THE DEFATTED RICE BRAN IN HUMAN'S FEEDING AND ITS POTENTIAL CONTRIBUTION TO THE QUESTION OF FOOD SECURITY IN BRAZIL

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Abstract

From an optimistic perspective, the world population in 2050 will reach the mark of nine billion people and a 100% more food must be produced to supply the population basic needs. Considering a finite amount of land, a major challenge is to improve production and ensure access to food for all, thus contributing to the issue of food security. The DRB (Defatted Rice Bran), rich in protein, fiber, carbohydrates and minerals becomes a viable food while their main destination currently is the animal feed. Directing the DRB for human consumption, such as in baking of mixed flours of wheat flour, higher energy use of the system is acquired, to which it planting area can feed a larger number of people, thus contributing to the issue of food security , an extreme important topic nowadays and for future generations.

Keywords:
Food Security; Sustainability; Reutilization of byproducts.

Resumo

Em uma perspectiva otimista, a população mundial em 2050 alcançará a marca de nove bilhões de pessoas e um total de 100% a mais de alimentos deverão ser produzidos para sanar suas necessidades básicas de alimentação. Considerando uma quantidade finita de terra, um dos principais desafios é aperfeiçoar a produção e garantir o acesso a alimentos a todos, colaborando assim para a questão da segurança alimentar. O FAD (Farelo de Arroz Desengordurado), rico em proteínas, fibras, carboidratos e minerais torna-se uma alternativa viável de alimentação humana ao passo que atualmente seu principal destino é a ração animal. Direcionando o FAD ao consumo humano, a exemplo na panificação de farinhas mistas de farinha de trigo, se têm um maior aproveitamento energético do sistema, ao qual a mesma área plantável poderá alimentar um maior número de pessoas, contribuindo assim com a questão da segurança alimentar, tópico de extrema importância atual e para futuras gerações.

Palavras-chave:
Segurança alimentar; Sustentabilidade; Reaproveitamento de subprodutos.

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INTRODUCTION

The knowledge of rice culture (*Oryza sativa L.*) dates from about 10.000 years and its origin is assign to Southeast Asia[1]. Increasingly this grain occupies a prominent place in an economic, social and nutritional point of view, which is a very important factor when we considered that from an optimistic context, in 2050, our planet will reach the mark of approximately nine billion people, and the food production will need to increase more 100% than the currently production[2,3]. In Brazil, the rice production, according to CONAB (Brazilian National Company Supply) in 2012 was 12.23 million tons[4], and consequently, an average of 2.31 million tons of husk and 1.22 million tons of bran were produced. In the Brazilian processing industry, the rice bran is consider the major byproduct obtained from the grain polishing process and, in the mostly, it is dissociated with husk[5]. Therefore, the study of viable alternatives for control of these byproducts in important to minimize its environmental impact.

Rice husk is represented by the outer part of grain, has a large amount of insoluble fiber and its weight in relation to the grain corresponds to an average of 19%[6]; the bran represents approximately 10% of the grain weight[7], and has a high fat content, an average of 30%[8]. This byproduct is widely used by part of rice oil industries and, generates a secondary byproduct after its extraction, named defatted rice bran (DRB)[9]. And lastly, as a product, the polished grain, having a high starchy and nutritious character[3].

The DRB still retains considerable concentration of nutrients, with significant amounts of protein, fiber, carbohydrates, vitamins, minerals and important antioxidants compounds[10]. Typically, this byproduct is destined to animal feed, which after being processed in meat, milk or eggs, is finally directed to human consumption. However, the addition of another trophic level in the food pyramid, represented by cattle, swine or poultry, results in a loss of approximately 90% in the energy originate of rice grain that is available for humans[11].

In view of the desired sustainability of paddy chain, the addition of a trophic intermediate level, between the plant and human beings, can compromise the longevity of system, especially at the current challenge of feeding more than seven billion people in a planet that has finite resources[11,2].

