Consumer Preferences and Factors Affecting Consumer Purchases of Pomegranates

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Abstract

Specialty crop production account for about 70% of Florida agriculture and is of great economic importance to the state. The farmers in Florida are facing competition from other US States and Mexico and this is pushing them to look for other specialty crops that can be grown in Florida. Pomegranate is the specialty crop that farmers in Florida have expressed interest in the last years and currently farmers have started to experiment growing pomegranates in their farms. In this study we use a sample of data obtained from an online survey and the focus of our study is to analyze the consumers' behavior and determine the factors that are significant in the consumption of the pomegranate. Besides preferences and tastes of consumers in the study we consider other factors such as health benefits due to the high nutritional value of pomegranates.

Introduction

The farmers in Florida are facing competition from other US States and Mexico and this is pushing them to look for other specialty crops that can be grown in Florida and diversify their investment. Pomegranate is the specialty crop that farmers in Florida have expressed interest in the last years and currently farmers have started to experiment in their farms. The fruit is known for its unique characteristics and health benefits. However data is not available when it comes to the total consumption of pomegranate's fruit and juice, total production and amount of acres grown in the United States. Hence in this study we use a sample of data obtained from an online survey and the focus of our study is to analyze the sample collected from a consumer stand point and determine the factors that affect the consumption of the fruit and juice. We obtain significant results that explain the consumer choices in the consumption of pomegranates.

Our main explanatory variables such as seasonality, location of the product, health benefits, internal quality, and relative prices are shown to be significant in determining consumers' consumption. We use two ordered logistic models to analyze the frequency of consumption of the fruit and juice and both models capture well the behavior of the data. Considering the ordered nature of the response variable the logistic model is the most appropriate where we assume that the disturbance term follows a logistic distribution. The two models are estimated independently and they both have variables in common. However the model that uses as a response the frequency of consumption has more explanatory variables than the other model. We expect that some of the main explanatory variables will be statistically significant in both estimated equations. The economic research in the consumption of pomegranates is very limited and mostly focuses on the production side. However using existing literature on other fruits we

are able to analyze the explanatory variables used in the model and explain the association that exists between the explanatory variables and response variables.

Literature Review

In the literature of specialty crops there is not much information of the economic analysis of pomegranates such as consumer patterns, purchasing power or consumer preferences and tastes. Florida's industry in the last years has expressed continuous interest in this crop in order to diversify their portfolio of specialty crops. Competition from other countries has incentivized the industry to invest more in pomegranates. Hence this lack of literature will be complemented with literature from other specialty crops which are discussed thoroughly and major contributions have been made in further enriching the literature on the consumer choices and preferences related to specialty crops. The literature on pomegranates is mostly on the production side and horticulture but our analysis will be on the consumption and purchasing behavior patterns.

Our analysis will be based mostly on consumption side where data from a national survey will be used to determine the main attributes that drive the consumption of pomegranates and how consumers' consumption patterns are affected by information on the health benefits of pomegranates. Growers always look for ways in order to improve the product attributes, competitiveness and marketability by using the information that they receive from consumer demand (Brumfield et al., 1993). A surge in the consumer interest for high food nutrition and the general opinion among the consumers that fresh produce posses the desirable nutrition and fiber have led to an increasing interest among growers to grow fresh produce (Brooker et al., 1987). Consumer choices on the consumption of tomatoes in Jew Jersey are influenced primarily from prices and income rather than product attributes such as color, freshness nutrition and

appearance. None of the latter attributes were significant in determining demand and New Jersey grown tomatoes were primarily perceived as superior quality (Brumfield et al., 1993).

Brooker et al. (1987) finds out that more than one half of consumers in Knox county in Tennessee who purchase tomatoes indicated than they are willing to purchase locally grown at a slightly higher price than for out-of-state tomatoes. However Carroll et al. (2013) finds out that Virginia, Maryland and Pennsylvania prefer locally grown tomatoes while consumers in New Jersey and Delaware prefer state program versions. Toler et al. (2009) finds out that consumers in Oklahoma had the tendency to allocate more of their income in purchasing tomatoes from local farmers rather than nonlocal farmers. A continued growth of the number of farmers markets from 2,410 in 1996 to 4,385 in 2006 reflects the consumer interest in locally produced products. (AMS, 2006).

