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Growth Dynamics of Poultry Products in India and Karnataka: A Focus on Egg and Meat Production

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

The present study evaluates the growth dynamics of egg and meat production in India and Karnataka from 2008-09 to 2022-23. The study was based on secondary data, Compound Annual Growth Rate, Coefficient of Variance and Cuddy Della Valley Instability Index were used to analyse the Growth and instability in Production of egg and mean in India and Karnataka At the national

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level, egg production increased significantly from 62.41 billion to 143.25 billion, with a Compound Annual Growth Rate (CAGR) of 6.63 per cent, while meat production grew from 4.2 million metric tons to 9.8 million metric tons, recording a CAGR of 6.06 per cent. In Karnataka, egg production grew from 4.54 billion to 7.49 billion, achieving a CAGR of 3.61 per cent, whereas meat production exhibited remarkable growth from 18,000 metric tons to 206,000 metric tons, with a CAGR of 18.54 per cent. The analysis highlights moderate variability in national egg production (CV: 30.43%) and meat production (CV: 25.27%), while Karnataka's egg production showed lower variability (CV: 15.77%) compared to meat production (CV: 63.29%). The Cuddy-Della Valle Instability Index (CDVI) reflects relative stability in national egg production (6.99) and meat production (3.71), with Karnataka's values of 0.49 for eggs and 11.17 for meat indicating a mature layer farming sector and dynamic broiler farming growthThe findings underscore the poultry sector's critical role in enhancing nutrition security, boosting rural livelihoods and driving economic development. Sustained investments in disease management, climate-controlled production systems and global trade opportunities will further strengthen the poultry industry's contribution to India's agricultural economy.

Keywords: Egg production; meat production; CAGR; coefficient of variation; cuddy-della valle instability index.

1. INTRODUCTION

India's poultry sector stands as a vital pillar of its agricultural economy, showcasing remarkable growth and efficiency (Pant et al., 2025). India ranks third globally in egg production and fifth in broiler meat production, demonstrating its growing importance in ensuring food security and nutrition (Narayan Murigeppa et al., 2024). The sector thrives on a combination of favorable climatic conditions, strong demand and technological advancements that have propelled India into a leadership role in global poultry markets (Kunal et al., 2017). Major production centers include Tamil Nadu, Karnataka andhra Pradesh, Telangana, Maharashtra and Punjab, where integrated farming systems and commercial poultry production dominate. The Indian poultry sector consists of two primary segments: broiler farming for meat production and layer farming for egg production. Broilers are grown in well-managed farms with scientific feed management and optimized production cycles, ensuring rapid growth and high yield. Layers are managed under controlled environments for optimal egg production, supplying the domestic market and exports. Supported by government initiatives such as the Rural Backyard Poultry Development Programme (RBPD) and National Livestock Mission (NLM), the sector has experienced a significant shift toward organized farming, enhancing productivity and income generation. Technological advancements like precision farming, feed formulation, vaccination programs and environment-controlled housing systems have minimized resource wastage and improved production efficiency (Jana Pauwel et al., 2025). Additionally, the adoption of post-harvest cold chain management and infrastructure development has strengthened the supply chain, ensuring consistent quality and reducing losses (Liverpool-Tasie et al.,2019).

The Indian poultry industry contributes significantly to rural employment by engaging small-scale farmers, landless laborers and entrepreneurs, particularly in allied activities such as feed production, hatchery management and processing (Madhu et al., 2024). Karnataka plays a critical role in India’s poultry industry due to its favorable agro-climatic conditions and entrepreneurial farming practices. With a focus on sustainable poultry farming, the state has seen steady growth in both broiler and layer production. Karnataka’s integrated poultry sector supports rural livelihoods and ensures a steady supply of affordable protein through chicken meat and eggs. The expansion of poultry processing units and export-focused production aligns with international quality standards such as ISO, HACCP and FSSC-22000, boosting India’s competitiveness in global trade (Annoff & Reddy, 2023). The outcome of this sector’s growth highlights its pivotal role in enhancing nutrition security, foreign exchange earnings and GDP contribution. With rising domestic and international demand for poultry products, India’s poultry sector provides immense opportunities for farmers, entrepreneurs and investors to scale production and explore export markets (Deshmanya & Jainuddin, 2023). By adopting sustainable and modern farming practices, India can further strengthen its position as a global leader, contributing to economic development,

rural employment generation and technological advancements in agriculture.

