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Evaluation of unsatisfactory reports of fruit derivatives of the Program of Monitoring Quality of Foods of the state of Minas Gerais (Progvisa/MG), from 2013-2015

Avaliação de laudos insatisfatórios de derivados de frutas do Programa de Monitoramento da Qualidade dos Alimentos do estado de Minas Gerais (Progvisa/MG) no período de 2013-2015

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ABSTRACT

Introduction: Fruits are highly perishable and easily deteriorated, so the production of derivatives in various forms such as pulps, jams and fruit in syrup is a conservation alternative. These derivatives must be prepared in accordance with the legislation requirements. **Objective:** The objective of this work was to evaluate the results of the unsatisfactory reports of the Minas Gerais Sanitary Surveillance (VISA/MG) of fruit derivatives (pulps, jams and fruit in syrup) sent to the National Agency of Sanitary Surveillance (Anvisa) in the period from 2013 to 2015, in order to identify the main irregularities. **Results:** We evaluated 25 reports (nine of jams in syrup, eight of fruit pulp and eight of jams). From the analyzed reports, 100% presented an unsatisfactory conclusion for the labeling analysis; a jam sample (12.5%) had artificial coloring not allowed; two samples of fig in syrup (29%) presented a copper content that did not comply with the legislation, and one of them (14%) had a lower carbohydrate content than that described in the labeling, indicating consumer fraud. Fruit pulps presented satisfactory results for analyses of histology and foreign matters. **Conclusions:** The irregularities found indicate that there is a need to adopt measures for companies to adapt their products to the requirements of the legislation.

KEYWORDS: Quality Control; Monitoring; Legislation; Good Manufacturing Practices; Safe Food

RESUMO

Introdução: Frutas são altamente perecíveis e de fácil deterioração, assim, a produção de seus derivados, sob variadas formas, como polpas, geleias e frutas em calda é uma alternativa de conservação. Estes derivados devem ser elaborados de acordo com os parâmetros e padrões estabelecidos nas legislações. **Objetivo:** Avaliar os resultados das análises de laudos insatisfatórios da Vigilância Sanitária de Minas Gerais (VISA/MG) de derivados de frutas (polpas, geleias e frutas em calda) encaminhados para a Agência Nacional de Vigilância Sanitária (Anvisa), no período de 2013 a 2015, a fim de se identificar as principais irregularidades. **Resultados:** Foram avaliados 25 laudos (nove de doces em calda, oito de polpas de frutas e oito de geleias). Dos laudos analisados, 100,0% apresentaram conclusão insatisfatória para a análise de rotulagem: uma amostra de geleia (12,5%) apresentou corante artificial não permitido; em duas amostras de figo em calda (29,0%) havia teor de cobre em desacordo com a legislação e, em uma destas (14,0%), teor de carboidratos menor do que o descrito na rotulagem, indicando fraude ao consumidor. As polpas de frutas apresentaram resultados satisfatórios para as análises de histologia e matérias estranhas. **Conclusões:** As irregularidades constatadas indicam que há necessidade de adoção de medidas para que as empresas adequem seus produtos aos requisitos da legislação.

PALAVRAS-CHAVE: Controle de Qualidade; Monitoramento; Legislação; Boas Práticas de Fabricação; Alimento Seguro

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INTRODUCTION

Fruit production is subject to oscillations due to climate conditions and the fact that many fruits are delicate and susceptible to crushing and consequent decomposition[1]. Fresh or raw fruit can be used as raw materials for processed products, including various derivatives like pulps, jams, creamy sweets, and fruits in syrup[2]. However, these products must be manufactured in accordance with Good Manufacturing Practices (GMP) and their composition must fulfill the physicochemical, microbiological and labeling requirements established by the law.

In order to verify that the products fulfill the requirements of the legislation, the National Health Surveillance System (SNVS) carries out sanitary inspections in processing facilities and monitors the products in stores. The SNVS is composed of the National Health Surveillance Agency (Anvisa), by the state, regional and municipal health surveillance bodies and the Central Public Health Laboratories (Lacen).

The monitoring consists of the collection of samples by the Health Surveillance body (VISA) at points of sale and/or processing establishments and the submission of these samples to the Lacen, where the analyses are done to verify whether that food meets the standards of identity and quality.

