ECONOMIC IMPACT OF COVID-19 PANDEMIC ON DAIRY FARMERS AND DAIRY COOPERATIVES IN BENGALURU RURAL AND CHIKKABALLAPURA DISTRICTS OF KARNATAKA

THESIS SUBMITTED TO THE
ICAR-NATIONAL DAIRY RESEARCH INSTITUTE
(DEEMED UNIVERSITY)
IN PARTIAL FULFILLMENT OF THE REQUIREMENTS
FOR THE AWARD OF THE DEGREE OF

MASTER OF SCIENCE

IN

AGRICULTURAL ECONOMICS

BY

THEJESH S
B. Sc. (Agriculture)

SOUTHERN RESEARCH STATION
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BENGALURU-560030, INDIA

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Approved by

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CERTIFICATE

This is to certify that the thesis entitled, **"Economic impact of COVID-19 pandemic on dairy farmers and dairy cooperatives in Bengaluru rural and Chikkaballapura districts of Karnataka"** submitted by **Mr. Thejesh S (19-M-ES-06)** towards the partial fulfillment for the award of the degree of **Master of Science in Agricultural Economics** of the **ICAR-National Dairy Research Institute (Deemed University)**, Karnal (Haryana), India, is a bonafide research work carried out by him under my guidance and no part of the thesis has been submitted for any other degree or diploma.

M. S

(Dr. M. Sivaram)
Major Advisor & Chairman

DEDICATED TO

MY PARENTS,

RESPECTED GUIDE,

MY BROTHER

AND

DYNO

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A journey is easier when accompanied with our dear ones. This thesis is the result of invaluable support shown by my well-wishers during the time period of nearly two years. It is a proud feeling that I have now the opportunity to express my gratitude to all of them.

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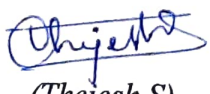

(Thejesh S)

Bengaluru
Date 27/08/21

ABSTRACT

The novel corona virus (COVID-19) which was first identified on November 17, 2019 in Wuhan city of China turned out to be a pandemic. As a preventive measure against the pandemic, the Government of India announced nationwide lockdown on 24 March, 2020 which continued till 31 May, 2020. This not only limited the movement of people across the country but also led to the implementation of the policies like quarantines, containment zones, social distancing, travel restrictions etc. These polices have affected every sector of the Indian economy including the dairy sector. Among the stakeholders of the dairy sector, dairy farmers and dairy cooperatives are the most affected. Against this backdrop, the present study was undertaken to assess the economic impact of COVID-19 pandemic on dairy farmers and dairy cooperative societies in Bengaluru rural and Chikkaballapura districts of Karnataka. The study covered pre-lockdown, lockdown and post- lockdown phases up to December 2020. The data was collected from 200 dairy farmers, 24 village dairy cooperatives and 2 milk unions. In order to meet the objectives, analytical tools such as quantity gap analysis, price gap analysis, Wilcoxon signed rank test and trend analysis were employed. The major conclusions of the study are as follows.

- There was no significant change in milk yield found in both the districts with respect to indigenous cows and buffalo during lockdown and post-lockdown periods when compared to pre-lockdown period. However, the milk yield of crossbred cattle was reduced by 2.26 per cent in Bengaluru rural district ($P < 0.01$) and by 4.01 per cent in Chikkaballapura district ($P < 0.001$) during lockdown as compared to pre-lockdown period. During post-lockdown period, the milk yield of crossbred was reduced by 2.35 per cent in Bengaluru rural district ($P < 0.01$) and by 0.94 per cent in Chikkaballapura district as compared to pre-lockdown period.
- In Bengaluru rural district, the procurement price of the milk was reduced from ₹ 29 per liter in pre-lockdown to ₹ 26.5 per liter in lockdown. Further, it was reduced to ₹ 23 per liter during post-lockdown period. In Chikkaballapura district procurement price of the milk remained same as ₹ 28 per liter during pre-lockdown and lockdown periods. But during the post-lockdown period, the procurement price of the milk was reduced to ₹ 26.15 per liter.

- When compared to pre-lockdown period, the cost of concentrate feeds was increased by about 37 per cent and 21 per cent in both the districts during lockdown and post-lockdown period respectively.
- About 81 per cent and 87 per cent of farmers from the Bengaluru rural and Chikkaballapura districts respectively witnessed loss in their income from dairying during lockdown or post-lockdown.
- In Bengaluru rural district, net return per liter of milk for high productivity crossbreds was reduced by 33.05 per cent during lockdown and by 48.64 per cent during post-down as compared to pre-lockdown period. Dairy farmers rearing moderate productivity crossbreds witnessed net return loss of 93.68 per cent per liter of milk during post-lockdown as compared to pre-lockdown period.
- In Chikkaballapura district, net return per liter of milk of high productivity crossbreds was reduced by 20.89 per cent during lockdown period and by 22.77 per cent during post-lockdown as compared to pre-lockdown period. Dairy farmers rearing cross-bred with moderate productivity witnessed loss of 42.71 per cent per liter of milk during post-lockdown as compared to pre-lockdown period.
- In BAMUL and KOMUL, there was no reduction in milk procurement quantity during lockdown and post-lockdown periods. While the quantity of milk sold by both the milk unions BAMUL and KOMUL increased during the month of April i.e., during lockdown as Government of Karnataka purchased milk from milk unions for distributing it to the poor. During rest of the months of lockdown i.e., May and during the post lockdown same trends were observed as that of previous years.
- Among the milk products, the sale of curd, paneer, Mysore Pak decreased during both lockdown and post-lockdown periods.
- The results suggest that there is an urgent need for revision of current milk procurement prices in Karnataka based on the recent trends in feed costs and labour wages.
- In general, there is a need to increase the demand of milk and milk products by engaging modern technologies. Hence, milk unions should establish collaboration with online consumer businesses like Zomato, Swiggy, Dunzo etc. and supply milk and milk products at doorsteps of consumers in order to ensure continuous demand.

सारांश

चीन के वुहान शहर में 17 नवंबर, २०१९ को पहली बार पहचाने गए नॉवल कोरोना वायरस (COVID-19) एक महामारी बन गया । महामारी के खिलाफ निवारक उपाय के रूप में भारत सरकार ने 24 मार्च २०२० को राष्ट्रव्यापी लॉकडाउन की घोषणा की जो 31 मई २०२० तक जारी रही । इससे न केवल देश भर में लोगों की आवाजाही सीमित हो गई बल्कि संगरोध, रोकथाम क्षेत्र, सोशल डिस्टेंसिंग, यात्रा प्रतिबंध आदि जैसी नीतियों को भी लागू किया गया । इन पुलिसों ने डेयरी क्षेत्र सहित भारतीय अर्थव्यवस्था के हर क्षेत्र को प्रभावित किया है। डेयरी क्षेत्र के हितधारकों में डेयरी किसान और डेयरी सहकारी समितियां सबसे अधिक प्रभावित हैं । इस पृष्ठभूमि में, कर्नाटक के बेंगलुरु ग्रामीण और चिक्काबलापुरा जिलों में डेयरी किसानों और डेयरी सहकारी समितियों पर COVID-19 महामारी के आर्थिक प्रभाव का आकलन करने के लिए वर्तमान अध्ययन शुरू किया गया था। इस अध्ययन में दिसंबर २०२० तक प्री-लॉकडाउन, लॉकडाउन और पोस्ट-लॉकडाउन चरणों को शामिल किया गया था । यह आंकड़े 200 डेयरी किसानों, 24 गांव डेयरी सहकारी समितियों और 2 दुग्ध संघों से एकत्र किए गए थे। उद्देश्यों को पूरा करने के लिए, मात्रा अंतर विश्लेषण, मूल्य अंतर विश्लेषण, विलकॉक्सन हस्ताक्षरित रैंक परीक्षण और प्रवृत्ति विश्लेषण जैसे विश्लेषणात्मक उपकरण नियोजित किए गए थे। अध्ययन के प्रमुख निष्कर्ष इस प्रकार हैं।

- प्री-लॉकडाउन अवधि की तुलना में लॉकडाउन और पोस्ट-लॉकडाउन अवधि के दौरान स्वदेशी गायों और भैंस के संबंध में दोनों जिलों में दूध की उपज में कोई महत्वपूर्ण परिवर्तन नहीं किया गया । हालांकि, प्री-लॉकडाउन अवधि की तुलना में लॉकडाउन के दौरान बेंगलुरु ग्रामीण जिले (पी < 0.01) में क्रॉसब्रीड मवेशियों की दूध की पैदावार में 2.26 प्रतिशत और चिक्काबलापुरा जिले (पी < 0.001) में 4.01 प्रतिशत की कमी आई। लॉकडाउन के बाद की अवधि के दौरान, बेंगलुरु ग्रामीण जिले (पी < 0.01) में क्रॉसब्रीड की दूध की पैदावार में 2.35 प्रतिशत और चिक्काबलापुरा जिले में 0.94 प्रतिशत की कमी आई, जबकि प्री-लॉकडाउन अवधि की तुलना में।
- बेंगलुरु ग्रामीण जिले में दूध का खरीद मूल्य प्री-लॉकडाउन में ₹29 प्रति लीटर से घटाकर लॉकडाउन में ₹26.5 प्रति लीटर कर दिया गया। इसके अलावा, लॉकडाउन के बाद की अवधि के दौरान इसे घटाकर ₹23 प्रति लीटर कर दिया गया। चिक्काबल्लापुरा जिले में दूध का खरीद मूल्य प्री-लॉकडाउन और लॉकडाउन अवधि के दौरान ₹28 प्रति लीटर के समान रहा । लेकिन लॉकडाउन के बाद की अवधि के दौरान दूध का खरीद मूल्य 26.15 रुपये प्रति लीटर तक कम हो गया।

- प्री-लॉकडाउन अवधि की तुलना में लॉकडाउन और पोस्ट-लॉकडाउन अवधि के दौरान दोनों जिलों में क्रमशः ध्यान फीड की लागत में लगभग ३७ प्रतिशत और 21 प्रतिशत की वृद्धि की गई।
- ज् बेंगलुरु ग्रामीण और चिक्काबलापुरा जिलों के लगभग ८१ प्रतिशत और ८७ प्रतिशत किसानों ने लॉकडाउन या पोस्ट-लॉकडाउन के दौरान डेयरी से अपनी आय में नुकसान देखा ।
- बेंगलुरु ग्रामीण जिले में, लॉकडाउन के दौरान उच्च उत्पादकता क्रॉसब्रीड के लिए प्रति लीटर दूध का शुद्ध रिटर्न ३३.०५ प्रतिशत और प्री-लॉकडाउन अवधि की तुलना में पोस्ट-डाउन के दौरान ४८.६४ प्रतिशत तक कम हो गया । मध्यम उत्पादकता का पालन करने वाले डेयरी किसानों ने प्री-लॉकडाउन अवधि की तुलना में लॉकडाउन के दौरान ९३.६८ प्रतिशत प्रति लीटर दूध का शुद्ध रिटर्न नुकसान देखा ।
- ज् चिक्काबल्लापुरा जिले में लॉकडाउन अवधि के दौरान उच्च उत्पादकता वाले क्रॉसब्रीड के दूध की शुद्ध वापसी में २०.८९ प्रतिशत और लॉकडाउन से पहले की तुलना में पोस्ट-लॉकडाउन के दौरान २२.७७ प्रतिशत की कमी आई । मध्यम उत्पादकता के साथ क्रॉस-नस्ल के डेयरी किसानों को प्री-लॉकडाउन अवधि की तुलना में लॉकडाउन के दौरान ४२.७१ प्रतिशत प्रति लीटर दूध का नुकसान देखा गया ।
- बामुल और कोमुल में लॉकडाउन और पोस्ट-लॉकडाउन अवधि के दौरान दूध खरीद की मात्रा में कोई कमी नहीं आई । जबकि दुग्ध संघों बामुल और कोमुल दोनों द्वारा बेचे जाने वाले दूध की मात्रा अप्रैल महीने के दौरान यानी लॉकडाउन के दौरान बढ़ गई क्योंकि कर्नाटक सरकार ने इसे गरीबों को वितरित करने के लिए दुग्ध संघों से दूध खरीदा था । लॉकडाउन के बाकी महीनों के दौरान यानी, मई और पोस्ट लॉकडाउन के दौरान पिछले वर्षों के रूप में एक ही रुझान देखा गया था।
- दुग्ध उत्पादों में लॉकडाउन और पोस्ट लॉकडाउन दोनों अवधियों के दौरान दही, पनीर, मैसूर पाक की बिक्री में कमी आई ।
- परिणाम बताते हैं कि फीड कॉस्ट और लेबर मजदूरी के हालिया रुझानों के आधार पर कर्नाटक में वर्तमान दुग्ध खरीद मूल्यों में संशोधन की तत्काल आवश्यकता है ।
- सामान्य तौर पर आधुनिक प्रौद्योगिकियों को शामिल करके दूध और दुग्ध उत्पादों की मांग बढ़ाने की जरूरत है । इसलिए दुग्ध संघों को ज़ोमैटो, स्विग्गी, डंजो आदि जैसे ऑनलाइन उपभोक्ता व्यवसायों के साथ सहयोग स्थापित करना चाहिए और लगातार मांग सुनिश्चित करने के लिए उपभोक्ताओं के दरवाजे पर दूध और दुग्ध उत्पादों की आपूर्ति करनी चाहिए ।

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AMUL	Anand Milk Union Limited
BAHS	Basic Animal Husbandry Statistics
BAMUL	Bangalore Urban, Rural & Ramanagara District Co-Operative Milk Producers Societies Union Ltd
BBMP	Bruhath Bangalore Mahanagara Palike
CRISIL	Credit Rating Information Services of India Limited
CSO	Central Statistical Organization
DAH&DF	Department of Animal Husbandry, Dairying and Fisheries, Ministry of Agriculture and Farmers Welfare
DCS	Dairy Cooperative Societies
DoAHVS	Department of Animal Husbandry and Veterinary Sciences
DoES	Directorate of Economic and Statistics
FAO	Food and Agriculture Organization
GoK	Government of Karnataka
GSDP	Gross State Domestic Product
GSVA	Gross State Value Added
GVA	Gross Value Added
ICAR	Indian Council of Agricultural Research
ICRISAT	International Crop Research Institute for Semi-Arid Tropics
KMF	Karnataka Milk Federation
KOMUL	Kolar-Chikkaballapura District Co-operative Milk Producers Union Ltd
KVK	Krishi Vigyana Kendra
MoC&I	Ministry of Commerce and Industry
MoF	Ministry of Finance
NABARD	National Bank for Agricultural and Rural Development
NAS	National Accounts Statistics
NDDB	National Dairy Development Board
ORGI	Office of Registrar General and Census Commissioner
SMP	Skimmed Milk Powder
WHO	World Health Organization

CHAPTER – 1

INTRODUCTION

1. INTRODUCTION

1.1 Indian dairy sector

The dairying is an important sector in the Indian economy. It is the main source of livelihood for about two-thirds of the rural population in India. As per the Census report of 2011 (ORGI, 2011), about 54.6 per cent of the total workforce in India is engaged in agricultural and allied sector activities which accounts for approximately 17.8 per cent of the country's Gross Value Added (GVA) at current prices for the year 2019-20 (CSO, 2020). The share of agriculture and allied sectors in GVA of the country has declined from 18.2 per cent in 2014-15 to 17.8 per cent in 2019-20. This is an outcome of the development process in which the relative performance of non-agricultural sectors has become more dominant over the agricultural sector.

Livestock sector is an important sub-sector of agriculture in the Indian economy. As per the estimates of National Accounts Statistics (MoSPI, 2019), the contribution of livestock in total agriculture and allied sector GVA (at constant prices) is 28.63 per cent in 2018-19. India continues to be the largest producer of milk in the world accounting for around 20 per cent of world's milk production. Milk production in India during the period 1950-51 to 2019-20, has increased from 17 million tonnes to 198.4 million tonnes as compared to 187.7 million tonnes during 2019-20 recording a growth of 5.70 per cent (NDDB, 2019). According to the 20^{th} livestock census of 2019 (DAHD&F, 2019 a), the total bovine population in India is 302.79 million, out of which the total number of cattle in the country is 192.49 million and the total buffalo population in the country is 109.85 million. India stands second in terms of cattle population and first in buffalo population in the world.

1.2 Dairy sector in Karnataka State

Karnataka is one among the important agrarian state of India. As per the Census report of 2011 (ORGI, 2011), about 30 per cent of the total workers in the state are still engaged in agricultural and allied sector activities which accounts for approximately 8.73 per cent of the Karnataka's gross state value added (GSVA) for the year 2019-20 (at

constant prices). In Karnataka, the Animal Husbandry and Livestock Sector has been playing a significant role in rural economy. During 2019-20, the share of animal husbandry in gross state domestic product (GSDP) of agriculture and allied activities was 21.81 per cent (DoES, 2021). The state is known for its species richness in livestock and is endowed with good number of livestock wealth. Karnataka state ranks 11th among Indian States in milk production (NDDB, 2019). In 2019-20, Karnataka contributed 4.68 per cent to the total milk production of India with production of 9.3 million tonnes. As per the 20th Livestock Census (DAHD&F, 2019 a), the share of Karnataka in all India livestock population is 5.40 per cent. The total cattle population of Karnataka is 8.46 million which accounts for 4.39 per cent of total cattle population in India. Karnataka is having 2.98 million of buffalo population which is 2.71 per cent of total buffalo population in India (DAHD&F, 2019b).

Karnataka is one of the forerunner states to start the cooperative movement in India. Karnataka Milk Federation popularly known as KMF is the apex body for dairy co-operatives in Karnataka. It evolved itself as a premier and second most successful dairy farmers' organization in India. KMF was constructed on the model of Anand Milk Union Limited (AMUL) in 1975. KMF is at present second largest amongst the dairy co-operatives in India. It stands first in terms of milk procurement as well as sales in southern India. KMF being the apex body in the three-tier structure has 14 Milk Unions covering all the districts of the state. The milk unions procure milk from the primary dairy cooperative societies (DCS) and distribute milk to the consumers in towns and cities. KMF plays an important role in marketing of milk and milk products under the brand name “Nandini” which is well known for its fresh and quality milk products. KMF is also involved in production and supply of cattle feeds. One of the major cattle feeds supplied by KMF to their members is Nandini gold (Type-1 feed). Nandini gold is a highly nutritive feed, having higher energy content, fat and total digestible nutrients. It will help the cattle to maintain good health and produce quality milk. As the Nandini gold feed is highly energetic and delicious feed, with sufficient positive energy balance, which results in good reproductive performance in the dairy animals along with increase in milk yield and immunity. The by-pass feed and mineral mixture are also supplied by KMF. Nandini Cattle

feed is distributed to milk producers through milk unions and dairy cooperative societies (KMF, 2020).

KMF apart from marketing the milk and milk products is providing timely and efficient input services at the door steps to dairy farmers such as balanced cattle feed at affordable price, veterinary services and artificial insemination services. This federation is striving to create a self-reliant rural economy in Karnataka for the past four decades. In Karnataka, individual Milk Unions regulate the milk procurement price of farmers and KMF manages the prices of concentrate feeds.

1.3 COVID-19 pandemic

Historically, global pandemics like small pox, plague, Spanish flu and cholera were not only affected the health of people across the world but also caused severe impact on global economy. In the past, various strategies followed worldwide to counter the pandemics were successful but the time taken to eradicate it was variable from one pandemic to another. The coronavirus disease that surfaced in the year 2019 is a challenge to mankind globally where advancement in the technological and economic spheres have been sharp and unparallel to the past. The first infection was reported in Wuhan city, People's Republic of China and in no time spread across the world like wildfire. The World Health Organisation (WHO) declared the novel coronavirus as pandemic and pronounced as "COVID-19". In order to contain the virus, many countries declared a lockdown of all the social and economic activities. India too observed nationwide lockdown from March 24, 2020 to May 3, 2020 followed by conditional unlocking of social and economic activities in a phased manner from April 20, 2020 and with strict lockdown in the containment zones (Table 1.1). Due to lockdown restrictions businesses, all modes of transport and movement of individuals were severely affected. Local governing bodies, societies, unions, etc., were also clueless with the continuation of their routine activities. Table 1.2 presents the number of COVID-19 cases, the recovery rate and death rate from the COVID-19 pandemic.

The economic activities worldwide came to standstill globally due to various restrictions and measures taken by each country as well as each geographical zones within

the country depending up on the extent of disease spread. Although India is known for smallholding agrarian system, the resilience shown by the sector indeed an eye-opener, particularly the stand taken by the cooperative societies. While lockdown during COVID-19 pandemic adversely affected the performance of non-agricultural sectors the agricultural sector came up with an uncompromised growth rate 3.4 per cent during 2020-21 (MoF, 2021).

Table 1.1 Lockdown and unlock phases in India to prevent the spread of COVID-19 pandemic

Phase	Date	Duration
Lockdown 1	25 March 2020 – 14 April 2020	21 days
Lockdown 2	15 April 2020 – 3 May 2020	19 days
Lockdown 3	4 May 2020 – 17 May 2020	14 days
Lockdown 4	18 May 2020 – 31 May	14 days
Unlock 1	1 June 2020 – 30 June 2020	30 days
Unlock 2	1 July 2020 – 31 July 2020	31 days
Unlock 3	1 August 2020 – 31 August 2020	31 days
Unlock 4	1 September 2020 - 30 September 2020	30 days
Unlock 5	1 October 2020 - 31 October 2020	31 days
Unlock 6	1 November 2020 - 30 November 2020	30 days
Unlock 7	1 December 2020 - 31 December 2020	31 days
Unlock 8	1 January 2021 - 31 January 2021	31 days
Unlock 9	1 February 2021 - 28 February 2021	28 days
Unlock 10	1 March 2021 - 31 March 2021	31 days
Unlock 11	1 April 2021 - 30 April 2021	30 days

Source: Wikipedia (2021). COVID-19 lockdown in India. COVID-19 lockdown in India - Wikipedia

Dairying is one among the important sub-sector in agriculture in general and the livestock sector in particular dealing with a highly perishable product - Milk. The impositions on transportation hit the dairy sector during the initial phase of lockdown although milk sales were categorized under essential commodities with restricted hours of business. The major disruption in demand and supply chain arose due to restricted hours of business, shutdown of bulk consumers such as hotels, confectionary industry, marriages, parties and inter-state transport (Chechi, 2020). Since seasonal supply continued to be the same without any reduction, the disposal of surplus milk invoked a new challenge for the dairy sector. This situation led to the distribution of procured milk at free of cost to the people rather than allow it to spoil. In order to build immunity against COVID-19 consumer focus exponentially increased on immune-boosting health products where milk and milk products always have an edge over other food products. A reverse migration of labour from urban to rural areas was also taking place (Sen, 2020). Many of such migrant labourers might have taken up dairying for their day-to-day livelihood.

Table 1.2 Number of COVID-19 cases, Recovered cases and Deaths due to COVID-19 (as on 19 April, 2021)

Region	Confirmed COVID-19 cases	Recovered cases	Deaths due to COVID-19
India	1,50,57,886	1,29,48,986	1,78,793
Karnataka State	11,61,065	10,14,152	13,351
Bengaluru rural	21,697	19,802	177
Chikkaballapura	15,192	14,161	122

Source: COVID19 India. (2020). Coronavirus Outbreak in India - covid19india.org

1.4 Statement of problem

The situation that aroused from COVID-19 pandemic has thrown various socio-economic challenges. The pandemic situation affected the supply chain and value chain of milk and milk products. Among the stakeholders of the dairy sector, dairy farmers and dairy cooperatives are the most affected during the pandemic (Bhandari and Ravishankara,

2020). In India, predominant proportion of milk produced is contributed by animals reared by landless, marginal farmers and small farmers. Dairy cooperatives are procuring around 70 to 80 per cent of milk of the organised sector directly from the dairy farmers (Jitendra, 2020). The popular schemes like feed distribution, veterinary services, breeding services etc., were crippled during the pandemic (Chandel *et al*, 2020). The dairy cooperatives found difficulty in procurement, sales, chilling, transportation and processing of milk. The impact of COVID-19 has not only reduced the income of the dairy farmers but also led to losses to dairy cooperatives.

The present study is an attempt to analyse such effects on the dairy sector by considering two of the major stakeholders viz, dairy farmers and dairy cooperatives. The extent of the impact also varied from individual farmer to farmer and across dairy cooperatives and places. To address the complexity in assessing the impact of COVID-19 pandemic a systematic scientific study is required at primary level. Hence, the present study is an attempt to assess the impact of COVID-19 pandemic on dairy farmers and dairy cooperatives at micro level which would help in decision and policy making. However, private players are excluded from the study because they are not organized, their claims are not easily assessable and negligible participation in dairying in the study areas.

1.5 Objectives of the study

1. To assess the economic impact of COVID-19 pandemic on dairy farmers in Bengaluru rural and Chikkaballapura districts of Karnataka
2. To assess the economic impact of COVID-19 pandemic at select Dairy Cooperative Societies

1.6 Limitations of the study

i. The present study is a short-term in nature limited to first wave of COVID-19 covering the time period up to 31 December 2020.

ii. This cross-sectional study was based on the primary data collected from the individual dairy farmers by personal interview method. The sample dairy farmers did not maintain any farm records. Hence, the data collected from the sample dairy

farmers was based on their memory, honesty and past experience where there is a possibility of bias. However, efforts were made to remove such bias to get accurate information by cross checking the data provided.

iii. There was another limitation with respect to number of milk products produced in both the Milk Unions. Since the limited number of milk products were produced by KOMUL (Kolar-Chikkaballapura District Co-operative Milk Producers Union Ltd) as compared to BAMUL (Bangalore Urban, Rural & Ramanagara District Co-Operative Milk Producers Societies Union Ltd), analysis is made only for such products produced on continuous basis.

iv. Due to the time and resource constraints, the sample respondents for the study were confined only to Bengaluru rural and Chikkaballapura districts comprising of 200 dairy farmers, 24 DCS and 2 milk unions (BAMUL and KOMUL). The generalization of the study has to be done with cautions.

v. As this is a micro-economic study, the findings and results of the study are confined only to those area considered for the study. However, the results and guidelines may be extended to other areas having similar agro-climatic and agro-economic conditions.

1.7 Practical utility of the study

i. The study will allow the policy makers to have insights into the economic impact of COVID-19 pandemic on dairy farmers and dairy cooperatives for policy interventions.

ii. The study will provide leads for efficient management of dairying during pandemic.

iii. The findings of this study would be helpful during the ongoing COVID-19 pandemic waves or any other pandemic in future.

1.8 Organization of the study

The present study is organized into five Chapters. The Chapter-1 deals with the introduction, statement of the problem, objectives, limitations and practical utility of the study. Chapter-2 comprises the critical review of relevant literature related to the objectives

considered for the study. Chapter-3 deals with the methodology of the study which includes description of the study area, nature and sources of the data collected and statistical tools used for data analysis. Chapter-4 presents the salient findings of the study and their discussion. Chapter-5 gives a brief summary and major conclusion of the study. At last, bibliography has been listed and appendices are given for more additional information.

CHAPTER – 2

REVIEW OF LITERATURE

2. REVIEW OF LITERATURE

Having the first-hand information on related concepts and past studies help in better understanding of the research problem in a proper perspective, formulating research hypothesis, formulating methodology and execution of the research. Thus, reviewing the previous studies performed on the subject of interest enables researchers to gain a better insight and knowledge in the specific field of research. Keeping in view, the objectives and nature of the study, the relevant literatures have been reviewed and chronologically arranged.

2.1 The economic impact of COVID-19 on dairy farmers

Bavadam (2020) reported that milk price had fallen by 40 per cent during the period of lockdown in Maharashtra. Farmers received ₹ 17 to ₹ 22.50 per liter of milk during lockdown as compared to ₹ 30 to ₹ 35 per liter which they used to receive during pre-lockdown. Dairies were hit by backlog of payments because of pandemic and also converted excess milk to skimmed milk powder.

Begum *et al.* (2020) reported that Bangladesh dairy farmers were unable to sell milk due to countrywide lockdown in the aftermath of coronavirus. 12 to 15 million liters of milk remained unsold everyday across the Bangladesh, which caused Tk 570 million loss to marginal dairy framers. Dairy framers were forced to sell milk at Tk 10 to Tk 12 per liter and in some places, farmers couldn't sell milk at all.

