Profile of peach palm fruit consumers in the Metropolitan Region of Belém, Pará, Brazilian Amazon

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Abstract

People in the Amazon highly value the fruit of the peach palm (Bactris gasipaes Kunth), but its commercialization is hampered because of consumers' difficulty in identifying fruit of good quality. This study seeks to evaluate the behavior of peach palm fruit consumers in municipalities in the Belém Region in Pará State by conducting a survey of 200 consumers. Peach palm consumption frequency is low, and it has not grown over the past five years in the largest proportion of consumers. The attributes most consumers looked for when purchasing peach palm were its external aspects, displaying a preference for red, oily pulp, medium-sized fruits that were pitted. Consumers enjoy purchasing peach palm as bunches of raw fruit, and while they believe that the price is too high, they are willing to pay more for fruit of proven quality.

Keywords: agricultural market, *Bactris gasipaes* Kunth, consumer behavior, fruit growing

1. Introduction

Peach palm (*Bactris gasipaes* Kunth) is a species native to tropical regions in the Americas. The first people of the Southwestern Amazon domesticated it from, having numerous primitive breeds (Clement et al., 2004). It presents a wide genetic diversity in its wild and domesticated populations, due to having gone through different stages of domestication and cultivation places, aiming to meet the preferences of human consumption in terms of color, flavor, and processing (Clement and Santos, 2002; Santos et al., 2011).

People in the Brazilian Amazon grown peach palms for fruit consumption. In the state of Pará, family farmers are the primary cultivators. Passed on from generation to generation, there are often clumps of peach palms scattered in backyards that serve as healthy and low-cost food for those who own the trees, which also provide income through the sale of their fruit.

People primarily consume peach palms after cooking and peeling them; it is often eaten with coffee, manioc flour, or salt. The fruit is an important food source for the population of Pará, as well as part of its cuisine and regional culture. Another common use is as animal feed.

Street markets, supermarkets, and street vendors sell fresh peach palms by the bunch or kilogram. At harvest time, street vendors sell the cooked fruit in neighborhoods and open markets, packaged in small polyethylene bags or plastic cups that contain 8 to 10 palms.

Peach palm has important nutraceutical properties, providing lipids, proteins, carbohydrates, starch, and fiber. It also contains carotene, a vitamin that contributes to the health of the eyes, hair, nails, and skin. Among the mineral salts present in the fruit are selenium, potassium, calcium, iron, and phosphorus (Cymerys and Clement, 2005). The total carotenoid gives the pulp an intense yellow color, significant

functional appeal, and a high caloric value (Yuyama and Cozzolino, 1996; Carvalho et al., 2009).

Currently, fruit with high levels of carotenoids attracts consumer attention because of its antioxidants, which fight free radicals present in the body that are responsible for the evolution of certain serious pathologies (Carvalho et al., 2013).

Peach palm fruits are among the vegetables with the highest selenium content (35 to 55 mcg/100 g), a mineral that aids in preventing cancer. A government program for sustainable development in the State of Amapá that added peach palm fruits to school menus, including them in porridges or mixed with savory dishes, has been well-received (Ministry of Health of Brazil, 2002).

In Costa Rica, researchers have proposed utilizing peach palm fruit as a substitute for corn due to its high nutritional value, particularly in retinol, since that is the nutrient most often lacking in the diet of children (Salas and Blanco, 1990).

Despite the countless studies that disclosed the important nutritional properties of peach palm fruits, consumption has not expanded of in the Amazon region or Brazil (Clement et al., 2004). One hypothesis is that there are no varieties of peach palm on the market with well-defined fruit characteristics. This factor restricts the options for consumption, because without clearly defined characteristics to assist consumers in selecting the fruit, the peach palms they choose are often not palatable. For this reason, it is important to cultivate peach palm varieties whose fruits have characteristics that meet consumer desires (Van Leeuwen, 2006).

This study therefore seeks to identify the consumer profile for peach palm fruits in the Metropolitan Region of Belém in the State of Pará. It does this by identifying the consumers' socioeconomic profiles and their preferences regarding the characteristics of the fruit. It also assesses the behavior of fruit prices at free fairs.

