



MARKETING SYSTEM AND CONSUMER PREFERENCES TOWARDS SWEET AND SALTY TASTE POTATO IN DISTRICT MULTAN

M. A. Iqbal¹, M. A. Qasim², M. Aslam^{2,3}, M. Yasin⁴ and M. A. Imran²

¹Department of Agriculture and Resource Economics, MNS-University of Agriculture, Multan, Pakistan

²Department of Agribusiness and Entrepreneurship Development, MNS- University of Agriculture, Multan, Pakistan

³School of Management, Jiangsu University, Zhenjiang, Jiangsu, China

⁴Department of Agricultural Extension, MNS-University of Agriculture, Multan, Pakistan

ABSTRACT

In several agro-climatic regions, including Pakistan, potato is a significant crop that is farmed extensively. Potato production and home consumption are important in Pakistan. It is one of the four main staple foods that greatly contribute to domestic food consumption and demands in the country. Due to several production and marketing restrictions, the performance of the potato business remains below optimal levels despite increases in area and production. One of them is a lack of understanding of consumer preferences study in hand evaluated consumer preferences for sweet taste and salty taste potatoes by gathered information from various areas of the district Multan through a survey of 75 potato consumers, 75 farmers, 15 wholesalers, 15 commission agent, and 15 retailers from various social classes. By using Stata 13.1, descriptive statistic and Binary Logit methods were applied to analyse the data. Consumers' preferences for buying and eating potatoes varied. Different factors, such as taste, freshness, aesthetics, income, age, education, and price paid for potato, had an impact on their consumer preferences. These results may assist in bridging Pakistan's policymakers, and consumers' differing perceptions of quality. To increase their profitability and the satisfaction of potato consumers in Pakistan, supply chain participants should respond to quality attributes consumers consider important in their purchase preferences. Both public and private sectors should involve to arrange trainings and outreach activities for the farming community in this regard.

Keywords: aesthetic factors, consumer preference, supply chain participant, quality attributes

INTRODUCTION

The flowering plant *Solanum tuberosum*, a member of the Solanaceae family, is the potato. The plant is believed to have originated in Peru (South America) and was transported to other regions of the globe by military campaigns or ships (Spooner *et al.*, 2019). All over the world, there are currently more than 5,000 different potato varieties. Almost all of these are unique to South America. Because of its high nutritional content, potential for a variety of applications (in both raw and processed form), and ease of accessibility for low-income customers, the crop is well-liked in Pakistan and across the rest of the globe (Zaheer and Akhtar, 2016).

For both consumers and farmers in Pakistan, potatoes are now a significant

vegetable crop. It is the third-most-popular staple food after wheat and rice and is consumed in a variety of ways, comprised of boiling, poached, French fries, crackers, and appetizers (Majeed and Muhammad, 2018a). The production of potatoes will rise by 35.1% from 2021 to 2022. As the area grows from 2.343 hectares to 313.800 hectares, domestic potato output climbs from 5.873 million tons in 2020-21 to 7.9371 million tons in 2021-22 (Government of Pakistan, 2022). Due to the increasing production, Pakistan has been able to export leftover potatoes, mostly to Afghanistan, Sri Lanka, Oman, and the United Arab Emirates. Although they are grown in all provinces, potatoes are mostly produced in Punjab (Majeed and Muhammad, 2018b). The potato value chain in Pakistan, like that of other horticulture products, includes a variety of businesses, including farm supplies, farmers, local traders,

*Corresponding author: manan.aslam@mnsuam.edu.pk



estate agents, manufacturers, distributors, and merchants (Badar *et al.*, 2019).

Preferences of food manufacturers and individual consumers, concerning the quality of the potato, depend on consuming habits in different countries. Cooked potato is widely consumed in Europe either with soft and delicate consistency or with a harder and drier consistency. Applied techniques for evaluation of potato quality comprise both physico-chemical and sensory assessment (Stiller *et al.*, 2008). Diversity of techniques for instrumental evaluation of potato quality in conjunction with and diversity of potato cultivars facilitate the quality characterization. The quality of tubers is affected, both by single components of potato and the interactions among them as well. Moreover, environmental factors such as temperature during growth period, geographical origin, harvest date and storage time were suggested to affect the properties of potato.

The effectiveness of a marketing system is frequently measured by the marketing margin or price spread (Abbott and Makeham, 2016). If used to illustrate how customers' spending is distributed across market participants at various levels of the marketing systems, it might be a valuable descriptive statistic. The price of a group of marketing services as a result of the interaction between supply and demand for those services is defined as the difference between what consumers pay and what producers get. In order to assess the efficiency of the marketing of agricultural goods, several studies have looked at the marketing margins for different kinds of commodities. Marginal marketing expenses under perfect competition may be to blame for fluctuations in the margin over time, but other elements like seasonality, technical advancements, and sales volume may also be to blame. (Aslam *et al.*, 2013).

