



INTEGRATION OF JAGGERY WITH ELECTROLYTE: NUTRITIONAL POTENTIAL AND EXPORT OUTLOOK OF JAGGERY

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Abstract: This study examines the significance of jaggery as a natural sweetener with notable health attributes, particularly its role as a potential source of electrolytes in daily consumption. This research is mainly focused on analysing the production and trade pattern of jaggery and confectionery, as well as secondary data on export value are used to understand the historical trade trends and market results. Using the statistical analysis and linear regression method, study projects the future export trend of jaggery and confectionery for the upcoming years. The findings highlight the growing demand and potential market opportunities for jaggery based products. And overall, this study provides insights into the future growth prospects of jaggery.

Keywords: Jaggery, Electrolytes, Jaggery Confectionery, Export Trends, Secondary Data Analysis, Linear Regression, Market Growth.

1.1 INTRODUCTION

Jaggery is a traditional natural sweetener widely used in India and is considered to have several medicinal and nutritional benefits. It also contains health benefits as well as many other minerals with rich content like calcium, phosphorus, and magnesium. Electrolyte, which is one of the major elements for oral rehydration, also helps in maintaining proper supplements in your body for hydration. The increasing demand for natural and functional food products has encouraged the development of healthier alternatives to synthetic energy and hydration drinks. So, integrating jaggery with electrolyte ingredients offers an encouraging solution that combines traditional nutrition with modern hydration needs. India's strong production of sugarcane and jaggery provides a significant opportunity for developing innovative health-oriented products with export potential. Therefore, this study focuses on the integration of jaggery and electrolytes while analyzing the market outlook and export trends of jaggery in the global market.

Jaggery is available in different types based on its source and method of preparation. Sugarcane Jaggery (Cane Gur) is the most popular and widely used form of jaggery. It is made by boiling sugarcane juice until it solidifies and is available in blocks, powders, or liquid forms. It has a golden brown to dark brown color depending on its purity. Date Palm Jaggery (Khajur Gur) is harvested from the sap of date palm trees during winter and is considered a delicacy in East India and Bangladesh. It has a soft texture, mild sweetness, and a slight hint of smokiness. Coconut Jaggery is produced from the sap of coconut palm flowers and is known for its dark color and deep, earthy flavor. It is commonly used in South Indian and Goan cuisine. Palm Jaggery (Taal Gur) is derived from the palmyra palm tree and is rich, dark, and dense in texture. Compared to cane jaggery, it is less

sweet but considered more nutritious.

Electrolytes are substances that conduct electricity when dissolved in water and are important for several body functions. They help maintain proper hydration, transmit nerve impulses, and regulate the body's pH levels. Electrolytes are found in many foods and drinks such as fruits, vegetables, sports drinks, and electrolyte supplements. They also help maintain fluid balance in the body, as water is the main component of blood and electrolytes help retain water in the body's cells and tissues. Sodium, potassium, and chloride are the main electrolytes that support this balance.

Pink Himalayan salt contains small amounts of minerals like calcium, magnesium, and potassium, which give it its pink colour. These minerals are present only in small quantities, so their health benefits are limited. However, like regular salt, it provides sodium, which helps maintain hydration and supports nerve and muscle function. Because of this, it can be useful for people who sweat heavily, such as athletes, as it helps maintain fluid levels in the body.

The health attributes and the mineral composition of jaggery are given below in tabular format.

Table 1: HEALTH ATTRIBUTES AND MINERAL COMPOSITION OF JAGGERY

S.NO	HEALTH ATTRIBUTES	MINERAL COMPOSITION
1	Nutrient Content	Iron, Mg, Ca, K, Zn, Cu, vitamins, proteins
2	Antioxidant Capacity	High: phenolics, flavonoids, antioxidants
3	Digestive Function	Enhances enzyme secretion, relieves constipation
4	Detoxification	Assists the liver by binding toxins
5	Anemia Prevention	High iron content supports hemoglobin
6	Energy Release	Gradual, steady (complex sugars)
7	Immunity	Supports via minerals/vitamins
8	Electrolyte Balance	Potassium content beneficial
9	Glycemic Index (GI)	84-84.4 (High)
10	Suitability for Diabetics	Not recommended (high GI)

(magnascientiapub.com)

1.2 OBJECTIVE OF THE STUDY

The study focuses on analyzing the growth potential and overall development of the jaggery industry. It examines the health attributes of jaggery and evaluates the role of electrolytes in daily hydration and normal lifestyle usage. The study also aims to identify a suitable combination of jaggery with electrolytes as a value-added product. In addition, it analyses the export performance of jaggery and confectionery from 2014 to 2025 and projects the future export trend from 2026 to 2035. Overall, the framework helps in understanding the increasing demand, market opportunities, and future growth prospects of jaggery.