Bhandari and Lal (2020) analyzed whether Indian dairy sector is buoyant enough or not to sail through COVID-19 crisis. During lockdown, the prices of cattle feed and dry fodder increased by 20 to 30 per cent. So, farmers fed less to cattle which reduced milk production and affected health of the cattle. The net income of the farmers reduced due to increase in cost of input and decrease in sales.

Bhandari and Ravishankara (2020) in their study on implications of COVID-19 pandemic for Indian dairy sector, reported problems faced by dairy farmers and processing units. Dairy farmers faced problems in procuring input and even selling output. Farmers

faced problems in arranging for feed and labourers. Feed prices were also found to be on rise. The key concern of dairy processors was the decrease in demand for dairy products.

Chandel *et al*. (2020) quantified the economic losses to the stakeholders of Indian diary sector due to reduction in demand of milk and other dairy products during 24th March to 30th June, 2020. They used economic surplus model to measure the impact on the economic welfare of the producers. They reported that milk production is expected to decrease due to non-availability of feed and fodder. The supply of concentrated feed was decreased by 40 to 50 per cent and its prices were also increased by the same proportion. In addition, there was inaccessibility of veterinary and insemination services. Demand for milk was reduced by 25 to 30 per cent and production almost remained same. Hence the milk price was reduced. They accounted 41 per cent of economic loss to the milk producers.

Dubey (2020) interviewed farmers from 14 states covering Kashmir to Kanyakumari. The price of one liter of milk has plunged to ₹ 15 to 16 per liter in majority of places. Lockdown had triple impact on dairy farmers in India, decrease in the price of milk, increase in input cost and finally decrease in demand for milk. The worst loss happened to small farmers who used to sell their milk to private consumers like hotels, tea shops etc.

FAO (2020) in mitigating the impacts of COVID-19 pandemic on the livestock sector reported that the movement restrictions caused labour shortages and disrupted supply of raw materials to the livestock farm. Failure in timely treatment of animals reduced yield of livestock products. The farmers sold their products at very cheap prices and in some extreme conditions they dumped raw milk.

ICAR- National Institute of Abiotic Stress Management (2020) reported that during the lockdown period, milk supply chain was severely affected. The milk production was adversely affected due to lockdown by three major ways i.e., unavailability of inputs like feed, fodder and medicines; labour shortage and disruption in marketing of milk and milk products. They also reported increase in cost of production of milk due to increase in the prices of inputs.

Kaur and Singh (2020) reported that small farmers in the Punjab were worst hit during the lockdown due to the lower demand and procurement was either partial or none. Since 70 per cent of milk produced in Punjab was handled by unorganized sector like milkmen, contractors and halwai shops, their non-functioning during lockdown forced the farmers to dump the milk. The production and sale of value-added dairy products by private players witnessed a major liquidity crisis.

Kumar (2020) reported that rural economy in Karnataka survived due to dairy sector at the time of difficulties to sell horticultural and agricultural produce during lockdown. Since milk procurement and regular payments was continued by milk producer's co-operative societies, dairy farmers remained relatively safe during the crisis.

NABARD (2020) assessed the impact of COVID-19 on Indian agriculture and rural economy. Online survey was conducted during lockdown (24 April 2020 to 4 May 2020) in 560 districts of 33 states. It was reported that the demand for processed dairy products like sweets, khoya, paneer and creams were adversely affected but, the demand for milk was not affected. Due to decline in demand, farmers did not get remunerative prices for their milk. Hence, they fed less quantity of feed and fodder to their animals leading to decline in milk productivity. Due to the reduction in the demand and disruption in the supply chain production of dairy sector was reduced by 6.6 per cent. Farm gate prices of dairy products was declined by 5.6 per cent and fodder availability was declined by 10.8 per cent. Prices of feed was increased by 11.6 per cent due to disruption in supply chain.

Popat *et al.* (2020) conducted a case study in Sangavi village, Satara district of Maharashtra. The primary data was collected from 128 farmers during the month of March to May, 2020 covering the lockdown period. They observed that there was no significant change in the milk production but demand continuously decreased during the outbreak and supply was also affected due to irregularity in milk collection. This resulted in reduction of the milk procurement price.

Rabo bank (2020) a multinational banking and financial company in its monthly update for April, 2020 stated that the dairy sector is in uncharted territory and is expected

to experience three waves of market movement over the next twelve months. These waves include panic-buying, muted retail demand and greater logistical challenges and finally, the longer-term loss of consumer purchasing power.

Singh *et al.* (2020) reported that there was no significant decline in milk prices. Dairy farmers were not found in any distress sale however, feed and concentrate mixture were not available for animals because of interrupted supply to the users. The study further reported that the majority of the respondents (70 per cent) of the study did not face any problem regarding availability of veterinarians in the dispensary.

Singh (2020) reported that the farmers in the Malwa region of Punjab found increase in the production cost by 40 per cent to 60 per cent owing to curfew restrictions during lockdown and wholesale price of milk also reduced, resulting in the doubling of loss to the farmers.

2.2 The economic impact of COVID-19 on dairy cooperatives

Biswal *et al.* (2020) reported a surge in the demand for the milk during initial 2 days of lockdown by 15 to 20 per cent due to the bulk purchasing by the consumers. Later, with the closure of tea-stalls, restaurants and hotels, about 15 per cent milk of total milk production of India were completely halted. There was a distress sale of milk by the farmers up to 50 per cent reduction in the price at several rural areas, where there was non-existence of milk co-operatives. In states where the dairy cooperatives are strong, the milk procurement was normal even with decrease in a demand. In such areas, surplus milk was converted into skimmed milk powder.

Biswas (2020) reported that demand for packed milk in India raised amid pandemic and sale of dairy products such as ultra-heat treated (UHT) milk, skimmed milk powder, cheese and butter rised almost to 20 per cent rise. AMUL has also seen 5 per cent increase in the sale of its pouched milk. This is because a large section of the people has been abstaining from poultry, meat and eggs as well as its long shelf life.

Chechi (2020) analyzed the impact of COVID-19 pandemic on the dairy industry. The major finding was decrease in demand for the dairy products by around 30 per cent due to closure of major milk consumers like restaurants, sweet and ice-cream shops, other small manufacturing units etc.

Cornall (2020) in his studies on impact of COVID-19 pandemic on dairy sector reported that sales of value-added products including ice cream, cheese, flavoured milk, curd and yogurt decreased by 2 to 3 per cent during the lockdown period which reduced operating profitability by as much as 50 to 75 basis points. There was a build-up of inventories due to conversion of surplus milk into skimmed milk powder. The sale of liquid milk was not affected and expected to rise 3 to 4 per cent in the fiscal year.

CRISIL (2020) reported that the sales of value-added products like ice cream, cheese, flavoured milk and yoghurt is expected to decrease by 2 to 3 per cent in 2020. The conversion of surplus milk to skimmed milk powder will add to the inventory thereby increasing the working capital. The apprehensions about consuming cold products like ice cream, flavoured milk and yoghurt during the pandemic impacted its sales in the first quarter of the financial year 2020-21.

Hussain (2020) observed that demand for milk and prices has reduced in India as the hotels, restaurants and catering sectors were closed which were consuming around 25 per cent of marketable surplus.

ICRISAT (2020) reported that the procurement of milk by organized players was affected due to labour shortage and transportation issues. Hence, the sale of dairy products had been hit during the lockdown period.

Jhajhira *et al.* (2020) conducted a study on COVID-19 lockdown on Indian Agriculture and allied sectors. With regard to dairy sector, they mentioned that the dairy sector faced severe problems in marketing as lockdown created restricted movement. The milk supply chains were adversely affected due to lack of availability of labour for collection, transportation, processing, packaging and distribution. The urban-based dairy farms faced scarcity of feed and fodder.

Kelkar (2020) said that as consumers were stuck in home during the lockdown period which coincided with the summer season, sales of the milk and milk products like ghee, chocolates, cheese and paneer except ice cream surged in AMUL.

Khan *et al.* (2020) studied the impact of COVID-19 pandemic and lockdown on dairy industry worldwide. They reported decrease in milk production and scarcity of the dairy products in the market due to disruption of the supply chain.

Mohan (2020) analysed the data of first six months (April-September) of 2020 and previous financial years in Karnataka. He observed that procurement of milk by dairy co-operatives remained high than the previous years despite the pandemic. Hence there was no direct loss to the farmers. However, the sale of milk by milk unions and federations were decreased due to the reduced demand. The surplus milk procured was converted into skimmed milk powder.

Mukherjee (2020) conducted study on massive inventories in the dairy industry. The report mentions that excess milk which remained unsold was converted into skimmed milk powder (SMP) as a result, cooperative milk unions in India were holding around 170,000 tonnes of SMP which was 62 per cent more than the same period last year.

Patil (2020) analysed the impact of COVID-19 on livestock production sector. He reported that due to the lack of transportation facilities and lockdown restrictions there was disruption in supply chain of feed market. Due to this, prices of feed increased during the pandemic. The demand for dairy products was decreased due to shutdowns amid nationwide lockdown. Shortage of labour due to lockdown reduced the processing capacity in the dairy processing industries.

Raghu and Deb (2020) reported that there was a sharp rise in the inventory of skimmed milk powder in India because of weak demand for ice cream during the peak summer season, which coincided with the nationwide lockdown. The sale of ice cream was reduced by almost 50 per cent during the months of April and May, 2020. The rise in the production of skimmed milk powder led to dip in its price.

Rath (2020) in his article reported that the sales of liquid milk by dairy cooperatives was declined by 15 per cent during lockdown period between March 15 to April 14. As large sections of consumers may shift from meat-based to milk-based protein, the pandemic has thrown up the real possibility for furthering the growth of dairy sector.

Shashidhar (2020) reported that demand has reduced by 25 per cent during the COVID-19 outbreak in India which also reduced the procurement prices of milk. Dairies procured more to help farmers which resulted in surplus milk.

Shenoy (2020) reported that during lockdown Karnataka Milk Federation (KMF) disposed around 8 to 10 lakh liters of unsold milk daily. The Milk Unions faced problems with respect to labour, transport and raw materials. During lockdown, except ghee and butter, all other dairy products found no place in market leading to stock up unconverted milk in the form of SMP.

Srivatsa (2020) reported that the district milk unions in Karnataka slashed the procurement prices ranging between ₹ 1.5 per liter in Bengaluru and Belagavi unions and ₹ 2.5 per liter of milk in Mysuru union. Further the sale of the milk had reduced by 30 to 40 per cent every day during the lockdown.

The literature on the impact of COVID-19 pandemic on dairy sector is mostly limited to newspaper reports and popular articles published online. The published literature in reviewed journals is scarce. From the above literature, the major constraints faced by the farmers during lockdown period are reduction in procurement price of milk, increase in prices of feed and fodder, reduced supply of feed, reduction in net income of farmers, inaccessibility to veterinary and insemination services. In some places framers were forced to sell milk at cheaper price and under extreme conditions, farmers even dumped the raw milk. The major constraint for dairy cooperatives during lockdown was reduction in demand of milk and other dairy products due to closure of tea-stalls, restaurants, hotels, sweet shops and convention halls. The excess milk which remained unsold was converted into SMP which added to the inventory cost of the cooperatives. The cooperatives also faced problems with respect to labour shortage and transportation of input to farmers.

CHAPTER – 3

RESEARCH METHODOLOGY

3. RESEARCH METHODOLOGY

This chapter gives a brief profile of the study area, time period covered, nature and sources of data collected and statistical tools used for the data analysis.

3.1 General description of the study area

The present study was conducted in Bengaluru rural and Chikkaballapura districts of Karnataka. A comprehensive understanding of the geographical location, climate, rainfall, soil type, cropping pattern, land-use pattern and infrastructural facilities for dairying in study area would help in a better perception of the problem and interpretation of the results. Thus, the above information is presented under the following subheadings.

3.1.1 Geographical location

Bengaluru rural district is located between 12.15^0 N to 13.38^0 N latitude and 77.05^0 E to 78.67^0 N longitude. It was formed in 1986, when Bangalore District was divided into Bengaluru (rural) and Bengaluru (urban). Presently in Bengaluru Rural district there are 4 Taluks (Devanahalli, Doddaballapura, Hosakote, Nelamangala), 20 Hoblis and 66 Grama Panchayats. It is the second smallest district in Karnataka with an area of 2,298 km^2. It shares border with Tamil Nadu along its south (DoES, 2017).

Chikkaballapura district is located at 13.43^0 N latitude and 77.72^0 E longitude. On 23 August 2007, it was carved out of the pre-existing Kolar district which was the fourth largest district (before bifurcation) of Karnataka by moving the taluks of Gauribidanur, Gudibanda, Bagepalli, Chikballapura, Sidlaghatta and Chintamani into the new district, Chikkaballapura. Presently in Chikkaballapura district there are 6 Taluks, 26 Hoblis and 157 Grama Panchayats. It covers an area of 4244 km^2 and shares border with Andhra Pradesh to its east (DoES, 2017).

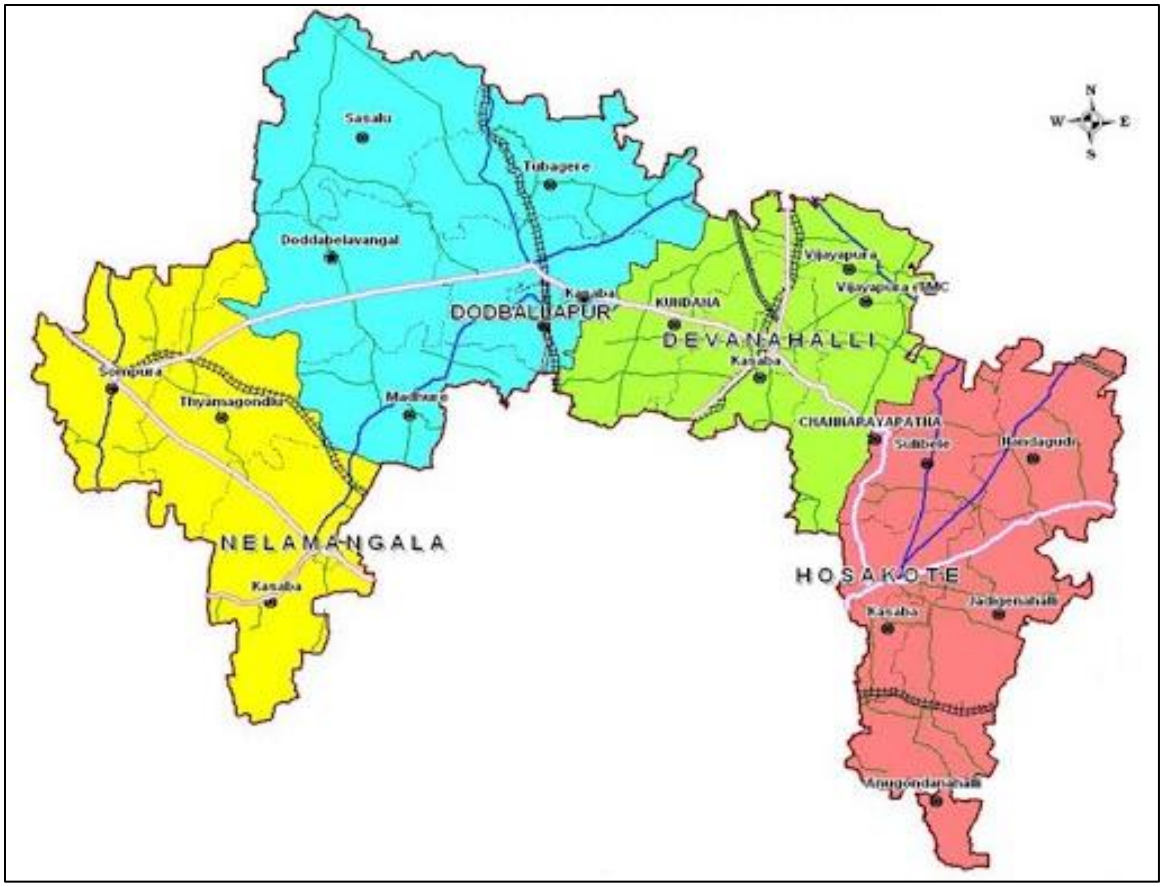

Figure 3.1 Map of Bengaluru Rural district

Figure 3.2 Map of Chikkaballapura district

3.1.2 Demography

As per 2011 census (DoES, 2017), population of Bengaluru rural district is 0.99 million with the population density of 441 per km^2 and population of Chikkaballapura district is 1.25 million with the population density of 298 per km^2 (Table 3.1). In Bengaluru rural district around 72 per cent of people live in rural areas and sex ratio is 946. While in Chikkaballapura district rural population comprised 77 per cent and sex ratio is 972 (DoES, 2017).

Table 3.1 Demographic characteristics of Bengaluru Rural and Chikkaballapura districts

Particulars	Bengaluru Rural	Chikkaballapura
Total population (No).	990923	1255104
Male (%)	51.38	50.71
Female (%)	48.62	49.29
Sex ratio (No of female per thousand male)	946	972
Rural population (%)	72.88	77.60
Urban population (%)	27.12	22.40
Population density (No per km^2)	441	298

Source: District at a Glance 2016-17. Directorate of Economics and Statistics, GoK.

3.1.3 Literacy

Table 3.2 shows the literacy rate in the study area. In Bengaluru rural district around 83.06 per cent of males and 66.80 per cent of females are literates in rural area and in case of urban area 89.57 per cent of male and 80.95 per cent of females are literates. The overall literacy rate in the district is 77.93 per cent.

In case of Chikkaballapura district, 66.39 per cent and 81.57 per cent of rural and urban population are literates. The share of female literates in rural and urban area are 57.10 and 77.06 respectively. The overall literacy rate of the district is 69.76 per cent.

Table 3.2 Literacy rate in Bengaluru Rural and Chikkaballapura districts

Gender	Bengaluru rural		Chikkaballapura	
	Rural	**Urban**	**Rural**	**Urban**
Male	83.06	89.57	75.41	86.01
Female	66.80	80.95	57.10	77.06
Overall	75.16	85.37	66.39	81.57

Source: District at a Glance 2016-17. Directorate of Economics and Statistics, GoK.

3.1.4 Climate and Rainfall

Under 10 Agro-climatic zones of Karnataka, both Bengaluru rural and Chikkaballapura districts are classified under Eastern Dry Zone. The annual temperature ranges from 16^0C during winter to 38^0C during summer season. The annual precipitation varies from 650mm to 850mm. Majority taluks in both the districts are categorized under draught prone area. About 50 per cent of the rainfall is received during south-west monsoon, 30 per cent during north-east monsoon and remaining rainfall is received during the summer month as the conventional currents or pre monsoon showers, which is also called as mango showers in these districts.

3.1.5 Soil type

Red sandy and red loamy soils cover a larger area in both the districts. These soils are having poor water holding capacity, deficient in nitrogen, phosphorous and have low humus content. These soils are derived from disintegration of igneous rocks like granite and gneiss. In some places of Chikkaballapura old laterite soils can also be found.

3.1.6 Cropping pattern

The larger area of Bengaluru rural and Chikkaballapura districts are under the cultivation of cereals and minor millets like ragi and maize. Horse gram, Pigeon pea, Avare and cow pea are important pulses grown in these districts (Table 3.3). Cultivation of horticulture crops like fruits and vegetables are practiced in larger area. Chintamani taluk of Chikkaballapura is famous for exporting tomato to other states. Sericulture activities

like cultivation of mulberry and rearing silk worms can also be found. Sidlaghatta taluk of Chikkaballapura district is famous for cocoon markets.

Table 3.3 Cropping pattern in Bengaluru Rural and Chikkaballapura districts

Major crops	Bengaluru Rural	Chikkaballapura
Cereals and minor millets	47.88	97.65
Pulses	4.51	20.47
Oilseeds	0.54	26.17
Commercial crops	0.03	0.21
Fruits	9.50	26.82
Vegetables	5.52	12.80

Source: District at a Glance 2016-17. Directorate of Economics and Statistics, GoK.

3.1.7 Land utilization pattern

The details on the land use pattern helps in understanding the allocation of land for various economic uses in the district. Forest land accounts to less than 1 per cent in Bengaluru rural district while Chikkaballapura district is having 12.28 per cent of the forest land (Table 3.4). Only 10.75 thousand hectares and 21.33 thousand hectares of the land are sown in Bengaluru rural and Chikkaballapura districts respectively. Large land area in both the districts fall under the category of land not available for cultivation and other uncultivated land.

Table 3.4 Land use pattern in Bengaluru Rural and Chikkaballapura districts

Land utilization details	Bengaluru rural	Chikkaballapura
Forest land	11.32	49.70
Land not available for cultivation	57.54	67.04
Other uncultivated land	21.21	66.78
Fallow land	34.85	18.27
Area sown	10.75	21.33
Total geographical area	229.51	404.90

Source: District at a Glance 2016-17. Directorate of Economics and Statistics, GoK.

3.1.8 Irrigation

Major source of irrigation in both the districts is tube wells. Other sources of irrigation like canals, tanks and open wells are not found. The gross and net irrigated area in Bengaluru rural district is 23.78 and 20.81 thousand hectares respectively. In Chikkaballapura district 59.71 and 50.17 thousand hectares of land are gross and net irrigated respectively.

3.1.9 Dairying

Dairying is the major source of livelihood in rural areas of Bengaluru rural and Chikkaballapura districts. In both the districts dairying is undertaken along with agriculture as mixed farming. A predominant proportion of milk from these districts are from crossbred cattle, followed by buffalo and indigenous cattle.

Bengaluru rural district is under the jurisdiction of Bangalore Urban, Rural & Ramanagara District Co-Operative Milk Producers Societies Union Ltd., (BAMUL) which was established during 1975 under Operation Flood II by keeping "AMUL" as its Model. At present BAMUL has Bangalore Urban, Bangalore Rural & Ramanagaram Districts of Karnataka State as its area of operation for Milk Procurement and selling milk in part of Bruhath Bangalore Mahanagara Palike (BBMP) area. The Union's daily average milk procurement is 16.40 lakh Kgs. BAMUL has seven Chilling Centers geographically located around Bangalore and 85 Bulk Milk Coolers at DCS Level. Bangalore Milk Union is providing various technical input & extension services to the milk producer members and their dairy animals through eleven camp offices situated in each taluk. At present BAMUL is producing more than 20 varieties of milk and milk products.

Chikkaballapura district is under the jurisdiction of Kolar-Chikkaballapura District Co-operative Milk Producers Union Ltd., (KOMUL) which is Karnataka's second highest milk producing district organisation (KOMUL, 2020). Once the district was named as Land of Gold, Silk and Milk. The union was established in 1987 after bifurcation from BAMUL. The area of operation is restricted to Kolar and Chikkaballapura Districts having 2919 villages of 11 revenue taluks. The present average milk procurement is 9.63 lakh kgs per

day from 2159 DCS. KOMUL has 3 chilling centers at Chintamani, Sidlaghatta and Gowribidanur.

3.2 Sampling design

In Karnataka state, two southern districts Bengaluru rural and Chikkaballapura were selected for the study. Both the districts are well developed in dairying and crossbred cows shared a predominant proportion in the bovine population (Figure 3.2). Both the districts fall under the jurisdiction of two separate milk unions. Bengaluru rural district is under the operation area of BAMUL, while Chikkaballapura district is under the KOMUL. Since, Bengaluru rural district is in close proximity to Bengaluru urban district it was likely to be more affected during the lockdown in terms of transportation and disruption in supply chain because the union has its headquarters in Bengaluru urban district which was one of the hotspots of COVID-19 pandemic. Chikkaballapura district being far away from Bengaluru urban district, the influence of the metropolitan city was less and moreover the supply chain of KOMUL is limited to two rural districts Kolar and Chikkaballapura which had less effect during the lockdown.

In each district two taluks were selected. Nelamangala and Doddaballapura taluks were selected from Bengaluru rural district. Similarly, Chintamani and Sidlaghatta taluks were selected from Chikkaballapura district. In total, 4 taluks were selected from two districts of the state. In each taluk 6 DCS were selected randomly. The criterion to select a DCS was that society should have started and functional for at least 3 years. From four taluks a total 24 DCS were selected randomly.

In each taluk 50 farmers were selected randomly in such a way that on an average eight to nine farmers from each village are covered. The criterion for selecting the farmers was that they should have engaged in dairy for at least 2 years. In total the sample contained 200 dairy framers.

3.3 Data collection

The data for the present study was collected from both primary and secondary sources to accomplish the set objectives. The data were collected with the help of a detailed,

well-structured and pre-tested interview schedule for eliciting required information for the study. For the present study, three sets of interview schedules were prepared. First interview schedule was used for collecting required information from farmers. Second interview schedule was for DCS and third interview schedule for getting detailed information from milk unions.

3.3.1 Primary data

Primary data for the study was collected from dairy farmers and DCS through personal and telephone interview using a standard interview schedule (Figure 3.4 and Figure 3.5). The information collected from the farmers covered the period of pre-lockdown, lockdown and post-lockdown. The time period from 1st January, 2020 to 23rd March, 2020 was considered as pre-lockdown period. Lockdown period comprised of time period from 24th March, 2020 to 31st May, 2020. The time period from 1st June, 2020 to 31st December, 2020 was considered as post-lockdown period. The information was collected regarding various aspects of socio-economic status of dairy farmers, profile of dairy animals, quantity of milk produced, average milk yield per animal per day, quantity of milk sold, household consumption, procurement price of the milk, frequency in payment of money from DCS, income of the dairy farmers, availability of feed and fodder, price of feed and fodder, accessibility for treatment of cattle and purchase or sale of milch animals.

The major constraints already faced by dairy farmers and DCS were identified from the review of literature of Bhandari & Ravishankara (2020), Jhajhira *et al.* (2020), Patil (2020) and Shenoy (2020). In this study, the severity of major constraints faced during the lockdown and post-lockdown periods like feed availability, transportation, reduction in milk quality, financial transactions and labour availability were assessed using 3-point scale (0 to 2). Score zero indicates the level of constraint was as before lockdown, score one indicates less severe and score two indicates severe.

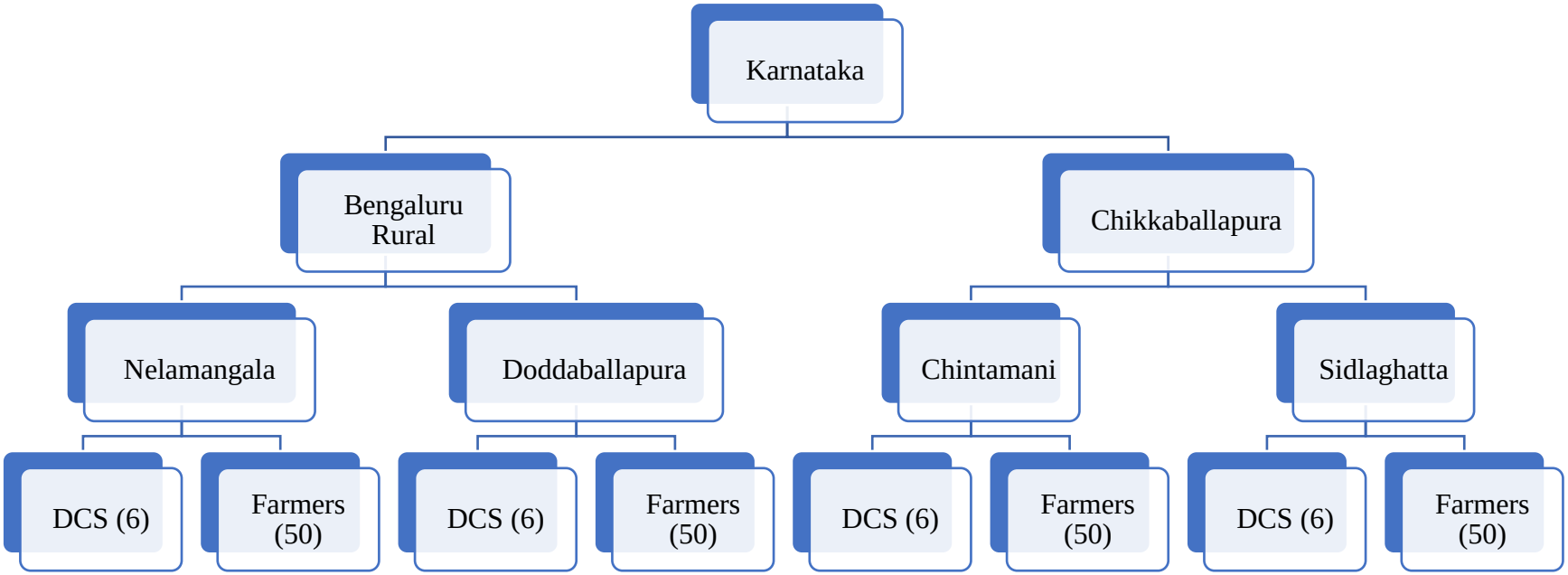

Figure 3.3 Sampling plan to select farmers to assess the economic impact of COVID-19

Figure 3.4 Interaction with dairy farmers of Bengaluru rural and Chikkaballapura districts

3.3.2 Secondary data

The secondary data for the study was collected from milk unions for the last four years from 2017 to 2020 by visiting the respective offices. The information collected from the milk unions included quantity of milk procured, procurement prices of milk, quantity of milk sold, quantity of milk converted to SMP, quantity of milk products sold such as curd, butter, ghee, paneer and Mysore Pak, quantity of type-1 and bypass feed sold and prices of type-1 and bypass feed. In addition, the information regarding total geographical

area, location, climate, rainfall, soil type, cropping pattern, land-use pattern and infrastructural facilities for dairying were collected from various sources viz. Basic Animal Husbandry Statistics (BAHS) report, Department of Animal Husbandry and Dairying, Livestock Census of India and Karnataka, Economic Survey of India and Karnataka, District at a Glance report of Bengaluru rural and Chikkaballapura districts.

