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A regional analysis of trends in milk production in India

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Abstract

The dairy industry in India is crucial for the country's economy. Over the past 40 years, it has experienced tremendous growth in milk production, making India the largest producer and consumer of dairy products. In the present study, an attempt has been made to use secondary data for 20 years (from 2003 to 2023) to understand the growth rate in milk production across five regions of India (North, East, West, South, and Central India) and also to analyse secondary data for a period of 20 years (from 2003 to 2023). The tools employed for the analysis were the Compound Annual Growth Rate and Trend Analysis to estimate the Growth Rate and Trends in Milk Production. Out of five regions, the North Zone exhibited the highest growth rate, followed by the South Zone. The CAGR of milk production witnessed a substantial increase during the second decade (From 2014 to 2023), showing an impressive increase of 43 percent when compared to the previous decade. The Trend analysis conducted in the study revealed that Milk Production in the North Zone was significantly higher in 20 years compared to the insignificant difference seen in Delhi, Goa, and Kerala states of the North, West, and South, respectively. The study indicates that there is a significant upward trend in milk production over the specified period, as analysed using Trend Analysis. The remarkable growth rate reflects the dairy industry's capacity to expand and cater to the rising demands for milk and its products.

Keywords: Milk, growth rate, trend, production, dairy sector

1. Introduction

Dairy assumes a vital role in enhancing the economic prospects of households belonging to small milk producers across various regions of India (Meena *et al.*, 2022) ^[1]. Milk has been an essential component of human diets for centuries because of its vital nutrition and health benefits. The Indian dairy industry stands at the forefront, catering to the ever-growing global demand for milk and its diverse range of products while adeptly adapting to changing dietary preferences and population growth. This makes milk production a critical and thriving sector in agriculture worldwide. According to (Nagpal *et al.*, 2018) ^[2], milk is rich in critical nutrients such as proteins, fat, lactose, vitamins, minerals, enzymes, hormones, immunoglobulins, and cells. This makes it an ideal dietary source for enhancing overall well-being. Within the dairy industry, the Livestock Sector serves as a lifeline, supporting the livelihoods of approximately two-thirds of the rural population and contributing significantly to employment generation. (Chellappa and Haran 2018) ^[3] and (Jaiswal *et al.*, 2018) ^[4] emphasised that milk production plays a pivotal role in rural households, accounting for one-third of their total revenue, thus ensuring sustenance and income.

India emerged as a prominent player in the global milk production landscape, attaining remarkable milestones over the year. As the world's largest milk producer, India's annual milk production is projected to reach 231.7 million metric tonnes in 2022–23, with a per capita availability of 460 grammes/day. The country's total livestock population has surged to 535.78 million in 2019, reflecting a notable growth of 4.6 percent compared to the Livestock Census of 2012. Specifically, the bovine population, including cattle, buffalo, Mithun, and yak, reached 302.79 million in 2019, showing a commendable 1.0 percent increase from the previous census (20th Livestock Census, 2019).

Milk production in India is mainly limited to rural areas, although demand exists throughout the country (Gandhi *et al.*, 2014) [6]. Around 45 percent of the country's milk production is used as liquid milk (Goktolga *et al.*, 2008) [7], whereas the remaining 47 percent undergoes processing to create a diverse range of traditional products like curd, butter, buttermilk, ghee, khoa, paneer, cheese, and ice cream. India's milk production has experienced an impressive average annual growth rate of 4 percent since 1970, leading to a significant milestone in 2006 when it emerged as the world's largest milk-producing country (Muhammad *et al.*, 2009) [8]. The Dairy sector in India has developed substantially over the years. As a consequence of judicious policy interventions, India ranks first among the world's milk-producing countries, attaining an annual production of 221.06 million metric tonnes for the years 2021–22 as compared to 210 million metric tonnes during 2020–21, recording a growth rate of 5.8 percent. The top five milk-producing states in India are Rajasthan, Uttar Pradesh, Madhya Pradesh, Gujarat, and Andhra Pradesh, which jointly contribute 53.11 percent of the country's total milk production. This emphasises the crucial role these states play in shaping the dairy industry's trajectory. Hence, this study was undertaken to analyse the Growth and Trend of Milk Production in India over a period of 20 years, from 2003–2023.

