Food Research 8 (2) : 257 - 267 (April 2024)
Journal homepage: https://www.myfoodresearch.com

FOOD RESEARCH

RESEARCH PAPER

Consumer preference in buying snack and beverage products made from sweet potato (*Ipomoea batatas* (L.) Lam.) and cassava (*Manihot esculenta* Crantz) in Southern Cebu, Philippines

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Article history:
Received: 21 September 2022
Received in revised form: 21 November 2022
Accepted: 6 December 2023
Available Online: 3 April 2024

Keywords:
Cassava,
Consumer preference,
Sweet potato,
Regression analysis

DOI:
https://doi.org/10.26656/fr.2017.8(2).481

Abstract

Sweet potato and cassava are staple root crops in the Philippines and other tropical and subtropical regions. These crops, like other root crops, are considered survival crops. Processing these root crops into different snacks is another way to enhance their commercial value. However, consumer acceptability and preference must be considered to ensure the marketability of new food products developed. This study aimed to assess the consumer's preference for sweet potato and cassava-based snack and beverage products and developed a strategy to effectively market the products, in Southern Cebu. A 5-point Likert scale survey instrument was used to determine the consumers' preference (n = 210) in buying root crops derivative products. Results showed that the most preferred products are sweet potato chips (47.02±0.02%), sweet potato juice (45.75±0.02%), and cassava chips (37.20±0.03%). In addition, flavor is the most desired quality and the first thing the consumers consider. Aside from the flavor, consumers also preferred snack and beverage products that are cheap. Based on the stepwise regression, the increasing influence of price, in both sweet potato and cassava snack products, showed a negative effect, with a coefficient (β) -0.155 (CI: -0.015, -0.005) and -0.095 (CI: -0.012, -0.001) respectively. In contrast, increasing the influence of the product quality was found to have an enhancing effect on consumers' buying preference for sweet potato beverage products, with a coefficient (β) 0.091 (CI: 0.002, 0.080). Therefore, strategies must be centered on these attributes to effectively market the snack and beverage products developed from sweet potato and cassava.

1. Introduction

Root crops are among the essential crops in the Philippines and are a staple in rural areas (Gayao *et al*., 2016). In addition, root crops are the country's third most important crop, next to rice and corn. It is considered a traditional and survival crop that can easily adapt and be cultivated in any agroecological condition (DA-CHARMP2 Scale-up, 2019). Sweet potato and cassava are among the few most common root crops grown and produced in the country. In 2018, the country's production of sweet potato and cassava amounted to 153.99 and 809.88 thousand metric tons, respectively (PSA, 2018).

Sweet potato (*Ipomoea batatas* (L.) Lam.) is a starchy root crop (Amagloh *et al*., 2021) that originated in tropical America and was introduced to Africa and Asia (Roullier *et al*., 2013). The skin is usually brown, beige, red, or purple, with white, red, pink, yellow, orange, or purple flesh (Mohanraj and Sivasankar, 2014). The fleshy root of sweet potato contains arrays of essential nutrients including protein, fibers, vitamin C, potassium, phosphorus, calcium, magnesium (Krochmal-Marczak *et al*., 2014), and antioxidants such as tannins, alkaloids, saponin, flavonoids and phenols (Akpe *et al*., 2021).

Like sweet potato, cassava (*Manihot esculenta* Crantz) is typically grown in tropical regions including Africa, Asia and the Americas (de Lima *et al*., 2017). It is characterized as a woody herbaceous plant that grows well on acidic and low-nutrient soils. It has fleshy and starchy storage roots, similar to that of sweet potato, having white or cream and yellow colored cortex (Roslim *et al*., 2016). This root crop produces higher carbohydrates, per hectare, but has relatively lower protein quality and quantity compared to other cereal crops. In addition, it is considered a dangerous toxic

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eISSN: 2550-2166
Published by Rynnye Lyan Resources

crop due to the presence of cyanogenic glucosides (CNglc) which release hydrogen cyanide (HCN) that can cause serious health effects when ingested at an above-recommended concentration (Chisenga *et al*., 2019; Quinn *et al*., 2022). However, this does not undermine the nutritional value of cassava. Cassava is a survival root crop with high content of essential minerals such as calcium, iron, potassium, magnesium, copper, zinc, manganese, and vitamins including vitamin A and ascorbic acid (Montagnac *et al*., 2009).

