



Unveiling India's Export Success: The Remarkable Performance of Gherkins

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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

Aim: As India is a major producer and exporter of gherkins in the world and Karnataka is the largest producer and exporter of gherkins in the country. The study aims to analyze the significant export performance of gherkins (Fresh/chilled, provisionally preserved and provisionally preserved by vinegar) from India, highlighted their remarkable performance in oversea markets. India's horticultural sector has witnessed significant growth, particularly in gherkins production and exports, call attention to its pivotal role in the global market.

Place and Duration of the Study: This study analyzed the export performance of Indian gherkins across three categories viz., fresh/chilled, provisionally preserved and preserved by vinegar, study conducted during the period from 2011-12 to 2022-23.

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Methodology: The growth rate of export performance of gherkins were analysed using Compound Annual Growth Rate. The instability in export quantity of gherkins were measured by using Coefficient of Variation and Cuddy-Della Valle Instability Index.

Result and Discussion: The export performance of Indian gherkins across various categories, fresh/chilled, provisionally preserved and preserved by vinegar, reveals distinct growth trajectories and market dynamics from 2011-12 to 2022-23. Fresh/chilled gherkins showed a modest Compound Annual Growth Rate (CAGR) of 4.06 per cent, indicating gradual but steady expansion, albeit with moderate instability (Cuddy-Della Valle Instability index of 42.35). The United Arab Emirates consistently dominated as the top importer of Indian gherkins. Provisionally preserved gherkins exhibited a stronger growth with a significant CAGR of 4.04 per cent and lower instability (CV of 18.28 %), highlighting stable demand for Indian gherkins in the international market. In contrast, gherkins provisionally preserved by vinegar saw varied trends across countries, with notable growth in markets like the USA and Germany, while others like France experienced declines. These insights underscore strategic imperatives for enhancing competitiveness through quality improvements, competitive pricing strategies and navigating regulatory landscapes to sustain India's global gherkins market presence.

Keywords: Gherkins; export performance; growth; instability; competitiveness; preserved vegetable.

1. INTRODUCTION

India's horticultural sector stands as a cornerstone of its agricultural economy, marked by robust growth and extensive diversity. With a production of 350.87 million metric tons during 2022-23, the highest recorded in its history, India solidifies its position as the second-largest producer of fruits and vegetables globally, following China [1]. The sector's success is underpinned by a rich agro-climatic diversity, spanning tropical to temperate zones, enabling the cultivation of a wide array of crops including fruits, vegetables, flowers, spices, medicinal plants and aromatic crops. This vast production not only fulfills domestic consumption needs but also propels India into a significant role in the global horticulture market. Supported by traditional knowledge complemented by modern agricultural techniques and government initiatives such as the National Horticulture Mission (NHM) and the Mission for Integrated Development of Horticulture (MIDH), the sector fosters innovation, enhances productivity, and promotes sustainable practices. Moreover, initiatives in precision farming, greenhouse cultivation and post-harvest management have bolstered year-round production, improved crop quality and minimized resource wastage, while advancements in infrastructure have strengthened India's competitiveness in international trade.

Gherkins, also known as bur gherkins or West Indian gherkins, are annual trailing vines belonging to the gourd family, prized for their edible fruit. Native to Southern Africa, gherkins

thrive in warm climates and are primarily cultivated in Karnataka, Tamil Nadu and Andhra Pradesh in India. The crop requires well-drained red sandy loam soil with a pH of 6.5 to 7.5 and is typically grown on small plots due to its intensive labor demands, including frequent irrigation and vigilant pest management (APEDA). Originally prompted by high production costs in Europe, which shifted cultivation to Turkey and then to India, gherkins are almost entirely exported, particularly to European countries and the USA, where they are a dietary staple. Harvested by hand and processed quickly after picking, gherkins undergo pickling using methods like brine fermentation or vinegar brining, enhancing their tangy flavor and extending shelf life. Beyond their culinary use as a popular condiment in sandwiches, salads and burgers, gherkins are valued for their nutritional benefits, contributing to their increasing global demand as a versatile and healthy snack (Indian Gherkins Exporters Association, Bengaluru).

