Determinants of fluid milk purchasing sources in Ethiopia

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Abstract

This study investigated main determinants affecting fluid milk purchasing sources of households in Ethiopia. From the collected household survey data, a multinomial logit model was estimated to analyze households' choices among processed, unpacked and both processed-unpacked fluid milk alternatives within the utility maximization framework. The results indicated that number of children under age six, education level, income level, price, consumer type, physician advice, and fat content of processed fluid milk are the most important factors of household choice. Households with at least one child under the age of six, who considers the price of processed fluid milk more expensive that unpacked fluid milk of indigenous or native type cows are more likely to purchase processed-unpacked fluid milk. Similarly, household heads whose education levels are formal and higher, who accept the statement 'price of processed fluid milk is expensive compared with unpacked fluid milk' of indigenous or native type are more likely to purchase unpacked fluid milk alternatives. Households with at least one child under the age of six, with middle and higher income levels and believe in the statement 'processed fluid milk fattens their children' are more likely to purchase processed-unpacked fluid milk sources. On the other hand, higher level income households, households who have at least one member has been ordered by a physician to consume milk, who accept the statement 'processed fluid milk fattens their children' tend to purchase processed fluid milk alternatives. The implications of these results for dairy value chain actors in development are discussed.

Keywords: Milk purchasing; Milk consumption; Multinomial logit; Processed and unpacked milk;

1. Introduction

Milk is the most nutritionally essential food to humans and contains nearly all nutrients. Therefore, it is advisable to consume an adequate amount of milk and milk products for healthy life. However, there is a significant gap between developed and developing countries in terms of fluid milk consumption. For

instance, annual per capita fluid milk consumption in developed and developing countries is 60-170 and 2-80 kg, respectively (USDA, 2007). In developed countries, fluid milk consumption pattern has changed significantly over the last several decades. Due to health concerns, aging of the population, increased education and income level factors in developed countries, low fat milk consumption has shown an increase but per capita consumption of whole fat milk has decreased (Jensen, 1995). In contrast, consumption of fluid milk in developing countries has not peaked yet and unpacked fluid milk takes a significant share of fluid milk consumption.

The average annual per capita consumption of fluid milk for Africa is 26kg while annual per capita consumption for east African countries; Kenya, Tanzania and Ethiopia is 80kg, 22kg and 17kg, respectively (Alemu et al., 2000). Annual consumption of fluid milk in Ethiopia increased from 725,400 metric tons to 905,000 metric tons with annual growth rate of 1.7% to 2.2% in 1993 to 2000. However, annual per capita consumption of unpacked fluid milk decreased from 19kg in 1980 to 17kg in 2000 (FAOSTAT, 2003). The decrease in consumption of unpacked fluid milk might be attributed to consumers' preference shift to packed milk and/or to unmet demand due to rapidly growing population. Yet fluid milk consumption in Ethiopia is very low as compared to even East African countries. Cultural, educational, beliefs, attitudes and economic factors often limit fluid milk consumption in Ethiopia. Moreover, the traditional perception, fluid milk being a product for children, further limits its consumption by household members.

Fluid milk consumption pattern in developing countries such as Ethiopia is quite different from more developed countries. In Ethiopia, fluid milk is consumed either as fresh or fermented (sour) form. Generally, out of the total annual milk production, 82.9% is used for home consumption, 6.61% is for sale, only 0.43% is used as wages in kind and the rest 10% is value added into milk products such as butter and cheese (CSA, 2009). Thus, most of the fluid milk is consumed in unpacked form, which is often unhygienic (Setbir, 2000). According to USA standard, bacterial count in unpacked milk is generally high and is regarded as 'C', which is considered as dangerous for human consumption (USAD, 2007). In addition to sanitation problems, the quality of unpacked milk is also generally very low. This problem partly stems from local additives, which are blended to prevent spoilage of unpacked fluid milk. Consumers prefer unpacked fluid milk because it is cheaper, has good taste and high buttermilk content. Furthermore, the milk is supplied at variable quantity and accessible to poor households as simple boiling removes most health hazard microorganisms.

