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JAGGERY: A REVOLUTION IN THE FIELD OF NATURAL SWEETENERS

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ABSTRACT

Jaggery is the natural sweetener which is prepared by sugarcane juice. It is available in solid, liquid & powder form. It is also called as Non centrifugal sugar (NCS) and is known by many different names in the world like Panela, Kokuto, Muscovado. The sap collected from some palm trees such as palmyra-palm (Borassus flabellifer L.), coconut-palm (Cocos nucifera L.), wild date-palm (Phoenix sylvestris Roxb.) .The methods of converting sugarcane and manufacturing sugar, gur and khandsari are different but a great value is added in the manufacturing of these consumable final products. The micronutrients which are present in Jaggery has many nutritional & medicinal aspects like its anti carcinogenic & antitoxic activity. Jaggery has proved itself better as compared to white sugar. Jaggery is known to produce heat and give instant energy to a human body. More than 70% of Jaggery is produced in India and that day is not so far when it creates a huge revolution better than sugar.

KEYWORDS: Jaggery, Sugarcane, Non centrifugal sugar.

INTRODUCTION

Jaggery is a traditional non-centrifugal cane sugar consumed in Asia and Africa. These sugars are a concentrated product of the cane juice without separation of the molasses and crystals[1] Non-centrifugal sugar (NCS) actually, is the technical name of the product obtained by evaporating the water in sugar cane juice, and is known by many different names in the world, the most important being un-refined muscovado, whole cane sugar, panela (Latin America), jaggery (South Asia) and kokuto (Japan). Jaggery, a sugar rich food product is produced and consumed worldwide under different names such as Gur/Desi (Pakistan), Rapadura (Brazil), Hakura (Srilanka) and so on.[2,3] India is world's largest producer of sugar and sugarcane. Sugarcane in India is processed in to sugar, gur and khandsari and undergoes considerable weight reduction during processing. These traditional sweeteners are natural mixtures of sugar and molasses. If pure clarified sugarcane juice is boiled, what is left (usually 65-85%sucrose)as solid is jaggery.[4] In India, of the 300 Mt of sugarcane produced, 53% is processed into white sugar, 36% into jaggery and khandsari, 3% for chewing as cane juice, and 8% as seed cane.[5]

COMPOSITION

It can vary from golden brown to dark brown in colour and contains up to 50% sucrose, up to 20% invert sugars, moisture content of up to 20%, and the remainder made up of other insoluble matter such as ash, proteins and bagasse fines. It contain all the vitamins. It is rich in important minerals (*viz.*, Calcium-40-100 mg, Magnesium-70-90 mg, Potassium-1056 mg, Phosphorus-20-90 mg, Sodium-19-30 mg, Iron-10-13 mg, Manganese-0.2-0.5 mg, Zinc-0.2- 0.4 mg, Copper-0.1-0.9 mg, and Chloride-5.3 mg per 100 g of jaggery), vitamins (viz., Vitamin A-3.8 mg, Vitamin B1-0.01 mg, Vitamin B2- 0.06 mg, Vitamin B5-0.01 mg, Vitamin B6-0.01 mg, Vitamin C-7.00 mg, Vitamin D2-6.50 mg, Vitamin E-111.30 mg, Vitamin PP-7.00 mg), and protein-280 mg per 100 g of jaggery, which can be made available to the masses to mitigate the problems of mal nutrition and under nutrition. The micronutrients present in the jaggery possess antitoxic and anti-carcinogenic properties.[6] It has moderate amount of calcium, phosphorous and zinc. Gur is high calorie sweetener and as it contains minerals, protein, glucose and fructose, it is known to be healthier in comparison to white sugar. A good quality Gur contains more than 70% sucrose, less than 10% of glucose and fructose, less than 5% minerals and less than 3% moisture.[7]

NUTRITIONAL ASPECTS OF JAGGERY

Jaggery is far complex than sugar, as it is made up of longer chains of sucrose. Hence, it is digested slower than sugar and releases energy slowly and not spontaneously. This provides energy for a longer time and is not harmful for the body. Jaggery also gathers a

considerable amount of ferrous salts (iron) during its preparation, as it is prepared in iron vessels. This iron is also good for health, particularly for those who are anemic or lack iron. Jaggery also contains traces of mineral salts which are very beneficial for the body. Mineral salts present in jaggery leaves a hint of salt on tongue. These salts come from the sugar cane juice where it is absorbed from the soil. Furthermore, jaggery is very good as a cleansing agent. It cleans lungs, stomach, intestines, oesophagus and respiratory tracts. Those who face dust in their day to day life are highly recommended to take a daily dose of jaggery. This can keep them safe from asthma, cough & cold, congestion in chest etc. Gur is known to produce heat and give instant energy to a human body. Gur is supplied to the workers for in order to protect them from dust allergies. And at the time of natural calamities, the district administration purchases Gur and distributes it to the victims for various health benefits.

