

## Households' Preferences for Dried Fruit And Nuts Consumption and their Willingness to Pay for Improved Quality of Local Products

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### Abstract

*This research work examined households' preferences for dried fruit and nuts consumption and their willingness to pay for improved quality of local products. A random sample of 200 households from urban and rural areas of Peshawar and Mardan were interviewed face to face for data collection. In the survey households' preferences for dried fruit and nuts were examined using 5-point Likert scale and their willingness to pay for improved quality produced was measured using open ended questionnaire. Results showed that on average, households are consuming considerable number of peanuts, almonds, raisins, walnuts, pistachio and cashew. They have strong preferences for dried fruit and nuts consumption in winter season and they were aware of its dietary importance for a normal human growth. On average the probability of households to pay for improved version of the local dried fruit and nuts were 0.9 (90 percent) and they were willing to pay a price premium of 37percent for the improved quality version. Regression analysis shows that head's education, job status, households' perception of the importance of dried fruit for human health and monthly income of the respondents are important determinants of households' WTP for dried fruit and nuts. As households were willing to pay considerable amount for improved quality version, the study recommends producers and processor to take necessary actions towards quality improvement of their produce. Awareness and introduction of oven drying techniques at subsidized rates can improve our products quality and their large-scale production.*

**Keywords:** *Dried Fruit and Nuts, Willingness to Pay, Contingent Valuation Method, Price Premium, Khyber Pakhtunkhwa, Pakistan.*

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### Introduction

Dried fruit are products of fresh fruits from which water is removed through different process (dehydrated figs, apricots, dried cherries, dried mangos, etc). Nutrient's content of fresh and dried fruits is almost same. By weight, the fiber content, vitamins and minerals in dried fruit is approximately 3.4 times more than fresh fruits (Bjarnadottir, 2017). Nuts are edible seeds, enclosed in a smooth or hard outer shell, utilized in the human diet (cashew nuts, pistachios, almonds, and walnuts). They can be consumed raw, can be roasted

or added to salad and flavoring foods. Tree nuts (also called dry fruits), e.g. almonds, walnuts, cashew, pistachio and raisins are called power house of nutrients. If consumed in reasonable quantity, most of the essential nutrients required for a healthy human body growth and functions (Kumar, 2018).

Dried fruit improve digestion and provide essential fatty acids required for stability in blood pressure and control in lipid level. They also increase energy and improve stamina which results in overall healthy life. For a vegetarian person the deficiency of iron and protein can be fulfilled with dried fruit consumption. They are good source of some vitamins and minerals which lead to healthy bones, teeth, skin and muscles (Khare, 2017). Dried fruit and nuts are considered as best source of essential nutrients as they provide protein, fatty acids, potassium, dietary fibers and bioactive compounds. They improve human health by reducing the chances of obesity, cardiovascular illnesses as well as they overcome the possibilities of diabetes (Carughi et al., 2015 ). Certain antioxidants in grapes and other dried fruit may help improve insulin response and protect the pancreas against inflammation and oxidative stress (Picincu, 2019). Dried plums are good source of vitamin K potassium and antioxidant phenolic acid and helps in bone formation. Almond and cashew have antioxidants which can beat cancer specifically breast cancer. Phytonutrients, found in apricots and apples, act as antioxidants and prevent the growth of cancer-causing cells. Lungs and prostate cancer can be reduced by antioxidant qualities of pistachio (Nair, 2019).

According to the 2017-18 statistics for tree nuts production, USA was the leading producer and it accounted for 38 percent of the total world's production. Its tree nut production was composed of almonds (62 percent), pistachios (17 percent), and walnuts (16 percent). Turkey and China were ranked as second and third producer for tree nuts, respectively. In dried fruit production, Turkey was the world top with a 19 percent share in overall production, and its top products were dried grape, dried apricot and dried fig. USA was the second top producer with a 12 percent share in overall production and was the first world prune producer and the second and third world dried grape and dried fig producer, respectively. Saudi Arabia and Iran were first and second leading table date producers, respectively (International Nut and Dried Fruit Council, 2018-19).

On consumption side, in 2016, the tree nuts consumption increased by 60 percent as compare to its consumption level in 2006. In high income economies<sup>1</sup>, almonds were the most consumed tree nut, followed by walnuts and cashews in equal proportion. In middle income economies<sup>2</sup>, walnuts were the most consumed tree nut, followed by cashews, pistachios and almonds. China, Iran, India, Turkey and Vietnam had an important relative weight as consumers of these nuts. Similarly, the consumption of dried fruit was higher in the high income economies, and a notable increase was observed in middle income economies. In 2016, dried grapes and dates were the highly consumed dried fruits both in high and middle-income economies (International Nut and Dried Fruit Council (INC), 2018-19).