Figure 3.5 Collection of Data from DCS and BAMUL

3.4 Analytical framework

For achieving the objectives of the study, the collected data were scrutinized, tabulated and analysed by employing appropriate analytical techniques. In order to summarize and analyse the data collected, the study used the statistical measures viz, mean and standard deviation of quantity of milk produced, average milk yield per animal per

day, quantity of the milk sold, household consumption and income of dairy farmers. The other tools and techniques used in the study are briefed as below.

3.4.1 Quantity gap analysis

It refers to the percentage difference between the average quantity of dairy products in t^{th} period and that of the (t-1) th period.

$$\text{Quantity gap } = \frac{\text{Quantity during } t^{\text{th}} \text{ period} - \text{ Quantity during } (t-1)^{\text{th}} \text{ period}}{\text{Quantity during } (t-1)^{\text{th}} \text{ period}} \times 100$$

Quantity gap analysis was made for quantity of milk produced, average milk yield per animal per day, quantity of milk sold and household consumption for dairy farmers. It was made with respect to two periods pre-lockdown period v/s lockdown period and pre-lockdown period v/s post-lockdown period.

3.4.2 Price gap analysis

It refers to the percentage difference between the average price of dairy products in t^{th} period and that of the (t-1) th period.

$$\text{Price gap } = \frac{\text{Price during } t^{\text{th}} \text{ period} - \text{ Price during } (t-1)^{\text{th}} \text{ period}}{\text{Price during } (t-1)^{\text{th}} \text{ period}} \times 100$$

Price gap analysis was made for procurement price of milk during pre-lockdown period v/s lockdown period and pre-lockdown period v/s post-lockdown period

3.4.3 Wilcoxon Signed Rank Test

The Wilcoxon signed rank test is a non-parametric test applied for paired data (e.g., consisting of pre and post treatment measurements) based on independent units of analysis. It can be used as an alternative to the paired Student's *t*-test (also known as "*t*-test for matched pairs" or "*t*-test for dependent samples") when the distribution of the difference between two samples' means cannot be assumed to be normally distributed. It is used to determine whether two dependent samples were selected from populations having the same distribution.

Wilcoxon signed rank test was used to test the significance of quantity of milk produced, average milk yield per animal per day, quantity of milk sold and household consumption by dairy farmers during pre-lockdown period v/s lockdown period and pre-lockdown period v/s post-lockdown period. The level of significance was tested at 5 percent ($P \leq 0.05$).

3.4.4 Trend Analysis

Multiple bar chart was drawn to depict the month-wise trends over the years (2017-2020) in the quantity of milk procured, quantity of milk sold, quantity of milk converted to SMP, quantity of milk products sold such as curd, butter, ghee, paneer and Mysore Pak, quantity of type-1 and bypass feed sold by milk unions. Line graphs were drawn to analyse the annual trends in the procurement prices of milk and prices of type-1 and bypass feed. The trend was analysed for both current prices and real prices. The trend was analysed from January 2017 to December 2020 to depict any changes in the trend of particular variable during the period of lockdown and post lockdown.

Nominal price (Current price): Nominal price is the current market price at which a product is sold. It is the price prevailing in the market.

Real price (Constant price): It is the price which is adjusted for inflation, enabling comparison of quantities as if prices has not changed. Change in the real terms therefore exclude the effect of inflation. Thus, the formula for real price is

$$\text{Real price} = \frac{\text{Nominal price}}{\text{WPI}} \times 100$$

The real prices of milk procurement price and prices of type-1 feed, by pass feed was worked out using WPI (*Wholesale Price Index*). The WPI data were collected from MoC&I (2020)

3.4.5 Estimation of cost and net returns of milk production during pandemic

The cost of milk production and net returns were computed recently by Gururaj (2020) in Karnataka state. His study areas included dairy farmers of Bengaluru rural district

falling under BAMUL. Therefore, an attempt was made to compute cost and net returns by substituting latest data wherever possible. The present study found significant increase in concentrate cost, reduction in average milk yield and decrease in procurement prices during lockdown and post-lockdown periods as compared to pre-lockdown period. These changes were effected in the cost and returns done by Gururaj (2020) suitably and revised cost and returns were worked out for pre-lockdown, lockdown and post-lockdown periods and compared. However, these computations were done based on the assumption that other components of cost and returns did not vary significantly since the time study done by Gururaj (2020). The methodology for cost and returns of milk production which was followed by Gururaj (2020) is given in Appendix I for reference.

CHAPTER – 4

RESULTS AND DISCUSSION

4. RESULTS AND DISCUSSION

The findings of the study are discussed and presented in this chapter under the following broad sections.

4.1. The socio-economic profile of the dairy farmers

4.2. The economic impact of COVID-19 pandemic on dairy farmers

4.3. The economic impact of COVID-19 pandemic on Dairy Cooperative Societies (DCS)

4.4. The economic impact of COVID-19 pandemic on Milk Unions

4.1 The socio-economic profile of the dairy farmers

In this section, socio-economic profile of the dairy farmers is discussed because it has influence on the decision-making process and thereby utilization of resources for dairy production. The socio-economic data collected from 200 dairy farmers belongs to Bengaluru rural and Chikkaballapura districts of Karnataka.

4.1.1 Religious status of the dairy farmers

Out of 200 farmer respondents 97.5 per cent belongs to Hindu religion and only 3 respondents *i.e.,* 1.5 per cent are only belonging to Christian religion (Table 4.1.1). However, the respondents who belong to other religious groups could not be traced in the sample.

Table 4.1.1 Religious status of the dairy farmers in Bengaluru Rural and Chikkaballapura districts

Religion	District		Total No. (%)
	Bengaluru Rural No. (%)	Chikkaballapura No. (%)	
Hindu	98 (98.0)	99 (99.0)	197 (98.5)
Christian	2 (2.00)	1 (1.00)	3 (1.5)
Total	**100 (50.0)**	**100 (50.0)**	**200**

4.1.2 Gender status of the dairy farmers

Though the dairying is a women friendly enterprise, majority of the dairy farmers were males. The percentage of the female dairy farmers was only 9 per cent in Bengaluru rural and 8 per cent in Chikkaballapura district (Table 4.1.2).

Table 4.1.2 Gender status of the dairy farmers in Bengaluru Rural and Chikkaballapura districts

Gender	District		Total No. (%)
	Bengaluru Rural No. (%)	Chikkaballapura No. (%)	
Male	91 (91.0)	92 (92.0)	183 (91.5)
Female	9 (9.00)	8 (8.00)	17 (8.5)
Total	**100 (50.0)**	**100 (50.0)**	**200**

4.1.3 Age profile of the dairy farmers

Age of the farmer is an important factor in a decision-making process. It was found that only 3.5 per cent of the dairy farmers were less than the age of 30 years. While around 38 per cent of the dairy farmers in both Bengaluru rural and Chikkaballapura districts aged between 30 to 45 and 45 to 60 years. Only 20 per cent of the dairy farmers were more than 60 years of age (Table 4.1.3).

4.1.4 Educational status of the dairy farmers

Educational status of the dairy farmers influences the decision making on the resource utilization for milk production. It was observed from the Table 4.1.4 that around 11 per cent and 16 per cent of farmers in Bengaluru rural and Chikkaballapura districts respectively were illiterates. The percentage of farmers studied up to primary school and higher primary school in both the districts was 13 per cent and 18 per cent respectively. Majority of the farmers (37.5%) studied up to secondary level. Further, dairy farmers with college and above was only 18 per cent.

Table 5.1.3 Age profile of the dairy farmers in Bengaluru Rural and Chikkaballapura districts

Age (in years)	District		Total No. (%)
	Bengaluru Rural No. (%)	Chikkaballapura No. (%)	
<30	6 (6.00)	1 (1.0)	7 (3.5)
30-45	38 (38.0)	38 (38.0)	76 (38.0)
45-60	37 (37.0)	38 (38.0)	76 (38.0)
>60	19 (19.0)	22 (22.0)	41 (20.0)
Total	**100 (50.0)**	**100 (50.0)**	**200**

Table 4.1.4 Educational status of the dairy farmers in Bengaluru Rural and Chikkaballapura districts

Qualification	District		Total No. (%)
	Bengaluru Rural No. (%)	Chikkaballapura No. (%)	
Illiterate	11 (11.0)	16 (16.0)	27 (13.5)
Primary	13 (13.0)	13 (13.0)	26 (13.0)
Higher primary	17 (17.0)	19 (19.0)	36 (18.0)
Secondary	36 (36.0)	39 (39.0)	75 (37.5)
College & above	23 (23.0)	13 (13.0)	36 (18.0)
Total	**100 (50.0)**	**100 (50.0)**	**200**

4.1.5 Occupational status of the dairy farmers

Occupational status of the dairy farmers can also have an influence on the decision-making process. Agriculture was the main occupation with around 90 per cent and 78 per cent of the farmers in Bengaluru rural and Chikkaballapura districts respectively. Negligible percentage of other occupations like labourer, self-employee, government-employee and home makers were observed (Table 4.1.5).

Table 4.1.5 Occupational status of the dairy farmers in Bengaluru Rural and Chikkaballapura districts

Occupation	District		Total No. (%)
	Bengaluru Rural No. (%)	Chikkaballapura No. (%)	
Farmer	90 (90.0)	78 (78.0)	168 (84.0)
Labourer	5 (5.0)	6 (6.0)	11 (5.5)
Self-employed	3 (3.0)	7 (7.0)	10 (5.0)
Govt-employed	1 (1.0)	5 (5.0)	6 (3.0)
Others	1 (1.0)	4 (4.0)	5 (2.5)
Total	**100 (50.0)**	**100 (50.0)**	**200**

4.1.6 Family type and family size of the sample households

Family labour contribution in dairy farming can be assessed by knowing the family size of the households. More than 85 per cent of the sample households belonged to small and nuclear family and only 14.5 per cent of households fell under the category of joint family. The average family size in Bengaluru rural and Chikkaballapura districts was 4.89 ± 1.94 (Mean ± SD) and 5.08 ± 2.16 respectively (Table 4.1.6).

Table 4.1.6 Family type of the sample households in Bengaluru Rural and Chikkaballapura districts

Family type	District		Total No. (%)
	Bengaluru Rural No. (%)	Chikkaballapura No. (%)	
Small (< 4)	45 (45.0)	51 (51.0)	96 (48.0)
Nuclear (5-7)	41 (41.0)	34 (34.0)	75 (37.5)
Joint (> 7)	14 (14.0)	15 (15.0)	29 (14.5)
Total	**100 (50.0)**	**100 (50.0)**	**200**

4.1.7 Family's annual income and share of dairying in family's annual income

The family's annual income ranged from ₹ 60,000 to ₹ 10,00,000 with median income of ₹ 4,00,000 in Bengaluru rural district. In Chikkaballapura district family's annual income ranged from ₹ 40,000 to ₹ 8,00,000 with median income of ₹ 2,50,000. The share of dairying in family's annual income ranged from 46.31 per cent in Chikkaballapura district to 53.77 per cent in Bengaluru rural district.

Table 4.1.7 Family's annual income in Bengaluru rural and Chikkaballapura districts

Family's annual income (in Lakh ₹)	District		Total No. (%)
	Bengaluru Rural No. (%)	Chikkaballapura No. (%)	
< 3.5	67 (67.0)	38 (38.0)	105 (52.5)
3.5-7.0	25 (25.0)	49 (49.0)	74 (37.0)
>7.0	8 (8.0)	13 (13.0)	21 (10.5)
Total	**100 (50.0)**	**100 (50.0)**	**200**

It can be inferred from Table 4.1.7 that 67 per cent and 38 per cent of dairy farmers in Bengaluru rural and Chikkaballapura fall under the income below ₹ 3.5 lakh. 25 per cent and 49 per cent of dairy farmers in Bengaluru rural and Chikkaballapura are in the income range of ₹ 3.5 lakh to ₹ 7 lakh. Further, only 8 per cent of farmers in Bengaluru rural district and 13 per cent of farmers in Chikkaballapura district earned ₹ 7 lakh and above.

4.1.8 Major sources of income of the dairy farmers

Dairying as an enterprise was undertaken as both specialized farming and as a component in diversified farming in the districts. Hence, analyzing the major sources of income of dairy farmers enable us to know the contribution of dairying in the farmers' annual income. As majority of the farmers practiced mixed farming, agriculture and dairying were the major sources of income for more than 80 per cent of the dairy farmers. It can be observed from the Table 4.1.8 that agriculture was the major source of income for 43 per cent and 41 per cent of dairy farmers in Bengaluru rural and Chikkaballapura district respectively. Dairying was the major source of income for 45 per cent and 38 per cent of the dairy farmers in Bengaluru rural and Chikkaballapura districts respectively. For the remaining farmers the major source of income was found to be regular salary, business and others.

Table 4.1.8 Major sources of income of farmers in Bengaluru rural and Chikkaballapura districts

Major sources of income	District		Total No. (%)
	Bengaluru Rural No. (%)	Chikkaballapura No. (%)	
Agriculture	43 (43.0)	41 (41.0)	84 (42.0)
Dairying	45 (45.0)	38 (38.0)	83 (41.5)
Regular salary	6 (6.0)	13 (13.0)	19 (9.5)
Business	3 (3.0)	5 (5.0)	8 (4.0)
Others	3 (3.0)	3 (3.0)	6 (3.0)
Total	**100 (50.0)**	**100 (50.0)**	**200**

4.1.9 Land holding status of the dairy farmers

From Table 4.1.9, it is inferred that the majority of the farmers in both the districts were marginal (48.5%) and small farmers (33%). In Bengaluru rural district, 48 per cent and 38 per cent of the farmers were marginal and small farmers respectively. Similarly, in Chikkaballapura district, 39 per cent and 28 per cent of the farmers were marginal and small farmers respectively. Only 5 per cent of the farmers in both the districts were found to be landless. 8 per cent and 28 per cent of the farmers in Bengaluru rural and Chikkaballapura districts respectively belonged to semi-medium category. Only one large farmer was noticed in Bengaluru rural district.

Table 4.1.9 Land holding status of the dairy farmers in Bengaluru rural and Chikkaballapura districts

Land holding status	District		Total No. (%)
	Bengaluru Rural No. (%)	Chikkaballapura No. (%)	
Landless	5 (5.0)	5 (5.0)	10 (5.0)
Marginal (<2.5 ha)	48 (48.0)	39 (39.0)	87 (48.5)
Small (2.5-5.0 ha)	38 (38.0)	28 (28.0)	66 (33.0)
Semi-medium (5.0-10 ha)	8 (8.0)	28 (28.0)	36 (18.0)
Medium (10-25 ha)	0 (0.0)	0 (0.0)	0 (0.0)
Large (>25 ha)	1 (1.0)	0 (0.0)	1 (0.5)
Total	**100 (50.0)**	**100 (50.0)**	**200**

4.2 The economic impact of COVID-19 pandemic on dairy farmers

4.2.1 Age-sex distribution of cattle and buffalo of dairy farmers in Bengaluru rural and Chikkaballapura districts

The size of the bovine population and its composition are very important factors in knowing the economic status of the sample households and perceiving their breed preferences. Bengaluru rural and Chikkaballapura districts of Karnataka have dominant proportion of crossbred cattle population when compared to other districts of Karnataka. This can be correlated to high demand of milk and milk products from metropolitan city Bengaluru. Table 4.2.1 reveals that crossbred cattle population recorded more than 90 per cent in both the districts.

Out of 200 sample households, 27 indigenous cattle were recorded. Of this 40.74 per cent were males and 59.26 per cent were females. Indigenous males were reared mainly for the draught purpose and milk from indigenous females were used for either household consumption or sold to private consumers. None of the farmers rearing indigenous breed poured milk to DCS.

In Bengaluru rural district, 310 crossbred animals were recorded. Of this 63.87 per cent were adults, 14.84 per cent were heifers and 21.29 per cent were calves. Out of 197 in-milk crossbred animals in Bengaluru rural district 21.32 per cent were in early lactation stage, 50.76 per cent were in mid lactation stage and 27.92 per cent were in late lactation stage. Similarly, in Chikkaballapura district 347 crossbred animals were recorded. Of this 62.54 per cent were adults, 17.29 per cent were heifers and 20.17 per cent were calves. Out of 209 in-milk crossbred animals in Chikkaballapura district, 15.31 per cent were in early lactation stage, 48.32 per cent were in mid lactation stage and 36.36 per cent were in late lactation stage.

The share of buffalo population of the total population ranged from 9.77 per cent in Bengaluru rural district to 2.92 per cent in Chikkaballapura district. Buffalo adult females composed of 73.53 per cent and 54.55 per cent to the total buffalo population in Bengaluru rural and Chikkaballapura districts respectively. The remaining 26.47 per cent and 31.11 per cent of the buffalo population in Bengaluru rural and Chikkaballapura districts respectively belonged to female calves.

Table 4.2.1 Age-sex distribution of cattle and buffalo of sample dairy farmers in Bengaluru rural and Chikkaballapura districts

Sl. No.	Description		Bengaluru rural			Chikkaballapura districts			Total		
			I*** Number (%)	C*** Number (%)	B*** Number (%)	I*** Number (%)	C*** Number (%)	B*** Number (%)	I*** Number (%)	C*** Number (%)	B*** Number (%)
a)	Females	Adults	2 (0.50)	198 (63.87)	25 (73.53)	12 (100)	217 (62.54)	6 (54.55)	14 (87.50)	415 (63.17)	31 (68.89)
		Heifers	0 (0.00)	46 (14.84)	0 (0.00)	0 (0.00)	60 (17.29)	0 (0.00)	0 (0.00)	106 (16.13)	0 (0.00)
		Calves	2 (0.50)	66 (21.29)	9 (26.47)	0 (0.00)	70 (20.17)	5 (45.45)	2 (12.50)	136 (20.70)	14 (31.11)
		Total	4 (100)	310 (100)	34 (100)	12 (100)	347 (100)	11 (100)	16 (100)	657 (100)	45 (100)
		In-milk animals	2 (100*)	197 (99.49*)	23 (92.0*)	6 (50.00*)	209 (96.31*)	6 (100*)	8 (87.5*)	406 (97.83*)	29 (93.54*)
		Stage: Early	0 (0.00**)	42 (21.32**)	3 (13.05)	2 (33.33**)	32 (15.31**)	0 (0.00**)	2 (25**)	74 (18.23**)	3 (10.35**)
		Mid	2 (100**)	100 (50.76**)	16 (69.56**)	3 (50.00**)	101 (48.32**)	4 (66.67**)	5 (62.5**)	201 (49.50**)	20 (68.96**)
		Late	0 (0.00**)	55 (27.92**)	4 (17.39**)	1 (16.67**)	76 (36.36**)	2 (33.33**)	1 (12.5**)	131 (32.27**)	6 (20.69**)
b)	Males	Adults	5	0	0	5	0	0	10	0	0
		Calves	0	0	0	1	0	0	1	0	0
	Total		9	310	34	18	347	11	27	657	45

*Percentage of in-milk animals to female adults

**Percentage of lactation stage of in-milk animals to total number of in-milk animals

I*** – Indigenous, C***- Crossbred, B***- Buffalo

4.2.2 Average milk yield per animal per day in Bengaluru rural and Chikkaballapura districts

The average milk yield per animal per day gives the milk productivity which is having direct effect on total milk production and income from dairy. The farmers were asked to provide the considered opinion on average milk yield of their animals during pre-lockdown, lockdown and post-lockdown periods (Table 4.2.2 and Table 4.2.3). Wilcox paired signed test was used to test the significance in the milk productivity across the three periods. The milk productivity of indigenous cattle and buffaloes did not vary significantly during the lockdown and post-lockdown periods in both the districts ($P > 0.05$).

The milk productivity of crossbred cattle showed a dip in both the districts during lockdown period. The milk yield was reduced by 2.26 per cent in Bengaluru rural district ($P < 0.01$) and by 4.01 per cent in Chikkaballapura district ($P < 0.001$) during lockdown as compared to pre-lockdown period. Further, the condition became normal in Chikkaballapura district during post- lockdown as that of pre-lockdown period ($P > 0.05$). But the milk yield of crossbred in Bengaluru rural district was further decreased to 2.35 percent during post-lockdown period ($P < 0.01$). Hence there was a significant difference in the milk yield of crossbred even during post-lockdown in Bengaluru rural district as compared to pre-lockdown period. Bhandari and Lal (2020) and NABARD (2020) also reported decrease in milk yield during the pandemic in their study.

Table 4.2.2 Average milk yield per animal per day in Bengaluru rural and Chikkaballapura districts (in liters)

Sl. No.	Breed	District	Pre-lockdown	Lockdown	Post-lockdown
a)	Indigenous cows	Bengaluru rural	2.63 ± 0.48	2.75 ± 0.50	2.88 ± 0.25
		Chikkaballapura	1.75 ± 0.35	1.75 ± 0.35	1.75 ± 0.35
		Total	2.33 ± 0.60	2.42 ± 0.66	2.50 ± 0.63
b)	Crossbred cows	Bengaluru rural	12.36 ± 2.13	12.08 ± 2.07	12.07 ± 2.51
		Chikkaballapura	11.47 ± 3.01	11.01 ± 2.87	11.36 ± 3.28
		Total	11.92 ± 2.64	11.54 ± 2.55	11.72 ± 2.93
c)	Buffaloes	Bengaluru rural	2.38 ± 0.63	2.38 ± 0.75	2.50 ± 0.58
		Chikkaballapura	2.40 ± 0.83	2.50 ± 0.87	2.67 ± 0.99
		Total	2.39 ± 0.77	2.47 ± 0.82	2.63 ± 0.91

Table 4.2.3 Gap analysis of milk productivity (%Δa) in Bengaluru rural and Chikkaballapura districts

Sl. No.	Breed	District	% Δa	
			Pre-lockdown vs lockdown	Pre-lockdown vs post-lockdown
a)	Indigenous cows	Bengaluru rural	4.563	9.51
		Chikkaballapura	0.00	0.00
		Total	3.86	7.30
b)	Crossbred cows	Bengaluru rural	-2.26**	-2.35**
		Chikkaballapura	-4.01***	-0.94
		Total	-3.19***	-1.68
c)	Buffaloes	Bengaluru rural	0.00	5.26
		Chikkaballapura	4.17	11.25
		Total	3.35	10.04

Significant at *P<0.05; **P<0.01; ***P<0.001

4.2.3 Total milk production in Bengaluru rural and Chikkaballapura districts

The total milk production not only depends on milk productivity but also on the herd size. Wilcoxon paired signed rank test was used to test the significance in the milk production across the three periods (Table 4.2.4 and Table 4.2.5). The total milk production of indigenous cattle and buffaloes did not vary significantly during the lockdown and post-lockdown periods in both the districts ($P > 0.05$). There was a dip in the total milk production of crossbred cattle in both the districts during lockdown period. The total milk production was reduced by 2.52 per cent in Bengaluru rural district ($P < 0.01$) and 4.03 per cent in Chikkaballapura districts ($P < 0.001$) during lockdown. Further, during the post-lockdown period the total milk production was increased in both the districts as compared to lockdown period. Hence there was no significant difference in total milk production of crossbred during post-lockdown in both the districts as compared to pre-lockdown period ($P > 0.05$). Chandel *et al.* (2020) in their study also reported that milk production is expected to decrease due to non-availability of feed and fodder caused by lockdown restrictions.

Table 4.2.4 Total milk production in Bengaluru rural and Chikkaballapura districts (in liters/day/household)

Sl. No.	Breed	District	Pre-lockdown	Lockdown	Post-lockdown
a)	Indigenous cows	Bengaluru rural	4.50 ± 1.29	4.75 ± 1.5	5.00 ± 1.41
		Chikkaballapura	1.75 ± 0.35	1.75 ± 0.35	1.75 ± 0.35
		Total	3.58 ± 1.74	3.75 ± 1.94	3.91 ± 2.01
b)	Crossbred cows	Bengaluru rural	25.75 ± 13.70	25.10 ± 12.97	25.48 ± 13.02
		Chikkaballapura	21.82 ± 10.91	20.94 ± 10.25	21.78 ± 10.92
		Total	23.79 ± 12.52	23.03 ± 11.85	23.64 ± 12.13
c)	Buffaloes	Bengaluru rural	4.13 ± 3.94	4.13 ± 3.96	4.25 ± 3.86
		Chikkaballapura	3.93 ± 2.98	4.13 ± 3.09	4.33 ± 3.11
		Total	3.97 ± 3.09	4.13 ± 3.17	4.32 ± 3.16

Table 4.2.5 Gap analysis of milk production (%ΔY) in Bengaluru rural and Chikkaballapura districts

Sl. No.	Breed	District	% Δ Y	
			Pre-lockdown vs lockdown	Pre-lockdown vs post-lockdown
a)	Indigenous cows	Bengaluru rural	5.56	11.11
		Chikkaballapura	0.00	0.00
		Total	4.75	9.22
b)	Crossbred cows	Bengaluru rural	-2.52**	-1.04
		Chikkaballapura	-4.03***	-0.18
		Total	-3.19***	-0.63
c)	Buffaloes	Bengaluru rural	0.00	2.90
		Chikkaballapura	5.09	10.18
		Total	4.03	8.82

Significant at *P<0.05; **P<0.01; ***P<0.001

4.2.4 Membership of farmers in DCS

In Bengaluru rural district 100 per cent of the dairy farmers and 98 per cent of dairy farmers in Chikkaballapura district were either members or milk pourers in DCS. This was mainly because of the easy accessibility to DCS, timely and regular payment of money, availability of feed and cattle treatment facilities. The remaining 2 per cent of the dairy farmers in Chikkaballapura district poured milk to the private dairy. Further, farmers who reared indigenous cattle and buffalos also sold milk to the private consumers.

Table 4.2.6 Membership of farmers in DCS in Bengaluru Rural and Chikkaballapura districts

District	Number (%)	Total
Bengaluru rural	100 (100)	100
Chikkaballapura	98(98)	100
Total	198(99)	200

4.2.5 Quantity of milk sold by farmers to DCS and private consumers

Quantity of milk sold is very important factor from economic point of view compared to total milk production because it is the actual quantity made available to the non-producing population of the country and the necessary infrastructural arrangements are made depending on the quantity of the milk sold by farmers. As high as 100 per cent and 98 per cent of the farmers in Bengaluru rural and Chikkaballapura districts sold milk in DCS. Only farmers who reared indigenous cattle and buffalos sold milk to the private consumers.

From Table 4.2.7 it can be observed that the quantity of milk sold by the farmers to DCS in Bengaluru rural district was reduced by 2.68 per cent from 24.95 litres per day per household during pre-lockdown period to 24.28 litres per day per household during lockdown period ($P < 0.01$). Similarly, quantity of milk sold by farmers to DCS in Chikkaballapura district was reduced by 4.42 per cent from 20.81 litres per day per household during pre-lockdown period to 19.89 litres per day per household during lockdown period ($P < 0.001$). Hence, there was a significant difference in the quantity of

milk sold by farmers to DCS in both the districts during lockdown as compared to pre-lockdown period.

