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Milk-shed area of Dhenkanal Co-operative milk producers' union (Odisha): A cost & return analysis

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Abstract
Milk is an important primary source of income for 70 million rural households engaged in dairying in India. The cost of milk production is an important tool for the evaluation of economics of dairy enterprise at producers' level as well as for fixing the procurement price at Dairy Co-operative Society level and to ensure that producers get remunerative price for milk and consumers get milk and milk products at reasonable price. An efficient marketing system is one, which minimises the cost of marketing, so as to ensure the largest share of producers in consumer's price. Keeping in view the milk marketing situation in the country, the study "Milk-shed area of Dhenkanal Co-operative Milk Producers' Union (Odisha)": A Cost & Return analysis" was undertaken in these aspects, to work out the cost and returns of milk production in the study area. Analysis of cost of milk production provides clues to the decision making bodies and helps the decision support system to understand whether or not farmers get remunerative prices. The cost of milk production, it is important to discuss here the physical quantities of feed and fodder fed to different species of animals in the study area as major share of cost goes towards the expenditure on feed and fodder. The feeding pattern during data collection period in the study area included green fodder, dry fodder and concentrates. Productivity of different milch animals has an economic significance. The cost of the local cow ranged from `25,000 to `30,000. In case of crossbred cow most of the farmers had Jersey cow. The cost of the crossbred cow ranged from `35,000 to `50,000. Mostly the dairy farmers of the area reared local buffalo namely Chilka which costs about `25,000 to `32,000. Judicious utilisation of feed, fodder, labour, health care management and other cost component, which constitute the bulk of the cost of rearing dairy animals, can be managed to accrue handsome profit even in a situation of meagre resource endowments. Cost and returns of milk production of milch cow, milch buffalo and milch crossbred cow has been depicted to analyze the actual figure of Dhenkanal Co-operative Milk Producers' Union.

Keywords: fixed cost, depreciation cost, OMFED, cost and return of milk production

Introduction
India ranks first in milk production, accounting for 18.5 per cent of world production, achieving an annual output of 146.3 million tonnes during 2014-15 (NDDB, 2015) as compared to 137.69 million tonnes during 2013-14. A growth of 6.26 per cent was recorded. Dairy industry has become an important secondary source of income for millions of rural households engaged in agriculture. Out of the total population engaged in agriculture, 60 per cent of them owned milch animals either for their main or subsidiary occupation. The milk production has increased due to two reasons. Firstly, the introduction of efficient milk production pattern integrated with agriculture and secondly, involvement of milk producers at various levels for procuring milk through dairy co-operatives. The dairy co-operatives in India follow a three-tier structure which is similar on the lines of AMUL model in Gujarat. At each level of Milk Producers' Cooperative society (village-level, district-level, and state-level). Dairy co-operatives provided inputs like animal health-care and extension services to the members of the society and also provided training the employees of village- and district-level dairy co-operatives. Recently due to the effects of LPG (i.e. Liberalization, Privatization and Globalization) the private competitors raced ahead. In this context a lot of efforts to be made to strengthen the co-operative societies, still the organized sector, collect about 20 per cent of milk. In the milk marketing chain, the unorganized system is still prevailing.
Although there is considerable increase in milk production over years the productivity has not been improved. One of the main reasons for such low productivity is, dairying not practiced

with economic outlook, especially in case of small and marginal farmers who are more in number. The production of milk largely depends upon on these millions of landless and small farmers scattered all over the country most of whom were illiterate and unskilled. Thus there is a need to give due attention to this vulnerable group and hence the study on economics of milk production has gained more importance.

The cost of milk production is an important tool for the evaluation of economics of dairy enterprise at producers' level as well as for fixing the procurement price at Dairy Co-operative Society level. The information on cost and returns from dairying constitute an important aspect for policy planning to ensure that producers get remunerative price for milk and consumers get milk and milk products at reasonable price.