2. Materials and method

We conducted this study at nine free fairs in the municipalities of Belém and Ananindeua in the Metropolitan Region of Belém. Various neighborhoods held the free fairs: the Icoaraci District and Batista Campos, Campina, Guamá, Marco, Barreiro, Jurunas, Cidade Nova 4, and Cidade Nova 6. The selection of these locations took into account the potential for great markets, in addition to the variability of consumer preferences regarding issues related to fruit quality, income, place of purchase, fruit price, and consumption. The total population of the municipalities of Belém and Ananindeua in 2015 was approximately 1.9 million (IBGE, 2019). The survey methodology consisted of questionnaires given to 200 respondents who bought peach palm fruits. The sample was representative, and had a margin of error of 6.93% at a 95% confidence level. The data was collected between March and June 2015, the peak period for the peach palm fruit harvest, on Saturdays and Sundays. This was because peach palm fruits usually arrived at the point of sale on Fridays, and trade was more intense on weekends.

The questionnaire's first section collected the consumer's socioeconomic information, including age, sex, place of birth, marital status, occupation, education, and average family income. The second section covered issues related to how frequently the consumers purchased fruit, the factors they utilized to make their purchase decisions, their preferences, the fruit characteristics they desired, and their issues with the price of the fruit.

The collected data were organized in a database, and a spreadsheet was utilized to prepare the tables that served as a basis for analysis and interpretation. LibreOffice version 6.3.5 was employed to analyze the data statistically.

3. Results and discussion

3.1 Socioeconomic Profiles

The results indicated that 59% of the respondents were male and 41% were female, and that 91.5% were from the state of Pará (see Table 1). Their ages varied between 18 and 95, with an average age of 51 and a standard deviation of 16. The predominant level of education was high school graduation (37.5%), followed by undergraduate degree (23%) and elementary school (16%). With regard to occupation, 33.5% of the respondents referred to themselves as self-employed, 20.5% worked in the private sector, 13.5% were civil servants, and 22.5% were retired or pensioners.

As for average family income, 62.1% earned below four minimum wages, while 31% had an average family income over five minimum wages. The research revealed that peach palm fruit consumption occurred across all social classes.

Table 1. Socioeconomic Characteristics of the Sample of Peach Palm Fruit Consumers (N=200) in the Metropolitan Region of Belém in the State of Pará.

Characteristic	Category	% of total
Gender	Man	59.0
	Woman	41.0
Age (years)	≤30	12.5
	31 – 45	24.5
	46 – 55	22.0
	56 – 65	21.5
	≥ 66	19.5
Marital status	Single	30.5
	Married	55.5
	Divorced	6.0
	Widow/Widower	8.0
Education level	Illiterate	0.0
	Elementary school	16.0
	Middle school	7.5
	Incomplete high school	7.5
	High school graduation	37.5
	Incomplete undergraduate	5.0
	Undergraduate degree	23.0
	Graduate degree	3.5
	Public server	13.5

Occupation	Private sector	20.5
	Retired/pensioner	22.5
	Autonomous	33.5
	Other activity	10.0
Origin	Metropolitan Region of Belém*	72.5
	State Interior	19.0
	Other State	8.5
Average family income (MW**)	Less than 1	4.0
	From 1 less than 2	23.0
	From 2 less than 3	21.0
	From 3 less than 4	14.5
	From 4 less than 5	6.5
	≥ 5	31.0

Source: Survey data (2015)

Notes: (*) Including the municipalities of Ananindeua, Belém, Benevides, Castanhal, Marituba, Santa Barbara do Pará, and Santa Isabel do Pará. (**) MW = Brazil's Minimum Wage during the research period (R$ 788.00 in 2015).

3.2. Preferences and Consumption

43.2% of respondents classified their consumption frequency of peach palm fruit at home as low, as they purchased the product only sporadically, even during the harvest period. 38.7% classified their consumption as average, purchasing the product only during the harvest period, and 18.1% of respondents said their consumption was high, since they bought the product whenever it was available at free fairs.