Different benefits of Jaggery powder are listed as

- Rich in mineral salts
- Easy to digest
- Develops unique taste as sweetener
- Treats throat and lung infections
- Easily dissolved and balances the deficiency of sugar level
- Sulphur less Organic Composition, a best to suite as preferred health alternative.
- As a cattle feed, in distillery, medicine manufacturing unit,
- Has also found a place in confectionary items.
- Used in leather and tobacco industries.
- Used in cement industries and coalmines[6,8]

COMPARISON BETWEEN JAGGERY & SUGAR

► The first difference is the difference in color as shown in fig.1 Sugar is bright white color, whereas the color of jaggery can range from golden-yellow to golden brown or dark brown.

► Both sugar and jaggery differ a great deal in texture. While sugar crystals are solid and hard, jaggery is semi-solid, softer than sugar and also amorphous. This is because the molasses and other impurities are not removed from it, as is the case with sugar.

Fig 1. showing Sugar & Jaggery

►To make sugar, the syrup is treated to remove any unwanted particles, so that after condensation and crystallization, the product is white in color. On the other hand, in case of jaggery, there is no treatment given to the juice and it also does not undergo the crystallization process. The sugarcane juice is boiled continuously, until thick paste is formed, after which the paste is poured into molds and blocks of desired size.

► There is a difference in composition of sugar and jaggery. While sugar is made only of sucrose, jaggery is made up of predominantly sucrose, mineral salts, iron and some fiber. Hence, consumption of jaggery is recommended in case of iron deficiency.

► Even the health influences are different. Sugar is the simplest form of sucrose. It is instantly absorbed in the blood, and burst of energy is released immediately. Hence, it is not recommended for people with diabetes. Jaggery on the other hand, is made up of longer chains of sucrose, therefore, it is digested slowly, and energy release is also slow. Hence, energy is provided for a longer period of time and it not harmful for the body.

► Since jaggery is made in iron vessels, it is a rich source of iron. It acts as a cleansing agent, and cleanses the lungs, stomach, intestines, esophagus, and respiratory tracts. It aids digestion and hence is very effective in curing constipation. It is very effective in increasing the overall immunity of the body. The high potassium content in jaggery assists in weight reduction, as it prevents water retention in the body. It also increases metabolism.

It is better to consume jaggery as compared to sugar for iron content, minerals, and vitamins present in it along with sucrose. Healthy people can substitute sugar with jaggery.[9]

► Along with decreasing physical activity, sugar consumption assumes significance in view of the high tendency for Indians to develop insulin resistance, abdominal adiposity, and hepatic steatosis, and the increasing "epidemic" of type 2 diabetes (T2DM) and cardiovascular diseases.[10]

COMMENTS ON JAGGERY

1. **According to Rohini Saran, clinical dietician and consultant in nutrition research with the NIPCCD (National Institute for Public Cooperation and Child Development)**, "Jaggery is a good source of iron and cost effective as well. When we eat sugar, extra heat is utilized by the body during digestion. We also use up our calcium and potassium reserves during this process. Jaggery on the other hand is easily digested and assimilated. Jaggery is not refined, does not involve much processing and hence nutrients are preserved to some extent. It also provides body and colour to a dish."
2. **According to Sridevi Balaji, consultant dietician and specialist in sports nutrition.** "One of the biggest benefits, stemming from its rich potassium content is that it helps maintain the acid balance in

the body by reducing accumulation of acids and acetones."

3. **According to a study conducted by A.P.Sahu and A.K.Saxena (Industrial Toxicology Research Centre, Lucknow)**, jaggery was found to provide protection for workers in a smoky and dusty environment. As pollution is rampant in cities and even small towns these days, jaggery assumes importance in our diets as an effective remedy. Its anti asthmatic properties, the study found, also eases breathing difficulties. This is good news for people who are sensitive or allergic to pollutants, but are constantly exposed to it.[11]

MANUFACTURING PROCESS

Jaggery manufacturing is done on a small scale by a group of farmers. The juice is extracted from fresh sugarcane. Then it is filtered and boiled in wide, shallow iron pans with continous stirring and, simultaneously soda or bhindi juice is added in required quantity. While boiling, brownish foams come at the top which are continuously removed to get golden yellow colour of jaggery. The consistency of the juice becomes thick and then it is poured into the small to medium sized iron or aluminum cans where blocks of jaggery are formed after cooling. Size of the blocks can vary from 1 kg. to 12 kgs. Finally, these blocks are packed in gunny bags. From 100 kgs. of sugarcane, 10 kgs. of jaggery is made. The process flow chart is as under [12]