The present study was proposed in the central zone of Odisha because this zone having less area under rain fed and rainfall is uneven. Therefore majority of farmer have to depend upon rearing of livestock. The number of milch cattle per 1000 household is 1595 which is above the state average. The livestock and bovine density in the district are 169 and 100 animals per sq. km respectively while for Odisha these are 148 and 79 (12th Livestock census). The Dhenkanal Milk Union is selected purposively out of the 11 milk unions in Odisha OMFED, due to maintenance and availability of up to date records on various parameters relevant to the study and also it is the only union located in the central zone of Odisha. The objective of this study is to work out the cost and returns of milk production in the study area.

Material & Methods

The detailed methodology used during the course of this study is described under the following sub-heads:

1. Sampling Design
2. Data Collection
3. Analytical Framework

1. Sampling design

The sampling design consisted of selecting the ultimate sampling units i.e. households using multistage random sampling method. The dairy co-operative societies, villages and sample households constituted the first, second and third stages of sampling.

1.1 Selection of the state

Odisha state was purposively selected as it comes under transient dairy production environment which reflects the transitory environment from the low-input and low-output subsistence based under development environment towards the dynamic environment. Moreover Odisha state with immense scope for dairy development. The number of district dairy cooperative societies registered under Orissa State Cooperative Milk Producers Federation (OMEFD) is 11 up to 31st July 2014. The number of dairy cooperative societies has increased three folded from 1483 in 2002-03 to 5281 during 2013-14. Similarly the milk procurement has increased from 41000 litres per day to 390000 litres per day during 2013-14.The production of milk has increased from 672000 tons to 1724000 tons during 2013-14. The state ranks 16th position in milk production in country and 3rd among eastern and north-eastern states. But the growth rate of milk production is 6 per cent which is more than national growth rate (4.8 per cent).The milk production is expected to be three folded in 2020 (ARD sector, 2011). Therefore, the tremendous progress in dairy development provided the suitable background to conduct this study in Odisha.

1.2 Selection of the district milk union

The present study was proposed in the central zone of Odisha because this zone having less area under rain fed and rainfall is uneven. Therefore majority of farmer have to depend upon rearing of livestock. The number of milch cattle per 1000 household is 1595 which is above the state average. The Dhenkanal Milk Union was selected purposively out of the 11 milk unions in Odisha under OMFED due to maintenance and availability of up to date records on various parameters relevant to the study and also it is the only union located in the central zone of Odisha.

1.3 Selection of village milk co-operative societies

There are 70 Milk Co-operative Societies (DCS) in this milk union out of which 9 different village milk cooperative societies in the district union namely Atinda, Gundichapda, Harekrushnapur, Joranda, Karanda, Mahadia, Neulapoi, Ranja and Talbarkot were randomly selected. Out of each dairy cooperative society 20 households were selected.

1.4 Selection of sample households

A predetermined sample of 180 sample households was drawn randomly from all 9 DCSs. The sample was post stratified into three categories i.e. small, medium and large using Cumulative Square Root Frequency Method on the basis of milch animals shown in Fig 1.

1.5 Selection of milk marketing agencies

Both the organized and unorganized sectors of milk marketing were functioning in the milk shed area of Dhenkanal Co-operative Milk Producers' Union. All the traditional marketing agencies that were collecting milk from the sample households were selected for data collection. Thus, 19 milk vendors, 20 tea stalls, 7 halwais were collecting milk form the selected households and formed the sample size. The description of the milk marketing agencies is given below.

- **Milk Vendor** – The person who collects milk from milk producers and sell it to the consumer or to the other milk marketing functionaries.
- **Tea stall** – Shop where milk, tea and snacks are sold.
- **Halwais** – A person who collect milk from milk producers or other milk marketing functionaries and sell it as per the demand from the consumers.

2. Data Collection

To meet the objective of the study the data for the present study was collected from both primary and secondary sources.