These production and consumption statistics reveals that in low-income economies the production and consumption of nuts and dried fruit are low. According to INC, 2018-19, the world's nuts and dried fruit monthly consumption expenditure share is 14 percent. However in Pakistan it is less than 1 percent of total monthly consumption expenditure (GoP, 2015-16). Expenditure share of nuts and dried fruit is on average 0.72% in the total monthly consumption expenditure per household. As compared to the world's average consumption expenditure level this figure is significantly lower (GoP, 2015-16).

Unfortunately, these valuable food stuffs can be contaminated and spoiled by microorganisms. As reported by USDA-Economic Research Service (2018), 18.9 billion pounds of fruits and vegetables are lost annually due to spoilage. Bacteria, fungi and insects are mainly involved in spoilage of these food stuffs. Food

<sup>1</sup> In high income economies per capita income is \$12,746 or more (Australia, Chile, Europe, USA...).

<sup>2</sup> In middle income economies per capita income is in the range of \$1,046 to \$12,746 (China, Cote d'Ivoire, India, South Africa...). In low income economies per capita is \$1,045 or less (Afghanistan, Burkina Faso, Kenya, Zimbabwe...).

contaminated with pathogens, such as Zygomycetes and Aspergillus result in acute poisoning, liver diseases, cancer and neural tube defects which are major causes of morbidity and mortality among immune suppressed population.

Pakistan's local dried fruit and nuts are of low quality because of microbial and insects contamination and spoilage. The sun-drying is a traditional method that raises the risks of contamination caused by microbes (Karam et al., 2016). All sun-dried fruit must be pasteurized to destroy any microbes, insects and their eggs. This can be done with heat or cold. Heat treatment (microwave/ oven-drying technique) benefit producers with shorter drying times, improved product quality and flexibility in producing a wide variety of dried products (Parit and Prabhu, 2017).

The use of advanced fruit drying and processing technologies for improved quality products would definitely rise cost. However, profit estimation and feasibility analysis for such transformation requires detailed study on consumers' preferences and their willingness to pay for improved quality produced and this was the main subject of this research work. This research work is designed to investigate households' preferences for dried fruit and nuts consumption; to elicit households' willingness to pay (WTP) for improved quality of local produce, identify its determinant; and forward policy recommendation for production and consumption of improved quality products

## Research Methodology

Details on data collection and analysis for achieving the objectives of the study are provided below.

### Study Area and Sampling

This research was done in rural and urban areas of Mardan and Peshawar districts. These are the most populated districts of the Khyber Pakhtunkhwa province of Pakistan and are big markets for agricultural products.

Mardan district spread over an area of 1,632 kilometer square. Its total population, according to 2017 consensus, is 2,373,061. Administratively, Mardan district is subdivided into five tehsils; Takhtbhai, Rustam, Katlang, Gharikapura and Mardan. It is famous for its archaeological sites of Takhtbhai, Jamal garhi and Sawaldhe.

Less number of populations is involved in industrial and employment sectors. Mardan has hot summers and very cold winters. Sometimes it experience thunder storms and hail storms. Economy of Mardan is improved by Rashakai town located at Nowshera and Mardan road because it is one of the important zone of China Pakistan Economic Corridor.

Peshawar district spread over an area of 1,257 km<sup>2</sup>. Its total population is 4,269,079 since GOP 2017. This district has one tehsil that is Peshawar tehsil. The district has four towns, 92 UCs out of which 56 are rural and 36 are urban. Economic position of the district was improved by Khyber Pass which was ancient travel route of trade between the countries.

Tourism played significant role in economy of Peshawar in the mid-20th century. The backbone of trade in Peshawar is the City Center road. University of Peshawar was established by the prime minister of Pakistan in October 1950. The district has hot summers and mild winters; the average rainfall levels in winters are higher than those of summers.

