

**Working Paper 01/2018**

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# Case of Cane - Prospects of Jaggery Sector in Bihar

## Abstract

The rising demand for sweeteners has brought focus on jaggery, an important cottage industry in economies such as Bihar for their implications on employment and income. As a traditional non-centrifugal sugar, jaggery is produced in small units using local machinery in rural areas. In Bihar, like in most parts of India, jaggery is produced conventionally through the process of heating purified cane juice by employing about 10 semi-skilled workers. The paper seeks to explore the status of jaggery sector in Bihar based on evidence gathered from published secondary sources to understand the implications of development of this sector. Agro-ecological conditions of the Gangetic plains provide ample opportunities for cultivation of sugarcane in both drought and water logging areas, which forms one of the main raw materials for jaggery production. During 2013-14, jaggery accounted for 1.95 per cent of the total value of output from agriculture and allied activities in Bihar, which was higher than that of India. The growing market for jaggery is evident in the increasing trend in retail prices during 2011-2016 in Patna market. Huge price variations exist with regard to retail prices of jaggery based on their local demand and therefore, measures by the government to stabilize prices, especially keeping in mind the welfare of its producers and consumers would benefit this sector.

Inadequate technology, infrastructure, and storage pose challenge for its production, processing and value addition. Transforming this sector, therefore, calls for efforts to strengthen agriculture-industry linkage to reap the benefits of market opportunities and technological advancements of the globalizing world. Providing government support to jaggery sector would have a two-fold effect on Bihar's economy; it would incentivize farmers towards its production and marketing while ensuring meeting the demand for nutritive sweeteners among the consumers. Jaggery sector would benefit from creation of market intelligence to make specific policy interventions.

**Keywords:** Cottage Industry, Rural Economy, Health Benefits

## 1. Introduction

Development narratives in emerging economies such as India revolve around ways to transform rural sector for the huge livelihood dependency (IFAD 2010). Despite rapid urbanization and growth in industrial and service sectors, progress of the rural economy remains central for overall socio-economic development owing to its forward and backward linkages. The liberalizing economy has brought about enhanced market and technological opportunities, thereby pushing for greater interface between the sub-economic sectors. A reallocation of factors of production from agriculture to more productive non-farm sectors would bring about the required transformation in rural-based economies (Chand, Srivastava and Singh 2017). In this regard, jaggery sector assumes importance for providing the “agriculture-industry” linkage by not only absorbing surplus labor from agriculture, but also spiraling economic activity to boost rural incomes. Fetching its main raw material from sugarcane economy, jaggery is processed in traditional small units and has wide scope for generating incomes through value addition.

Jaggery is one of the most nutritive among all sweeteners and nearly employs close to 2.5 million people in India (Madan 2004, Dwidevi 2010). About 32 per cent of the demand of total sweeteners' consumption in the country is met with jaggery and *Khandsari* mostly in rural areas (Said and Pradhan 2013). Generally referred to as the poor man's sugar, jaggery contains minerals and energy content which is used for human consumption and animal feed. As a traditional non-centrifugal sweetener, the demand for jaggery is growing in both national and international markets due to its high nutritive content and the growing awareness of ill-effects of sugar consumption. Jaggery making is one of the most important agro-processing industries in Bihar and the sub-tropical climate is conducive to cultivate sugarcane, which is also used in jaggery making. Growth of jaggery industry on a higher scale is expected to transform a large number of poor households in rural Bihar as jaggery is mostly produced on a small scale to meet the local demand. However, concerns have emerged over a lack of policy focus towards sustenance of these jaggery units. In this regard, it would be valuable to assess the status of jaggery sector in the state of Bihar.

The paper is organized into five sections. After a brief background, the second section provides an overview of sugarcane and sugar economy in Bihar followed by a discussion on the growing demand for sweeteners in the country. The third section explores jaggery

as a viable alternative for sweeteners and provides a description of its nutritive content. The next section explores jaggery sector in Bihar in detail including its production and marketing aspects. Lastly, the paper concludes with a few policy suggestions.

## 2. An Overview of Sugarcane Economy in Bihar

Sugarcane is a vital input for production of sugar, jaggery and *khandsari* and other products and is mostly grown in tropical and sub-tropical climatic conditions. Before exploring jaggery sector in Bihar, trends in production of sugarcane, which is the chief raw material for processing jaggery is discussed in this section. Sugarcane occupied nearly 4.9 million hectares in the country producing about 348.4 million tonnes during 2015-16. The tropical regions of Maharashtra, Tamil Nadu, Gujarat, Andhra Pradesh, and Odisha; and the sub-tropical regions of Uttar Pradesh, Uttarakhand, Haryana, Punjab, Bihar and West Bengal are the major sugarcane growing regions in the country. During 2015-16, the sub-tropical regions contributed to around 57.6 per cent of the total area and 53.2 per cent to total production, with an average productivity at 65.7 tonnes per hectare during 2015-16. On the other hand, the average productivity of tropical regions was higher at 78.2 tonnes per hectare contributing to about 42.5 per cent of the area and 46.8 per cent to India's total production.

