

## Determinants consumers' preferences for milk in Maranhão, Brazil

### Fatores determinantes das preferências dos consumidores de leite no Maranhão, Brasil

Francisco Martins de Castro<sup>1</sup>; Zinaldo Firmino da Silva<sup>2\*</sup>;  
Ivan Barbosa Machado Sampaio<sup>3</sup>; Taciana Galba da Silva Tenório<sup>4</sup>

#### Abstract

In cities with different population profiles and marketing, cultural aspects can prevail in a purchase decision. The milk markets are different in the cities of Chapadina, Imperatriz, and São Luís, Maranhão State, Brazil. To study milk consumption semi-structured questionnaires were filled among consumers in order to register their habits and preferences during the dry and rainy seasons. Socioeconomic and cultural data of the consumers and aspects referring to the milk type consumed were considered. The results from 2,134 respondents were treated using descriptive statistics and the chi-squared test. The consumption and preference for milk type differed ( $P<0.01$ ) between the cities. Higher proportions of milk drinkers were found in Chapadina and São Luís compared to Imperatriz. The inhabitants of Chapadina, São Luís, and Imperatriz preferred powdered, UHT, and pasteurized milk, respectively. Powdered milk was chosen in Chapadina due to price and convenience ( $P<0.001$ ). The milk types in São Luís (UHT) and Imperatriz (pasteurized) were chosen to ensure the populations' health. The differences in the purchasing power of the inhabitants, dairy farming traditions, and milk types offered at each site explains the varied consumption behavior. Disclosing information to the public about the nutritional and health aspects of formal milk must take into account the regional diversity of the consumers.

**Key words:** Informal milk, consumer preferences, milk supply chain

#### Resumo

Em cidades com perfis mercadológicos e populacionais distintos, aspectos culturais podem prevalecer na decisão de compra. Com o objetivo de conhecer a proporção da população de consumidores de leite de três cidades maranhenses e seus hábitos e preferências de consumo, foram aplicados questionários semi-estruturados à população. Foram consideradas informações socioeconômicas e culturais dos consumidores e de aspectos referentes ao tipo de leite consumido. Os resultados de 2.134 respondentes foram tratados por meio de estatística descritiva e do teste de qui-quadrado. O consumo e preferência pelo tipo de leite diferiram ( $P<0,01$ ) entre as cidades. Em Chapadina e São Luís identificou-se maior proporção de consumidores de leite em comparação a Imperatriz. Os habitantes de Chapadina, São Luís e Imperatriz preferiram, respectivamente, leite em pó, longa vida e pasteurizado. A escolha pelo

<sup>1</sup> Discente, Pós-graduação em Agronomia Tropical, Universidade Federal do Amazonas, UFAM, Manaus, AM, Brasil. E-mail: fcastrozoot@hotmail.com

<sup>2</sup> Prof., Curso de Zootecnia, Centro de Ciências Agrárias e Ambientais, Universidade Federal do Maranhão, UFMA, Chapadina, MA, Brasil. E-mail: zf.silva@ufma.br

<sup>3</sup> Prof., Escola de Veterinária, Universidade Federal de Minas Gerais, UFMG, Belo Horizonte, MG, Brasil. E-mail: ibms@vet.ufmg.br

<sup>4</sup> Prof<sup>o</sup>, Dept<sup>o</sup> Clínica e Cirurgia Veterinária, Universidade Federal do Piauí, UFPI, Teresina, PI, Brasil. E-mail: tacionagalba@yahoo.com.br

\* Autor para correspondência

leite em pó em Chapadinha foi devida ao preço e conveniência ( $P < 0,001$ ). Em São Luís (longa vida) e em Imperatriz (pasteurizado) a escolha pelo tipo de leite foi em função das garantias à saúde. As diferenças no poder aquisitivo dos habitantes, na tradição pecuária leiteira e na oferta dos tipos de leite de cada local explicam a variação no comportamento do consumo. A divulgação de informações junto à população sobre os aspectos nutricionais e de saúde do leite formal precisam se adequar a diversidade regional dos consumidores.

