ESTIMATION OF HOUSEHOLD DEMAND FOR MILK IN KOHAT CITY

FARHANA GUL¹ AND MARIA GHAFFAR²
¹Department of Agriculture, University of Swabi, KP, Pakistan
farhana@uoswabi.edu.pk
²Department of Agriculture and Applied Economics, University of Agriculture, Peshawar

ABSTRACT. The purpose of this study was to estimate the household demand for milk in Jungle Khel, Kohat. A sample of 120 households was collected and the data was collected from the female head of households. A statistical method of ordinary least square (OLS) was used to analyze the data. The analysis shows that most of the respondents (83.33%) were literate. Majority of the respondents (40%) fall in the income group Rs.13000–25000. The study reveals that respondents having large family size consume more quantity of fluid (fresh and UHT) milk. Prices of fresh and UHT milk, income, literacy level, family size, number of children and infants in a household are the important determinants of household demand for milk. On the basis of results of the research study recommendations are forwarded to regulate the demand and supply of milk and provide good quality milk at reasonable prices. Therefore, proper policy needs to be formulated and introduced to develop the dairy sector on sustainable basis.

Keywords: Milk consumption, Household, Demand for milk

1. Introduction. Milk is essential for maintaining good health in every age. It is a good source of calcium which is important for growth and development. As human body undergoes physiological changes, it requires energy- and nutrient-dense foods for optimal development of hormonal, muscular, circulatory and reproductive systems. Milk is very important for secondary school going children (Belewu, 2009).

Pakistan is the fourth largest milk producing country in the world after India, China and the United States. Pakistan economy largely depends on the agriculture sector. Livestock is one of the important components of agriculture sector. The livestock sector in Pakistan contributes 12 percent to the national GDP, and out of this 12 percent, the share of only milk is 9 percent. The annual milk production of the country is 30-35 billion liters per year approximately. The per capita milk and dairy products consumption rates is 150-200 liters per year (Khan, 2011).

In Pakistan, the demand for milk is low as compared to the other developing economies. The fall in per capita consumption of milk is due to increase in the prices of milk and rising population. Furthermore, the conflicting seasonal fluctuations also influence the demand and supply of milk and milk products in Pakistan. People consume more milk products like ice cream and yogurt in summer, therefore the demand and supply increases. It is also observed that the purchasing power of people is decreasing due to rising inflation rate (nationwide survey carried out by Gallup Pakistan during April, 2011 to assess Milk Consumption of a Pakistani Household).

Khyber Pakhtunkhwa is a milk deficit province. It relies on milk from Punjab. Milk is mainly consumed as fresh milk, processed milk, yogurt, whey (lassie), clarified butter (ghee), cheese, ice-cream and other dairy products. Rapidly growing population, higher per capita income and awareness about the nutritional value are the factors responsible for rising milk demand. Price and income also influences the demand for milk.
Furthermore, the change in income level determines the form and level of milk consumption (Khatoon, 1999).

**IMPORTANCE OF THE STUDY.** The study is aimed at highlighting different variables which determines the demand for fluid milk. The findings will present background information for further research in the area concerned. The study will establish guidance for policy formulation, thereby will be important for government policy makers, public and private organizations in the relevant field. It will be helpful for other researchers for understanding the application of mathematical and econometric techniques, which are used in this study.

**OBJECTIVES OF THE STUDY.**

i) To estimate the consumption and demand for milk (fresh and UHT) by the households in Kohat City.

ii) To examine the factors which influence the household demand for milk.

iii) To find out the preferences of households for particular type of milk (fresh or UHT).

**2. Materials and Methods.**

**RESEARCH SITE**

The study is conducted in District Kohat. Considering time and other constraints, Jungle Khel area of Kohat city is taken as study area. The female head of each household are interviewed with a well-designed interview schedule to collect the required information.

**TIME OF STUDY**

The study was conducted to estimate the household demand for milk during May- June 2012.

**SAMPLE SIZE**

The technique which is used for selecting samples in this study is simple random sampling. In this study a sample size of 120 households is used for research objectives.