Due to changes in lifestyle and financial level, consumers' taste preferences have risen significantly (Yaseen *et al.*, 2016). Consumers now place priority on intangible marketing and food safety-related traits in addition to physical quality characteristics like size, taste, and price (Akkerman *et al.*, 2010; Badar *et al.*, 2015). Only when they get the needed quality attributes are they prepared to pay a premium price. According to (Chamhuri and Batt 2015), customers ultimately select which food quality characteristics are necessary. Hence, it is believed that the growth of agri-food sectors throughout the world depends on having a thorough awareness of the factors that affect

consumer preferences (Bond *et al.*, 2008; Montouto-Grana *et al.*, 2012). Yet, consumer research on taste published literature is few in undeveloped nations. Pakistan is a typical example of a country where consumer preferences for horticulture crops have not been studied and research has historically been heavily centered on production-related issues. Consumer preferences for the taste of vegetables, including potatoes, have not been studied. By identifying consumer preferences for sweet and salty taste potatoes in Pakistan and the variables affecting them, this research attempted to close this research gap. The results should help both public and commercial stakeholders align potato value chain operations with targeted consumer value.

The potato (*Solanum tuberosum* L.) may be stored following harvest to provide a year-round supply for industry and domestic consumers. Storage at sub-ambient temperature and controlled humidity slows down the metabolic processes in the tuber thereby prolonging shelf-life. Nevertheless, changes in tuber composition during storage do occur, including modified profiles of dry matter (Misra and Kulshrestha, 2003) and enhanced the content of sugars, amino acids, and other chemical components (Brierley *et al.*, 2000). Effective storage should be a top priority for growers or storage managers involved in the fresh, processed, or seed segments of the industry. The goal of storage is to maintain both the quality and quantity of marketable tubers throughout the storage period to maximize economic returns. Clearly, profitability is tightly linked to both tuber quality and mass loss (shrinkage) (Kleinkopf *et al.*, 2003).

The variables studied toward determining storage losses were the potato cultivar, pre-storage conditions (environmental conditions) and storage conditions. One should bear in mind that storage losses cannot be avoided even by optimal storage. Suitable storage conditions can merely limit the losses in product over relatively long periods of storage. Storage losses are often specified as weight and quality losses (physico-chemical and sensory properties) of potatoes (Eltawil *et al.*, 2006).

The quality of potatoes, especially the colour of processed items, is significantly influenced by the quantity of sugars in the potato tuber. The most important chemical factors influencing the colour of processed potato products are often thought to be sugars (Smith, 1987), (Roe *et al.*, 2014). The sugar levels in a potato tuber are

influenced by a variety of factors, including genotype, ambient conditions, and cultural practices used during development as well as a number of post-harvest events, such as storage.

Consumers today prefer intellectual marketing and food safety-related features in addition to tangible quality attributes like size, flavor, and price (Akkerman *et al.*, 2010; Badar *et al.*, 2015). If you give them the desirable quality, they will only pay a premium price. Consumers ultimately decide the desired qualitative characteristics of the food they eat (Chamhuri and Batt 2015). Therefore, it is believed that the growth of the global agri-food business depends on having a thorough understanding of the elements that affect consumer preferences. As a result, considering the significance of the research question, the current study was created to examine consumer preferences for sweet and salty taste potatoes in particular regions.

METHODOLOGY

A sufficient and scientifically based sample was necessary if a small-scale inquiry was to produce reliable results. For normal distribution of curve, sample size should consist of at least 150 or more respondents (Kieftenbeld and Natesan 2012). So, as a representative sample of 75 Potato farmers, 15 commission agents, 15 wholesalers, 15 retailers, and 75 Potato consumers were chosen. A sample size of 75 farmers, 75 consumers and 45 middlemen (15 commission agents, 15 wholesalers, 15 retailers), were selected from Multan district by consulting Department of Extension and Adaptive Research, Multan and Market Committee Multan.

We opted the formula developed by Yamane (1967). The sample size derived on this formula, generally used by many researchers (Asongu and Andrés, 2020; Shah *et al.*, 2023). The sample size for this research work was determined at 10% confidence level. The margins of suppliers and retailers were measured by using margin analysis formulas. Binary logit regression is a regression model where the target variable is binary, that is it take only two values, 0 or 1. Therefor binary logit model were applied for analyze the consumer preferences for sweet and salty taste potato.