Unpacked fluid milk in Ethiopia is mainly delivered directly to consumers by individual farmers, restaurants, traders or cooperatives without having to undergo any safety controls. The marketing and distribution is characterized with no licensing requirement and regulations and lower costs of operation. Furthermore, distributors incur no packaging costs since consumers supply their own milk containers. Hence, the price of unpacked fluid milk is much lower than processed fluid milk and this might stimulate households, especially those with a low income, to select unpacked fluid milk as their primary fluid milk source. In addition to price concerns, processing milk into other products are also important factors with respect to purchasing unpacked fluid milk.

In realizing the marketing and consumption patterns of the unpacked fluid milk the government promoted cooperatives which brought major improvement in production, marketing and consumption of fluid milk. Some private milk processing enterprises have been established in some urban areas of the country. Though their share of fluid milk consumption is low, it is common to see their products in super markets and in small "kiosks" even in remote rural towns in Ethiopia. This is a significant development indicating the profitability and potential of private investment in dairy enterprise. Given the current structure of fluid milk production, marketing and consumption in Ethiopia, there is a need for empirical research studies to identify the main determinants affecting fluid milk purchasing behaviors of households. To date, considerable work has been conducted on factors affecting purchasing patterns of milk and milk products (Hsu and Kao, 2001; Hsu and Liu, 2000; Nayga and Siebert, 1999; Watanabe, Suzuki and Kaiser, 1999; Gould, 1995; Jensen, 1995). Nevertheless, none of these studies has focused on Ethiopia and on unpacked fluid milk purchasing behaviors of households.

In this study, we presented a model to estimate the impact of socioeconomic, demographic and other relevant factors on fluid milk purchasing alternatives of households. The major contribution of this study is to provide insights into factors that influence fluid milk purchasing sources of households. In addition, the results will also be of interest to dairy value chain actors including milk processing firms and government agencies that could use the information derived from this study in determining marketing strategies and supporting policy tools.

2. Materials and methods

This study is conducted in Wolaita Sodo, Boditi and Areka towns of Wolaita Zone in Ethiopia. These towns, while they obviously do not represent all Ethiopia, are

perceived to be comprehensive enough to shed insight to Ethiopian consumers' of fluid-milk in various socioeconomic groups. Findings from this study are comprehensive enough to shed insight to dairy value chain actors in developing countries and developed world from which milk products are imported. It also provides adequate information for countries supporting developing countries through Food Aid Program and HIV/AIDS related supports.

The sample size was determined by ungrouped one stage random likelihood sampling method (Collins, 1986).

$$n = \frac{t^2\, Xpq}{e^2}$$

(1)

Where:

n= the sample size

t = the significance level (assumed to be 95%)

p= the probability of the situation being searched (for this study, probability of household consuming packed fluid milk to be 15%)

q= the probability of the household not consuming packed fluid milk (1-p)

e= the accepted error (assumed to be 5%) thus,

$$n = \frac{1.96^2\, X\,(0.15 \times 0.85)}{0.05^2} = 198$$

(2)

Proportional stratified sampling method was employed on the basis of geography and gender. The major advantage of this sampling method is that it guarantees representation of defined groups in the population. Hence, it improves the precision of inferences made to the full population. The proportional shares of towns in sampled population in totals are 25% in Boditi, 51% in Sodo and 24% in Areka. The proportional shares of female headed households in total sample are 32% in Boditi, 21% in Sodo and 21% in Areka towns. A total of 198 randomly sampled consumer households were surveyed in July 2010. However, 4 households, not consuming milk, were dropped from the sample, thus, the data of 194 households were analyzed. Households responded to questions on their choices of purchasing fluid milk alternatives and also provided socioeconomic and demographic information.