**DATA COLLECTION**

A comprehensive interview schedule is prepared to collect information on milk demand. Efforts are made to make the questionnaire simple and understandable in order to gather data on income, price, number of household, number of infants, number of children, years of schooling and quantity demanded of fresh and UHT milk. A total of 120 households are included and interviewed in the sample.

**DATA ANALYSIS**

According to Economic theory we expected negative relationship between price of milk and quantity demanded of milk. Similarly, the theoretical background suggested positive relationship of the income, household size, number of children, and number of infants with milk demand.

Household demand for fresh milk in the study area was calculated with the help of equation (1) as.

\[
QD_F = \beta_0 + \beta_1X_1 + \beta_2X_2 + \beta_3X_3 + \beta_4X_4 + \beta_5X_5 + \beta_6X_6
\]  

(1)

\(\beta_0\) = Intercept of demand function.

\(QD_F\) = Quantity demanded of fresh milk by the household

\(\beta_1, \beta_2, \ldots, \beta_7\) = Coefficients of the variables

\(X_1\) = Price of the fresh raw milk (PFM)

\(X_2\) = Price of substitute (PUHT)

\(X_3\) = Income of fresh milk respondents (INC_F)

\(X_4\) = Household size of fresh milk respondents (NOH_F)

\(X_5\) = Number of children of fresh milk respondents (NOC_F)

\(X_6\) = Schooling year of fresh milk respondents (SY_F)

Household demand for UHT (Ultra Heat Treated) milk in the study area was calculated with the help of equation (2) as.

\[
QD_U = \beta_0 + \beta_1Y_1 + \beta_2Y_2 + \beta_3Y_3 + \beta_4Y_4 + \beta_5Y_5 + \beta_6Y_6
\]  

(2)

\(\beta_0\) = Intercept of demand function.

\(QD_U\) = Quantity demanded of UHT milk by the household

\(\beta_1, \beta_2, \ldots, \beta_7\) = Coefficients of the variables

\(Y_1\) = Price of the UHT milk (PUHT)

\(Y_2\) = Price of substitute (PFM)

\(Y_3\) = Income of the UHT milk respondents (INC_UHT)

\(Y_4\) = Household size of the UHT milk respondents (NOH_UHT)

\(Y_5\) = Number of children of the UHT milk respondents (NOC_UHT)

\(Y_6\) = Schooling year of the UHT milk respondents (SY_UHT)
RESULTS AND DISCUSSION
SOCIO-ECONOMIC FEATURES OF THE HOUSEHOLDS:

It is observed that household size, income level, and educational status are important determinants of household demand for milk in study area.

Educational Level of the Respondent:

The findings reveal that 17.5 percent of the total 120 sample respondents were illiterate and the remaining 82.5 percent of 120 respondents were literate. The figures show that literacy rate is high among the respondents in the study area.

Among the 60 fresh milk respondents, 28.33 percent are under metric, 23.33 percent are metric, 16.67 percent are intermediate, 10 percent are graduates and 6.67 percent are above graduate. Furthermore, the table 1 also indicates that among the 60 literate UHT milk respondents, 26.67 percent are under metric, 20 percent are metric, 15 percent are intermediate, 8.33 percent are graduates and 15 percent are above graduate.

<table>
<thead>
<tr>
<th>LITERARY STATUS</th>
<th>No. of fresh milk Respondents</th>
<th>%age</th>
<th>No. of UHT milk Respondents</th>
<th>%age</th>
</tr>
</thead>
<tbody>
<tr>
<td>Illiterate</td>
<td>9</td>
<td>15</td>
<td>12</td>
<td>20</td>
</tr>
<tr>
<td>Literate</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Under Metric</td>
<td>17</td>
<td>28.33</td>
<td>16</td>
<td>26.67</td>
</tr>
<tr>
<td>Metric</td>
<td>14</td>
<td>23.33</td>
<td>12</td>
<td>20</td>
</tr>
<tr>
<td>Intermediate</td>
<td>10</td>
<td>16.67</td>
<td>9</td>
<td>15</td>
</tr>
<tr>
<td>Graduate</td>
<td>6</td>
<td>10</td>
<td>5</td>
<td>8.33</td>
</tr>
<tr>
<td>Above Graduate</td>
<td>4</td>
<td>6.67</td>
<td>6</td>
<td>10</td>
</tr>
<tr>
<td>Total</td>
<td>60</td>
<td>100</td>
<td>60</td>
<td>100</td>
</tr>
</tbody>
</table>