The fertile Gangetic soil and agro-climatic endowments in Bihar provide ample opportunities for cultivation of sugarcane in both drought and water logging areas of the state. Table 1 presents the trends in area, production and productivity of sugarcane crop in India and Bihar for the period 2010-11 to 2015-16. In Bihar, sugarcane production increased from 134.14 lakh tonnes in 2010-11 to 181.76 lakh tonnes in 2015-16, registering a compound annual growth rate of 5.36 per cent. The average productivity of sugarcane was 68.97 tonnes per hectare in Bihar, which was slightly lower than all-India's productivity of 70.72 tonnes per hectare during 2015-16. Bihar contributed to 5.22 per cent of total sugarcane production in the country with an area of 0.26 million hectares.

Despite facing issues of water-logging and floods, the sub-tropical climate and adequate government support has enabled a good quantum of sugarcane production in the state as evident in Table 1. The provisioning of subsidy, other incentives and training to farmers towards adoption of improved variety of seeds have facilitated the increase in production. However, more attention needs to be paid to improve its yield and resistance to climatic risks to achieve higher quality of sugarcane produce.

**Table 1 : Area, Production and Productivity of Sugarcane in India and Bihar**

Period	India			Bihar		
	Area (’000 Hectare)	Production (’000 Tonne)	Productivity (Kg/Ha)	Area (’000 Hectare)	Production (’000 Tonne)	Productivity (Kg/Ha)
2010-2011	4885	342382	70091	250	13414	53740
2011-2012	5038	361037	71668	255	17746	69722
2012-2013	4999	341200	68254	274	22220	81024
2013-2014	4993	352142	70522	284	17939	63080
2014-2015	5067	362333	71511	315	21117	67040
2015-2016	4927	348448	70720	264	18176	68970
*CAGR (%)	0.17	0.37		2.74	5.36	

Note: \*CAGR denotes compound annual growth rate

Source: Ministry of Agriculture and Farmers Welfare, GOI; Department of Sugarcane, GOB

## 2.1. Sugar Economy in Bihar

Nearly 60 per cent of the total cane produced in the country is used for production of white sugar, while about 15-20 per cent is utilized for jaggery and *khandsari*, and the rest for other purposes including seed (Indian Council of Agricultural Research 2011). Sugar is one of the second largest agro-based industries, next to textiles and employs close to 5 lakh skilled and semi-skilled laborers in India (Venkatesh and Venkateshwarlu 2017). Interestingly, the price of cane is decided as per the recommendations of Commission for Agricultural Costs and Prices (CACP) based on consultations from state governments and sugar industry associations. The fair and remunerative price (FRP) and the state advised price (SAP), which is an offer price above the FRP, governs the pricing aspect of sugarcane to legally guarantee minimum price to sugarcane farmers by the sugar mills. Currently, 9 private sugar mills are in operation in Bihar and 2 new mills are being run by Hindustan Petroleum Corporation Limited (HPCL) after being handed over by the Bihar State Sugar Corporation since 2011 on a long-term lease. Most of the operating private sugar mills are located in the northern plains while sugarcane is cultivated widely across all the districts in Bihar.

In recent years, some sugar mills are partially functioning due to unresolved conflicts

between mills and farmers. Meager financial resources, obsolete machinery and technology, partial decontrol in operation of sugar mills have brought the issue of their viability in focus (Gaikwad and Jadhav 2017). The presence of multiple stakeholders in sugar industry makes it challenging to devise a viable and sustainable policy. As such, poor functioning of sugar mills, volatility in sugar prices and ill-effects of sugar consumption call for a re-orientation of policy focus towards healthier sweeteners such as jaggery.

## 2.2. Demand for Sweeteners

The estimates by the National Commission of Agriculture (1976) show that per capita requirement of sweeteners would increase to 40 kg per head per annum by 2020 A.D. in India. Table 2 shows projections of sweetener requirement in India based on a study by Nerkar (2004). Accordingly, by 2020, per capita consumption of jaggery and *khandsari* along with export is going to be 23.8 kg per annum. Evidence has shown association between high sugar intake and incidence of obesity and diabetes, especially among adolescents and young adult population (Gulati & Misra 2014). The recent surge in awareness of the negative health effects from consumption of refined sugar has consequences for alternative products of sugarcane. Therefore, this calls for a need to look beyond sugar to meet the growing demand for sweeteners in the country.

