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Dass SRC
PG Scholar, Department of Livestock reduction Management, College of Veterinary Science, P V Narsimha Rao Telangana Veterinary University, Hyderabad, Telangana, India

Kishan Kumar M
Professor and University Head, Department of Livestock Production Management, College of Veterinary Science, Rajendranagar, P V Narsimha Rao Telangana Veterinary University, Hyderabad, Telangana, India

Rajanna N
Programmed Coordinator & Head, Krishi Vigyan Kendra, Mamnoor, Warangal District, P V Narsimha Rao Telangana Veterinary University, Telangana, India

Venkateswarlu M
Professor and University Head, Department of Animal Nutrition, College of Veterinary Science, Korutla, Jagityal District, P V Narsimha Rao Telangana Veterinary University, Telangana, India

Corresponding Author:
Dass SRC
PG Scholar, Department of Livestock reduction Management, College of Veterinary Science, P V Narsimha Rao Telangana Veterinary University, Hyderabad, Telangana, India

A study on milk supply chain in Sanga Reddy district of Telangana

Dass SRC, Kishan Kumar M, Rajanna N and Venkateswarlu M

Abstract
Exploratory design was selected to carry out a study on milk supply chain in Sanga Reddy district of Telangana. Three mandals in Sanga Reddy district and three villages from each of the mandal were selected to carry out the survey. A total of 90 dairy farmers and 30 value chain actors and 10 consumers total of 130 respondents were selected randomly. Five marketing channels in milk supply chain were farmer to consumer directly, through the middlemen, through the retailer, to the dairy co-operatives and through tea / sweet seller. Majority of the buyers were middlemen in the un-organized marketing of milk. The sale price and net returns were highest in buffalo milk in the channel-I (direct to consumer). The tea/ sweet sellers were selling the milk after value addition to the consumers with a market margin of Rs 62.79 per liter which was highest market margin, but the producer's share in consumer price was least at 34.57%.

Keywords: Marketing channel, market margin, price spread, marketing efficiency

Introduction
The dairy sector is a very important productive activity in Indian agriculture, milk is the second largest agricultural commodity contributing to G.D.P, next only to rice, and generates a regular flow of income to the farmer's family throughout the year. According to Black's Law glossary "the path from hawker to the consumer of a company's goods and services, flowing in one direction. Also, this is the path that expenses from consumer to the vendor generated by sales flood in the reverse direction. Therefore, the present study emphasized on milk supply chain and links between various levels of marketing channels and analysis.

Material and Methods
Milk Production: The cost of milk production was estimated by taking the input data from the farmer through interview schedules. For calculating the various costs such as fixed costs, variable costs, the following method was used.

Fixed Cost: It has the components like interest on loans, property tax and depreciation on farm equipment. Depreciation cost calculated on the equipment and milch animals at the rate of 10.00 percent and as 5.00 percent on animal sheds.

Variable Cost: It included feed, labor, transportation, medicines and miscellaneous expenditure. The variable expenses like fodder, green grass, concentrate mixture, labor expenses, transportation and miscellaneous expenses such as medicines, Veterinary, insurance, breeding or A.I. services were collected from the dairy farmers.

Cost Concepts: Gross cost was obtained by adding fixed and variable costs i.e.
Gross cost =Total fixed cost+ Total variable cost.
Net cost= Gross cost- income from dung.
Gross returns= quantity of milk yield (Kg) × sale price of milk (Rs)
Net income = Gross returns- net cost.

Cost of Milk Production: The cost of milk production per liter was estimated by taking the actual expenditure incurred per animal per day and the average milk yield of animal per day.

Total net cost = $X_1+X_{2+}X_{3+}X_{4+}X_{5+}X_{6+}X_7–VD$

$$\text{i.e., cost of milk production} = \frac{\text{Total net cost (in Rupees)}}{\text{Milk produced per animal per day (in Kgs)}} \quad (1)$$

{X_1=Cost of fodder/feed
X_2= Cost of labor
X_3= Cost of transportation
X_4= Cost of medicines &Veterinary
X_5= Miscellaneous cost
VD=Value of dung in Rupees.}

Milk Marketing: The data was collected on the marketing of liquid milk, the criteria fixed for sale price of milk at time of selling by the farmer, marketing expenses and price spread over the different markets and over different value chain actors. The price spread was estimated by collecting the data from farmers, middlemen, retailers, tea/sweet seller and finally consumers.