The simplest cooking method for these two root crops is by boiling. Aside from the traditional cooking methods, these two root crops can be processed into varieties of food products (flour, noodles, bread, juice) (Vargas-Aguilar, 2016; Wang *et al*., 2019; Banwo *et al*., 2020). Several studies reveal that the preparation and processing of sweet potato and cassava can affect the sensory quality of the product. Ogliari *et al*. (2020) reported a higher sensory score for sweet potatoes cooked in fried methods compared to boiled and baked. Hou *et al*. (2020) found high overall acceptability in roasted sweet potato varieties - Yanshu No. 25 and Pushu No. 32. Coelho *et al*. (2018) reported relatively high acceptability for sweet potato chips with 96% of the panel rated above 6 (liked slightly) using a 9-scale hedonic. Dada *et al*. (2018) developed a highly acceptable cassava strip formulated from 80% cassava flour and 20% cowpea flour blend. Eyenga *et al*. (2018) revealed that 24 hrs soaking of peeled cassava roots resulted in the highest overall quality of chips regardless of the varieties.

In Southern Cebu, cassava and sweet potato are commonly cooked and processed into caramelized sweet potato (locally known as “kamote cue”), steamed grated cassava (locally known as “puto balanghoy), and cassava cake. The introduction of new processing methods for sweet potato and cassava requires market pre-assessment studies to develop effective strategies. Alburo *et al*. (2021) recommended that sensory acceptability in Cebu must be centered on product market promotion. With this, consumer preference and buying intention must be considered. Hence, this study aimed to assess the consumers’ preferences and identify the factors that greatly influence their preferences in buying sweet potato and cassava snack and beverage products.

2. Materials and methods

2.1 Conceptual framework

The study hypothesized that socio-demographic and product-related factors can be used as predictors in determining the consumers’ buying preference for the two root crops products (Figure 1). By doing cross-comparison and subjecting both predictors to linear regression analysis, a more precise model and coherent data on consumers’ buying preferences can be drawn.

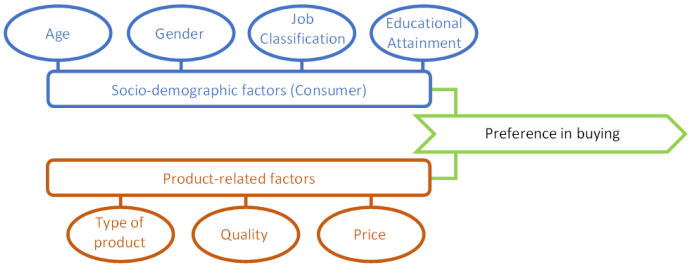

Figure 1. Conceptual framework.

2.1.1 Definition of variables

2.1.1.1 Socio-demographic factors

a. Age. Describes how old the respondent is during the survey. This study adopted the age brackets according to Ahmed *et al*. (2021) namely: early working age (18-24), prime working age (25-54), mature working age (55-64), and elderly (65 and above).

b. Gender. Represents sex-linked characteristics and identities of men (male) and women (female) based on the social norm (Balogun and Guntupalli, 2016).

c. Job classification. Refers to the three job categories during the pandemic (i) frontline workers, (ii) essential workers, and (iii) others (students).

d. Educational attainment. Refers to the highest education obtained by the respondents during the survey period (did not receive formal education, elementary undergraduate, elementary graduate, high school undergraduate, high school graduate, college undergraduate, college graduate, and post-graduate).

2.1.1.2 Product-related factors

a. Type of product. Refers to the subject products of the study. For sweet potato and cassava snacks: (i) chips, (ii) nutribar, (iii) binangkal, and (iv) butchi. For sweet potato beverages: (i) juice, (ii) tea, and (iii) latte.

b. Quality. Refers to the overall feature and attribute of a food product that is acceptable by the consumer (Kotler and Keller, 2012; Purba *et al.,* 2018). For sweet potato and cassava snacks: (i) flavor, (ii) texture, (iii) color, (iv) aroma, and (v) nutritional value. For sweet potato juice: (i) flavor, (ii) consistency, (iii) color, (iv) aroma, and (v) nutritional value.