For 56% of the respondents, their peach palm fruit consumption over the last five years had remained constant, with no significant increase or decrease in their consumption of the fruit at home. 24.5% of respondents, however, had increased their consumption over the last five years. Thus, the percentage of respondents who did not decrease their consumption was 80.5%, demonstrating that the fruit has the potential to expand its consumption.

Culture is one of the primary determinants of consumer behavior, so we sought to obtain data on consumers' consumption habits with regard to peach palm fruits. In most cases, people consume the fruit cooked and as a side dish. Only 11.5% of respondents reported consuming the fruit without any accompaniment (see Table 2). Among the side dishes listed by the respondents, coffee stood out, as 71% of consumers said they consumed the fruit with coffee as an afternoon snack. Another 22% mentioned cassava flour, a widely-used delicacy in Amazonian cuisine that enriches the diet, since peach palm fruits have a beneficial amount of protein. Only 7% of respondents reported consuming the fruit with other foods such as guava, cupuaçu candy, curd, tapioca flour, salt, lemon, pepper sauce, cheese, or honey.

Table 2. Peach Palm Fruit Consumption Methods in the Metropolitan Region of Belém, in the State of Pará.

Method of peach palm fruit consumption	**%**
Consumption habit	
Without an accompaniment	11.5
With an accompaniment	88.5
Method of peeling fruit	
Remove the peel with a spoon	1.91
Remove the peel with a knife	34.93
Remove the peel with your teeth	44.98
Remove the peel with your hands	18.18
Form of consumption	
Cooked	88.5
Other forms	11.5

Source: Survey data (2015).

Consumers are strongly impacted by their personal attributes, which relate to their experiences as children and their psychological characteristics. In general, people's past and current experiences influence them (Cobra, 2009). This may help explain the fact that many consumers (44.98%) reported that they peeled the cooked fruit with their teeth, while 18.18% said they peeled it with their hands, a common habit among Pará families (see Table 2).

One of the primary pleasures of consuming peach palm fruit is in the way one peels the fruit. If the way sellers presented peach palm fruit for sale changed, such as by offering pre-cooked and peeled fruit, consumers would probably not be satisfied with the new sales option. Thus, we can infer that culture strongly influences the habits related to both the consumption and peeling of peach palm fruits by passing those habits from generation to generation.

Consumers most often consumed the fruit directly, as 88.5% of the respondents reported consuming it plain after cooking it in salt water. However, there are other methods of preparation, especially among consumers with higher incomes. Among respondents who ate more elaborate peach palm fruit dishes at home, 60% were in the high family income category. Respondents reported preparing dishes such as: cream of peach palm fruit with pink shrimp, peach palm fruit flour, peach palm fruit with beef or fish, peach palm fruit jam, cakes, pudding, or puree, peach palm fruit lasagna, and stroganoff and risotto with peach palm fruit,.

According to Clement et al. (2004), the peach palm fruit is an arboreal potato, and competes in the market against other sources of starch. Therefore, it has been highly valued in regional cuisine by renowned chefs. The southern part of the State of Bahia in Northeast Brazil has no tradition of consuming peach palm fruit; however, as news disseminates of the fruit's nutritional value and consumption methods, the people there have expressed interest in knowing, experimenting, and creating new means of eating the fruit, such as in porridge, cookies, cakes, couscous, or vatapá. An important aspect of the fruit is that it is gluten-free, allowing its use as flour in the diets of people allergic to gluten (Silva et al., 2011).

For consumption as either human or animal food, people must deactivate the peroxidase enzyme in the

peach palm fruit by subjecting the fruit to a heat treatment (Silva et al., 2011). On average, the way to deactivate the enzyme is to heat it to the ideal temperature of 105 °C for 20 minutes (Gallardo and Sierra, 1993). In light of this, 17.5% of respondents answered that some family members experienced throat irritation when they consumed peach palm fruits, which may be attributable to the presence of this enzyme.