FAMILY SIZE OF THE RESPONDENTS

The results indicate that 18.33 percent of the fresh milk respondents have family size 1-4 and 45 percent of the fresh milk respondents have family size 5-8. Out of 60 fresh milk respondents, 35.83 percent have above 8 persons per household. Moreover, the findings reveal that 15 percent of the UHT milk respondents have family size 1-4 and 51.67 percent have family size 5-8. The remaining 33.33 percent of the UHT milk respondents have more than 8 persons per household.

<table>
<thead>
<tr>
<th>Family Size of the Household</th>
<th>No. of fresh milk Respondents</th>
<th>%age</th>
<th>No. of UHT milk Respondents</th>
<th>%age</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-4</td>
<td>11</td>
<td>18.33</td>
<td>9</td>
<td>15</td>
</tr>
<tr>
<td>5-8</td>
<td>27</td>
<td>45</td>
<td>31</td>
<td>51.67</td>
</tr>
<tr>
<td>Above 8</td>
<td>22</td>
<td>36.67</td>
<td>20</td>
<td>33.33</td>
</tr>
<tr>
<td>Total</td>
<td>60</td>
<td>100</td>
<td>60</td>
<td>100</td>
</tr>
</tbody>
</table>

Source: Survey data

Income Status of the Respondent: Table 3 shows that 10 percent of the fresh milk respondents have income status up to 13000, 15 percent lie in 13001-25000, whereas 45 percent fall in the income group 250001-50000, and 30 percent have monthly income above 50000. Furthermore, 30 percent of the UHT milk respondents have income status up to 13000, 35 percent lie in 13001-25000, whereas 15 percent fall in the income group 250001-50000, and 20 percent have monthly income above 50000.
Table 3: Income Level of Respondents

<table>
<thead>
<tr>
<th>Income</th>
<th>No. of fresh milk Respondents</th>
<th>%age</th>
<th>No. of UHT milk Respondents</th>
<th>%age</th>
</tr>
</thead>
<tbody>
<tr>
<td>Up to 13000</td>
<td>6</td>
<td>10</td>
<td>18</td>
<td>30</td>
</tr>
<tr>
<td>13001 – 25000</td>
<td>9</td>
<td>15</td>
<td>21</td>
<td>35</td>
</tr>
<tr>
<td>25001 – 50000</td>
<td>27</td>
<td>45</td>
<td>9</td>
<td>15</td>
</tr>
<tr>
<td>Above 50000</td>
<td>18</td>
<td>30</td>
<td>12</td>
<td>20</td>
</tr>
<tr>
<td>Total</td>
<td>60</td>
<td>100</td>
<td>60</td>
<td>100</td>
</tr>
</tbody>
</table>

Source: Survey data

DAILY MILK CONSUMPTION OF FRESH AND UHT MILK WITH RESPECT TO FAMILY SIZE

Fresh Milk Consumed By Household: The table 4 indicates that consumption of household having family size 1-4 consumes 1 liter milk daily and 30 liters milk monthly. The household having family size 4-8 consume 1.5 liters milk daily and 45 liters milk monthly. The daily and monthly consumption of household above 8 are 2.5 and 75 respectively. The household having larger family size consumes more quantity of milk.

Table 4: Fresh milk consumed by household

<table>
<thead>
<tr>
<th>Family size</th>
<th>Monthly Consumption in Liters</th>
<th>Daily Consumption in Liters</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-4</td>
<td>30</td>
<td>1</td>
</tr>
<tr>
<td>4-8</td>
<td>45</td>
<td>1.5</td>
</tr>
<tr>
<td>Above 8</td>
<td>75</td>
<td>2.5</td>
</tr>
</tbody>
</table>

Source: Survey data

UHT Milk Consumed By Household: The table 5 indicates that consumption of household having family size 1-4 consumes 0.5 liter milk daily and 15 liters milk monthly. The household having family size 4-8 consume 1 liters milk daily and 30 liters milk monthly. The daily and monthly consumption of household above 8 are 1.5 and 45 respectively.

