Journal DOI: 10.36713/epra1013 | SJIF Impact Factor (2024): 8.431 ISSN: 2347-4378
EPRA International Journal of Economics, Business and Management Studies (EBMS)
Volume: 11 | Issue:7 | July 2024 -Peer-Reviewed Journal

GROWTH OF MILK PRODUCTION AND PER CAPITA AVAILABILITY OF MILK: A COMPARATIVE STUDY BETWEEN GUJARAT AND INDIA AT NATIONAL LEVEL

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ABSTRACT
India is the global leader in milk production in the world by contributing 24% share in global milk production with the total production of 22 crore tonnes in year 2021-22. Majority of India farmers have milk animals in their houses to fulfill the requirement of milk and milk products. They are now able to generate good income from them. The livelihood of milk producers is improved and they have stated living a dignified life. This paper is focused on two regional areas viz. Gujarat and India. In this paper, it is tried to study and analyse the growth rate of milk production and availability of per capita milk in Gujarat and in India. It is found that Milk production is increased around 80% in both selected areas whereas per capita availability of milk in Gujarat is increased around 51% as well as at India level, it is around 56% in 2020-21 compared to 2009-10.
KEY WORDS: *Dairy industry, Cooperative society, Milk production, Per capita availability of milk, India, Gujarat*

1. INRODUCTION

India is the largest milk producing country in the world contributing 24% in global milk production with the total production of 22 crore tones in the year 2021-22. This milestone of the success has been achieved by the collective efforts of great visionary Dr. Verghese Kurien, National Dairy Development Board of India and Government of India. Foundation of National Dairy Development Board (NDDB) was established as an apex body for the dairy development activities in the year 1965 with a motive to organize dairy developmental activities. Dairy products specially Milk was consumed in India from the Vedic period, from the year 1969-70 a major initiative named "Operation Flood" was implemented by NDDB to make our country self-reliable in dairy products and transformed the dairy industry. At present Rajasthan, Uttar Pradesh, Madhya Pradesh, Gujarat and Andhra Pradesh are top 5 milk producing states of India which collectively contribute 53.11% of total Milk production of the nation.

Being an agricultural country majority families have milk animals in their houses and all their needs of milk and milk product are satisfied with that. With the passage of time and as a positive result of the operation flood programme, production of milk has been considerably increased in all areas of the nation and rural farmers have been able to generate good income from the dairying activities. Today rural farmers are generating good income through agriculture as well as dairying activities.

In this research, data of Gujarat and India is collected paper to study the milk production and dairy development. It is also tried to focus on study of national level and state level development of milk production and availability of milk. It has been tried to analyse dairy development with the help of milk production and per capita availability of milk in Gujarat and in India.

2. REVIEW OF LITERATURE

Desmukh (2014) examined the growth and development of Dairy sector in India using data of dairy development published by Government of India (GOI) & various government authorities related to dairy sector. He has compared total milk production, per capita availability of milk, state wise milk production, state wise number of dairy plant & its milk processing capacity in the world with special reference to production of India. It was revealed that there was sustained growth in the availability of milk for the increasing population of the country. The per capita availability of milk was also increased during study period. In spite of decline in the share of

agriculture sector in total GDP of the country, the share of livestock sector increased tremendously. It was also concluded that growth in dairy sector was observed over the year by implementing various progressive plans, but it still needed progressive measures to implement for the upliftment of dairy sector.

Sopanrao (2018) has observed a considerable increment in milk production during the study period and share of livestock in GVA of agriculture has been rising since 2011-12. India has achieved the huge success in dairy sector by the implementation of Operation Flood programme, Intensive cattle development programme and key village scheme. They have further observed that organised sector in dairy industry has limited coverage and benefits of dairy development. Coverage of dairy sector development should be reached to each and every village level milk producer farmer of the entire country. He has concluded that though we have achieved great success in dairy development but still there are some issues and challenges which should be overcome through adoption of systematic approach and planning.