3.3. Consumer preferences for the fruit's physical attributes

According to 30% of respondents, the external aspect (its roughness, stains, rot, cracks, and thorns) of the peach palm fruit is the most important attribute when selecting fruit to take home. The next most popular aspects were: oiliness (chosen by 18.5% of respondents), texture (16%), color (14%), fruit size (8%), bunch size (5%), and seed size (5%).

Fruit rot is associated with the presence of the fungus *Colletotrichum gloeosporioides*, which changes the color and texture of the fruit's epidermis from green/yellow to lighter tones, and later wrinkles and blackens it (Mota and Gasparotto, 1998). Cracks in the fruit are an important indicator of the fungus; however, in most cases, consumers buy them anyway because cracks also indicate coveted characteristics such as oiliness and texture.

One undesirable external aspect is the presence of thorns, since consumers do not want to risk injuring their mouths while eating. The thorns result from inadequate harvests, when the fruits grow towards the plant stem and come into contact with its spines.

An external characteristic that consumers do appreciate is the presence of bird pecking marks on the fruit. According to some respondents, this characteristic is an indication of superior quality fruit.

Texture is also important when making a purchase decision. The report of one respondent demonstrated this well by highlighting important characteristics during the fruit's preparation: "there are certain types of peach palm fruit that do not salt." Most respondents expressed a dislike of peach palm fruits with fibrous pulp and high moisture content. According to some consumers, one method to test for good texture is to peel the fruit at the time of purchase. If one can manage to remove the entire peel, then the fruit has good texture.

Examining consumption preferences related to the fruit's characteristics, 35.5% of respondents were indifferent to the color of the fruit. Some consumers explained that fruits with identical colors could be good or bad, so they did not consider color when selecting fruit. Despite this, red-colored peach palm fruit was the most desirable, favored by 29% of respondents, followed by yellow-colored fruit (23.5%), as shown in Table 3. For consumers in the city of Manaus, in the State of Amazonas, surveys have indicated that more than 50% of respondents preferred red-colored peach palm fruits (Clement and Santos, 2002).

Table 3. Preferences of peach palm fruit Consumers in the Metropolitan Region of Belém.

Consumer preferences regarding the characteristics of peach palm fruit (%)				
Color				
Indifferent	Yellow	Red	Orange color	Green
35.5	23.5	29.0	7.5	4.5
Pulp				
Indifferent	Oily	Dry	-	-

8.0	78.5	13.5	-	-
Size				
Indifferent	Great	Medium	Little	-
26.0	20.0	46.5	7.5	-
Seed				
Indifferent	Great	Medium	Little	Pitted
24.5	2.0	19.0	20.0	34.5

Source: Survey data (2015)

The respondents' appreciation for oily pulp fruit is indisputable. When questioned about their fruit pulp preferences, 78.5% opted for oily pulp fruit. As to their preferred fruit size, 46.5% of respondents opted for medium-sized fruit.

When carrying out morphometric analysis, researchers have classified peach palm breeds based on the size of the fruit, and assumed that the size reflected the breed's degree of domestication. One breed has intermediate-sized fruits and bunches, and is among the best for consumption. It has a pleasant texture and reasonable levels of carotene and oil, which contribute to its pleasant flavor (Souza et al. 2001).

Some respondents reported that there were large-sized peach palm fruits available for sale in the off-season that originated from planned plantings. However, the large fruit tends to be dry and have high levels of starch, which means it tends to have less oil content (Clement at al. 1998); this may explain why some consumers report disliking these off-season peach palm fruits.

As for peach palm seed size, 34.5% of consumers preferred seedless peach palms, as they have higher yield. This is because the peach palm is predominantly cross-pollinated, causing parthenocarpy that usually occurs in the first fruiting. Genetic, nutritional, and climatic factors are among those associated with parthenocarpy, along with the low efficiency of pollinating insects; when these factors interact, parthenocarpy occurs more frequently (Silva, 2015).

We tabulated the data to correlate respondent ages with their preferences in relation to fruit color. We discovered that indifference to fruit color gradually increased with age (see Table 4). This fact may be related to consumers' experiences, as consumers learn over time that the color of the fruit does not correlate with its quality. Thus, learning may also influence consumer behavior.