The quantity of milk sold by farmers to DCS in both the districts during post-lockdown did not differ significantly as compared to pre-lockdown period (P > 0.5). Bhandari and Lal (2020) in their study reported decrease in sale of milk by farmers which reduced their net income. Kaur and Singh (2020) reported dumping of milk by dairy farmers in Punjab due to non-functioning of unorganized sector like milkmen, contractors and halwai shops during lockdown.

Table 4.2.7 Quantity of the milk sold by farmers to DCS and private consumers in Bengaluru rural and Chikkaballapura districts (in liters/day/household)

Sl. No.	Milk Sold	District	Pre-lockdown	Lockdown	Post-lockdown
a)	Dairy Cooperative Societies	Bengaluru rural	24.95 ± 13.66	24.28 ± 12.95	24.68 ± 12.99
		Chikkaballapura	20.81 ± 10.87	19.89 ± 10.20	20.83 ± 10.77
		Total	22.89 ± 12.49	22.08 ± 11.83	22.76 ± 12.06
b)	Private consumers	Bengaluru rural	2.71 ± 1.25	2.71 ± 1.25	2.71 ± 1.25
		Chikkaballapura	3.22 ± 2.86	3.11 ± 2.97	3.33 ± 2.92
		Total	3.00 ± 2.25	2.94 ± 2.32	3.06 ± 2.29

Table 4.2.8 Gap analysis of milk sold (%ΔS) in Bengaluru rural and Chikkaballapura districts

Sl. No.	Milk Sold	Districts	% Δ S	
			Pre-lockdown vs lockdown	Pre-lockdown vs post-lockdown
a)	Dairy Cooperative Societies	Bengaluru rural	-2.68**	-1.08
		Chikkaballapura	-4.42***	0.09
		Total	-3.54***	-0.57
b)	Private consumers	Bengaluru rural	0.00	0.00
		Chikkaballapura	-3.42	3.42
		Total	-2.00	2.00

Statistically significant at *P<0.05; **P<0.01; ***P<0.001

There was no statistically significant decline in quantity of milk sold by farmers to private consumers in Bengaluru rural and Chikkaballapura districts. Only during the initial days of lockdown some farmers declined to come outside and pour milk. Further, the private consumers also denied to purchase milk from dairy farmers. Hence, a slight reduction was observed in quantity of milk sold by farmers in both the districts during the lockdown period.

4.2.6 Quantity of household consumption by farmers in Bengaluru rural and Chikkaballapura districts

Quantity of milk sold depends not only on total milk production but also on the quantity of milk consumed by the household. The quantity of milk consumed by the households ranged from 0.2 liters per day to 2.5 liters per day depending on the family size. The quantity of milk consumed by the households increased by 2.10 per cent in Bengaluru rural district and 10.28 per cent in Chikkaballapura district during the lockdown as compared to pre-lockdown period (Table 4.2.10). However, the increase seen in Chikkaballapura district during lockdown was alone found to be significant ($P < 0.01$).

During post-lockdown, the quantity of milk consumed by households remained same as that of pre-lockdown period in Bengaluru rural district ($P > 0.05$). But in Chikkaballapura district the quantity of milk consumed by households was increased by 0.93 per cent during post-lockdown period as compared to pre-lockdown period which was statistically not significant ($P > 0.05$).

Table 4.2.9 Quantity of household consumption by farmers in Bengaluru rural and Chikkaballapura districts (in liters/day)

Sl. No.	District	Pre-lockdown	Lockdown	Post-lockdown
a)	Bengaluru rural	0.95 ± 0.48	0.97 ± 0.51	0.95 ± 0.48
b)	Chikkaballapura	1.07 ± 0.45	1.18 ± 0.61	1.08 ± 0.49
c)	Total	1.01 ± 0.47	1.07 ± 0.58	1.02 ± 0.49

Table 4.2.10 Gap analysis of household consumption (%ΔH) in Bengaluru rural and Chikkaballapura districts

Sl. No.	District	% Δ H	
		Pre-lockdown vs lockdown	Pre-lockdown vs post-lockdown
a)	Bengaluru rural	2.10	0.00
b)	Chikkaballapura	10.28**	0.93
c)	Total	5.94	0.99

Statistically significant at *P<0.05; **P<0.01; ***P<0.001

4.2.7 Procurement price of milk in Bengaluru rural and Chikkaballapura districts

The procurement price of the milk has a direct influence on income of dairy farmers. The procurement price of the milk in Bengaluru rural district was reduced by 8.62 per cent from ₹ 29 per litre in pre-lockdown to ₹ 26.5 per litre in lockdown (Table 4.2.11). Further, it was reduced by 13.21 per cent to ₹ 23 per litre during post-lockdown period. So, farmers in Bengaluru rural district were badly affected by reduction in the procurement price by around 20 per cent compared to pre-lockdown period (Table 4.2.12).

When compared to pre-lockdown period, there was no reduction in procurement price of milk in Chikkaballapura district and remained same as ₹ 28 per litre even during lockdown. But during the post-lockdown period, procurement price of the milk was reduced by 6.61 per cent from ₹ 28 per litre to ₹ 26.15 per litre. Farmers in the Bengaluru rural district witnessed more impact with respect to reduction in procurement price as compared to the farmers in Chikkaballapura district. These findings are in conformity with the findings of Bavadam (2020), Begum *et al*. (2020), Chandel *et al*. (2020), Dubey (2020), NABARD (2020), Popat *et al*. (2020) and Singh *et al*. (2020).

In addition to the procurement price of milk, dairy farmers received additional amount of ₹ 5 per litre of milk poured in DCS by Government of Karnataka as an incentive. There was no change in this amount during lockdown and post-lockdown period.

Table 4.2.11 Procurement price of milk in Bengaluru rural and Chikkaballapura districts during pre-lockdown, lockdown and post-lockdown periods

District	Procurement price in ₹/litre		
	Pre-lockdown	Lockdown	Post-lockdown
Bengaluru rural	29	26.5	23
Chikkaballapura	28	28	26.15

Table 4.2.12 Gap analysis of milk procurement price (% ∆P) in Bengaluru rural and Chikkaballapura districts

Districts	% ∆P	
	Pre-lockdown vs lockdown	Pre-lockdown vs post-lockdown
Bengaluru rural	-8.62	-20.69
Chikkaballapura	0.00	-6.61

4.2.8 Distribution of farmers whose income from dairying affected during lockdown or post-lockdown

The share of dairying in family's annual income ranged from 46.31 per cent in Chikkaballapura to 53.77 per cent in Bengaluru rural. 81 per cent and 87 per cent of dairy farmers from Bengaluru rural and Chikkaballapura districts respectively witnessed loss in their income from dairying either during lockdown or post-lockdown period or in both the periods (Table 5.2.17). Bhandari and Lal (2020), Chandel *et al*. (2020) and Singh (2020) also reported loss in the income of dairy farmers due to the COVID-19 pandemic crisis.

Table 4.2.13 Distribution of farmers whose income from dairying affected during lockdown or post-lockdown in Bengaluru rural and Chikkaballapura districts

Districts	Famers whose family income affected No. (%)	Total
Bengaluru rural	81(81)	100
Chikkaballapura	87(87)	100
Total	168(84)	200

4.2.9 Reduction in family income from dairying due to COVID-19 pandemic during lockdown period vis-a-vis pre-lockdown period

It is inferred from Table 4.2.18 that the percentage reduction in family income from dairying during lockdown ranged from 5 per cent to 40 per cent with mean of 18.89 per cent in Bengaluru rural district. In Chikkaballapura district, the mean percentage reduction in family income from dairying during lockdown was 18.85 per cent with minimum of 10 per cent and maximum of 60 per cent. The reduction in the income from dairying was mainly due to reduction in the procurement price and increase in the prices of the concentrates. Chandel *et al*. (2020) accounted 41 per cent of economic loss to the milk producers during lockdown period.

Table 4.2.14 Percentage reduction in family income from dairying during lockdown period

District	% Reduction in family income from dairying				
	Minimum	Maximum	Mean	SD	% CV
Bengaluru rural	5	40	18.89	9.52	50.39
Chikkaballapura	10	60	18.85	9.92	52.62
Total	10	60	21.25	11.59	54.54

4.2.10 Reduction in family income from dairying due to COVID-19 pandemic during post-lockdown vis-a-vis pre-lockdown

In Bengaluru rural district, the mean percentage reduction in family income from dairying during post-lockdown was 23.82 per cent with minimum loss of 10 per cent to maximum of 50 per cent. In Bengaluru rural district, the procurement price of milk was further reduced during the post-lockdown period leading to more income loss in family income from dairying as compared to lockdown period.

In Chikkaballapura district, the mean percentage reduction in family income from dairying during post-lockdown was 13.67 per cent with minimum loss of 5 per cent to maximum of 40 per cent.

Table 4.2.15 Percentage reduction in family income from dairying during post-lockdown period

District	% Reduction in family income from dairying				
	Minimum	Maximum	Mean	SD	% CV
Bengaluru rural	10	50	23.82	12.93	54.82
Chikkaballapura	5	40	13.67	8.95	65.47
Total	5	40	16.19	9.81	60.59

4.2.11 Distribution of farmers whose frequency in payment of money from DCS/ private companies/ personnel affected

The dairy farmers of Karnataka state were paid regularly even during the lockdown and post-lockdown period. This was mainly because of efforts of the government to minimize the impact of COVID-19 on dairy farmers and well-organized structure of dairy cooperatives in the state. It can be observed from Table 4.2.16 that only 3 per cent and 4 per cent of farmers from Bengaluru rural and Chikkaballapura districts were affected with the payment due to them during lockdown and none of the farmers were affected during post-lockdown. Kumar (2020) also reported that regular payments to farmers was continued by DCS during the crisis.

Table 4.2.16 Percentage of farmers whose frequency in payment of money from DCS/ private companies/ personnel affected

Period	Districts		Total (%)
	Bengaluru Rural (%)	Chikkaballapura (%)	
Lockdown	3	4	7
Post-lockdown	0	0	0

4.2.12 Purchase and sale of milch animals by farmers in Bengaluru rural and Chikkaballapura districts during lockdown/ post-lockdown

During lockdown and post-lockdown periods 7 farmers and 3 farmers from Bengaluru rural and Chikkaballapura districts respectively purchased milch animals. The number of milch animals purchased ranged from 1 to 2 animals in Chikkaballapura district.

Similarly, 14 farmers and 15 farmers from Bengaluru rural and Chikkaballapura districts respectively were engaged in selling milch animals. The number of milch animals sold by the farmers ranged from 1 to 5 animals and 1 to 6 animals in Bengaluru rural and Chikkaballapura districts respectively. It can be observed that a greater number of farmers were engaged in selling the milch animals than purchase of milch animals.

Table 4.2.17 Purchase and sale of milch animals during lockdown or post-lockdown period

Sl. No.	Purchase or sale	Districts	Number of farmers	Total milch animals	Minimum	Maximum
a)	Purchase	Bengaluru rural	7	7	1	1
		Chikkaballapura	3	4	1	2
		Total	10	11	1	2
b)	Sale	Bengaluru rural	14	18	1	5
		Chikkaballapura	15	23	1	6
		Total	19	41	1	6

4.2.13 Severity of major constraints faced by the dairy farmers

a) Input procurement

Majority of dairy farmers faced no problem in arranging green fodder and dry fodder, as these were cultivated in their own land (Table 4.2.18). Only 12 per cent and 4 per cent of farmers from Bengaluru rural and Chikkaballapura districts respectively found difficulty in procuring green fodder. Similarly, only 5 per cent and 9 per cent of the farmers from Bengaluru rural and Chikkaballapura districts respectively found difficulty in procuring dry fodder. Further, during the post-lockdown period none of the farmers faced problems in procurement of green fodder and dry fodder.

With respect to concentrates, even though some of the concentrates like by-pass feed, type-1 feed and mineral mixture were made available to dairy farmers by their respective DCS, other concentrates like rice husk, wheat barn were purchased directly from the local input dealers. During the lockdown period, closure of cattle feed shops and lack

of transportation facilities caused difficulty to farmers difficulty in procuring other concentrates. During lockdown, 56 per cent of farmers faced less severe and 32 per cent of farmers faced severe constraints in procuring concentrates in Bengaluru rural district. Similarly, in Chikkaballapura district 49 per cent of farmers faced less severe and only 4 per cent of farmers faced severe constraints in procuring concentrates during lockdown. Later, negligible percentage of farmers faced constraints in procuring concentrates during the post-lockdown period. The findings of the study in line with the observations made by Bhandari and Ravishankara (2020), Chandel *et al*. (2020), FAO (2020), NABARD (2020), Singh *et al*. (2020). Chandel *et al*. (2020) reported that supply of concentrated feeds was decreased by 40 to 50 per cent during lockdown in their study. NABARD (2020) in its study reported that fodder availability was declined by 10.8 per cent.

b) Sale of milk

Sale of milk was not a major constraint for most of the farmers in both the districts. As every village had a DCS, there was no need for framers to travel longer distance to reach DCS. Only those farmers who were in containment zone or whose family members were affected with COVID-19 faced constraints in selling milk. Only 6 per cent of farmers from both Bengaluru rural and Chikkaballapura districts faced constraints in selling milk (Table 4.2.19). Further, none of the farmers faced problems in selling milk during the post-lockdown period.

c) Accessibility for treatment of cattle

Strict lockdown policy during the initial stages of lockdown restricted the movement of people including veterinary doctors. Hence, farmers faced problems in providing treatment to their diseased cattle and some farmers couldn’t make arrangements for artificial insemination when their cattle were in heat. Table 4.2.20 shows that 60 per cent and 11 per cent of farmers faced less severe and severe constraints respectively in providing treatment to their cattle in Bengaluru rural district during lockdown. Further only 3 per cent of farmers faced problems during post-lockdown. In Chikkaballapura district, 35 per cent of farmers faced less severe and only 4 per cent of farmers faced severe constraints in providing treatment to their cattle during lockdown. During the

Table 4.2.18 Severity of constraints faced by dairy farmers in input procurement

Input	Severity	Bengaluru rural		Chikkaballapura		Total	
		Pre-lockdown vs Lockdown	Pre-lockdown vs Post-lockdown	Pre-lockdown vs Lockdown	Pre-lockdown vs Post-lockdown	Pre-lockdown vs Lockdown	Pre-lockdown vs Post-lockdown
Green fodder	As before	88	100	95	100	183 (91.50)	200 (100)
	Less severe	12	0	4	0	16 (8.00)	0 (0.00)
	Severe	0	0	1	0	1 (0.50)	0 (0.00
Dry fodder	As before	95	99	91	100	186 (93.00)	199 (99.50)
	Less severe	4	1	9	0	13(6.50)	1 (0.05)
	Severe	1	0	0	0	1 (0.50)	0 (0.00)
Concentrates	As before	12	93	47	99	59 (29.50)	192 (96.00)
	Less severe	56	7	49	1	105 (52.50)	8 (4.00)
	Severe	32	0	4	0	36 (18.00)	0 (0.00)

Figures in parenthesis are in percentage.

Table 4.2.19 Severity of constraints faced by dairy farmers in sale of milk

Constraint	Severity	Bengaluru rural		Chikkaballapura		Total	
		Pre-lockdown vs Lockdown	Pre-lockdown vs Post-lockdown	Pre-lockdown vs Lockdown	Pre-lockdown vs Post-lockdown	Pre-lockdown vs Lockdown	Pre-lockdown vs Post-lockdown
Sale of milk	As before	94	100	94	99	188 (94.00)	199 (99.5)
	Less severe	6	0	6	1	12 (6.00)	1 (0.50)
	Severe	0	0	0	0	0 (0.00)	(0.00)

Figures in parenthesis are in percentage.

post-lockdown period, none of the famers faced problem in contacting veterinary doctors in Chikkaballapura district. Chandel *et al*. (2020) and FAO (2020) also reported that there was inaccessibility of veterinary and insemination services during the nationwide lockdown.

d) Reduction in milk procurement price

Reduction in milk procurement price was the major concern for dairy farmers, especially to the farmers of Bengaluru rural district where milk procurement price was reduced up to 20 per cent from pre-lockdown to post-lockdown period. It can be seen from Table 4.2.21 that during lockdown period, 64 per cent and 32 per cent of farmers faced less severe and severe constraints respectively due to reduction in milk procurement price in Bengaluru Rural district. Further, during post-lockdown period 64 per cent of farmers faced less severe constraints and 30 per cent of farmers faced severe constraints due to reduction in milk procurement price.

In Chikkaballapura district procurement price of milk was reduced only by 6.61 per cent. Hence during lockdown period, 46 per cent and 45 per cent of farmers faced less severe and severe constraints respectively. Further, during post-lockdown period 49 per cent of farmers faced less severe constraints and 42 per cent of farmers faced severe constraints due to reduction in milk procurement price.

e) Increase in input prices

Since green fodder and dry fodder were cultivated by majority of the farmers in their own land, negligible percentage of farmers faced problem with respect to their prices. Increase in the prices of concentrates was the major concern for dairy farmers. It can be seen from Table 4.2.22 that 32 per cent and 66 per cent of farmers faced less severe and severe constraints respectively during lockdown in Bengaluru rural district due to increase in concentrates prices. Further 76 per cent of the dairy farmers faced less severe constraint and 18 per cent of the farmers faced severe constraint during post-lockdown in Bengaluru rural district. In Chikkaballapura district, 28 per cent of farmers faced less severe and 63 per cent of farmers faced severe constraints due to increase in concentrate prices during

Table 4.2.20 Severity of constraints faced by dairy farmers in treatment of cattle

Constraint	Severity	Bengaluru rural		Chikkaballapura		Total	
		Pre-lockdown vs Lockdown	Pre-lockdown vs Post-Lockdown	Pre-lockdown vs Lockdown	Pre-lockdown vs Post-Lockdown	Pre-lockdown vs Lockdown	Pre-lockdown vs Post-Lockdown
Accessibility for treatment of cattle	As before	29	97	61	100	90 (45.00)	197 (98.5)
	Less severe	60	3	35	0	95 (47.50)	3 (1.5)
	Severe	11	0	4	0	15 (7.50)	0 (0.00)

Figures in parenthesis are in percentage.

Table 4.2.21 Severity of constraints faced by dairy farmers in reduction of milk procurement price

Constraint	Severity	Bengaluru rural		Chikkaballapura		Total	
		Pre-lockdown vs Lockdown	Pre-lockdown vs Post-Lockdown	Pre-lockdown vs Lockdown	Pre-lockdown vs Post-Lockdown	Pre-lockdown vs Lockdown	Pre-lockdown vs Post-Lockdown
Reduction in milk procurement price	As before	4	6	46	49	50 (25.00)	55 (27.50)
	Less severe	64	64	45	42	109 (54.50)	106 (53.00)
	Severe	32	30	9	9	41 (20.50)	39 (19.50)

Figures in parenthesis are in percentage.

lockdown. During post-lockdown, 63 per cent of the farmers faced less severe and 17 per cent of the farmers faced severe constraint. Bhandari and Lal (2020), Bhandari and Ravishankara (2020), Chandel *et al*. (2020), Dubey (2020), NABARD (2020) also reported that increase in prices of concentrate feed was a major constraint to the dairy farmers during the pandemic.

e) Transportation to reach DCS/Milk vendor

Even though lockdown limited the movement of people and transportation facilities only 5 per cent of farmers in Bengaluru rural district faced problems with regard to reaching DCS or milk vendor during the lockdown period (Table 4.2.23). Further, none of the farmers faced transportation problem in Chikkaballapura district during both lockdown and post-lockdown periods. This was mainly because of closer proximity of DCS to every farmer as every village in both the districts had a DCS.

4.2.14 Status of cost and returns of milk production during lockdown and post-lockdown in Bengaluru rural and Chikkaballapura districts of Karnataka

An attempt was made to assess the impact of COVID-19 on the cost and returns of milk production based on the available data from literature and certain plausible assumptions (also discussed under section 3.4.5). Major components in the cost and returns of milk production that can cause economic loss to the dairy farmers were identified (Table 4.2.24). Among the variable costs, cost of the concentrates was found to increase drastically (discussed under section 4.2.13e) while other costs due to green fodder, dry fodder, labour cost, veterinary and miscellaneous expenses were assumed to be more or less same during lockdown and post-lockdown periods. Hence, variations can be observed in total variable cost during pre-lockdown, lockdown and post-lockdown periods. It was assumed that total fixed cost was not affected during the pandemic.

Table 4.2.22 Severity of constraints faced by dairy farmers in increase of input prices

Input	Severity	Bengaluru rural		Chikkaballapura		Total	
		Pre-lockdown vs Lockdown	Pre-lockdown vs Post-Lockdown	Pre-lockdown vs Lockdown	Pre-lockdown vs Post-Lockdown	Pre-lockdown vs Lockdown	Pre-lockdown vs Post-Lockdown
Green fodder	As before	97	100	100	100	197 (98.50)	200 (100)
	Less severe	3	0	0	0	3 (1.50)	0 (0.00)
	Severe	0	0	0	0	0 (0.00)	0 (0.00)
Dry fodder	As before	93	100	97	100	190 (95.00)	200 (100)
	Less severe	7	0	3	0	10 (5.00)	0 (0.00)
	Severe	0	0	0	0	0 (0.00)	0 (0.00)
Concentrates	As before	2	6	4	20	6 (3.00)	26 (13.00)
	Less severe	32	76	28	63	60 (30.00)	139 (69.50)
	Severe	66	18	68	17	134 (67.00)	35 (17.50)

Figures in parenthesis are in percentage.

Table 4.2.23 Severity of constraints faced by dairy farmers in transportation to reach DCS/Milk vendor

Constraint	Severity	Bengaluru rural		Chikkaballapura		Total	
		Pre-lockdown vs Lockdown	Pre-lockdown vs Post-Lockdown	Pre-lockdown vs Lockdown	Pre-lockdown vs Post-Lockdown	Pre-lockdown vs Lockdown	Pre-lockdown vs Post-Lockdown
Transportation to reach DCS/Milk vendor	As before	95	100	100	100	195 (97.50)	200 (100)
	Less severe	5	0	0	0	5 (2.50)	0 (0.00)
	Severe	0	0	0	0	0 (0.00)	0 (0.00)

Figures in parenthesis are in percentage.

Table 4.2.24 Status of cost and returns of milk production during lockdown and post-lockdown in Bengaluru rural and Chikkaballapura districts of Karnataka

Particulars	₹ /Animal/ Day
1. Variable cost	
A. Green fodder	Unaffected
B. Dry fodder	Unaffected
C. Concentrate	Affected
Feed & fodder cost (D = A+B+C)	Affected
E. Labour cost	Unaffected
F. Veterinary & miscellaneous cost	Unaffected
Total variable cost (TVC = D+E+F)	Affected
2. Total fixed cost (TFC)	Unaffected
Total cost (TC = TVC + TFC)	Affected
Value of dung (G)	Unaffected
Net cost (NC = TC – G)	Affected
Milk yield (MY) (Liter/ Milch animal)	Affected
Milk price (MP) (Rs. /liter)	Affected
Gross return (GR = MY*MP)	Affected
Net return (NR = GR – NC)	Affected
Cost of milk production/ liter (NC/MY) (Rs. /liter)	Affected
Net return/liter (NR/MY) (Rs. /liter)	Affected

Among the return components, both milk yield and milk procurement price showed variations during pre-lockdown, lockdown and post-lockdown periods. The variation in milk yield in Bengaluru rural and Chikkaballapura districts has been discussed under 4.2.2 and variations in milk procurement price has been discussed under 4.2.7. Hence, the dairy farmers in Bengaluru rural and Chikkaballapura districts witnessed economic loss during

lockdown and post-lockdown due to increase in cost of concentrates, reduction in milk yield and reduction in milk procurement price. The available recent literature (DoAHVS, 2019) reveals different milk productivity levels. Therefore, computation of economic loss was considered under two scenarios viz., high productivity (12.36/ litre/day/animal) and moderate productivity (8.20 litre/day/animal) levels were considered. The percentage decline to these levels during lockdown and post-lockdown periods were considered as obtained from the present study. It was assumed that total fixed cost was not affected during the pandemic.

4.2.15 Economic loss to the dairy farmers rearing crossbred due to COVID-19 pandemic in Bengaluru rural district

Since the majority of cattle in Bengaluru rural district was crossbred income loss to framers due to COVID-19 was done only for crossbred. Economic loss to dairy farmers rearing high productivity crossbred in Bengaluru rural district is presented in Table 4.2.25. Due to increase in cost of concentrates the total variable cost was increased by 18.22 per cent during lockdown. The net returns decreased by 34.65 per cent due to increase in cost of concentrates, reduction in milk yield and reduction in milk procurement price. As a result, the net return per liter of milk was reduced by 33.05 per cent during lockdown. During post-lockdown, even though the total variable cost was reduced by 7.07 per cent due to further decrease in the milk procurement price, the net return per liter of milk was decreased by 48.64 per cent as compared to the pre-lockdown period. Chandel *et al*. (2020) accounted 41 per cent of economic loss to the milk producers during lockdown period.

Similarly, the economic loss to the dairy farmers rearing moderate productivity crossbred due to COVID-19 pandemic in Bengaluru rural district is presented in Table 4.2.26. For the moderate productivity crossbred, the net returns per liter of milk was reduced by 72.58 per cent during lockdown as compared to pre-lockdown period. During dairy farmers in Bengaluru rural district rearing moderate productivity crossbred witnessed net return loss of 93.68 per cent per liter of milk during post-lockdown as compared to pre-lockdown period. The findings of the study are consistent with the observations made by Bhandari and Lal (2020), Chandel *et al*. (2020), NABARD (2020) and Singh (2020).

Table 4.2.25 Economic loss to the dairy farmers rearing high productivity crossbred due to COVID-19 pandemic in Bengaluru rural district

Particulars	Pre-lockdown	Lockdown	Post-lockdown
1. Variable cost (₹/litre)			
A. Green fodder *	28.25	28.25	28.25
B. Dry fodder *	13.29	13.29	13.29
C. Concentrate	78.54	108.15	95.44
Feed & fodder cost (D = A+B+C)	120.08	149.69	136.98
E. Labour cost *	25.51	25.51	25.51
F. Veterinary & miscellaneous cost *	4.35	4.35	4.35
Total variable cost (TVC = D+E+F)	149.84	179.55	166.84
2. Total fixed cost (TFC) *	20.44	20.44	20.44
Total cost (TC = TVC + TFC)	170.38	199.99	187.28
Value of dung in ₹ (G) *	7.94	7.94	7.94
Net cost in ₹ (NC = TC – G)	162.44	192.05	179.34
Milk yield (MY) (Liter/ Milch animal)	12.36	12.08	12.07
Milk price (MP) (₹/litre)	29	26.5	23
Gross return in ₹ (GR = MY*MP)	358.44	320.12	277.61
Net return in ₹ (NR = GR – NC)	196	128.07	98.27
Cost of milk production/ liter (NC/MY) (₹/litre)	13.15	15.89	14.86
Net return/liter (NR/MY) (₹/litre)	15.85	10.61	8.14

*Source: Gururaj. (2020). Impact of dairy cooperatives among milk producers of Karnataka state: A comparative study. *Ph. D. Thesis* submitted to National Dairy Research Institute (Deemed University), Bengaluru.

Table 4.2.26 Economic loss to the dairy farmers rearing moderate productivity crossbred due to COVID-19 pandemic in Bengaluru rural district

Particulars	Pre-lockdown	Lockdown	Post-lockdown
1. Variable cost (₹/litre)			
A. Green fodder *	28.25	28.25	28.25
B. Dry fodder *	13.29	13.29	13.29
C. Concentrate	78.54	108.15	95.44
Feed & fodder cost (D = A+B+C)	120.08	149.69	136.98
E. Labour cost *	25.51	25.51	25.51
F. Veterinary & miscellaneous cost *	4.35	4.35	4.35
Total variable cost (TVC = D+E+F)	149.84	179.55	166.84
2. Total fixed cost (TFC) *	20.44	20.44	20.44
Total cost (TC = TVC + TFC)	170.38	199.99	187.28
Value of dung in ₹ (G) *	7.94	7.94	7.94
Net cost in ₹ (NC = TC – G)	162.44	192.05	179.34
Milk yield (MY) (Liter/ Milch animal)	8.20	8.01	8.00
Milk price (MP) (₹/litre)	29	26.5	23
Gross return in ₹ (GR = MY*MP)	237.80	212.26	184.0
Net return in ₹ (NR = GR – NC)	75.36	20.21	98.27
Cost of milk production/ liter (NC/MY) (₹/litre)	19.81	23.98	22.48
Net return/liter (NR/MY) (₹/litre)	9.19	2.52	0.58

*Source: Gururaj. (2020). Impact of dairy cooperatives among milk producers of Karnataka state: A comparative study. *Ph. D. Thesis* submitted to National Dairy Research Institute (Deemed University), Bengaluru.