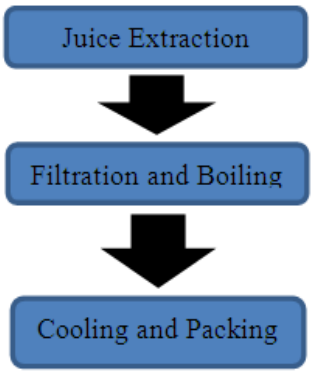

Fig.2. showing Manufacturing Process

Jaggery is produced in different forms viz., solid, liquid and powder or granular forms, which are described as.

1. Liquid Jaggery

It is that product which is obtained during concentration of purified sugarcane juice during jaggery making, and is semi liquid syrup like product as shown in fig 3. The quality of liquid jaggery largely depends upon quality and composition of cane juice, type of clarificants used, and striking temperature at which concentrating juice is collected. For quality liquid jaggery, the juice concentrate is removed from boiling pan, when it reaches striking point temperature of 103-106°C, depending upon the variety and agro-climatic zone. To avoid crystallization and to make liquid jaggery attractive in colour, citric acid is added at 0.04% (400 mg/kg of liquid jaggery), whereas to improve shelf life of liquid jaggery without deterioration in quality, potassium metabisulphite @ 0.1% (1 g/ kg of liquid jaggery), or Benzoic acid @ 0.5% (5 g/kg of liquid jaggery), is added. Liquid jaggery is then allowed to settle for period of 8-10 days at ambient conditions. Later after filtration, it is properly packaged in sterilized bottles.

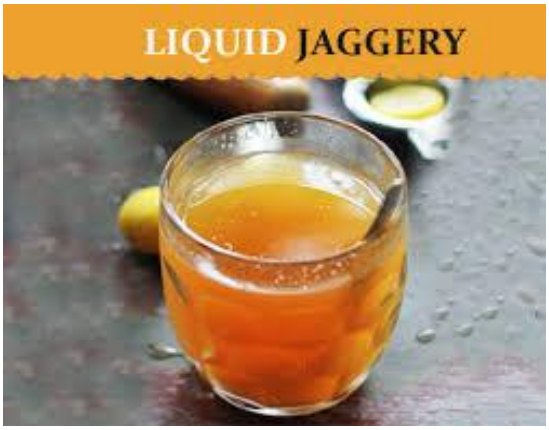

Fig.3. showing Liquid Jaggery

Chemical composition of typical liquid jaggery could be: Water 30-36%, Sucrose 40-60%, Invert sugar 15-25%, Calcium 0.30%, Iron 8.5-10 mg/100 mg, Phosphorus 05/100 mg, Protein 0.10/100 mg, and Vitamin B 14/100 mg.[13,14]

2. Granular or Powder Jaggery

The process of making granular jaggery is similar up to concentration. The concentrating slurry is rubbed with wooden scrapper, for formation of grains. The granular jaggery is then cooled and sieved. It is yellow to golden brown in colour as shown in fig.4. Less than 3 mm sized crystals are found to be better for quality granular jaggery. Raising of pH of cane juice with lime, up to 6.0-6.2, and striking point temperature of 120°C was found to yield quality granular jaggery with high sucrose content of 88.6%, low moisture of 1.65%, with good colour, friability and crystallinity. The process can be seen in the fig 5. Jaggery in the form of granules (sieved to about 3 mm), sun dried and moisture content reduced to less than 2%, and packed in polyethylene polyester bags or polyethylene bottles, can be stored for longer time (more than two years), even during monsoon period with little changes in quality.[15,16] The caloric value.

Fig.4. showing Powder Jaggery

of jaggery is same as compared to solid jaggery. The composition per 100 gm of granular jaggery is 80-90gm sucrose, 5-9gm reducing sugar,0.4gm protein,0.1gm fat, 9mg calcium,4mg phosphorous and 12 mg iron.[17]