Results

Milk Production

The cost component of milk production and returns from dairy animals is presented in the Table 1.

It was revealed that mean cost of milk production per liter of milk was Rs 35.87 for buffalo milk and Rs 27.77 for cow milk. It was observed that the sale price of milk per liter was Rs 49.38 and Rs 36.70 for buffalo and cow milk. The net return was as Rs 13.51 and Rs 8.98. The total feed expenditure incurred per animal per day was Rs 114.48 and Rs 110.26 for buffalo and cow which contributing 63.97 and 61.12 percent of gross cost of milk production per animal per day.

It was observed that labor, veterinary, transportation and miscellaneous cost incurred per animal per day was Rs 28.41, 1.97, 1.28 and 4.70 for buffalo and Rs 31.51, 1.73, 1.18 and 6.28 for cow. Total variable cost incurred was Rs 150.84 (84.28%) and Rs 150.91 (83.65%), while total fixed cost was observed as Rs 28.13 (15.72%) and 29.49 (16.35%) for buffalo and cow. Total gross cost, value of dung and total net cost per animal per day was Rs 178.97, 2.80 and Rs 176.17 for buffaloes, Rs 180.40, 2.75 and Rs 177.65 for cows.

The sale price of milk observed as Rs 49.38 and Rs 36.70 for buffalo and cow per liter. The milk production observed as 4.91 and 6.41 liter per animal per day for buffalo and cow. Thus, gross returns calculated as Rs 242.45 and Rs 235.24 per animal per day for buffalo and cow, the net return as Rs 66.28 and Rs 57.59. The cost of milk production was Rs 35.87 and Rs 27.77 per liter for buffalo and cow milk. The net return from buffalo milk was Rs 13.51 and Rs 8.98 from cow milk per liter. Thus, the benefit cost ratio as 1.37:1 and 1.32:1.

Table 1: Cost components of milk production and returns from dairy animals.

S No	Cost Components (per animal per day)	Buffalo	Cow
1	Total feed cost (Rs)	114.48 (63.97%)	110.26 (61.12%)
2	Labor cost (Rs)	28.41 (15.87%)	31.51 (17.47%)
3	Veterinary & medicines cost (Rs)	1.97 (1.10%)	1.73 (0.96%)
4	Transportation cost (Rs)	1.28 (0.71%)	1.18 (0.65%)
5	Miscellaneous cost (Rs)	4.70 (2.62%)	6.28 (3.48%)
6	Total variable cost (TVC) (Rs)	150.84 (84.28%)	150.91 (83.65%)
7	Depreciation on FC (Rs)	14.73 (8.23%)	15.44 (8.56%)
8	Interest on FC (Rs)	13.40 (7.49%)	14.05 (7.79%)
9	Total fixed cost (TFC) (Rs)	28.13 (15.72%)	29.49 (16.35%)
10	Gross cost (TVC+TFC) (6+9) (Rs)	178.97 (100.00%)	180.40 (100.00%)
11	Value of dung (Rs)	2.80	2.75
12	Net cost (9-10) (Rs)	176.17	177.65
13	Sale price of milk per liter (Rs)	49.38	36.70
14	Milk production (liters)	4.91	6.41
15	Gross return (Rs)	242.45	235.24
16	Net return per animal per day (Rs)	66.28	57.59
17	Cost of milk production per liter (Rs)	35.87	27.77
18	Net return (Rs)	13.51	8.98
19	Benefit cost ratio (B.C.R.)	1.37:1	1.32:1

Milk Marketing

The following five (5) marketing channels were found, and the details presented in Table 2.

Disposal Pattern of Milk

It was observed that only 5.60% of buffalo milk disposed through the organized marketing channel, remaining 94.40% disposed through un-organized market.

In the un-organized category 58.00% of the marketed buffalo milk reached to the consumer through the middlemen followed by 19.28, 9.08, directly by the farmer to the consumer, through retailer and only 8.04 percent of the buffalo milk was marketed after value addition by tea/sweet seller.

