Consumers' Willingness to Pay for Liquid Milk in Sri Lanka

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ABSTRACT: The purpose of this paper is to estimates consumer willingness to pay (WTP) for liquid milk in Sri Lanka. Data were gathered through structured questionnaires conducted with 391 respondents in 9 provinces in Sri Lanka. Exploratory factor analysis was adopted to extract the main factors of consumers' perception and motivation regarding liquid milk. Furthermore, the double-bounded dichotomous contingent valuation method was used to estimate the mean WTP and the factors that affect the consumers' WTP for liquid milk, that is, raw and pasteurized milk. The findings showed that consumers were willing to pay Rs.81.41/litre and Rs.153.54/litre for raw milk and pasteurized milk, respectively. Additionally, consumers who were female, increasing in age and number of family member were more likely to pay more for raw milk. On the other hand, male consumers with high education level and high perception of health and convenience were more willingness to pay for pasteurized milk. Consumers who had fewer children in their household and were price-conscious consumers raised consumers' WTP for raw and pasteurized milk.

Keywords: Consumer behaviour, willingness to pay, liquid milk, Sri Lanka

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Introduction

In Sri Lanka, the livestock contributes only 1.2 per cent to the national Gross Domestic product (GDP) (Perera and Jayasuriya, 2008). Domestic total milk (cow and buffalo) production is recorded as 374.4 million liters in 2015. The highest amount of milk (90%) was collected from smallholder dairy farmers in rural areas. Average farm-gate price per liter of raw milk in 2015 was around Rs.61/liter (Department of Census and Statistics, 2016).

The Sri Lankan dairy industry satisfies only one-third of domestic consumers' dairy needs (Nanayakkara, 2013). The price of liquid milk in Sri Lanka is mainly based on the raw milk price of domestic producers. This results in the price of raw and pasteurized milk being higher than the price of imported powdered milk in the dairy market. The Sri Lankan has to spend around US$300 million yearly on the importation of milk powder (Central Bank of Sri Lanka, 2014). Powdered milk is consumed as major milk products and has increased from 1.59 kg/person/year in 1980 to 3.63 kg/person/year in 2006. On the other hand, the consumption of liquid milk has a declining trend from 1980 to 2007 (Kodithuwakku et al., 2008).

Government has promoted of production and consumption of local fresh milk. This aims to contribute to rural economy of the country and improve consumers' health (Kodithuwakku et al., 2008). Fresh milk is obviously more nutritious than powdered milk, because some nutrients are destroyed or converted into other types when it is processed into powder (Muehlhoff et al., 2013).

Many research studies have measured consumers' willingness to pay for liquid milk and quality product. Jacob (2012) concluded that consumers are willing to pay a premium of $1.495 per gallon for local milk in Rhode Island; furthermore, he explained that people with a higher income and better education are willing to pay more for local fresh milk. Aaker (1991) found that consumers consider the product quality, reputation and guarantee attributes before they purchase a product. Oyekale et al. (2013) revealed that factors influenced willingness to pay for pasteurized milk were age, sex, household size, knowledge of the milk benefits, price, shelf life and flavour of milk. Even though various studies have investigated consumers' willingness to pay for liquid milk in many countries, few have been published on the willingness to pay for liquid milk in Sri Lanka.

Therefore, to understand the significant factors influence the consumers' willingness to pay for liquid milk, including raw and pasteurized milk can increase the demand for a domestic dairy product and benefit to dairy farmers and producers in Sri Lanka.

Methodology

Research Design

The data used to assess consumers' willingness to pay (WTP) for liquid milk was collected from a survey conducted between December 2016 and January 2017. The target

population utilized in this research consisted of the consumer who is grocery primary shopper for their households and age ranged from 15 to 60 years living in Sri Lanka. Face-to-face structured questionnaires were administered to 391 respondents in Sri Lanka using the stratified and convenience sampling techniques. Stratified sampling was performed based on the geographical location of households in Sri Lanka in nine provinces – Uva, North Central, North, Central, Sabaragamuwa, Southern, North Western, Eastern and Western. Then, convenience sampling was conducted to sample the subject and location, allowing a large number of respondents to be interviewed, with different socio-economic and demographic backgrounds.