Data from a national survey find out that consumers place a higher value to locally grown products over organic products (Thilmany et al., 2008). A quite similar result were found by Hu et al. (2009) which investigated Kentucky consumers' willingness to pay and found out that consumer preference were stronger for locally grown blueberries. The studies indicate that consumers' prefer locally grown products and a survey in Colorado by Loureiro and Hine (2002) shows that consumers' WTP is higher for potatoes labeled as "Colorado grown" compared to potatoes designated as organic or GMO free. Same results were found in Minnesota by Yue and Tong (2009) that studied the organic and locally grown tomatoes. Hu et al. (2009) finds that local products and organic formulations received a positive willingness to pay. However Hughner et al. (2007) argues that consumers' interest on organic products varies mostly due to their lack of understanding the term "organic".

Consumer decision process in the consumption of fresh fruits is determined by perception and choice (Shepherd, 1989). Engelet al., (1995) and Mowen (1993) find that motivation is related to preference and choice which both form the consumer attitude. Another important factor is time and it has an impact on the decision making process of the consumer (Assael, 1995, Meiselman, 1996). Income of consumers is another important factor that has an impact on the amount of consumed fresh fruits or freshly produced products. In a survey conducted in UK Dibsdall et al. (2002) finds out that low income groups tend to consume less fruits and vegetables than higher income groups and traditionally they spend proportionally more on food. Dibsdall et al. (2002) finds out that accessibility to fruits and vegetables is not a significant factor for eating healthy but other factors such as motivation and lifestyle present bigger barriers.

Cox et al. (1998) finds out in a survey conducted in UK through the postal service system that consumers might have an incentive to consume more vegetables and fruits if they were informed of how little they presently eat. The study recommends that producers and retailers should promote fruits and vegetables dishes as value for money and they expect a positive change in consumers' daily intake of fruits and vegetables (Cox et., 1998). Informing the consumers on a consistent basis about the health benefits and on the daily intake quantity may prove to have a positive result since many consumers are not aware of the health benefits that a certain fruit may have on their health. Huang (1996) finds that consumer decision is affected by appearance quality of organically grown products and they are less willing to buy organically grown products if sensory defects are present. Consumers may find it difficult to judge the pomegranates by the appearance and that has an effect on purchasing the fruit.

Huang (1996) finds that consumers who are more concerned about the use of chemical pesticides are the potential buyers of organically grown products and high income households

are less willing than low income to accept sensory defects in organically grown products. Many US States have implemented promotion programs for the freshly produced products and the results have been positive. Brown (2003) finds out that a majority of shoppers are not fully informed on the state promotion program. Brown (2003) in a mail survey in southeast Missouri finds that households with knowledge on environmental issues and educated responded positively to paying a higher premium for local produce. Farmers in Florida can use similar programs to promote locally grown pomegranates.

Consumers who are concerned about the food safety and nutritional value are highly likely to consume organically grown products. (Hertog et al., 1997a,b) finds that products that are high in phenolic content reduce cardio- and cerebrovascular diseases and cancer mortality. The rich nutritional content of pomegranates is shown in many studies and high antioxidant activity has been reported (Schubert et al., 1999). The rich levels of antioxidants make the fruit more attractive when it comes to its health benefits. A fruit that is close to pomegranates and exhibits the same properties and has high levels of antioxidants is the blueberry. Blueberries are rich in antioxidants and have anti-inflammatory properties. McLeay et al. (2012) finds that a blueberry smoothie prior to and after an exercise-induced muscle damage helps in speeding the recovery process of the muscle. High nutritional value of pomegranates is an important attribute that will be used in our analysis to determine if consumers are aware of the high nutritional value in pomegranates.

According to Seeram at al. (2005) the economic impact of pomegranates in the food and beverage industry is large and there is still a great potential for growth. This great potential is CAM (complementary alternative medicine) therapies are used by more than 60% of the Americans and more than 60 million Americans use herbal and other supplements with a total

spending of 600 million where extracts of pomegranates are used as ingredients (Seeram et al., 2005). Hu et al. (2011) finds that demographic characteristics play a major role in determining willingness to pay and factors such as consumer income and education affect WTP nonlinearly. While the status of the family health condition represented by existence of diabetes and heart diseases are not significant in explaining the variations in WTP (Hu et al., 2011). Gracia et al. (2011) finds out that consumer preference for natural juice products has an upward trend. In the grocery stores we find that consumers may not be fully aware of all the ingredients that juice may have because the juice may be a mixture of several other In a study by Lawless et al. (2012) three different fruits were used in a sensory evaluation. (blackberry, blueberry and Concord grape). After the consumer group was introduced to information that all three juices were high in anthocyanins consumers responded positively to the consumption of the juice.