Marketing margin analysis

For calculating the margins of different stakeholders (Rasool *et al.*, 2015).

$$MM = Ps/Sp * 100_{\text{...}} \quad (1)$$

Where; “

MM = Marketing Margin”

Ps = Price spread”

Sp = Sale price”

Price spread=Sale price–Purchase price”

$$GM = Sp-Pp'' \quad (2)$$

Where;

GM = Gross Margin”

Sp = Sale price”

Pp = Purchase price”

$$NM = GM-TC'' \quad (3)$$

Where;

NM = Net Margin”

GM = Gross Margin”

TC = Total cost

Binary logistics regression

This model is best fitted to our dependent and independent variables as our dependent variable is consisted of two categories. Furthermore, our dependent variable is not based on orders or ranks. So, this technique is the simplest and easiest approach to employ for delineating the impact quantitative variables on categorical dependent variable. Due to its mathematical approach, the logistic regression process has been used in several research studies and applications (Greene, 2003). In this research study, it was used to examine the relevance of preference regarding purchasing the sweet taste potato or the salty taste potato. The binary logit's formula is stated as (Long, 1997; Field, 2009);

$$Pr \left(y = \frac{1}{x'} \right) = \frac{\exp(x' \beta)}{1 + \exp(x' \beta)} = (X' \beta) \quad (4)$$

Equation 4 depicts the possibility of an event occurring, the dependent variable keeps a value of 1 given the independent factor (x). The x' depicts the vectors of all the independent factors. The descriptive power of the independent factor is explained by the β coefficient. The dependent factor is the possibility of a consumer being prefer sweet taste potato or salty taste potato. This dependent factor keeps two distinct values, which is 1 if the consumer is consuming salty taste potato or 0 if the consumer is consuming sweet taste potato.

The model represents the maximum likelihood of a consumer being prefer and not prefer sweet and salty taste potato. The β coefficient in the given model portrays a relationship of how deviations in independent regressors influence the predicted log of odds of a consumer being consuming salty taste potato versus consuming sweet taste potato. The given relationship between dependent and independent factors can be depicted employing the antilog of β ($\exp\beta$) that is the odd ratio. A formula of the odd ratio is described below.

$$\frac{P_i}{1-P_i} = 1 + \frac{e^{(x' \beta)}}{1 + e^{-(x' \beta)}} = e^{(x' \beta)} \quad (5)$$

Where P_i is the possibility of being consuming salty taste potato ($P_{ry}=12$) in equation (4) and $1-P_i$ is the possibility of being consuming sweet taste potato. Equation (5) represents the odd ratio in favor of being consuming salty taste potato which is the ratio of the possibility that a respondent is consuming salty taste potato to the possibility or consuming sweet taste potato. An odd ratio that is bigger than 1 indicates that a unit improvement in the continuous factor or distinct change in the categorical factor in the regressors moves towards a reduction in the odd ratio of a consumer being consuming salty taste potato versus consuming sweet taste potato. The more universal form of the model is given as:

$$Y = (P/1-p) \quad (6)$$

$$\text{Loge}(p/1-p) = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 Z_1 + \beta_7 Z_2 + \beta_8 Z_3 + \beta_9 Z_4 + \beta_{10} D_1 + \beta_{11} D_2 + \beta_{12} D_3 + \beta_{13} D_4 + \beta_{14} D_5 + \beta_{15} D_6 + \epsilon \quad (7)$$

Whereas,
P=Possibility of dependent factor (being consuming salty taste potato or consuming sweet taste potato)

$$\text{Ln}(\text{Odds}) = \text{Ln}(p / 1 - p) = \beta_0 + \beta_i \quad (8)$$

$p=1$ if consumer is consuming salty taste potato and 0 otherwise. A specific structure of this relationship is described as:

$$\text{Ln}[p/1-p] = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 Z_1 + \beta_7 Z_2 + \beta_8 Z_3 + \beta_9 Z_4 + \beta_{10} D_1 + \beta_{11} D_2 + \beta_{12} D_3 + \beta_{13} D_4 + \beta_{14} D_5 + \beta_{15} D_6 + \epsilon \quad (9)$$

Whereas,
 X_1 = Consumer income (Rs)
 X_2 =Consumer age (years)
 X_3 =Education of consumers (schooling years)
 X_4 =Family size of consumers (in numbers)

X_5 =Price paid by consumers (rupees/kg)

D_1 =Dummy variable, used to capture the effect of family Where 1 = adult and 0 = children.

D_2 =Dummy variable, used to capture the effect of the fulfillment of health concerns Where 1 = if respondents prefer due to health concerns and 0 = otherwise.

D_3 =Dummy variable, used to measure the impact of taste. Where 1 = if respondents prefer due to taste and 0 = otherwise

D_4 =Dummy variable, used to measure the impact of freshness. Where 1 = if respondents prefer due to fresh potato and 0 =otherwise

D_5 =Dummy variable, used to assess the effect of aesthetic factor Where 1 = if respondents prefer due to shape of potato and 0 = Otherwise
 D_6 =Dummy variable, used to evaluate the impact of occupation. Where 1 = if respondents prefer due to employees and 0 = Otherwise

Z_1 =Qualitative variable, used to determine the effect of cooking preferences for fries.

Z_2 =Qualitative variable, used to capture the effect of cooking preference for mashed potato.

Z_3 =Qualitative variable, used to capture the effect of cooking preferences for potato chips.