The Food Quality Monitoring Program in the Brazilian state of Minas Gerais (Progvisa) was created in 2000 to monitor the quality of food marketed in the state, including food categories agreed with Anvisa[3]. Initially, the program was seen as a food collection tool, focused on one-off complaints related to food outbreak investigation and consumer complaints, and involved a small number of municipalities. Over the years, the program has come to be seen as an important tool for health surveillance in the promotion of a comprehensive public health policy, increasing municipal and regional demand. As a result, new categories of food began to be considered in the program, including fruit-based products like jam, fruit pulp and fruit in syrup.

The current legislation regulating jam is Resolution of the Collegiate Board of Directors (RDC) n. 272, of September 22, 2005[4]. In the monitoring of jams, the artificial dyestuff research is performed to verify compliance with RDC n. 8, of March 6, 2013[5], which does not foresee the use of artificial colors for this type of food. Artificial dyes are a class of non-nutritive additives introduced into food and beverages with the sole purpose of giving them color to make them more appealing[6].

According to Jackix[7], the pH of jams should be at most 3.40 in order to obtain a firm gel with no tendency to syneresis. According to Torezan and Pezoa Garcia[8], the greatest concern in the processing of jams is the presence of molds and yeasts, since these multiply in a wide range of pH.

In the state of Minas Gerais there is a century-old tradition, which is passed down from generation to generation[9], to produce sweets in copper pots. RDC n. 20, of March 22, 2007[10], provides that copper, brass or bronze utensils which are fully coated with a technically pure gold, silver, nickel or tin coating may be used in the production of equipment and metal containers that will be in contact with food. That is, there is no ban on the use of copper pots. The only requirement of the legislation is that these pots be coated to prevent changes in the composition of the foodstuffs[11].

Fruit pulp is the non-fermented, non-concentrated, undiluted product obtained from pulpy fruits by means of a suitable technological process with a minimum total solids content. The pulp should come from the edible part of the fruit. Fruit pulp should not contain: dirt, soiling, parasites, insect fragments and inedible parts of the fruit or of the plant[12]. Through the microscopic analysis of the fruit pulps, we can identify the histological elements that make up the product, in addition to isolating and checking for foreign matter or dirt[13].

The assessment of food labeling information enables the identification of the origin, composition and nutritional characteristics of the products, also allowing its traceability. It is, therefore, a key element for public health[14].

In this study, 25 unsatisfactory reports (nine of fruit in syrup, eight of fruit pulp and eight of jams) from Progvisa were evaluated from 2013 to 2015, in order to identify the main irregularities for each category. We only used information from the reports sent by the Board of Food Health Surveillance from the Health Surveillance agency of the state of Minas Gerais to Anvisa. For jams, we carried out analyses related to copper, mold and yeast, artificial dyes and carbohydrates. Histology and foreign matter analyses were done for the fruits in syrup. The fruit pulps were evaluated for the presence of artificial dyes and the content of molds and yeasts. The labeling of all products was evaluated. The results of the analyses of the unsatisfactory reports, evaluated based on the current legislation, were transcribed and systematized in Tables 1, 2 and 3.

RESULTS AND DISCUSSION

Fruits in syrup

Table 1 shows the results for copper, mold and yeast, artificial dyes, carbohydrates and labeling of unsatisfactory reports on fruits in syrup - figs and peaches - collected by Progvisa/MG from January 2013 to October 2015.

We analyzed seven (100.0%) reports with unsatisfactory results regarding sweet figs in syrup.

The limit for copper in fresh and processed fruits, vegetables and oilseeds is 10 mg/kg[15]. Of the seven (100.0%) evaluated reports of figs in syrup, two (28.6%) presented unsatisfactory results regarding the copper assay. The peaches in syrup we analyzed showed copper content within the limits allowed by the legislation.

The analyzed figs and peaches in syrup did not present artificial dyes in their composition. Therefore, they were in agreement with RDC n. 8/2013[5]. In 2010, in the state of Minas Gerais, Brandão, Braga and Miranda[16] analyzed 46 samples of commercial fruit sweets and found that six (13.0%) were unsatisfactory in the test for artificial dyes. The dyes found in the research were bright blue, twilight yellow, yellow tartrazine, burgundy and red 40.

Vegetable and mushroom preserve samples were analyzed in terms of labeling and sulfur dioxide content in the years 2011 to 2013 by Progvisa/MG. Of the 46 analyzed samples, 21 (45.7%) were unsatisfactory, 20 (95.2%) had problems related only to labeling and one (4.8%) had issues related to the labeling and the sulfur dioxide content[17].