Table 5: UHT milk consumed by household:

<table>
<thead>
<tr>
<th>Family size</th>
<th>Monthly consumption in liters</th>
<th>Daily consumption in liters</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-4</td>
<td>15</td>
<td>0.5</td>
</tr>
<tr>
<td>5-8</td>
<td>30</td>
<td>1</td>
</tr>
<tr>
<td>Above 8</td>
<td>45</td>
<td>1.5</td>
</tr>
</tbody>
</table>

Source: Survey data

HOUSEHOLD PREFERENCE FOR MILK: The table 6 indicates that 17.5 percent households prefer fresh milk due to its higher cream content, natural taste, and traditional views about its nutritional value. 38.33 percent of the households prefer UHT milk due to good taste of tea, easy storage and access; and poor quality of fresh milk. Moreover, 44.17 percent of households prefer both fresh and UHT milk. These households consume fresh milk for drinking purposes and UHT milk for thickness of tea.

Table 6: Household preference for milk

<table>
<thead>
<tr>
<th>Milk Preference</th>
<th>No. of Household</th>
<th>%age</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fresh milk</td>
<td>21</td>
<td>17.5</td>
</tr>
<tr>
<td>UHT milk</td>
<td>46</td>
<td>38.33</td>
</tr>
<tr>
<td>Both fresh and UHT milk</td>
<td>53</td>
<td>44.17</td>
</tr>
<tr>
<td>Total</td>
<td>120</td>
<td>100</td>
</tr>
</tbody>
</table>

Source: Survey data

HOUSEHOLD AVERAGE MONTHLY EXPENDITURE: The table 7 indicates that household monthly expenditure on milk having family size 1-4 spends Rs.1950 on 30 liters fresh milk and Rs.1215 on 15 liters
UHT milk. The household having family size 4-8 spends Rs.2925 on 45 liters fresh milk and Rs.2430 on 30 liters UHT milk. The monthly expenditure of household above 8 is Rs.4875 on 75 liters fresh milk and Rs.3645 on UHT milk. Moreover, the household having larger family size have high rate of monthly expenditure on milk.

Table 7: Avg. Monthly Expenditure of Household on Milk Consumption

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1 to 4</td>
<td>30</td>
<td>1950</td>
<td>15</td>
<td>1215</td>
</tr>
<tr>
<td>5 to 8</td>
<td>45</td>
<td>2925</td>
<td>30</td>
<td>2430</td>
</tr>
<tr>
<td>Above 8</td>
<td>75</td>
<td>4875</td>
<td>45</td>
<td>3645</td>
</tr>
</tbody>
</table>

Source: Survey data

3. ECONOMETRIC ANALYSIS

Two models are used to estimate the impact of various variables on the demand of fresh and ultra-heat treated milk (UHT milk) separately.

A. ESTIMATION OF HOUSEHOLD DEMAND FOR FRESH MILK:

The following model is applied to quantify the impact of various variables on the fresh milk demand.

$$Q_D^F = \beta_0 + \beta_1 PFM + \beta_2 PUHT + \beta_3 INC_F + \beta_4 NOH_F + \beta_5 NOC_F + \beta_6 SY_F$$

Where,\( Q_D^F \) is the quantity demanded of fresh milk, PFM is the price of fresh milk; PUHT is the price of ultra-heat treated milk (price of substitute), INC\(_F\) is income of the sample respondent, NOH\(_F\) is the number of households, NOC\(_F\) is the number of children, and SY\(_F\) is the schooling year. In this equation \( Q_D^F \) is a dependent variable, whereas PFM, PUHT, INC\(_F\), NOH\(_F\), NOC\(_F\), and SY\(_F\) are independent variables. The results of this model are as follows:

$$Q_D^F = 0.619 \times 0.041 PFM + 0.014 PUHT + 0.254 INC_F + 0.526 NOH_F + 0.379 NOC_F + 0.285 SY_F$$

(1.997)

\( t \)-values are given in parenthesis.