Z_4 =Qualitative variable, used to quantify the effect of cooking preferences for fully cooked.

Based on our given function, we employed binomial logit model to estimate the coefficients of variables

RESULTS

Potatoes marketing begins from the farm gate. After growing and harvesting Potatoes the farmer keeps some quantity of potatoes for his own use and they are transported from the farm to the nearest market for the commission agent or wholesalers who assemble them to a big city market and sell to other wholesalers, retailers, or consumers. The current research demonstrates that the district of Multan's wholesale market lacks essential amenities such adequate waste removal methods, drinking water, shed availability, toilet facility, and platform availability, and availability of proper sewerage system.

Categorize the respondents with respect to socio-economic features. Demographic factors and Socioeconomic are significant in social science research because they serve as the base for market segmentation and play a significant and crucial effect in consumers' purchasing decisions. Significant demographic determinants include age, marital status, number of siblings, gender, earnings,

professional career, and level of education. Since demographic factors are needed to determine the target market's size, finding, and evaluating the demographic profile of the target market is essential for marketers.

Exploring the marketing system of potatoes in selected areas. There were three marketing channels active in district Multan which were summarized below:

Channel I. Potato grower→ Commission Agent→ Wholesaler→ Retailer

Channel II. Potato grower→ Commission Agent→ Retailer

Channel III. Potato grower→ Wholesaler→ Retailer

Every station has positives and negatives. Although the first and second channels had the benefit of having buyers at their doorsteps, there was a high possibility that farmers would receive less money for their potatoes. In addition, the scale was set up such that the potato was underweighted. There was a serious problem with "katoti" in the case of the first and second channel (Jr. and Tran, 2021).

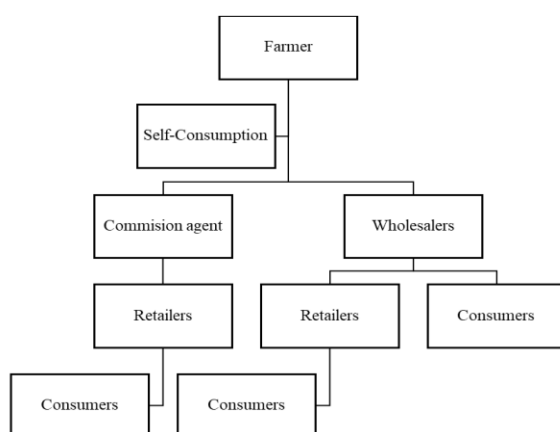


Figure 1. Marketing system of potato Author's own illustration

Determining the impact of factors affecting consumer preferences towards sweet and salty taste potatoes and suggest policies for improving the current marketing system of potatoes. Traditionally, in the fresh market, consumer often choose potatoes based on aesthetic factors such tuber size, shape, colour, and skin brightness. However, population-based epidemiological studies that emphasize the crucial role of diet (especially mineral malnutrition) and lifestyle in the emergence of many degenerative chronic diseases like cancers and cardiovascular diseases, in both developed and developing countries, have

increased consumer interest in using the nutrient-rich potato (Andre *et al.*, 2007).

Table 1. Marketing margins of commission agents (Rs. / maund)

Item	Potatoes	Percentage
Average Sale Price	1008	
Average Purchase price	928	
Gross margin	80	7.9
Total Cost	20	25
Net Profit Margin	60	75
Net Profit as % of sale price		5.9

Source: Author's own calculations

The commission agent paid an average price of Rs. 928 per maund for potatoes, which he sold to another investor for an average price of Rs. 1008 per maund. Commission agent made a gross profit of Rs. 80 per maund on marketing expenses of Rs. 20 per maund. Therefore, the net margin per maund was Rs. 60. The commission agent received 0.086 Percent of the overall margin in the potato marketing chain in the district of Multan. 0.064 Percent of the sale price represented the net profit. Marketing expenses made up 25 Percent of the commission agent's gross margin; the remaining 75 Percent came from earnings. Transportation, labor (loading and unloading), and other expenses are included in the total price. The data is presented in summary form in (Table 1).

Table 2. Marketing Margins of Wholesalers (Rs. / Maund)

Item	Potatoes	Percentage
Average Sale Price	1280	
Average Purchase price	1142	
Gross margin	138	10.7
Total Cost	60	43.4
Net Profit Margin	78	56.5
Net Profit as % of sale price		6

Source: Author's own calculations

The wholesalers paid an average price of Rs. 1142 per maund for potatoes, which he then sold to another investor for an average price of Rs. 1280 per maund. wholesalers made a gross profit of Rs. 138 per maund on marketing expenses of Rs. 60 per maund. Therefore, the net margin per maund was Rs. 78. The wholesalers received 0.10% of the overall margin in the potato marketing chain in the district of Multan. 6.09% of the sale price represented the net profit. Marketing expenses made up 43.4% of the wholesaler's gross margin; the remaining 56.6% came from earnings. Transportation, labor (loading and unloading), and other expenses are included in the total price. The data is presented in summary form in (Table 2).