Table 4. Percentage of Customers Indifferent to Peach Palm Fruit Color by Age.

Age range(years)	≤ 30	31 - 45	46 - 55	56 - 65	> 65
Percent indifferent (%)	2.8	16.9	22.5	25.4	32.4

3.4. Price behavior

When asked about their satisfaction with the way seller market the fruit in clusters, 70% of respondents said they were satisfied with this sales pattern, regardless of their places of birth, family sizes, or family incomes. This behavior is associated with local culture, since purchasing peach palm fruit in clusters is the traditional way of marketing the fruit throughout the Amazon region.

Currently, peach palm fruit is sold raw in bunches or by the kilogram, while cooked peach palm fruit is

sold individually or by the kilogram. The price varies according to the form and quantity of the fruit. 54% of respondents considered the price of peach palms to be high, 42.5% thought it was satisfactory, and only 3.5% thought it was low. However, 68.5% of respondents stated that they would be willing to pay more for fruit that had the quality they desired.

The data in Table 5 indicate that the average sales price for raw peach palm fruit in the Metropolitan Region of Belém was R$7.29/kg, with a standard deviation of R$ 2.52/kg. There was a clear variation in fruit prices between the different research sites, with the lowest price observed at a fair in the neighborhood of Barreiro, and the highest in the neighborhood of Cidade Nova in Ananindeua. This fact occurs because of the consumers of these places that are differentiated, primarily, in terms of income and demand regarding fruit quality.

Table 5. Average Price per Kilogram of Peach Palm Fruit in Natura at Fairs in the Metropolitan Region of Belém during the 2015 Fruit Harvest.

Free fair/Neighborhood	**Average price (R$/kg)**	**Standard deviation**	**Variance coefficient VC (%)**
Barreiro	6.00	2.66	44.31
Jurunas	6.15	2.13	34.61
Icoaraci	6.43	1.95	30.31
Guamá	7.08	2.74	38.79
Ver-o-Peso	7.67	3.29	42.88
Feira da 25	8.05	2.83	35.21
Batista Campos	8.07	2.23	27.69
Cidade Nova	8.39	1.96	23.37
Total	**7.29**	**2.52**	**34.60**

Source: Survey data (2015)

We observed the commercialization of cooked peach palms only in the free fairs such as 25 fair, Batista Campos, and Cidade Nova. In those places, sellers usually sold the fruit cooked as well as raw, providing free cooked fruit samples to consumers. The average price of portions with 8 to 10 fruits ranged between R$2.00 and R$5.00, with an average of R$2.57 and a standard deviation of R$1.07.

4. Conclusion

Cooked peach palm fruit is highly valued by both urban and rural residents of the Brazilian Amazon, and is one of their favorite options for consumption during its harvest period. Therefore, a wide field of research seeks a better quality fruit to offer to the final consumer, since there is currently great variability in the fruit available.

Standardization of peach palm fruits for domestic consumption may expand the fruit's commercialization by helping consumers recognize the fruit characteristics they desire. Currently, its broad diversity, and consumers' difficulty in identifying good quality peach palms by their external characteristics before

cooking, restricts consumption of the fruit.

There is also ample potential for utilizing the fruit in regional cuisine by elaborating new, sophisticated dishes that serve a public with growing income. This niche can contribute to the strengthening of the market for this traditional Amazonian product.

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6. References

A.V. Carvalho, J.C. Beckman, R de A. Maciel, and J.T. Farias Neto. Características físicas e químicas de frutos de pupunheira no estado do Pará, Revista Brasileira de Fruticultura, 2013, pp.763-768.

A.V. Carvalho, M.A.M. Vasconcelos, P.A. Silva, and J. L. R. Ascheri. Produção de snacks de terceira geração por extrusão de misturas de farinhas de pupunha e mandioca, Brazilian Journal of Food Technology, 2009, pp.277-284.