A questionnaire survey is a research tool used to collect data from target consumers. Before completing the final questionnaire, the focus group discussion method was used to elicit consumer behaviour regarding liquid milk consumption, and a related literature review provided information to help design the survey questionnaire. The complete questionnaire consisted of four sections. In section 1, data were collected regarding the respondents' socio-economic factors. Questions relating to perception, that is, nutrition and sensory attributes, were included in section 2, and section 3 required the respondents to rate their motivation regarding health and convenience, advertisements, price and hygiene **(Tables 1 and 2).**

Table 1 Statements of perceptions regarding liquid milk

Variables	Statements	Source
Nutritional	1. Liquid milk is nutritious	Steptoe, Pollard and Wardle (1995)
	2. Liquid milk contains a lot of protein, vitamins and minerals	De Alwis et at. (2011)
	3. The nutritional quality of liquid milk is much higher than that of milk powder	
	4. Liquid milk is good for my skin, teeth and hair	Steptoe et at. (1995)
	5. Drinking liquid milk makes me healthy	Padel and Foster (2005)
	6. Liquid milk is a healthy drink	Kurajdova et al. (2015)
Sensory	1. Liquid milk tastes good	Steptoe et al. (1995)
	2. Taste is very important when buying liquid milk	Glanz et al. (1998)
	3. Liquid milk is tastier than other processed milk products	De Alwis et al. (2011)
	4. Liquid milk has a nice smell	Steptoe et al. (1995)

Table 2 Statements of consumers' motivation regarding the health and convenience, advertisements, price and hygiene of liquid milk

Variables	Statements	Source
Health and convenience	1. It is easy for me to find liquid milk	De Alwis, et al. (2011)
	2. The high availability of liquid milk motivates me to have higher consumption	Steptoe et al. (1995)
	3. Drinking milk helps to keep bones strong and to prevent osteoporosis, and this influences me to buy liquid milk	
	4. Milk is a great source for the bone development of children, which persuades me to buy it	
	5. The ability of milk to strengthen teeth and prevent tooth decay and cavities drives me to buy liquid milk	
Advertising	1. Advertising convinces me to buy the advertised product	Papaioannou et al. (2015)
	2. Advertising influences me in my decision to purchase milk	
	3. The message in the advertisement attempts to persuade me to buy food products	Jaafar et al. (2012)
Hygiene	1. I think unhygienic liquid milk production causes spoilage due to bacteria and germs	Yilma and Faye (2006)
	2. I think that, if good hygiene is practised during milking, then fresh milk remains fresh for a long time	Alberra (2010)
	3. I think liquid milk with good hygiene influences me to buy liquid milk	Lore et al. (2006)
Price	1. Liquid milk is expensive and this may be a barrier to milk consumption	Bus and Worsley (2003)
	2. I would buy more liquid milk if the price was reduced	De Alwis et al. (2011)

The fourth section was devoted to questions on the WTP for liquid milk. Raw (fresh milk from farms without pre-cooking) and pasteurized milk products were selected to estimate consumers' WTP, as these are two liquid milk products that consumers prefer to buy. The double-bounded contingent valuation method (CVM) was used to extract information regarding the respondents' WTP for two types of liquid milk. In the double-bounded CVM, the respondents were asked whether they would be willing to pay a presented price. First, the respondents were offered the first bid (initial bid) followed by the second bid of the product; the first bid price was taken as three different prices in three versions of the questionnaire (versions A, B and C) based on the top three bids from the pre-survey. This is described in **Table 3.**

Table 3 Bids in three versions of the willingness to pay for liquid milk question