"Average purchase price (Rs. / Maund)"	= 928
"Average sale price (Rs. / Maund)"	= 1008
"Gross marketing margin (Rs. / Maund)"	= 80
"Percent marketing margin"	= $80/1008 \times 100 = 7.9\%$
"Average total costs (Rs. / Maund)"	= 20
"Net Profit (Rs. / Maund)"	= $80 - 20 = 60$
"Net Profit as Percentage of margin"	= $60/80 \times 100 = 75\%$
"Net Profit as a Percentage of sale price"	= $60/1008 \times 100 = 5.9\%$

"Average purchase price (Rs. / Maund)"	= 1142
"Average sale price (Rs. / Maund)"	= 1280
"Gross marketing margin (Rs. / Maund)"	= 138
"Percent marketing margin"	= $138/1280 \times 100 = 0.10\%$
"Average total costs (Rs. / Maund)"	= 60
"Net Profit (Rs. / Maund)"	= $138 - 60 = 78$
"Net Profit as Percentage of margin"	= $78/138 \times 100 = 56.52\%$
"Net Profit as a Percentage of sale price"	= $78/1280 \times 100 = 6.09\%$

Table 3. Retailers Marketing Margins (Rs. / Maund)

Item	Potatoes	Percentage
Average Sale Price	1310	
Average Purchase price	965	
Gross margin	345	26.3
Total Cost	44	7.5
Net Profit Margin	301	87.2
Net Profit as % of sale price		22

Source: Author's own calculations

The retailers/ merchants paid an average of Rs. 965 per maund for potatoes that they can sell to another investor for an average of Rs. 1310 per maund. Retailers' gross marketing margin was Rs. 345 per mound; their marketing expense was Rs. 26 per mound. Therefore, the net margin per maund was Rs. 319. Retailers received 26.33% of the chain's overall margin in the potato marketing chain in the Multan region. 24.35 Percent of the sale price represented the net profit. Marketing expenses made up 7.5 Percent of retailers' gross margin, while profits made up the remaining 92.5%. Total expenses comprise market fees, labor costs, etc. The data is presented in summary form in (Table 3).

Average purchase price (Rs. / Maund)"	= 965
"Average sale price (Rs. / Maund)"	= 1310
"Gross marketing margin (Rs. / Maund)"	= 345
"Percent marketing margin"	= $345/1310 \times 100 = 26.33\%$
"Average total costs (Rs. / Maund)"	= 26
"Net Profit (Rs. / Maund)"	= $345 - 26 = 319$
"Net Profit as Percentage of margin"	= $319/345 \times 100 = 92.46\%$
"Net Profit as a Percentage of sale price"	= $319/1310 \times 100 = 24.35\%$

The explanation for the consumers' income odds ratio of 0.095 is that for every 1% increase of income, consumer preference for salty potatoes rose by 0.095 times. The positive sign shows that as consumers' income among the chosen consumers rises, so does their preference for salty potatoes in the research region. The chosen consumers' education has a beneficial role in their preference for purchasing potatoes with a salty taste. The explanation for the consumer education odds ratio of (1.447) is

that it increases the likelihood that a consumer would choose to purchase salty taste potatoes by (1.447) times for every 1% of knowledge gained. The positive sign shows that as consumers' level of knowledge rises, so will those consumers' preferences for salty potatoes in the research region. According to findings, children of the selected consumers contribute negatively to prefer regarding buying of sweet taste potato. The odds ratio of children consumers (-0.460) is explained as for every 1% increase in the children, there are (-0.460) times chances consumer preference towards sweet taste potato was increased. The sign of negative shows that if children of selected consumers increased then selected consumer preference towards sweet taste potato will also improve in study area. The explanation for the odds ratio of consumers' health concerns (1.192) is that there are 1.192 times for every 1% as many opportunities for consumers to choose potatoes with a salty taste. The positive sign shows indicates that if the health concerns of the chosen consumers will rise, the research area's salty taste potato preference would also rise among the chosen consumers.

Table 4. Statistical results summary logit model

Consumer preference to buy potato	Exp(β)	Std. Err.	P-value	Coef.
Income	0.095	1.381	.082*	2.401
Age	1.084	.073	.195	.095
Education	1.447	.202	.064*	.373
potato price	0.980	.339	.997	.021
Children	-0.460	3.523	.025**	7.902
Health Concern	1.192	1.524	.069*	2.773
Taste	1.293	2.513	.066*	4.627
Fresh	1.511	1.408	.089*	2.394
Aesthetic factors	0.046	.717	.116	1.127
Consume for fries	-3.321	1.782	.052*	3.463
Consume for fully cooked	0.603	.927	.075*	1.889
Consume for potato chips	3.791	.687	.108	1.103
Constant	2.677	4.938	.057*	9.388
Number of observations	75	LR chi ² (12)		73.35
Pseudo R ²	0.74	Prob > chi ²		0.000