Survey results revealed that households had more than two choices for purchasing fluid milk: processed, unpacked and a third component, "processed-unpacked". If there are a finite number of choices greater than two, Multinomial Logit estimation are appropriate to analyze the effect of exogenous variables on choices. The

Multinomial Logit model has been used widely in recent years by researchers such as Ferto and Szabo (2002), El-Osta and Morehart (1999) and Schup, Gillepsie and Reed (1999).

In this study, we follow a standard Random Utility model as its theoretical basis (Hanemann, 1984; McFadden, 1981). The household faces a choice decision among products that is assumed to be generated from the household's utility maximization. Suppose that each household i (i= 1,2,...,N) has a choice J+1 (j=0,1,....,J) consisting of alternative choices, where j=0,1, and 2 are choices on processed, unpacked and processed-unpacked fluid milk, respectively. Let P_{ij} be the probability that the household i select j^{th} choice as the primary fluid milk purchasing source. We assume that indirect utility function for each household is given as:

$$U_{ij} = x'_i\beta_j + \varepsilon_{ij} \quad (i=1, 2,... N; j=0, 1, ..., J)$$

(3)

Where:

X_i represents a vector of socioeconomic and demographic characteristic of households and other variables, β_j denotes a vector of parameters to be estimated, and ε_{ij} is stochastic term. If household I choices on purchasing fluid milk alternative j which maximizes utility, then the level of utility is expressed as:

$$p_{ij} = prob(U_{ij} > U_{ik}) = \frac{e^{x'_i\beta_j}}{\sum_{k}^{J} e^{x'_i\beta_k}} \text{ For } j=0, 1, 2, ..., J \text{ and } j \neq k$$

(4)

In Eq. (4), it is assumed that U_{ij} is the maximum among the J+1 choice when household i selects fluid milk purchasing source j. Multinomial logit[1] model is under identified in the current form in Eq. (4). In order to identify the parameters of the model, it is required to remove indeterminacy in the model. We normalized the model assuming $\beta_0 = 0$ that is reference choice is 'processed fluid milk'. Hence Eq. (4) can be expressed as:

$$p_{ij} = \frac{e^{x'_i\beta_j}}{\sum_{k}^{J} e^{x'_i\beta_k}} \text{ For } j=1, 2, ..., J$$

(5)

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[1] The reader is referred to Maddala (1983) and Greene (2000) for a more rigorous exposition of the model.

Using Eq. (5), log-odds ratios of J can be computed: ln $(Pij/Pi0) = x'i \beta j$. Thus, the coefficients, βj , in the model denote the effect of socioeconomic and other characteristics on the relative size of probability that the household i will select j^{th} alternative as opposed to reference choice. Multinomial Logit model (5) can be estimated by the maximum likelihood method. The coefficient estimates for the βj vectors that maximize the log likelihood function can be obtained using the Newton method (Greene, 2000). The estimated coefficients of β do not allow direct determination of marginal effects in multinomial logit model but measures the marginal change in the logarithms of odds alternatives j over the reference alternative.

Therefore, given a household's socioeconomics and other characteristics and using sample mean values, marginal effects were obtained from the multinomial logit results employing the following formula (Greene, 2000).

$$\frac{\partial P_{ji}}{\partial X_{ji}} = P_{ji}\left(\beta_j - \sum P_{ki}\beta_k\right) \text{ For } j=0, 1, 2, ..., J$$

(6)

Where β and P represent the parameter and probability, respectively, of one of the choices. Marginal probability gives better indications and represents changes in the dependent variable for given changes in a particular regressor whereas holding the other regressors at their sample means. The model is estimated under maximum likelihood procedures using the LIMPDEP econometric software (Greene, 2007).