To identify the actual content of fruit in syrup, we performed carbohydrate tests and labeling analysis. The legislation tolerates a ± 20% variation in the amounts of nutrients informed on the label[18]. One of the samples of figs in syrup (14.0%) had a lower carbohydrate value than that stated in the nutrition facts. In these cases, the actual composition of the product was different from that indicated on the label, that is, there was less fruit and more syrup, indicating fraud against the consumer. The company was notified of the irregularity and required to take the appropriate measures. According to Almeida[17], carbohydrate analysis was performed on 28 fruit sweet samples in 2013, in Progvisa. The analysis produced a percentage of unsatisfactory samples of 42.9%.

According to the microbiological analyses for the enumeration of molds and yeasts, the fruits in syrup we analyzed met the requirements of RDC n. 12, of January 2, 2001[19], which establishes a tolerance of 10^4 UFC.g^{-1} for molds and yeasts. These results suggest that GMPs were adopted over the procedures performed during the processing of sweets in syrup.

Table 1. The results for copper, mold and yeast, artificial dyes, carbohydrates and labeling of unsatisfactory reports on fruits in syrup collected by Progvisa/MG from January 2013 to October 2015.

Product	State	Molds and yeasts* CFU/g	Copper (mg/kg)**	Artificial dyes	Carbohydrates ± 20,0% label content	Labeling
Whole figs in syrup	RS	< 100	0.36 ± 0.14	Absent	Satisfactory	Nutrition facts: items 3.3.1, 3.4.3.1, 3.4.4.2 of RDC n. 360/2003***
Whole figs in syrup	SP	< 100	< LD	Absent	Satisfactory	Misleading/confusing statement: item 3.1.a of RDC n. 259/2002**** "Natural"
Whole figs in syrup	RS	< 100	0.60 ± 0.13	Absent	Satisfactory	Nutrition facts: items 3.3.1, 3.4.3.1, 3.4.4.2 of RDC n. 360/2003***
Figs in syrup	RS	< 100	9.42 ± 0.19	Absent	29.0% lower than the value stated on the label Stated value: 50.0 g/100 g Value found in the analysis: 35.7 g/100 g	Misleading/confusing statement: item 3.1.a of RDC n. 259/2002**** "No preservatives"
Whole figs in syrup	RS	< 100	0.50 ± 0.17	Absent	Satisfactory	Nutrition facts: items 3.3.1, 3.4.3.1, 3.4.4.2 of RDC n. 360/2003***
Half peaches in syrup	PR	100	0.43 ± 0.10	Absent	Satisfactory	Misleading/confusing statement: item 3.1.a of RDC n. 259/2002**** "Special"
Peaches in syrup	RS	100	0.56 ± 0.09	Absent	Not performed	Misleading/confusing statement: item 3.1.a of RDC n. 259/2002**** "Learn more about the benefits of peach for your health" Nutrition facts: item 3.4.4.1 of RDC n. 360/2003***
Sweet figs in syrup	MG	100	> 10	Absent	Not performed	Nutrition facts: items 3.3.1, 3.4.3.1, 3.4.4.2 of RDC n. 360/2003***
Figs in syrup	RS	100	12.7 ± 0.28	Absent	Not performed	Nutrition facts: items 3.3.1, 3.4.3.1, 3.4.4.2 of RDC n. 360/2003***

*Progvisa/MG: Food Quality Monitoring Program in Minas Gerais; State: State of the Manufacturer; CFU: Colony Forming Unit; RS: Rio Grande do Sul; SP: São Paulo; PR: Paraná; MG: Minas Gerais; RDC: Resolution of the Collegiate Board of Directors; LD: Detection limit.
*RDC n. 12, of January 2, 2001: establishes tolerance of 10^4 CFU.g^{-1} for molds and yeasts.
**Ordinance n. 685, of August 27, 1998: copper threshold for fresh and processed fruits, vegetables and oilseeds is 10 mg/kg.
***RDC n. 360, of December 23, 2003: mandatory nutrition labeling.
****RDC n. 259, of September 20, 2002: labeling in general.

Table 2. Results of histology and foreign matter analysis of unsatisfactory reports of fruit pulps collected by Progvisa/MG, from January 2013 to October 2015.