**Table 2 : Projections of Sweetener Requirement in India**

Year	Expected Population (Million)	Per Capita Expected Consumption (kg/annum)			Sweetener requirement, million tonnes including export		
		Sugar	Jaggery and <i>Khandsari</i>	Total	Sugar	Jaggery and <i>Khandsari</i>	Total
1998-99*	950	14.9	10.4	25.3	14.2	9.9	24.0
2010	1100	19.0	15.0	34.0	23.0	17.0	40.0
2020	1250	21.6	19.0	40.0	27.0	23.8	50.8

\*Actual; projected data calculated based on expected human population and per capita sugar consumption  
Source: Nerkar, Y.S (2004).



### 3. Jaggery as a Viable Alternative

An alternative use of sugarcane lies in production of a traditional product known as jaggery which is produced by evaporating sugarcane juice without separation of the molasses and crystals (Awasthi, et al. 2017). Jaggery is a concentrated product of cane juice or date palm which is highly nutritive. Jaggery is not only used as a sweetener in diet among the rural masses but also in preparation of traditional herbal medicines (Pattnayak and Misra 2004). The increasing awareness of its health benefits has accentuated its market demand thereby creating a greater scope for jaggery industry in rural areas (Dwivedi 2013). Also referred to as lump sugar, jaggery is a solid or semi-solid mass prepared using traditional crude methods while *khandsari* is obtained by modified centrifugation and lime sulphitation for juice clarification which yields sugar in crystalline form (Ghosh, Shrivastava and Agnihotri 1998). In common parlance, it is referred to as *Gur*, *Gud* in Hindi or *Bella*, *Vellam*, in southern India. Traditionally, jaggery is manufactured by cane growers in their own farm or in conventional units by small and marginal farmers in rural areas (Ghosh, Shrivastava and Agnihotri 1998). Gradually, more number of units are procuring cane from cane growers and manufacturing jaggery as an enterprise. Delayed payment by sugar mills, complex transaction mechanisms, higher price and immediate sale of cane has made cane growers favor supply of sugarcane to these jaggery units (Nath, et al. 2015).

#### 3.1 Nutritional Content of Jaggery

The nutritional content of jaggery, *khandsari* and white sugar per 100 gms is given in Table 3. Accordingly, a 100 gm of jaggery provides about 383 calories of energy, while same quantity of sugar yields higher energy of 398 calories. However, sulphur-less organic composition in jaggery helps the body to easily absorb and digest leading to a sustained release of energy in the body unlike white sugar (Shrivastav, et al. 2016). *Khandsari* produced in non-sulphur process yield better nutritive composition compared to the ones prepared in sulphur process. White sugar merely contains sucrose of about 99.5 per cent while jaggery has many nutritive sub-components to include sucrose (51.0 per cent), protein (0.25 per cent), glucose (21.20 per cent), and minerals (3.4 per cent) and smaller amounts of fats (0.02 to 0.03 per cent), calcium (0.39 per cent), vitamins (0.25 per cent) and energy calories which makes it easier to digest and a healthier option compared to white sugar (Rao, Das and Das 2007). Evidence has shown that jaggery consumption assists in

blood purification and maintenance of bone strength and prevents rheumatic afflictions, bile disorders and anemia (Sahu and Saxena 1994; Sahu and Paul 1998; Singh, Solomon and Kumar 2013). The presence of mineral salt, calcium and iron content in jaggery makes it as one of the preferred health sweeteners (Shrivastav, et al. 2016).

**Table 3 : Nutritive Value of Jaggery, *Khandsari* and Sugar per 100 gm**

Particulars	Jaggery	<i>Khandsari</i>		Sugar
		Sulphur Process	Non-Sulphur process	
Sucrose	65-85	97.5	96.0	99.5
Reducing sugars	10-15	—	—	—
Proteins (g)	0.4	—	—	—
Fats (g)	0.1	—	—	—
Total Minerals	0.6-1.0	0.05	0.2	0.05
Calcium (mg)	8	100	100	—
Phosphorus (mg)	4	—	—	—
Iron (mg)	11	—	—	—
Moisture (g)	3-10	0.3	0.5	0.2-0.4
Energy (Kcal)	383	395	388	398

Source: (J. Singh 1998)