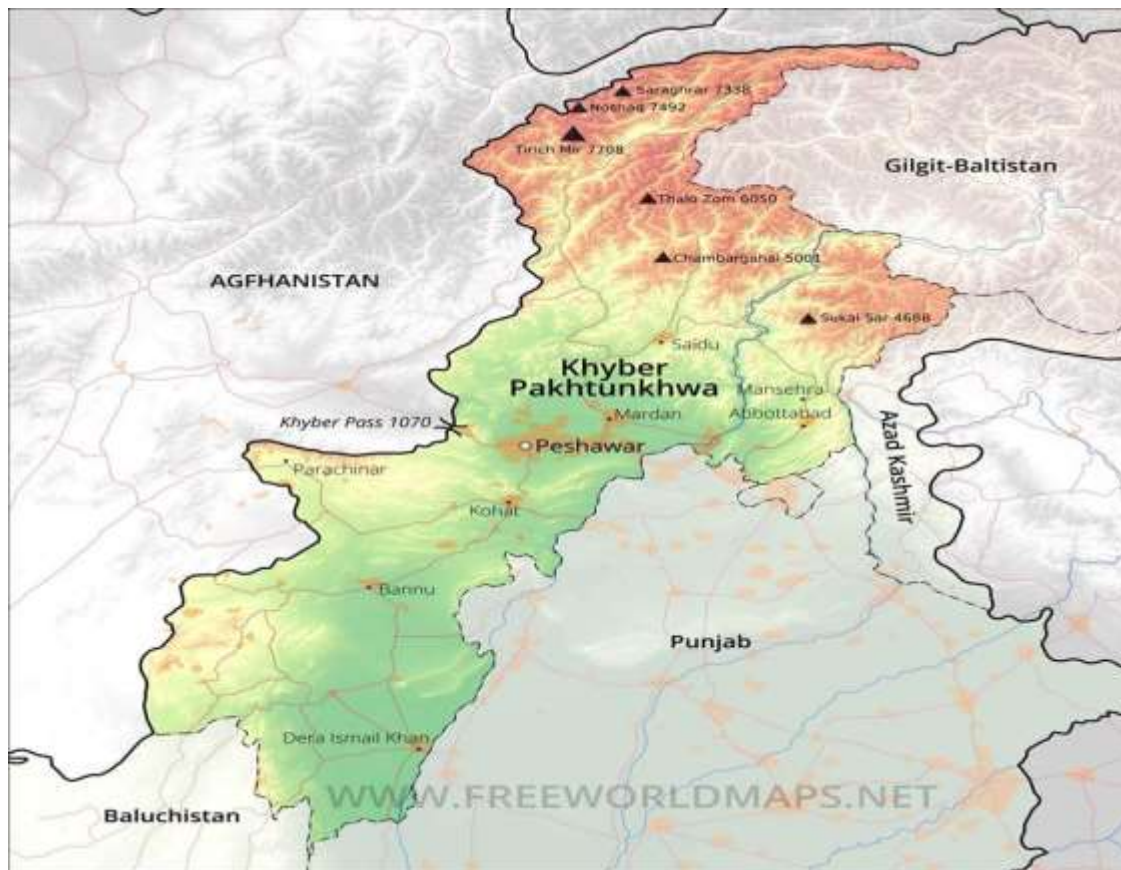


Figure 1: Khyber Pakhtunkhwa Districts

To select a best representative sample of households for this study, a multistage stratified random sampling technique was used. In the first stage, both Mardan and Peshawar districts were randomly selected from Khyber Pakhtunkhwa province of Pakistan. In the second stage one urban and one rural UC were selected from each district. Thus, in total 2 urban and 2 rural union councils were selected from the study area. 100 households were selected randomly and collectively samples of 400 households were randomly selected from the study area. Due to financial and time constraint the proper sampling techniques such as proportional allocation sampling, etc., were not applied for sample selection at the 3rd stage of sample selection. And the sample selection was restricted to 200 respondents.

The required data set, such as information regarding households' preferences for nuts and dried fruit consumption and their willingness to pay for improved quality local produce, were collected through a well-structured questionnaire from the sampled households.

#### **Elicitation of Households' Preferences and WTP**

Households' perception of the importance of dried fruit and nuts for human health and their preferences for consumption of different dried fruit and nuts was quantified over a 5 points Likert scale, and were analyzed through descriptive statistical tools. Their willingness to pay for improved quality version of the local nuts and dried fruit were elicited using contingent valuation survey method (CVM). CVM is a survey-based method used for measuring consumers' preferences and their WTP for food attributes (Khan et. al., 2018; Khan et. al., 2019).