2. METHODOLOGY

The study is based on secondary data for egg and meat production in India and Karnataka from 2008–09 to 2022–23 and collected from INDIASTAT. To analyze growth patterns, the Compound Annual Growth Rate (CAGR) was calculated to measure average annual growth. The Coefficient of Variation (CV) was used to evaluate variability in production levels, while the Cuddy-Della Valle Index (CDVI) assessed the stability of growth trends. Separate analyses were conducted for India and Karnataka to draw comparative insights, with findings systematically presented in tables and figures for clarity.

2.1 Compound Annual Growth Rate Analysis

For computing compound annual growth rates of export of gherkins in both quantity terms, the exponential function of the following form was used. (Gunadal *et al*, 2023; Marmat et al., 2024)

$$Y_t = a\, b^t\, U_t \quad \text{----------} \quad (1)$$

Where,

Y = Dependent variable (export quantity) in the year 't'
a = Intercept term indicating Y in the base period (t=0)
b = Regression coefficient
t = Time period
U_t = error term

The equation (1) was transformed into log linear form and written as;

$$\log Y = \log a + t \log b + Ut \quad \text{----------} \quad (2)$$

The coefficients were estimated by using Ordinary Least Squares (OLS) technique.
Compound growth rate (g) was then computed

$$g = (b - 1) \times 100 \quad \text{----------} \quad (3)$$

Where,

g = Compound growth rate in per cent per annum
b = Antilog of log b

The standard error of the growth rate was estimated and tested for its significance with 't' test statistic.

2.2 Instability Analysis

In order to study stability of growth in gherkins with respect to export quantity, instability techniques were employed.

2.2.1 Co-efficient of Variation (C.V)

The co-efficient of variation was estimated using the expression given below. (Gunadal *et al*, 2024)

$$\boldsymbol{CV = \frac{Standard\ Deviation}{Mean} \times 100}$$

Linear trend was fitted to the original data of export quantity for the period of 12 years from 2011-12 to 2022-23. The trend coefficients were tested for their significance. Whenever, the trend of series found to be significant; the variation around the trend rather than the variation around mean was used as an index of instability.

2.2.2 Cuddy Della Valle Instability Index (CDVI)

The instability in export quantity of gherkins crop were measured by using Cuddy-Della Valle Index. This method is being used by number of researchers as a measure of variability in time series data. CDVI corrects the deficiencies of CV method. CDVI is expressed as follows (Gunadal *et al*, 2024)

$$\boldsymbol{CDVI = CV\sqrt{1 - Adj\ R^2}}$$

Where,

CV = Coefficient of variation (in percent)

Adj R^2 = Coefficient of determination from a time trend regression adjusted by the number of degrees of freedom

The Cuddy-Della Valle Instability index was used to compute the degree of variation around the trend.

The range of CDVI e given as follow

Low instability: 0 to 15
Medium instability: 15 to 30
High instability: 30 and above

3. RESULTS AND DISCUSSION

3.1 Growth Performance of Egg and Meat Production in India

The analysis from Table 1 and Fig. 1 on poultry sector in India, particularly egg production and meat quantity from 2008-09 to 2022-23, reveals significant growth and steady progress. Egg production increased consistently from 62.41 billion in 2008-09 to 143.25 billion in 2022-23, recording a Compound Annual Growth Rate (CAGR) of 6.63 per cent. Similarly, meat production exhibited a steady rise, growing from 4.2 million metric tons to 9.8 million metric tons during the same period, with a CAGR of 6.06 per cent. The mean values for egg production and meat quantity stand at 93.98 billion and 6.97 million metric tons, respectively, highlighting the sector's consistent contribution to India's agricultural output. The Coefficient of Variation (CV) for egg production (30.43%) and meat quantity (25.27%) indicates moderate variability, with egg production showing slightly higher fluctuations compared to meat output. Despite these variations, the Cuddy-Della Valle Instability Index values of 6.99 for egg production and 3.71 for meat quantity suggest that both segments have maintained relative stability over the years. This reflects the sector's resilience, backed by improved management practices, advancements in technology and government support through programs like the National Livestock Mission and Rural Backyard Poultry Development Programme.