Khongsai (2020) has studied the entrepreneurship development through milk production by taking data of year 2008-09 to 2015-16. He has observed that being the massive producer of milk India's position in world market as a supplier was decreasing due to lower productivity of cattle compared to other developed and developing countries. Major portion of milk production is handled by unorganised sector and consumed domestically. He has also observed that production of milk can be increased by promoting indigenous cattle with the available resources and inputs from the government can boost production of milk in the country. He has concluded that government should take some effective measures to increase milk production in India by providing subsidised electricity, high quality breed cattle with high lactation yield with insurance coverage to small farmers. Rural entrepreneur should benefit with credit facility and milking machine at concession rate as well as longer repayment facility. In addition to these proper training on feed management, value addition on milk products and marketing to small milk producers should provide to make India milk sufficient and milk surplus country.

Seilan (2011) has found that Indian dairy sector is enormously contributing to the nation. Milk revolution in the nation can be possible with the great efforts and support by cooperative sector. He has observed that the dairy industry is sustained in the country because of the import subsidized efforts of the government. He has further found that despite the entry of private sector and multinationals in the dairy sector dairy cooperative sector is on top and it can sustain due to its labor intensiveness as well as cost effectiveness. Farmers' hard work and efforts were one of the key factors behind its self-reliance. He concluded that to cope up with the new economic changes governments should make and revised their policies related to dairy cooperatives regularly and government should generate enough surpluses at low cost by maintaining due quality standards to uplift the welfare of millions of Indian farmers.

3. RESEARCH METHOD

Present research work is carried out with objectives to study the growth and development of milk production and per capita availability of milk at Gujarat level and at India level. This research work is of descriptive and analytical research which is carried out by collecting area wise data of 12 years from the 2009-10 to 2020-21 from the statistics published by National Dairy Development Board (NDDB). Statistical analysis and hypothesis testing of the collected data is performed using Student's independent t test at 95% confidence interval i.e., at significance level of 0.05.

4. DATA ANALYSIS AND INTERPRETATION

Table no. 1.1 & graph no. 1.1 represent data of milk production in Gujarat and in India. It can be observed from the table no. 1.1 that Milk production is considerably increasing in both selected areas in Gujarat as well as in India. In this study as practical comparison of production of milk is not possible at India level and Gujarat level so, here to make the comparison of both areas more practical and effective, growth rate of production of milk in both selected areas are considered for research. Here it is observed from the data of milk production that production of milk for both areas is almost double in the year 2020-21 compare to the 2009-10. In case of Gujarat and India it has found that highest milk production is recorded in 2020-21. In terms of growth rate in milk production it has observed that in Gujarat highest growth rate has reported in 2013-14 with the considerable growth of nearly 8% compared to previous year, whereas lowest growth rate has reported in the year 2020-21 at rate of 3.67%. Fluctuating trend has observed in the milk production in Gujarat during the study period. In case of the milk production at India it can be depicted that in the year 2012-13 it has lowest growth rate in milk production at 3.52% in comparison of its previous year whereas in 2017-18 it has highest growth rate in milk production at nearly 7% compared to its previous year 2016-17. For the year 2010-11 to 2012-13 fluctuating

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growth has found but there after an increasing growth rate for milk production has observed during entire study period till 2020-21 except the year 2018-19. From the graph presented here it can also visualise that growth rate of production of milk in India is more stable compare to growth rate of production of milk in Gujarat.

Table-1.1 Milk Production in Gujarat & India

Year	Milk Production in Gujarat ('000 tonnes)	Growth Rate of Gujarat (%)	Milk production in India (Million tonnes)	Growth Rate of India (%)
2009-10	8844	-	116.4	-
2010-11	9321	5.39%	121.8	4.64%
2011-12	9817	5.32%	127.9	5.01%
2012-13	10315	5.07%	132.4	3.52%
2013-14	11112	7.73%	137.7	4.00%
2014-15	11691	5.21%	146.3	6.25%
2015-16	12262	4.88%	155.5	6.29%
2016-17	12784	4.26%	165.4	6.37%
2017-18	13569	6.14%	176.3	6.59%
2018-19	14493	6.81%	187.7	6.47%
2019-20	15292	5.51%	198.4	5.70%
2020-21	15853	3.67%	210	5.85%