R-Square = 0.701    \( F = 20.708 \)

The model depicts that quantity demanded and price of fresh milk (PFM) has a negative and significant relationship, which means that when price of fresh milk increases by one rupee, the quantity demanded of milk will decrease by 0.041 liters. Thus, the coefficient of price is consistent with economic theory. The coefficient of PUHT, which is price of substitute, is positive and significant statistically. The value of coefficient shows that fresh milk and UHT milk are substitutes. As far as income variable is concerned, it is positive and statistically significant as expected. The value of the income coefficient indicates that with the increase in one rupee income of the household their demand for fresh milk will increase by 0.254 liters. Therefore, income is an important determinant of household milk demand and indicates a strong relationship between household income and quantity demanded of milk. As expected, the household size also has positive and significant relationship with milk consumption. The results show that an addition of one person in the family will raise milk demand by 0.526 liters. The coefficient of the schooling year is positive but statistically insignificant, which means that schooling year has no effect on quantity demanded of milk.

The R-square value (0.701) shows that 70% variation in the dependent variable has been explained by explanatory variables. As 20.708 > 2.09 that means \( F_{cal} > F_{tab} \) at 5% level of significance, therefore overall effect of various explanatory variables on quantity demanded is significant.

B. ESTIMATION OF DEMAND FOR UHT MILK:

The following model is applied to quantify the impact of various variables on the demand for UHT milk:

$$Q_D^U = \beta_0 + \beta_1 PUHT + \beta_2 PFM + \beta_3 INC_U + \beta_4 NOH_U + \beta_5 NOC_U + \beta_6 SY_U$$

Where, \( Q_D^U \) is the quantity demanded of UHT milk, PUHT is the price of ultra-heat treated milk; PFM is the price of fresh milk (price of substitute), INC\(_U\) is income of the sample respondent, NOH\(_U\) is the number of households, NOC\(_U\) is the number of children, and SY\(_U\) is the schooling year. In this equation \( Q_D^U \) is a dependent variable, whereas PUHT, PFM, INC\(_U\), NOH\(_U\), NOC\(_U\) and SY\(_U\) are independent variables. The results of this model are as follows:
The model depicts that quantity demanded and price of ultra-heat treated milk (PUHT) has a negative and significant relationship, which means that when price of fresh milk increases by one rupee, the quantity demanded of milk will decrease by 0.007 liters. Therefore, the coefficient of price is consistent with economic theory. The coefficient of PFM, which is price of substitute, is positive and insignificant statistically. The value of coefficient shows that it’s a compliment of UHT milk. As far as income variable is concerned, it is positive and statistically significant as expected. The value of the income coefficient indicates that with the increase in one rupee income of the household their demand for fresh milk will increase by 0.254 liters. Therefore, income is an important determinant of household milk demand and indicates a strong relationship between household income and quantity demanded of milk. As expected, the household size also has positive and significant relationship with milk consumption. The results show that an addition of one person in the family will raise milk demand by 0.526 liters. The coefficient of the schooling year is positive but statistically insignificant, which means that schooling year has no effect on quantity demanded of milk. Similar results for schooling year were found by Adem, who estimated that the effect of higher education was positive for packed fluid milk expenditure but not statistically affected fluid milk consumption (Adem, 2003).

The R-square value (0.613) shows that 61% variation in the dependent variable has been explained by explanatory variables. As 14.012 > 2.09 that means F_cal > F_tab at 5% level of significance, therefore overall effect of various explanatory variables on quantity demanded is significant.

4. Conclusions and recommendations. Based on the statistical model used in the study, it may be concluded that consumers are price sensitive and demand for milk rises if there is decline in prices. Milk in the study area is demanded for consumption in various forms such fluid form, yogurt, milk shakes, tea and so on. The relative monthly expenditure of households on UHT milk is higher as compared to the monthly expenditure on fresh milk.

Most of households in Kohat city prefer fresh milk due to its natural taste and traditional views about its nutritional value. In order to meet this increasing demand for fresh milk government should provide optimal packages to establish dairy farms so that the household get adequate supplies of fresh milk.

The government or local representation should promote dairy farming by creating awareness through advertising campaigns and through provision of incentives for the stakeholders (livestock breeders and shopkeepers). Dairy sector can play a vital role in uplifting our national economy. For the development and enhancement of the dairy sector, the government has to formulate policies and implement apposite regulations in order to meet international standards of FAO and WTO.

REFERENCES