India dominates the global gherkins market as the largest producer and exporter, contributing significantly to agricultural exports. With a production concentrated mainly in Karnataka, Tamil Nadu, Andhra Pradesh and Telangana, India accounted for 15 per cent of global production and 25-27 per cent of global exports in recent years, earning approximately \$223 million in 2020-21 (APEDA). The sector engages around 90,000 small and marginal farmers across 65,000 acres, with production yields averaging 7.43 metric tonnes per acre per crop. Gherkins are primarily exported to over 20 countries, including major markets like the USA,

European nations and Australia (APEDA). The industry not only bolsters rural employment but also adheres to international quality standards, with processing plants certified by ISO, BRC, IFS, FSSC-22000, and HACCP, ensuring product safety and meeting global demand for both bulk industrial use and consumer-ready packs. APEDA's support has been pivotal in infrastructure development, quality enhancement and market promotion, further consolidating India's position as a key player in the global gherkins trade.

The outcome of the study will pave the way for the upcoming entrepreneurs who want to go for the gherkins production and export business. Since there is greater demand for gherkins crops on the global market, India has a rare opportunity to increase its export share of gherkins there. By doing so, India will increase its foreign exchange reserves and increase its foreign earnings. The Indian farmer has to seize this opportunity to maximize their income by starting new ventures in the agri-business of gherkins production and export and existing farmers can expand their business to a larger extent to earn more foreign earnings. The export performance of gherkins from India provides a comprehensive understanding of its economic, market and policy implications, benefiting various stakeholders from farmers to policymakers and enhancing India's position in global agricultural trade. The export performance of gherkins plays a significant role in enhancing economic development through foreign exchange earnings, GDP contribution, employment generation, infrastructure development and technological advancements, thereby fostering overall economic growth and stability.

2. METHODOLOGY

The study was purely based on secondary data. For the study of export performance of gherkins in quantity terms from India. The secondary data pertaining to the export of gherkins from India were collected from Agricultural and Processed Food Products Export Authority (APEDA), Directorate General of Commercial intelligence and statistics (DGCIS) websites and other published sources.

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. [2].

$$Y_t = a b^t U_t \quad (1)$$

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;

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

The coefficients were estimated by using Ordinary Least Squares (OLS) technique.

Compound growth rate (g) was then computed

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

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.

$$CV = (\text{Standard Deviation}) / \text{Mean} \times 100$$

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 (Honyal et al, 2023).

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, 2023).

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

Where,

- CV = Coefficient of variation (in percent)
- Adj R² = 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 in Export Quantity of Gherkins (Fresh/Chilled) from India

The compound growth rates calculated for the export quantity for the period 2011-12 to 2022-23. The detailed performances of Indian gherkins (fresh/chilled) exports are presented in Table 1 and Fig. 1. The results revealed that over a period of 12 years the quantity of export of gherkins (fresh/chilled) experienced marginally a positive growth rate i.e., Compound Annual Growth Rate (CAGR) of 4.06 per cent which was non-significant. Because, India's gherkins (fresh/chilled) exports depend mainly on the international market demand-supply scenario. A country has an export advantage when the international prices are high. The result reveals that the Cuddy Della Valle Instability (CDVI) of the quantity were 42.35, which showed moderate instability of growth in quantity export over the study period. It indicate opportunity in export of gherkins (fresh/chilled) from India. The exporters of gherkins need to understand these things before planning for gherkins exports from the country [3-5].