#### 4. Jaggery Sector in Bihar

The districts of Madhepura, Bhagalpur, Banka, Gopalganj, Darbhanga, West Champaran, and Madhubani are the major jaggery producing parts in Bihar. The conversion of sugarcane to jaggery is a four step process starting from harvesting of sugarcane; extraction, purification and heating of cane juice for solidification before setting into moulds to obtain jaggery. The matured sugarcane is harvested by labor manually by chopping off the top which is usually reserved for cattle feed and rest of the cane stocks are transported to crushing units. Firstly, the cleaned sugarcane is crushed in a cane crusher, mostly driven by diesel engine and the juice is collected in a tank and pumped into a heating pan. Chemicals are added to the cane juice for purification and transferred to a

high-heat pan for boiling at a temperature of 115°C to 117°C, which yields an opaque liquid in grey or dark green in color, containing all the soluble constituents of cane (Roy 1951). The obtained jaggery is in a semi-solid state or in the shape of '*chakki*' (round shape) before it is packed in tin containers. The manufactured jaggery is stored by farmers for domestic consumption or transported to market for sale. The jaggery processing units are operated in an area of 500 square meters which require a total of 4-5 skilled workers with about 5 helpers whose total monthly wage amounts to Rs 15,000-20,000 (Uppal, Thind and Gill 2005). The small jaggery processing units provide alternative sources of income and employment to the family farmers and hired laborers .

Most of the jaggery production is seasonal, with the peak cane crushing months beginning from October-November and lasting upto February-March. The processing units work for about 5-7 months in a year. However, the market for jaggery remains round the year in both rural and urban areas, while its shelf-life is merely a couple of months. When sealed in plastic bags in cold storage units, jaggery can be preserved close to 9 months while retaining its nutritive content. Given that most of the farmers involved in jaggery making are small or marginal, jaggery is mostly stored in traditional ways such as in open, or in *matka* or gunny bags in India (Nath, et al. 2015, Shrivastav, et al. 2016). During monsoons, preserving quality jaggery while retaining its nutritive and energy content become problematic due to humidity and microbial activity; and high storage costs preventing its storage among the smaller enterprise units or among small farmers. Generally, jaggery is high on demand during winter season and is sold at the village market, sometimes even at less than remunerative prices.

#### **4.1 Production and Value of Output of Jaggery in Bihar**

There was no official database of jaggery production in the state from the government departments. Therefore, jaggery production in the state has been estimated based on discussion with the Department of Sugarcane, Government of Bihar and literature. Table 4 presents the estimated figures of jaggery production in Bihar for the period 2010-11 to 2016-17.

**Table 4 : Estimated Figures of Jaggery Production in Bihar (Million Tonnes)**

<b>Year</b>	<b>Sugarcane production</b>	<b>Weight of sugarcane utilized for jaggery production</b>	<b>Jaggery Production</b>
2010-11	13.41	1.61	0.13
2011-12	17.75	2.13	0.17
2012-13	22.22	2.67	0.21
2013-14	17.94	2.15	0.17
2014-15	21.12	2.53	0.20
2015-16	18.18	2.18	0.17
2016-17	18.24	2.19	0.18

Note: Assumed that 12 per cent of sugarcane is utilized for jaggery production; Recovery percentage for jaggery as 8 per cent

Source : Anwar Alam, 1999; Nerkar, Y.S, 2004, Rao, Das and Das 2007

Out of the total sugarcane produced in the state, 20 per cent has been assumed to be the utilization in producing jaggery and *khandsari* production, while about 45-50 per cent goes to sugar production, 20-25 per cent for seed production and 10 per cent for chewing/wastage based on discussion with Department of Sugarcane, Government of Bihar. Sucrose content of cane measured as the recovery rate for jaggery was assumed to be around 8 per cent in Bihar while manufactured in small farmer household units. Based on the estimation, jaggery production has been fluctuating over the years. In 2016-17, jaggery production in the state is estimated to be approximately 0.18 million tonnes.

Table 5 presents the value of output from jaggery across different states. Jaggery accounted for about 1.95 per cent of the total value of output from agriculture and allied activities in Bihar during 2013-14 which is higher than India's value of output at 0.94 per cent. In Bihar, the value of output from jaggery at 2011-12 prices was Rs. 1, 49,500 lakh in 2013-14 which was slightly lower than Rs. 1, 62,852 lakh in 2011-12. It decreased by 8.2 per cent between 2011-12 and 2013-14. Bihar contributed to about 7.9 per cent of India's total value of output from jaggery in 2013-14. Highest value of output of 3.56 per cent from jaggery came from Uttar Pradesh in the same period. At the all-India level, there was a substantial increase in value of output from jaggery by 21.2 per cent.

