	12.56 ±3.23	16.97 ±1.22	14.95 ±0.55	7.5

Source: Authors.

Table 1 express the resulting values of physical-chemical analysis from type 1 wheat flour samples. It is possible to observe that the granulometry values from samples A and C showed results above the limits imposed by MAPA – 95 % - it means, doesn't fits inside of tolerance limit. However, sample B, does not shows bigger standard of deviation values, but shows a result inside the tolerance limit. In reason of this parameter, with ashes in dry base, being crucial in wheat flour classification on type 1, 2 or integral, it is observed some samples out of type (Costa et al, 2008).

Related to grease acid content, the value settled by the normative instruction from the Agriculture, Livestock and Supply Ministry is 100 (mg of KOH/100 g). By that measure, according to Table 1, this parameter showed results inside the settled standards for all samples, highlighting sample B, which showed a standard deviation value bigger then samples of type A and B. Emilia & Zarebelni (2015) rated in their article wheat flour's shelf life, comparing different crushing processes for 90 days, and this parameter was inside the settled limits by law.

For humidity, the normative standard is 15,0 %. The humidity contents of all samples showed results below the settled standard by norm, which means its quality is appropriate. According to Costa et al (2008) this parameter stands out as a main factor of chemical reactions acceleration in this type of food, very often changing nutritional and technological characteristics. As compared with Vieira et al (2015); Cerqueira, Dias & Freitas (2016) in the amaranth, quinoa, soy and manioc starch flours comparison, the wheat flour showed a bigger humidity proportion. However, the results of chemical composition found in its studies was according to the law's standards.

For ashes content the settled standard is 0,8 %. At the determination of this parameter on humid base, the values shown were inside the limits. The ashes content in wheat samples obtained from national grains shows more satisfactory results when compared to samples obtained from international grains. Additionally, high ashes contents in flours can indicate a high extraction, with crumbs, which is undesirable since provides a darker color and a inferior cooking (Costa et al, 2008). There are reports that high ashes content does not pose a risk to consumers, and besides, it is common for these values be above the law's standards. Considering this fact and the dry base ashes data int his article, it would be opportune to discuss the requirement of a limit for flour ashes in the law (Cerqueira, Dias & Freitas, 2016).

As to protein content, the values are exposed both in humid base and in dry base, and according to the normative instruction, the tolerance limit model is 7,5 % being essential considering them in dry base. The samples protein content both in humid base and dry base are above of settled limits by normative instruction and, thus, are considered out of type. As a general matter, when we compare white type wheat flour and whole wheat flour, the latter contains higher protein levels and this result was expected by the fact that whole wheat wheat flour included leaven and crumbs which are normally removed in crushing process (Bae et al. 2014).

The results of the present study with type 1 wheat flour are important in the literature for comparing with other researches, also contributes with law by indicating if the characteristics parameters of the type of flour are within the standards allowed.

4. Conclusion

Wheat is seen as a reference in volume of world production, besides being a potential feedstock used in a wide variety of products, considering the importance of this cereal, as well as its characterization through quality control to consumers. It was observed that variated type 1 wheat flour samples analyzed showed some parameters as granulometry, dry base ashes and protein was not according to the quality norm settled in law, which can cause damages to consumers. Thus, oversight and monitoring from the relevant authorities is imperative. So, it is necessary to show quality in cultivation conditions, crushing unit production, harvest and storage of the feedstock, people and rural properties adequation who work on this cereal production.

In addition, it was observed that just grease acid and humidity parameters showed results concerning to the law's standards.

Considering the results obtained by this article, future researches with type 1 wheat flour is essential, because it has been observed a insufficiency about the discussed theme in literature.

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