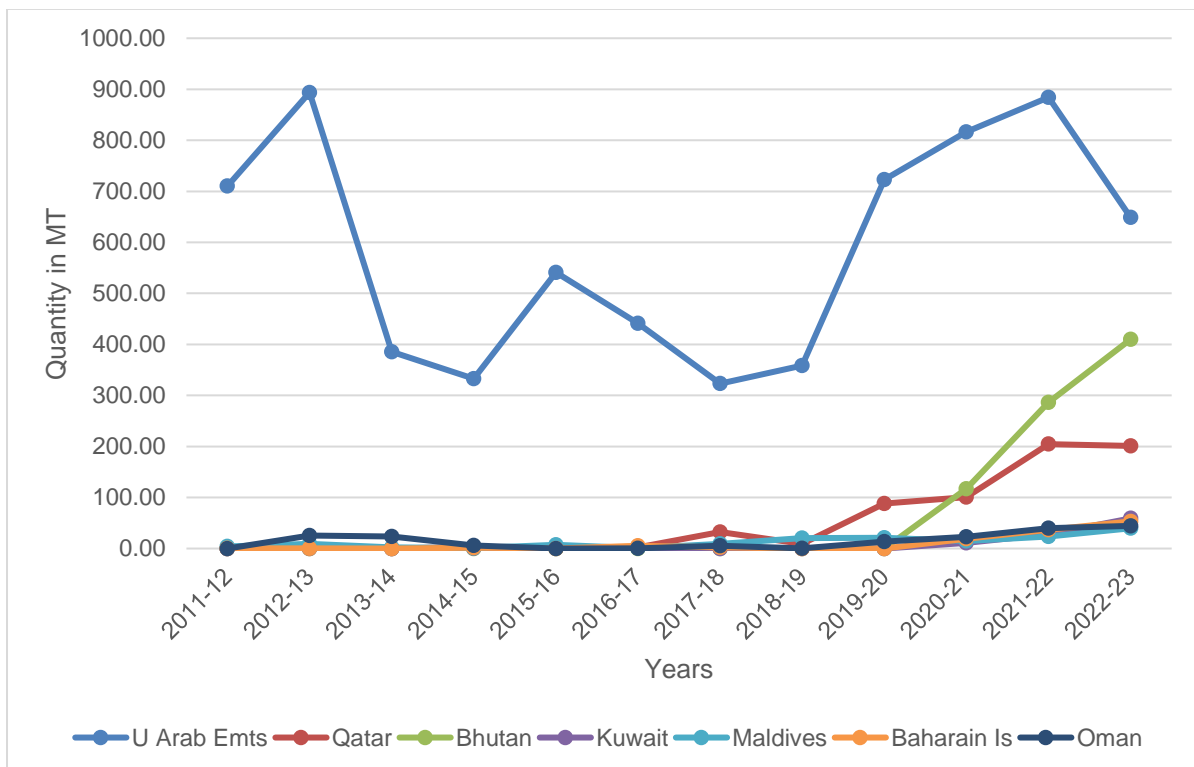


Fig. 1. Growth rate of export performance of gherkins (Fresh/chilled) from India

Table 1. Growth in export quantity of gherkins (Fresh/Chilled) from India (Quantity in mt)

Maket/ Year	United Arab Emirates	Qatar	Bhutan	Kuwait	Maldives	Baharain Is	Oman	Others	Total
2011-12	710.21	0.00	0.00	0.00	4.28	0.31	0.00	176.12	890.92
2012-13	893.72	0.00	0.00	0.16	9.29	0.15	25.29	56.36	984.97
2013-14	385.64	0.00	0.00	0.00	2.11	0.00	23.28	693.13	1104.16
2014-15	333.06	3.71	0.00	0.33	0.86	1.55	5.76	870.86	1216.13
2015-16	541.02	0.22	0.00	3.01	7.37	0.00	0.00	24.23	575.85
2016-17	441.47	2.51	0.00	1.75	0.84	5.21	0.30	36.79	488.87
2017-18	323.20	32.18	0.00	0.02	9.07	2.04	5.21	220.39	592.11
2018-19	358.46	9.32	0.00	0.00	20.61	0.00	0.06	37.77	426.22
2019-20	723.14	88.29	0.00	0.00	21.04	0.00	13.48	685.01	1530.96
2020-21	816.47	100.84	117.32	11.07	14.84	18.90	23.25	51.98	1154.67
2021-22	883.88	204.55	286.65	27.99	23.56	36.52	39.94	164.33	1667.42
2022-23	649.20	201.00	410.00	59.02	39.68	53.16	44.38	66.35	1522.79
Mean	588.29	53.55	67.83	8.61	12.80	9.82	15.08	256.94	1012.92
CAGR	2.30 ^{NS}	80.03 ^{**}	69.23 ^{**}	44.83 ^{NS}	26.83 ^{NS}	54.00 ^{**}	16.83 ^{NS}	-5.88 ^{NS}	4.06 ^{NS}
CV (%)	37.05	145.67	203.12	207.45	91.25	178.86	105.81	119.44	42.40
CDVI	37.99	70.38	138.29	172.82	71.24	99.24	107.08	123.39	42.35