c. Price. Refers to the equivalent amount or value of the food product.

https://doi.org/10.26656/fr.2017.8(2).481

2.2 Sampling and data gathering

Cebu province is among the highly industrialized provinces in the Philippines. The province is composed of nine cities and 44 municipalities (PSA, 2021a), of which, 18 municipalities and three component cities are located in the southern part. The province has an estimated population of 3,325,385 as of May 2020, with an annual population growth rate of 2.63% (PSA, 2021b). Agriculture is the main source of living in Southern Cebu due to its large farming areas. In 2010 - 2014, Cebu province is among the top producers of white corn, sugarcane, cavendish and saba banana, mango, cabbage, sweet potato, cassava, eggplant, mung bean, peanut, and tomato (Matildo and Ruiz, 2022). In addition, the province is also among the major producers of sweet potato and cassava in the same inclusive period, contributing 14,324 and 21,035 metric tons in the overall production (PSA, 2015) hence, a suitable site for the study.

A 5-point Likert scale (1 = most; 5 = least) survey instrument was used in the study. To measure the reliability and internal consistency of the constructed instrument, a pre-test was conducted among 15 (n) individuals (Sheatsley, 1983; Julious, 2005; Ruel *et al*., 2016). The measure of the internal consistency of the instrument was tested using Cronbach's α and composite reliability (CR) measures while the validity of the constructed values was indicated by the average variance extracted (AVE). The minimum acceptable AVE value for a dimension to be valid is 0.50 indicating at least 50% of the construct explains the variance of its indicators. The recommended composite reliability (CR) value is between 0.60 to 0.95 at 95% confidence interval. Values below 0.60 indicate no internal consistency while above 0.95 indicates redundancy. For Cronbach's α, coefficient value greater than 0.60 but lesser than 0.80 is considered "reliable" and while coefficient value greater than 0.80 but lesser than 1.00 is "highly reliable" (Hair *et al*., 2019; Hair *et al*., 2021; Kaya and Cinel, 2021).

The reliability coefficient (Table 1) for each scalar item in the survey instrument ranged from 0.622 to 0.880 for the Cronbach's α, indicating reliable to highly reliable dimensions. Moreover, the composite reliability coefficient ranged from 0.695 to 0.892, indicating an internal consistency among scalar dimensions. On the other hand, the AVE ranged from 0.424 to 0.734. Two AVE values (424 and 464) were at the borderline but are included in the instrument and are still valid (Kaya and Cinel, 2021).

Overall, data were gathered from 210 respondents. The socio-demographic profile (Table 2) of the respondents includes their gender, age, educational level, and classification as frontline or essential workers.

2.3 Data analysis

A nonparametric repeated-measures analysis of variance (Friedman's two-way ANOVA) was used to determine the mean rank of each item (Rodrigue *et al*., 2000; Richter *et al*., 2010; Bakr and Ayinde, 2013). Nemenyi post hoc test was used to determine the significant difference ($p \leq 0.05$) between individual mean ranks. Kendall's W (0 to 1) was used to determine the degree of agreement between different raters, such that the value equivalent to 0 indicates no agreement among respondents' rates.

All response variables were subjected to stepwise regression to determine the effect of each factor on consumer preference in buying. A simple linear regression was used to construct a predictor-buying

Table 1. Reliability coefficients.

	Construct	Cronbach's α[a]	Average Variance Extracted[b]	Composite Reliability[c]
Sweet potato snacks	Type of product	0.760	0.519	0.783
	Product preference	0.742	0.464	0.763
	Quality desired	0.778	0.509	0.805
	Price	0.808	0.635	0.872
Sweet potato beverages	Type of product	0.622	0.518	0.695
	Product preference	0.750	0.538	0.777
	Quality desired	0.819	0.712	0.881
	Price	0.880	0.734	0.892
Cassava snacks	Type of product	0.693	0.424	0.741
	Product preference	0.793	0.571	0.841
	Quality desired	0.863	0.661	0.883
	Price	0.797	0.617	0.865

[a] Reliable if $0.60<\alpha<0.80$ and highly reliable if $0.80<\alpha<1.00$

[b] Accepted AVE$\gtrsim$0.50

[c] Acceptable Reliability Index: Minimum = 0.60 - 0.70 and Maximum = 0.95

https://doi.org/10.26656/fr.2017.8(2).481

Table 2. Socio-demographic profile of respondents.