2.1 Primary Data

Primary data were collected in the year 2015 and 2016 from 180 sample households, 19 milk vendors, 20 tea stalls and 7 halwais by using structural and semi –structural interview schedule through personal interview of head of the households, vendors, tea stall and halwais. The collection of information on various aspects on family size and composition, education of head of family, land holding, herd size, type of animals, dairy equipments, cattle shed along with its present value and expected life, quantity of feeds and fodder fed to animals along with their prevailing prices, family and hired labor used along with prevailing wage rate miscellaneous expenditure were collected. The information on milk production and its selling price, consumption, utilisation,

marketed surplus, disposal pattern of milk and milk marketing agencies was also collected. In addition to this, data from the following intermediaries were also collected to study the marketing efficiency.

(A) Milk Vendors
The information was collected by personal interview from the milk vendors on average quantities of milk purchased per day from the producers and sold to the consumers and contractors at different prices, along with the purchase and sale prices, investment on vehicle and equipment. Purchase price and expenditure on repairs. The data were also obtained on license fee, fuel, labor, time spent in milk collection distance covered per day for milk collection and also distribution was recorded.

(B) Tea stalls
The information was collected by personal interview from the owner of tea stalls on average quantities of milk purchased per day from the producers and sold to the consumers, along with the purchase and sale price, investment on building, vehicle and different type of equipment, purchase price and expenditure on repairs.

(C) Halwais
The information was collected by personal interview from the halwais on average quantities of milk purchased per day from the producers and vendors and sold to the consumers, along with the purchase and sale price, investment on vehicle and different type of equipments, purchase price and expenditure on repairs.

2.2 Secondary Data
Secondary data regarding total geographical area of the district, agro climatic features, cropping pattern, bovine population, number of registered dairy plants infrastructure facilities for dairying and animal husbandry, milk co-operative societies, etc. were collected from various sources like, Basic Animal Husbandry Statistics Odisha, Statistical Abstract, etc.

3. Analytical Framework
To achieve the objectives of the study, the data collected from 180 dairy households were scrutinized, tabulated and analyzed by employing various analytical tools. The analytical tools used for analysis of data are discussed in the present sections.

Tabular Analysis
The data were subjected to tabular analysis for working out the socio-economic profile and cost and returns of milking and milch animals across various categories of sampled households. Marketed surplus of milk and disposal of milk to different milk marketing agencies by different categories of households and further cost and returns of milk marketing agencies was also worked out by using tabular method.

Estimation of cost of milk production
It is important to study the cost of milk production as it is an indicator of economic efficiency of milk production and indicates the profitability of the enterprise. The various cost components were identified as fixed cost and variable cost. These costs are discussed briefly in this section.

Fixed costs
Fixed costs do not vary with the level of output and remain unchanged over a short period of time. The various components of fixed cost are depreciation and interest on fixed capital. Capital Recovery Cost method was used to calculate depreciation. The cost item interest on fixed capital does not need to be accounted for separately when CRC approach is followed.

Depreciation costs
It is the loss in the value of an asset due to normal wear and tear, time and technological obsolescence. It can be accounted for by using the Capital Recovery Cost (CRC) Method. The CRC method is defined as the annual payment that will repay the cost of fixed input over the useful life of input and provide an economic rate of return on investment.
The formula for estimation of CRC is:

$$R = Z[\frac{(1+r)^n r}{(1+r)^n - 1}]$$

Where,
R = Capital recovery cost
Z = Initial value of the capital asset
R = Interest rate
N = Useful life of the assets

In case of practical difficulties in getting the information on initial outlay at the field level, the current value of asset was considered. When the asset was purchased from borrowed capital the actual interest rate charged by the bank was taken as 'r', while in case of owned funds, the interest on term deposit of 1-5 years was taken. The useful life of assets was assumed to be 50 years for pucca cattle shed, 10 years for katcha shed, 6 years for manual chaff cutter, 10 years for power operated chaff cutter. The useful life of milch animals also varied with the type of animal and was taken as 10, 8 and 10 years for local cow, crossbred cow and buffalo, respectively. The total CRC was then apportioned to the individual animal in accordance with the Standard Animal Units (SAUs).