Source: Author's own calculations

The consumer preference for potatoes with a salty taste is said to have grown by 1.293 times for every percent increase in the consumer's taste, according to the odds ratio of taste of 1.293. The positive sign indicates that if the taste factor of the chosen consumer rose, the chosen consumer's desire for potatoes with a salty taste would also grow in the research location. The explanation for the fresh potato odds ratio of 1.511 is that for every percent increase of fresh potatoes, consumer preference for salty potatoes rose by 1.511 times. The positive sign shows that as fresh potato consumption among the chosen consumers

risers, so does their desire for salty potatoes in the research region. Odds ratio of fries (-3.321) is explained as for every 1% improvement in category the consumer preference for fries, there are (-3.321) times chances consumer preference towards sweet taste potato was increased. The negative sign shows that if consumer purchase potato for fries, then selected consumer preference towards sweet taste potato will also improve in the study area. The odds ratio of fully cooked potato 0.603 is explained as for every 1% improvement in category the consumer preference for fully cooked, there are 0.603 times chances consumer preference towards salty taste potato was increased. The positive sign shows that if consumer purchase potato for fully cooked, then selected consumer preference towards salty taste potato will also improve in the study area.

DISCUSSION

The flowering plant *Solanum tuberosum*, a member of the Solanaceae family, is the potato. The plant is believed to have originated in Peru (South America) and was transported to other regions of the globe by military campaigns or ships (Spooner *et al.*, 2019). All over the world, there are currently more than 5,000 different potato varieties. Almost all of these are unique to South America. Because of its high nutritional content, potential for a variety of applications (in both raw and processed form), and ease of accessibility for low-income customers, the crop is well-liked in Pakistan and across the rest of the globe (Zaheer and Akhtar, 2016; Hussain *et al.*, 2013; Aslam *et al.*, 2013). Preferences of food manufacturers and individual consumers, concerning the quality of the potato, depend on consuming habits in different countries. Cooked potato is widely consumed in Europe either with soft and delicate consistency or with a harder and drier consistency. Applied techniques for evaluation of potato quality comprise both physicochemical and sensory assessment (Stiller *et al.*, 2015). Diversity of techniques for instrumental evaluation of potato quality in conjunction with and diversity of potato cultivars facilitate the quality characterization. The quality of tubers is affected, both by single components of potato and the interactions among them as well. Moreover, environmental factors such as temperature during growth period, geographical origin, harvest date and storage time were suggested to affect the properties of potato (Tzouros and Arvanitoyannis, 2017).

An important demographic element is age. Adults tend to be more skilled and experienced in the production and cultivation of crops, whereas teens seem to be learning. Among the selected potato farmers 17%, 38%, 25%, and 20% belongs to under the age of 40, 40-50, 51-60 and above 60 years respectively. Irrigated land produces more than dry land because it is more fertile. This result is supported by the studies of Aslam *et al.* (2012); Adeel *et al.* (2018). Out of 15 commission agents, 2 received less than Rs. 900 per maund, making up 13% of the total, 2 received between Rs. 900 and Rs. 950 per maund, making up 13% of the total, 3 received between Rs. 951-1000 per maund, making up 20% of the total, and 8 received greater than 1000 per maund, making up 54%. The commission agent paid an average price of Rs. 928 per maund for potatoes, which he sold to another investor for an average price of Rs. 1008 per maund. Commission agent made a gross profit of Rs. 80 per maund on marketing expenses of Rs. 20 per maund. Therefore, the net margin per maund was Rs. 60. The commission agent received 0.086% of the overall margin in the potato marketing chain in the district of Multan. 0.064% of the sale price represented the net profit. The remaining expenses made up 25% of the commission agent's gross margin; the remaining 75% came from earnings. Transportation, labor (loading and unloading), and other expenses are included in the total price. The wholesalers paid an average price of Rs. 1142 per maund for potatoes, which he then sold to another investor for an average price of Rs. 1280 per maund. Wholesalers made a gross profit of Rs. 138 per maund on marketing expenses of Rs. 60 per maund. Therefore, the net margin per maund was Rs. 78. The wholesalers received 0.10% of the overall margin in the potato marketing chain in the district of Multan. 6.09% of the sale price represented the net profit. Marketing expenses made up 43.4% of the wholesaler's gross margin; the remaining 56.6 Percent came from earnings. Transportation, labor (loading and unloading), and other expenses are included in the total price. The retailers/ merchants paid an average of Rs. 965 per maund for potatoes that they can sell to another investor for an average of Rs. 1310 per maund. Retailers' gross marketing margin was Rs. 345 per maund; their marketing expense was Rs. 26 per pound. Therefore, the net margin per maund was Rs. 319. Retailers received 26.33% of the chain's overall margin in the potato marketing chain in