1.3 REVIEW OF LITERATURE

Anand Mahendra (2023) explains that electrolytes such as sodium, potassium, and calcium are minerals essential for conducting electricity, which helps regulate hydration, nerve signalling, and muscle movement. They also support fluid balance across cell membranes and help stabilize pH, thereby ensuring proper biological function. Imbalances from dehydration or excessive sweating can cause symptoms from muscle cramps to heart problems. While these minerals are vital, sodium intake should be controlled to prevent hypertension, and foods high in potassium are beneficial for cardiovascular health. Consuming a balanced diet that includes fruits, vegetables, and dairy provides minerals that support systemic homeostasis. To replace lost nutrients and promote overall health, staying well-hydrated with water or electrolyte drinks is most effective.

Dong-Hun Choi., Joon-Yong Cho. (2021) investigated how an electrolyte drink compares to plain water in ten healthy men during intense exercise. Participants drank 250 mL of fluid before and after working out. The study tracked body composition, water-regulating hormones, and serum lactate levels. Results showed that the electrolyte drink significantly improved water retention and maintained higher intracellular and extracellular water levels than plain water. Although ADH and aldosterone levels didn't differ much, sodium levels were more stable with the electrolyte supplement. Additionally, serum lactic acid was lower in the electrolyte group, indicating faster recovery from fatigue. These findings support the use of electrolyte drinks over water to improve balance and athletic performance.

Er. PD Ukey., VM Ingale., & SB Wategaonkar. (2023) state that jaggery is a traditional Indian sweetener produced by heating and concentrating sugarcane juice without using chemicals. With increasing awareness about healthy food, consumers are showing greater interest in natural and nutrient-rich products like jaggery. It contains essential nutrients such as proteins, vitamins, and minerals and is known for benefits like improving digestion, purifying blood, enhancing metabolism, and helping prevent certain respiratory problems. Therefore, improving product quality and reducing production costs are necessary to strengthen the industry. The development of value-added jaggery through nutritional fortification and improved processing technologies can increase its export potential and market value. Researchers and institutions are currently working on advancements in jaggery processing, preservation, storage, and packaging to support the growth of the industry.

Gurpreet Dhillon., Amardeep Kour., Navjot Gupta. (2025) emphasizes the use of jaggery as a natural sweetener in osmotic dehydration to enhance food quality and nutrition. Process parameters, including temperature, concentration, and time, were optimized to maximize water loss, nutrient retention, and colour. Jaggery-treated papaya demonstrated higher levels of phenolics and lycopene compared to honey-treated samples. Solar drying further improved the quality of these papaya cubes. The pear candy study employed jaggery as a pre-treatment before drying to extend shelf life. Optimized conditions promoted water loss while preventing excessive solute absorption. Jaggery-based pear candy contained more minerals than those made with sucrose, and consumer acceptability was greater for jaggery products. Overall, jaggery is a promising, healthier alternative to refined sugar in food processing.

Pavitra Chakravarty., Nagpal., Rahul Malve., Harshad Patil., Amol. (2025) highlights the role of oral electrolyte supplements in treating paediatric non-diarrheal illnesses such as fever, RTIs, and dengue. The study, involving more than 55,000 patients, reports that ready-to-drink solutions such as ORSL and ORSL Plus are commonly prescribed for symptoms such as fatigue and vomiting. Patients who received oral electrolytes had a higher rate of RTI resolution (57.35% vs 48.57%) and experienced a faster fever resolution. The findings advocate including electrolyte and energy formulations to address fluid deficits and enhance recovery, and recommend updating paediatric guidelines to expand oral rehydration therapy beyond diarrheal illnesses.