This research is exploratory in nature; there are few previous researches to help in selecting exogenous variables that might have effect on choice of fluid milk alternatives. In previous studies of dairy food purchases, educational status, household size, income, number of children, ethnicity, advertising, etc. have been included as exogenous variables (Hatirli et al, 2004; Hsu and Liu, 2000; Watanabe, Suzuki and Kaiser, 1997). In this study, the variables considered affecting choices of fluid milk alternatives are derived from participatory research conducted prior to formal survey on the study area. These variables include children under the age of six years (NC), average household size (AHS), education (EDU2 and EDU3), income (INC2 and INC3), doctor order (DO), gender, response of households to price differences between unpacked and processed milk (PRICE), processed fluid milk is fattening (PFMF), unpacked fluid milk is not healthy (UFMNH), advertising influences people so they buy more milk (ADVERTISEMENT) and residence type (RT). In this study, variables are coded binary and adding the

number of sub groups was not possible due to not having sufficient number of observations in each sub-group that reduces reliability of estimates in the multinomial logit model (Kennedy, 1996) (Table 1).

In order to reveal the purchasing behaviors of the households for the different education levels, we divided education level into three groups: illiterates (EDU1), 1-12 grades complete (INC2) and greater than 12 grades complete (EDU3). The illiterate level was chosen as a reference group that represents those respondents with characteristics omitted from the explanatory variables. Since the variable was coded as dummy variables, omission of at least one variable is necessary to avoid the dummy variable trap and ensures that perfect multi-collinearity is avoided.

It is hypothesized that households who have children under age of six are more likely to choose processed milk than unpacked milk due to considering unpacked fluid milk generally unhygienic. In addition, we assume that average household size and educational level are significant factors of choice of households for consuming fluid milk. We hypothesized those households whose average size higher than sample average is less likely to purchase processed fluid milk and education level above elementary school are more likely to have positive effect in the choice of processed fluid milk alternative. Household income level is an essential characteristic that influences households purchasing behavior. In order to reveal the purchasing behaviors of the households for the different income levels, we divided income level into three groups: low income (INC1), middle income (INC2) and high income (INC3). The low income was chosen as a reference group that represents those respondents with characteristics omitted from the explanatory variables. Since the variable was coded as dummy variables, omission of at least one variable is necessary to avoid the dummy variable trap and ensures that perfect multi-collinearity is avoided. It is hypothesized that high income households are more likely to consume processed fluid milk than other income level households. Regarding the price variable, we considered that fluid milk price is one of major factors with respect to households' decision since there is a significant price difference between processed and unpacked fluid milk. We expect that households who consider price as a significant factor have the propensity to choose unpacked fluid milk as a primary fluid milk source.

It is observed from the research area that households have improved access to mass media. It is common for households to hear a number of radio and television programs that are federal and regional in nature which broadcasts information including advertisement to consumers. It is, therefore, hypothesized that advertisement influences household choice of processed fluid milk than unpacked

fluid milk. As noted from participatory study, children who are fed on processed fluid milk tend to be fatter than those who are fed on unpacked fluid milk. It is, therefore, hypothesized that those households who believe in the statement 'processed fluid milk is fattening' prefer to purchase processed fluid milk. Similarly, households who accept the statement 'unpacked fluid milk is not healthy' are hypothesized to purchase processed fluid milk due to family health. From preliminary study, female headed household heads are more likely to accept that processed fluid milk fattens their children and hypothesized to purchase both processed and unpacked fluid milk than either of the choices alone. Similar result showed that HIV/AIDS victims in the study area tend to purchase processed fluid milk than unpacked ones due to stigma and discrimination.

3. Results and discussions

According to the survey results, the average household size was found to be 5.42 people that is higher than the average household size (5.06 people) in the urban areas of Ethiopia (CSA, 2007). The majority of households (57%) consist of below 5 people per household suggesting that nucleus family type is dominant in the research area. The survey results demonstrated that 57% of the households have at least one or more children under the age of six years indicating high demand for fluid milk. The survey result also showed that 16%, 44% and 40% of the households' head were illiterate, completed grades between 1 and 12 and higher than 12 grades, respectively. This indicates that majority (84%) of the household head had formal schooling and hence may have better awareness towards alternative fluid milk choices. Average monthly income of sampled households was $107 of which about 11.6% of the income was spent on fluid milk expenditures. About 58% of the sampled households belong to middle and high income groups. The ratio of fluid milk expenditure in the total expenditure was 21%, 29.1% and 50% in low, middle and high income groups, respectively. The households with low income spent almost 14.2% of their income on fluid milk purchase, whereas these ratios were 20% and 65.8% in the middle and high income groups, respectively.