4.2.16 Economic loss to the dairy farmers rearing crossbred due to COVID-19 pandemic in Chikkaballapura district

The variation in feed cost and milk procurement price were suitably substituted as observed for Chikkaballapura district. However, the productivity levels were assumed to be as that of Bangalore rural district for the purpose of computing economic loss due to COVID-19 in Chikkaballapura district (Table 4.2.27). During lockdown, the total variable cost was increased by 18.92 per cent due to increase in cost of concentrates. Due to increase in cost of concentrates and reduction in milk yield, the net returns were decreased by 24.08 per cent during lockdown period. As a result, the net return per liter of milk was reduced by 20.89 per cent during lockdown as compared to pre-lockdown period. During the post-lockdown period, even though the total variable cost was reduced by 6.71 per cent due to decrease in the milk procurement price, net return per liter of milk was further decreased by 2.36 per cent. Hence, the net return per liter of milk reduced by almost 22.77 per cent for the farmers rearing high productivity crossbreds during post-lockdown as compared to the pre-lockdown period.

Similarly, the economic loss to the dairy farmers rearing moderate productivity crossbred due to COVID-19 pandemic in Chikkaballapura district is presented in Table 4.2.28. For crossbred with moderate productivity crossbred, the net returns per liter of milk was decreased by 46.79 per cent during lockdown period. During post-lockdown period, the net return loss was 42.71 per cent per liter as compared to pre-lockdown period.

4.3 The economic impact of COVID-19 pandemic on Dairy Cooperative Societies (DCS)

In this section, the analysis of constraints faced by DCS during lockdown and post-lockdown are presented and discussed. The findings of 24 DCS covering both Bengaluru rural and Chikkaballapura districts are presented below.

Table 4.2.27 Economic loss to the dairy farmers rearing high productivity crossbred due to COVID-19 pandemic in Chikkaballapura district

Particulars	Pre-lockdown	Lockdown	Post-lockdown
1. Variable cost (₹/litre)			
A. Green fodder *	28.25	28.25	28.25
B. Dry fodder *	13.29	13.29	13.29
C. Concentrate	71.48	98.52	86.17
Feed & fodder cost (D = A+B+C)	113.02	140.06	127.71
E. Labour cost *	25.51	25.51	25.51
F. Veterinary & miscellaneous cost *	4.35	4.35	4.35
Total variable cost (TVC = D+E+F)	142.88	169.92	157.57
2. Total fixed cost (TFC) *	20.44	20.44	20.44
Total cost (TC = TVC + TFC)	163.32	190.36	178.01
Value of dung in ₹ (G) *	7.94	7.94	7.94
Net cost in ₹ (NC = TC – G)	155.38	182.42	170.17
Milk yield (MY) (Liter/ Milch animal)	11.47	11.01	11.36
Milk price (MP) (₹/litre)	28	28	26.15
Gross return in ₹ (GR = MY*MP)	321.16	308.28	297.06
Net return in ₹ (NR = GR – NC)	165.78	125.86	126.89
Cost of milk production/ liter (NC/MY) (₹/litre)	13.55	16.57	14.98
Net return/liter (NR/MY) (₹/litre)	14.45	11.43	11.16

*Source: Gururaj. (2020). Impact of dairy cooperatives among milk producers of Karnataka state: A comparative study. *Ph. D. Thesis* submitted to National Dairy Research Institute (Deemed University), Bengaluru.

Table 4.2.28 Economic loss to the dairy farmers rearing moderate productivity crossbred due to COVID-19 pandemic in Chikkaballapura district

Particulars	Pre-lockdown	Lockdown	Post-lockdown
1. Variable cost (₹/litre)			
A. Green fodder *	28.25	28.25	28.25
B. Dry fodder *	13.29	13.29	13.29
C. Concentrate	71.48	98.52	86.17
Feed & fodder cost (D = A+B+C)	113.02	140.06	127.71
E. Labour cost *	25.51	25.51	25.51
F. Veterinary & miscellaneous cost *	4.35	4.35	4.35
Total variable cost (TVC = D+E+F)	142.88	169.92	157.57
2. Total fixed cost (TFC) *	20.44	20.44	20.44
Total cost (TC = TVC + TFC)	163.32	190.36	178.01
Value of dung in ₹ (G) *	7.94	7.94	7.94
Net cost in ₹ (NC = TC – G)	155.38	182.42	170.17
Milk yield (MY) (Liter/ Milch animal)	8.20	7.87	8.12
Milk price (MP) (₹/litre)	28	28	26.15
Gross return in ₹ (GR = MY*MP)	229.60	220.36	212.34
Net return in ₹ (NR = GR – NC)	74.22	37.94	42.17
Cost of milk production/ liter (NC/MY) (₹/litre)	18.94	23.18	20.96
Net return/liter (NR/MY) (₹/litre)	9.06	4.82	5.19

*Source: Gururaj. (2020). Impact of dairy cooperatives among milk producers of Karnataka state: A comparative study. *Ph. D. Thesis* submitted to National Dairy Research Institute (Deemed University), Bengaluru.

4.3.1 Severity of major constraints faced by DCS in Bengaluru rural and Chikkaballapura districts of Karnataka

Table 4.3.1 depicts the severity of major constraints faced by DCS in Bengaluru rural and Chikkaballapura districts of Karnataka during lockdown and post-lockdown periods. As provisions were given by the Government of Karnataka for supply of essential commodities during lockdown and post-lockdown, none of the DCS in both the districts faced problems with regard to transportation of milk to milk chilling centers.

DCS, apart from procuring milk it also ensures the supply of concentrate feed like type-1 feed, by pass feed and mineral mixture to its members. These are supplied to DCS by respective Milk Unions. During the initial stages of lockdown, supply of these concentrate feed was disrupted due to transportation restrictions. It can be observed from Table 4.3.1 that 8 out of 12 DCS in Bengaluru rural district and 5 out of 12 DCS in Chikkaballapura district faced less severity with respect to feed supply from Milk Unions. Later, no such constraints were faced by DCS during post-lockdown period. Patil (2020) also reported disruption in supply chain of feed during lockdown due to transportation restrictions.

It was noticed that during the period of lockdown some farmers fed less to their cattle due to unavailability of feed and fodder. This had an impact on milk productivity and quality. From Table 4.3.1 it can be observed that only 2 DCS from Bengaluru rural district and 1 DCS from Chikkaballapura district faced less severe constraint of reduction in milk quality during lockdown. But no such constraints were noticed during post-lockdown.

Government of Karnataka took all the necessary measures to minimize the loss for the dairy farmers during lockdown period. As a result, majority of the farmers were paid regularly against their claim at DCS i.e., once in 15 days. Only 2 DCS out of 12 in Bengaluru rural district faced difficulties in timely payment during lockdown. Later, no such problems occurred during post-lockdown in Bengaluru rural district. In Chikkaballapura district, none of the DCS faced problems with respect to financial transactions during lockdown as well as post-lockdown.

Table 4.3.1 Severity of major constraints faced by DCS in Bengaluru rural and Chikkaballapura districts

Constraints	Severity	Bengaluru rural		Chikkaballapura		Total	
		Pre-lockdown vs Lockdown	Pre-lockdown vs Post-lockdown	Pre-lockdown vs Lockdown	Pre-lockdown vs Post-lockdown	Pre-lockdown vs Lockdown	Pre-lockdown vs Post-Lockdown
Transportation from DCS to Milk Chilling Centers	As before	12 (100)	12 (100)	12 (100)	12 (100)	24 (100)	24 (100)
	Less severe	0	0	0	0	0	0
	Severe	0	0	0	0	0	0
Availability of feed from milk unions to DCS	As before	4 (33.33)	12 (100)	7 (58.33)	12 (100)	11 (45.83)	24 (100)
	Less severe	8 (66.67)	0	5 (41.67)	0	13 (54.17)	0
	Severe	0	0	0	0	0	0
Reduction in milk quality	As before	10 (83.33)	12 (100)	11 (91.67)	12 (100)	18 (75.0)	24 (100)
	Less severe	2 (16.67)	0	1 (8.33)	0	6 (25.0)	0
	Severe	0	0	0	0	0	0
Financial transactions: Crediting the amount in farmers' account	As before	10 (83.33)	12 (100)	12 (100)	12 (100)	22 (91.67)	24 (100)
	Less severe	2 (16.67)	0	0	0	2 (8.33)	0
	Severe	0	0	0	0	0	0
Arranging veterinary services to the members	As before	4 (33.33)	9 (75.0)	5 (41.67)	10 (83.33)	9 (37.5)	19 (79.17)
	Less severe	7 (58.33)	3 (25.0)	5 (41.67)	2 (16.67)	12 (50.0)	5 (20.83)
	Severe	1 (8.33)	0	2 (16.66)	0	3 (12.50)	0

The figures in parenthesis are in percentage.

DCS also makes arrangement for veterinary services to its members. Due to transportation restrictions and as a precautionary measure against the pandemic, veterinary doctors made limited visits to villages. In Bengaluru rural district, 7 DCS faced less severe constraints and 1 DCS faced severe constraints in arranging veterinary services to its members during lockdown. Further, even during post-lockdown 3 DCS in Bengaluru rural district faced less severe problem. In Chikkaballapura district, 5 DCS faced less severe constraints and 2 DCS faced severe constraints in arranging veterinary services to its members. Later, during post-lockdown 2 DCS faced less severe constraints in Chikkaballapura district.

4.4 The economic impact of COVID-19 pandemic on Milk Unions

Quantity and price are important performance indicators of any business enterprise. The findings of analysis of such indicators with respect to milk, milk products and feed items of two milk unions, BAMUL and KOMUL are discussed and presented in this section.

4.4.1 Trends in quantity of milk procured by Milk Unions

Figure 4.1 and Figure 4.2 present the monthly trends in the quantity of milk procured by BAMUL and KOMUL respectively for the period 2017 to 2020. Though there were many constraints faced by the unions with respect to disruption in the supply chain and transportation restrictions during the initial stages of lockdown, the monthly trend in milk procurement was seen similar over the years. There was no reduction in milk procurement in both the unions during lockdown and post-lockdown periods. The findings of the study are similar to the analysis made by Mohan (2020) during April to September, 2020 in Karnataka.

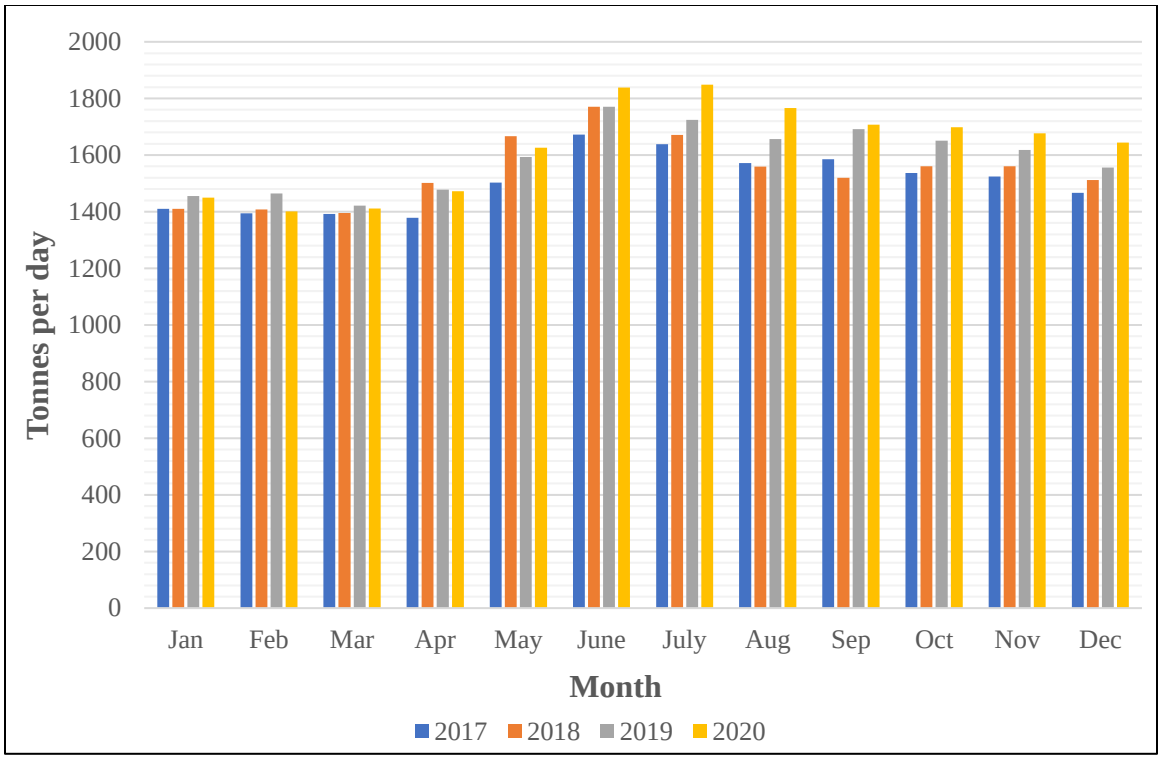

Figure 4.1 Trends in quantity of milk procured by BAMUL (2017-2020)

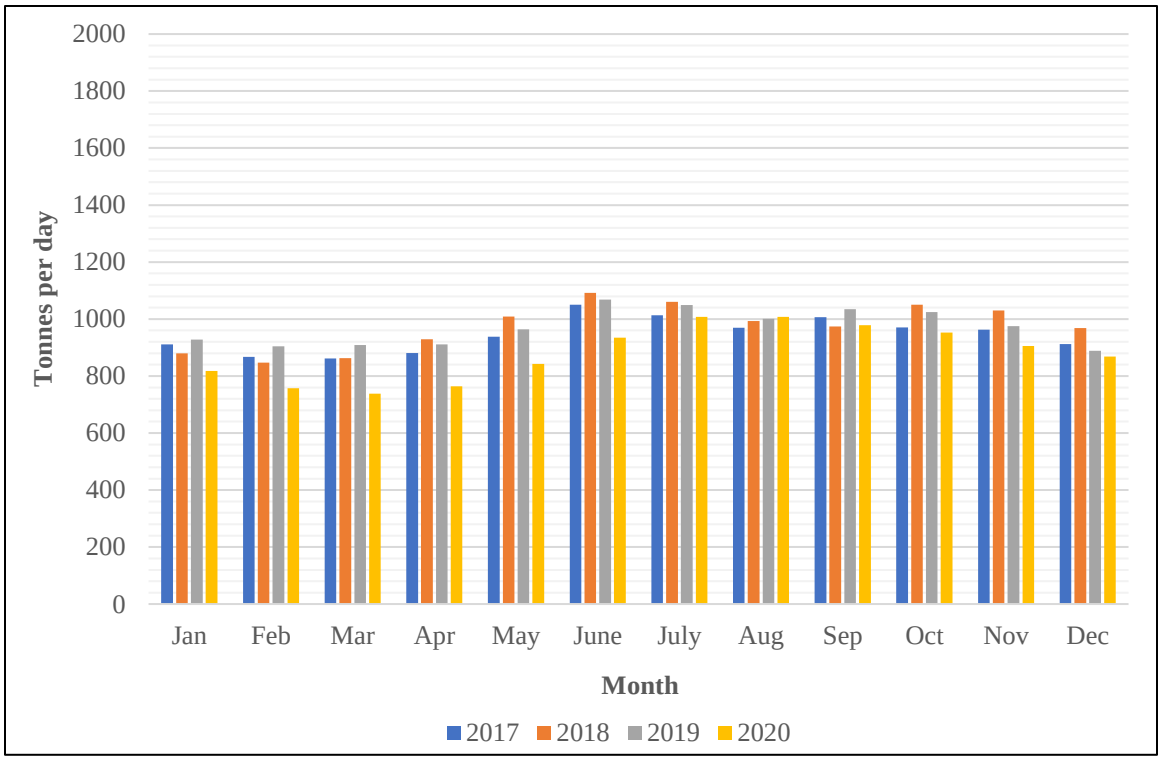

Figure 4.2 Trends in quantity of milk procured by KOMUL (2017-2020)

4.4.2 Trends in quantity of milk sold by Milk Unions

Figures 4.3 and 4.4 present the monthly trends in quantity of milk sold by BAMUL and KOMUL respectively for the period 2017 to 2020. During lockdown, on 1st April, 2020 the Government of Karnataka announced to distribute the surplus amount of milk procured by 14 milk unions to the residents residing in slums and poor people through urban local bodies, as a measure for the benefit of dairy farmers and consumers. As a result, the quantity of milk sold by both the milk unions BAMUL and KOMUL increased during the month of April i.e., during lockdown. However, during other months of lockdown i.e., May and during the post lockdown same trends were observed as that of previous years. The sale of milk by BAMUL showed increased by 1.58 per cent in April, 2020 as compared to April, 2019. While there was a significant increase in quantity of milk sold by KOMUL in April, 2020 by 27.82 per cent as compared to April, 2019. Biswas (2020) reported that demand for packed milk in India raised amid pandemic and AMUL has also seen 5 per cent increase in the sale of its pouched milk. Cornall (2020) also reported that the sale of liquid milk in India is expected to rise 3 to 4 per cent in the fiscal year amid pandemic.

4.4.3 Trends in quantity of SMP produced by Milk Unions

Figures 4.5 and 4.6 present the monthly trends in quantity of SMP produced by BAMUL and KOMUL respectively for the period 2017 to 2020. Since the quantity of milk sold increased during the lockdown period especially in the month of April, SMP production decreased in both the milk unions. In BAMUL, during lockdown i.e., April and May there was no production of SMP. Even during initial stages of post-lockdown i.e., June and July 0.16 and 1.13 tons of SMP were produced daily which is around 98 per cent and 89 per cent less respectively, as compared to average production in the same months of previous three years. Later, in the month of August and September SMP production increased rapidly with production of 25.77 and 48.80 tons per day.

In KOMUL, production of SMP was drastically reduced during the month of April as the quantity of milk sold in that month was increased by 27.82 per cent compared to April, 2019. During the post lockdown period, even though the production of SMP increased it stood below as compared to previous years.

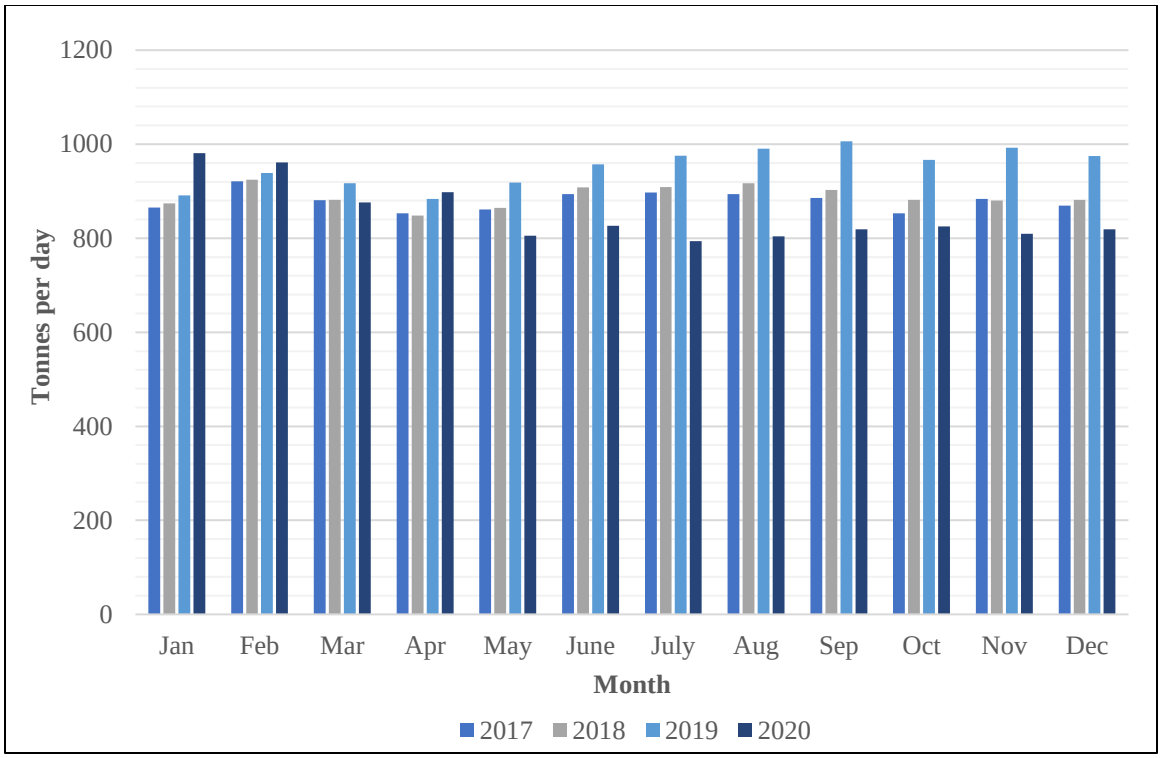

Figure 4.3 Trends in quantity of milk sold by BAMUL (2017-2020)

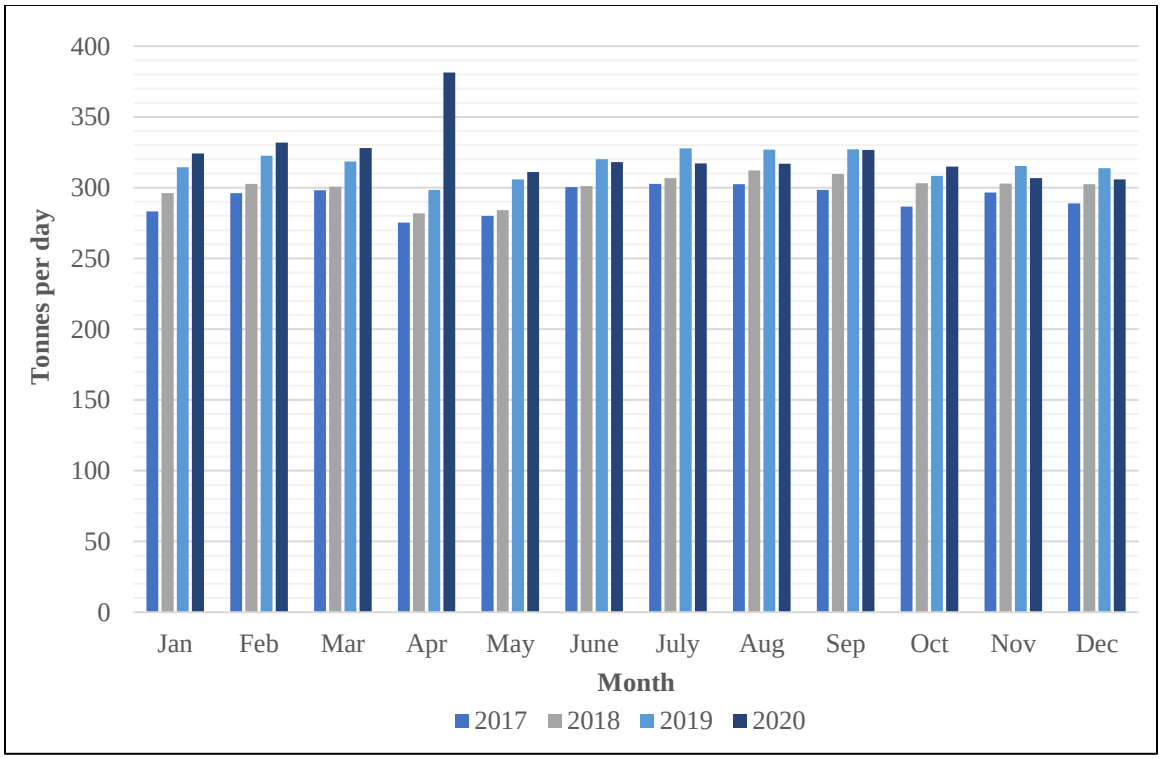

Figure 4.4 Trends in quantity of milk sold by KOMUL (2017-2020)

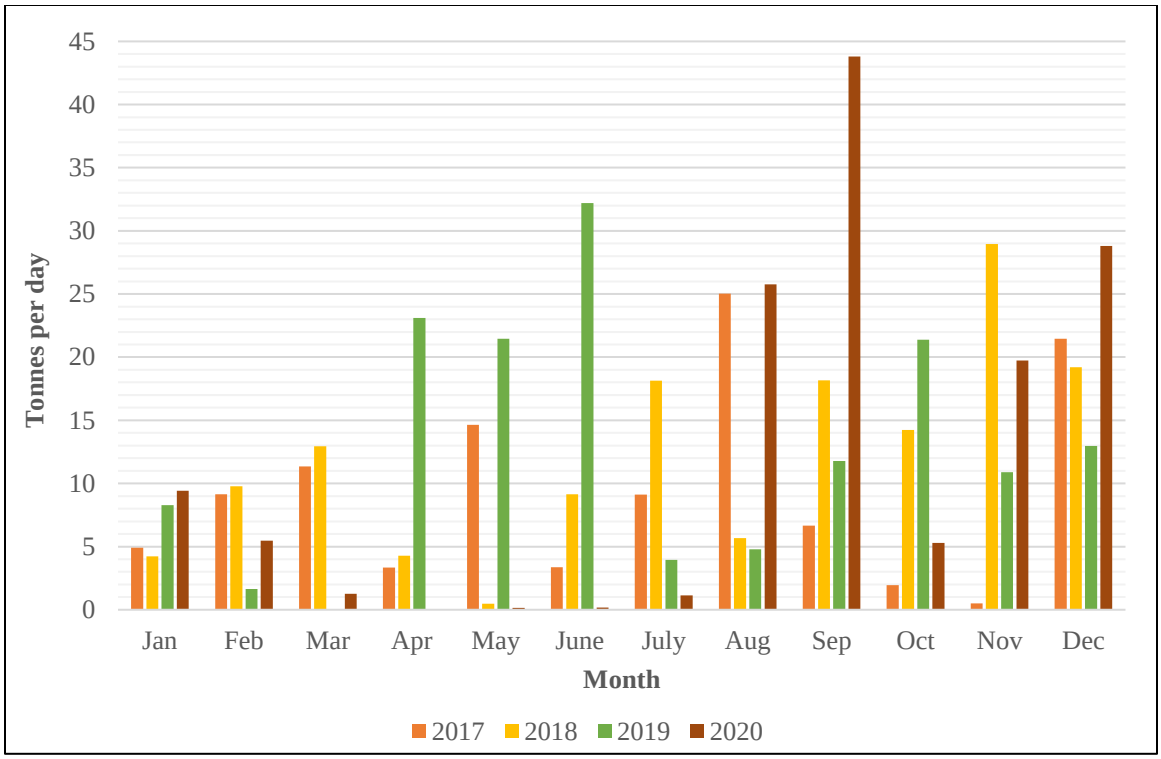

Figure 4.5 Trends in quantity of SMP produced by BAMUL (2017-2020)

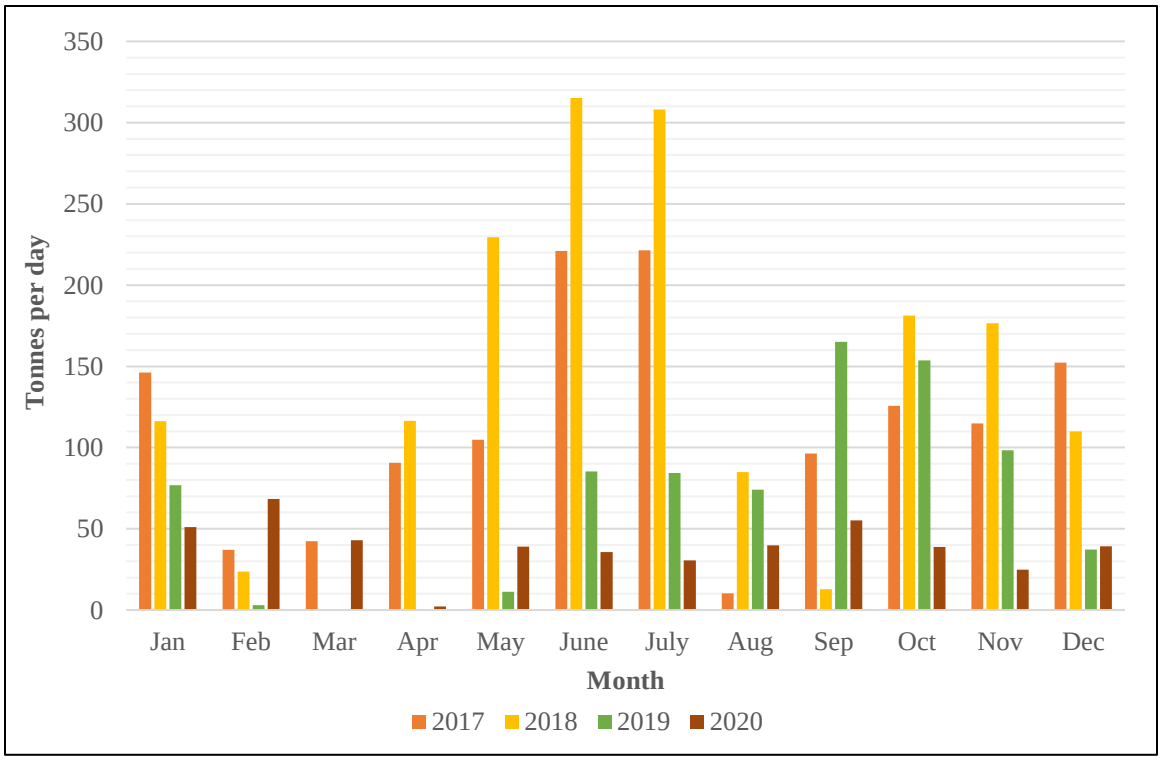

Figure 4.6 Trends in quantity of SMP produced by KOMUL (2017-2020)

4.4.4 Trends in quantity of curd sold by Milk Unions

Figure 4.7 presents the monthly trends in the quantity of curd sold by BAMUL for the period 2017 to 2020. In 2020, except the months of January and February other months showed decreased sale as compared to 2019. The decline was highest in the month of April (32.04 %) and least in March (9.91 %). Hence, the quantity of curd sold by BAMUL was affected both during lockdown and post-lockdown periods.