**Table 5 : State-wise Value of Output of Jaggery (2011-12 to 2013-14)**

(Rs. in Lakh)

States	2011-12	2012-13	2013-14
Andhra Pradesh	72550 (0.69)	88419 (0.79)	104549 (0.88)
Bihar	162852 (2.16)	164540 (2.04)	149500 (1.95)
Gujarat	21416 (0.14)	—	—
Haryana	24805 (0.31)	45931 (0.59)	—
Himachal Prasad	831 (0.05)	1372 (0.08)	1186 (0.07)
Jharkhand	13025 (0.44)	13154 (0.42)	13160 (0.43)
Karnataka	23054 (0.25)	—	—
Kerala	—	—	6513 (0.12)
Madhya Pradesh	692 (0.01)	—	—
Maharashtra	135638 (0.76)	—	127157 (0.66)
Odisha	713 (0.01)	4009 (0.07)	6376 (0.12)
Punjab	40196 (0.42)	50248 (0.52)	48476 (0.49)
Rajasthan	9242 (0.06)	8031 (0.05)	6230 (0.04)
Tamil Nadu	287012 (2.65)	265353 (2.72)	372124 (3.46)
Telangana	16048 (0.24)	8394 (0.12)	476 (0.01)
Uttar Pradesh	620885 (2.54)	556579 (2.17)	909474 (3.56)
Uttarakhand	35302 (2.15)	44098 (2.67)	38503 (2.41)
West Bengal	50631 (0.36)	48645 (0.34)	59197 (0.41)
Others	46946 (0.38)	47123 (0.36)	49695 (0.37)
<b>All-India</b>	<b>1561838 (0.82)</b>	<b>1345896 (0.69)</b>	<b>1892616 (0.94)</b>

Note: Figures in parentheses indicate per cent share to Total Value of Output from Agriculture and Allied Sector

Source: CSO, MOSPI, Government of India, 2016

## 4.2 Market Information of Jaggery in Bihar

Achieving price stability in agricultural markets is important not only for macroeconomic stability but also to ensure welfare of its producers and consumers. In this regard, an analysis of wholesale and retail prices of jaggery becomes important. The wholesale and retail price of jaggery in Patna market is presented in Figure 1 for the period 2011-2016. Accordingly, the retail price of jaggery was slightly higher at Rs. 38 per kg than the wholesale price (Rs. 34 per kg) during 2016. Both the wholesale and retail prices have shown an increasing trend in Patna market in the 5-year period clearly indicating the high demand for jaggery in the market.

Figure 1 : Wholesale and Retail Price of Jaggery in Patna Centre, Bihar (2011-2016)

(Rs. per Kg)



Source: Department of Agriculture and Farmer's Welfare, Government of India

An analysis of monthly wholesale price of jaggery reveals the presence of intra-year fluctuations. Table 6 presents variations in monthly price of jaggery in Patna centre for the years 2011-2016. The extent of divergence between price across months reveal that jaggery prices are generally the lowest during February to April and highest during October to December as they coincide with the peak festive season. Interestingly, both the wholesale and retail prices of jaggery have shown a similar increasing trend over the period 2011-2016 in Patna centre.

**Table 6 : Variations in Monthly Price of Jaggery in Patna Centre (2011-2016)**

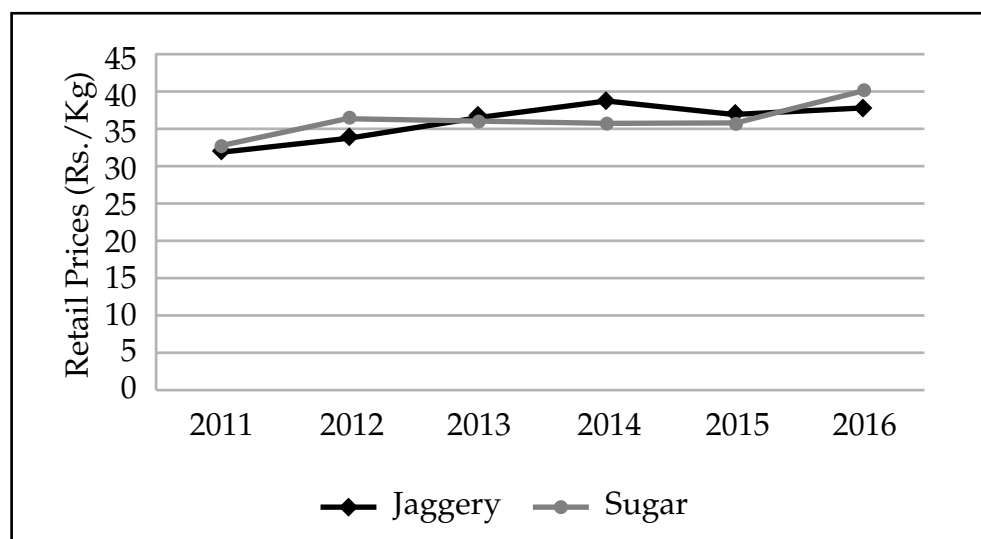
Year	Deviation of the lowest price from the highest (%)	Coefficient of Variation (%)	Month (Lowest)	Month (Highest)
2011	38.0	11.1	Feb, Mar	Sep
2012	37.4	12.0	Apr	Oct
2013	24.6	8.4	Feb	Oct, Nov
2014	20.8	5.4	Mar	Oct
2015	17.2	4.5	Dec	Sep
2016	9.5	2.4	Jan	Dec

Source: Department of Agriculture and Farmer's Welfare, Government of India.