Graph-1.1 Milk Production in Gujarat & India

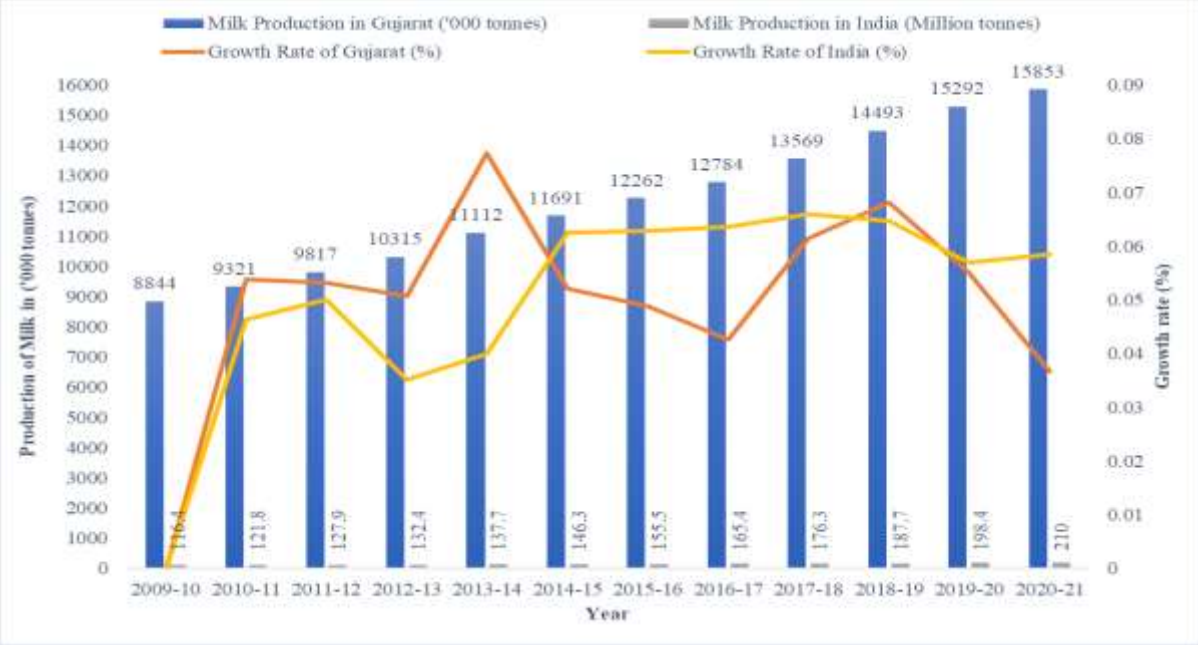


Table- 1.2 Descriptive Statistics of Growth Rate in Milk Production

	Area	N	Mean	SD	Minimum	Maximum
Growth Rate in Milk Production	Gujarat	11	5.46	1.11	3.66	7.66
	India	11	5.52	1.07	3.52	6.59

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Table no. 1.2 exhibits the descriptive statistics of growth rate of milk production during the study period. From the data it has found that average growth rate for milk production of India 5.52 is higher than the average growth rate for milk production of Gujarat 5.46. More fluctuations are found in the milk production growth rate of Gujarat compared to India. Maximum value is observed in Gujarat and minimum value is observed in India for the Milk production growth rate.

Assumption of Normality & Homogeneity for Growth Rate in Milk Production

H_0: The growth rate of milk production of each selected area follows normal distribution.

H_1: The growth rate of milk production of each selected area does not follow normal distribution.

Table- 1.3 Shapiro-Wilk test for Growth Rate in Milk Production

Area	statistic	p -value	statistic	p -value
Gujarat	0.963	0.809	0.980	0.917
India	0.872	0.083		

It can be observed from the table no. 1.3 that p value of Shapiro Wilk test statistic for growth rate of production of milk is greater than 0.05. So, it can be said that the growth rate of production of milk for both selected areas follow normal distribution. In other words, assumption of normality for growth rate of production of milk is not violated. So, to test the significant difference between growth rate of production of milk for selected areas, an independent sample t-test is applied. To decide whether to apply Student's t or Welch's t test assumption of homogeneity of variance is checked.

H_0: There is homogeneity of variance between selected areas for growth rate of milk production.