Table 2: Disposal of milk to different value chain actors (liters per day) in the study area

S. No	Particulars		Buffalo milk
1	Unorganized sector	Direct to consumer	372 (19.28%)
2		Middlemen	1119 (58.00%)
3		Retailer	175 (9.08%)
4		Tea/ sweet seller	155 (8.04%)
		Unorganized sector total	1821 (94.40%)
5	Organized sector	Dairy co-operative	108 (5.60%)
Total			1929 (100%)

Milk Marketing Channels, Price Spread, Marketing Margin and Marketing Efficiency in Buffalo Milk

The results are depicted in the Table 3. The cost of milk production in the marketing channels I, II, III, IV and V was found to be Rs 36.57, 36.48, 35.02, 35.25 and 36.03 per liter of milk production. The transportation charges born by the milk producer observed in marketing channel I and V was Rs 1.28 and 1.16. Total cost of milk production observed was Rs 37.85, 36.48, 35.02, 35.25 and 37.19 per liter of buffalo milk in the marketing channels I, II, III, IV and V. The sale price of the milk per liter was Rs 52.34, 45.90, 47.11, 45.23 and 49.71 and net return per liter of milk was 14.49, 9.42, 12.09, 9.98 and 12.52 in the marketing channels I, II, III, IV and V.

The marketing costs incurred by the middlemen in the channel-II was Rs 3.63 per liter, purchase price of milk was Rs 45.90, and sale price of milk was Rs 65.87 and a net profit of Rs 16.34 per liter. In the same channel the retailer incurred marketing costs of Rs 2.00 per liter of milk, purchase price of milk was Rs 65.87, and sale price of milk was Rs 75.40 per liter of buffalo milk and thus a net profit gained by the retailer was found to be Rs 7.53 per liter. The total marketing costs incurred by the retailer in the channel-III found to be Rs 4.80 per liter, purchase price Rs 47.11, and sale price Rs 63.20 and a net profit of Rs 11.29 per liter of buffalo milk. The total marketing costs incurred by the dairy cooperative in the channel-IV found to be Rs 5.00 per liter, purchase price of milk was Rs 45.23, and sale price Rs 61.00 and a net profit of Rs 10.77. The total marketing cost incurred by the tea / sweet seller in the channel-V was Rs 31.30 per liter, purchase price was Rs 49.71, and sale price of value-added milk was Rs 143.80 and a net profit of Rs 62.79 per liter. The consumer paid a price of Rs 52.34, 75.40, 63.20, 61.00 and 143.80 per liter milk in the marketing channel I, II, III, IV and V.

The marketing margin in the five marketing channels was observed to be Rs 0, 23.87, 18.40, 10.77 and 62.79 while the price spread Rs 0, 29.50, 23.20, 15.77 and 94.09. The producer's share in consumer price was observed in the five marketing channels as 100, 60.88, 75.54, 74.15 and 34.57 percent. The marketing margin, consumer price was 0, 31.66, 29.11, 17.66 and 43.66 percent. The marketing efficiency was infinitive, 01.56, 02.03, 02.87 and 00.53.

Table 3: Marketing channels, price spread, marketing margin and marketing efficiency for buffalo milk in the study area (Rs per liter)

S. No	Parameter	Name of the market channel				
		I (Direct consumer)	II (Middlemen)	III (Retailer)	IV (Dairy co-operative)	V (Tea/ sweet seller)
1	Milk producer's level					
a)	Cost of milk production (Rs/lit)	36.57	36.48	35.02	35.25	36.03
b)	Transportation cost Rs/liter	1.28	0	0	0	1.16
c)	Total Cost of milk production (Rs/lit) (a+b)	37.85	36.48	35.02	35.25	37.19
d)	Sale price of milk per liter (Rs/liter)	52.34	45.90	47.11	45.23	49.71
e)	Net return	14.49	9.42	12.09	9.98	12.52
2	Middlemen level					
a)	Marketing costs	---	---	---	---	---
(i)	Labour	---	01.38	---	---	---
(ii)	Transportation charges	---	02.25	---	---	---
(iii)	Total marketing cost	---	03.63	---	---	---
b)	Sale price of milk per liter (Rs/liter)	---	65.87	---	---	---
c)	Net return	---	16.34	---	---	---
3	Retailer level					
a)	Marketing costs	---			---	---
(i)	Labour	---	02.00	02.80	---	---
(ii)	Transportation charges/ Rent	---	00.00	02.00	---	---
(iii)	Total marketing cost	---	02.00	04.80	---	---
b)	Sale price of milk per liter (Rs/liter)	---	75.40	63.20	---	---
c)	Net return	---	07.53	11.29	---	---
4	Cooperative level					
a)	Marketing costs	---	---	---		---