Conner and Booth (1998) find that when compared with younger consumers older consumers are willing to accept unusual taste of juices with a pomegranate base, while young consumers prefer orange based juices and dislike unusual tastes. Luckow and Delahunty (2004) argue that the reasons why older consumers are more willing to accept unusual tasting is due to their exposure to different aromas and flavors over time. Older consumers seem to accept exploring other tastes even if it may be quite unusual for their usual tastes. Consumers with high educational level experience a low food neophobia and have an aptitude for uncommon flavors.

(Tuorila et al., 2001) and Nakamura et al. (2001) find that females have a higher preference for sweet foods. Pom wonderful is the main pomegranate that is sold in the US grocery stores and tends to be sweeter than other types of pomegranates. Individuals prefer juices based on pomegranate but rich in sugar and polyphenols and this group of consumers reads the labels of the product even if they are not aware of polyphenols and the study finds out that

unmarried young individuals who eat fruit as a snack do not read the label of the product and they prefer juices based on orange and blood orange (Edrizzi et al., 2010). The complexity of the consumer decision making process imply that the motives and barriers faced by consumers vary between products they select to purchase (Padel and Foster, 2005).

In the recent years minimally processed vegetables and fruits are purchased by a wide range of consumers and families with young children and higher education have a tendency to buy more this type of products (Ragaert et al., 2003). Ragaert et al., (2003) finds that consumers prefer purchasing minimally processed vegetables and fruits due to convince and speed but consumers in the survey showed that they were willing to trade off speed and convince at a certain extend against health. Consumer decision making process is based on different criteria and heterogeneity among them makes it the process difficult. Grunert et al. (1996) and Steenkamp (1989) divide attributes into intrinsic and extrinsic.

In their daily decisions to purchase fruits and vegetables consumers use their previous experience in making better choices and they start to become aware of product attributes (Gardial, Clemons, Woodruff, Schumann, & Burns, 1994). Pomegranates are one of the fruits that cannot be tried in advance before buying them so according to Zeithaml (1998) consumers will have to rely of extrinsic attributes such as package and appearance. Ragaert et al. (2003) finds that consumers who purchase minimally processed vegetables show less interest in taste and information.

In the grocery stores you may also find packaged pomegranate arils that consumers are willing to buy since they are able to see the arils appearance and they will rely on it. At the buying stage search attributes were more significant and experience attributes were important at consumption stage and credence attributes such as safety were important in both buying and

consumption stage. (Ragaert et al., 2003). Karp (2006) finds out that only 5% of US consumers have tried fresh pomegranates prior to 2006 and Anon (2008b) finds that efforts to increase domestic consumption and establish export capacities are being made by US growers. Anon (2009) finds that US retailers offer whole pomegranates to consumers that are marketed for use in desserts and salads and pomegranates are sold at weekly Farmer's markets.

The largest producer of pomegranates in the US is Pom Wonderful which also produces high quality juice (University of California, 2009). Pomegranate juice is either 100% concentrated or is blended with other distinct fruits. Many studies in consumption of pomegranate juice find improvements in the health conditions of consumers. However consumers are not aware of the many benefits that the consumption of pomegranates has on health conditions and sporting activities. The literature agrees on many points that highly educated individuals are more likely to consume products that are organic and high in nutritional value. These individuals would prefer to consume locally grown products and organic. While low income households would spend more of their income on food and they are less likely to consume organic products or locally grown products.