Types of products	Bid version	Bid amounts (rupees/litre)		
		First bid	Second bid	
			Lower amount	Upper amount
Raw milk	A	65.50	49.25	82.00
	B	75.00	56.25	93.75
	C	84.50	63.25	105.50
Pasteurized milk	A	148.75	111.50	185.75
	B	170.00	127.50	212.50
	C	191.25	143.50	239.00

Statistical Analysis

Principal component factor analysis was performed to extract the major factorial dimension of consumers' general perception and motivation statements regarding liquid milk to avoid the difficulty of handling a large number of statements in the WTP regression model. Each statement was given a score by each consumer on a Likert scale from one to five, where one represents strong disagreement and five refers to strong agreement. The results of the factor analysis of the perception of liquid milk purchase behaviour are presented in **Table 4**. The principal component extraction and varimax rotation resulted in two factors (KMO score = 0.877 and Bartlett's test = 0.000). The factor loading for all ten proposed items was above 0.5. Furthermore, all the communality extraction scores were loaded from 0.5 to 0.7. The first factor, labelled as nutrition, was created from six items, and the sensory attributes were the second extracted factor, corresponding to four statements (Tables 1 and 4).

For consumers' motivation for purchasing liquid milk, the principal component extraction and varimax rotation resulted in four factors (KMO score = 0.827 and Bartlett's test < 0.01). Statements with a factor loading and communality extraction score above 0.5 were retained (0.5–0.7). Finally, four factors, with a total of thirteen statements, were retained and renamed as the health and convenience, advertising, hygiene and price factors **(Tables 2 and 4).**

Table 4 Results of the principal component factor analysis of consumers' perceptions and motivation

Statements	Eigenvalue	Variance explained (%)	Cumulative variance (%)	Cronbach's alpha
Consumers' perceptions				
Factor 1. Nutrition	5.243	52.427	52.427	0.879
Factor 2. Sensory	1.439	14.386	66.813	0.858
Consumers' motivation				
Factor 1. Health and convenience	4.847	37.283	37.283	0.806
Factor 2. Advertising	4.847	13.830	51.113	0.813
Factor 3. Hygiene	1.402	10.788	61.901	0.748
Factor 4. Price	1.003	7.716	69.617	0.631

Econometric Model

The double-bounded contingent valuation method was applied to estimate the amount and the significant variables of consumers' willingness to pay for the attributes offered by liquid milk. This method is preferred to asking a sequence of open-ended questions to narrow down where the consumer's true WTP lies. is assumed to be a consumer presented with two bids. The respondent is asked to indicate an initial offer price , followed by a second bid or . The four possible responses to the first and second bids are yes/yes, yes/no, no/yes or no/no; thus, the consumers' true WTP lies only in the range of four intervals, (B_i^u, ∞), (B_i^d, B_i^u), (B_i^d, B_i^u) and $(0, B_i^d)$, respectively (Hanemann, Loomis and Kanninen, 1991). The bid design for four possible responses used in this research was given in **Table 3.**

To estimate the mean WTP, the equation of consumers' WTP can be presented as:

$$\text{WTP}\ (x_\iota, \varepsilon_\iota) = x_\iota \beta + \varepsilon_\iota$$

where x_i is the independent variables of respondent i (Table 5), β represents the coefficients to be estimated; and ε is a random disturbance. The cumulative density functions (CDFs) of the probability distribution of the four possible outcomes are obtained as follows:

$$Y^{yy}\ (B_i, B_i^u) = \Pr(B_i \le WTP_i \ and \ B_i^u \le WTP)$$

$$\text{Since, with } B_i^u > B_i, \Pr(B_i \le WTP_i \mid B_i^u \le WTP) \equiv 1$$

$$Y^{yn}\ (B_i, B_i^u) = 1 - G(B_i^u; \theta),$$

$$Y^{ny}\ (B_i, B_i^u) = \Pr(B_i \le WTP_i \le B_i^u) = G(B_i^u; \theta) - G(B_i; \theta)$$

$$Y^{ny}\ (B_i, B_i^d) = \Pr(B_i \ge WTP_i \ge B_i^d) = G(B_i; \theta) - G(B_i^d; \theta)$$