Variable cost
Variable costs are those costs, which are incurred on the variable factors of production and can be altered in the short run. Variable cost includes three items i.e. feed and fodder cost, labour cost and veterinary and miscellaneous expenditure.

Feed and fodder cost
This included the cost of feeding dry fodder, green fodder and concentrates to animals. In case of purchased feed and fodder, the cost was worked out as product of quantity fed to animal and purchase price of respective feed. In case of home-grown feed and fodder, the relevant prices were the farm-harvest prices. For certain types of fodder, especially cultivated green fodder, where farm-harvest prices were not available, the imputed value of crop is worked was taken as the prevailing price of standing crop in the village. In case the animal was fed with collected grass and tree leaves from the common property resources, its imputed value was their expected sale price and was accounted for while estimating the cost. When the concentrate feed was prepared at home, its cost was computed by taking the weighted prices of ingredients used in the concentrate, the weights being the share of each ingredient in the concentrate composition.

Labour cost
Total time spent was converted to man days by using conversion as:

1 day of women labour = 0.67 man day (3 women = 2 men) by assuming 8 working hours a day.

Veterinary and miscellaneous costs
The expenditure on breeding and health care of the animals was covered under the veterinary expense. It included, cost of artificial insemination (AI), natural service, vaccination, medicines, fee of veterinary doctor and other related expenses. The miscellaneous expenditure included expenses on repair of fixed assets, water and electricity charges, insurance premium and any other incidental charges. These being joint costs, apportionment of the same based on SAU were done.

Apportionment of joint costs
Among the various cost items discussed, certain expenses are incurred on the entire herd as a whole. For instance, the fixed assets like cattle shed, stores, mangers, water tub, buckets *etc.*, are jointly used by the entire herd. Also, the information on cost on labour and miscellaneous items were not available animal wise but for the entire herd as a whole. Therefore, for the apportionment of these joint costs the total number of animal were converted into standard animal units.

Regional Standard Animal Units (SAUs)
Considering the differences in regional endowments of animal wealth and species, the SAUs have been formulated by Sirohi *et al*. (2015) [7] at regional level for five regions viz; Eastern (including north-east), Western, Southern, Northern plains and Hills. Most of the earlier studies have considered only labour utilization as the basis of apportionment. In this case, apart from labour utilization, the body weight of the animal was also taken into consideration for the estimation of the SAUs. Based on expert opinion 60 per cent weight was given to labour utilization and 40 per cent to body weights of animals for the final estimation. As the study area falls in the Eastern region so standard animal Units for this region shown in Table 1 was used as given below:

Table 1: Standard animal units for eastern regions of India

Animals	Crossbred cattle	Buffalo	Local cow
Adult male (≥3 years)	1.07	1.02	0.92
Adult female (≥3 years)	1.20	0.86	1.00
Young stock male (<1 year)	0.25	0.25	0.27
Young stock female (<1 year)	0.24	0.23	0.24
Young stock male (>1 year)	0.51	0.42	0.41
Young stock female (>1 year)	0.38	0.38	0.37
Heifer	0.71	0.63	0.64

Other cost concepts used
Gross cost: It was obtained by adding all the cost components including fixed and variable costs.
Gross cost = Total variable cost + Total fixed cost

Net cost: The net cost was worked out by deducting the imputed income earned through dung, from the gross cost.
Net cost = Gross cost − Value of dung

Gross returns: Gross returns were obtained by multiplying milk yield of an individual milch animal with respective prevailing prices in the study area
Gross returns = Quantity of milk × Market price of milk

Net returns: Net return was calculated by subtracting net cost from gross returns
Net returns = Gross returns - Net cost