**Palavras-chave:** Cadeia produtiva do leite, leite informal, preferências de consumo

## Introduction

The Brazilian Health Ministry, through its Food Guide, recommends the daily consumption of three servings of milk and / or its products (BRASIL, 2006). In Brazil, the theoretical milk availability -produced plus imports and minus exports - is 178 liters per inhabitant per year. Nevertheless, the Brazilian national mean consumption *per capita* of 45 and 93.5 liters of dairy product equivalents, for the lower and higher income classes, respectively, as evidenced by Zoccal (2013) in compiled data from the 2008/2009 Household Budget Survey (Pesquisa de Orçamentos Familiares) of the Brazilian Institute of Geography and Statistics (INSTITUTO BRASILEIRO DE GEOGRAFIA E ESTATÍSTICA - IBGE). The relative contribution of dairy products to the diet of Brazilian households is only 5.77%, with 76.94% of this quantity in the form of liquid milk (LEVY et al., 2012).

In addition to the insufficient quantity, there is variation in the composition and quality of the milk consumed, especially raw milk, which presents a health risk (RIBEIRO NETO et al., 2012). Although illegal, the sale of raw milk in Brazil represents an important alternative trade, although informal milk consumption is decreasing annually with the progressive industrialization of milk (IBGE, 2013b).

Of the five geographic mesoregions that comprise Maranhão State, Brazil, the western mesoregion, formed by three microregions (Pindaré, Gurupi, and Imperatriz), represents 62.6% of all milk production in the state. The Imperatriz microregion alone, comprising 16 municipalities, produces half of this milk (IBGE, 2012). Additionally, 76% of the dairy industries under state and federal

inspection of the state are concentrated in the area around the municipality of Imperatriz. In contrast, municipalities such as Chapadinha (located in the eastern mesoregion) and São Luís (the state capital located in the northern mesoregion), which lack expressive milk production, differ in the diversity query and availability of commercial products. The municipality of São Luís has a higher number and diversity of retail chains containing milk and its derivatives, whereas in Chapadinha, the largest supply of milk is powdered and has a UHT. This situation is important because it represents differences in the supply of products to consumers and can influence consumption habits (ENGEL, 2000).

This study aimed to determine the proportion of consumers of milk from Maranhão population and consumer preferences in different markets in order to be identified its determinants.

## Material and Methods

This study was conducted as a survey using semi-structured questionnaires that were administered verbally and individually to the population in the second half of 2009 and then in the first half of 2010. The questionnaires contained multiple choice questions about personal information, education, family income and consumption behavior of milk according to the type of processing (UHT, powdered, pasteurized and in raw milk) and the reasons that led him to make choices (price, convenience, security aspects of health or taste) in each of the three cities studied. The respondents were approached at their own convenience, in public places with population flows at different times of the day, to cover a wider

range of possible respondent types. Half of the forms were administered to men, and the other half were administered to women, since men than women participate less in voluntary surveys (COLONNA et al., 2011).

The study was conducted at two different times, considering the highest and lowest rainfall in Maranhão State, Brazil (SILVA et al., 2011), during the dry season (October, November, and December) and rainy season (March, April, and May). This schedule was selected due to the variation in milk supply, mainly raw milk, which naturally undergoes changes throughout the year due to differences in rainfall and the consequent impact on pasture production.

The sample consisted of 2,400 forms, of which 800 were distributed per city, divided equally into two seasons. The cities studied, Chapadinha, Imperatriz, and São Luís had populations of 65,000, 232,000, and 998,000 inhabitants, respectively (IBGE, 2013a). General social, economic, and cultural data and aspects related to preferences and reasons for choosing different milk types consumed in each of the three cities studied were considered.