2. Materials and Methods

The secondary data pertaining to Milk Production in India was collected for 20 years (2003–23). Data on milk production in India was collected from various sources via India Stat, NDDDB Stat, BAHS (Basic Animal Husbandry and Statistics), and the Department of Animal Husbandry and Dairying, Ministry of Fisheries, Animal Husbandry, and Dairying, Government of India, Annual Report 2022–23. The exponential compound annual growth rates were estimated using the linear log function on the time series data on milk production. The CAGR was worked out by using

$$Y_t = ab^t$$

Taking log on both sides, we have

$$\text{Log } Y_t = \text{log } a + t \text{ log } b$$

Where t is the time in years, Y t is the characteristic, a and b are the parameters (Ramakrishna and Bhave, 2017)

Where,

Y_t = Milk production,

a= Constant,

b= Regression coefficient,

t = Time variable.

Compound annual growth rate has been estimated as follows:

$$r = [\text{antilog} (\ln b) - 1] \times 100$$

3. Results and Discussion

The analysis focused on trends in milk production within India, where India was grouped into regions, and specific states within those regions were chosen for in-depth trend analysis.

The states categorised under each region are as follows:

Region 1: Haryana, Himachal Pradesh, Jammu & Kashmir, Punjab, Uttar Pradesh, Uttarakhand, Delhi

Region 2: Bihar, Jharkhand, Odisha, and West Bengal

Region 3: Goa, Gujarat, Rajasthan, and Maharashtra

Region 4: Andhra Pradesh, Karnataka, Kerala, Tamil Nadu, and Telangana

Region 5: Chhattisgarh and Madhya Pradesh

3.1 Milk Production in India

Boosting milk production has been a key focus of India's dairy progress since its independence. To achieve this goal, the country has implemented various strategies for dairy development (Kumar *et al.*, 2013) [10]. The most recent step in this direction is the Perspective of the National Dairy Development Plan. The dairy industry has changed a lot, with milk production going up from 17 million metric tonnes in 1950–51 to 231.7 million metric tonnes in 2022–23. But from 1951 to 1973, milk production only grew by about 1 percent per year. Things improved in the 1970s, when milk production increased by 4.5 percent each year.

During this period, a significant programme named 'Operation Flood' was initiated to enhance milk production. In the 1980s, the growth in milk production gained even more speed, reaching a rate of 5.4 percent. This momentum persisted, although with a slight slowdown. This marked a phase when India began focusing on making its own products and achieving self-sufficiency, a trend that continued until the late 1990s. The availability of milk per person per day rose from 110g in 1972–73 to 460g in 2022–23.

Table 1: Production of Milk in India (2023)

Year	Production (Million Tonnes)	Per Capita Availability (gms/day)
2003-04	88.1	225
2004-05	92.5	233
2005-06	97.1	241
2006-07	102.6	251
2007-08	107.9	260
2008-09	112.2	266
2009-10	116.4	273
2010-11	121.8	281
2011-12	127.9	290
2012-13	132.4	299
2013-14	137.7	307
2014-15	146.3	322
2015-16	155.5	337
2016-17	165.4	355
2017-18	176.3	375
2018-19	187.7	394
2019-20	198.4	406
2020-21	210.0	427
2021-22	221.1	444
2022-23	231.7	460

Source: Basic Animal Husbandry Statistics, MoFAHD, DADH, GoI

3.2 Regional Trends in Milk Production

Regional patterns in dairy farming vary significantly across the country. The top five milk-producing states in India are Rajasthan (15.05 percent), Uttar Pradesh (14.93 percent), Madhya Pradesh (8.06 percent), Gujarat (7.56 percent), and Andhra Pradesh (6.97 percent), which together contribute over 50 percent of the country's total milk production.