4. Result & Discussion
Cost and Returns of milk production
Analysis of cost of milk production provides clues to the decision making bodies and helps the decision support system to understand whether or not farmers get remunerative prices. Generally, dairy farmers can increase their family income in two ways *i.e.*, by increasing milk production or by reducing cost of milk production. The first alternative is limited as productivity enhancement of the individual milch animal is influenced by certain biological as well as climatic factors such as genetic potential of the animal, climatic parameter like temperature, rainfall, relative humidity, etc. These externalities by no means are subjected to control by the farmer and therefore, an economic sense can only be applied on the latter issue. The second alternative can be achieved through judicious use of various factors of production.
Therefore, before presenting the cost of milk production, it is important to discuss here the physical quantities of feed and fodder fed to different species of animals in the study area as major share of cost goes towards the expenditure on feed and fodder. The feeding pattern during data collection period in the study area included green fodder, dry fodder and concentrates. The major part of the green fodder fed to the animals was hybrid Napier grass, *dhanicha*, dry fodder included paddy straw and concentrate included both homemade (rice bran) and purchased (ground nut oil cake, mustard oil cake).

1. Average quantity of feed and fodder fed to animals
Table 2 shows that overall intake of green fodder for milch cow was 12.60 kg, which varies from 10.64 kg in small category, 11.92 kg in medium to 15.24 kg in large category. The overall intake of dry fodder for milch cow was 7.10 kg and which varies from 7.84 kg in small category,8.18 kg in medium to 5.29 kg in large category. The overall intake of concentrate for milch cow was 1.29 kg, which varies from 1.18 kg in small category,1.04 kg in medium to 1.67 kg in large category. Table 2 revealed that overall intake of green fodder for milch buffalo was 16.08 kg, which varies from 14.70 kg in small category, 12.24 kg in medium to 15.32 kg in large category. The overall intake of dry fodder for milch buffalo was 6.03 kg and which varies from 7.88 kg in small category, 5.32 kg in medium to 4.91 kg in large category. The overall intake of concentrate for milch buffalo was 1.65 kg, which varies from 1.31 kg in small category, 2.07 kg in medium to 1.57 kg in large category. Table 2 revealed that overall intake of green fodder for milch crossbred cow was 17.23 kg, which varies from 16.90 kg in small category, 17.02 kg in medium to 17.79 kg in large category. The overall intake of dry fodder for milch crossbred cow was 6.63 kg and which varies from 5.77 kg in small category, 9.65 kg in medium to 4.54 kg in large category. The overall intake of concentrate for milch crossbred cow was 2.46 kg, which varies from 2.75 kg in small category, 2.13 kg in medium to 5.49 kg in large category.

Table 2: Average quantities of feed and fodder fed to animals

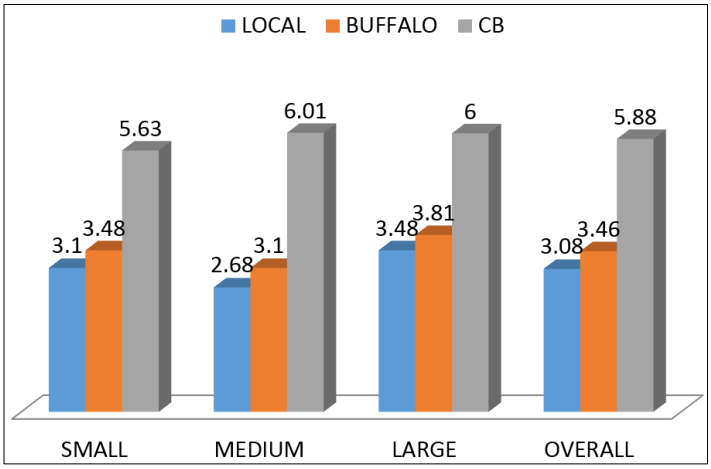
Feed and Fodder	Different Animals	Herd size category			Overall
		Small	Medium	Large	
Green fodder	Local cow	10.64	11.92	15.24	12.60
	Buffalo	14.70	12.24	15.32	16.08
	Cross bred	16.90	17.02	17.79	17.23
Dry fodder	Local cow	7.84	8.18	5.29	7.10
	Buffalo	7.88	5.32	4.91	6.03
	Cross bred	5.77	9.65	4.54	6.63
Concentrate	Local cow	1.18	1.04	1.67	1.29
	Buffalo	1.31	2.07	1.57	1.65
	Cross bred	2.75	2.13	2.51	2.46

(*Kg/animal/day*)
Small (1-4 milch animals); Medium (5-7 milch animals); Large (8 & above milch animals)

2. Productivity of different milch animals

Productivity has the economic significance. Since, it is the ultimately main source of income to an enterprise. In dairy enterprise the milk yield ultimately brings returns to the milk producers and has important role in economic analysis of a dairy enterprise. Milk production of a household depends on the milk yield of the animals maintained, number of animals in milk and herd size.