Socio-demographic Profile	Classification	Frequency Count (n)	Percent (%) of Cases
Gender	Male	100	47.60
	Female	110	52.40
Age	18 - 24 (early working age)	44	21.00
	25 - 54 (prime working age)	149	71.00
	55 - 64 (mature working age)	15	7.10
	65 and above (elderly)	2	1.00
Educational level	Did not receive formal education	2	1.00
	Elementary undergraduate	6	2.90
	Elementary graduate	8	3.80
	High school undergraduate	14	5.70
	High school graduate	17	8.10
	College undergraduate	48	22.90
	College graduate	77	36.70
	Post-graduate	40	19.00
Respondent Classification	Frontline workers	160	76.20
	Essential workers	28	13.30
	Others	22	10.50
Total number of Respondents (n)		210	

preference model.

Other descriptive statistics such as frequency counts and percentages were used to determine the respondent's preferred product. All data were analyzed using IBM SPSS version 26.

3. Results and discussion

3.1 Root crop product preference

Root crop product preference was determined using frequency counts. Respondents were asked which among the listed products they preferred to be developed from sweet potato and cassava. Based on the frequency counts, respondents (210) from Southern Cebu preferred sweet potato chips, sweet potato juice and cassava chips (Table 3).

Flavor is the most desired quality and the first thing the respondents considered when buying food products from sweet potato and cassava (Figure 2). The flavor is influenced by the receptors in the mouth (taste) and nose (aroma). Aroma is produced by aromatic volatile compounds, which provide scent or flavor upon being perceived by the smell receptors. While taste, on the other hand, is a result when receptors encounter food molecules in the mouth, signaling the brain to identify the specific taste (Barrett *et al*., 2010; Flores and Olivares, 2014). In this study, flavor is the first to be considered by consumers in buying sweet potato- and cassava-derived products. According to Guichard (2002), flavor is one of the most important attributes in determining food acceptability by the consumer. Flavor and taste are the key factors in achieving market success and are factors in guiding consumers when choosing functional products (Kraus, 2015).

In addition, it can be observed that respondents have similar price preferences for sweet potato and cassava snack products (Figure 3). This indicates that consumers in Southern Cebu preferred lower-priced food products. One reason for this can be attributed to the type of product. Snacks and beverages are considered inferior goods, as compared to rice and corn which are staples. Inferior goods are products in which the demand is inversely affected by the percentage increase in income (Graves and Sexton, 2009). As such, an increase in income can significantly decrease the quantity demand

Table 3. Respondent's preference for food products to be developed from sweet potato and cassava (n = 210).

	Product	Percent (%±SEM)	Quality Desired	Preferred Price (₱)
Sweet potato Snack	Chips (100 g)	47.02±0.02	Flavor	40
	Nutribar (50 g)	22.42±0.04	Flavor	20
	Binangkal (100 g)	19.56±0.04	Flavor	50
	Butchi (40 g)	10.99±0.06	Flavor	5
Sweet potato Beverage	Juice (330 mL)	45.75±0.02	Flavor	30
	Tea (230 mL)	32.03±0.03	Flavor	20
	Latte (200 mL)	22.22±0.04	Flavor	50
Cassava Snack	Chips (100 g)	37.20±0.03	Flavor	40
	Nutribar (50 g)	27.39±0.03	Flavor	20
	Binangkal (100 g)	19.84±0.04	Nutritional value	50
	Butchi (40 g)	15.58±0.05	Flavor	5