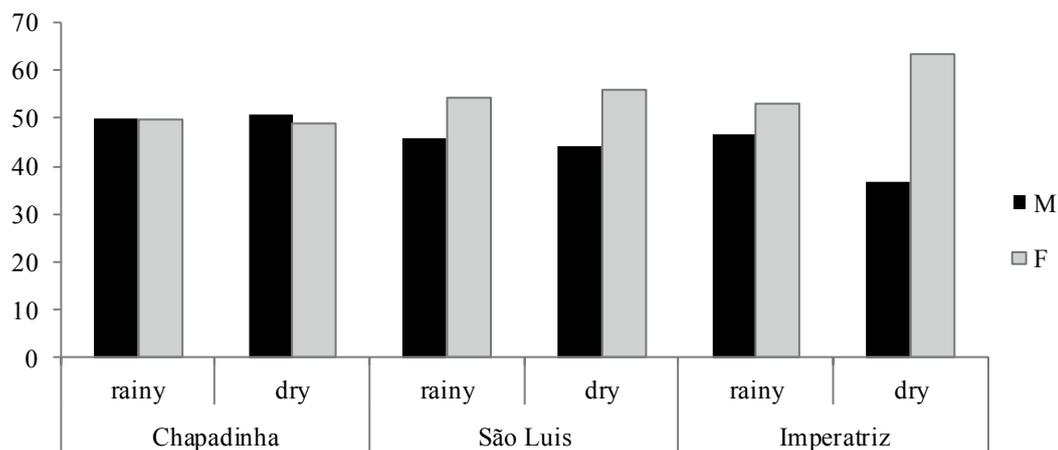
The data obtained were analyzed using descriptive statistics to obtain the relative frequencies of the attributes of the sample studied and the variables related to the respondent profiles (sex, age, marital status, educational background, and income).

The chi-squared test was used to test the association between all variables for milk consumption and cities or seasons (dry and rainy). The milk consumption declared by the respondents was considered to be the dependent variable, and the variables related to the milk type and the reasons for the consumers' purchase choice were considered to be independent variables. Probability values of less than 0.05 indicated that the test was significant and that the variables were associated.

## Results and Discussion

Questionnaire responses from 2,134 respondents were used to analyze the milk consumer profiles and consumption preferences in the three cities studied. Participation by both genders in the study was equivalent between the cities and seasons (Figure 1).

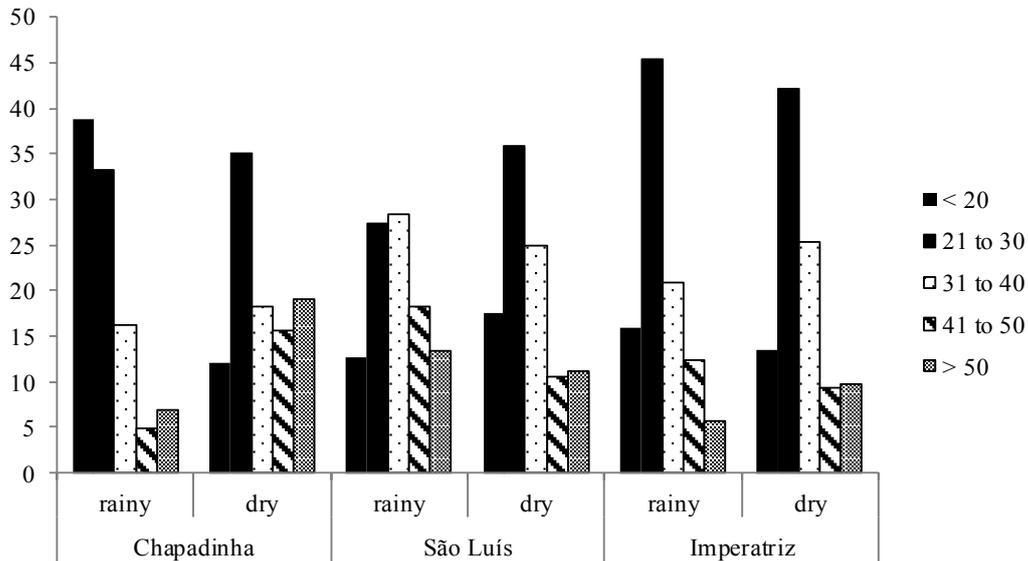
**Figure 1.** Gender of the milk consumers in Chapadinha (n=641), São Luís (n=698), and Imperatriz (n=340), Maranhão State, Brazil, during the rainy and dry seasons.



There was a different situation regarding the respondent age, in which the city of Chapadinha had a higher proportion of people who were less

than 20 years of age during the rainy season (Figure 2). In general, the 21- to 30-year-old age range was more frequent and predominated compared with the 20- to 40-year-old age range.