In case of milch crossbred cow, milk yield was observed highest in medium herd size category (6.01litres) followed by large (6.00 litres) and small herd size category of households (5.63 litres). In case of milch buffalo, the highest average daily milk yield was observed in the households of large herd size (3.81 litres) category followed by small category (3.48 litres) and medium herd size category (3.10 litres). In case of milch local cow, the highest average daily milk yield was observed in the large size category (3.48litres) followed by small category (3.10litres) and medium sized category (2.68 litres) as shown in Fig 1.



Small (1-4 milch animals); Medium (5-7 milch animals); Large (8 & above milch animals)

Fig 1: Average productivity of milch animals in different herd size category

3. Breeds of Animals

The cost of the local cow ranged from `25,000 to `30,000. In case of crossbred cow most of the farmers had Jersey cow (Fig. 1). The cost of the crossbred cow ranged from `35,000 to `50,000. Mostly the dairy farmers of the area reared local buffalo namely Chilka which costs about `25,000 to `32,000 (Fig. 1).

4. Maintenance cost and returns from milk production of different animals

Judicious utilization of feed, fodder, labour, health care management and other cost component, which constitute the bulk of the cost of rearing dairy animals, can be managed to accrue handsome profit even in a situation of meagre resource endowments. This endeavour requires the essence of economics of milk production, which in addition to cater the above interest, also serves as an important policy resolution in milk pricing as well. This section therefore, devotes to accentuate the issue that pertains to work out the cost and returns from milk production.

The cost of milk production presented in this section has been summed up under maintenance costs, which include variable and fixed costs as delineated in the methodology chapter. The returns from milk production were computed taking weighted average of milk for different species of bovines into consideration. The gross returns were worked out taking the milk price and quantity of milk as well as deducting the imputed value of dung from cost together. Hence, analysis of cost of milk production across the milch species forms an important aspect in bovine husbandry.

5. Cost and Returns of Milk production from Milch Local cow

Table 3 shows that the overall gross maintenance cost for milch local cow was worked out to be `80.70 per day which varied from `81.51 for small category ` 73.11 for medium category to `94.61 for large category. The overall total fixed cost was found to be `21.95 and total variable cost to be `58.42. Feed cost accounted for the major share of gross cost varying from `51.49 (54.42%) for large category to `30.39

(41.57 %) for small category which is in agreement with similar findings of earlier studies by Singh (2015) in Ranchi district of Jharkhand. Overall per litre cost of milk production was worked out to be `26.05 per milch local cow. A net return per litre per milch animal was found to be positive for all the categories. It was highest for large category (`0.34) and lowest for medium category (`0.11).

Table 3: Cost and returns of milk production from milch local cow (*`/animal/day*)

