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Marketed Surplus and Factors Affecting Milk Market Outlet Choices in Raipur District of Chhattisgarh

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ABSTRACT

The present study was undertaken in Raipur district of Chhattisgarh. A total of 100 milk producing sample households comprising of 52 small, 38 medium and 10 large herd size categories were randomly selected from the four village viz. Sarkhi and Kolar from Abhanpur block and Farfoud and Shivani from Aarang block. Marketed surplus and disposal pattern of dairy farmers were worked out through tabular analysis while Multinomial Logit Model was employed to analyze factors affecting milk market outlet choice. Among the herd size categories, of the total milk produced marketed surplus ranges from 45% for small category to 76% for large category. Largest share of milk was disposed to Dairy Co-operative Society (DCS) constituting 58.71% followed by consumer (23.57%) and the least (17.71%) to market. Small category disposes maximum quantity of milk to consumer while medium and large category dispose maximum quantity to DCS. Among the different milk outlet choice maximum of the dairy farmers prefer to sell to local consumer directly, followed by DCS and market. Analysis on the factor affecting milk market outlet choices revealed that education, milch animal holding and DCS positively affect the selection of local consumer as a milk outlet choice while land holding and non-farm income negatively affect the selection of consumer as a milk outlet choice. For sale of milk to DCS and market, age of head of household and milch animal holding had a positive effect.

Keywords: Milk consumption, Milk market outlet choices, Disposal pattern, Multinomial logit model.

Marketing of milk is as important as dairy farming itself, for better performance of dairy business. Therefore, market reforms ought to be an integral part of any policy for dairy development. Since the launching of White Revolution in 1970's and National Dairy Plan 2011, there has been a considerable progress in the overall milk production and lot of technological innovation has taken place in the Indian dairy sector. But the marketing system is still inefficient and underperforming which affect the milk producers especially the small holders milk producers. Importance of marketing has been realized not recently, but in the past also.

This fact has been supported by the report of the National Commission on Agriculture (1976) which emphasized that it is not enough to produce a crop or an animal product; it must be satisfactorily marketed. Therefore, marketing not only stimulates production and consumption but also accelerate the pace of economic development.

An efficient marketing system minimises cost, ensure remunerative price to the milk producers and provide good quality milk and milk products to the consumers at reasonable prices. Despite the appreciated growth of milk in the past and present, the dominance of traditional/ unorganized marketing channels still persists. About 80% of the milk marketed in the country is handled by the traditional/ unorganized channels consisting of milk venders, middlemen, etc. Even co-operative dairy society has not been effective to remove the dominance of the traditional milk marketing channels (Kumar *et al.* 2011).

Milk sold to the market is the main source of income for the small holder's dairy farmers. The amount obtained from the sale of milk is used to meet the family expenses

and their livelihood. Milk is highly perishable and resource poor dairy farmers do not have the facility to store milk at household level and hence need to disposed milk at the available market outlets. The different type of milk outlets available are milk vendor, local consumer, local market, Dairy Co-operatives, Private Dairy, hotels, etc. These market outlets are also a source of physical and financial support to the dairy farmers while providing backward linkages. Selection of milk outlet is crucial because different market outlets have different marketing pattern, price and payment mode. Availability of alternative market outlet choice also makes milk marketing competitive which is favorable for the small holder's milk producers.

Liberalization of the dairy sector has led to the expansion of dairy infrastructure and dairy marketing network in the country. It has also opened up new avenues for the dairy farmers to dispose off their milk. This lead to competition between the existing traditional unorganized milk market consisting of milk vendors (middleman), hotels, *halwai's* etc. with the upcoming new organized outlets.

Dairy farmers choose an alternative if and only if its utility is greater than other alternatives (Samuelson *et al.* 1950). Farmers are less likely to select the private traders market channel when there is the option of selling to individual customers (Staal *et al.* 2006). Increase in the scale of milk production would lead a shift away from cooperatives to market as point of first sale (Bardhan *et al.* 2012). Though there are a number of alternative to sell milk, the decision of milk producers to choose a particular outlet depends on a number of factors viz. level of milk production, quantity of marketed surplus, market information, price obtain, road connectivity, distance to market, availability of local market, existence of Dairy co-operative society (DCS) etc. (Bardhan *et al.* 2012; Onoja *et al.* 2012; Kuma *et al.* 2013). Though a number of milk disposal outlets were available, many of the dairy farmers were not able to sell their produce effectively and profitably. Systematic identification of factors faced by households in market outlet choice is increasingly seen by agricultural research as important component of any strategy for reaching the Millennium Development Goals (Giuliani *et al.* 2005). The knowledge on selection of market outlet will help in formulating a realistic policy for dairy development in the region. Therefore, it is of vital importance to study marketed surplus and factors affecting milk market outlet choice of dairy farmers.