The milk production trends of Region-1 for the period of 2023–23, which covers eight states namely Haryana, Himachal Pradesh, Jammu & Kashmir, Punjab, Uttar Pradesh, Uttarakhand, Delhi, and Chandigarh, are shown in Figure 1. Which revealed that there was an increasing trend in the production of milk in different states and the overall region. Maximum average milk production was observed in Punjab (107005.1 TMT), followed by Uttar Pradesh (24360.3 TMT),

Haryana (7943.15 TMT), Jammu & Kashmir (1918.05 TMT), Uttarakhand (1516.2 TMT), and Delhi (330.3 TMT). A

minimum production of milk was observed in Chandigarh (46.2 TMT).

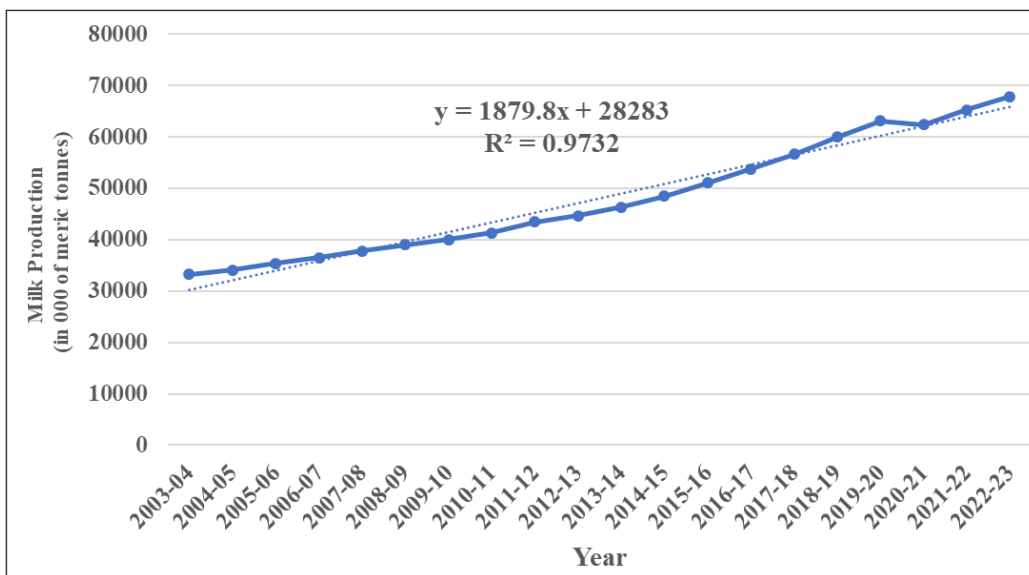


Fig 1: Trend in Production of Milk in Region-1 (2003-2023)

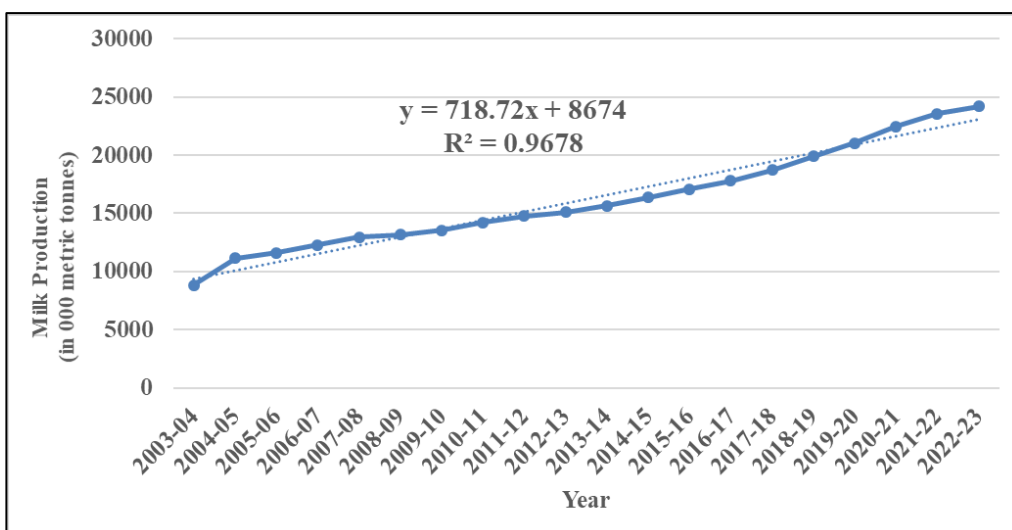


Fig 2: Trend in Production of Milk in Region-2 (2003-2023)