Cost components	Herd size category			
	Small	Medium	Large	Overall
Total fixed cost	21.94 (26.92)	20.58 (28.15)	25.40 (26.85)	21.95 (27.31)
Green fodder(F1)	10.64 (13.05)	11.92 (16.30)	15.94 (16.85)	11.87 (14.77)
Dry fodder(F2)	7.84 (9.62)	8.18 (11.19)	8.59 (9.08)	8.07 (10.04)
Concentrates(F3)	15.74 (19.31)	10.29 (14.07)	26.96 (28.50)	15.39 (19.15)
Total feed cost (V1=F1+F2+F3)	34.22 (41.98)	30.39 (41.57)	51.49 (54.42)	35.33 (43.96)
Labour cost(V2)	15.57 (19.10)	14.48 (19.81)	11.28 (11.92)	14.56 (18.11)
Misc. Expense(V3)	9.78 (12.00)	7.66 (10.48)	6.44 (6.81)	8.53 (10.62)
Total variable cost TVC=V1+V2+V3	59.57 (73.08)	52.53 (71.85)	69.21 (73.15)	58.42 (72.69)
Gross cost (A)=TFC+TVC	81.51 (100)	73.11 (100)	94.61 (100)	80.37 (100)
Dung value(B)	2.11	2.38	1.75	2.16
Net cost(C)=A-B	79.40	70.73	92.86	78.21
Price of milk	25.92	26.50	27.02	26.29
Gross return(D)	80.35	71.02	94.03	78.96
Avg. milk production/animal/day(E)	3.10	2.68	3.48	3.00
Net return(D-C)	0.95	0.29	1.17	0.74
Cost /litre(C/E)	25.61	26.39	26.68	26.05
Return/litre	0.31	0.11	0.34	0.24

6. Cost and returns of milk production from milch buffalo

Table 4 shows that the overall gross maintenance cost for milch buffalo was worked out to be `90.78 per day which varied from `91.04 for small category, `86.47 for medium category to `100.64 for large category. The overall total fixed cost was found to be `26.01 and total variable cost to be `64.77. Feed cost accounted for the major share of gross cost varying from `47.66 (47.35 %) for large category to `39.73 (43.64 %) for small category. Overall per litre cost of milk production was worked out to be `26.27 per milch buffalo. A net return per litre per milch animal was found to be positive for all the categories. It was highest for large category (`2.93) and lowest for medium category (`0.98). The net profit per day was higher for buffaloes compared to local cows which are in agreement with similar findings of earlier studies by Singh (2015) [5] and Kumari (2015).

Table 4: Costs of Milk Production and Returns from Milch Buffalo (*`/animal/day*)

Cost components	Herd size			
	Small	Medium	Large	Overall
Total fixed cost	25.80 (28.34)	25.89 (29.94)	26.98 (26.81)	26.00 (28.65)
Green fodder(F1)	16.70 (18.34)	14.24 (16.47)	17.32 (17.21)	15.90 (17.52)
Dry fodder(F2)	7.88 (8.65)	5.32 (6.15)	4.91 (4.88)	6.53 (7.18)
Concentrate(F3)	15.15 (16.64)	15.58 (18.01)	25.43 (25.26)	16.79 (18.49)
Total feed(V1)=F1+F2+F3	39.73 (43.64)	35.14 (40.63)	47.66 (47.35)	39.22 (43.20)
Labor(V2)	13.20 (14.49)	15.99 (18.49)	17.84 (17.73)	14.88 (16.38)
Miscexp(V3)	12.31 (13.52)	9.45 (10.93)	8.16 (8.11)	10.68 (11.76)
Total variable cost (TVC=V1+V2+V3)	65.24 (71.66)	60.58 (70.05)	73.66 (73.19)	64.77 (71.35)
Gross cost(A)=TFC+TVC	91.04 (100)	86.47 (100)	100.64 (100)	90.78 (100)
Value of dung(B)	1.93	2.04	1.05	1.84
Net cost(C)=A-B	89.11	84.43	99.59	88.93
Price of milk	27.28	28.22	29.07	27.88
Gross return(D)	94.93	87.48	110.76	94.53
Avg. milk production/animal/day(E)	3.48	3.10	3.81	3.39
Net return=D-C	5.82	3.05	11.17	5.59
Cost/litre=C/E	25.61	27.24	26.14	26.27
Return/litre	1.67	0.98	2.93	1.61

Small (1-4 milch animals); Medium (5-7 milch animals); Large (8 & above milch animals)
Figures in parentheses indicate percentage to the total

7. Cost of milk production and returns from milch crossbred cow

Table 5 shows that the overall per day gross maintenance cost for milch crossbred cow was worked out to be `136.67 per day which varied from `128.92 for small category, ` 145.27 for medium category and `141.68 for large category. The overall total fixed cost was worked out to be `37.53 and total variable cost was `99.14. The overall per cent share of feed cost to the total maintenance cost was 46.47 per cent varying from 46.38 per cent for small category to 47.16 per cent for large category. Feed cost was found to be the other major component in variable cost whose overall cost was found to be `63.52 per day.