the Multan region. 24.35% of the sale price represented the net profit. Marketing expenses made up 7.5% of retailers' gross margin, while profits made up the remaining 92.5%. Total expenses comprise market fees, labor costs, etc. The consumer income odds ratio of 0.095 may be explained by the fact that consumer preference for salty potatoes increased by 0.095 times for every 1% rise in income. The good news is that consumers' preferences for salty potatoes in the study area increase as consumer income among the selected consumers grows. The chosen consumers' propensity for buying potatoes with a salty taste is positively influenced by their education. The reason for the consumer education odds ratio of 1.447 is that for every 1% of information acquired, the chance that a consumer will choose to buy potatoes with a salty flavor increase by 1.447. The good news is that consumers' tastes for salty potatoes in the study area will increase as their level of knowledge increases. The results show that children of the chosen consumers have a detrimental influence on their preference for sweet tasting potatoes. The explanation for the odds ratio of children consumers (-0.460) is that there are -0.460 times as many opportunities for consumer preference for sweet-tasting potatoes to grow for every 1% increase in the number of children. The indication of a negative indicates that the research area's sweet potato preference will grow as the number of children of chosen consumers increases. There are 1.192 times as many options for consumers to select potatoes with a salty flavor, which accounts for the odds ratio of consumers' health worries (1.192). The good news is that if the research area's salty flavor potato preference among the chosen consumers increases, then it is likely that their health worries would as well. According to the odds ratio of taste of 1.293, the consumer preference for potatoes with a salty flavor is stated to have increased by 1.293 times for every 1% rise in the consumer's taste. The good news is that the desire for potatoes with a salty flavor would increase in the research site if the chosen consumer's taste factor increased. The consumer preference for salty potatoes increased by 1.511 times for every 1% increase of fresh potatoes, which is the rationale for the fresh potato odds ratio of 1.511. The good news is that when fresh potato intake increases among the targeted consumers, so does their preference for salty potatoes in the study area. According to the definition of the odds ratio of fries (-3.321), there are -3.321 times more odds

that consumers' preference for sweet flavor potatoes rose for every 1% rise in the category of fries. The bad indicator indicates that if consumers buy potatoes for fries, then their preferred potato flavor will also increase in the research location. The completely cooked potato odds ratio of 0.603 is defined as the probability that a consumer will choose a salty-tasting potato for every 1% increase in category preference for fully cooked potatoes. The good news is that if consumers buy potatoes that are thoroughly cooked, their preferences for salty potatoes will also increase in the research region.

CONCLUSION

The current research found that the wholesale market in district Multan lacked basic amenities such as a proper mechanism for removing waste material, drinking water, the availability of a shed, the availability of toilet facilities, the availability of a platform, and the availability of a proper sewerage system. These services are essential to the efficient functioning of the market and should be made available by the market committee. There is a need to improve their marketing efficiency, the marketing margins should be lessened according to our research findings, many market anomalies are present in the supply chain of potato. So, the government should take action by involving price control magistrates who should monitor the marketing margins. The research discovered aspects in marketing, health, aesthetics, taste, and pricing that affect consumers' choices for purchases. These results may aid in closing the quality perception gap between consumers, policymakers, and others involved in the supply chain of potato. In order to improve the farm earnings, potato peasants must modernize their procedures to produce their production for meeting consumer demand. Participants in the supply chain should react to the quality characteristics that consumers prefer in their purchasing decisions.