Method Section

The endogenous variables in our models are frequency of consumption of pomegranates and juice. Let y^* denote a latent variable and let us specify the model as follows.

$$y^* = \boldsymbol{x}'\boldsymbol{\alpha} - \varepsilon$$

where the latent variable y^* is unobserved and $\boldsymbol{x_i}$ is a K $\times$ 1 vector of regressors. We observe

$$\begin{aligned} \mathrm{y} &= 0 \quad \text{if} \quad \mathrm{y}^* \leq 0 \\ &= 1 \quad \text{if} \quad 0 < \mathrm{y}^* \leq 1 \\ &= 2 \quad \text{if} \quad 1 < \mathrm{y}^* \leq 2 \\ &= 3 \quad \text{if} \quad 2 < \mathrm{y}^* \leq 3 \end{aligned}$$

$$= 4 \quad \text{if} \quad 3 < \text{y}^*$$

where y is an ordered endogenous variable and is the frequency of consumption of pomegranates. This model is the first model that we will estimate using maximum likelihood. In the second model y is the frequency of consumption of pomegranate juice and we specify the model as follows

$$y^* = \boldsymbol{z}'\boldsymbol{\beta} - u$$

where $\boldsymbol{z}$ **is** Q $\times 1$ vector of regressors. We observe

$$\begin{aligned} \text{y} &= 0 \quad \text{if} \quad \text{y}^* \leq 0 \\ &= 1 \quad \text{if} \quad 0 < \text{y}^* \leq 1 \\ &= 2 \quad \text{if} \quad 1 < \text{y}^* \leq 2 \\ &\vdots \\ &= 7 \quad \text{if} \quad 6 < \text{y}^* \end{aligned}$$

The order of the endogenous variable y is important in both models and we assume that the stochastic terms $\varepsilon|\boldsymbol{x}$ and $u|\boldsymbol{x}$ are both logistically distributed. We use maximum likelihood estimator in order to derive the estimates $\boldsymbol{\alpha}$ for model 1 and $\boldsymbol{\beta}$ for model 2. The log likelihood function for the 1st model is:

$\sum_{i=1}^{N}\{\sum_{j=1}^{m-1} 1\{y_i = j\} log\left[F\left(c_j - \boldsymbol{z}'\boldsymbol{\alpha}\right) - F(c_{j-1} - \boldsymbol{z}'\boldsymbol{\alpha})\right] + 1\{y_i = 0\} \log[F(c_0 - \boldsymbol{x}'\boldsymbol{\alpha})] + 1\{y_i = m\} \log\left[1 - F(c_{m-1} - \boldsymbol{x}'\boldsymbol{\alpha})\right]\}$

where $j = 0,1,2,3,4$ are the alternatives for the first model. And c_j are the thresholds which in our case are all known such as $c_0 = 0, c_1 = 1, c_2 = 2, c_3 = 3$, and $c_4 = 4$. The log likelihood function for the 2nd model

$\sum_{i=1}^{N}\{\sum_{j=1}^{m-1} 1\{y_i = j\} log\left[F\left(c_j - \boldsymbol{z}'\boldsymbol{\beta}\right) - F(c_{j-1} - \boldsymbol{z}'\boldsymbol{\beta})\right] + 1\{y_i = 0\} \log[F(c_0 - \boldsymbol{z}'\boldsymbol{\beta})] + 1\{y_i = m\} \log\left[1 - F(c_{m-1} - \boldsymbol{z}'\boldsymbol{\beta})\right]\}$

where $j = 0,1,2,3,4,5,6,7$ are the alternatives and the thresholds are $c_0 = 0, c_1 = 1, c_2 = 2, c_3 = 3, c_4 = 4, c_5 = 5, c_6 = 6$, and $c_7 = 7$.

F(.) is the logistic distribution $\Lambda(x) = \frac{exp\{x\}}{1+\exp(x)}$

Data

The main objective of the survey was to collect information on consumers' consumption on pomegranate fruit and juice and determine the factors that are associated with the consumption. The survey was conducted online on a national level and a sample of 2023 was collected. Questions in the survey were divided in two groups. The first group of questions aimed in indentifying how factors such as fruit location in the grocery store, season of the fruit, relative price of other fruits and juices, internal quality of the fruit, sweetness of the fruit and juice and color of the arils are associated with the consumption. The second group of questions aimed in observing the consumption when consumers are faced with information related to the nutritional value of the fruit and juice.

Our main question is to find out the factors that impact the consumption of pomegranate whole fruit and juice. In our analysis we have two important dependent variables: frequency of consumption of whole pomegranate and frequency of consumption of pomegranate juice.