Overall cost of milk production per litre of milk was worked out to be `23.10. The lowest cost per litre of milk was observed for small category (`22.50) and highest for medium category (`23.88).Net returns per litre of milk was found to be positive for all the categories which found overall as `3.33 per

litre. It was highest for large category (`3.62) and lowest for medium category (`2.82) which is in agreement with similar findings of earlier studies by Singh (2015) [5] and Kumari (2015).

Table 5: Cost of Milk production and Returns from Milch Crossbred Cow (*`/animal/day*)

Cost components CB	Herd size			
	Small	Medium	Large	Overall
Total fixed cost	32.97 (25.57)	43.02 (29.61)	39.41 (27.81)	37.53 (27.46)
Green fodder(F1)	16.9 (13.10)	17.02 (11.71)	17.79 (12.55)	17.07 (12.49)
Dry fodder(F2)	5.77 (4.47)	9.65 (6.64)	9.02 (6.37)	7.64 (5.59)
Concentrate(F3)	37.13 (28.80)	40.61 (27.95)	40.02 (28.24)	38.80 (28.39)
Total feed(V1=F1+F2+F3)	59.80 (46.38)	67.28 (46.31)	66.83 (47.16)	63.52 (46.47)
Labor(V2)	17.22 (13.35)	18.59 (12.79)	20.17 (14.23)	18.14 (13.27)
Miscexp(V3)	18.93 (14.68)	16.38 (11.27)	15.27 (10.77)	17.48 (12.79)
Total variable cost TVC=V1+V2+V3	95.95 (74.43)	102.25 (70.38)	102.27 (72.18)	99.14 (72.53)
Gross cost(A)=TFC+TVC	128.92 (100)	145.27 (100)	141.68 (100)	136.67 (100)
Value of dung(B)	2.25	1.74	2.14	2.05
Net cost(C)=A-B	126.67	143.53	139.54	134.62
Price of milk	26.11	26.70	26.84	26.43
Gross return(D)	147.00	160.47	161.31	153.93
Avg. milk production/animal/day(E)	5.63	6.01	6.01	5.82
Net return=D-C	20.33	16.94	21.77	19.31
Cost/litre=C/E	22.50	23.88	23.22	23.10
Return/litre	3.61	2.82	3.62	3.33

Small (1-4 milch animals); Medium (5-7 milch animals); Large (8 & above milch animals)
Figures in parentheses indicate percentage to the total

References

1. Baruah DK, Sarker AB, Bora NN. A study of economics of milk production in Assam. Indian J Dairy Sci. 1996; 49(1):17-23.
2. Das S. Economic Efficiency of Milk Production and Marketed Surplus in Rural Area of Burdwan District (West Bengal). M.Sc. Thesis, NDRI (Deemed University), Karnal, Haryana, India, 2004.
3. Khan AR. Economic Analysis of Milk Production Systems in New Alluvial Zone of W.B. Ph.D Thesis, NDRI, (Deemed University), Karnal, Haryana, 2006.
4. Singh V. Economic analysis of traditional milk marketing chain in Karnal district of Haryana. M.Sc Thesis, NDRI (Deemed University), Karnal, Haryana, 2013.
5. Singh P. Economic analysis of traditional milk marketing chain in Ranchi district of Jharkhand. M.Sc Thesis, NDRI (Deemed University), Karnal, Haryana, 2015.
6. Sinha M. Economic Analysis of Dairy Enterprise in Nalanda District of Bihar, M.Sc. Thesis, N.D.R.I. (Deemed University), Karnal, Haryana, 1997.
7. Sirohi S, Joshi BK, Kumar Y. Economics of milk production variations across productivity levels. Indian Journal of Dairy Science. 2007; 60(2):124-128.