1.4 SOURCE OF DATA

The study is based on secondary data collected from reliable online sources. The required data for the research has been gathered from the Agricultural and Processed Food Products Export Development Authority of India (APEDA), which provide relevant statistical information related to jaggery production, export, and related agricultural data. These sources were used to obtain historical data required for analysis and for forecasting the future export trends of jaggery and confectionery.

1.5 RESEARCH METHODOLOGY

The research examines the export of jaggery from India to top different countries in the 2024 - 25. In addition, the study analyses the export value of jaggery and confectionery in USD to estimate future export performance. Using the linear regression method, the paper projects the export value of jaggery and confectionery for the next ten years.

1.6 EXPORT ANALYSIS

Analyzing the data for which the jaggery and confectionery is exported to top different countries from India in the year (2024 -25) and mainly presenting the export data of jaggery and confectionery from (2014 - 25).

Table 2 : EXPORT OF JAGGERY FROM INDIA TO TOP DIFFERENT COUNTRIES (2024 - 2025)

COUNTRY	VALUE IN (USD MILLION)	%	QUANTITY IN (METRIC TONNES)	%
INDONESIA	33.13	17.46	63877.59	26.37
USA	29.68	15.64	23826.97	9.84
UAE	20.81	10.97	20258.32	8.36
NIGERIA	20.8	10.96	22605.41	9.33
NEPAL	18.08	9.53	34707.59	14.33
TANZANIA	16.61	8.75	21888.13	9.04
CAMEROON	14	7.38	13635.9	5.63
KENYA	13.32	7.02	20955.12	8.65
CONGO	12.13	6.39	12062.68	4.98

CANADA	11.19	5.90	8428.84	3.48
TOTAL	406.84	100.00	242246.55	100.00

(apeda.gov.in)

Table 2 presents the exports of jaggery from India to different countries during the year 2024–25. It highlights the major countries that import jaggery from India in the given period. Among the countries across the globe, USA, UAE, Nigeria, Nepal, Tanzania, Cameroon, Kenya, Congo, and Canada are identified as the top importers of jaggery from India. These countries play an important role in the international trade of jaggery.

The export data clearly shows the demand for Indian jaggery in these markets. During the year 2024–25, India exported jaggery to these countries with a total export value of 189.75 USD million. The total quantity exported during this period is recorded as 242246.55 million tonnes. This information reflects the presence of Indian jaggery in different international markets. It also indicates the importance of these countries in the export trade of jaggery. Overall, the data explains the major export destinations of jaggery from India in the year 2024–25.

Table 3: EXPORTS OF JAGGERY AND CONFECTIONERY (2014 - 2025)