Note: ^{**}Significant at 1 per cent probability level, ^{NS}- Non-Significant

Table 1 presents growth rate of exports of gherkins (fresh/chilled) to major destinations for the study period. It is clear from the table that, among the top seven countries, United Arab Emirates (UAE) was importing more quantity followed by Bhutan, Qatar, Kuwait, Baharain IS, Oman and Maldives. The results indicated that there is a huge demand for Indian Gherkins (fresh/chilled) in the international market. All the countries studied showed positive growth rate over the years which may be due to quality of Indian gherkins or less prices as compared to other gherkins producing countries in the world.

The UAE (2.30) consistently maintains the highest market share across the years, indicating its robust and dominant position in the region's markets. The UAE's strategic location, business-friendly policies and modern infrastructure likely contribute to its sustained market leadership. Qatar exhibits significant fluctuations in its market share with a remarkable Compound Annual Growth Rate (80.03) and high Coefficient of Variation (CV). Bhutan also demonstrates considerable variability in its market share, with a notable CAGR (69.23) and high CV (203.12). Relative political stability and security in the region, compared to other parts of the Middle East, have contributed to investor confidence and business continuity, supporting steady

market shares in countries like the UAE and Oman. Bilateral and multilateral trade agreements have facilitated cross-border trade and investment, enabling countries to expand their market shares through increased access to foreign markets and diversified export opportunities [6-8].

3.2 Growth in Export Quantity of Gherkins (Provisionally Preserved) from India

The results in Table 2 and Fig. 2 shows the growth rate and instability in export gherkins (Provisionally preserved) in India for the period from 2011-12 to 2022-23. The gherkins export (Provisionally preserved) has increased from 73,709.33 MT in 2011-12 to 1,00,732.73 MT in 2022-23 with an average quantity of 81,239.97 MT. The Compound Annual Growth Rate (CAGR) of overall export (Provisionally preserved) of gherkins in quantity terms for the period 2011-12 to 2022-23 was 4.04 per cent per annum which was significant at 1 per cent probability level and the co-efficient of variation was found to be 18.28 per cent [9]. The Cuddy-Della Valle Instability index for overall export (Provisionally preserved) of gherkins from India was found 13.13, which indicates moderate level of instability.