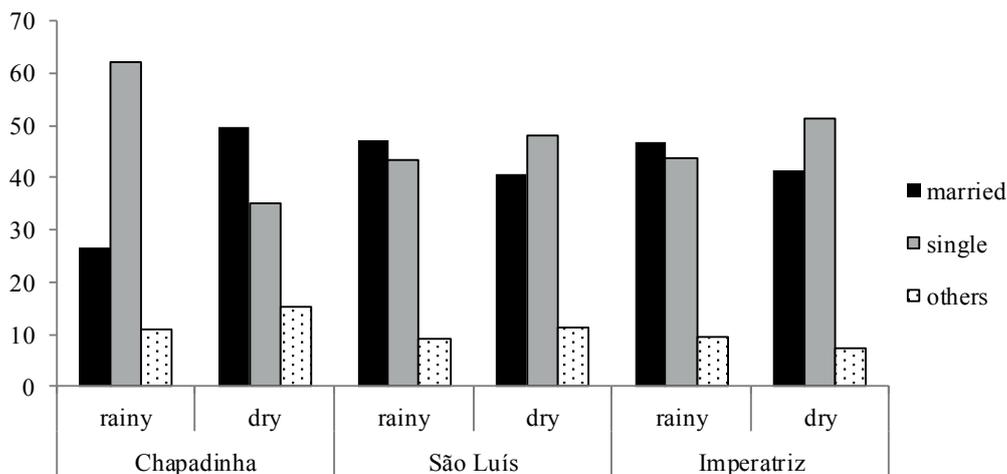
**Figure 2.** Age range (in years) of the milk consumers in Chapadinha (n=619), São Luís (n=702) and Imperatriz (n=343), Maranhão State, Brazil during the rainy and dry seasons.



The marital status of the respondents was equivalent the seasons, except for the city of Chapadinha during the rainy season, which exhibited

approximately 30% more single individuals (Figure 3). This finding is consistent with the higher concentration of younger respondents observed (Figure 2).

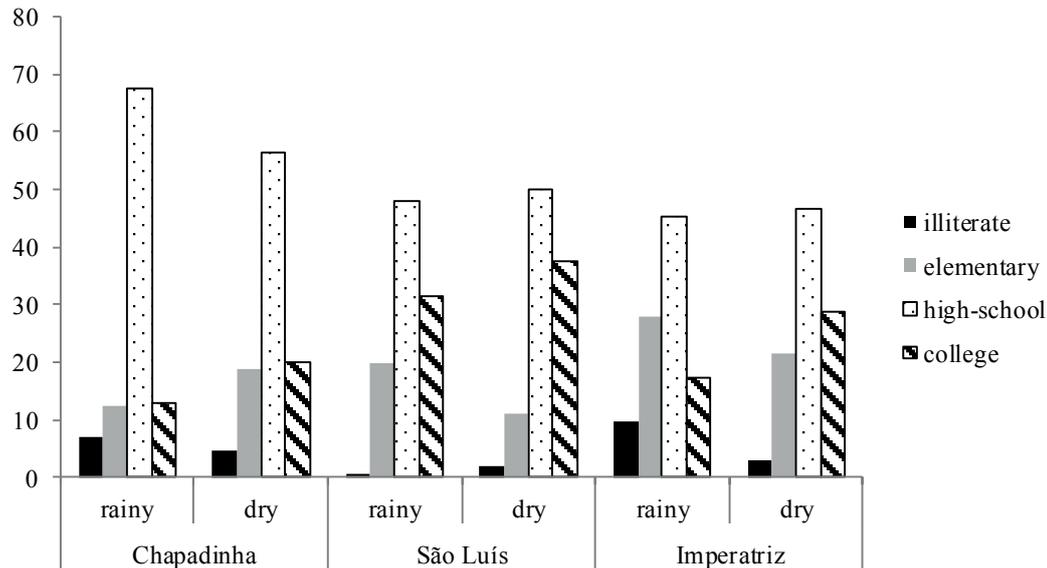
**Figure 3.** Marital status of the milk consumers in Chapadinha (n=641), São Luís (n=690), and Imperatriz (n=339), Maranhão State, Brazil, during the rainy and dry seasons.



Regarding respondents' education levels, a high school-level education was predominant in all of the cities (Figure 4). Chapadina and Imperatriz

had more illiterate and fewer college-level milk consumers than São Luís. The education was equivalent between the seasons (Figure 4).

**Figure 4.** Education level of the milk consumers in Chapadina (n=642), São Luís (n=688), and Imperatriz (n=336) during the rainy and dry seasons.