The consistent rise in production can be attributed to increased demand for affordable protein sources, better feed management, scientific breeding practices and the expansion of commercial poultry farms. Additionally, the adoption of modern production systems, such as precision farming and climate-controlled poultry housing, has enhanced productivity and minimized losses (Lenis Saweda O Liverpool-Tasie et al., 2019). Overall, the significant growth in egg and meat production underscores the poultry sector's pivotal role in enhancing nutrition security, rural livelihoods and economic development. With sustained investments in infrastructure, disease management and global trade opportunities, the poultry industry is poised for further growth, ensuring its continued contribution to India's agricultural economy (Kuppan et al., 2024; Veeresh et al., 2023).

Table 1. Growth performance of Egg and Meat production in India

Sl. No.	Year	Egg Production (Bn)	Meat Quantity (Mt)
1.	2008-2009	62.41	4.2
2.	2009-2010	64.99	4.5
3.	2010-2011	67.47	4.9
4.	2011-2012	69.79	5.5
5.	2012-2013	71.00	5.9
6.	2013-2014	72.95	6.2
7.	2014-2015	76.58	6.7
8.	2015-2016	76.99	7
9.	2016-2017	94.51	7.4
10.	2017-2018	101.75	7.7
11.	2018-2019	113.03	8.1
12.	2019-2020	119.71	8.6
13.	2020-2021	129.61	8.8
14.	2021-2022	136.93	9.3
15.	2022-2023	143.25	9.8
	Mean	93398.37	6.97
	CV	30.43	25.27
	CAGR	6.63**	6.06**
	CDVI	6.99	3.71