$$Y^{nn}\ (B_i, B_i^d) = \Pr(B_i > WTP_i \ and \ B_i^d > WTP)$$

$$= \Pr(WTP_i < B_i^d) = G(B_i^d; \theta)$$

where: $G(B_i^\bullet; \theta)$ is the cumulative distribution function (CDF), $B_i^\bullet$ is the value of the first bid or the second bid and θ is the unknown parameter to be estimated. The log-likelihood function for the double-bounded CVM is presented as:

$$\ln L^D(\theta) = \sum_{i=1}^{N} \begin{Bmatrix} d_i^{yy} \ln Y^{yy}\ (B_i, B_i^u) + d_i^{yn} \ln Y^{yn}\ (B_i, B_i^u) \\ + d_i^{ny} \ln Y^{ny}\ (B_i, B_i^d) + d_i^{nn} \ln Y^{nn}\ (B_i, B_i^d) \end{Bmatrix}$$

Then, the set of parameters, θ, can be estimated by the maximum likelihood function (MLE) subject to a specified probability distribution (Bateman et al., 2002).

Table 5 Description of the independent variables for modelling consumers' WTP for liquid milk

Variable	Variable name	Description	Mean	N	S.D.
Independent (X)					
Gender	GEN	1=if respondent is female; 0=male	0.54	391	0.499
Age	AGE	Age of respondent in years	35.96	391	12.274
Education	EDU1	1=if respondent has below primary education (not gone to school or achieved grade 5); 0=otherwise	0.04	391	0.192
	EDU2	1=if respondent has up to secondary education (up to O/L and up to A/L); 0=otherwise	0.55	391	0.498
	EDU3*	1=if respondent has tertiary education (diploma, graduate, postgraduate); 0=otherwise	0.42	391	0.494
Employment	EMP	1=if respondent is in employment; 0=otherwise	0.72	391	0.450
Personal income	INC	1=if personal income more than Rs30,000; 0=otherwise	0.63	391	0.483
Marital status	MS	1=if respondent is married; 0= otherwise (single, widowed, divorced, separated)	0.66	391	0.473
Household size	SIZE	Number of members of the family	3.90	391	1.216
Presence of children	CHILD	1=if household has children; 0=otherwise	0.55	391	0.498
Older people	OLDER	1=if a member of the household is over 60; 0=otherwise	0.31	391	0.465
Household income	HINC	1=if monthly household income more than Rs45,000; 0=otherwise	0.61	391	0.489
Nutrition	P1NUT	Perception about nutrition of fresh milk (mean score)	4.55	391	0.543
Sensory	P2SEN	Perception about sensory factors of fresh milk (mean score)	4.13	391	0.824
Health and convenience	M1HC	Perception about health and convenience factors of fresh milk (mean score)	3.97	391	0.811
Advertisement	M2AD	Motivation from awareness of advertisement (mean score)	3.65	391	0.879
Hygiene	M3HY	Motivation from hygiene of fresh milk (mean score)	4.32	391	0.659
Price	M4PR	Motivation from low price of fresh milk (mean score)	4.11	391	0.876

Notes: * Indicates the reference category, which was dropped from the models to avoid perfect collinearity.

Results and Discussion

Table 6 reveals the consumer liquid milk purchasing behaviour; the majority of the respondents (27.9%) consumed liquid milk two to three times a week, and 52.2% of respondents drank liquid milk in the morning. The results show that consumers frequently bought liquid milk directly from farmers (34.3%) followed by supermarkets (33.5%).

Table 6 Liquid milk purchasing pattern

Attribute		Number	Percentage
Frequency of consumption	Two to three times a week	109	27.9
	Once a week	71	18.2
	Once in two weeks	24	6.1
	Once a month	52	13.3
Drinking time*	Morning	204	52.2
	Afternoon	6	1.5
	Evening	36	9.2
	Night	33	8.4
	No specific time	97	24.8
Place of purchase*	Supermarkets	131	33.5
	Liquid milk outlets	65	16.6
	Retail shops	66	16.9
	From farmers	134	34.3
	Others	13	3.3

Note: * Multiple responses.