A cursory look at the coefficient of variation shows that the deviation in highest and lowest prices was 12 per cent in 2012 and it reduced to 2.4 per cent during 2016. On an average, deviation of the lowest price from the highest price of jaggery decreased during 2016 as compared to 2011. All these point to the fact that intra-year fluctuations persist in jaggery prices which requires measures by the government to stabilize prices, specially keeping in mind the welfare of its producers and consumers.

**Figure 2 : Retail Prices of Jaggery and Sugar at Patna Centre (2011-2016)**

(Rs. per Kg)



Source: Ministry of Agriculture, Government of India

The retail prices of jaggery and sugar in Patna centre have shown mixed trends during 2011-2016 as reflected in Figure 2. In 2011, the retail prices of both commodities were overlapping while by 2016, the retail price of sugar had surged higher than jaggery in Patna market. Earlier, jaggery was seen as an alternative replacement for sweeteners in rural areas due to its low price. With rising costs of production and awareness about its nutritive content, the prices of jaggery have surged. Also, jaggery is not produced on a commercial scale despite increasing demand in urban areas resulting in high prices. Issues such as price risk, labor shortage, poor quality and lack of adequate government support towards jaggery making proves it challenging to procure cane and limits its high production (Nath, et al. 2015). Concerns have emerged over lack of adequate storage structures and packaging mechanisms which are crucial to retain the nutritive content of jaggery. Also, lack of modern technology, marketing and infrastructure facilities, labor and inherent price risk makes it challenging to get good quality cane from small traditional units (Ramaswamy, Uma and Manimegalai 1999).

## 5. Conclusion

Bihar is, undoubtedly one of the major producers of sugarcane in the country and nearly 50 per cent is used for production of sugar. The growing awareness of the harmful effects of consumption of refined sugar have brought a need to focus on alternative nutritive sweeteners such as jaggery. The palatability and high nutritive content in jaggery makes it the most sought-after sweetener. The medicinal properties and high energy content present in jaggery have enabled it to be used in herbal medicines.

In this context, Bihar holds a lot of potential in the production of jaggery in rural areas both for consumption and meeting the export demands. As an unorganised sector, it is one of the important rural-based cottage industries providing alternative sources of income. Jaggery is processed using traditional manufacturing processes in traditional units by small farmers using sugarcane as a primary raw material. Jaggery accounted for about 1.95 per cent of the total value of output from agriculture and allied activities in Bihar during 2013-14. A brief examination of the wholesale and retail prices of jaggery and sugar in Patna centre reveals not much price differentials. Poor packaging and availability of quality jaggery influence its price and demand.

Various problems bog down the development of this sector in Bihar. Lack of factors such as organized market, progressive technology, proper supply chain, research and development make it challenging to promote jaggery manufacturing in Bihar. Even



though sugarcane production is carried out in all districts of Bihar, jaggery production is mostly biased towards northern plains. No clear policy focus exists in the state regarding production or marketing of jaggery which has dire consequences for incomes of rural farmers. Inadequacies in availability of data on production, market arrival, and price of jaggery have made the process of policy making for jaggery more challenging.

However, government would need to give greater attention to jaggery production in order for it to play an important role in Bihar. There should be incentives that assure prices to sugarcane growers to sell sugarcane to jaggery producing units. Also, given that some of the sugar producing units underperform and are not financially viable, they can be encouraged to take up jaggery production to use their infrastructure and sugarcane processing capacity to manufacture quality jaggery. Since most jaggery producing enterprises are small, a cooperative arrangement which would organize the producers and offer ways to arrive at reasonable solutions for processing, packaging and marketing of jaggery would be beneficial. Sugar production has been backed by extensive research in the refinement process, marketing and packaging to consumers in attractive ways. Similarly, government could encourage research in jaggery processing, packaging and storage to offer jaggery to consumers in friendly ways and at the same time, process jaggery in a scientific manner.

Also, jaggery manufacturing needs to be streamlined to encourage ways to enhance its quality and availability to the general consumer at affordable prices while being remunerative to its producers. Jaggery needs to be promoted at the state level using awareness programs as a nutrient-rich alternative to refined sugar. Government support in terms of credit for small and medium jaggery units to buy better machinery for jaggery processing would be beneficial. Provision of storage and infrastructure support would also go a long way in preserving the nutritive content of jaggery. Creation of an organized supply chain and value addition to solid jaggery will help accentuate its demand, export potential and shelf life. Further, Bihar would benefit from creating market intelligence on data related to jaggery sector to regulate prices and make specific policy interventions.