AUTHOR'S CONTRIBUTION

M. A. Iqbal: Supervisor: Assist the student in each phase of research.

M. A. Qasim: MS Student

M. Aslam: Assist the student in each phase of research.

M. Yasin: Improve the write up of thesis/manuscript.

M. A. Imran: Data Analysis and Interpretation.

REFERENCES

- Abbott, J. C. and J. P. Makeham. 2016. *Agricultural Economics and Marketing in the Tropics* 2nd Ed. Intrmed. Journal of Tropical Agriculture. Series. Longman. Group Ltd. London. UK.
- Adeel, A., M. Aslam, H. H. Ullah, Y. M. Khan and M. A. Ayub. 2018. Marketing Margins of Selected Stakeholders in the Supply Chain of Dates in South Punjab, Pakistan. *Cercetări Agronomice in Moldova*, 173 (1): 109-124.
- Akkerman, R., P. Farahani and M. Grunow. 2010. Quality, safety and sustainability in food distribution: a review of quantitative operations management approaches and challenges. *OR Spectrum*. 32: 863-904.
- Aslam, M., A. Ghafoor and S. Rasool. 2012. Hedonic Price Estimation for Seed Cotton: A Case Study of District Khanewal, Pakistan. *Pakistan Journal of Applied Economics*, 22 (1 and 2): 67-75.
- Aslam, M., A. Ghafoor, A. H. Hashmi, M. A. Raza and S. Rasool. 2013. Marketing Margins Analysis of Seed Cotton in district Khanewal, Pakistan. *Pakistan Journal of Science*, 65 (2): 224-227.
- Asongu, S. A. and A. R. Andrés, 2020. Trajectories of Knowledge Economy in SSA and MENA countries. *Technology in Society*, 63: 101119.
- Badar, H., A. Ariyawardana and R. Collins. 2015. Capturing consumer preferences for value chain improvements in the mango industry of Pakistan. *International Food and Agribusiness Management Review*, 18: 131-148.
- Badar, H., A. Ariyawardana and R. Collins. 2019. Dynamics of mango value chain in Pakistan. *Pakistan Journal of Agriculture Science*, 56: 523-530.
- Bond, C. A., D. Thilman and J. K. Bond. 2008. Understanding consumer interest in product and processbased attributes for fresh produce. *Agribus*. 24: 231-252.
- Chamhuri, N. and P. J. Batt. 2015. Factors influencing consumer's decision to purchase fresh potatoes in Malaysia. *In: P. J. Batt (Ed.), Acta Horticulture*, 1103:101-108.
- Field, A. 2009. *Discovering statistics using SPSS*. 3rd Ed. Sage Publications. London, UK.
- Government of Pakistan. 2022. *Agricultural statistics of Pakistan 2022*. Ministry of national food security and research, government of Pakistan, Islamabad.
- Hussain, M. B., M. Aslam and S. Rasool. 2013. An Estimation of Marketing Margins in the Supply Chain of Tobacco in district Faisalabad, Pakistan. *Academic Research International*, 4 (6): 402-408.
- Jr., J. E. Z. and T. P. Tran. 2021. Two decades of the Journal of Marketing Channels' research: Providing direction for the future of inter-organizational research, 27: 2-14.
- Kieftenbeld, V. and P. Natesan. 2012. Recovery of graded response model parameters: A comparison of marginal maximum likelihood and Markov chain Monte Carlo estimation. *Applied Psychological Measurement*, 36 (5): 399-419.
- Long, S. 1997. *Regression models for categorical and limited dependent variables*. Sage Publications, Thousands Oak, London, UK.
- Majeed, A and Z. Muhammad. 2018. Potato production in Pakistan: challenges and prospective management strategies. A review. *Pakistan Journal of Botany*, 50: 2077-2084.
- Montouto-Grana, M., S. Cabanas-Arias, S. Porto-Fojo, M. L. Va'zquez-Ode'riz and M. A. Romero-Rodr'iguez. 2012. Sensory characteristics and consumer acceptance and purchase intention toward fresh-cut potatoes. *Journal of Food Science*, 71: 540-546.
- Rasool, S., A. Ghafoor and M. Aslam. 2015. An estimation of marketing margins of inland fish in district faisalabad, pakistan. *Kashmir Economic Review*, 24 (1 and 2): 34-42.
- Roe, M. A. and R. M. Faulks. 2014. Colour development in a model system during frying: Role of individual amino acids and sugars. *Journal of Food Science*, 56: 1711-1713.
- Shah, Z. A., M. A. Dar, E. A. Dar, C. A. Obianefo, A. H. Bhat, A. H., Ali, H. A. Alatawi, H. I. Ghamry, M. Shukry and S. Sayed. 2023. A multinomial approach to sustainable and improved agricultural technologies vis-a-vis socio-personal determinants in apple (*Malus domestica*) cultivation. *Journal of King Saud University-Science*, 34 (7): 102286.
- Smith O. 1987. Effect of cultural and environmental conditions on potato processing. *In Potato Processing*, pp. 73-74.
- Spooner, D. M., K. McLean. G. Ramsay, G. R. Waugh and G. J. Bryan. 2019. A single domestication for potato based on multilocus amplified fragment length polymorphism

- genotyping. Proceedings of the National Academy of Sciences, 102 (41): 14694-14699.
- Stiller, I., S. Dulai, M. Kondrák, R. Tarnai, L. Szabó, O. Toldi and Z. Bánfalvi. 2008. Effects of drought on water content and photosynthetic parameters in potato plants expressing the trehalose-6-phosphate synthase gene of *Saccharomyces cerevisiae*. *Planta*, 227 (2): 299-308.
- Yamane, T. 1967. Elementary sampling theory (pp. x-405). Englewood Cliffs, New Jersey: Prentice-Hall, Inc., USA.
- Yaseen, A., M. Mehdi, S. Somogyi and B. Ahmad. 2016. Consumer preference to pay a price premium for quality attributes in Pakistani grown mangoes. *Pakistan Journal of Commerce and Social Sciences (PJCSS)* 10 (3): 615-637.
- Zaheer, K and M. H. Akhtar. 2016. Potato production, usage, and nutrition-review. *Crit. Review of Food Science Nutrition*, 56: 711-721.

(Received: October 10, 2023; Accepted: February 28, 2024)