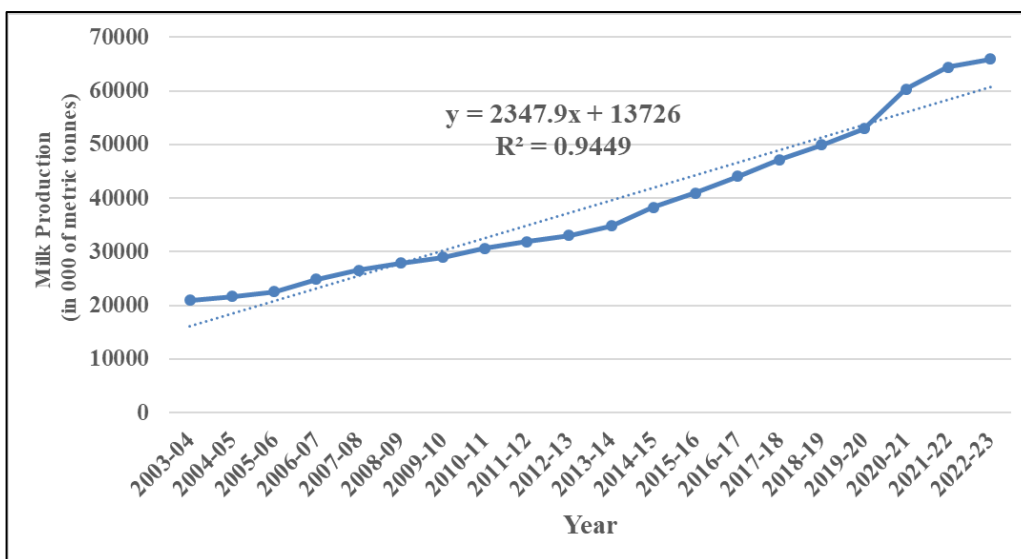


Fig 3: Trend in Production of Milk in Region-3 (2003-2023)

The milk production trends of Region-2 for the period of 2003–23, which covers four states, namely Bihar, Jharkhand, Orissa, and West Bengal, are shown in Figure 2. Which revealed that there was an increasing trend in the production of milk in different states and the overall region. Maximum average milk production was observed in Bihar (7695.05 TMT), followed by West Bengal (4896.4 TMT), Orissa (1840.9 TMT), and Jharkhand (1788.2 TMT).

The milk production trends of Region-3 for the period of 2000–2023, which covers four states namely Goa, Gujarat, Rajasthan, and Maharashtra, are shown in Figure 3. Which revealed that there was an increasing trend in the production of milk in different states and the overall region. The Maximum average milk production observed in Rajasthan (17613.3 TMT) was followed by Gujarat (11168.6 TMT), Maharashtra (9540.05 TMT), and Goa (57.7).