Therefore, the search for alternatives that can link the rice bran directly to the human feed, eliminating the "biological middleman" in order not only the higher using of the nutritional value of this byproduct, but as better conservation of the system energy is needed. This can lead to a reduction in the environmental impact of this important activity in order to improve the use of natural resources used by it. However, there is a dearth of information about the relationship between the defatted rice bran in human feed with the food security issue.

Thus, the aim of this review was to address the use of defatted rice bran, specific in brazilian case, as a potential contributor to the food security issue, as well as to expose the favorable and limiting factors of its incorporation inhuman feed.

FOOD SECURITY

A finite amount of land, coupled with a growing world population and its sustainable development brings greater demand for land, water, energy and, consequently, food. Currently, one in each seven people do not have access to the minimal energetic amount stipulated by FAO, which points to the food security issue[2].

The term food security is described by FAO as a state in which all people at all times, have the physical or economic access to food, in order to meet their dietary needs for an active and healthy life[12].

Some authors include not only these requirements, but also the availability, stability and utilization of these food[13]. The National Plan for Food and Nutrition of Brazil (PNAN) established in 2011, that the term of food security could also refer to food practices that promote healthy that respect the cultural diversity and that are environmental, cultural, economically and socially sustainable[14]. Schmidhuber & Tubiello (2007) also point out that is not enough food being "available", but people have to have monetary and nonmonetary resources that every human being has to access to adequate food portions.

Barriers between the technology and production can accentuate the problem of food security. Factors such as climate alterations, low socioeconomic development and lack of investment in transport and infrastructure, can have an effect on food production[13].

The social and economic stability has strong influence on food costs, especially in development countries, as Brazil[2]. One of the individual mitigating in the acquisition of food is the power supply for its transportation and production, especially petroleum that is a finite resource. In this context, not only the quantity of land must be increased or the production maximized, but optimized by a diversity of technical and scientific resources to contribute for the food security issue[2].

DEFATTED RICE BRAN AND ITS INCORPORATION IN HUMAN FEED

The best utilization of nutrients with a lower or equal amount of planting area, have been aroused interest in the academy community[15,16,17]. One alternative that can be used is the byproducts reuse, such as defatted rice

bran, that has low cost and high nutritional value[9], showing an average around 13.3% of moisture, 46.76% of carbohydrates, 16.6% of protein, 7.41% of total fiber, 0.33% of fat and 15.7% of mineral material[10].

One of the most used methods for incorporation of DRB in human feed is by baking. In this process, the wheat is the commonly used ingredient, for giving rise to only flour with ability to form a cohesive and tenacious mass, able to retain gases and give light and sanded products after the process of cooking[18]. This property is possible because of the capacity of gluten formation, a heterogeneous mixture of protein, especially gliadins and glutenins, that in presence of water form a network, retaining gases produced by yeast in the fermentation process of bakery products[18,19,20].

One of the aspects to be taken into account in relation to wheat corresponds to its situation as a product in Brazil. This is affected by the sharp import, especially from Argentina. Thus, it is an important point in the fragility of brazilian wheat culture, coupled with the low technological quality for mills, and consequently, commercialization of this flour for pasta industry, which requires a wheat that rarely the Brazilian harvest can offer[21]. Although some alternatives as production linked directly to agriculture industry has been encouraged the industry and made more competitive imports that corresponds to the largest wheat portion used in Brazil[21].

Thus, alternatives that enable the food security issue in order to replace total or partiality a dependent product from import for a native food with lower price arise.

According to Fisberg et al. (2008), the rice, followed by bread and beef, constitute the major energy source for brazilian population. Based on a population study, the rice constitutes 16.7% of energy intake for men, followed by beef (11.6%) and beans (9.3%). For women, the rice also occupies the first position with 16% of energy intake, followed by bread (9.3%) and beef (8.4%).