The perceived importance of the attributes, beliefs, knowledge and importance ratings are presented in Table 1. The perception of lower price was important to most of the responding consumers. Out of the total sample, about 80% of respondents agreed that price of processed fluid milk is expensive compared to unpacked fluid milk. This was an important attribute influencing the consumers' purchase. Interestingly, 43% of respondents believed that unpacked milk is not

healthy, but 57% of the respondents disagreed with this statement. Majority of respondents (67%) believed that feeding children with processed milk fattens their children. Great majority of respondents (80%) agreed that advertising influenced their behavior to purchase more of processed milk. About 11% of the respondents said that there is at least one member in the household who consumes milk by recommendation of Medical doctor.

Table 1 Definition of variables and their descriptive statistics

Variable definitions	Variable name	Mean (SD)
1 if the household has at least one or more children under the age of six and 0 otherwise	NC	0.57(0.496)
1 if the average household is equal to 5.4 or higher and 0 otherwise	AHS	0.43(0.497)
1 if the highest level of education by household head is between 1 and 12 grades and 0 otherwise	EDU2	0.44(0.498)
1 if the highest level of education by household head is higher than 12 complete and 0 otherwise	EDU3	0.40(0.492)
1 if the household income is between 1000 and 2000 birr and 0 otherwise	INC2	0.32(0.468)
1 if the household income is greater than 2000 birr and 0 otherwise	INC3	0.26(0.441)
1 if the fluid milk price is a major factor on household choice and 0 otherwise	PRICE	0.80(0.398)
Gender of household head (Male=1; Female=0)	GENDER	0.76(0.426)
1 if the residence type is indigenous and 0 otherwise	CONTYPE	0.93(0.251)
1 if there is at least one member in the household who consume milk by doctor order and 0 otherwise	DORDER	0.11(0.311)
Advertisement influences people so they buy more milk (agree=1; Not agree=0)	ADVERTISE	0.80(0.398)
Processed milk is fattening (agree=1; Not agree=0)	FATTENING	0.67(0.471)
Unpacked milk is not healthy (agree=1; Not agree=0)	HEALTH	0.43(0.497)

Survey results revealed that the largest fluid milk alternative purchased by sample households was only unpacked fluid milk with 78.4% (Table 2). While 7.7% of consumers purchased only processed fluid milk, 13.9% purchased both unpacked-processed fluid milk.

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Table 2 Consumers fluid milk consumption choices

Milk consumption	Number of households	Marginal Percentages
Only unpacked milk	152	78.4
Only processed milk	15	7.7
Both unpacked and processed milk	27	13.9
Total number of consumers	194	100

The estimated results of Multinomial Logit model are provided in Table 3. The overall Model is statistically significant at 1% level with a Chi square value of 108.994. It is clear that multinomial logit is estimated through maximum likelihood. Moreover, based on the McFadden pseudo R^2 of 0.42, the model appears to have a good fit, especially for multinomial logit model and when the underlying data are cross sectional (McFadden, 1973). Seven explanatory variables, EDU2, EDU3, INC3, PRICE, CONTYPE, DORDER and FATTENING, have statistically significant coefficients for unpacked fluid milk in the case of first equation. Regarding to households' choice of processed-unpacked over the processed fluid milk alternatives, three independent variables, NC, CONTYPE and DORDER appeared to have statistically significant coefficients. However, these exogenous variables with the exception of NC, INC2, INC3 and FATTENING were statistically insignificant in explaining household choice between unpacked and processed-unpacked fluid milk alternatives.