MATERIALS AND METHODS

Data

The study was conducted in Raipur district of Chhattisgarh state. The state occupies second position in the country in term of state wise percentage of local cow milk to total milk production in the country. Among the 27 districts in the state, Raipur has been selected because it is having the highest milk production 158.17 ('000MT) and highest number of local cow, crossbred and buffaloes in the state. Raipur is also the commercial hub of the state with a number of alternatives for marketing of milk (Kumar S. *et al.*). From Raipur district two blocks viz. Abhanpur and Aarang were randomly selected and from each block two villages were randomly selected from the study. The villages were Sarkhi and Kolar from Abhanpur block and Farfoud and Shivani from Aarang block.

Complete enumeration of milk producer's households was conducted in all the selected villages. There were altogether 294 milk producing households. The milk producers were classified into three categories based on the number of milch animals using cumulative square root frequency method. The household were categorized as small having 1 milch animal, medium having 2 to 3 milch and large having 4 and above milch animals. The overall average land holding per household was 3.9 acre which ranges from 3.50 acre for small to 8.40 acres for large category respectively. Thereafter, 100 households were selected according to the probability proportional to the size of milch animals in each category. Thus, there were 52 dairy farmers in small category, 38 in medium category and 10 in large category. The detailed information required for the study was collected from each of the selected household during the year 2014 using pre-tested schedules by personal interview method.

Methodology

Two types of data analysis, namely descriptive statistics and econometric models were used to analyze the data collected from the sample households. Descriptive statistics was used to analyze marketed surplus and disposal pattern of milk. Marketed surplus is the total amount of milk available for sale after meeting family consumption requirement while pattern is the outlet where the milk is sold.

In the study area, there were different alternatives/choices for the sale of milk viz. sale to consumer, dairy co-operative society, village market, milk vendor, hotel, *halwai*, etc. To identify factors affecting the choice of milk market outlet, multinomial logit model was used. For this the dairy farmers were classified into four groups viz., did not sell milk, sell directly to consumer, sell to market consisting of hotel, *halwai* and milk vendor and sell to dairy co-operatives. Considering the different alternative for the sale of milk, the probability that a particular household *i* choose alternative *j* is given by the expression.

$$\Pr[Y_{i=j}] = P_{ij} = \frac{e^{\beta_{0j} + \beta_{1j}X_{1j} + \ldots \beta_{nj}X_{nj} + \varepsilon}}{1 + e^{\beta_{0j} + \beta_{1j}X_{1j} + \ldots \beta_{nj}X_{nj} + \varepsilon}}$$

where, $\Pr[Y_{i=j}]$ is the probability that i^{th} household choose outlets j = 0 (does not sell milk), 1 (sell milk to consumer), 2 (sell milk to market) and 3 (sell milk to co-operative).

$$i = 1, 2, \ldots\ldots..,100$$

The marginal effect for the multinomial model is given by,

$$\frac{\partial P_{ij}}{\partial x_{ij}} = P_{ij}\left(\beta_j - \Sigma P_{ij}\beta_j\right)$$

Altogether 10 variables have been considered for the study. The details of the variables are given below:

Variables	Variable description
Family Size (FAM)	Number of members in a household measured as adult equivalent (2 adult male=3 adult female =4 children)
Age (AGE)	Age of head of household (years)
Education (EDU)	Educational level of head of household 0 for illiterate, 1 for primary, 2 for secondary, 3 for graduation, 4 for post graduation
Land holding (LAND)	Size of landholding of household (acre)
Milch animal holding (MAH)	Number of milch animals owned by household measured as Standard Animal Units (S.A.U.)
Distance to market (DST)	Average distance from farm to market for sale of milk (km) 1 for within village, 2 for outside village but less than 2 km, 3 for 2 to 5 km and 4 for 5 to10 km
Access to information (INFO)	Yes = 1 and No = 0
Dairy cooperative in village (DCS)	Yes = 1 and No = 0
Non-farm income (NFINC)	Yes = 1 and No = 0
Price of milk received (WTPRIC)	Weighted average price received for each litre of milk sold (₹)