An alternative to keep this consumption of bread without relying on import would be the use of products and byproducts from the rice processing, or even the inclusion of unusual components in baking such as cassava starch or potato, since they attempt to appropriate technological parameters.

With the gluten removal from the diet, the sector may also rely on the inclusion of "food for special purposes". This term is described at PNAN and is related to food specially formulated to attend people's needs in specific metabolic and physiological conditions[14] and in this case is characterized as celiac disease, a process occurring in the intestine of a person allergic to gluten. With an infectious character, it interferes in the food digestion and in the absorption of micro and macronutrients, in some cases, may induce to intestinal ulcers if the intake of this component in not concluded.

According to PNAN, in Brazil there is a concern about offering foods that, beyond the usual guarantee of biological quality, health and nutritional, also contain significant technological quality (BRASIL, 2011). Several studies[23,24,25,26] have been reporting the use of devices to present gluten-free breads with good technological characteristics.

Studies realized by Sairan et al. (2011) on the addition of defatted rice bran in baking at different levels showed that, as did the addition of defatted rice bran in the formulation of bread, there was a decrease in the specific volume and changing in color. What may favor its use in baking, despite the drawbacks, is that the price is reduced and there is the benefit of dietary fibers incorporation. Several studies demonstrate that these fibers have hypocholesterolemic characteristics, as well as reduce the incidence of colon cancer, helping the peristaltic movement and being degraded by microorganisms, providing substrates for the natural intestinal flora[19,27].

A study sponsored by Lairon et al. (2005) showed that higher intake of dietary fibers is associated to a lower risk of cardiovascular disease, weight gain, blood pressure, waist circumference, cholesterol and triglyceride in both genders.

The theme links to another problem addressed in PNAN, in Brazil, the cases of obesity are increasing, which accentuate the creation of viable proposes for both innutrition and obesity problems[14], where the defatted rice bran may fulfill both roles.

A greater purchasing power lead to an exponential increase in the number of obese people, and sometimes, a direct transition between innutrition and obesity, where itis estimated that in 20 years about 70% of Brazilian people will be overweight, being necessary national strategies for reducing obesity, promoting that individuals

make healthy choices[14]. Thereby, the society is dichotomous in relation to nutrition, for while some do diets for losing weight, another suffer with innutrition.

THE POTENTIAL OF DEFATTED RICE BRAN IN FOOD SECURITY ISSUE

The term "food security" according to the National Plan for Food and Nutrition of Brazil (PNAN), takes into account several relevant aspects addressed by FAO, and recommends that the health-promoting food practices be environmental sustainable[14]. It is worth mentioning that the use of defatted rice bran in the diet also fits in this approach, since its application in baking or in any other food, reduces its trophic level and, consequently, provides greater energy use[11].

Trophic level is a concept coined in the 19th century, to designate consumer levels (primary, secondary) whereby energy and assimilated matter is transformed by the producers' pass[29]. Thus the green plant, that represents the first trophic level, turns inorganic matter into organic by the complexion of CO2 in photosynthesis. On the other hand, the herbivore that corresponds to the secondary trophic level assimilates the plant and loses as heat in breathing, 90% of the absorbed energy, as the first law of thermodynamics. Thus, the carnivore, as a component of the third trophic level, consumes herbivore, providing only 10% for the subsequent trophic level[11]. Which means, in general, less humans can be sustained, as more intermediaries exist between the plant and the final consumer. If the defatted rice bran trophic level is reduced, which was previously used to animal feed, (turn on later consumption of meat) to human destination, it might have an energy gain in the order of 90%.This may contribute to the food security issue, because it can feed a greater number of people, with the same total initial cultivable area.

CONCLUSION

The defatted rice bran shows some restrains in its food incorporation. However, it also presents great potential to combat dichotomy obesity x innutrition, as well as having potential contribution to the food security issue stipulated by FAO, justified, especially, by the reduction of trophic level and energy system conservation.

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