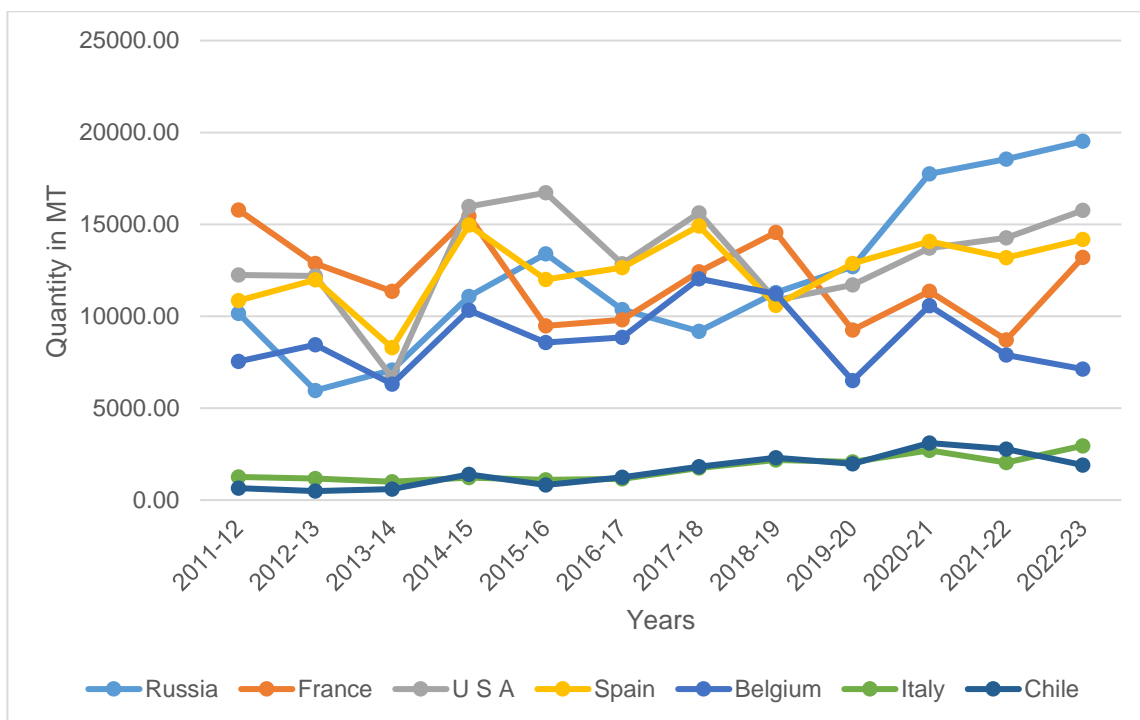


Fig. 2. Growth rate of export performance of gherkins (Provisionally preserved) from India

Table 2. Growth in export quantity of gherkins (Provisionally Preserved) from India (Quantity in mt)

Market/ Year	Russia	France	U S A	Spain	Belgium	Italy	Chile	Others	Total
2011-12	10155.77	15784.19	12253.73	10847.93	7539.64	1251.38	646.70	15229.99	73709.33
2012-13	5964.95	12874.06	12201.88	11979.17	8457.41	1162.40	488.67	11874.83	65003.37
2013-14	7076.96	11356.82	6675.80	8289.66	6311.26	996.72	590.76	10309.81	51607.79
2014-15	11078.07	15459.67	15974.12	14955.21	10333.40	1224.26	1388.56	17018.27	87431.56
2015-16	13398.34	9471.62	16718.12	12007.92	8565.98	1107.56	820.33	13322.34	75412.21
2016-17	10369.77	9806.59	12850.73	12651.19	8854.24	1152.57	1245.09	14744.65	71674.83
2017-18	9178.84	12420.36	15619.68	14911.13	12042.68	1752.96	1816.70	22186.11	89928.46
2018-19	11285.74	14561.34	10878.16	10583.48	11223.80	2184.76	2307.70	26790.01	89814.99
2019-20	12707.05	9247.66	11714.81	12874.90	6493.18	2081.73	1973.76	19658.67	76751.76
2020-21	17741.92	11361.89	13710.24	14080.61	10567.13	2698.00	3103.25	28431.39	101694.43
2021-22	18556.92	8714.16	14259.24	13194.05	7895.19	2044.90	2779.30	23674.41	91118.17
2022-23	19521.31	13204.37	15770.01	14176.15	7129.12	2954.93	1908.90	26067.94	100732.73
Mean	12252.97	12021.89	13218.88	12545.95	8784.42	1717.68	1589.14	19109.04	81239.97
CAGR	8.71**	-2.25 ^{NS}	2.32 ^{NS}	2.32 ^{NS}	0.41 ^{NS}	9.75**	16.79**	8.17**	4.04**
CV (%)	35.68	20.32	21.16	15.65	21.37	38.98	54.90	32.59	18.28
CDVI	21.30	19.52	20.93	14.33	22.36	19.11	26.43	19.00	13.13

Note: **Significant at 1 per cent probability level, NS- Non-Significant

Russia shows a consistent growth trend over the years, with a Compound Annual Growth Rate (CAGR) of 8.71 per cent which was significant at one per cent probability level. This indicates a healthy expansion of its market. France, on the other hand, demonstrates a slightly negative CAGR of -2.25 per cent, suggesting stagnation or decline in its market size [10-12]. The USA has a positive but modest CAGR of 2.32 per cent, indicating stable growth. Spain also shows a similar CAGR as the USA, suggesting a stable market size. Italy and Chile exhibit significant growth rates, with CAGRs of 9.75 per cent and 16.79 per cent respectively, indicating potentially lucrative markets. Belgium, despite having a positive CAGR, shows relatively slower growth compared to other countries. The result aligns with Indhushree and Kuruvila, 2019.