https://doi.org/10.26656/fr.2017.8(2).481

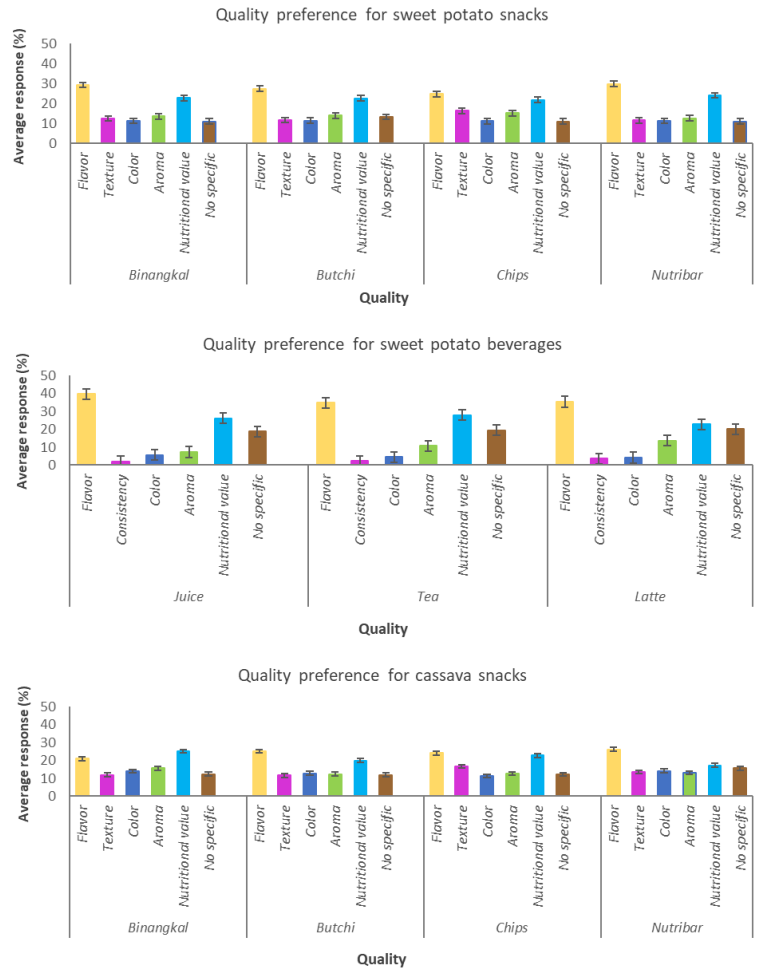

Figure 2. Consumers' preferred quality of root crop snack and beverage products

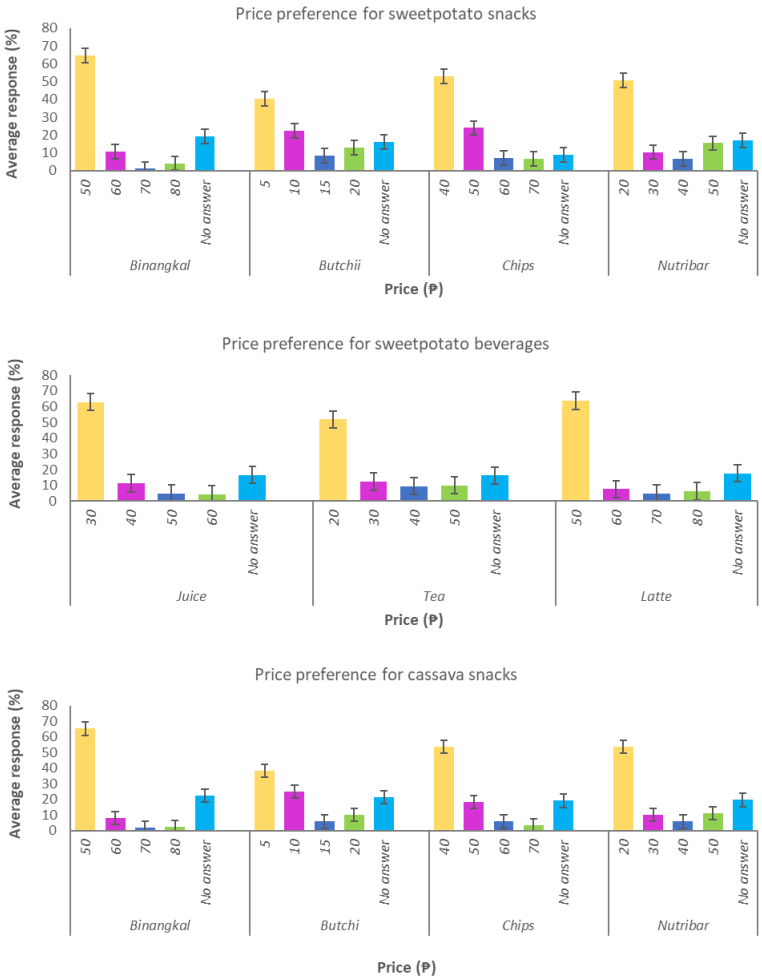

Figure 3. Willingness to pay on root crop snack and beverage products at a specific price.