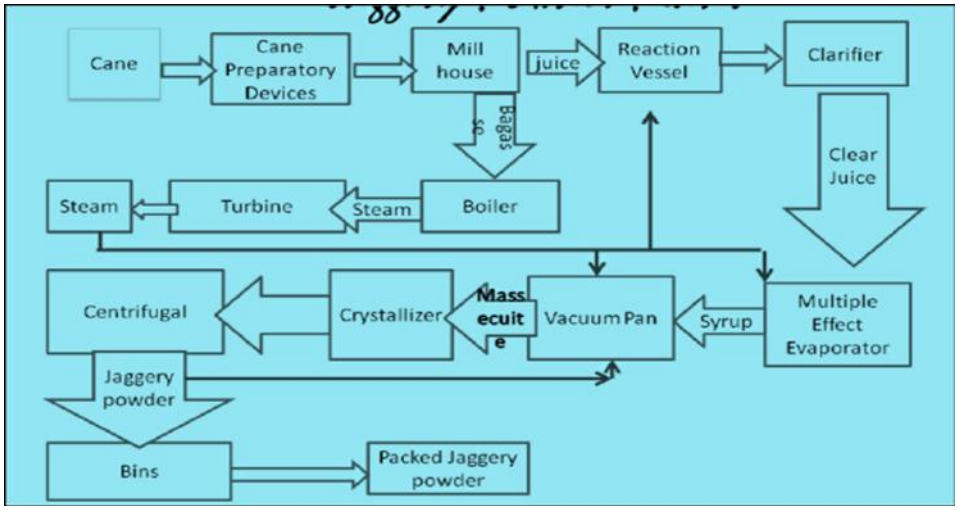

Fig. 5. showing Manufacturing of Jaggery Powder

3. Solid jaggery (Cube shape)

The filtered cane juice was pumped into open pans kept on triple pan furnace, and heated with the begasse as fuel. The juice was clarified with herbal clarificant (deola extract @ 45 g/100 kg juice), to make light coloured jaggery by eliminating impurities in suspension, colloidal and colouring compounds by accumulation. The juice was then boiled and concentrated to make jaggery in desired shape and size as shown fig.6.[18]

Fig.6. showing Solid Jaggery

PACKAGING AND STORAGE LIFE OF JAGGERY

In India, the traditional methods of jaggery storage prevalent in western and eastern regions like open storage, matka, gunny bags etc. Jaggery samples could be stored in cold storage but sometimes it is difficult to store the samples for small scale farmers as cost involved is the main constraint for that. Also the energy consumption is very high. Jaggery from cold storage is used in off-season at high cost.[19]

Chand et al.[20] studied the storage behaviour of jaggery samples stored under hilly climatic conditions of Uttrakhand. Samples were packed in polythene bags, IISR bins and hanging baskets and stored for a period of five months during which changes in product parameters such as moisture content, sucrose, reducing sugar and colour were determined at an interval of 30 days. The result revealed that good keeping quality of jaggery could be maintained with little changes in sucrose content, colour, total moisture content and reducing sugar under cool hilly climate with IISR drying cum storage bin.

Mandal et al.[21] studied the effect of common packing materials on keeping quality of sugarcane Jaggery during monsoon season. In their studies, it was revealed that the best packing material for storing Gur during monsoon season was heat sealed LDPE (Low Density Polyethylene) packet of 150 gauge followed by glass jars. LDPE packets prevented moisture ingress, fall in pH and inversion of sucrose in the stored Gur to the maximum extent.

MARKET POTENTIAL

"Gur gur reha, chela sakkar ho giya" goes the old saying but sugar has lagged far behind. Gur has always got respect in Ayurveda. The usefulness of it has now been recognised at the international level. Kudos to our gur as it has been branded as "millennium gur' and is in great demand in 23 countries, including the USA, Japan, Canada, Hong Kong, Germany, etc. In the recently concluded 88th India science congress in New Delhi, the scientists impressed upon the use of new technology integrating the traditional knowledge in the preparation of gur. This will move India from the green to rainbow revolution. The usefulness of jaggery has been recognized at International level . Now India should concentrate on gur production instead of sugar. Due to heavy competition for food, fibre and oilseeds, there is little scope for increase in the area under sugarcane to meet the increasing demand of gur. Therefore, the only alternative left is to increase the productivity of sugarcane and gur by adopting efficient management practices for sugarcane cultivation. The average yield of sugarcane in different states during 1997-98 is given below.[22]

State	Yield in tonnes / hectare
Andhra Pradesh	72
Bihar	41
Gujarat	72
Haryana	53
Karnataka	91
Kerala	93
Maharashtra	33
Orissa	61
Punjab	56
Tamil Nadu	106
Uttar Pradesh	65
West Bengal	70

CONCLUSION

Jaggery industry is growing at a rapid pace. The demand for jaggery is steadily growing in the urban, rural and semi-urban areas. Several applications of jaggery and its use in households makes it a better choice as compared to sugar . It is also cheaper than the sugar. Due to its nutritional & medicinal values it became highly recommendable by the health experts also. Apart from individual households, it is used in large quantities in restaurants, road-side dhabas, other eateries, hostels and clubs and by caterers. In view of its constantly growing market, it should not be difficult for a new entrant to enter and capture the market.

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