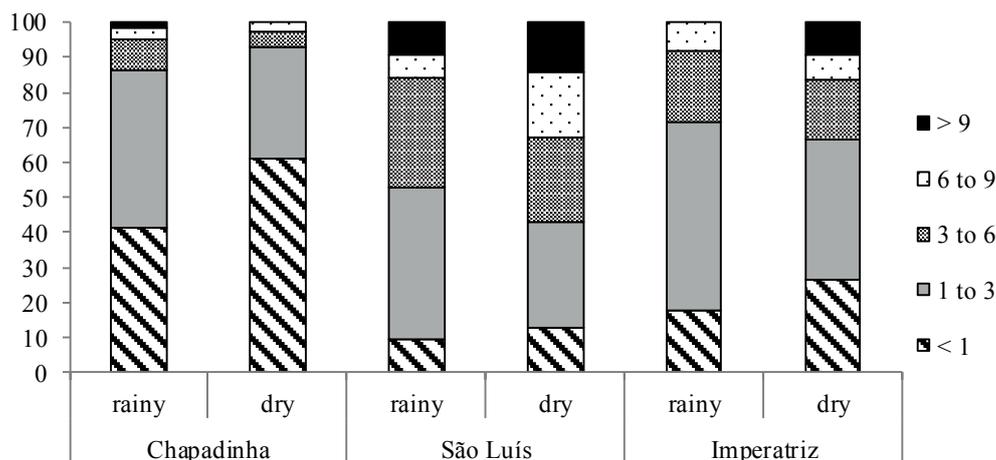
Chapadina had a higher proportion of respondents with a family income of less than minimum wage (BR \$678.00 is equivalent to US \$293.50), followed by those who received between one and three times the minimum wage (Figure 5). Similarly, Imperatriz had a higher proportion of people with low income, although the largest portion of the sample consisted of those who received between one and three times the minimum wage. The respondents in São Luís had higher incomes, with some of them receiving between one and three times the minimum wage, followed by those who received between three and six times the minimum wage. In summary, the income level in descending order for the respondents was those from São Luís, Imperatriz, and Chapadina. The chi-squared test revealed that populations in Chapadina and São Luís had higher ( $P < 0.01$ ) proportions of milk consumers compared with Imperatriz (Table 1).

In general, the proportion of milk consumers in these populations was lower than that observed in a study in Southeastern Brazil (91%) in Janaúba-MG (AGUILAR et al., 2012). This finding is consistent with the lower relative proportion of these components in the diets of northeastern Brazilians compared with consumers from the southern and southeastern regions of Brazil (LEVY et al., 2012).

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Only the city of Chapadina had a lower ( $P < 0.01$ ) proportion of milk consumers during the dry season compared with the rainy season, with a 10% difference (Table 2).

**Figure 5.** Monthly income ranges (in minimum wages, BR \$678.00 is equivalent to US \$293.50) of the milk consumers in Chapadinha (n=637), São Luís (n=642), and Imperatriz (n=334), during the rainy and dry seasons, Maranhão State, Brazil.



**Table 1.** Absolute and relative frequencies of milk consumers in the cities of Chapadinha, São Luís, and Imperatriz, Maranhão State, Brazil.

Milk consumption	No	Yes
Chapadinha	130 (17%)	640 (83%)
Imperatriz	206 (38%)	340 (62%)***
São Luís	92 (12%)	698 (88%)

\*\*\*Significant difference between the cities by the chi-squared test (df 2, P<0.0001).

**Table 2.** Relative frequency of milk consumption during the rainy and dry seasons in Chapadinha, São Luís, and Imperatriz, Maranhão State, Brazil.

City	Season	Milk consumption		P<
		No	Yes	
Chapadinha	Rainy	62 (15.5%)	338 (84.5%)	**
	Dry	98 (24.5%)	302 (75.5%)	
São Luís	Rainy	43 (11%)	357 (89%)	ns
	Dry	49 (13%)	341 (87%)	
Imperatriz	Rainy	68 (39%)	105 (61%)	ns
	Dry	138 (37%)	235 (63%)	

\*\*Significant difference between the seasons by the chi-squared test (df 1, P<0.01).

ns Not significant by the chi-squared test (df 1, P>0.05).