Figure 4.8 presents the monthly trends in the quantity of curd sold by KOMUL for the period 2017 to 2020. Unlike BAMUL, every month in 2020 showed positive trend when compared to 2019 except in the month of April which had shown a decline of 3.20 per cent, indicating reduction in the sale of curd. Hence, the sale of curd by KOMUL had impact only during April which was the initial phase of lockdown. Cornall (2020) also reported that sale of curd decreased by 2 to 3 per cent during the lockdown.

4.4.5 Trends in quantity of butter sold by BAMUL

The monthly trends in quantity of ghee sold by BAMUL for the period 2017 to 2020 is presented in Figure 4.9. During the lockdown period, the sale of butter by BAMUL was increased by 17.06 per cent in April, 2020 as compared to April, 2019 and decreased during May, 2020 by 6.30 per cent compared to May, 2019. Every month in the post-lockdown showed decline as compared to 2019 ranging from – 0.68 per cent in December to -26.83 per cent in July. Hence, sale of butter by BAMUL showed significant increase during initial stages of lockdown but it was affected during post-lockdown. Shenoy (2020) reported similar findings in his study. In KOMUL, butter is produced only when the demand is high and not produced on continuous basis.

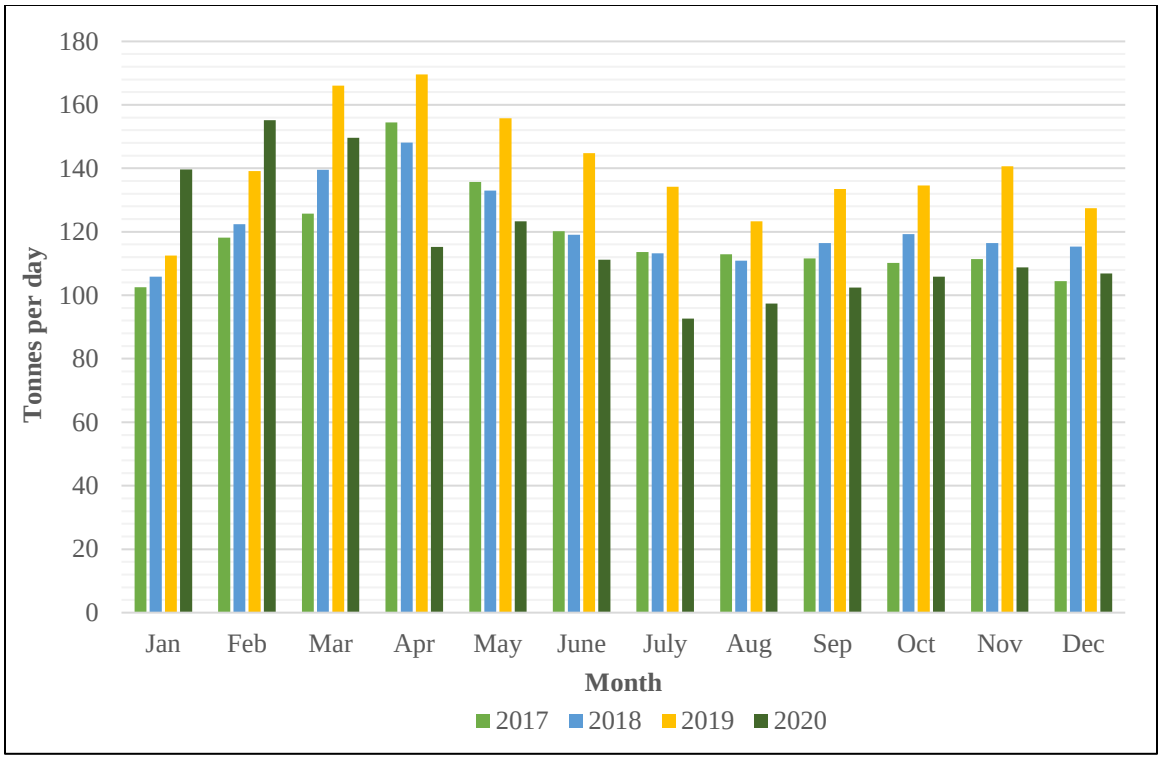

Figure 4.7 Trends in quantity of curd sold by BAMUL (2017-2020)

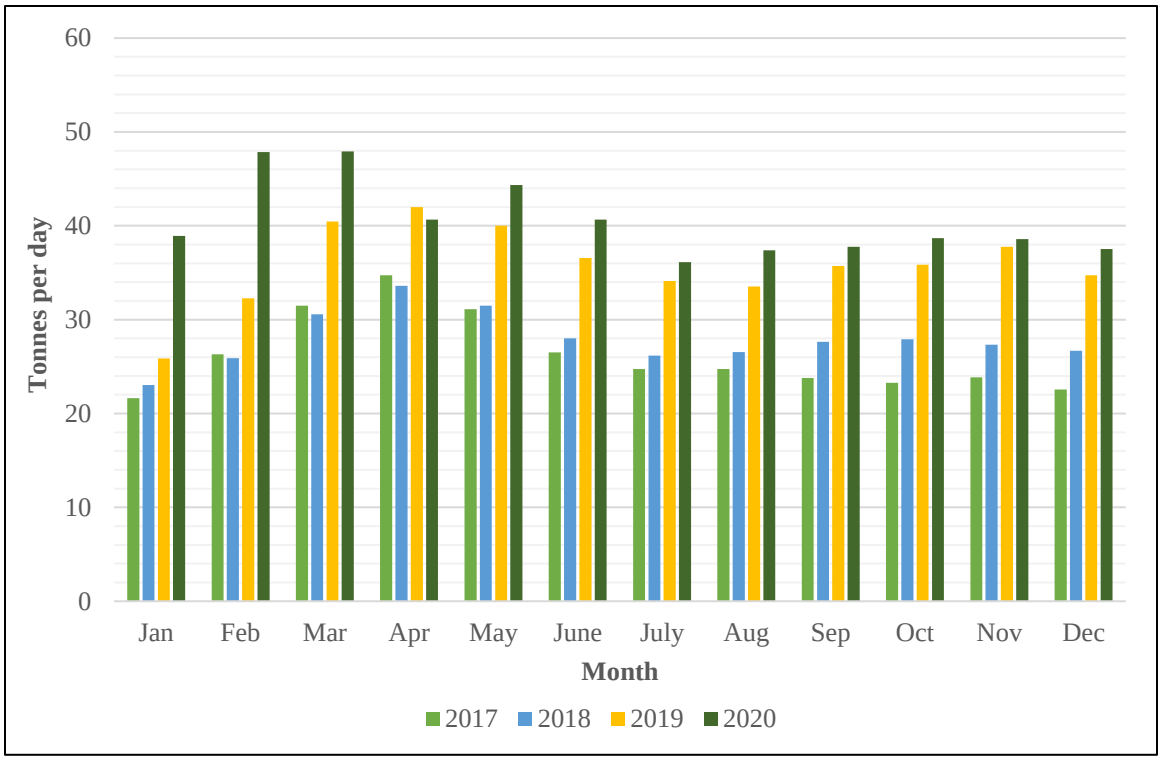

Figure 4.8 Trends in quantity of curd sold by KOMUL (2017-2020)

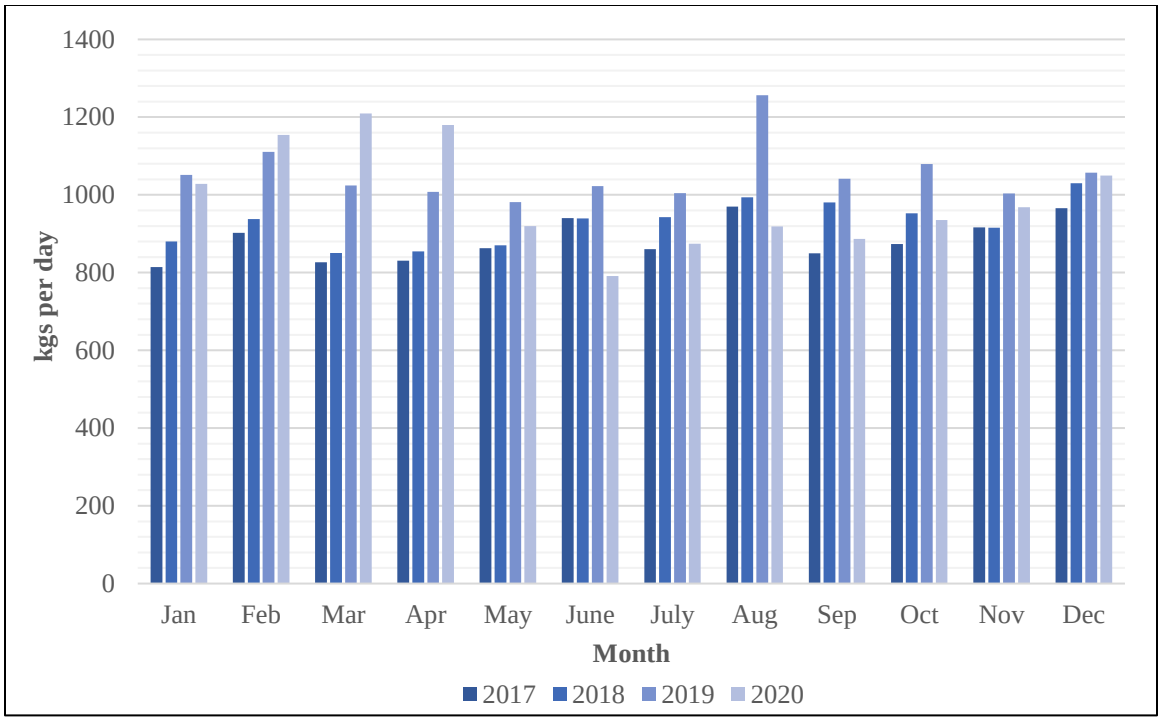

Figure 4.9 Trends in quantity of butter sold by BAMUL (2017-2020)

4.4.6 Trends in quantity of ghee sold by Milk Unions

The monthly trends in quantity of ghee sold by BAMUL is presented in Figure 4.10 for the period 2017 to 2020. During the lockdown period, the quantity of ghee sold by BAMUL was unaffected as its sale was increased during April and May, 2020 by 83 per cent and 40 per cent respectively as compared to same months in 2019. Kelar (2020) reported that as consumers were stuck in home during the lockdown period sales of ghee surged in AMUL. During the post-lockdown period from June, every month except July showed a decreasing trend. Hence the sale of ghee by BAMUL was affected during post-lockdown than lockdown periods.

Figure 4.11 presents the monthly trends in the quantity of ghee sold by KOMUL for the period 2017 to 2020. The sale of ghee by KOMUL during pre-lockdown period showed positive trend. During lockdown, though the sale of butter was increased in April, 2020 it was least by 1.5 per cent and the month of May showed highest decline by 43.51 per cent. During the post-lockdown period, every month showed declining trend except December, 2020.

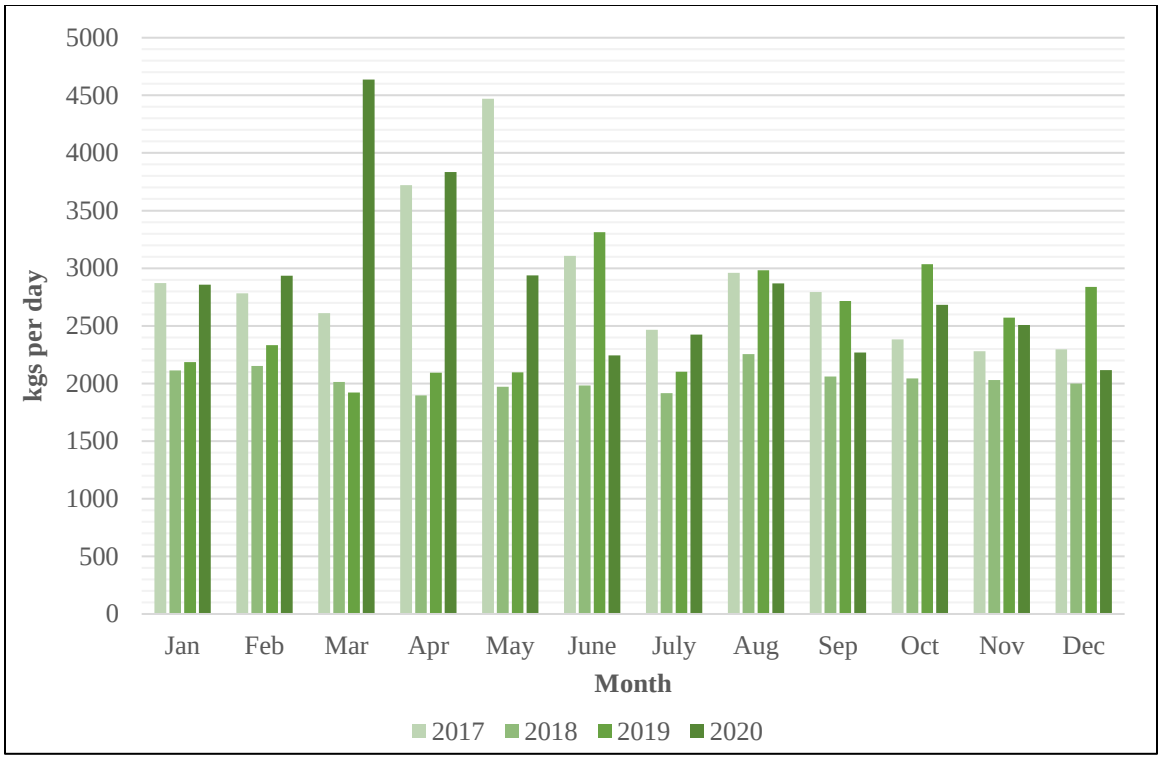

Figure 4.10 Trends in quantity of ghee sold by BAMUL (2017-2020)

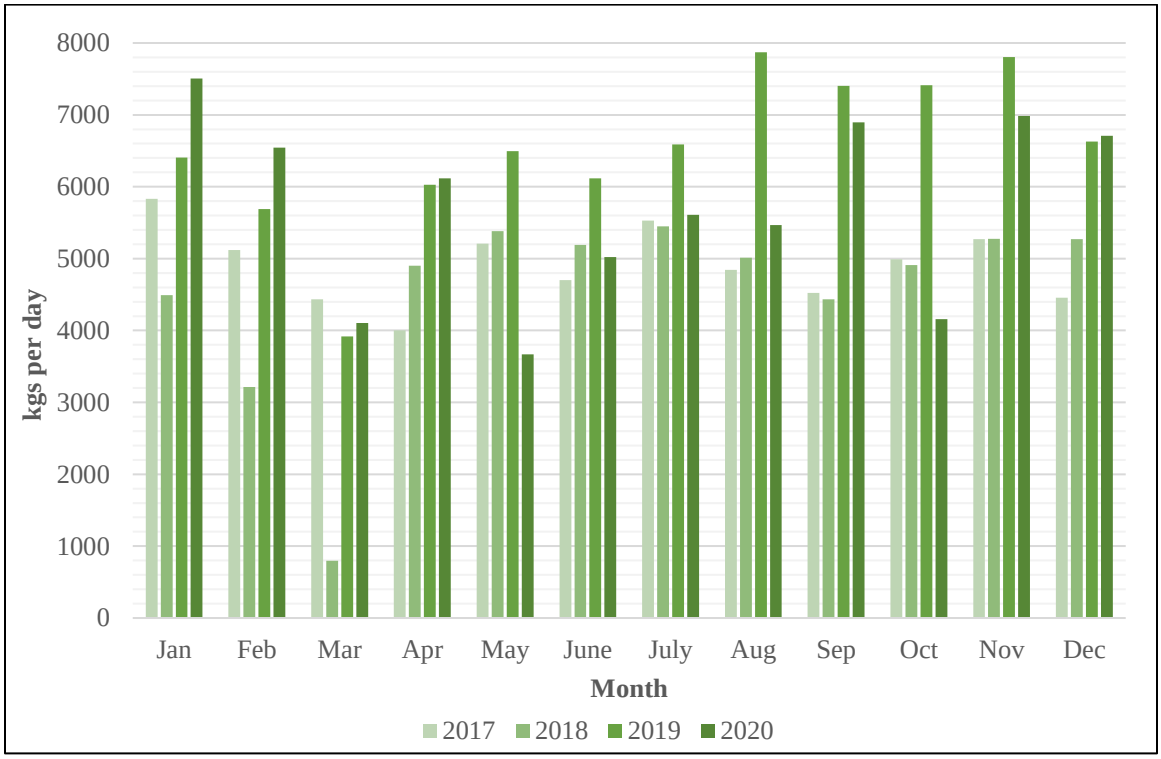

Figure 4.11 Trends in quantity of ghee sold by KOMUL (2017-2020)

4.4.7 Trends in quantity of paneer sold by BAMUL

Paneer is one of the major dairy products consumed by the urban population. The paneer was produced only by BAMUL. During pre-lockdown period, increase in sale of paneer was observed (Figure 4.12) while the sale of panner showed declining trend during lockdown and post-lockdown periods as compared to same periods during previous years. Highest decline in sale of paneer was obtained in the month of October, while March showed highest increase.

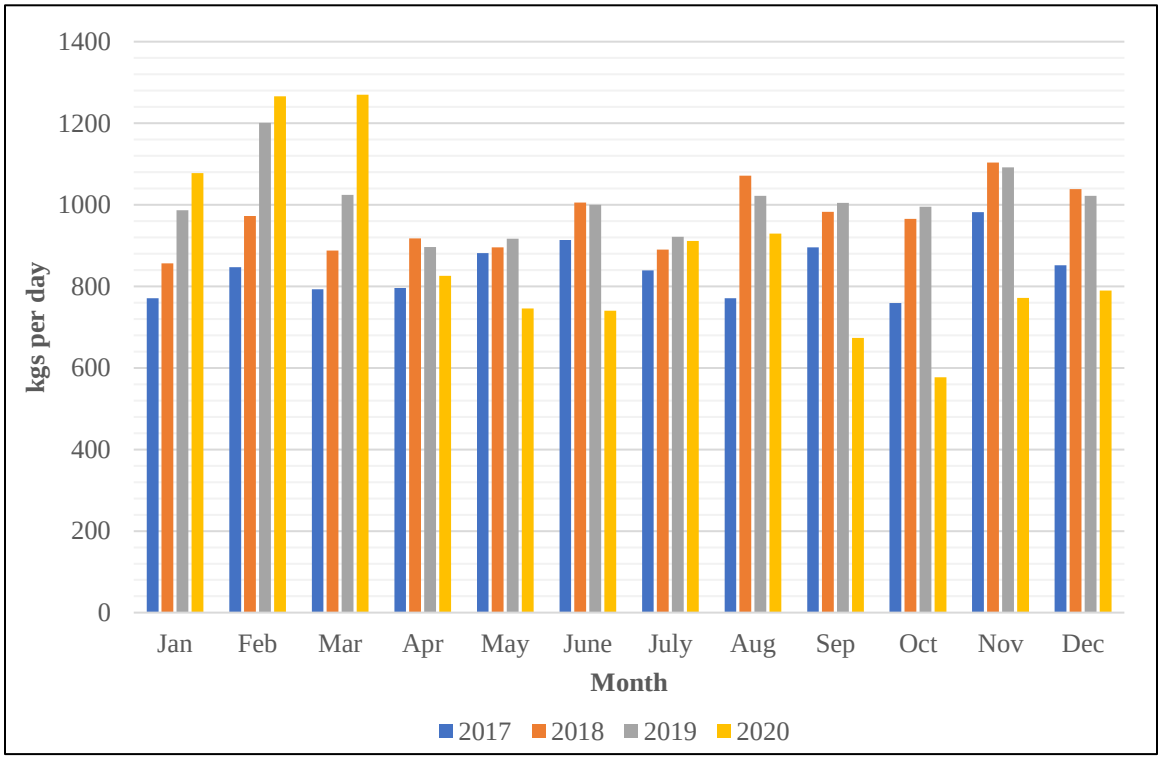

Figure 4.12 Trends in quantity of paneer sold by BAMUL (2017-2020)

4.4.8 Trends in quantity of Mysore Pak sold by Milk Unions

Mysore Pak of Nandini is known for its taste and quality. Hence it is having high demand among the other sweets produced by KMF. The monthly trends in the sale of Mysore Pak by BAMUL for the period 2017 to 2020 is depicted in Figure 4.13. The sale of Mysore Pak showed declining trend during March and April due to the lockdown restrictions when compared to same months of previous years. However, May month

during the lockdown showed a positive trend. Later, during post-lockdown period, except November and December other months showed negative trend. Usually, the sale of Mysore Pak increases during the month of October due to high demand caused by continuous festivals. In 2020, due to the ongoing pandemic the demand in the month was almost reduced by 34 per cent compared to previous year. Figure 4.14 presents the monthly trends in the sale of Mysore Pak by KOMUL for the period 2017 to 2020. Unlike BAMUL, sale of Mysore Pak by KOMUL showed an increasing trend during lockdown and post-lockdown periods when compared to same months of previous years.

4.4.9 Trends in quantity of Type-1 feed sold by Milk Unions

Figure 4.15 and figure 4.16 presents the monthly trends in the quantity of type-1 feed sold by BAMUL and KOMUL for the period 2017 to 2020 respectively. Since, there was a disruption in the supply chain of feed during the lockdown period due to transportation restrictions, the sale of type-1 feed was reduced in the month of March and April. This can be observed from those particular months of previous years. The sale of type-1 feed by BAMUL in April 2020 was increased only 3.65 per cent. Similarly, the sale type-1 feed by KOMUL in March 2020 was decreased by 31.54 per cent. This was due to transportation restrictions in the beginning of phase-1 of lockdown from March 24th. This was followed by increase in the demand for type-1 feed in the successive months, which was fulfilled by increase in the sale of type-1 feed by both the unions. The sale feed by BAMUL in the months of May and June, 2020 was increased by 28 per cent and 34 per cent respectively as compared to same months in 2019. Similarly, the sale of feed by KOMUL in the months of April and May, 2020 was increased 29 and 28 per cent respectively as compared to same months in 2019. In other months of post-lockdown stage similar trends were observed as that of previous years indicating no impact in its sale.

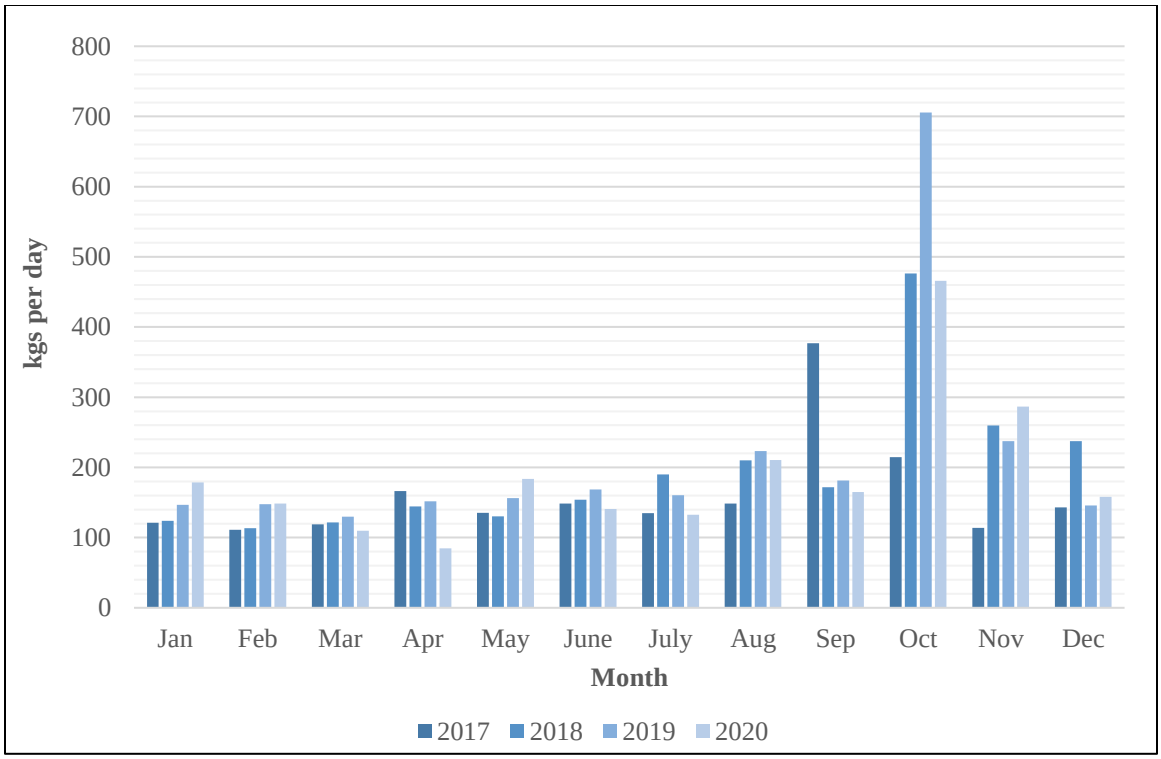

Figure 4.13 Trends in quantity of Mysore Pak sold by BAMUL (2017-2020)