Note: (**) – Significant at 1 per cent level

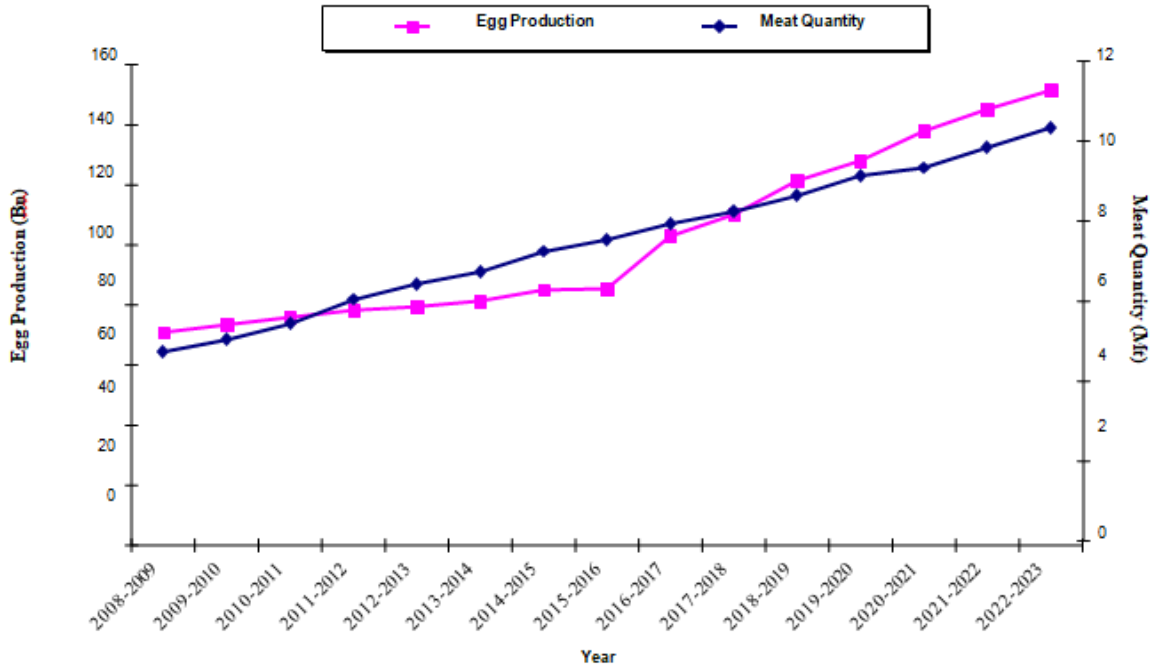

Fig. 1. Growth performance in production of poultry egg and meat of India

3.2 Growth Performance of Egg and Meat Production in Karnataka

Results in Table 2 and F. 2 on egg and meat production from 2008-09 to 2022-23 reveals significant trends in the poultry sector, demonstrating its growing contribution to India's agricultural economy. Egg production increased from 4.54 billion in 2008-09 to 7.49 billion in 2022-23, with a Compound Annual Growth Rate (CAGR) of 3.61 per cent. In contrast, meat production showed an impressive increase from 18,000 metric tons to 206,000 metric tons, recording a substantially higher CAGR of 18.54 per cent. The mean values for egg and meat production stand at 5.9 billion and 98.93 thousand metric tons, respectively, underscoring the sector's steady contribution to food security and nutritional needs.

The Coefficient of Variation (CV) for egg production is 15.77 per cent, indicating relatively low variability and consistent growth over the years. However, meat production exhibited higher variability with a CV of 63.29 per cent, reflecting rapid but fluctuating growth, driven by increasing demand for poultry meat as a low-cost protein source. The Cuddy-Della Valle Instability Index (CDVI) further confirms this trend, with values of 0.49 for egg production and 11.17 for meat production. The low instability in egg production highlights the mature and stabilized nature of layer farming, while the relatively higher instability in meat production reflects the dynamic expansion of broiler farming, driven by market demand and technological advancements.

The robust growth in poultry meat production can be attributed to the expansion of commercial broiler farming, improved breeding practices, scientific feed management and growing consumer demand (Lal & Azad, 2023). Meanwhile, egg production's steady rise is supported by advancements in layer management, efficient disease control and government support programs. Overall, the data underscores the poultry sector's role in boosting nutrition security, income generation and employment opportunities. With sustained efforts in technology adoption, infrastructure development and market integration, the poultry industry is well-positioned to meet domestic demand and strengthen its export potential, contributing significantly to India's agricultural and economic growth.

The poultry sector can adopt various environmental sustainability practices to reduce its ecological footprint. Key measures include improving feed conversion efficiency, conserving water and energy and utilizing waste products like manure and litter for biogas or organic fertilizer. Sustainable feed production, such as using alternative ingredients and promoting

regenerative agriculture, can further lower emissions (Lal & Azad, 2023). Efficient waste and emission management, including methane capture and odor control, help minimize environmental impact. Additionally, adopting circular economy initiatives, adhering to regulatory standards, and leveraging innovative technologies ensure long-term sustainability while fostering biodiversity conservation and reducing operational costs.

Table 2. Growth performance of Egg and meat production in Karnataka

Sl. No.	Year	Egg Production (Bn)	Meat Production (000 mt)
1.	2008-09	4.54	18
2.	2009-10	4.73	25
3.	2010-11	4.92	33
4.	2011-12	5.12	41
5.	2012-13	5.31	50
6.	2013-14	5.5	62
7.	2014-15	5.7	75
8.	2015-16	5.91	89
9.	2016-17	6.12	104
10.	2017-18	6.34	122
11.	2018-19	6.56	139
12.	2019-20	6.78	157
13.	2020-21	7.01	174
14.	2021-22	7.25	189
15.	2022-23	7.49	206
	Mean	5.9	98.93
	CV	15.77	63.29
	CAGR	3.61**	18.54**
	CDVI	0.49	11.17