Results indicate that households' choices of fluid milk sources were significantly influenced by the number of children. Specifically, households who have children under age of six are less likely to choose processed fluid milk, whereas more likely to consume processed-unpacked and unpacked fluid milk. This result is consistent with our priori expectations that households who have children tend to consume processed-unpacked fluid milk. Respondents who were native to the research areas are more likely to purchase unpacked and processed-unpacked fluid milk alternative than immigrants. Immigrants on the other hand responded that they tend to purchase processed fluid milk alternatives than others because they feel that unpacked fluid milk is unhygienic. They also feel that they have more exposure to outsides than the natives and hence influenced them to choose processed over the others even though its price is much higher than unpacked.

As expected, it was hypothesized that there would be a positive relationship between educational levels (EDU2 and EDU3) and purchasing behavior of processed fluid milk. The sign of education variables is negative and statistically significant for unpacked fluid milk choice. Results indicate that households with better education were less likely to choose unpacked milk over the processed and processed-unpacked fluid milk. Regarding the income variable, the results reveal that higher income level (INC3) has a significant influence on the households' decision in choosing fluid milk alternatives. Households with higher income level were less likely to choose processed and processed-unpacked over unpacked fluid milk because many of the higher income households were traders. Therefore, our hypothesis that higher income level households are more likely to choose processed over unpacked and processed-unpacked fluid milk alternatives than other income group is disproved.

The results indicate that household choices of purchasing fluid milk sources were significantly influenced by the price level. In fact, survey results showed that due to price concerns, many households were more likely to select unpacked and processed-unpacked fluid milk and less likely to choose processed fluid milk. Regarding doctor order to consume fluid milk, households who have at least one member ordered by a doctor to consume milk are more likely to choose processed fluid milk sources than others because many of them were HIV/AIDS positive. They choose this alternative due to stigma and discrimination of dairy producers and free access to processed fluid milk through *Medhane* Act nongovernmental organizations. However, few other household members ordered by doctors because of gastritis purchase unpacked fluid milk alternatives.

FATTENING is statistically significant for unpacked fluid milk indicating that households who accept the statement 'processed fluid milk is fattening' were more likely to choose processed fluid milk alternatives as compared to unpacked and processed-unpacked sources. Advertisement and health concerns were insignificant predictor of the consumers' fluid milk purchase sources. The insignificant relationship between fluid milk purchase and health and advertisement gives further evidence that fluid milk consumers are not affected from advertisement and health issues.

Table 3 Estimates of Multinomial logit Model

Variable	Unpacked milk vs. processed milk	Processed-unpacked vs. processed milk	Unpacked vs. processed-unpacked milk
Constant	23.804 (0.000)***	-3. 052(...)	26.85(0.000)***
NC	-0.259(0.755)	1.611(0.099)*	-1.870(0.003)***
AHS	0.209(0.792)	0.311(0.724)	-0.102(0.850)
EDU2	2.249(0.053)**	0.648(0.642)	1.601(0.146)
EDU3	4.556(0.008)***	2.850(0.122)	1.707(0.138)
INC2	-0.639(0.549)	1.548(0.234)	-2.187(0.021)**
INC3	-1.910(0.099)*	0.966(0.484)	-2.876(0.004)***
PRICE	-21.103(0.000)***	-19.893(0.000)***	-1.210(0.212)
GENDER	-0.501(0.588)	0.203(0.849)	-0.704(0.329)
CONTYPE	4.256(0.000)***	2.519(0.043)**	1.736(0.129)
DORDER	-4.192(0.001)***	-3.543(0.012)**	-0.649(0.517)
ADVERTISE	-0.427(0.730)	20.633(0.752)	-21.060(0.435)
FATTENING	-4.882(0.015)**	-2.492(0.268)	-2.390(0.033)**
HEALTH	-0.367(0.684)	0.497(0.611)	-0.864(0.116)
Model Chi square		108. 994(000)***	
Pseudo R square			
Cox and Snell		0.430	
McFadden		0.423	

*, **, and *** indicate the significance level of 1%, 5% and 10% respectively. Numbers in brackets indicate p-values. 1US $ was equivalent to 13.632 during the time of data collection.