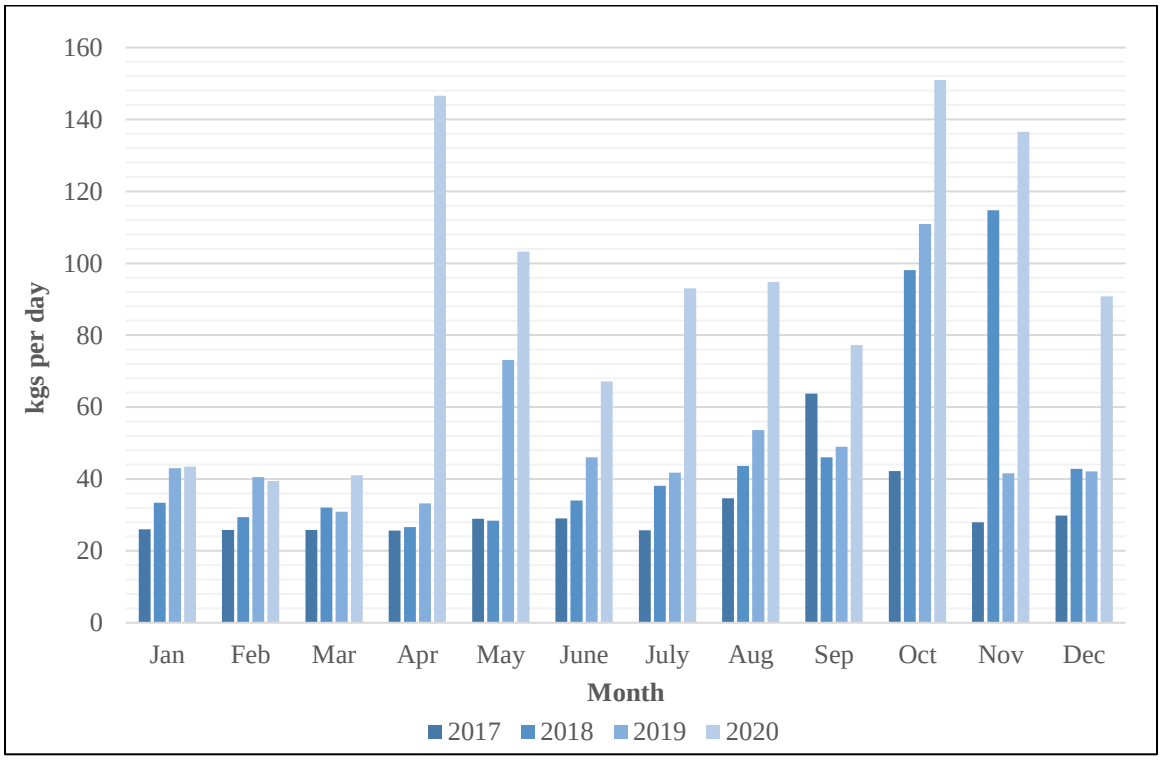

Figure 4.14 Trends in quantity of Mysore Pak sold by KOMUL (2017-2020)

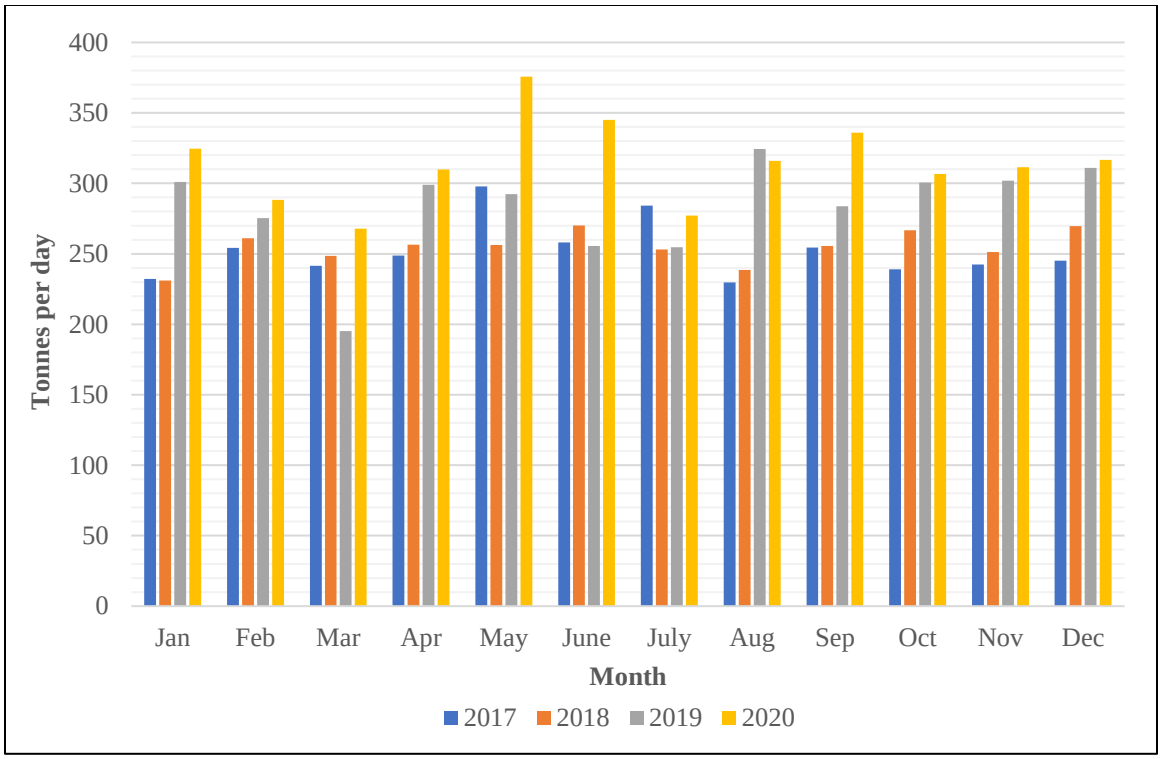

Figure 4.15 Trends in quantity of Type-1 feed sold by BAMUL (2017-2020)

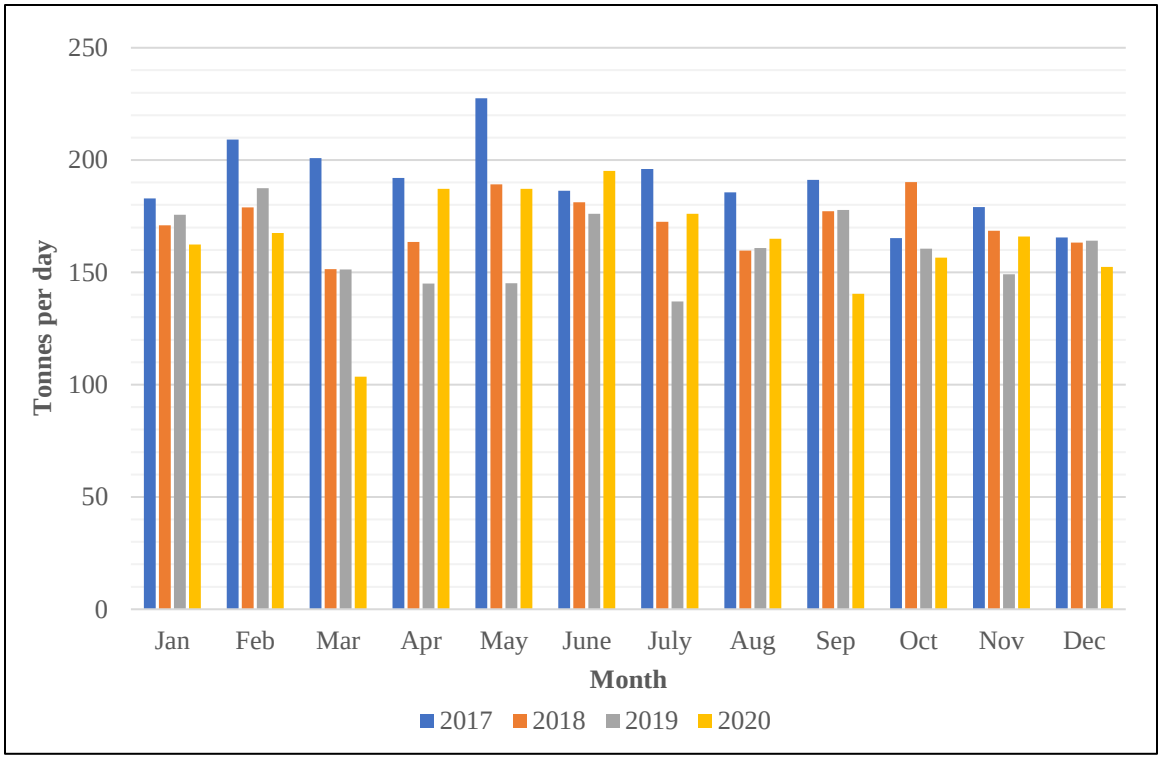

Figure 4.16 Trends in quantity of Type-1 feed sold by KOMUL (2017-2020)

4.4.10 Trends in quantity of Bypass feed sold by BAMUL

Another important feed sold by BAMUL is bypass feed. The trends in the sale of bypass feed by BAMUL is presented in Figure 4.17. The sale of bypass feed was drastically reduced during the month of April due to lockdown restrictions. Similar trend was also observed with respect to type-1 feed by BAMUL. With the sale of only 1.4 tons per day in April, the percent decrease was 92.54 per cent which is the least in 2020. Even during the post-lockdown period except the months of October and November, other months recorded negative trend. Hence, the sale of bypass feed by BAMUL was severely affected in the month of April like that of type-1 feed. But unlike type-1 feed, sale of bypass feed was affected even during the post-lockdown stage.

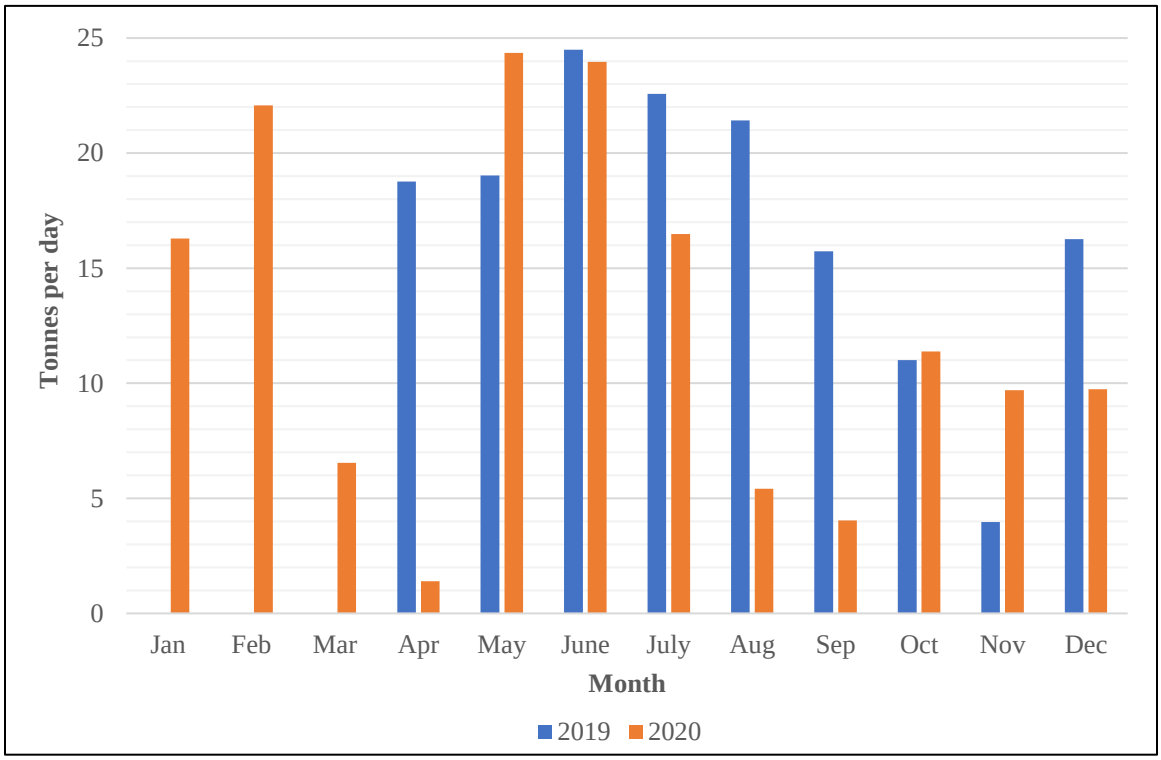

Figure 4.17 Trends in quantity of Bypass feed sold by BAMUL (2019-2020)

4.4.11 Trends in the milk procurement price of BAMUL

The milk procurement price is the price per liter of milk at which Milk Unions purchase milk from dairy farmers. In Karnataka, milk procurement prices are fixed by respective Milk Unions. Hence, at a particular time one can observe variations in the milk procurement price from one Milk Union to another. From Figure 4.18 we can observe that the milk procurement price of BAMUL at current price in 2020 was more as compared to previous years till July. However, during the lockdown period milk procurement price was reduced from ₹ 29 to ₹ 27.5 per liter in April and to ₹ 26.5 per liter in June. During the post-lockdown period i.e., from August milk procurement price was further reduced to ₹ 23 per liter which is the least in the past 4 years. In the same year 2020, milk procurement price was almost reduced by ₹ 6 per liter about 20.68 per cent. Hence, the dairy farmers in Bengaluru rural district were severely affected with the reduction in milk procurement price during post-lockdown than in the lockdown. The same trend was observed in the milk procurement price of BAMUL at constant (real) price (Figure 4.19).

4.4.12 Trends in the milk procurement price of KOMUL

The trends in milk procurement prices of KOMUL at current prices is depicted in Figure 4.20. During the lockdown period, the milk procurement price at current prices was not affected. But during the post-lockdown, milk procurement price was reduced twice. In July, it was reduced by ₹ 1 per liter from ₹ 28 per liter to ₹ 27 per liter and again in September it was reduced to ₹ 26.15 per liter. In the same year 2020, milk procurement price was almost reduced by ₹ 1.85 per liter. Hence, the dairy farmers in the Chikkaballapura district were affected with the reduction in the milk procurement price during post-lockdown and were unaffected during lockdown. With respect to milk procurement price of KOMUL at constant/ real price, similar trends were observed (Figure 4.21).

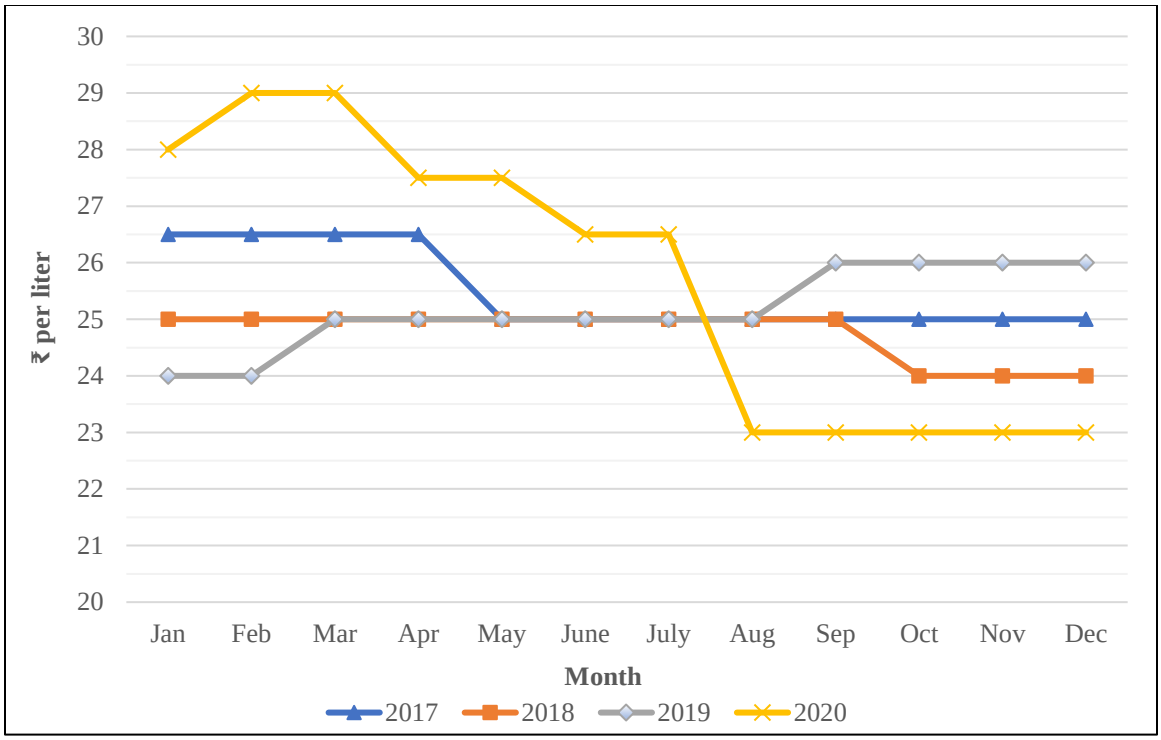

Figure 4.18 Trends in the milk procurement prices of BAMUL at current prices (2017-2020)

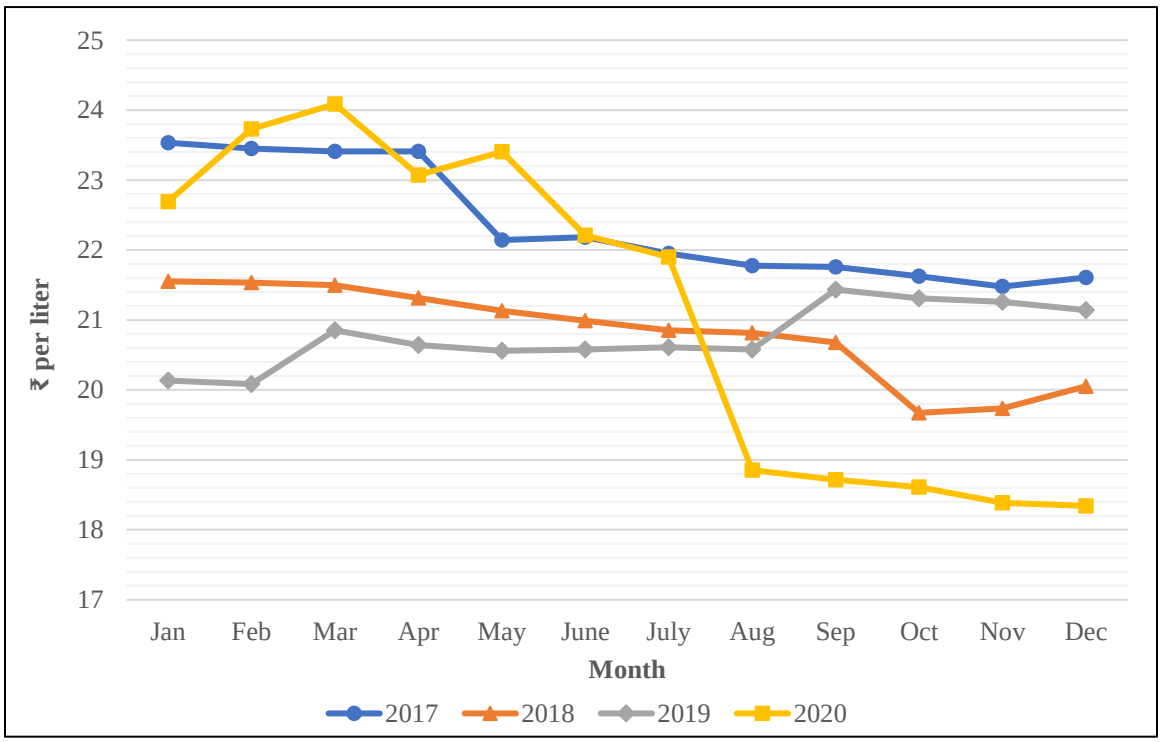

Figure 4.19 Trends in the milk procurement price of BAMUL at real prices (2017-2020)

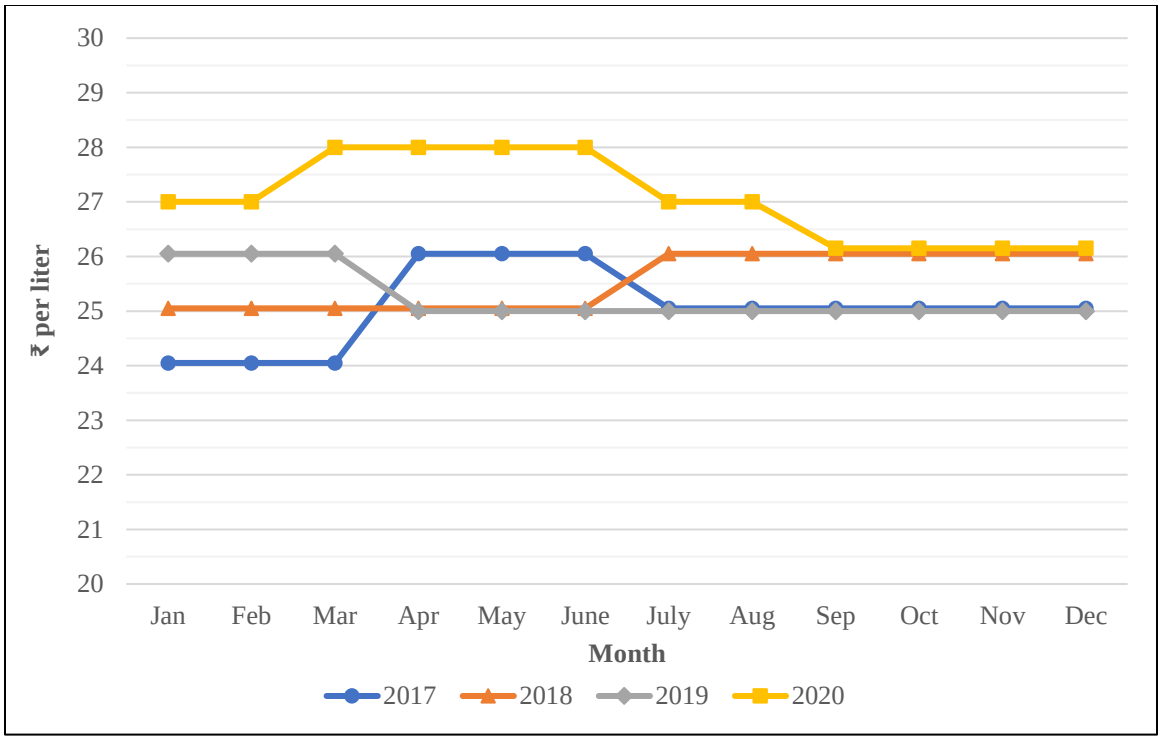

Figure 4.20 Trends in the milk procurement price of KOMUL at current prices (2017-2020)

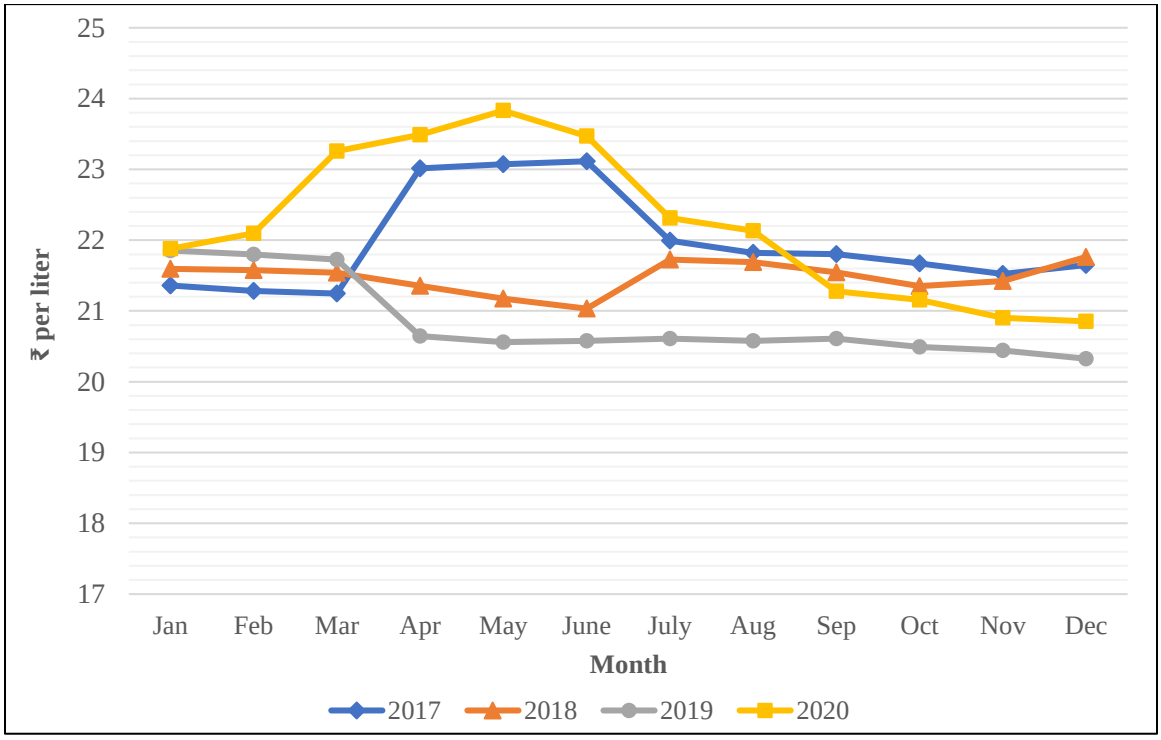

Figure 4.21 Trends in the milk procurement price of KOMUL at real prices (2017-2020)

Table 4.4.1 Forecasted nominal milk procurement price (₹/liter) using Vector Autoregressive (VAR) model

Year	₹/liter
2019-20	28.81
2020-21	30.73
2021-22	32.30
2022-23	33.77

Source: Gayathri. (2019). Forecasting of milk prices in Karnataka and Telangana states using multivariate time series models. *M. Sc. Thesis* submitted to National Dairy Research Institute (Deemed University), Bengaluru.

Gayathri (2019) had forecasted the milk procurement prices in Karnataka using Vector Autoregressive (VAR) model. In this study, VAR model with lag period as one was applied to forecast the procurement price of milk using predictors of the past year's feed prices (Nandini Gold and Bypass feed), agricultural labour wages and its own prices (independent variables). The forecasted milk procurement price in Karnataka for the financial year 2020-21 is ₹ 30.73 per litre. But, the present procurement price for the financial year 2020-21 is ₹ 25.53 in BAMUL and ₹ 27.05 in KOMUL. Even with the increase in feed prices, milk procurement prices have gone down. There is a difference of ₹ 5.2 per litre of milk in BAMUL, which accounts to loss of 16.92 per cent to the farmers only due to the reduction in milk procurement price. Similarly, in KOMUL, the milk procurement price is ₹ 3.68 less than the forecasted milk procurement price per litre, which accounts to loss of 11.98 per cent to the farmers. Milk which is a staple diet in India and also a cheapest source of protein is paid less. But at the same time, the value-added products produced from milk are sold at expensive prices. Ultimately, the dairy farmers who are backbone to the dairy industry are incurring continuous loss and their condition further worsened during the pandemic. Hence, there is a need for revision of current milk procurement prices in Karnataka based on the recent trends in feed costs.

4.4.13 Trends in the Type-1 feed price of BAMUL

The trends in the type-1 feed prices of BAMUL at current prices has been presented in Figure 4.22. The type-1 feed price remained unchanged during the lockdown period. During post-lockdown period, increase in the type-1 feed price was observed twice. In June, type-1 feed price was increased by ₹ 500 from ₹ 19,200 per ton to ₹ 19,700 per ton and again in August, it was increased by ₹ 1,100 to ₹ 20,800 per ton. Hence, an increase of 8.33 per cent was observed in the prices of type-1 feed due to the pandemic. Later price was reduced by ₹ 500 per ton in November.

4.4.14 Trends in the Type-1 feed price of KOMUL

Figure 4.24 depicts the trends in the Type-1 feed price at current prices. No change was observed in the current prices of type-1 feed during lockdown. However, during post-lockdown period in June, type-1 feed price was increased by ₹ 500 per ton from ₹ 19,450 per ton to ₹ 19,950 per ton. Again, in November its price was increased to ₹ 21,538 per ton and brought back to original price of ₹ 19,450 per ton in December. Hence, the prices of type-1 feed were increased during post-lockdown but later it was brought to original price that existed during pre-lockdown period.

4.4.15 Severity of major constraints faced by Milk Unions

From Table 4.4.1 it can be interpreted that both the milk unions faced less severe constraints with regard to transportation of milk form milk unions to milk parlors, financial transactions with bank and other financial institutes. It also faced less severe constraints due to reduction in demand for milk and curd as well as managing the surplus milk produced. In addition to that, BAMUL faced less severe constraints due to reduction in demand for paneer and ice-creams. Shortage of labour in processing units was another constraint for KOMUL. Meanwhile, both milk Unions faced no problems with regard to cold storage, labour shortage in collection units and reduction in milk quality. Even the demand for butter ghee and sweets continued to be as before lockdown.