Note: (**) – Significant at 1 per cent level

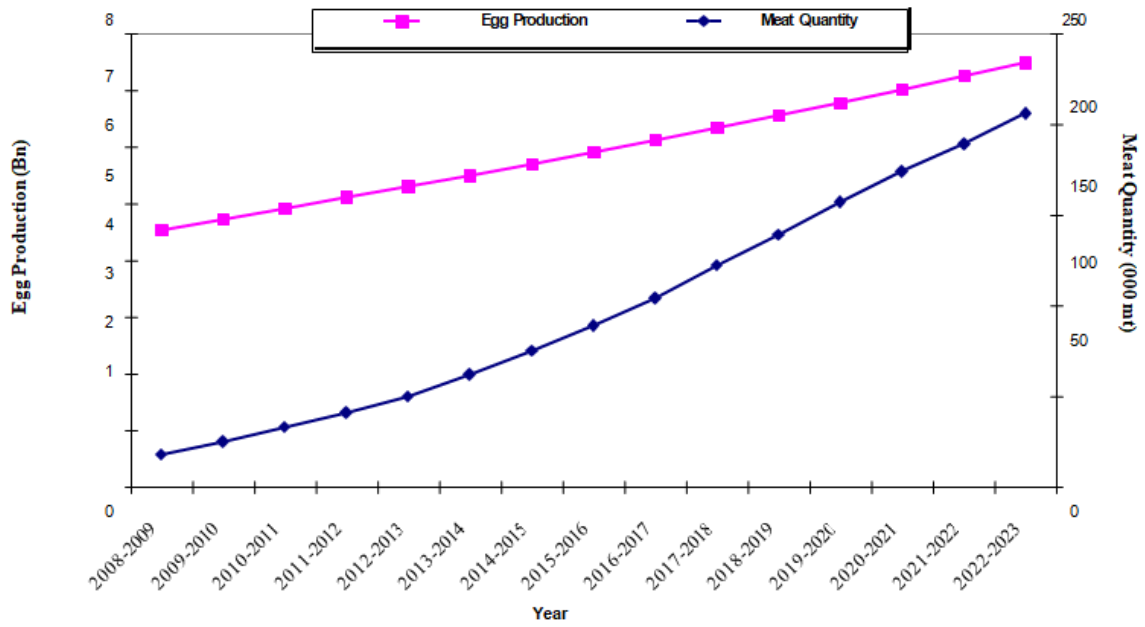

Fig. 2. Growth performance in production of poultry egg and meat of Karnataka

4. CONCLUSION

The analysis of egg and meat production from both datasets reveals significant growth and notable trends in India's poultry sector, highlighting its critical role in the agricultural economy. Egg production has shown consistent growth, increasing from 62.41 billion to 143.25 billion and 4.54 billion to 7.49 billion over their respective periods, with CAGR values of 6.63 per cent and 3.61 per cent, demonstrating stability and moderate growth. The low variability (CV: 15.77 % and 30.43 % and low instability (CDVI: 0.49 and 6.99) indicate that layer farming has matured, providing a steady and reliable source of nutrition and income. In contrast, meat production has exhibited rapid growth, increasing from 4.2 million metric tons to 9.8 million metric tons and 18,000 metric tons to 206,000 metric tons, with significantly higher CAGR values of 6.06 per cent and 18.54 per cent. However, the variability (CV: 25.27 per cent and 63.29 per cent) and instability (CDVI: 3.71 and 11.17) suggest fluctuations due to dynamic market forces, rising demand and expansion of commercial broiler farming.

The study underscores significant growth in poultry production in India and Karnataka, with eggs exhibiting steady and consistent growth and meat showing rapid but variable development. Despite overall positive trends, variability in production, especially for meat, poses challenges that need to be addressed to sustain growth. Policymakers and stakeholders must focus on stabilizing production through better disease management, market interventions and infrastructure development. Ensuring predictable growth in the poultry sector is critical for meeting rising consumer demand and strengthening the agricultural economy. This study provides a framework for addressing variability and fostering sustainable development in the poultry industry. Overall, the poultry sector has experienced remarkable progress, driven by technological advancements, efficient farm management and increasing consumer demand for affordable protein sources. With steady growth in eggs and rapid expansion in meat production, the sector plays a pivotal role in enhancing nutrition security, employment generation and economic growth, positioning India as a major global player in poultry production.

DISCLAIMER (ARTIFICIAL INTELLIGENCE)

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc) and text-to-image generators have been used during writing or editing of this manuscript.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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