Coefficient of Variation (CV) measures the variability of market sizes. A higher CV indicates greater volatility. Belgium has the highest CV, suggesting its market is more volatile compared to others. Spain has the lowest CV, indicating relative stability in its market size. CDVI measures the dispersion of the data points. A higher CDVI implies more dispersed data. Again, Belgium stands out with the highest CDVI, indicating greater variability in its market size.

The export performance of gherkins provisionally preserved was influenced by evolving consumer preferences, dietary habits and culinary trends worldwide. Market trends such as the increasing demand for convenience foods, growing interest in healthy and natural products, and rising popularity of international cuisines drive the demand for gherkins. Factors such as product quality, price competitiveness, distribution networks and branding influence the market share of gherkins exporters.

Export performance is also influenced by trade policies, tariffs, regulations and sanitary and phytosanitary standards imposed by importing and exporting countries. Adopting sustainable agricultural practices, promoting responsible sourcing and ensuring transparency and traceability in the supply chain enhanced the marketability and competitiveness of gherkins exports from India.

3.3 Growth in Export Quantity of Gherkins (Prepared/Preserved by Vinegar) from India

The Table 3 and Fig. 3 presents the export performance of gherkins (provisionally preserved

by vinegar) to selected countries in quantity terms from 2011-12 to 2022-23. Total exports of gherkins (provisionally preserved by vinegar) in quantity terms have shown fluctuations over the years across the selected countries. While some countries have experienced consistent growth, others have witnessed fluctuations and even declines in export quantities.

The USA has shown a slight increase in export quantities, with a Compound Annual Growth Rate (CAGR) of 2.37 per cent. This indicates a relatively stable export performance in terms of quantity. Germany, Canada and Australia, these countries also demonstrate modest growth rates, with CAGRs ranging from 2.28 per cent to 3.07 per cent. The export quantities of gherkins (provisionally preserved by vinegar) from these countries have remained relatively steady over the years. Both France and the Netherlands show negative growth rates, with CAGRs of -4.79 per cent and -4.81 per cent respectively.

This suggests a decline in export quantities from these countries over the period under consideration. The category of "Others" shows a significant negative CAGR of -10.70 per cent, indicating a notable decrease in export quantities from these countries over time. The mean export quantity provides an average benchmark for assessing the overall export performance across the selected countries. The mean value indicates the total average quantity of exports over the period. The Coefficient of Variation (CV) measures the variability of export quantities across countries. Higher CV values imply greater variability. Notably, France and "Others" exhibit the highest variability, suggesting fluctuations in their export quantities. The CDVI indicates the dispersion of data points around the mean export quantity. Higher CDVI values imply more dispersed data. France and Netherland show relatively higher CDVI values, indicating greater variability in export quantities compared to other countries.

The overall export performance of gherkins (provisionally preserved by vinegar) in quantity terms reflects varying trends and dynamics across different countries. Stable or modest growth rates in export quantities suggest consistent demand or market stability for certain countries, such as the USA, Germany, Canada and Australia. Negative growth rates and higher variability in export quantities for countries like France and the Netherland may indicate