Table 7 shows the maximum log likelihood functions of the data on the log-normal, log-logistic and Weibull probability distributions of the double-bounded WTP estimates. The three probability distribution models restricted to independent parameters were used for comparison. The result shows that the consumers' WTP was estimated using the log-normal distribution for raw milk and the Weibull distribution for pasteurized milk (Hanemann and Kanninen, 1998).

Table 7 Values of the log-likelihood function by the log-normal, log-logistic and Weibull probability distributions

Distributions	Values of the maximum log-likelihood function	
	Full model	
	Raw milk	Pasteurized milk
Log-normal	-443.636	-284.658
Log-logistic	-445.048	-287.952
Weibull	-447.349	-277.752

The WTP mean and median were calculated for the purpose of finding the WTP for liquid milk. In Table 8, the average consumer is willing to pay Rs81.41/l for raw liquid milk and Rs153.54/l for pasteurized milk. When compared with the market price, it was found that the estimated consumers' WTP mean for both liquid milks is in the market price range.

Table 8 Coefficients of the double-bounded dichotomous choice model for liquid milk

	Coefficients	
	Raw milk	**Pasteurized milk**
Intercept	4.366	5.034
Scale	0.263	0.331
Median	78.69	136.00
Mean	81.41	153.54

Estimation of the Factors Influencing Consumers' WTP for Raw Milk

Table 9 shows the full-model and reduced-model estimates of consumers' WTP for raw milk. The results indicate that the explanatory variables, including the GEN, AGE, SIZE, CHILD and M4PR coefficients, were significant at the 10% level.

The empirical results demonstrate that consumers who are female (GEN) are more likely to be willing to pay for raw milk than male consumers, consistent with Jerop (2012), who also found that women had a greater WTP for goats' milk than men. Thus, we can conclude that women are concerned about the nutritional adequacy of their household. Njeri (2007) and Carpio and Isengildina (2008) made similar observations that female consumers were willing to pay an additional premium for local characteristics of animal products relative to male consumers.

The greater the household size (SIZE), the greater the WTP for raw milk. Consumers with a high number of family members were more likely to pay for raw milk. The results confirm those of prior studies. For example, in Zhang, Bai and Wahl's (2012) study, a larger proportion of households with more family members stated that they were willing to purchase traceable milk than families with fewer members.

Having children less than 18 years of age (CHILD) in the household resulted in a lower likelihood of paying for raw milk. The coefficient was negative, which contradicts the prior research findings of Zhang et al. (2010), which confirmed that the reputation of milk producers has greater importance for households with children in determining milk safety than for those without children. Moreover, the price (M4PR) coefficient was the only motivation factor that was statistically significant in affecting consumers' WTP for raw milk. This result concludes that consumers with lower motivation from low price of fresh milk would be willing to pay more on raw milk. The findings of Oyekale et al. (2013) confirmed that consumers in Nigeria were willing to pay for liquid milk because they have nutritional awareness.

In the reduced-model, it shows that older consumers are willing to pay more for raw milk. In this study, this could be attributed to raw milk properties that can meet the nutritional and medicinal challenges attendant to old age. These results are similar to the findings of Jerop (2012) and Wayua et al. (2009).

Estimation of the Factors Influencing Consumers' WTP for Pasteurized Milk

Table 9 shows the estimated results of consumers' WTP for pasteurized milk. The result in the full-model shows that the GEN, EDU1, EDU2, EMP, CHILD and M4PR coefficients are negatively significant in influencing the consumers' WTP for pasteurized milk and that the P1NUT and M1HC factors are positively significant.