The estimated parameters of multinomial logit results are better interpreted in the concept of marginal probability, which measures the change in the probability of each fluid milk outcome with respect to the change in each explanatory variable whereas holding the other regressors at their sample means. Following equation 6, marginal probabilities were calculated from the estimated multinomial logit model and presented in Table 4. Marginal effect of children number indicates that having children under the age of six increases the probability by 13.86% for processed-unpacked fluid milk alternatives. On the other hand, it decreases the probability of selecting unpacked fluid milk by 11.11% and processed fluid milk by 2.75%. Marginal effect of attending formal schooling between grades 1 and 12 increases the probability by 9.75% and 0.59% for unpacked and processed fluid milk alternatives, respectively. On the other hand, it decreases the probability of choosing processed-unpacked fluid milk choice by 10.34%. Higher education level

households' head enhances the probability of purchasing processed-unpacked fluid milk by 10.4% and negatively influences selection of unpacked and processed fluid milk alternatives by 52.9% and 5.11% respectively. This finding implies that higher educated households are more concerned about safety and hygienic conditions of unpacked fluid milk and price of processed fluid milk, hence, they have the propensity to choose processed-unpacked fluid milk alternatives.

Marginal effects of income variable indicates that the probability of selecting unpacked and processed-unpacked fluid milk alternatives increases for middle income groups by 0.27% and 4.8%, respectively, while it decreases processed fluid milk choice for this income group by 5.08%. On the other hand, choosing processed fluid milk as a primary purchasing source was positively associated with increasing income. In fact, the probability of choosing processed-unpacked and processed fluid milk alternatives increases by 7.72% and 0.86% for higher income level households, whereas it deceases by 8.58% for unpacked fluid milk alternative. This finding supports our priori expectation that higher income level has a positive impact on the choice of purchasing processed fluid milk.

The price level of fluid milk has a positive influence on the households' decision in selecting unpacked and processed-unpacked fluid milk alternatives, whereas the opposite was true for the processed fluid milk choice. Results show that the households' response to price difference increases the probability of selecting unpacked and processed-unpacked fluid milk alternatives by 16.5% and 1.23%, respectively. On the other hand, it decreases the probability of selecting processed fluid milk choice by 15.27%. This confirms the hypothesis that the existence of price difference stimulates households to purchase unpacked and processed-unpacked fluid milk rather than processed milk. Not surprising, the estimation of the model for the stated fattening of fluid milk choices in human diet is an important consideration in consumers' fluid milk purchase sources. The households who believe that processed milk is fattening are about 7.08% more likely to purchase processed fluid milk. On the other hand, it decreases the probability of selecting unpacked and processed-unpacked fluid milk choice by 22.42% and 15.34%, respectively.

The variable, consumer type (whether indigenous or immigrant) next to EDU3 seems to be the variable with the strongest influence on the households' decision to choose among fluid milk alternatives. Indigenous fluid milk consumers have a positive influence on households' decision in selecting unpacked fluid milk alternatives, whereas the opposite was true for processed-unpacked and processed fluid milk choices. Results show that being indigenous or native to the research

area increases the probability of selecting unpacked fluid milk by 52.1%, whereas decreases the probability of selecting processed-unpacked and processed fluid milk sources by 32.3% and 19.8% respectively. This confirms our hypothesis that immigrants such as Muslims have better exposure to outside world and consider unpacked fluid milk unhealthy and hence tend to select processed fluid milk alternative. Marginal effect of doctor order variable indicates that the probability of selecting processed fluid milk source increases for households with at least one member who consume milk by doctor order by 12.3%, while it deceases unpacked and processed-unpacked fluid milk alternatives for these households by 7.93% and 4.37%, respectively.