RESULTS AND DISCUSSION

Marketed surplus and disposal pattern of milk

The average milk production, consumption and marketed surplus of milk are presented in Table 1. It was observed from Table 1 that the overall average milk production per household per day was 2.76 litres. Milk production increased with increase in herd size category and ranged from 1.54 litres in small category to 8.53 litres in large category. The overall average milk consumption per household was 1.01 litre which was highest for large category (2.05 litres) and lowest for small (0.85 litres) respectively.

Table 1. Average milk production, consumption and marketed surplus of milk across herd size categories (Litre/Day/ Household)

Categories	Production	Consumption	Marketed Surplus
Small	1.54	0.85	0.69
	(100)	(55.19)	(44.81)
Medium	2.92	0.96	1.96
	(100)	(32.88)	(67.12)
Large	8.53	2.05	6.48
	(100)	(24.03)	(75.97)
Overall	2.76	1.01	1.75
	(100)	(36.59)	(63.41)

Figures in parentheses indicate percentage to total production

The overall average marketed surplus of milk was 1.75 litre accounting for 63.41% of the total milk production. The percentage of marketed surplus to total milk production was highest for large category (75.97%) followed by medium (67.12%) and small category (44.81%), respectively.

Table 2. Disposal pattern of milk to various agencies (Litre/Day/ Household)

Milk sold to	Consumer	Market[1]	DCS[2]	Total
Small	0.47	0.08	0.14	0.69
	(67.83)	(11.19)	(20.98)	(100.00)
Medium	0.45	0.54	0.97	1.96
	(22.82)	(27.52)	(49.66)	(100.00)
Large	0.65	0	5.83	6.48
	(10.04)	(0.00)	(89.96)	(100.00)
Overall	0.41	0.31	1.03	1.75
	(23.57)	(17.71)	(58.71)	(100.00)

Figures in parentheses indicate percentage to total

[1]Market: Milk Vendors, Middle man and Hotel, [2]DCS: Dairy Cooperative Society

Table 3. Independent Variable Means of farmers participating in milk market

Parameters	Overall n= 85	Consumer n= 36	Market n = 16	DCS n = 33
CONSTANT	1.00	1.00	1.00	1.00
FAM	5.60	5.81	5.70	5.30
AGE	52.91	55.62	52.00	51.11
EDU	1.05	0.93	0.86	1.38
LAND	3.90	4.29	4.38	3.04
MAH	1.75	2.73	1.10	1.43
DST	2.99	2.75	3.20	3.02
INFO	0.39	0.56	0.33	0.30
DCS	0.72	0.56	0.73	0.88
NFINC	0.45	0.31	0.66	0.38
WTPRIC	29.27	29.06	28.71	30.05

The agency wise disposal pattern of milk to various agencies is presented in Table 2. A perusal of Table 2 reveals that largest share of milk was disposed to DCS (58.71%) followed by consumer (23.57%) and the remaining 17.71% to market. Category wise analysis reveal that small category dispose maximum quantity of milk to consumer (67.83%) while medium and large category dispose maximum quantity i.e. 49.66% and 89.96% to DCS.

Socio-economic characteristics of dairy farmers in different marketing channels

Of the 100 milk producing dairy farmers, 85 households participated in milk marketing with 36 household selling directly to local consumer, 16 selling to market and 33 selling to DCS while 15 household does not sold milk. In the multinomial logit model only those household which sell milk are selected. The mean of the independent variables considered to study the determinants of market outlet choice is presented in Table 3. It was observed from Table 3 that there was no much difference in the mean average family size of farmers who sell milk directly to consumer (5.81) and who prefer selling milk directly in market (5.70) but farmer who choose DCS (5.30) as a marketing channel have a smaller family size. The average age of farmers selling milk was 52.92 years the younger farmers prefer to sell milk to DCS while older farmers prefer to sell to direct consumers or local market. Farmers who sell their produce to DCS are younger in age and more educated compared to farmers who sell to consumers and local market. The mean land holding of the farmers was 3.96 acres. Farmers selling milk to market have the highest land size followed by those selling to consumer and DCS respectively. As regard the number of milch animals, farmers who sell milk directly to consumer had the number of milch animal (2.73 Standard Animal Unit) while that selling to market had the least number of milch animals. The average mean distance travelled by the farmer to sell milk was 2.79 km which ranges from 2.75 km to 3.20 km. The dairy farmers who sell milk directly to consumer have a higher access to market information. Presence of DCS within the village encourages the farmers to choose DSC as a milk outlet channel. Dairy farmers who had a low non-farm income prefer to sell milk directly to consumers while farmers with high non-farm income prefer to sell to market. The weighted average price offered by DSC market outlet was ₹ 30 which is higher than price offered by other market outlets.