WTP question: Suppose your favorite dried fruit and nuts available in a local market cost you around Rs.500 per Kilogram. Our local dried fruit and nuts are of low quality. Microbial and insects contamination is responsible for their quality degradation. If an improved quality of the same dry fruits and nuts, free of microbes and insects are available in the local market. Would you and your households like to consume them?

Ans: Yes/ No

If Yes, then “how much you would like to pay above 500 rupees per kilograms for the best quality of dried fruit and nuts?”

Ans: \_\_\_\_\_ rupees per kilogram

**Econometric model for WTP estimation**

The following Log-Log model was used to estimate households’ WTP for improved quality of local nuts and dried fruit.

$$\ln(WTP_i) = \alpha_0 + \alpha_1 \log(X_{1i}) + \dots + \alpha_n \log(X_{ni}) + \varepsilon_i \quad (1)$$

Where:

- WTP is the ith household WTP per kg of the improved quality nuts and dried fruit.
- Ln is the natural log.
- i = (1,2,3,...,I) number of households (sample).
- X= is the explanatory variables.
- ε = is the error term.

**Results and Discussion**

**Socioeconomic characteristics of the households’**

Summary statistics for socioeconomic characteristics of the sampled households’ are given in Table 1. Head’s age was on average 53 years, 91 percent of them were male; 52 percent of them were on government jobs and their average education level was around 10 years of schooling. Average household size was 6 individuals and the number of working individuals per household were around 2. Their average monthly income was 55595 Pakistani Rupees (PKR)and monthly food consumption expenditures were 29451 PKR.

Table 1: Households’ Socio-demographic characteristics

Variables	All	Min	Max	Std. Dev
Age	53.21	28	76	11.357
Gender	0.91	0	1	0.2869
Education	9.985	0	22	5.324
Job status	0.525	0	1	0.501
Household size	6.485	3	12	1.875
No of working Individuals	1.67	0	5	0.908
Income	55595	20000	200000	26100.14
Food Consumption	29451	7000	50000	8352.608

**Households’ Perception about dried fruit and nuts consumption**

Table 2 shows perception of households’ related to the quality of dried fruit and nuts that are locally produced. Information was gathered from households’ through Likert scale technique. The scale was constructed into 1-5 points starting from 1 (extremely important / very high / very good) to 5 (do not know).

In response to the question related to dried fruit and nuts in human diet, 26% of the respondent believed that they are extremely important, 32 percent replied with important, 19 percent respond with somewhat important, 20.50 percent answered with less important and 2 percent don’t know about its inclusion. The 25.50 percent respondents rank the dried fruit and nuts for mental health as very high, 38 percent replied as high, 18 percent respond as low, 17.50 percent answered with no whereas 1 percent replied with don’t know about its importance.

In response to the question related to role of dried fruit and nuts in proper heart functioning, 13 percent of the respondent rank them as very high, 45 percent response as high, 17 percent answered with low, 23.50 percent react as no while 1.50 percent don’t know about its role. The importance of dried fruit and nuts for stronger bone formation, 19 percent respondent rank them as very high, 38 percent answered as high, 21.50 response as low, 18.50 replied with no and 3 percent react as don’t know about its importance.

The 14.50 percent respondents believed that consumption of dried fruits and nuts for shiny skin and hairs as very high, 51 percent respond as high, 19.50 replied as low, 15 percent react as no and 5 percent don’t know about its importance.

The market price of available dried fruit and nuts, 28 percent respondents ranked its prices as very high, 21 percent replied high, 22 percent answered as reasonable, 11.50 percent respond low while 17.50 don’t know about its price. The quality of dried fruit and nuts, 16 percent of the respondent ranked its quality as very high, 17 percent respond as high, 39 percent replied as reasonable, 27 percent answered as low whereas 1 percent react as don’t know about is quality.

About the processing and production method of dried fruit and nuts, no one respond as very good, 22 percent believed as good, 38 percent react with low, 17.50 answered as bad while 22 percent don’t knows about its methods.

In replied to the question related to the comparison of the quality of our local products with those imported from Afghanistan, Iran, Turkey, China and USA, 15 percent of the respondent believed the quality as very good, 20 percent as good, 29 percent react as low, 19,50 respond as bad and 16.50 percent don’t know about its comparison.

