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## Socioeconomic impacts of adulteration in goat cheese production to public health in Brazil

Elisangela de Albuquerque Sobreira **Lage**<sup>a</sup>, Alcido Elenor **Wander**<sup>bc</sup>, Albenones José de **Mesquita**<sup>a</sup>, Moacir Evandro **Lage**<sup>a</sup>

<sup>a</sup>Federal University of Goiás (UFG)/School of Veterinary Medicine. P.O. Box 131, 74001-970 - Goiânia, GO, Brazil.

<sup>b</sup>Brazilian Agricultural Research Corporation (EMBRAPA)/National Rice and Beans Research Center. P.O. Box 179, 75375-000 - Santo Antonio de Goias, GO, Brazil. E-mail: [awander@cnpaf.embrapa.br](mailto:awander@cnpaf.embrapa.br)

<sup>c</sup>Faculdades Alves Faria (ALFA), Av. Perimetral Norte, 4129 – Vila João Vaz, 74445-190 - Goiânia, GO, Brazil.

### *Abstract*

The authenticity of foods became a serious world-wide problem. It is becoming more and more important to detect the introduction of adulterated food in the market. The adulteration of goat cheese is becoming more frequent in Brazil. Seasonality in production of goat milk and higher prices than those for cow milk are the main reasons why producers are adulterating goat cheese. Preliminary results show that each year about 70 to 245 thousands of new cases of allergy to cow milk in children up to 12 months of age are reported in Brazil. Thus, the development and adoption of fraud detection techniques become compulsory. This study aims to assess the socioeconomic impacts of adulteration of goat milk products with cow milk. The main impacts to the public health system are related to the cost of treatment of allergic children after consuming cow milk instead of goat milk products. In Brazil, the most used methods to detect IgE antibodies, which are responsible for the allergy, are the RAST and the skin test with immediate result. Another alternative is to remove cow milk from allergic children's diets. These treatment and prevention methods are expensive and hard to implement in public health programs. Genetic techniques like molecular markers became useful to check the quality of new food products, enabling the identification of origin of components contained in those products. With this technique it is possible to detect cow milk in goat cheese through the differences of molecular weight of the  $\beta$ -casein fragments. With this study it was possible to show that, comparing to other techniques, molecular markers represent a fast and cost-effective method to detect goat cheese adulteration with cow milk. This improves food safety to consumers with cow milk allergy and thereafter, increases the demand for original goat cheese, benefiting the whole chain, including farmers, dairy industries and traders.

Key words: molecular markers, allergy to cow milk, economics of biotechnology

## **2 Background and Aim of the Study**

In the elaboration of goat cheese, the substitution of goat milk through cow milk is the most common fraud in Brazil. Seasonal goat milk production and the higher price for goat milk than for cow milk represent incentives to cheese producers to alter their traditional cheese, from goat milk to cow milk. The detection of this fraud is important because goat cheese with cow milk inside without any alert on packing may cause allergic reaction on sensitive individuals.

The cow milk allergy is the most common alimentary allergy in children. Usually, allergic reactions to milk have clinical characteristics of involving specific IgE antibodies. The interval between milk consumption and the appearance of the symptoms varies from a few minutes up to two hours. Additionally to the classic reaction through IgE antibodies, milk consumption may cause many types of immunologic reactions (Brandão, 2003).

The diagnostic of cow milk allergy is done by associating typical anaphylactic reactions and the detection of IgE antibodies, which are specific to some cow milk fractions. The most used methods to detect IgE antibodies are the RASR and the skin test with immediate result. If they are positive, suggest a participation of the food in allergic reaction.

The RAST is a more expansive alternative, needs a blood sample and is less sensitive than the skin test of food allergy. Another alternative is to remove cow milk from allergic children's diets and to introduce dietetic products like soybean formula, hydrolyzed proteins, heat treated cow milk, elementary diets, vegetable formulas, goat milk, meat based formulas, home prepared food and human milk. As medicine treatment to prevent of this allergy disodium cromoglycate and cetotiphen can be used. Those prevention and treatment methods are quite expensive and hardly included in public health system in Brazil. Genetic techniques, like molecular markers, became useful tools to check the quality of new products from the food industry, as they allow identifying the origin of different food components. Through this technique, it is possible to detect cow milk in goat cheese due to the differences in molecular weight of the  $\beta$ -casein gene (253 pb for cow milk and 247 pb for goat milk).

The main objective of this study was to assess the economic impact of goat cheese adulteration on the public health system in Brazil. Specifically, the objectives are to assess the costs of utilizing RAPD molecular markers to identify frauds in goat cheese production and to estimate the benefit-cost-ratio of its use in Brazil.

## **3 Methods**

The main methodology is based on principles used in Wander et al. (2004).

### **3.1 The costs**

Considering that the development of technology of molecular markers was initiated abroad, the research costs spent on the method development have not been included in the analysis, as it focuses the national level only.

The costs for detecting frauds in goat cheese with cow milk with RAPD molecular markers were estimated based laboratory analysis. The information was obtained from laboratories of genetics carrying out the needed tests.

Only the costs for analyzing samples on a regular basis are considered to be sufficient to inhibit frauds in goat cheese.

### **3.2 The benefits**

The benefits of fraud detection are the saved costs of medicine treatment with disodium cromoglycate and cetotiphen.

### 3.3 The benefit-cost-ratio

The benefit-cost-ratio (BCR) is done based on annual information. It represents the relationship between the benefits of saving costs to public health system and the costs to analyze goat cheese samples in a regular basis in order to ensure a 'zero fraud level'.

The fraud detection system based on RAPD molecular markers are interesting for policy makers if the BCR is higher than 1.0.

## 4 Results and discussion

### 4.1 The costs

In Brazil, there are about 1,700 farms producing goat milk at commercial level. Each farm need to have samples analyzed every six months, i.e. 3,400 samples to be analyzed per year. The analysis of each sample with RAPD molecular markers costs about R\$ 180. Thus, the total annual costs of analyzing goat milk samples sums R\$ 612,000.

Table 1 – Total costs for analyzing commercial goat milk production in Brazil with RAPD molecular markers.

Item	Unit	Quantity	Unit price (R\$)	Total (R\$)
Analysis by RAPD molecular markers	samples	3,400	180	612,000

Source: Field research.

### 4.2 The benefits

Each option of medicine treatment (dissodic chromeglycate and cetotiphen) costs about R\$ 25 each and lasts one week. Both products are essential for medicine treatment. As in Brazil there are about 245 persons with cow milk allergy per year, the total cost of medicine treatment would be about R\$ 637,000.

Table 2 – Total saved costs when avoiding frauds of cow milk in goat milk in Brazil.

Item	Unit	Quantity	Unit cost (R\$)	Total (R\$)
Medicine treatment of food allergy with dissodic chromeglycate and cetotiphen	Person/year	245	2,600	637,000

Source: Field research.

### 4.3 The BCR

Considering the amount costs of analyzing goat milk samples of R\$ 612,000 per year and the resulted saved costs of R\$ 637,000, the BCR is 1.04 i.e. higher than 1.0, which means that, under the considered conditions, the adoption of systematic goat milk testing against adulteration by cow milk is an economically relevant option for public health policy in Brazil.

## 5. Conclusions

Adulteration of goat milk through cow milk and its resulting allergy problems costs about R\$ 637,000 per year to the Brazilian public health system.

The adoption of systematic goat milk testing to avoid frauds under the considered conditions is economically viable and recommendable.

## 6 References

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