Factors affecting milk market outlet choices in the study area

The result of analysis of the multinomial logistic regression model on Milk Market Outlet Choices keeping not selling as the base category is given in Table 4. The multinomial logistic regression model has been estimated

Table 4. Results of Multinomial Logit Regression on Milk Market Outlet Choices

Variables	Consumer n= 36				Market n = 16				DCS n = 33			
	Coeff	P value	Marginal	Odd ratio	Coeff	P value	Marginal	Odd ratio	Coeff	P value	Marginal	Odd ratio
CONS	-5.263	0.420	-0.884		-5.403	0.493	-0.849		7.909	0.312	1.590	
FAM	-0.153	0.591	0.000	0.858	-0.197	0.578	0.000	0.821	-0.267	0.396	-0.015	0.765
AGE	0.044	0.344	-0.002	1.045	0.101	0.078*	0.004	1.107	0.094	0.080*	0.004	1.099
EDU	1.047	0.031*	0.096	2.849	0.402	0.479	-0.023	1.495	0.511	0.350	-0.009	1.667
LAND	-0.528	0.016**	-0.047	0.590	-0.291	0.167	0.001	0.748	-0.233	0.260	0.013	0.792
MAH	2.092	0.072*	-0.021	8.100	3.384	0.004***	0.076	29.479	3.574	0.002***	0.160	35.668
DST	-0.230	0.438	-0.015	0.795	-0.117	0.731	0.009	0.889	-0.227	0.476	-0.011	0.797
INFO	-1.026	0.255	-0.065	0.358	0.344	0.748	0.165	1.411	-1.609	0.138	-0.176	0.200
DCS	2.395	0.036**	0.269	10.964	-0.208	0.861	-0.160	0.812	0.970	0.393	0.019	2.637
NFINC	-2.665	0.004***	-0.248	0.070	-1.576	0.153	-0.024	0.207	-0.874	0.388	0.110	0.417
WTPRIC	0.117	0.533	0.043	1.124	-0.070	0.753	0.019	0.933	-0.520	0.03*	-0.068	0.595
Multinomial Logistic Regression Model Fitness Attributes												
Log-Likelihood							-131.143					
p-value							0.000					
McFadden's Rho-squared							0.392					
Cox and Snell R square							0.642					

Taking do not sell as a base outcome ***, ** and * denote significance at 1%, 5% and 10% levels

by using maximum likelihood method. Like in the case of binomial logistic regression, the P-value for the model fit statistic is less than 0.05 and highly significant at ($p<0.001$) with ten degree of freedom, indicating that at least one of the parameter in the model is non zero. The McFadden's R-square or Pseudo R^2 is 0.39, indicating that 39% of the variations in probabilities of participating in various milk market outlet was explained by the covariates defined in the logistic model. Out of the 100 sample households, 85 household participated in the milk market while the remaining 15 household does not sell milk. In case of selling directly to consumers, among the ten variables taken in the model, five variables viz. education, land, milch animal holding, presence of DCS and non-farm income were found to be statistically significant. Education, milch animal holding and presence of DCS in the village positively affect choice of consumer as a milk sale outlet while size of land holding and non-farm income negatively affect the choice.

The marginal effect on education indicated that as the level of education increased, the probability of selling milk to consumer increased by 9.6%, all other factors held constant. A unit increase in education increases the odd of selling milk to consumer by 185%. The marginal effect on land holding indicated that as the land holding increases by one unit *i.e.* one acre the probability of selling milk directly to consumer decreases by 4.7%, all other variables held constant. A unit increase in land holding decrease the odd of selling milk to consumer by 41%, which is in accordance with the results of Bardhan *et al*. (2012) where increase in landholding-size decreased the probability that a producer will sell directly to consumer and increased the likelihood of selling to a cooperative. The sign of marginal effect on number of milch animals is in contrast with that of estimated co-efficient, so no definite effect can be established.