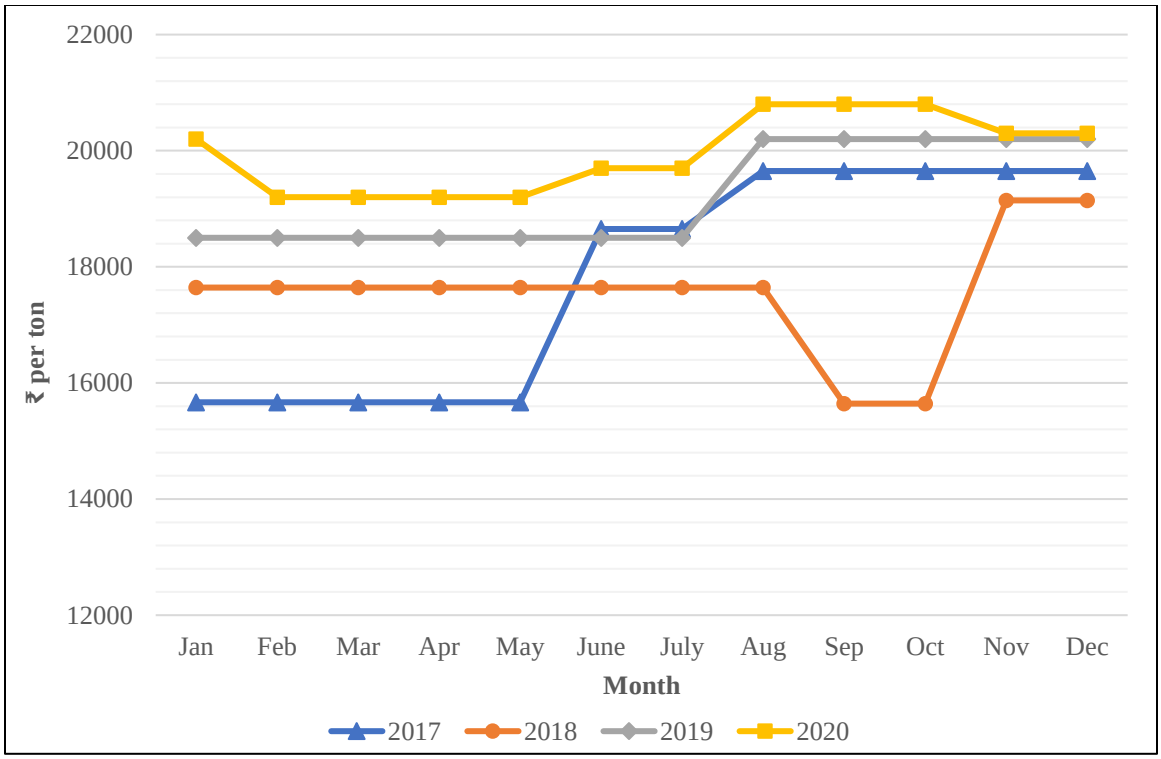

Figure 4.22 Trends in type-1 feed prices of BAMUL at current prices (2017-2020)

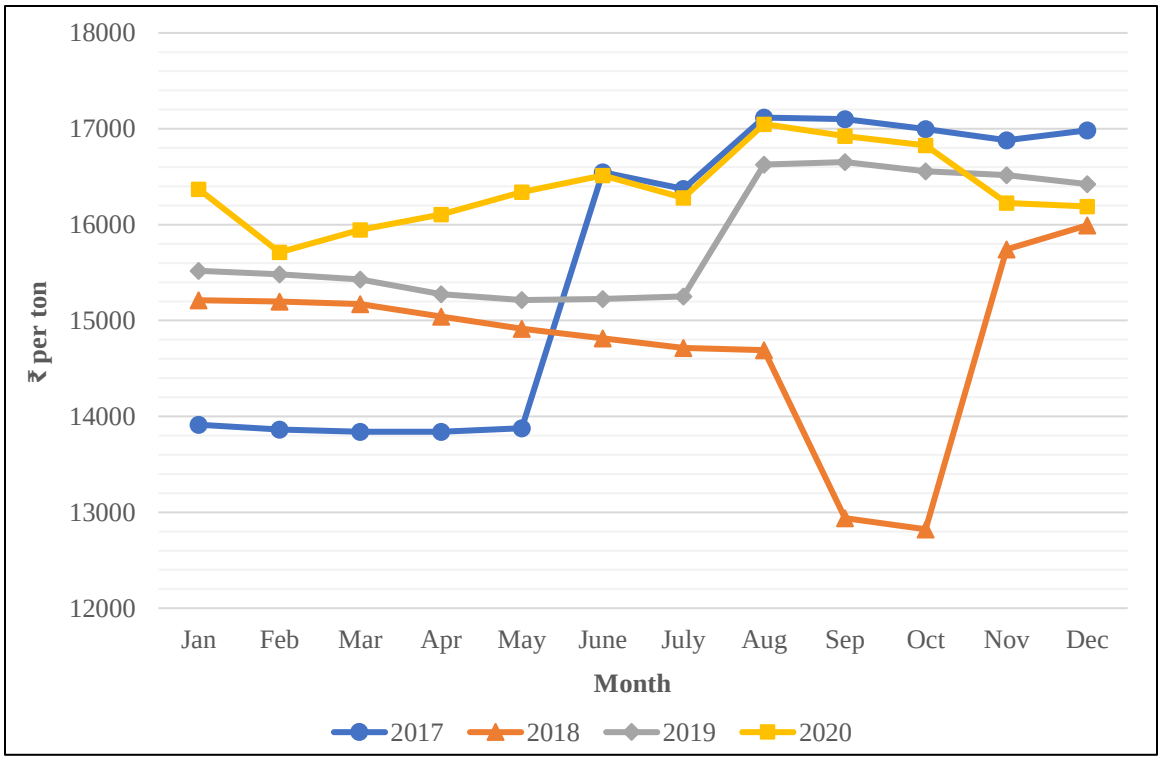

Figure 4.23 Trends in type-1 feed prices of BAMUL at real prices (2017-2020)

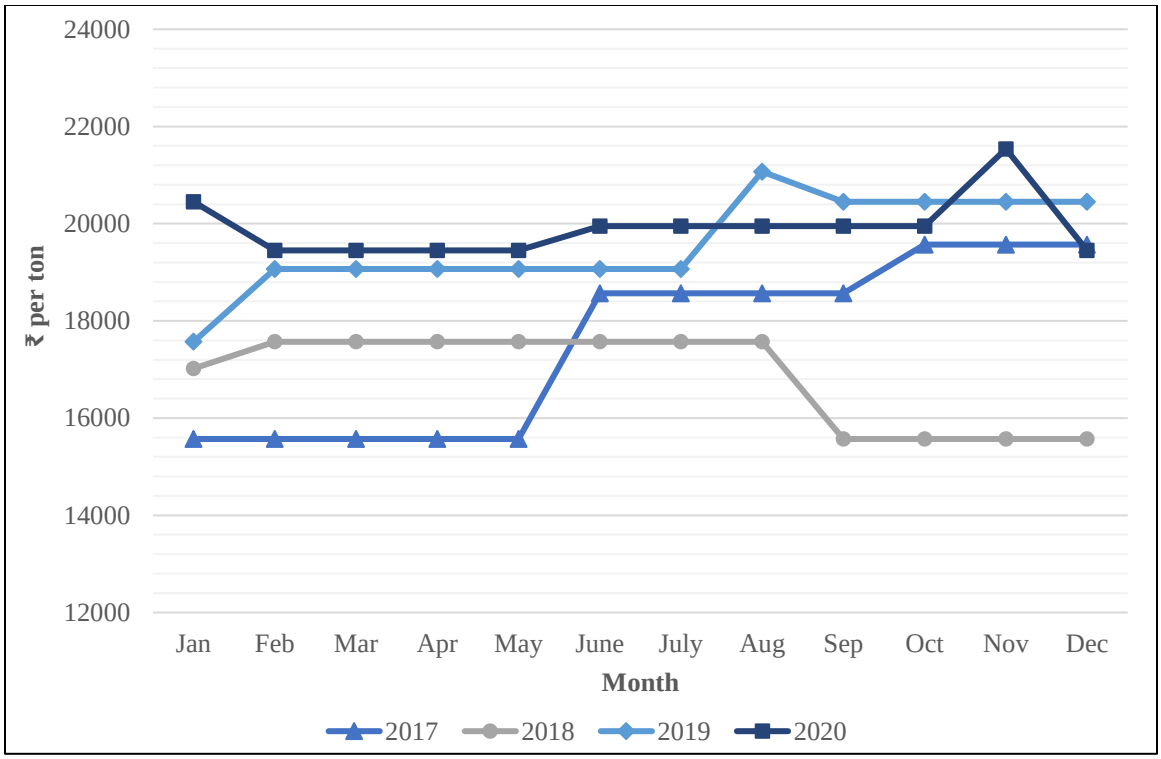

Figure 4.24 Trends in type-1 feed price of KOMUL at current prices (2017-2020)

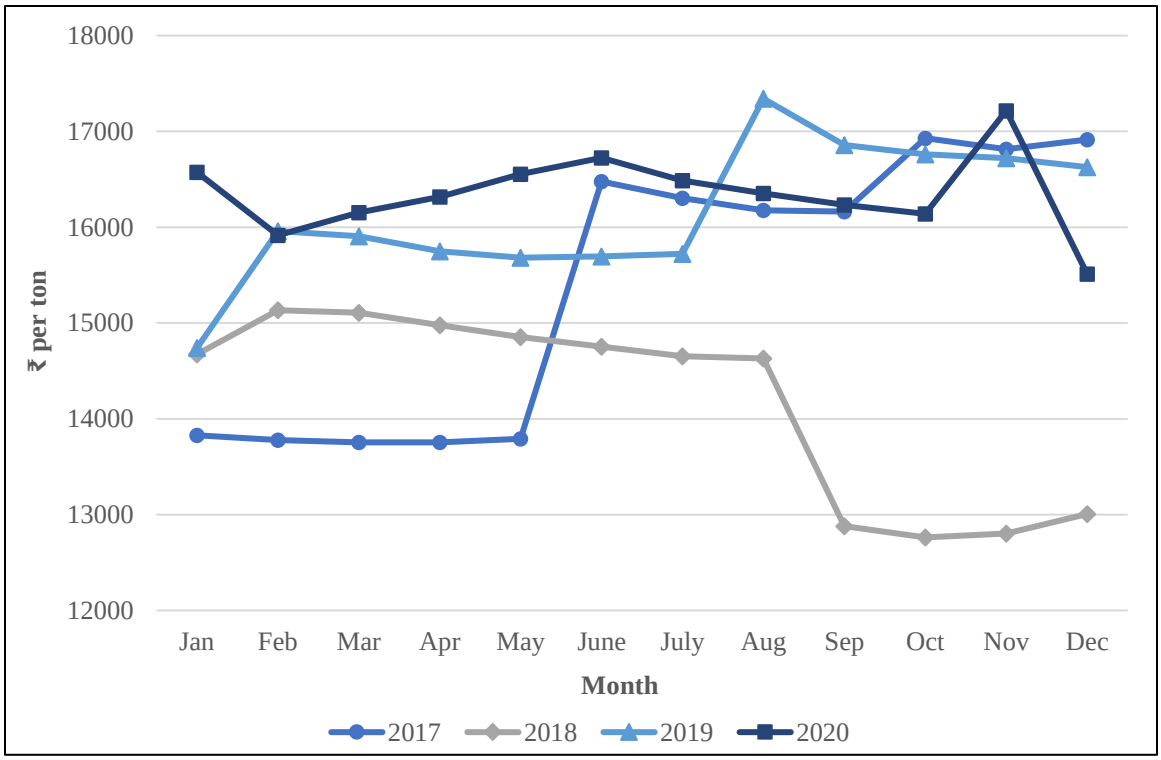

Figure 4.25 Trends in type-1 feed price of KOMUL at real prices (2017-2020)

Table 4.4.2 Severity of major constraints faced by Milk Unions

Sl. No.	Major constraints	BAMUL		KOMUL	
		Pre-lockdown vs Lockdown	Lockdown vs Post-Lockdown	Pre-lockdown vs Lockdown	Lockdown vs Post-Lockdown
1.	Transportation				
	a) From chilling centers to milk unions	0	0	0	0
	b) From milk unions to milk parlors	1	0	1	0
2.	Cold Storage	0	0	0	0
3.	Labour shortage in				
	a) Processing units	0	0	1	0
	b) Collection units	0	0	0	0
4.	Reduction in milk quality	0	0	0	0
5.	Financial transactions with bank and other institutes	1	0	1	0
6.	Reduced demand for dairy and value-added dairy products				
	a) Milk	1	0	1	0
	b) Curd	1	0	1	0
	c) Butter	0	0	0	0
	d) Ghee	0	0	0	0
	e) Paneer	1	0	0	0
	f) Sweets	0	0	0	0
	g) Ice-creams	1	0	0	0
7.	Managing the surplus milk procured	1	0	1	0

(0-as before, 1- less severe, 2 severe)

CHAPTER – 5

SUMMARY AND CONCLUSIONS

6. SUMMARY AND CONCLUSIONS

The livestock sector is an important sub-sector of agriculture in the Indian economy which contributes 28.63 per cent to GVA of total agriculture and allied sector. The novel coronavirus which was first identified in Wuhan city of People's Republic of China on November 17, 2019, turned out to be a pandemic. The COVID-19 pandemic became the greatest global humanitarian challenge the world has faced since World War II. As a preventive measure against the pandemic, the Government of India on 24 March 2020 announced a nationwide lockdown which continued till 31 May 2020. This not only limited the movement of people across the country but also led to the implementation of policies like quarantines, lockdowns, social distancing, travel restrictions, etc. These policies had a hit on every sector of the Indian economy including the dairy sector. Among the stakeholders in the dairy sector, dairy farmers and dairy cooperatives are the most affected during the pandemic. Hence, the present study is an attempt to analyse such effects on the dairy sector by considering the two of the major stakeholders viz, dairy farmers and dairy cooperatives. Against this backdrop, the present study was undertaken with the following objectives.

1. To assess the economic impact of COVID-19 pandemic on dairy farmers in Bengaluru rural and Chikkaballapura districts of Karnataka
2. To assess the economic impact of COVID-19 pandemic at select Dairy Cooperative Societies

The study was conducted in Bengaluru rural and Chikkaballapura districts of Karnataka, comprising 200 dairy farmers, 24 DCS and 2 Milk Unions. The primary data for the study was collected from dairy farmers and DCS through personal and telephone interviews using a standard interview schedule, covering the period of pre-lockdown, lockdown and post-lockdown. The secondary data for the study were collected from two milk unions BAMUL and KOMUL for the period 2017 to 2020 by visiting these respective offices. To meet the first objective, statistical tools like quantity gap analysis, price gap analysis and Wilcoxon signed rank test were used. Concerning the second objective, trend analysis was employed.

Salient findings

The economic impact of COVID-19 pandemic on dairy farmers

- There was no significant change in milk yield found in both the districts for indigenous cows and buffalo during the lockdown and post-lockdown periods when compared to pre-lockdown period. However, the milk yield of crossbred cattle was reduced by 2.26 per cent in Bengaluru rural district ($P < 0.01$) and by 4.01 per cent in Chikkaballapura district ($P < 0.001$) during lockdown as compared to pre-lockdown period. During post-lockdown period, the milk yield of crossbred was reduced by 2.35 per cent in Bengaluru rural district ($P < 0.01$) and by 0.94 per cent in Chikkaballapura district as compared to pre-lockdown period.

- No significant effect of lockdown and post-lockdown was observed in total milk production of buffaloes and indigenous cattle in both the districts. However, there was a dip in the total milk production of crossbred cattle in both the districts during lockdown period. The total milk production was reduced by 2.52 per cent in Bengaluru rural district ($P < 0.01$) and 4.03 per cent in Chikkaballapura districts ($P < 0.001$) during lockdown.

- During lockdown period, the quantity of milk sold by farmers to DCS in Bengaluru rural district was reduced by 2.68 per cent and by 4.42 per cent in Chikkaballapura district.

- The quantity of milk consumed by the households of dairy farmers was increased by 2.10 per cent in Bengaluru rural district and 10.28 per cent in Chikkaballapura district during the lockdown period. Further during post-lockdown period, the quantity of milk consumed remained same in Bengaluru rural district while it was increased by 0.93 per cent in Chikkaballapura district as compared to post-lockdown period.

- The procurement price of milk in Bengaluru rural district was reduced by 8.62 per cent from ₹ 29 per liter in pre-lockdown to ₹ 26.5 per liter in lockdown. Further, it was reduced to ₹ 23 per liter during post-lockdown period which is about 20 per

cent less as compared to pre-lockdown period. When compared to pre-lockdown period, there was no reduction in procurement price of milk in Chikkaballapura district and remained same as Rs 28 even during lockdown. But during the post-lockdown period, the procurement price of milk was reduced by 6.61 per cent from Rs 28 to Rs 26.15.

- When compared to pre-lockdown period, the cost of concentrate feed was increased by about 37 per cent and 21 per cent in both the districts during lockdown and post-lockdown period respectively.

- Dairy farmers in Bengaluru rural and Chikkaballapura districts witnessed economic loss during lockdown and post-lockdown due to an increase in cost of concentrates, reduction in milk yield and reduction in procurement prices of milk.

- About 81 per cent and 87 per cent of farmers from the Bengaluru rural and Chikkaballapura districts respectively witnessed loss in their income from dairying during lockdown or post-lockdown.

- In Bengaluru rural district, net return per liter of milk for high productivity crossbreds was reduced by 33.05 per cent during lockdown and by 48.64 per cent during post-down as compared to pre-lockdown period. Dairy farmers rearing moderate productivity crossbreds witnessed net return loss of 93.68 per cent per liter of milk during post-lockdown as compared to pre-lockdown period.

- In Chikkaballapura district, net return per liter of milk of high productivity crossbreds was reduced by 20.89 per cent during lockdown period and by 22.77 per cent during post-lockdown as compared to pre-lockdown period. Dairy farmers rearing cross-bred with moderate productivity witnessed loss of 42.71 per cent per liter of milk during post-lockdown as compared to pre-lockdown period.

- Dairy farmers of Bengaluru rural and Chikkaballapura districts faced constraints in procuring concentrate feeds, accessibility for treatment of cattle, reduction in milk procurement price and increase in cost of concentrate feeds.

The economic impact of COVID-19 pandemic on DCS and Milk Unions

- DCS in Bengaluru rural and Chikkaballapura districts faced constraints with regard to supply of feed from Milk Unions and arranging veterinary services to the members. DCS did not face any problems with respect to transportation of milk, financial transactions and milk quality.

- In BAMUL and KOMUL, there was no reduction in milk procurement quantity during lockdown and post-lockdown periods. While the quantity of milk sold by both the milk unions BAMUL and KOMUL increased during the month of April i.e., during lockdown as Government of Karnataka purchased milk from milk unions for distributing it to the poor. During rest of the months of lockdown i.e., May and during the post lockdown same trends were observed as that of previous years.

- During lockdown, there was no production of SMP by BAMUL while it was drastically decreased in KOMUL. During the post lockdown period production of SMP by both milk unions was decreasing.

- The sale of curd by BAMUL was affected both during lockdown and post-lockdown periods. While the sale of curd by KOMUL had an impact only during April which was the initial phase of lockdown and the same trend continued during post-lockdown period.

- The sale of butter by BAMUL increased during initial stages of lockdown but it was affected during post-lockdown period. Though the quantity of ghee sold by BAMUL and KOMUL increased during lockdown period, it decreased during post-lockdown period.

- The quantity Mysore Pak sold by BAMUL was affected both during lockdown and post-lockdown period while the sale of Mysore Pak by KOMUL remained unaffected by the pandemic. The sale of paneer by BAMUL also showed a

declining trend both during lockdown and post-lockdown periods when compared to the same period of previous years.

- The sale of type-1 feed and bypass feed by BAMUL and KOMUL were affected only during the initial stages of lockdown which later became normal as before.

- The prices of type-1 feed remained the same during lockdown. Later, during the post-lockdown period both the Milk Unions increased the feed price twice. The price of type-1 feed was increased by Rs 1.6 per kg by BAMUL and Rs 2.0 per kg by KOMUL respectively.

Conclusions and Policy implications

The findings of the study would be of practical significance for researchers, policy makers, administrators, dairy farmers and milk unions so as to make rational decisions for the benefit of dairy farmers and consumers.

- The procurement price of milk was reduced due to the pandemic which led to income loss to the dairy farmers by around 50 per cent. Hence, the government should not decrease the procurement price of milk to the dairy farmers, instead it should increase the milk procurement price especially during this pandemic.

- There was an increase in prices of the concentrate feeds due to the disruption in supply chain during lockdown. This increased prices also continued during post-lockdown period. This had a direct effect on net return of dairy farmers. Hence, government should ensure smooth supply of concentrate feeds during lockdown without reducing their prices.

- Government should continue extending the subsidy amount given on feeds supplied by DCS. Its withdrawal will be having effect on net returns of fairy farmers thereby their welfare.

- Inaccessibility for treatment of cattle was one of the major constraints for dairy farmers during the lockdown. Necessary arrangements should be made for regular visits of veterinary doctor during the lockdown.

- During lockdown periods, demand for milk, curd, paneer, sweets and ice-creams were decreased. Due to this milk unions faced loss. In general, there is a need to increase the demand for milk and milk products by engaging modern technologies. Hence, milk unions should establish collaboration with online consumer businesses e.g., Zomato, Swiggy, Dunzo etc. and supply milk and milk products at doorsteps of consumers in order to ensure continuous demand.

- The present situation warrants revision of current milk procurement prices in Karnataka based on the recent trends in an increased cost of feed inputs and labour wages.

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APPENDICES

APPENDIX-I: Methodology followed by Gururaj (2020) for estimating cost and returns of milk production

The cost and returns of milk production were estimated through tabular analysis. The total costs involved in the dairying were composed of variable costs and fixed costs.

Variable costs: Variable costs are those costs which do not vary with the level of output and can be altered in the short run. Variable costs include feed costs due to green fodder, dry fodder and concentrate feeds, labour costs and veterinary & miscellaneous expenditure.

Fixed costs: These costs do not vary with the level of output and remain unchanged in the short run. These costs include costs due to depreciation and interest on fixed capital.

Returns: Milk yield and milk price are the two components of returns.

Cost concepts

Gross cost: The cost obtained by adding fixed costs and variable cost components.

$$\text{Gross cost} = \text{Total variable cost} + \text{Total fixed cost}$$

Net cost: It is the cost obtained after deducting the imputed income earned by the dung from the gross cost.

$$\text{Net cost} = \text{Gross cost} - \text{Value of dung}$$

Gross returns: It is obtained by multiplying milk yield of an individual milch animal with respective prevailing price of milk in the study area.

$$\text{Gross returns} = \text{Quantity of milk} \times \text{Procurement price of milk}$$

Net returns: Net return was calculated by subtracting net cost from gross returns.

$$\text{Net returns} = \text{Gross returns} - \text{Net cost}$$

All the costs were calculated for per animal per day. This also indicates the cost of maintaining an animal per day.

APPENDIX-II: Interview Schedule for Dairy farmers

1. Name of the respondent: …….. Date & Time: …….

2. Address & Mobile No: ……..
……...
……...

I. Socio-economic Profile

3. Religion: Hindu/Muslim/Christian/Others

4. Age (in years) …….

5. Qualification: Illiterate/ Primary/ Higher primary/ Secondary/ College and above

6. Occupation: Farmer/Labourer/Self-employed/Government employee/Homemaker/Retired/Student/Unemployed/Others

7. Family type: Small/ Nuclear/ Joint

8. Family size (Number)……

9. Family's Annual Income (in Rs) ……..

10. Major Source(s) of Income: Agriculture/Dairy/Regular salary/Business/others

11. What is the percentage contribution of dairying to total family's annual income? (%).....

12. Total Land Area (Acre) …….

13. Whether your residence was under containment zone? Yes/No

14. Whether any family member was affected by COVID-19: Yes/No

II. Information on Dairying

15. Livestock details

Sl. No	Description		I*	C*	B*
a)	Females	Adults (more than 2 years)			
		Heifers (1-2 years)			
		Calves (less than 1 year)			
		In-milk animals			
		Stage: Early			
		Mid			
		Late			
b)	Males	Adults (more than 2 years)			
		Calves (less than 1 year)			
	Total				

I* – Indigenous, C*- Crossbred, B*- Buffalo

16. Are you a member of the Dairy Cooperative Society (DCS)? Yes/No

17. If yes name of the DCS…….

If No name of the company/firm to whom you pour milk……

18. Average milk yield per animal per day (liters)

Sl. No.	Average milk yield per animal per day	Pre-lockdown	Lockdown	Post-lockdown
a)	Indigenous cows			
b)	Crossbred cows			
c)	Buffaloes			
	Total			

19. Total milk production (liters/day)

Sl. No.	Milk Production	Pre-lockdown	Lockdown	Post-lockdown
a)	Indigenous cows			
b)	Crossbreds			
c)	Buffaloes			
	Total			

20. Quantity of the milk household consumption/sold (liters/day)

Sl. No.	Milk Sold	Pre-lockdown Sold (household consumption)	Lockdown Sold (household consumption)	Post-lockdown Sold (household consumption)
a)	Dairy Cooperative Societies			
b)	Private consumers			
	Total			

21. Procurement price of the milk (Rs.)

Pre-lockdown price ……...

Lockdown price ……

Post-lockdown price …….

22. Family income from dairying affected (Yes/No)

If yes:

What percentage of income was affected during?

a) Lockdown: ……(Rs.) …….(%)
b) Post-Lockdown: ……(Rs.) ……(%)

23. Frequency in payment of money from Dairy Cooperative Societies/Private Companies/personnel

    During Lockdown: (Affected/Unaffected)

    During Post-Lockdown: (Affected/Unaffected)

24. Purchase or sale of milch animals during Lockdown/Post-Lockdown period

    Purchase: …… (breed details: …….)

    Sale: …… (breed details: ……)

25. Disease status of the animals during Lockdown/Post-Lockdown period

    Foot & Mouth - If yes; no. of animals (breed-wise)

    Mastitis – If yes; number of animals (breed-wise)

26. Severity of major constraints faced by farmers (0-as before, 1- less severe, 2 severe)

Sl. No.	Major constraints	Lockdown	Post-Lockdown
a)	Input procurement a) Green fodder b) Dry fodder c) Concentrates		
b)	Sale of milk		
c)	Accessibility for treatment of cattle		
d)	Reduction in milk procurement price		
e)	Increase in input prices a) Green fodder b) Dry fodder c) Concentrates		
f)	Transportation to reach DCS/Milk vendor		

----------x----------

APPENDIX-III: Interview Schedule for Dairy Cooperative Societies

1. Name of DCS……..

2. Address & Mobile No……..

……...

……...

3. Year……

Severity of major constraints faced by DCS (0-as before, 1- less severe, 2 severe)

Sl. No.	Major constraints	Lockdown	Post-Lockdown
1.	Transportation from DCS to Milk Chilling Centers		
2.	Availability of feed from milk unions to DCS		
3.	Reduction in milk quality		
4.	Financial transactions: Crediting the amount in farmers' account		

Appendix-IV: Interview schedule for Milk Unions

Sl. No.	Month	Quantity of milk procured (000s liters)	Procurement prices of milk (Rs)	Quantity of milk sold (000s liters)	Quantity of milk converted to SMP (000s tones)	Quantity of milk products sold (000s tones)				
						Curd	Butter	Ghee	Panneer	Mysorepak
1.	January									
2.	February									
3.	March									
4.	April									
5.	May									
6.	June									
7.	July									
8.	August									
9.	September									
10.	October									
11.	November									
12.	December									
13.	Total									

Sl. No.	Month	Quantity of feed sold (000s tones)		Feed prices (Rs.)	
		Type 1	Bypass	Type 1	Bypass
1.	January				
2.	February				
3.	March				
4.	April				
5.	May				
6.	June				
7.	July				
8.	August				
9.	September				
10.	October				
11.	November				
12.	December				
13.	Total				

Severity of major constraints faced by District Milk Unions (0-as before, 1- less severe, 2 severe)

Sl. No.	Major constraints	BAMUL		KOMUL	
		Pre-lockdown vs Lockdown	Lockdown vs Post-Lockdown	Pre-lockdown vs Lockdown	Lockdown vs Post-Lockdown
1.	Transportation a) From chilling centers to milk unions b) From milk unions to milk parlors				
2.	Cold Storage				
3.	Labour shortage in a) Processing units b) Collection units				
4.	Reduction in milk quality				
5.	Financial transactions with bank and other institutes				
6.	Reduced demand for dairy and value-added dairy products a) Milk b) Curd c) Butter d) Ghee e) Panneer f) Sweets g) Ice-creams				
7.	Managing the surplus milk procured				

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- Secured 12th Rank in ICAR's JRF All India Entrance Exam (2019)
- Secured 2nd Rank in Karnataka State Police Sub-Inspector Exam (2020)

DECLARATION

I hereby declare that all statements made in the above are true and correct to the best of my knowledge and belief.

Date: 27/08/21
Place: Bengaluru

(Signature)