https://doi.org/10.26656/fr.2017.8(2).481

of an inferior good. In the same case, a decrease in income also decreases the price of an inferior good, since price and demand are negatively related. Since snack and beverage products are not a basic need, people are most likely willing to buy them only at a lower price. The shifts in food prices had an important impact on consumers' food purchasing behavior (Griffith *et al*., 2015). Practically, price is considered an important factor in food choice, especially for low-income consumers (Steenhuis *et al*., 2011). Similar findings were reported by Li and Houston (2001) where price levels positively influenced consumers' choice of the purchase of processed foods.

A significant difference was observed among sweet potato snacks ($p = 1.65\times10^{-9}$), sweet potato beverages ($p = 7.94\times10^{-6}$), and cassava snacks ($p = 1.48\times10^{-6}$) product ranking (Table 4). The table also showed a substantial level of concordance for sweet potato snacks and beverages accounting for 79% and 65% agreement among the respondents. However, a moderate consistency in the rankings given by the respondents was observed for cassava snacks with a 40% level of agreement (Burn *et al.*, 2009). The mean ranks of the products in Table 4 correlate with the buying preference (percent) in Table 3. In the current study, chips ranked first in both sweet potato (mean rank = 2.00; $\chi^2 = 49.76$) and cassava (mean rank = 2.14; $\chi^2 = 22.94$) snack products. This means that consumers in Southern Cebu preferred chip snacks. Commercial chips are very common in the market and have been considered portable, quick, satisfying, less perishable, and more durable food products, hence are popular among consumers worldwide (Dinushika and De silva, 2017). Fried products, like chips, are common snacks accessible by all consumer groups (Dery *et al*., 2021). Chips, particularly potato chips, have been a popular snack with retail sales amounting to $6 billion per annum in the US (Pedreschi *et al*., 2008) and are considered the largest snack sector in the market (Riaz, 2016). Fried chips have also become popular among consumers. Pineda (2007) reported that consumers preferred fried tortilla chips over their baked counterparts.

Sweet potato is rich in essential nutrients including amino acids, total and reducing sugars, vitamin C and a wide range of macroelements (Krochmal-Marczak *et al*., 2014) making it a complete food. Processing sweet potato into juice will make it more convenient to consume. In the current study, the consumers preferred juice (mean rank = 1.79; $\chi^2 = 26.58$) sweet potato beverages. The popularity of juice products among consumers is driven by the demand for naturally healthy food. People are well aware of the kind of drink they intake and prefer healthy and convenient drinks (Caswell, 2009; Rajauria and Tiwari, 2018). Similar findings were reported by Mamo *et al*. (2014) in which the high overall acceptability was obtained from orange-flesh sweet potato juice products blended with varying concentrations and combinations of ginger and mango. Eissa *et al*. (2021) also found high general acceptability in pasteurized sweet potato juice with high content of vitamin C, total phenolics, and carotenoids.

3.1 Coefficient (β) regression model

The effect of predictors influencing the consumers' buying preference for sweet potato and cassava snacks and beverage products was determined using stepwise regression estimates. No significant difference was found among socio-demographic factors against buying preference for sweet potato and cassava snacks and beverage products. The increasing influence of price, in both sweet potato and cassava snack products, showed a negative effect, with regression coefficient (β) -0.155

Table 4. Between-group comparison[1] on sweet potato snacks, sweet potato beverages, and cassava snacks product ranking.

	Product	Mean Rank	Chi-square	Kendall's W [2]
Sweet potato Snack	Chips (100 g)	2.00[a]	49.76*	0.79
	Nutribar (50 g)	2.58[b]		
	Binangkal (100 g)	2.63[b]		
	Butchi (40 g)	2.79[c]		
Sweet potato Beverage	Juice (330 mL)	1.79[a]	26.58*	0.65
	Tea (230 mL)	1.95[a]		
	Latte (200 mL)	2.26[b]		
Cassava Snack	Chips (100 g)	2.14[a]	22.94*	0.40
	Nutribar (50 g)	2.61[b]		
	Binangkal (100 g)	2.62[b]		
	Butchi (40 g)	2.63[b]		

Mean values with different superscripts within the same column are statstically significantly different using the Nemenyi posthoc test ($p\leq0.05$).
[1]Friedman's two-way ANOVA.
[2]Coefficient of concordance.
*Significant at $p\leq0.05$.