Increased localized demand, availability of cane and its health and employment related benefits are reasons to encourage jaggery production in the state. Targeting jaggery sector would have a two-fold effect on Bihar's economy; firstly, it would enhance availability of nutritive sweetener and secondly, provide alternative sources of livelihood to the small farmers. Thus, it is evident that jaggery industry holds potential and promise in the context of meeting the demand for alternative sweeteners and contributing to the rural economy in general in Bihar.

## References

- Acharya, S.S. "Agribusiness in India: Some Facts and Emerging Issues." *Agricultural Economics Research Review* 20 (Conference Issue) (2007): 409-424.
- Anjugam, M, K Govindarajan, and Suresh D Kumar. "Value-addition of sugarcane – A case of jaggery production." *Agricultural Economics Research Review* 20 (2007): 606.
- Arya, Pankaj K, Satish Kumar, and U.K. Jaiswal. "Design Based Improvement in a Three Pan Jaggery Making Plant For Rural India." *International Journal of Engineering Research* 2, no. 3 (2013): 264-268.
- Awasthi, Vishal, et al. "Case Study of Jaggery Production at Akbarpur Ambedkarnagar." *International Journal of Agriculture Innovations and Research* 6, no. 1 (2017): 1-5.
- Bhardwaj, Amit, and Narendra Singh. *Diversion of Sugarcane to Jaggery/Gur and Khandsari Units in UP in 2012-13*. New Delhi: Indian Sugar Mills Association, 2013.
- Chand, Ramesh, S.K. Srivastava, and Jaspal Singh. *Changing Structure of Rural Economy of India: Implications for Employment and Growth*. Discussion Paper, New Delhi: National Institution for Transforming India (NITI Aayog), 2017.
- Das, B.M. Lal. "Diagnostic Study on SME-Gur/Khandsari Cluster Udakisanganj (Madhepura)." The Training Programme for the Cluster Development Agents, Organised by Unido CDP, New Delhi and The Entrepreneurship Development Institute of India, 2001.
- Das, Madhusweta, S.K. Das, and P.V.K. Jagannadha Rao. "Jaggery – A Traditional Indian Sweetener." *Indian Journal of Traditional Knowledge* 6, no. 1 (2007): 95-102.
- Dwivedi, Amit Kumar. "Case of Indian Jaggery Industry: Bhagirathi Gur Manufacturers." *Journal of Rural and Industrial Development* 1, no. 1 (2013): 1-4.
- Dwivedi, Amit Kumar, and Amodkant Mishra. "A Study on Gur (Jaggery) Industry in India." Faculty Column, 2009.
- "Financial Appraisal of Organic and Inorganic Jaggery Preparation in Bagalkot District-An Economic Analysis." *Karnataka Journal of Agricultural Sciences* 27, no. 4 (2014): 481-484.
- Gaikwad, Chandrashila, and Shweta Jadhav. "Challenges Faced by Sugarcane Mills and Farmers in India." *7th International Conference on Science, Technology and Management*. Nashik, 2017. 439-446.

Gangwar, L S, S Solomon, and S I Anwar. "Technological and Policy Options for Modernization of Jaggery Industry in India." *Indian Institute of Sugarcane Research*, 2012: 1-6.

Ghosh, Ajit K, Ashok K Shrivastava, and Virendra P Agnihotri. *Production Technology of Lump Sugar-Gur/Jaggery*. Delhi: Daya Publishing House, 1998.

Government of India. *State-wise and Item-Wise Estimates of Value of Output from Agriculture and Allied Activities*. New Delhi: Central Statistics Office, Ministry of Statistics and Programme Implementation, Government of India, 2017.

Gulati, Seema, and Anoop Misra. "Sugar Intake, Obesity, and Diabetes in India." *Nutrients* 6, no. 12 (2014): 5955–5974.

IFAD. *Rural Poverty Report 2011: New Realities, New Challenges: New Opportunities for Tomorrow's Generation*. Rome: International Fund for Agricultural Development, 2010.

Indian Council of Agricultural Research. *Vision 2030*. Lucknow: Indian Institute of Sugarcane Research, 2011.

Indian Sugar Mills Association. *Press Release: Sugar Production upto 15th February, 2017*. February 15, 2017.

Jayamala, G B, M Chowde Gowda, H N Ramya, M Shankar, and P N Krishnamma. "Prospects of Jaggery Industry in Karnataka- A Case Study." *International Journal of Applied Agricultural Research (International)* 4, no. 3 (2009): 203-214.