	Freq of Poms Consumption	Freq of Juice Consumption	Location	Season	Relative Price	Internal Quality	Sweetness	Color	Antioxidants	Nutrition	Exercising
Mean	1.32	0.87	2.70	0.20	0.20	0.22	6.59	6.05	4.59	4.54	4.46
Standard Error	0.04	0.03	0.04	0.01	0.01	0.01	0.03	0.04	0.02	0.02	0.03
Median	0.00	0.00	2.00	0.00	0.00	0.00	7.00	7.00	5.00	5.00	4.00
St. Dev	1.69	1.42	1.71	0.40	0.40	0.42	1.52	1.87	0.92	0.90	1.19
Kurtosis	-1.34	0.33	-0.28	0.16	0.15	-0.21	5.41	1.50	2.44	3.44	0.14
Skewness	0.67	1.34	1.00	1.47	1.47	1.34	-2.06	-1.34	-0.97	-1.05	-0.44
Range	4.00	7.00	6.00	1.00	1.00	1.00	8.00	8.00	6.00	6.00	6.00
Minimum	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Maximum	4.00	7.00	6.00	1.00	1.00	1.00	8.00	8.00	6.00	6.00	6.00
Count	2023	2023	2023	2023	2023	2023	2023	2023	2023	2023	2023

Frequency of consumption of whole pomegranate is an ordered dependent variable coded as freqpom where 1 is for daily, 2 for weekly, 3 less than monthly, and 4 for monthly consumption. In the survey consumers had to choose how much they consume pomegranates and the other dependent variable frequency of consumption of pomegranate juice is coded as freqjuice where 1 is for daily, 2 for weekly, 3 less than monthly, and 4 for monthly consumption. Considering the ordered nature of our dependent variables we will use an ordered logit model where we assume that our disturbance term has a logistic distribution. The ordered nature of our response variables leads us to test for heteroscedasticity and use weights to correct for this problem that might lead to biased estimates.

We are aware that the order matters and important information is contained in the way the dependent variable is ordered. Since we have two dependent variables frequency of consumption of whole pomegranate and frequency of consumption of pomegranate juice we will consider two sets of independent variables. So we will estimate two models. The first model to estimate will have freqpom as a response variable and the predictors will be location, season, relative price of other fruits, internal quality, sweetness, color, antioxidants, nutrition, and exercising. However in the first model that we will estimate we will also control for interaction among the independent variables. The interaction variables are internalquality*color, sweetness*color, antioxidants*nutrition and antioxidants*exercising. The four interaction terms will be included in estimated the first model where the dependent variable is frequency of whole pomegranate consumption. In grocery stores consumers find it difficult to locate pomegranates and we expect that the sign of the estimated coefficient on location to be negative and

significant. Location is a categorical independent variable coded from 1 to 6 where 1 indicates that the consumer never looks for the product, 2 that it is much easier to find pomegranates and 6 for much harder to find pomegranates.

Season is another independent variable and we expect that during the season of pomegranates consumption will increase and the sign of the estimated coefficient of season to be positive and significant. Season is a binary variable coded as 0 for not season and 1 for season. As relative price of other fruits will increase we expect that the sign of the estimated coefficient on relative price to be positive and significant. Internal quality of the pomegranate fruits is a major factor since when consumers purchase pomegranates they are unable to observe the internal quality of the product but we expect that the estimated coefficient of internal quality to be statistically significant and have a positive sign. Internal quality is a binary variable where 1 indicates that it matters to consumers and 0 that it is not important.

In our model we control for sweetness which we expect that the estimated coefficient to be not significant variable. Sweetness is coded from 1 to 8 where 1 indicates the least amount of sweetness and 8 the maximum amount of sweetness. Color is expected to be significant and have a positive impact on the consumption of the fruit. Color is coded from 1 to 8 where 1 indicates less attractive color and 8 is the red ripe color which tends to be highly preferred from consumers. Antioxidants and nutrition are expected to be significant and have a positive impact on the consumption of the fruit. Pomegranates are high in antioxidants and consumers that are aware of the nutritional value tend to consume more of the fruit. We also expect that consumers who exercise are more likely to consume pomegranates and the estimated coefficient on exercise will be statistically significant and positive.