In developed countries, many researches have been conducted on factors affecting fluid milk consumption behavior of households. Most of the studies have implied that low-fat milk consumption is positively related to income and whole milk consumption is negatively affected by income level. Furthermore, previous studies indicate that household size, presence of children in household and higher education levels are positively affected on low-fat milk consumption (Corik, Cox and Gould, 1994; Gould, 1995; Jensen, 1995; Schmit *et al.*, 2000).

Table 4 Estimated marginal probabilities

Variable	Unpacked milk	Processed-unpacked	Processed milk
NC	-0.1111	0.1386	-0.0275
AHS	-0.0021	0.0385	-0.0363
EDU2	0.0975	-0.1034	0.0059
EDU3	-0.529	0.1040	-0.0511
INC2	0.0027	0.0481	-0.0508
INC3	-0.0858	0.0772	0.0086
PRICE	0.1650	0.0123	-0.1527
GENDER	0.0643	-0.0363	-0.0280
CONTYPE	0.5213	-0.3231	-0.1982
DORDER	-0.0793	-0.0437	0.1230
ADVERTISE	-0.1182	0.1124	0.0058
FATTENING	-0.2242	0.1534	0.0708
HEALTH	-0.0613	0.0627	-0.0014

4. Conclusions

Fluid milk marketing system in Ethiopia is quite different from developed countries and the majority of fluid milk is consumed in the form of unpacked fluid milk. Additionally, per capita fluid milk consumption in Ethiopia is very low and this indicates a potential to expand the market of fluid milk and milk products. In this study, we examined the impact of various factors affecting on households' choices of fluid milk purchasing alternatives, namely, processed, unpacked and processed-unpacked. For estimation technique, multinomial logit model was specified and analyzed using household data.

The findings of the study revealed that the number of children under age six, education levels (formal schooling and higher education), middle and higher income levels, price, consumer type, physician's advice and fattening of processed fluid milk are the most important factors of household choice. Results showed that households with at least one child under the age of six, who accept the statement 'price of processed fluid milk is expensive' compared with unpacked fluid milk and indigenous or native type are more likely to purchase processed-unpacked fluid milk over processed fluid milk source. Similarly, results implied that household heads whose education levels are formal and higher, who accept the statement 'price of processed fluid milk is expensive compared with unpacked fluid milk' and indigenous or native type are more likely to purchase unpacked over processed fluid milk alternatives. Households with at least one child under the age of six, with middle and higher income levels and believe in the statement 'processed fluid milk fattens their children' are more likely to prefer processed-unpacked over unpacked fluid milk sources. On the other hand, higher level income households, households who have at least one member ordered by doctor to consume milk, who accept the statement 'processed fluid milk fattens their children' tend to purchase processed fluid milk over unpacked fluid milk alternatives.

Results from this study have several implications and may help value chain actors in planning, implementing and evaluating dairy upgrading strategies. Even though a significant portion of fluid milk is taken in the form of unpacked fluid milk, it is done without having any quality and hygienic inspection. This may reduce competition of informal sector value chain actors as urban consumers get more exposed, educated, income increased and look for fluid milk which is safe. In order to establish fluid milk marketing system, Ethiopian government needs to establish some standards in the fluid milk marketing system to keep consumers health protected. One of the reasons for a significant share of unpacked fluid milk consumption arises due to having structural problems of dairy farms. This structure

can be improved by supporting modern dairy farms and encouraging dairy cooperatives.

It appeared that households with low and middle income category had a propensity to consume unpacked and processed-unpacked fluid milk choices due to significant lower price of unpacked fluid milk. Therefore, fluid milk processing enterprises and importers need to improve their technology level to reduce cost of processing fluid milk to attract more households. Since current fluid milk marketing structure in Ethiopia creates unfair competition environment for modern fluid milk processors, the Ethiopian government should introduce new policy tools in favor of fluid milk processing such as providing financial support at lower interest rate, reducing tax and encouraging investment for both domestic (especially dairy cooperatives) and international firms. Moreover, processors and importers of processed fluid milk should use mass media for advertisement and influence consumers' choices.

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