Table 2: Households’ perception/ awareness about dried fruit and nuts

<b>Perception/ Awareness questions</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>
How much important is the inclusion of dried fruits and nuts in a human diet?	26.00 Extremely important	32.00 Important	19.00 Somewhat important	20.50 Less important	2.00 Do not know
How would you rank the importance of dried fruits and nuts for proper mental growth?	25.50 Extremely important	38.00 Important	18.00 Somewhat important	17.50 Less important	1.00 Do not know
How would you rank the role of nuts and dried fruits in proper hearth functioning?	13.00 Extremely important	45.00 Important	17.00 Somewhat important	23.50 Less important	1.50 Do not know

How would you rank the importance of dried fruits and nuts for stronger bones formation?	19.00 Extremely important	38.00 Important	21.50 Somewhat important	18.50 Less important	3.00 Do not know
What is the importance of nuts and dried fruits consumption for good and shiny skin and hairs?	14.50 Extremely important	51.00 Important	19.50 Somewhat important	15.00 Less important	0.00 Do not know
How would you rank the market price for the available dried fruit and nuts?	28.00 Very High	21.00 High	22.00 Low	11.50 Very low	17.50 Do not know
How would you rank the production and processing of local dried fruit and trees nuts?	16.00 Very good	17.00 Good	39.00 Poor	27.00 Very Poor	1.00 Do not know
How would you rank the quality of local dried fruits and nuts?	0.00 Very good	22.00 Good	38.00 Poor	17.50 Very Poor	22.00 Do not know
How would you rank the production and processing of local dried fruit and trees nuts production?	15.00 Very good	20.00 Good	29.00 Poor	19.50 Very Poor	16.50 Do not know

Source: Survey data

### Households' WTP question response

A question related to the willingness to pay was asked from respondents that if their favorite dried fruit and nuts are available in a local market cost Rs. 500 per Kg. During their production and processing, different chemicals and pesticides are used which effects quality of these fruits. If a better quality of same nuts and dried fruit are offered in the local market, would your household liked to consume? Results of the survey showed that 90.50 percent of the respondent answered as yes and 9.50 percent respond as no. The average of the respondents was willing to pay 37 percent (186PKR) price premium for improved quality local produce. Households' response regarding their willingness to pay is shown in table 3.

Table 3: Households' WTP for Improved Quality Produce

WTP question	Willingness To Pay Response		Price Premium (per Kg)
	Yes	No	
WTP for improved dried fruits and nuts	90.50%	9.50%	37% on current price (186 PKR)

Source: Survey data

### Consumption of dried fruit and nuts in winter and summer seasons

#### Winter Season

Table 4. shows the descriptive statistics of households' consumption of dried fruit and nuts share in winter season. On average the sample households' mostly consume peanuts (2.17 kg/m), almonds (1.299 kg/m), raisins (1.105 kg/m) and walnuts (1.015 kg/m) as compared to other dried fruit and nuts in the winter season. The sample households' might have strong preferences for pistachio, cashew and pine nuts but their market prices were very high, may be they are not able to them. Though the mean consumption of peanuts

is high at 2.17 kg/m, however the standard deviation is around 1.8 which shows huge deviation from the mean consumption level. It means that peanuts are consumed mostly by the poor households.

Table 4: Consumption of dried fruit and nuts in winter (kgs/month)

Variables	Mean	Std.Dev	Min	Max
Almond	1.299	0.6892	0	3
Walnuts	1.015	0.6852	0	5
Pistachio	0.8125	0.4864	0	2
Cashew	0.6875	0.4633	0	2
Pine nuts	0.00125	0.0176	0	0.25
Peanuts	2.17	1.799	0	10
Apricot	0.5025	0.5962	0	3
Fig	0.3875	0.5500	0	2
Raisins	1.105	0.7871	0	4

### Summer Season

Table 5 shows the descriptive statistics of households' consumption of dried fruit and nuts share in summer season. On average the sampled mostly consume almonds (0.6407 kg/m), raisins (0.5512 kg/m), walnuts (0.4612 kg/m) and fig (0.28 kg/m) as compared to other dried fruit and nuts in the summer season. In summer season the consumption of dried fruit and nuts is significantly lower as compared to the winter season.

Table 5: Consumption of dried fruit and nuts in summers (kg/month)

Variables	Mean	Std.Dev	Min	Max
Almond	0.6407	0.4794	0	3
Walnuts	0.4612	0.4669	0	3
Pistachio	0.035	0.2311	0	3
Cashew	0.025	0.1372	0	1
Pine nuts	0	0	0	0
Peanuts	0.095	0.4409	0	3
Apricot	0.2425	0.3816	0	2
Fig	0.28	0.4876	0	3
Raisins	0.5512	0.4822	0	3

### OLS Estimated Results for WTP Model

The OLS estimates for the log-log WTP model are given in Table 6. The F-statistic and the related P-value indicate that the all variables of the model are statistically significant which shows variation in willingness to pay model. The R-square estimated value suggests that the model is able to predict an actual households' WTP with 59 percent chances of being accurate.