The three last independent variables; antioxidants, nutrition and exercising are coded on a 1 to 6 level, where consumers were asked if they concur with the statement about pomegranates and 1 indicates “strongly disagree”, 2 “disagree”, 3 “neither agree nor disagree”, 4 “agree”, 5 “strongly agree” and 6 “I don’t know”. The four interaction terms are important for our analysis. An interaction between internal quality and inside color of the fruit will have a positive impact on the consumption of the fruit and we expect that the estimated coefficient to be positive and significant. We also control for another interaction between color and sweetness and don’t except that estimated coefficient to be significant. We expect that the interaction between nutrition and antioxidants to have a positive impact on the consumption of the fruit and be statistically significant. The last interaction effect is between antioxidants and exercising and we expect that the estimated coefficient of the interaction term to be statistically significant.

The second model will have as dependent variable the frequency of consumption of pomegranate juice. The dependent variable is ordered where 1 is for daily, 2 for weekly, 3 less than monthly, and 4 for monthly consumption of juice. However the independent variables that we will be using will be relative price, sweetness, color, antioxidants, nutrition, exercising, sweetness*color, antioxidant*nutrition, antioxidant*exercising, and nutrition*exercising. We expect that all this variables to be statistically significant and have the same signs as described in the first model.

Table 1: Percentages of consumption of pomegranate and other juices

	In the last week	In the last month	In the last 3 months	In the last year	Very rarely or never buy
100% Pomegranate Juice	5%	11%	13%	7%	65%
Juice blend with pomegranate juice	6%	13%	13%	11%	58%
100% Grape Juice	13%	14%	16%	18%	39%
Juice blend with grapefruit juice	4%	9%	12%	8%	67%
100% Orange Juice	41%	11%	9%	23%	16%
Juice blend with orange juice	14%	13%	12%	17%	44%
100% Apple Juice	20%	15%	16%	18%	30%

In table 1 we present in terms of percentages the consumption of pomegranate and other juices across different periods where the results were derived from our sample. The consumption of 100% pomegranate juice in the last week is the lowest when compared with the other 100% juices such as apple, and orange juice. Also 65% of the consumers responded that they consumed 100% pomegranate juice very rarely or never buy. And 58% of the consumers responded that they very rarely or never buy juice blend with pomegranate juice. While in the last month and in the last three months consumers responded that they consumed 11% and 15% respectively and juice blend with pomegranate juice was at the same level of 13% for the last month and in the last three months. As we can see from the results consumers in the survey showed that they do not consume pomegranates in a frequent basis when compared to the consumption of other juices such as orange and apple juice.

Table 2: Percentages of consumption of pomegranate and other fruits

	In the last week	In the last month	In the last 3 months	In the last year	Very rarely or never buy
Pomegranate	4%	10%	18%	8%	60%
Grapes	32%	17%	19%	23%	9%
Strawberry	35%	12%	19%	23%	11%
Grapefruit	10%	12%	16%	11%	50%
Tangerine/Mandarin/Clementine	21%	15%	18%	22%	25%
Peach	10%	15%	40%	12%	23%
Banana	57%	9%	6%	21%	6%
Goji Berry	1%	2%	4%	1%	92%
Cactus Pears	1%	2%	4%	1%	92%
Starfruit (carambola)	1%	3%	7%	1%	88%

In Table 2 we summarize the percentages of consumption of pomegranate and other fruits. The results indicate that only 4% of the consumers had pomegranate fruit in the last week and in the last month 10% responded that they consumed the fruit. While the percentage of consumers that had pomegranates in the last three months was 18%. However 60% of consumers responded that they consumed very rarely or never buy pomegranates. The percentages in this case for the consumption of the pomegranate fruit follow the results obtained on Table 1 where 65% of the consumers responded that they very rarely or never tried 100% pomegranate juice. Consumption of other fruits such as strawberries and grapes is higher when compared to the consumption of pomegranates.

Analysis and discussion

The first model we estimate in Table 3 is an ordered logistic model.