The comparison of milk consumption between the two rainy seasons was important because milk production in Maranhão State, Brazil, is exclusively pasture-dependent (SILVA et al., 2012) and this

pasture-dependent production, in turn, is directly affected by rainfall. The rainy and dry seasons in Maranhão State, Brazil, occur during the second and fourth quarter of the year, respectively (SILVA et al., 2011).

A difference ( $P < 0.0001$ ) was observed between the cities regarding the milk type consumed (Table 3). The inhabitants of Chapadinda, São Luís, and Imperatriz preferred powdered, UHT, and pasteurized and fresh milk, respectively (Table 3).

**Table 3.** Milk type preferred by consumers in Chapadinda, São Luís, and Imperatriz, Maranhão State, Brazil.

City	Milk type			
	Powdered	Raw	UHT	Pasteurized
Chapadinda	447 (70%)*	96 (15%)	68 (11%)	29 (5%)
São Luís	359 (52%)	59 (8%)	234 (34%)*	45 (6%)
Imperatriz	71 (21%)	93 (28%)*	56 (17%)	112 (34%)*

(\*). Significant difference between the cities by the chi-squared test (df 6,  $P < 0.0001$ ).

Liquid milk (UHT, raw, and pasteurized) was more preferred than powdered milk ( $P < 0.001$ ) by the inhabitants of Imperatriz (79%). Raw milk consumption was prevalent in Imperatriz as the second largest proportion of milk type consumed (28%, Table 3). This finding is explained by the increased milk supply in this city, as Imperatriz is one of eight cities with the largest production in the state, unlike Chapadinda and São Luís, which have no representation in the production segment (IBGE, 2012). However, the percentage of raw milk consumers in Imperatriz was lower than the means for the cities of southeastern Brazil (35%) (AGUILAR et al., 2012) and was close to the national mean of 31% in 2011 (IBGE, 2013b). However, raw milk consumption is not recommended due to the high variation in its microbiological quality (MATTOS et al., 2010; TEBALDI et al., 2008) and to the risk it therefore presents to consumer health. As evidenced by Ribeiro Neto et al. (2012),

milk from Maranhão State had the second highest total bacterial count (TBC=1,460,000.93 CFU/mL milk) in northeastern Brazil, which could be due to flaws in the milking and milk-cooling procedures on dairy farms. This corroborates the findings of Silva et al. (2012), who showed that the practice of manual milking in an open corral, without a cemented floor and with suckling calves still with the cow is the majoritarian system in the largest dairy farms in the state of Imperatriz.

Powdered-milk consumers may consume less milk per day in liter equivalents compared with consumers who prefer fluid milk. Thus, there are reasons to believe that the differences observed in the proportion of consumers between the cities do not represent differences in the quantities consumed - as for example, in the cities of Chapadinda and Imperatriz. There was a change in consumer habits in the three cities studied regarding the milk type consumed between seasons (Table 4).

**Table 4.** Milk type preferred by consumers during the rainy and dry seasons in the cities of Chapadinha, São Luís, and Imperatriz, Maranhão State, Brazil.

City	Season	Milk type				P<
		Powdered	Raw	UHT	Pasteurized	
Chapadinha	Rainy	215 (64%)	52 (15%)	58 ( <b>17%</b> )	13 (4%)	***
	Dry	232 ( <b>77%</b> )	44 (15%)	10 (3%)	16 (5%)	
São Luís	Rainy	<b>203 (57%)</b>	19 (5%)	113 (32%)	21 (6%)	**
	Dry	156 (46%)	40 (12%)	<b>121 (35%)</b>	24 (7%)	
Imperatriz	Rainy	13 (13%)	10 (10%)	13 (13%)	<b>66 (65%)</b>	***
	Dry	58 (25%)	<b>83 (36%)</b>	43 (19%)	46 (20%)	

(\*\*) Significant difference between the cities by the chi-squared test (df 3, P<0.01)

(\*\*\*) Significant difference between the cities by the chi-squared test (df 3, P<0.001).

Powdered milk was chosen more (P<0.001) during the dry season in Chapadinha, which was most likely due to the combination of a lower raw milk supply and a higher price per liter - due to lower production - which in turn would be associated with lower purchasing power by the population (Figure 5).