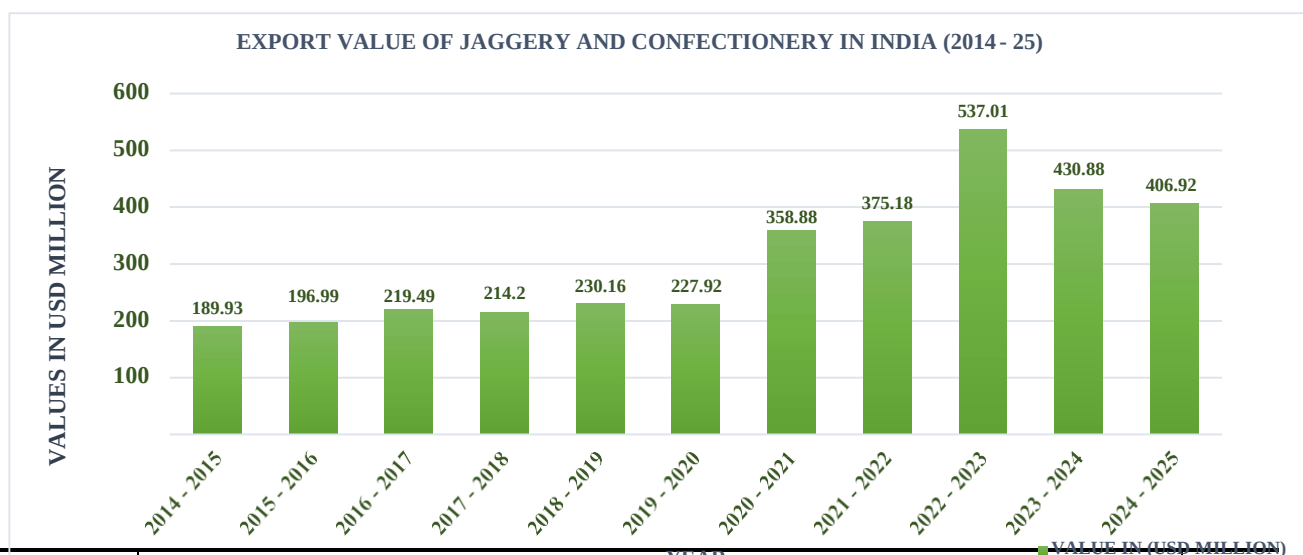
YEAR	QUANTITY IN (MT)	%	VALUE IN (USD MILLION)	%
2014 - 2015	2,58,252.73	5.51	189.93	5.61%
2015 - 2016	2,92,841.25	6.25	196.99	5.82%
2016 - 2017	2,97,680.57	6.35	219.49	6.48%
2017 - 2018	2,52,142.85	5.38	214.2	6.32%
2018 - 2019	3,13,869.81	6.69	230.16	6.79%
2019 - 2020	3,41,155.34	7.28	227.92	6.73%
2020 - 2021	6,31,895.81	13.48	358.88	10.59%
2021 - 2022	5,51,716.73	11.77	375.18	11.08%
2022 - 2023	7,61,640.19	16.24	537.01	15.85%
2023 - 2024	5,16,746.16	11.02	430.88	12.72%
2024 - 2025	4,71,057.30	10.05	406.92	12.01%
TOTAL	46,88,998.74	100.00	3387.56	100%

(apeda.gov.in)

Table 3 presents, from 2014 to 2025, the percentages of the quantity and value of exports, respectively. Exports increased steadily in both quantity (2.58 to 2.97 lakh MT) and value (189.93 to 219.49 USD million). A slight decline occurred in 2017-2018, but exports recovered again by 2018-2020 with moderate growth.

A major rise is seen in 2020 - 2021, where quantity increased to 6.31 lakh metric tonnes (13.48%) and value to 358.88 USD million (10.59%). The peak was reached in 2022-2023 with the highest quantity of 7.61 lakh metric tonnes (16.24%) and export value of 537.01 USD million (15.85%). After this, exports slightly declined in 2023 - 2025 but remained higher than in earlier years. Overall, the key highlight is the strong growth after 2020, the slight increase in 2022 - 2023, and a mild correction afterward, with total exports of 46.88 lakh metric tonnes valued at 3387.56 USD million over the period.

Chart 1: SHOWING THE EXPORT OF JAGGERY AND CONFECTIONERY IN VALUES (USD) MILLION



With the help of table and chart of export data of jaggery and confectionery (2014 - 2025) the trend projection can be calculated using the linear regression method

1.7 TREND ANALYSIS AND INTERPRETATION

Trend analysis for future jaggery export is by calculating and studying the export data from previous years to better understand the increase or decrease of exports over time. The exports of jaggery and confectionery seem to be on a growing path from the year 2015 - 2025.

Ten years of data from 2015 - 2025 and the value from 189.93 to 406.92 USD million, and the export value of jaggery and confectionery is summed up with a total of 3387.56 USD million. It is clearly notable that there is a continuous increase in the value of jaggery export from 2015 to 2023 which denotes a high possibility of demand for the jaggery and confectionery. Using the linear regression method, the trend projection from 2026 - 2035 can be calculated.

Linear regression Where, $Y = a + b(X)$

From the above given equation, we calculate the intercept value (b) and slope value (a). To determine the value of (b), we take the total XY value and dividing it by X^2 value, and we get the intercept value of 31.125. To determine the value of (a), we take the total export value of jaggery and dividing it by the total number of years given, so we get the slope value 307.96.

Table 4 : PROJECTION OF JAGGERY AND CONFECTIONERY EXPORTS FOR (2026 - 2035)

YEARS	PROJECTED VALUE OF EXPORTS
2026	494.71
2027	525.835
2028	556.96
2029	588.085
2030	619.21
2031	650.335
2032	681.46
2033	712.585
2034	743.71
2035	774.835

Table 4 shows there is a continuous increase in projected value of jaggery exports and there is a high possibility in increase and expansion of jaggery related products which has a great demand for the next ten years (2026 - 2035).