Product	State	Identification of histological elements	Foreign matter search	Labeling irregularities
Frozen whole-mango pulp	SP	Presence of characteristic histological elements	Absence of foreign matter	Nutrition facts: Annex B of RDC n. 360/2003* Preservation conditions: item 6.6.2 of RDC n. 259/2002** Misleading/confusing statement: item 3.1.a of RDC n. 259/2002**** "Whole"
Mango pulp	SP	Presence of characteristic histological elements	Absence of foreign matter	Preservation conditions: item 6.6.2 of RDC n. 259/2002 Misleading/confusing statement: item 3.1.a of RDC n. 259/2002 "Selected fruits", "Whole"
Guava pulp	BA	Presence of characteristic histological elements	Absence of foreign matter	Preservation conditions: item 6.6.2 of RDC n. 259/2002 Misleading/confusing statement: item 3.1.a of RDC n. 259/2002 "Selected fruits", "the highest quality standard" Nutrition facts: item 3.4.4.2 of RDC n. 360/2003
Whole-mango pulp	BA	Presence of characteristic histological elements	Absence of foreign matter	Misleading/confusing statement: item 3.1.a of RDC n. 259/2002 "100% natural", "Whole" Nutrition facts: items 3.3.1, 3.4.2, 3.4.3.1, 3.4.3.2, 3.4.4.2 of RDC n. 360/2003
Guava pulp	BA	Presence of characteristic histological elements	Absence of foreign matter	Preservation conditions: item 6.6.2 of RDC n. 259/2002 Nutrition facts: item 3.4.3.1 of RDC n. 360/2003
Mango pulp	BA	Presence of characteristic histological elements	Absence of foreign matter	Net content: Inmetro Ordinance n. 157/2002 Nutrition facts: items 3.1.1, 3.2.1, 3.3.1, 3.4.2, 3.4.3.1, 3.4.3.2, 3.4.4.1, 3.4.4.2 of RDC n. 360/2003 Preservation conditions: item 6.6.2 of RDC n. 259/2002
Pasteurized whole guava pulp	BA	Presence of characteristic histological elements	Absence of foreign matter	Nutrition facts: item 3.4.3.1 of RDC n. 360/2003 Preservation conditions: item 6.6.2 of RDC n. 259/2002
Mango pulp	BA	Presence of characteristic histological elements	Absence of foreign matter	Preservation conditions: item 6.6.2 of RDC n. 259/2002 Nutrition facts: item 3.4.4.2 of RDC n. 360/2003

Progvisa/MG: Food Quality Monitoring Program in Minas Gerais; State: State of the Manufacturer; SP: São Paulo; BA: Bahia; RDC: Resolution of the Collegiate Board of Directors; Inmetro: National Institute of Metrology, Quality and Technology.
*RDC n. 360, of December 23, 2003: mandatory nutrition labeling.
**RDC n. 259, of September 20, 2002: labeling in general.
***Inmetro Ordinance n. 157, of August 19, 2002: Technical Metrological Regulation.

Table 3. The results for artificial dyes, mold and yeast of unsatisfactory reports on jams collected by Progvisa/MG from January 2013 to October 2015.

Product	State	Artificial dyes	Molds and yeasts CFU/g	Labeling irregularities
Premium blackberry jam	MG	Absent	< 100	Misleading/confusing statement: item 3.1.a of RDC n. 259/2002* "*Premium*" and lid with illustrations of fruits that are not part of the product Nutrition facts: items 3.4.2 and 3.4.4.2 of RDC n. 360/2003**
Strawberry jam	SP	Absent	Not performed	Nutrition facts: item 3.1.a of RDC n. 259/2002
Strawberry jam	SP	Absent	< 100	Misleading or confusing statement: regarding the illustration of other fruits that cannot be found in the product. RDC n. 259/2002
Strawberry jam	SP	Absent	< 100	Nutrition facts: RDC n. 360/2003
Strawberry jam	SP	Absent	< 100	Nutrition facts: RDC n. 360/2003
Guava jam	GO	Absent	< 100	RDC n. 259/2002 "*Premium*"
Grape jam	MG	Presence of burgundy red dye	> 10^4	RDC n. 259/2002 and Decree-Law n. 986/1969***
Frutimix jam	MG	Absent	< 100	Net content: Inmetro Ordinance n. 157/2002**** Nutrition facts: RDC n. 360/2003 and RDC n. 54/2012*****

Progvisa/MG: Food Quality Monitoring Program in Minas Gerais; State: State of the Manufacturer; CFU: Colony Forming Unit; SP: São Paulo; MG: Minas Gerais; GO: Goiás; RDC: Resolution of the Collegiate Board of Directors; Inmetro: National Institute of Metrology, Quality and Technology.
*RDC n. 259, of September 20, 2002: labeling in general.
**RDC n. 360, of December 23, 2003: mandatory nutrition labeling.
***Decree-Law n. 986, of October 21, 1969: basic food standards
****Inmetro Ordinance n. 157, of August 19, 2002: Technical Metrological Regulation.
*****RDC n. 54, of November 12, 2012: food labeling.