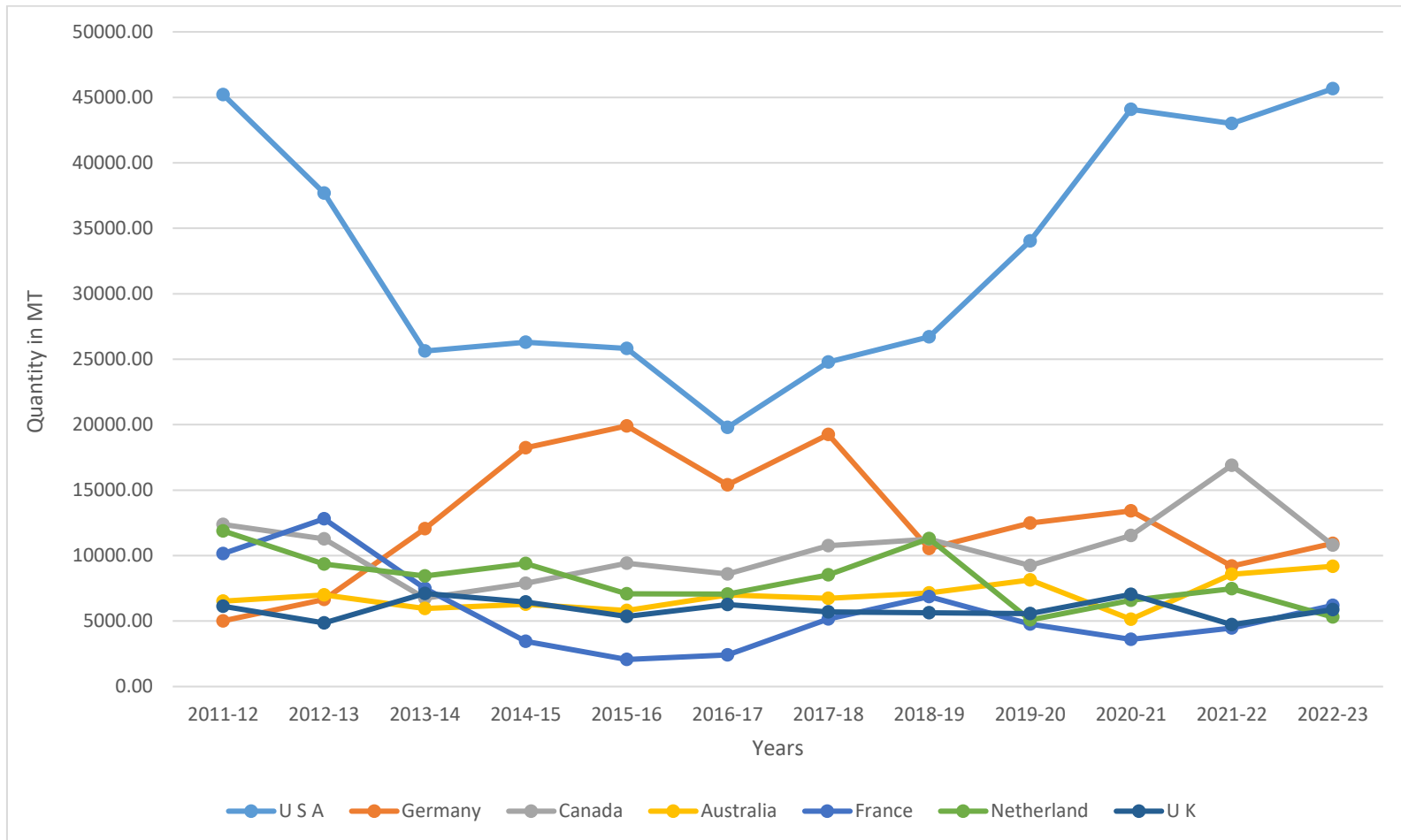


Fig. 3. Growth rate of export performance of gherkins (Provisionally preserved) from India

Table 3. Growth in export quantity of gherkins (Prepared/Preserved by Vinegar) from India (Quantity in mt)

Maket/ Year	U S A	Germany	Canada	Australia	France	Netherland	U K	Others	Total
2011-12	45211.42	5018.11	12376.24	6524.13	10151.74	11889.25	6131.58	87591.24	184893.71
2012-13	37682.85	6659.38	11286.35	7001.19	12810.31	9361.41	4866.84	83953.18	173621.51
2013-14	25627.06	12053.02	6746.09	5968.48	7503.64	8453.49	7111.80	93678.41	167141.99
2014-15	26298.08	18225.80	7886.78	6281.18	3447.44	9399.48	6448.86	85763.79	163751.41
2015-16	25827.64	19907.79	9424.35	5799.50	2068.20	7083.60	5348.23	52082.94	127542.25
2016-17	19793.07	15397.85	8601.43	6993.55	2422.41	7071.56	6264.04	41442.22	107986.13
2017-18	24789.89	19261.29	10764.27	6742.47	5171.28	8535.02	5693.78	50052.74	131010.74
2018-19	26699.00	10537.67	11258.44	7155.35	6859.88	11292.05	5646.30	43556.19	123004.88
2019-20	34045.61	12479.59	9249.88	8141.70	4773.18	5086.83	5567.64	33246.73	112591.16
2020-21	44074.18	13423.40	11545.36	5140.88	3612.92	6589.43	7044.67	30390.27	121821.11
2021-22	42996.71	9201.74	16899.73	8583.19	4477.85	7465.80	4725.75	32052.49	126403.26
2022-23	45654.39	10934.53	10793.10	9183.90	6191.14	5320.85	5877.30	33011.06	126966.27
Mean	33224.99	12758.35	10569.34	6959.63	5790.83	8129.06	5893.90	55568.44	138894.54
CAGR	2.37 ^{NS}	3.07 ^{NS}	2.64 ^{NS}	2.28 ^{NS}	-4.79 ^{NS}	-4.81 ^{NS}	-0.51 ^{NS}	-10.70 ^{**}	-3.77 ^{**}
CV (%)	28.50	37.31	24.56	16.98	54.88	26.15	12.77	44.66	18.70
CDVI	28.60	37.79	23.64	15.57	54.44	20.35	13.26	16.90	17.53