There was a decreased demand for powdered milk and an increased demand for UHT milk (P<0.01) in São Luís. In contrast, the population's demand for pasteurized milk decreased (P<0.001) in Imperatriz during the dry season, but the demand for raw milk increased (P<0.001). According to the Brazilian Association of UHT Milk (ASSOCIAÇÃO BRASILEIRA DE LEITE

LONGA VIDA, 2012), the demand for powdered milk is increasing due to the low raw-material supply for liquid-milk processing in northern and northeastern Brazil.

The reasons for choosing the milk types per city were also tested (Table 5), considering the milk type preference already declared. Thus, powdered milk was chosen in Chapadinha due to its price and convenience (P<0.001). In São Luís, UHT milk was chosen due to its convenience and health guarantee, and in Imperatriz, pasteurized milk was chosen for ensuring health. The aspect of health guarantee has been increasingly valued among the various options that determine the choice of milk (BARRETO et al., 2012).

**Table 5.** Absolute (relative) frequencies of the main factors influencing the decision to purchase different milk types in the cities of Chapadinha, São Luís, and Imperatriz, Maranhão State, Brazil.

Milk type	Selection attributes				P<
	Flavor	Health	Price	Convenience	
Chapadinha					
<b>Powdered</b>	195 (44%)	89 (20%)	<b>89 (20%)</b>	<b>72 (16%)</b>	***
Raw	57 (59%)	34 (35%)	2 (2%)	3 (3%)	
UHT	44 (65%)	15 (22%)	0 (0%)	9 (13%)	
Pasteurized	9 (31%)	15 (52%)	2 (7%)	3 (10%)	

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São Luís					
Powdered	170 (47%)	51 (14%)	35 (10%)	102 (28%)	
Raw	22 (37%)	23 (39%)	6 (10%)	8 (14%)	
<b>UHT</b>	79 (34%)	<b>59 (25%)</b>	14 (6%)	<b>80 (34%)</b>	***
Pasteurized	7 (16%)	13 (29%)	12 (27%)	13 (29%)	
Imperatriz					
Powdered	35 (49%)	9 (13%)	8 (11%)	19 (27%)	
Raw	32 (34%)	19 (20%)	28 (30%)	14 (15%)	
UHT	7 (13%)	38 (69%)	1 (2%)	9 (16%)	***
<b>Pasteurized</b>	24 (22%)	<b>58 (52%)</b>	22 (20%)	7 (6%)	

\*\*\* Significant difference between the cities by the chi-squared test (df 9, P<0.0001).

Income, prices, individual preferences and beliefs, cultural traditions, and geographic, environmental, social, and economic factors have been considered as interconnected and complex factors for creating food consumption patterns (GEROSA; SKOET, 2009). A higher powdered milk supply in Chapadinha, combined with a lower purchasing power (Figure 5) of the families, led to their preference, as did the consideration of the geographical location, which is close to Piauí State, Brazil. Zoccal (2013), compiling data from the 2008/2009 Household Budget Survey (Pesquisa de Orçamentos Familiares) of the IBGE, showed that Piauí State is the largest powdered milk consumer in Brazil (2.6 kg *per capita* per year).

In Imperatriz, the region's ranching tradition influenced the people's preference for liquid milk, including a high proportion of raw milk consumers. The existence of this type of product on the market, regardless of the reasons for its choice, maintains its habitual consumption. By contrast, the population with a high education level (Figure 2) demanded pasteurized or UHT milk. Finally, in the state capital, São Luís, the selection of UHT and powdered milks well represents the reality of the dynamics of the city's population because the products are more easily found and used in their homes, considering that there is a pasteurized milk supply in the market.

## Conclusions

The cities of Chapadinha and São Luís have higher proportion of milk consumers of Imperatriz, although this does not represent differences in volume consumed. The inhabitants of Chapadinha prefer milk powder, Imperatriz of pasteurized milk and São Luís prefer the UHT and powdered milk. Moreover, Imperatriz has a higher proportion of raw milk consumers. The inhabitants of Chapadinha prefer powdered milk, those in Imperatriz prefer the liquid form (with a prevalence of pasteurized milk), and those in São Luís prefer UHT milk (followed by powdered milk).

Differences in the purchasing power of the inhabitants, in the dairy farming tradition of the regions, and in the supply of the milk types available on the market affect consumer behavior.

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