(i)	labor	---	---	---	02.00	---
(ii)	Transportation charges	---	---	---	03.00	---
(iii)	Total marketing cost	---	---	---	05.00	---
b)	Sale price of milk per liter (Rs/liter)	---	---	---	61.00	---
c)	Net return	---	---	---	10.77	
5	Tea/sweet seller level					
a)	Marketing costs	---	---	---	---	
(i)	labor	---	---	---	---	07.50
(ii)	Transportation charges	---	---	---	---	00.00
(iii)	Other charges (value addition)	---	---	---	---	23.80
(iv)	Total marketing cost	---	---	---	---	31.30
b)	Sale price of Tea/sweet per liter after value addition (Rs/liter)	---	---	---	---	143.80
c)	Net return	---	---	---	---	62.79
6)	Price paid by the consumer	52.34	75.40	63.20	61.00	143.80
7)	Marketing cost	00.00	05.63	04.80	05.00	31.30
8)	Marketing margin	00.00	23.87	18.40	10.77	62.79
9)	Price spread (Rs / liter)	00.00	29.50	23.20	15.77	94.09
10)	Producer's share in consumer price	100%	60.88%	75.54%	74.15%	34.57%
11)	Marketing margin in consumer price	00.00%	31.66%	29.11%	17.66%	43.66%
12)	Marketing efficiency	∞	01.56	02.03	02.87	00.53

Average Milk Production per Day, Milk Consumption and Market Surplus

The results are depicted in the Table 4. The average milk production in marketing channel-II (middlemen) was highest (27.5 liters per farmer per day) and followed by 15.60, 25.25, 13.45 and 20.00 liters per day in case of channel-I, III, IV and V.

The milk consumption per family was 1.30, 1.40, 1.50, 0.85 and 1.25 liters per family per day in channel-I, II, III, IV and V and the marketed surplus as 91.67, 94.91, 94.06, 93.68 and 93.75 percent of the total milk production per farmer per day.

Table 4 Average milk production per day, milk consumption and market surplus in the study area ((liters per farmer per day)

S. No.	Particulars	Marketing channel				
		I	II	III	IV	V
1	Average Milk Production	15.60	27.50	25.25	13.45	20.00
2	Milk consumed by family	1.30	1.40	1.50	0.85	1.25
3	Average marketed surplus liters per day	14.30 (91.67)	26.10 (94.91)	23.75 (94.06)	12.60 (93.68)	18.75 (93.75)

Criteria for Fixing the Rate of Milk at the Time of Selling by Farmer:

The results are presented in the Table 5. Majority (52.22%) of the farmers follow the criteria for fixing the price of milk at the time of selling was decided by the buyers, while 28.89, 11.11 and 7.78% were fixed by seller, based on fat and SNF content and existing market price.

Table 5: Criteria for fixing the rate of milk at the time of selling by farmer in the study area.

S. No	Particulars	No of farmers (N=90)
1	Fat % & SNF %	10 (11.11%)
2	Existing market price	7 (7.78%)
3	Seller decides	26 (28.89%)
4	Buyer decides	47 (52.22%)
	Total	90 (100%)

Mode of Marketing of Milk at the Time of Selling by Farmer

The results presented in the Table 6. The majority (51.11%) of the farmers marketed the milk at producer's home/farm followed by 28.89, 11.11, 4.44 and 4.44 percent at consumer's door step, at cooperative milk collection center, retailer and tea/sweet shop. Majority (58.80%) of the produced milk was sold at farmers home/farm, followed by 17.95, 11.73, 6.01 and 5.51 percent at consumer's doorstep, retailer, cooperative milk collection center and tea/sweet shop, respectively.