C.R. Clement, J.P.L. Aguiar and D.B. Arkcoll. Composição química do mesocarpo e do óleo de três populações de pupunha (*Bactris gasipaes*) do Rio Solimões, Amazonas, Brasil. Revista Brasileira de Fruticultura, 1998, pp.115-118.

C.R. Clement and L.A. Santos. Pupunha no mercado de Manaus: preferências de consumidores e suas implicações. Revista Brasileira de Fruticultura, 2002, pp.778-779.

C.R. Clement, J.C. Weber, J. Van Leeuwen, C. Astorga Domian, D.M. Cole, L.A. Arévalo Lopez and H. Argüello.Why extensive research and development did not promote use of peach palm fruit in Latin America, Agroforestry Systems, 2004, pp. 195-206.

M. Cobra. Administração de marketing no Brasil. 3rd Edition, Elsevier, Rio de Janeiro, 2009.

M. Cymerys and C.R. Clement. Pupunha *Bactris gasipaes* Kunth. In: P. Shanley and G. Medina, (Eds.). Frutíferas e Plantas Úteis na Vida Amazônica, Acre, 2005, pp. 203-208.

V.M. del S. Gallardo and C.E.M. Sierra. Condiciones de secado para laobtención de harina de chontaduro (*Bactris gasipaes*). In: congresso internacional sobre biologia, agronomia e industrialización del pijuayo, Universidad de Costa Rica, San José, 1993, pp. 294-295.

IBGE, Instituto Brasileiro de Geografia e Estatística. Banco de dados agregados. Retrieved from http://www.sidra.ibge.gov.br. Updated: Feb 17, 2019.

Ministry of Health of Brazil. Alimentos regionais brasileiros. Brazil, Brasília, 2002.

A. M. Mota and L. Gasparotto, L. Fungos associados a "Síndrome da queda de frutos" da pupunheira. Rev. U. A. Série: Ciências Agrárias, 1998, p. 69-79.

G.G. Salas and Blanco A. Un alimento infantil com base en pejibaye: su desarrollo y evaluación. Boletim Informativo, U.C.R , 1990, p.12-14.

R.P. Santos, M. Cristo-Araújo, D. Picanço-Todrigues, S. Astolfi-Filho and C.R. Clement. Variabilidade genética e fluxo gênico em populações híbridas e silvestres de pupunha acessada com marcadores RAPD. Revista Brasileira de Fruticultura, 2011, p. 1200-1208.

M.G.C.P.C. Silva, T.F. Maier, W.S. Barreto and B.A. Melo Nelo. Avaliação da composição química da farinha de pupunha processada crua e pós cozimento. I Simpósio Brasileiro da Pupunheira, desenvolvimento com sustentabilidade. Ilhéus, Bahia. 2011. Retrieved from: http://www.ceplac.gov.br/paginas/pupunheira/download/Apresentacoes/ap%2822%29.pdf. Updated May 20, 2015.

M.G.C.P.C. Silva. Cultivo da pupunheira. 2015. Retrieved from: http://www.ceplac.gov.br/radar/CULTIVO%20DA%20PUPUNHEIRA.pdf. Updated: August 12, 2015.

N.R. Souza , D.P. Rodrigues, C.R. Clement, E.O. Nagao, and S. Astolfi-Filho. Discriminação de raças primitivas de pupunha (*Bactris gasipaes*) na Amazônia brasileira por meio de marcadores moleculares (RAPDS). Acta amazônica, 2001, pp. 539-545.

J. Van Leeuwen. O melhoramento participativo da pupunheira (*Bactris gasipaes*) para a produção de fruto, uma proposta preliminar. In: ProBio: Pupunha: raças primitivas e parentes silvestres. INPA, Manaus, 2006, pp.2. Retrieved from:<(http://www.inpa.gov.br/pupunha/probio/melhora-particip.pdf)>. Updated May 20, 2015

L.K.O. Yuyama and S.M.F. Cozzolino. Efeito da suplementação com pupunha como fonte de vitamina A em dieta: estudo em ratos. Revista de Saúde Pública, 1996, pp.61-66.