Joshi, P.K., Ashok Gulati, Pratap S Birthal, and Laxmi Tewari. *Agriculture Diversification in South Asia: Patterns, Determinants and Policy Implications*. MSSD Discussion Paper No. 57, Washington, D.C.: International Food Policy Research Institute, 2003.

KPMG. *The Indian Sugar Industry- Sector Roadmap 2007*, KPMG India, 2007.

Kumbhar, Yogesh Shankar. "Study on Gur (Jaggery) Industry in Kolhapur." *International Research Journal of Engineering and Technology* 3, no. 2 (2016): 590-594.

Madan, H.K., U.K. Jaiswal, J.S. Kumar, and S. K. Khanna. "Improvement in Gur/Jaggery Making Plants for Rural Areas." *Journal of Rural Technology* 1, no. 4 (2004): 194-196.

Nath, A, D Dutta, Pawan Kumar, and J P Singh. "Review on Recent Advances in Value Addition of Jaggery based Products." *Journal of Food Processing Technology* 6, no. 4 (2015): 1-4.

Nerkar, Y.S. "Present Scenario and Thrust Area for Making Sugarcane and Sugar Productivity in India." *Financing Agriculture Oct-Dec* 29 (2004).

Pattnayak, P K, and M K Misra. "Energetic and Economics of Traditional Gur Preparation:A Case Study in Ganjam District of Orissa, India." *Biomass and Bioenergy* 26 (2004): 79-88.

Ramaswamy, C, K Uma, and Manimegalai. "An Analysis of Supply: Price Relationship in Sugarcane." *Indian Journal of Agricultural Marketing* 13, no. 1 (1999): 15-24.

Rao, I.V.Y.Rama, and K Sriram. "Assessing the Performance of Jaggery Market in Andhra Pradesh State, India." *International Journal of Environment, Agriculture and Biotechnology (IJEAB)* 1, no. 4 (2016).

Rao, P.V.K. Jagannadha, Madhusweta Das, and S.K. Das. "Jaggery – A Traditional Indian Sweetener." *Indian Journal of Traditional Knowledge* 6, no. 1 (2007): 95-102.

Roy, S.C. *Monograph on the Gur Industry of India*. New Delhi: Indian Central Sugarcane Committee, 1951.

Sahu, A.P., and A.K. Saxena. "Enhanced Translocation of Particles from Lungs by Jaggery." *Environmental Health Perspective* 102, no. 5 (1994): 211-214.

Sahu, A.P., and A.P. Paul. "The Role of Dietary Whole Sugar-Jaggery in Prevention of Respiratory Toxicity of Air Toxics and in Lung Cancer." *Toxicology Letters* 95, no. 1 (1998): 154.

Said, P.P., and R.C. Pradhan. "Preservation and Value Addition of Jaggery." *International Journal of Agricultural Engineering* 6, no. 2 (2013): 569-574.

Said, Prashant Pandharinath, and Ramachandra Pradhan. "Preservation and Value Addition of Jaggery." *International Journal of Agricultural Engineering* 6, no. 2 (2013): 569–574.

Shrivastav, Priyanka, Abhay Kumar Verma, Ramanpreet Walia, Rehana Parveen, and Arun Kumar Singh (Sr.). "Jaggery: A Revolution in the Field of Natural Sweeteners." *European Journal of Pharmaceutical and Medical Research* 3, no. 3 (2016): 198-202.

Singh, Jaswant, R.D. Singh, S. I. Anwar, and S. Solomon. "Alternative Sweeteners Production from Sugarcane in India: Lump Sugar (Jaggery)." *Sugar Tech* 13, no. 4 (2011): 366-371.

Singh, Jaswanth. "Perspective for 2020 A.D. Jaggery." *Khandsari Res. Digest* 96 (1998).

Singh, S Solomon, and D Kumar. "Manufacturing Jaggery, a Product of Sugarcane, as Health Food." *Agrotechnology* S11 (2013): 1-3.

The Hindu Daily. *Jaggery Making More Profitable for Farmers*. Bangalore, November 4, 2004.

Unde, P.A., P.V. Adagale, Syed Imran Hashmi, and Abdul Raheem. "Effect of Different Particle Sizes of Jaggery Powder on Storability." *World Journal of Agricultural Sciences* 7, no. 2 (2011): 157-160.

Uppal, S.K., K.S. Thind, and R.S. Gill. "Relative performance of sugarcane genotypes for jaggery (gur) quality and storage." *Sugar Tech* 7, no. 4 (2005): 136-140.

Venkatesh, D, and M Venkateshwarlu. "An Overview of the Indian Sugar Industry." *BIMS International Journal of Social Science Research*, 2017: 11-16.

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