Table 6 Mode of marketing of milk at the time of selling by farmer in the study area.

S. No.	Particulars	No of farmers (N=90)	Quantity of milk sold (liters/day)
1	At producer's home/farm	46 (51.11%)	1654 (58.80%)
2	At cooperative union milk collection center	10 (11.11%)	169 (6.01%)
3	At consumer's doorstep	26 (28.89%)	505 (17.95%)
4	At tea/sweet shop	4 (4.44%)	155 (5.51%)
5	Retailer	4 (4.44%)	330 (11.73%)
	Total	90 (100%)	2813 (100%)

Discussion

Milk Production

The demand for cow milk is very less due to less consumer preference and its flavor and less fat content and resulted in net return per liter of cow milk was very less than buffalo milk. The findings were similar to the observations of Jitendra *et al*. (2017) [10] who reported that total cost of milk production and net profit for buffalo milk was higher than that of cow milk in Uttar Pradesh.

The farmers were feeding more quantity of dry fodder due to less availability of green fodder round the year and high cost of concentrate mixture. The feed cost is the major contributing factor in milk production. The observations were

corroborated with the findings of Nischay Patel and Bharathkumar Ashwar (2019) [14], who reported that expenditure on feed and fodder was highest (73.77%) in northern Gujarat.

The results regarding variable costs were dissimilar to the observations of Nischay Patel and Bharathkumar Ashwar (2019) [14] on certain parameters, who reported that labor and miscellaneous expenditure as 7.61 and 1.59 percent, while similar observations were reported on other parameters such as veterinary cost (1.69%), total variable cost (84.67%) and total fixed cost (15.33%) in a study in Aravalli district of north Gujarat.

The results on sale price of milk, gross returns and net returns indicated that there is a wide margin in the parameters of milk production between buffalo and cow. The reasons stated are the milk production in buffalo is less but creamier than cow milk where milk production in cow is more but less fat content. The demand for buffalo milk is more than cow milk due to the consumer preference.

Milk Marketing

The most prevalent (51.12%) milk marketing channel was channel-II i.e., farmer to consumer through middlemen. The reasons are lack of marketing infrastructure, transportation facilities, presence of insubstantial dairy co-operatives, the farmers chose the dairy as a supplementary income source etc. The findings were in concurrence with Akila and Senthilvel (2012) [2] and Anjani Kumar and Shinoj Parappurathu (2013) [15] who reported that majority of the farmers sold the milk to middlemen and milk vendors. The findings were dissimilar to the observations of Ahirwar *et al.* (2010) [1] and Gagandeep (2011) who reported that majority of the milk sold by the farmers to the consumers directly. The results regarding milk sold to dairy co-operative societies were in contrast to the observations of Malsawmdawngliana and Rahman (2016) [13] and Kotresh *et al.* (2017) [12] who reported that majority (92.00%) of the milk produced by the farmers marketed through the dairy co-operatives. These findings were similar to the observations by Islam *et al.* (2018) [9] regarding tea sellers, where only 5.00 percent of marketed milk reached to the consumer after value addition.

Disposal Pattern of Milk

The majority of the milk produced from buffalo disposed through un-organized market. In the un-organized category (58.00%) was the middlemen followed by 19.28% directly from the farmer to the consumer, 9.08% through retailer and 8.04% milk was marketed after value addition by tea/sweet seller. The reasons are the marketing network in the organized sector was not much developed. The findings were dissimilar to the observations of Anil Gupta (1993) who stated that 41.95% of the marketed milk was channelized through organized market in Haryana. Badal (1994) stated that majority of the farmers sold the milk to the tea shops and halwais followed by milk vendors and consumers directly in Gopalgunj district of Bihar. The findings were similar by Priyanka Singh and Datta (2016) the majority of the marketed milk was channelized through milk vendor followed by directly to the consumer and sweet seller, whereas least quantity of total marketed milk was distributed to through dairy co-operative society in a study in Ranchi district of Jharkhand.