H_1: There is no homogeneity of variance between selected areas for growth rate of milk production

Table- 1.4 Homogeneity of Variances Tests for Growth Rate in Milk Production

		F	df	df2	p
Growth Rate in Milk Production	Levene's	0.150	1	20	0.702
	Variance ratio	1.09	10	10	0.897

It can be derived from the table no. 1.4 that p – value of Levene's test statistic is greater than 0.05. So, it can be said that there is homogeneity of variance between selected areas for growth rate of milk production. In other words, assumption of homogeneity of variance is not violated. So, to test the significant difference for growth rate of milk production between selected areas Student's t test is applied.

H_0: There is no significant difference for growth rate of milk production between selected areas.

H_1: There is significant difference for growth rate of milk production between selected areas.

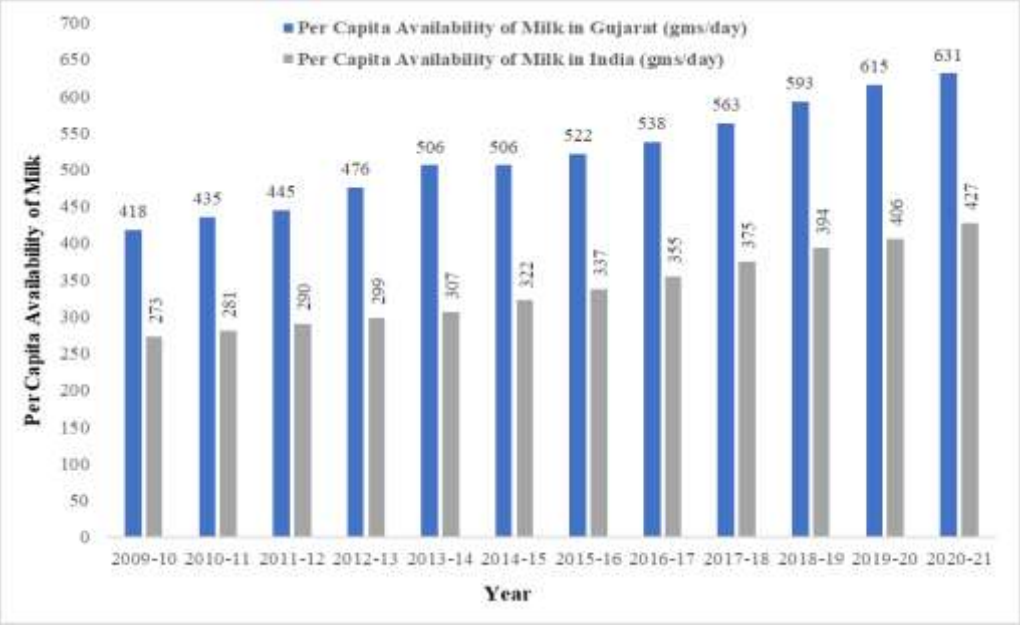
Table- 1.5 Independent Samples T-Test for Growth Rate in Milk Production

		Statistic	df	p
Growth Rate in Milk Production	Student's t	-0.131	20.0	0.897

It can be inferred from the table no. 1.5 that the p value of test static for growth rate in milk production is greater than 0.05. So, it can be inferred that at 5% level of significance, there is no significant difference for growth rate in milk production between selected areas. In other words, it can be said that there is statistically minor difference between growth rate in milk production between selected areas. Highest milk production growth rate is observed in India compared to Gujarat.

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Table- 2.1 Per Capita Availability of Milk in Gujarat & India		
Year	**Per Capita Availability of Milk in Gujarat (gms/day)**	**Per Capita Availability of Milk in India (gms/day)**
2009-10	418	273
2010-11	435	281
2011-12	445	290
2012-13	476	299
2013-14	506	307
2014-15	506	322
2015-16	522	337
2016-17	538	355
2017-18	563	375
2018-19	593	394
2019-20	615	406
2020-21	631	427



Graph- 2.1 Per Capita Availability of Milk in Gujarat & India

From the table no. 2.1 it can be depicted that per capita availability of milk in Gujarat is higher compared to per capita availability of milk in Inia. In Gujarat per capita availability of milk is increasing till 2013-14 and it remains same for 2014-15 thereafter again it increase during the entire study period. In case of India per capita availability of milk is continuously increasing during the entire study period. From the graph no 2.1 it can be also inferred that the per capita availability of milk in Gujarat is higher in comparison of per capita availability of milk in India.