The marginal effect on DCS in the village indicated that as the presence of DCS increases the probability to sell

milk to local consumer increase by 26.9%, other variables hold constant. A unit increase in DCS increases the odd of selling milk to consumer by 996%. The marginal effect on non-farm income indicated that as the non-farm income increases by one unit the probability of selling milk to local consumer decreases by 24.8%, other variables held constant. A unit increase in non-farm income decrease the odd of selling milk to consumer by 93%.

In case of selling to market, among the ten variables taken in the model, only two variables viz. age and milch animal holding are found to be positively significant at 10% and 1% respectively. The marginal effect on age indicated that as the age of head of household increases, the probability to sell milk to market increases by 0.4%, all other factors held constant. A unit increase in age of head of household increases the odd of selling milk to market by 10.7%. The marginal effect on number of milch animals indicated that as the number of milch animals' increases, the probability to sell milk to market increases by 7.6%, all other factors held constant. A unit increase in milch animal holding increases the odd of selling milk to market by 2848%.

In case of selling to Dairy Co-operative society, among the ten variables taken in the model, three variables viz. age, milch animal holding and price of milk were found to be statistically significant. The positive sign of co-efficient of estimates of age and number of milch animals indicated that with the increase in age and number of milch animals the probability of choosing DCS as a milk sale outlet increases. The marginal effect on age indicate that for one unit increase in age the probability to sell to DCS increases by 0.4%, all other factors held constant. A unit increases in age of head of household increases the odd of selling milk to DCS by 9.9%. Bardhan *et al.* (2012), in a study in Uttarakhand, had also reported that age seemed to significantly reduce the likelihood that a producer will sell to a cooperative, implying that as age advances, producers shift away from cooperatives towards other marketing channels. The marginal effect on number of milch animals indicated that for one unit increase in milch animal the probability to sell to DCS increases by 16 per cent, all other factors held constant. A unit increase in milch animal holding increases the odd of selling milk to DCS by 3467%.

This finding was in consistence with Kuma *et al.* (2013) from a study in Ethiopia that number of milking cows owned by households negatively and significantly affected accessing cooperative milk market outlet as compared with accessing individual consumer milk market outlet. The negative sign of co-efficient of estimates of price indicate that as the weighted average price of milk increases, the probability of selling to DCS decreases by 6.8%, all other factors held constant. A unit increase in price of milk decreases the odd of selling milk to DCS by 40.5%. Kuma *et al.* (2013) in a study in Ethiopia, had also reported that price offered by milk market outlet per liter of milk significantly and negatively affected accessing cooperative milk market outlet as compared with accessing individual consumer milk market outlet.

Overall, the analysis shows that with the increase in age the probability of dairy farmers choosing market and DCS as a milk marketing outlet increases. This depicts that the older farmers prefer to select a market outlet which is fixed and reliable on a long term basis. On the contrary, the younger farmers prefer to sell to the local consumers as they can sell on door to door basis where they get a relatively higher price. The number of milch animal holding had a significant impact on the choice of selling of milk in all the three market channels. As the number of milch animals increased the milk production also increased leading to higher market participation.

CONCLUSION

The study revealed that of the total milk production, marketed surplus accounted for 63.41% while the rest 36.59% was used for household consumption. Of the total marketed surplus maximum quantity of milk (58.71%) was sold to DCS followed by local consumer (23.57%) and the remaining (17.71%) to market. But of all the 85 dairy farmers participating in the milk market maximum number of farmers prefer to sell to local consumers followed by DCS and market. This shows that suitable initiative and measures has to be taken up to promote DCS in term of coverage and membership so that its benefit reaches to all the dairy farmers for holistic dairy development in the state. Analysis on the factor affecting milk market outlet choices revealed that education, milch animal holding and DCS positively affect the selection of consumer as a milk outlet choice while land holding and non-farm income negatively affect the selection of consumer as a milk outlet choice. For sale of milk to

market and DCS, age of head of household and milch animal holding positively affect the selection. In order to increase marketed surplus and safeguard the long term sustainability of smallholder dairy farmers; herd size has to be increased along with the productivity of the milch animals, organized milk marketing should be promoted and dairy extension services should be strengthened.

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