Milk Marketing Channels, Price Spread, Marketing Margin and Marketing Efficiency in Buffalo Milk

It was observed that the sale price and net returns were highest (Rs 14.49) in marketing channel-I i.e. the milk channelized directly to the consumer by the milk producer in the study area. The reasons are the consumers' preference to purchase the milk directly from the dairy farmer due to the belief that they pour unadulterated and quality milk. The net returns were lowest (Rs 9.42) in the marketing channel-II, the reasons are the involvement of several value chain actors like middlemen and retailers. It is inevitable to the dairy farmers to accept the middlemen due to lack of milk marketing at door step of the farmers in the unorganized marketing, where the middlemen collect the milk from the farmers at the price fixed by them and sale the milk to the next value chain actor i.e. retailer. Due to the handling of milk at various levels and due to involvement of transportation charges, labor charges and the profit margins by the value chain actors, so that the milk sale price to the consumer can't be increased, resulting in decrease of sale price of the milk by the farmers. In dairy co-operative channel also the price paid to the dairy farmers was noted as low due to the price as per fat and S.N.F. content of the milk at lesser rates. As the milk passes through different value chain actors, it exert a pull on the consumer price. Highest market margin observed in channel-V due to the value addition takes place in the channel-V.

The producer's share in consumer price noted as absolute (100%) in channel I and lowest in channel V. This can be attributed to the fact that in the channel I, no value chain actors were involved thus benefitting both producer and consumer. But after value addition the sale price of the tea or sweet increases resulting in benefit to the tea or sweet seller. These findings are in concurrence with Sharma *et al.* (2007) [16] who reported that the producer's share in consumer price was highest in producer to direct consumer milk marketing channel. Whereas the findings were dissimilar to the observations of Anjani Kumar *et al.* (2010) [4] who reported that the producer got a higher share when they sold the milk to wholesalers or processors. The market efficiency observed as lowest in channel V and highest in channel I. Thus, the channel-I was more benefitting to the farmer, but all the farmers are not involved in the channel-I due to lack of infrastructure and facilities for milk marketing. Similar observations were noted by Sujatha *et al.* (2015) [17] who reported that the involvement of mediators in milk marketing resulted in low marketing efficiency.

Average Milk Production per Day, Milk Consumption and Market Surplus

The majority of the farmers use the middlemen to sell their milk due to more availability of marketed surplus, whereas only few farmers sell their milk directly to the consumer due to availability of less quantity of marketed surplus with them. The observations were similar to the findings of Kaushlendra Vikram Mishra and Goyal (2015) in a study in Azamgarh district of Uttar Pradesh.

Criteria for Fixing the Rate of Milk at the Time of Selling by Farmer

Majority (52.22%) of the farmers indicated that the criteria was decided by the buyers for fixing the price of milk, while the practice of selling the milk based on fat and S.N.F was observed only in dairy co-operative channel due to less

remunerative price. These findings were similar to the observations of Anjani *et al*. (2013) [5].

Mode of Marketing of Milk at the Time of Selling by Farmer

The majority (51.11%) of the farmers marketed the milk at producer's home/farm followed by 28.89, 11.11, 4.44 and 4.44 percent at consumer's doorstep, at cooperative milk collection center, retailer and tea/sweet shop. The reasons stated that the due to lack of transportation facilities for farmers for marketing their milk and taking part in other agriculture related activities and readily availability of the middlemen, the farmers were pouring the milk to them. Similar findings were observed by Bhavar *et al.* (2019) [7] who reported that majority of the marketed milk was sold to un-organized sector due to door step collection of milk by the mediators in a study in northern dry zone of Karnataka.

Conclusion

The farmer, who is selling the milk directly to the consumer, is getting reasonable profits. Milk bought by value chain actors from dairy farmers fetch them more profit, but the milk producers get little profits due to high input costs and labor expenses. It is evident that the dairy farmers can earn better profit, if they market their milk directly to the consumers and also make arrangement for selling milk products. It can be concluded that the dairy sector is a value chain-based development activity in which milk producers, value chain actors and consumers are equally essential in developing the dairy sector. The managemental and financial constraints such as infertility problem, high cost of milch animals, feed/fodder cost, transportation cost and exploitation by middlemen etc. are leading to less economic returns to the farmers.

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