Fruit pulp

The results of the analysis of the pulps in Table 2 showed that the analyzed samples presented satisfactory results for histology and foreign matter tests, indicating that there was no addition of other plant species in the pulp. Apparently, GMPs were complied with. In seven (88%) fruit pulps we verified the absence of information regarding the maximum and minimum product storage temperature.

The test for dirt in fruit pulps is more comprehensive because of the grinding that the fruit undergoes, with consequent dispersion of the soils in the form of fragments that are invisible to bare eyes in all the resulting paste. The results of this type of research also enable us to evaluate the hygiene conditions of the raw material used in the process and of the plant itself, indicating possible critical control points[20].

Ramos[20] evaluated the soils in frozen fruit pulps produced in Petrolina/PE and in Juazeiro/BA and found that the pulps of acerola, guava and mango were in disagreement with the legislation in force regarding the presence of foreign matter. Of the various foreign matters that are harmful to human health identified, the fragments of insects stand out as regards their quantitative aspect. Moreover, the high levels of contamination of the samples of pulp of acerola and guava attest to the poor quality of the raw material used in their production process.

Bueno et al.[21] performed microbiological, physicochemical and microscopic analyses of 15 different samples of frozen fruit pulp. Microscopic analyses showed that 60% of the samples had fragments and/or larvae of insects and mites. The results indicated that 53% of the samples were classified as unacceptable for consumption in terms of microscopic characteristics.

Jam

The results of the artificial dye, mold and yeast, and labeling analyses of unsatisfactory jam reports are set out in Table 3. In all reports, jam labels were in disagreement with current legislation. Irregularities in nutrition facts and claims that may cause consumer confusion were found.

Of the eight (100%) reports on jams, only one (12.5%) had the presence of artificial burgundy red dye, thus in disagreement with current legislation. Color changes in jams can occur due to several factors. To name a few: use of excessively ripe fruit; use of discolored pulps, juices or fruit. Artificial dyes can be used to conceal these problems[22]. Fruit cooking and processing change the structure of the pigments and the natural color of the fruits. To restore it, artificial dyes are used.

In only one (12.5%) of the jam reports did we verify that the levels of molds and yeasts did not meet the requirements of RDC n. 12/2001[19], which establishes a tolerance of 10^4 UFC.g^{-1}. Scolforo e Silva[23] evaluated the growth of coliforms or molds and yeasts in apple jam formulations, which were not found in any of the jam samples.

Jam has a high sugar content in its composition. According to Ribeiro et al[24], the presence of sugar decreases the water activity of the product by promoting the increase of the osmotic pressure, creating unfavorable conditions for the growth and reproduction of most microorganisms.

Labeling

The labels of all the products were in disagreement with the legislation. Claims such as “special”, “natural” or “whole” have been found and can be misleading or confusing to consumers, inducing them to buy the product for purportedly premium quality. There were also irregularities in the presentation of nutrition facts.

CONCLUSIONS

We found lack of compliance with the legislation regarding labeling in 100% of the fruit product reports we analyzed. The results demonstrated the need to adopt measures for companies to fit their products with the requirements of the legislation. The measures may involve workforce training, stricter monitoring and inspection actions in the establishments

The analyzed pulps were made of the fruits informed in the labels, since no histological material other than the fruits identified in the label was found. Also, no foreign matter was found in the pulps, indicating compliance with GMP.

In the case of jams, 87.5% presented satisfactory results for the parameters of artificial dye and molds and yeasts.

In 28.6% of the reports of figs in syrup, copper levels were higher than those allowed by the legislation. In one of these reports we also verified that the actual composition of the fig in syrup differed from that stated on the label, which means fraud against the consumer.

We also verified that the peaches in syrup complied with the legislation regarding the analyses of: molds and yeasts, artificial dyes, copper content and carbohydrates.

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Conflict of Interest

Authors have no potential conflict of interest to declare, related to this study's political or financial peers and institutions.