Table 3: Ordered Logistic Model

	Coef	(St.Err)
Explanatory Variables		
Location	−0.25***	(0.03)
Season	0.97***	(0.11)
Relative Price	0.29***	(0.11)
Internal Quality	1.76***	(0.47)
Sweetness	0.06	(0.10)
Color	0.31***	(0.11)
Antioxidants	0.62***	(0.23)
Nutrition	−0.49	(0.34)
Exercising	1.01***	(0.29)
Interaction Terms		
Internal Quality × Color	−0.17**	(0.07)
Sweetness × Color	-0.01	(0.02)
Antioxidants × Nutrition	0.08	(0.07)
Antioxidants × Exercising	−0.21***	(0.06)
N	2023	

Note: Cell entries are logit coefficients with robust standard errors. *p < .10, **p < .05, ***p < .01, two tailed test

The results obtained from estimating the first model indicate that location, season, relative price, internal quality, color, antioxidants and exercising are all statistically significant at .01 significance level. While the estimated coefficient for the interaction term internal quality*color is statistically significant at .05 significance level and the interaction term

antioxidants*exercising is statistically significant at .01 significance level. The estimated coefficient for location is statistically significant at .01 and the negative sign of the estimated parameter indicates that consumers' consumption of the pomegranate fruit is affected negatively by the difficulty in locating or not availability of the product in the store. Season is statistically significant at .01 and it shows that during the season the consumption of pomegranates' increases. As relative prices of other fruits in the grocery stores increases consumers tend to buy more pomegranates as indicated by the positive sign in the estimated coefficient for relative price that is significant at .01. Internal quality and color are both statistically significant at .01 and their signs are positive indicating that color of the arils and the internal quality lead to an increase in the consumption.

In our estimated model sweetness is not statistically significant. Antioxidants and exercising are both statistically significant at .01 significance level and they have positive signs on the estimated coefficients. This shows that consumers are aware of the health benefits that antioxidants have and their presence in high levels in pomegranates. The significance at .01 of the estimated coefficient for exercising indicates that consumers are aware that pomegranates are good before and after exercising activity. The only estimated coefficients of interaction effects that are statistically significant are internal quality*color and antioxidants* exercising. The estimated coefficient for the interaction term internal quality*color has a negative sign indicating that as we improve the internal quality of the fruit the effect of color decreases. And the estimated coefficient for the interaction term antioxidants*exercising has a negative sign which shows that as the level of antioxidants increases the effect of exercising decreases.

Table 4: Ordered Logistic Model

	Coef	(St.Err)
Explanatory Variables		
Location	−0.193***	0.035
Relative Price	0.021	0.117
Sweetness	0.078	0.103
Color	0.171	0.113
Antioxidants	1.134***	0.311
Nutrition	0.387	0.386
Exercising	0.973***	0.305
Interaction Variables		
Sweetness × Color	0.003	0.016
Antioxidants × Nutrition	−0.054	0.080
Antioxidants × Exercising	−0.220***	0.064
N	2023	

Note: Cell entries are logit coefficients with robust standard errors. *p < .10, **p < .05, ***p < .01, two tailed test

The results represented in Table 4 are for the second model we estimate using maximum likelihood estimation method. The estimated coefficient for the variable location is statically significant at .01 indicating that consumers find it difficult to locate pomegranate juice or juice blended with pomegranates. While as we can see from the Table 2 the estimated coefficients for relative price, sweetness, and color are not statistically significant in this model. While the estimated coefficient on antioxidants and exercising is statistically significant at .01 which indicates that consumers are aware of the health benefits for exercising and high level of antioxidants in the pomegranate juice or any other juice which is blended with pomegranates.

From the interaction terms the only variable that is statistically significant is antioxidants and exercising indicating that as antioxidants increase the effect of exercising decreases. From Table 2 results we can say that consumers do not consider significant the relative price of other juices, sweetness and color.

Conclusion

The results from the two models indicate that location, exercising, and antioxidants are all important for consumers when they consume the fruit and juice. While from the models we see that the interaction between exercising and antioxidants is negative this implies that when consumers increase their exercising activity that has a negative impact on the effect of antioxidants and vice versa. The results estimated from the two models indicate that consumers are aware of the high level of antioxidants and that pomegranates' help in exercising activity due to their high nutritional value. Internal quality of the fruit is statistically significant and that shows that consumers would prefer a fruit that is good from inside.

Surprisingly consumers do not deem sweetness as a significant variable in the consumption of the fruit and juice. It seems that consumers do not prefer the fruit or the juice to be sweet as we would have expected. Consumers are willing to experiment with other flavors that are not sweet. The relative price of other fruits is significant when it comes to the frequency of consumption of the fruit however the variable is not significant for the consumption of juice. Relative price of other juices doesn't seem to have a significant effect on the consumption of pomegranate juice.

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