The impacts of the socio-demographic factors are informative. The negative effect of GEN indicates that women are willing to pay less for pasteurized milk. This implied that women having more time to boil raw milk before drinking while men easily decide to pay more money for ready to drink milk. The result is similar to the findings of Bekele et al. (2017), which implied that men are willing to pay a

[3] The WTP mean and median were calculated for log-normal distribution (median = e^{μ} and mean = $e^{(\mu+0.5\ \alpha 2)}$) and for the Weibull distribution: (median = $e^{\mu} *(\ln 2)\ \sigma$ and mean = $e^{\mu} *\Gamma(1+\sigma)$).

premium for pasteurized milk. Furthermore, consumers with low level of education (EDU1 and EDU2) have lower WTP for pasteurized milk. It also can be implied that consumer who has tertiary education are willing to pay more for pasteurized milk. This result is similar to the finding of Wayua et al. (2009), who concluded that participants with no formal education were not willing to pay as much for milk quality (Jerop, 2012; Akaichi et al., 2016).

Surprisingly, the respondents who were employed (EMP) were willing to pay less for pasteurized milk. The pasteurized milk is highly perishable and they prefer powered milk as it could be preserved for long period of time. This finding is similar with Oyekale et al. (2013).

Table 9 Estimated models of consumers' willingness to pay for liquid milk

Variables	Raw liquid milk				Pasteurized milk			
	Full-Model		Reduced-Model		Full-Model		Reduced-Model	
	Coefficient	p-value	Coefficient	p-value	Coefficient	p-value	Coefficient	p-value
GEN	0.1050***	0.0021	0.0891***	0.0034	-0.0925*	0.0630	-0.1095**	0.0275
AGE	0.0023	0.1113	0.0021*	0.0852	-0.0013	0.5200		
EDU1	-0.1267	0.1436			-0.2974*	0.0904	-0.2996*	0.0878
EDU2	0.0253	0.4504			-0.1157**	0.0223	-0.1062**	0.0230
EMP	0.0032	0.9381			-0.1544**	0.0188	-0.1207**	0.0443
INC	0.0032	0.9312			0.1005	0.1146		
MS	0.0028	0.9463			0.0652	0.3077		
SIZE	0.0321**	0.0231	0.0373***	0.0033	0.0159	0.4719		
CHILD	-0.1087***	0.0033	-0.1138***	0.0003	-0.1439***	0.0069	-0.1175***	0.0089
OLDER	0.0512	0.1425			0.0674	0.1843		
HINC	-0.0355	0.3257			-0.0765	0.2049		
P1NUT	-0.0131	0.7257			0.0839	0.1100	0.0740	0.1013
P2SEN	-0.0268	0.2531			0.0159	0.6545		
M1HC	0.0066	0.7890			0.0617	0.1153	0.0712*	0.0510
M2AD	-0.0064	0.7383			0.0368	0.2161		
M3HY	-0.0060	0.8372			-0.0475	0.2865		
M4PR	-0.0348*	0.0657	-0.0416**	0.0168	-0.0654**	0.0248	-0.0656**	0.0166
Intercept	0.2481***	0.001	4.3321		4.8992***	0.001	4.9590	
Scale (bid price)	0.2481		0.2519		0.2947		0.3014	
LL model	-425.526		-429.764		-257.834		-261.448	
LLnull	-443.636		-443.636		-277.752		-277.752	
No. of servations used	335		335		335		335	

Note: *, ** and *** indicate that the estimated coefficients are significant at the 10%, 5% and 1% level, respectively.

The empirical results also showed that consumers buy pasteurized milk because of their perception of its nutrition and motivated by the healthiness of the milk and its high availability. Policy makers will be able to persuade more consumers to pay more for liquid milk by providing more information and engaging in educational promotional campaigns on liquid milk. Providing information about the health and nutrition benefits of liquid milk over powdered milk for children and increasing consumers' understanding of the term 'pasteurized' may induce consumers to pay a high price of liquid milk for their children. Furthermore, the availability and range of pasteurized milk products in supermarkets, retail shops and milk outlets will make it possible to reach the majority of consumers who might be interested in paying for liquid milk.

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