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(CI: -0.015, -0.005) and -0.095 (CI: -0.012, -0.001) respectively. In contrast, increasing the influence of the product quality was found to have an enhancing effect on consumers' buying preference for sweet potato beverage products, with a regression coefficient (β) 0.091 (CI: 0.002, 0.080) (Table 5). The results of the stepwise simple linear regression were used to generate a predictor-buying preference model in which the price and quality of the product showed influencing effects (Figure 4).

Figure 4. Final framework.

Price is among the most influential factors in consumers' purchasing decisions for products in the market. It is believed that the higher the product is priced, the fewer items can be sold, while higher sales were expected for products sold at prices lower than the market (Wu *et al*., 2022). Jagannathan and Ravichandran (2019) found a similar relationship between price and consumer buying behavior such that consumers are willing to buy items at a suitable price. Zhao *et al*. (2021) recommended, based on their findings, to focus on pricing strategies as it has a significant relationship with buyers' decision process. Levrini and dos Santos (2021) reported that product price greatly influences and changes the purchase intention of consumers. They further identify the different consumer profiles such as (1) those who value quality and attributes, (2) those who value low price, and (3) the ones who value a balance between quality and price.

On the other hand, quality refers to the overall feature and attribute of a product or service that will lead to satisfaction of the needs (Kotler and Keller, 2012; Purba *et al*., 2018). The current study has similar findings to Kupiec and Revell (2001) where the majority of the consumer's reason for buying cheese in a speciality shop is attributed to quality. Moreover, Tsiotsou (2006) reported that perceived product quality predominantly affects, and is considered the primary determinant, overall satisfaction. Similarly, Swamy *et al*. (2012) reported that poor quality, along with high price and poor taste are the reasons consumers do not prefer particular brands of instant food products.

4. Conclusion

Based on the results and data obtained, consumers in Southern Cebu have a high preference for chips as snacks from sweet potato and cassava while juice is the preferred beverage from sweet potato. Therefore, the development of snack items must be centered on these root crop products. In addition, flavor and price must be considered in making these snack and beverage products, since the majority of consumers preferred snack and beverage products at a lower cost. Relative to that, the coefficient (β) regression analysis revealed the negative influence of increasing the price of sweet potato and cassava snacks, while a positive effect was observed in increasing the quality of sweet potato beverages. Such that, these attributes greatly influence the consumers' preference in buying sweet potato and cassava snack and beverage products.

Conflict of interest

The authors declare no conflict of interest.

Acknowledgments

The research work was funded by the Department of

Table 5. Stepwise regression estimates of predictors with influence on consumers' buying preferences (n = 210).

Factor	Regression Estimates[a]						
	β	SE	R^2	95% CI		Collinearity	
				Lower	Upper	Tolerance	VIF
Sweet potato Snacks Product Preference[b]							
Price	-0.155*	0.003	0.018	-0.015	-0.005	0.969	1.032
Sweet potato Beverage Product Preference[c]							
Quality	0.091*	0.020	0.057	0.002	0.080	0.999	1.001
Cassava Snack Product Preference[d]							
Price	-0.095*	0.003	0.008	-0.012	-0.001	1.000	1.000

[a]Probability of F to enter ≤0.05 and probability of F to remove ≥0.01.
[b]Influential factor model: constant + price. F change = 8.048, Sig F change = 0.005. Regression and Residual ANOVA: F = 8.048, p = 0.000.
[c]Influential factor model: constant + quality. F change = 4.192, Sig F change = 0.041. Regression and Residual ANOVA: F = 4.192, p = 0.000.
[d]Influential factor model: constant + price. F change = 5.316, Sig F change = 0.021. Regression and Residual ANOVA: F = 5.316, p = 0.021.
*Significant at p≤0.05.

https://doi.org/10.26656/fr.2017.8(2).481

Science and Technology- Philippine Council for Agriculture, Aquatic and Natural Resources Research and Development (DOST-PCAARRD).

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