Table- 2.2 Descriptive Statistics of Per Capita Availability of Milk

	Region	**N**	**Mean**	**SD**	**Minimum**	**Maximum**
Per Capita Availability of Milk	Gujarat	12	521	70.3	418	631
	India	12	339	52.1	273	427

Table no. 2.2 exhibits the descriptive statistics of per capita availability of milk during the study period. From the data it has found that average per capita availability of milk in Gujarat 521 gms/day is higher than the average per capita availability of milk in India 339 gms/day. More fluctuation is found in the per capita availability of milk in Gujarat compared to in India. Maximum value for per capita availability of milk is observed in Gujarat and minimum value for per capita availability of milk is observed in India.

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Assumption of Normality & Homogeneity for Per Capita Availability of Milk

H_0: The per capita availability of milk of each selected area follows normal distribution.

H_1: The per capita availability of milk of each selected area does not follow normal distribution.

Table- 2.3 Shapiro-Wilk test for Per Capita Availability of Milk

Area	statistic	p -value	statistic	p -value
Gujarat	0.959	0.767	0.970	0.671
India	0.937	0.46		

It can be seen from the table no. 2.3 that p value of Shapiro Wilk test statistic for per capita availability of milk is greater than 0.05. So, it can be said that the per capita availability of milk for both selected areas follow normal distribution. In other words, assumption of normality for per capita availability of milk is not violated. So, to test the significant difference between per capita availability of milk for selected areas, an independent sample t-test is applied. To decide whether to apply Student's t or Welch's t test assumption of homogeneity of variance is checked.

H_0: There is homogeneity of variance among selected areas for per capita availability of milk.

H_1: There is no homogeneity of variance among selected areas for per capita availability of milk

Table- 2.4 Homogeneity of Variances Tests for Per Capita Availability of Milk

		F	df	df2	p
Per Capita Availability of Milk	Levene's	0.894	1	22	0.355
	Variance ratio	1.82	11	11	0.334

It can be derived from the table no. 2.4 that p – value of Levene's test statistic is greater than 0.05. So, it can be said that there is homogeneity of variance between selected areas for per capita availability of milk. In other words, assumption of homogeneity of variance is not violated. So, to test the significant difference for per capita availability of milk between selected areas Student's t test is applied.

H_0: There is no significant difference for per capita availability of milk between selected areas.

H_1: There is significant difference for per capita availability of milk between selected areas.

Table- 2.5 Independent Samples T-Test for Per Capita Availability of Milk

		Statistic	df	p
Per Capita Availability of Milk	Student's t	7.20	22.0	< .001

It can be depicted from the table no. 2.5 that the p value of test static for per capita availability of milk is less than 0.05. So, it can be inferred that at 5% level of significance, there is significant difference for per capita availability of milk between selected areas. Highest per capita availability of milk is observed in Gujarat compared to India.

5. FINDINGS AND CONCLUSION

- The milk production in Gujarat as well as in India has increased considerably. This achievement is made possible due to collective efforts of Dairy industry, NDDB, Government of India as well as by the hardship of all the milk producing farmers.
- it has observed that in last two years during study period 2019-20 and 2020-21 growth rate of milk production is decreased in comparison of its previous years so, it can conclude that it may be due to effect of Covid-19.
- In case of per capita availability of milk, it has found that availability of per capita milk is more in Gujarat compare to India. It suggests that we have reached the milestone of success by becoming world's largest milk producing country but being agriculture-oriented country there is a need of more improvement in milk production which can be possible by inclusion of unorganised small farmers resides in the remote areas in the industrial mainstream, providing them best skill education and training for milk production and marketing.
- Inferential statistical analysis of the milk production indicating that similarity is found for growth rate in milk production between selected areas as there is no significant difference between them.
- Further, in case of per capita availability of milk it has observed that the significant difference is found for per capita availability of milk between selected areas of study.
- It can be concluded from the research study that in terms of milk production as well as per capita availability of the milk positive improvement is noted for both the area under study.

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**This Research work is a part of Ph.D. research of first author.*