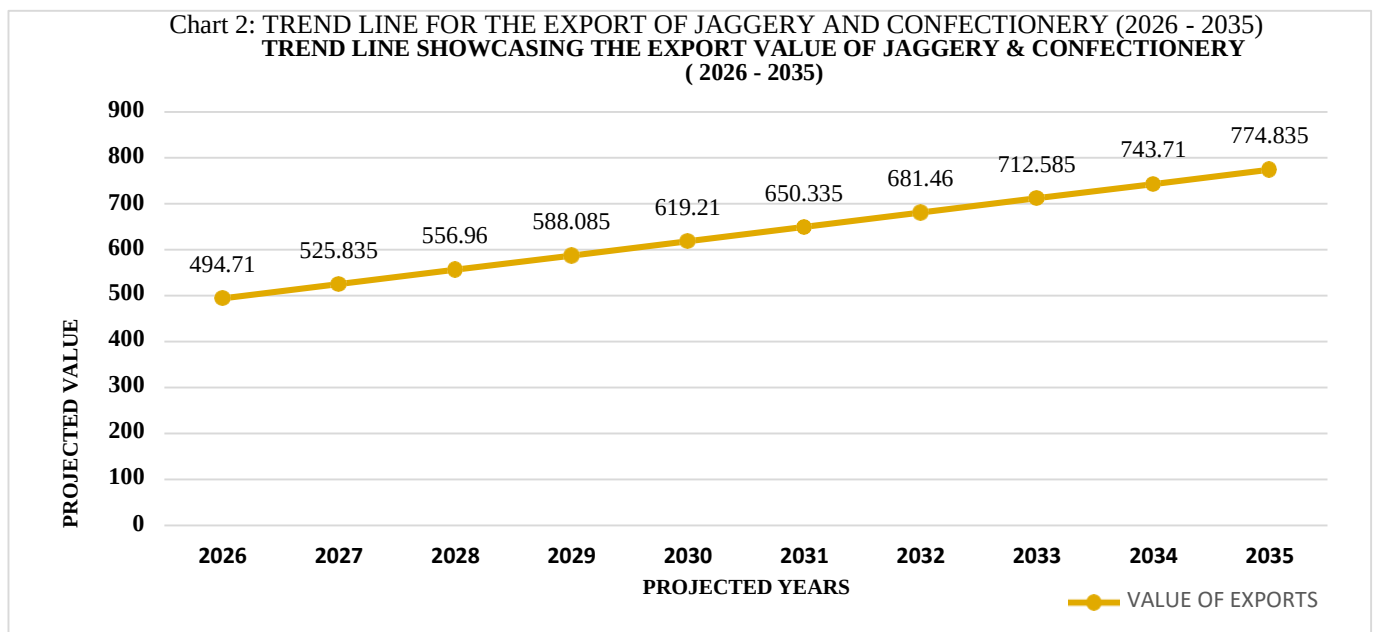


Chart 2 clearly demonstrates a rise in the projected value of jaggery exports and also results in a positive long-term growth for jaggery exports.

1.8 RESULT FROM TREND PROJECTION

In the year 2026 the projected export value of jaggery and confectionery in USD million and from that there is a continuous increase till the year 2035 with the export value of 774.835 USD million, and we can see there is a rise in trend direction which denotes an uptrend from the year 2026 - 2035. The values are significantly increasing without any decrease and fluctuation which is there are no possibility for decline and hence it shows positive growth for jaggery exports and also resulting in highly market demand for jaggery products.

1.9 CONCLUSION

The study indicates a strong and steady growth in the export of jaggery and confectionery from India over the projected period 2026 to 2035. The forecasted values show a consistent upward trend, reflecting the increasing importance of jaggery in international trade. This pattern suggests that the global market for jaggery products is expected to expand in the coming years. The continuous rise in export values also highlights the growing opportunities for production and trade. The increasing values reflect the strong potential of jaggery in the export sector. Overall, the analysis confirms a positive outlook for the future growth and market potential of jaggery exports.

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