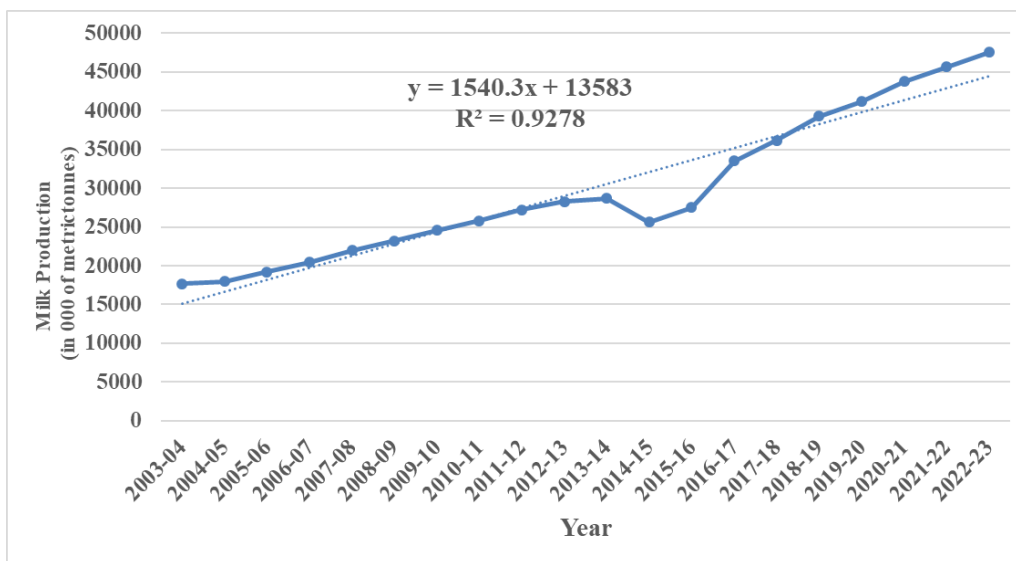


Fig 4: Trend in Production of Milk in Region-4 (2003-2023)

The milk production trends of Region-4 for the period of 2023–23, which covers five states, namely Andhra Pradesh, Karnataka, Kerala, Tamil Nadu, and Telangana, are shown in Figure 4. Which revealed that there was an increasing trend in the production of milk in different states and the overall

region. Maximum average milk production was observed in Andhra Pradesh (11545.8 TMT), Tamil Nadu (7300.3 TMT), Karnataka (6465.25 TMT), and Kerela (2471.15 TMT). Milk production in Telangana (1973.36 TMT) is negligible.

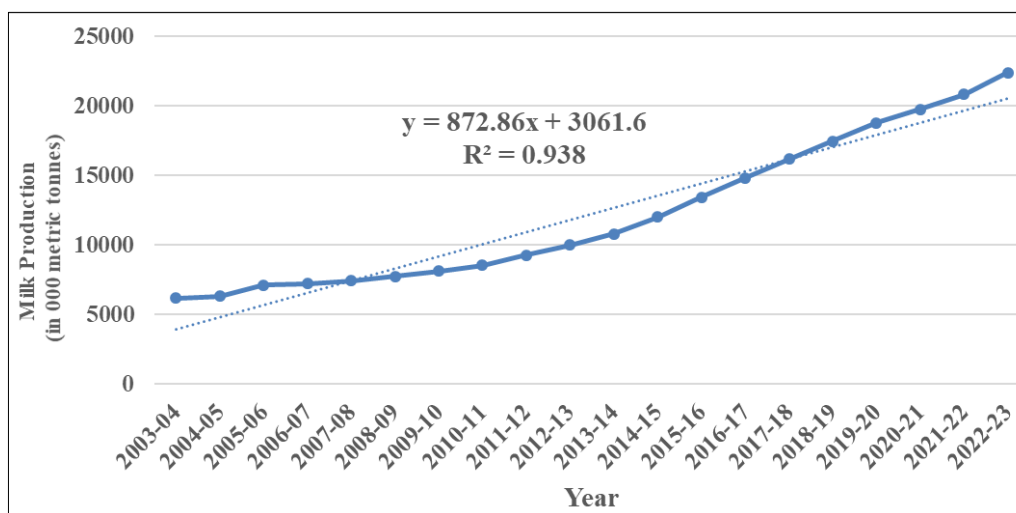


Fig 5: Trend in Production of Milk in Region-5 (2003-2023)

The milk production trends of Region-5 for the period of 2023–23, which covers two states, namely Chhattisgarh and Madhya Pradesh, are shown in Figure 5. Which revealed that there was an increasing trend in the production of milk in different states and the overall region. Maximum average milk production was observed in Madhya Pradesh (10992.4 TMT) and Minimum in Chhattisgarh (1234.25 TMT).

India saw a big increase compared to the earlier years. The overall rise was 43.6% between 2014 and 2023.

Conclusion

Milk Production has become one of the most important and has potential for increasing opportunities, steady employment and income for many people. The results of the Compound annual growth rate showed a positive and significant trend at the Indian level (43.6 percent) during the second decade (from 2014 to 2023). Promoting milk production will help enhance

Interpretation for Overall India: Looking at how milk production grew in different states and regions, it's clear that

nutritional and livelihood security in both rural and urban areas.

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