Results of the findings highlighted various factors influencing households' willingness to pay for improved quality dried fruit and nuts. The coefficient of district is negative and its P-value is significant (0.09) at 10 percent. It shows that households' are willingness to pay for improved quality of local produce at Peshawar district is significantly lowers (3%) as compared to households at Mardan district.



The estimated coefficient age is negative and its p value is significant (0.01) which shows that the willingness to pay for households' headed by young and middle aged individuals are significantly greater than the households' headed by an old aged individuals.

The variable education shows a positive and significant correlation with willingness to pay. The variable education shows a positive and significant correlation with willingness to pay. The positive sign reveals that when education level of households head increases, its WTP also increases. Education develops awareness regarding food and other products. More educated consumers are more aware of the health benefits related with good food. These findings are in parallel with Khan et al, 2018 who conducted research on the factors influencing households' willingness to pay for pesticides free fruit in district Peshawar, KP Pakistan.

Job status has a significant effect on the willingness to pay for nuts and dried fruit which show that people having job is willing to pay more price as compared to people who have no job. These findings are related with Khan et al, (2019) who stated a direct relationship between employment and household WTP for fruits free from pesticides in Peshawar district, KP Pakistan.

Importance of dried fruit in human diet is statistically significant shows that people who are aware about the importance of dried fruit for human health will pay more as compare to the people who are not aware. The estimated coefficient of household income is positive as well as significant which implies that increase in income has directly related to the increase in the willingness to pay for dried fruit and nuts. These findings are similar to the study conducted by Khan et al, 2018 on the factors influencing households' willingness to pay for fruits free from pesticides district Peshawar, KP Pakistan.

Households' size has an insignificant effect on willingness to pay. It means that an increase in number of people has reduced WTP for dried fruit and nuts. The estimated coefficient for households' perception of local products current quality is positive but statistically insignificant which is against the researcher prior expectation.

Table 6: Estimated WTP Model for Dried Fruit and Nuts

Variables	Coefficients	t-statistics	P-values
District (1 for Peshawar, 0 for Mardan)	-0.0312463	-1.69	0.093
Head's Age (years)	-0.1043292	-2.49	0.014
Head's Education Level			
Edu-1(1 if 1-5 years, 0 otherwise)	0.1263025	1.98	0.049
Edu-1(1 if 6-10 years, 0 otherwise)	0.1342051	2.47	0.014
Edu-1(1 if >10 years, 0 otherwise)	0.1581211	7.43	0.000
Head's Job Status (1 if yes, 0 otherwise)	0.0418009	2.03	0.044
Perception of dietary importance. (1 if considered important, 0 otherwise)	0.0826219	3.13	0.002
Awareness of dried fruit's quality (1 if consider low, 0 otherwise)	0.0959881	1.60	0.111
Household size (individuals)	0.0975001	1.60	0.112
Household's monthly income (PKR)	0.093556	2.68	0.008
Constant	5.499381	14.53	0.000

No of observation = 200; F = 69.29; Prob> F = 0.000; R-squared adjusted = 0.58

## Conclusion and Recommendations

This research study aimed to investigate households' preferences for nuts and dried fruit consumption and their willingness to pay for improved quality of local products and also identify its determinants. Contingent valuation method (CVM) was adopted to achieve the objectives. On average, households' are consuming considerable amount of peanuts, almonds, raisins, walnuts, pistachio and cashew. They have strong preferences for dried fruit and nuts consumption in winter season and they are aware of its dietary importance for a normal human growth. Around 90 percent of them are willing to pay for its improved quality version, and on average they are willing to pay 37 percent price premium for improved quality local produce. Head's education, job status, households' perception of the importance of dried fruit for human health and monthly income of the respondents are important determinants of households' WTP for dried fruit and nuts.

As households' are willing to pay considerable price premium for improvement in locally produced dried fruit and nuts, producers and processor needs to take necessary actions towards quality improvement of their produce. Awareness, introduction and subsidized provision of oven drying technology can improve our products quality and their large-scale production.

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