Note: ^{**}Significant at 1 per cent probability level, NS- Non-Significant

challenges or shifts in market demand and competitiveness.

4. CONCLUSION

Gherkins (*Cucumis anguria*), also known as bur gherkins or West Indian gherkins, are annual trailing vines belonging to the gourd family, prized for their edible fruit. Native to Southern Africa, gherkins thrive in warm climates and are primarily cultivated in Karnataka, Tamil Nadu and Andhra Pradesh in India. India dominates the global gherkins market as the largest producer and exporter, contributing significantly to agricultural exports. With a production concentrated mainly in Karnataka, Tamil Nadu, Andhra Pradesh and Telangana, India accounted for 15 per cent of global production and 25-27 per cent of global exports in recent years, earning approximately \$223 million in 2020-21 (APEDA). The sector engages around 90,000 small and marginal farmers across 65,000 acres, with production yields averaging 7.43 metric tonnes per acre per crop. Gherkins are primarily exported to over 20 countries, including major markets like the USA, European nations and Australia (APEDA). The study was purely based on secondary data. For the study of export performance of gherkins in quantity terms from India. The secondary data pertaining to the export of gherkins from India were collected from Agricultural and Processed Food Products Export Authority (APEDA), Directorate General of Commercial intelligence and statistics (DGCIS) websites and other published sources. The Compound Annual Growth Rate, Coefficient of Variance and Cuddy Della Valley Instability Index were employed to analysed the data.

The export performance of Indian gherkins across different categories—fresh/chilled, provisionally preserved and preserved by vinegar—reflects a nuanced landscape of growth and stability from 2011-12 to 2022-23. Fresh/chilled gherkins saw a modest Compound Annual Growth Rate (CAGR) of 4.06 per cent, although statistically non-significant, indicating a steady albeit slow increase in export quantities. The sector exhibited moderate instability with a Cuddy-Della Valle Instability index of 42.35, pointing to fluctuations in market demand. The United Arab Emirates emerged as the leading importer, consistently maintaining a significant market share. Meanwhile, provisionally preserved gherkins demonstrated a more robust growth trajectory with a notable CAGR of 4.04

per cent which was significant at one per cent probability level and lower instability (CV of 18.28%), suggesting stable demand and performance. Russia stood out with a strong growth rate, while markets like France showed stagnation. In the category of gherkins preserved by vinegar, export quantities varied across countries: the USA and Germany maintained stable growth rates, whereas France and the Netherlands experienced declines.

Overall, these insights highlight the need for strategic market interventions to capitalize on stable growth areas and address challenges in fluctuating markets, ensuring India's sustained competitiveness in the global gherkins trade. The export performance of Indian gherkins underscores the importance of understanding international market dynamics, consumer preferences and economic factors influencing trade. While certain markets show stable growth and demand, others exhibit volatility and fluctuating export quantities. Strategic measures such as enhancing product quality, competitive pricing and navigating regulatory frameworks will be crucial for sustaining and expanding India's footprint in the global gherkins market. Future research and policy initiatives should focus on addressing market-specific challenges and leveraging opportunities to further strengthen India's position as a leading exporter of gherkins worldwide.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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