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REVIEW ARTICLE

A Critical Analysis of Sugarcane Based Sweeteners and Their Health Effects

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ABSTRACT

Various sweeteners like sugar, jaggery, *khaand* (naturally prepared brown sugar), brown sugar etc. are being used in food industry since long time in India. In *Ayurveda* too, a lot of description about properties of sugarcane juice and its different products is given. In present era, the method of manufacture of these products has been changed. This study focuses on whether these newer methods of preparation are safe or not and what impact they have on human health. The objective of this study is to critically analyze the myths and facts about various sugarcane products with special reference to their effects on health and to compare both the methods of preparation and usage of sugarcane products. On analysis, it was found that white sugar, jaggery and other items like brown sugar or *Khaand* are more or less equal in terms of safety, if the sugar industries follow the standards. Also, jaggery and brown sugar do have some nutritive additions due to presence of molasses but that is too insignificant to meet the daily demands.

Key words: Health effects, Sugarcane, Sweeteners

INTRODUCTION

Various sweeteners like sugar, jaggery, *khaand* (naturally prepared brown sugar), brown sugar are being used in food industry since long time in India and abroad too. India is world's largest producer of sugar and sugarcane. [1] There are two primary sources of sweeteners- sugar cane and sugar beet. Two-thirds of the world's sugar comes from sugarcane.

Sweeteners were made in northern India between 7th and 4th centuries BC. [2] In *Ayurveda*, a lot of description about properties of sugarcane juice and its products has been given. Today, the method of preparation of these sweeteners has been changed. Hence, an obvious question arises whether these newer methods of preparation are safe or not.

Also, there are prevailing a lot of myths regarding white sugar being unhealthy and the entry of new products like brown sugar is being hyperbolized. Though white sugar is being consumed the most out of all sugarcane products. So, here a research question arises that in which ways the use of sugarcane and its products is useful or harmful and ideally how their uses should differ from person to person.

Objectives

The objectives of this study are to critically analyze and compare both the ancient and modern methods of preparation of sugarcane based sweeteners and also to critically analyze the myths and facts about them with special reference to their health effects on human beings.

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MATERIALS AND METHODS

The material of this study has been collected after reviewing various ancient *Ayurveda* literature, different textbooks, various research papers and information from the internet including government websites regarding the sugarcane industry and manufacturing processes of these products. After compiling all the material, all the literature was critically analyzed and the findings were observed.

REVIEW AND DISCUSSION

Guda (Jaggery)

This sugarcane product is made by heating and concentrating the sugarcane juice till it settles at the bottom in water. It is the traditional non-refined, non-centrifugal, natural sweetener used in India. [3] It is available in three forms viz, solid jaggery, liquid jaggery and granular or powder jaggery. Manufacturing process involves crushing of sugarcane to its juice followed by filtration and boiling in shallow iron pans, after a required consistency it is cooled and shaped into blocks. Ancient and modern technique is more or less the same, but traditionally vegetable origin clarificants like mucilage of *Deola (Hibiscus Ficulneus)*, Groundnut (*Arachis Ypogea*), *Bhindi (Hibiscus Esculentus)*, Bark of *Semal (Bombax Malabaricum)*, Bark of *Falsa tree* (*Grewia Asiatica*), *Sukhlai (Kydia Calycina)*, Castor seed (*Ricinus Communis*) etc were used. [4]

Chemicals like citric acid, hydrogen peroxide are being used for clarification of the juice in modern sugar industry. Potassium metabisulphate, benzoic acid may also be added for improving the shelf life. [5]

As opined by *Ayurveda*, *Guda* is *ushna* (heating effect) in nature, [6] therefore best indicated in winter season. As it becomes older the more properties it possesses. [7] Owing to its preparation in iron pans, it gathers some amount of iron and is thus useful in anemic individuals. In diabetes, it is advisable over white sugar because it has complex chains of sugar which cause the energy to be released slowly and glycemic index of the individual does not shoot up suddenly. [8] But, *Guda* is not advisable for those suffering from intestinal parasites or worms as per the principles of *Ayurveda*. [9] It has got some nutritional advantage over white sugar i.e. presence of some micronutrients like (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.[10]

***Khaand* and *Sharkara* (Brown and white sugar)**

In ancient time *Khaand* was prepared by sugarcane juice extraction, purification and concentration by open pan boiling, solidification of concentrated juice.[11] Therefore *Khaand* is large piece of sugar, somewhat brownish in colour due to presence of molasses. The *Sharkara* (cane sugar) was prepared after grinding the *Khaand*. This grinded sugar is white as compared to *Khaand* but still brown as compared to contemporary white sugar due to presence of molasses.

The manufacture of white sugar consists of two major steps, first one is raw sugar production and second, refining of raw sugar. [12] The modern sugar industry has adopted the use of sulphur dioxide in production of white sugar; first, while boiling the sugarcane juice (for clarification of the juice) and second, during crystallization process (for bleaching purpose). This is called as double sulphitation process. Majority of soluble sulfur compounds get drained along with molasses, but a little bit are left within the final product. Sulfur, when consumed more than the requirement of the body is known to cause various respiratory diseases, e.g. sneezing, sore throat, tightness of chest, suffocation, bronchitis, asthma, bronchitis, asthma, shortness of breath, irritation of upper respiratory tract, etc.

The maximum permissible limit for SO_2 according to Bureau of Indian Standard is 70 ppm. According to International standards, it is 10 ppm. The sugar industries claim to be the amount of SO2 in white sugar is 20-70 ppm. [13] If the amount of sulphur exceeds the permissible limits, it is highly toxic and accounts for the defamation of white sugar. The modern process involves refining of raw sugar which along with the impurities also removes molasses; thereby rendering sugar devoid of any nutrition.

Brown sugar

It is more popular in the market due to absence of sulfur and presence of some nutrients. Actually, two types of brown sugar are available in the market:

Natural brown sugar: it is unrefined or partially refined sugar with some amount of residual molasses.

Commercial brown sugar: it is made by addition of molasses to already refined white sugar. [14] Brown sugar has some advantages over white sugar. It adds a deep, aromatic flavor and color to the recipes and is good for sweetening bakery items as it retains moisture.

Table 1: A comparative nutritive value table of different sweeteners [15]

Components	White Sugar	Brown Sugar	Jaggery
Energy	1,619 KJ (387 Kcal)	1,576 KJ (377 Kcal)	1590 KJ (380 Kcal)
Carbohydrates	99.98 g	97.33 g	98 g
Sugars	99.91 g	96.21 g	97 g
Dietary fiber	0 g	0 g	0 g
Fat	0 g	0 g	0 g
Protein	0 g	0 g	280 mg
Water	0.03 g	1.77 g	-

As per the principles of *Ayurveda*, the properties of these products are as follows:

- *Guda* is *Madhura* (sweet in taste), *Snigdha* (unctuous), *Natisheeta* (not so cooling effect as sugar), *Raktamutrashodhaka* (purifies blood and urine), *Vatashaamaka* (alleviate *Vata Dosha)*, *Kaphavardhaka* (enhance *Kapha* and *Meda*), *Balya* (enhances strength) and *Vrishya* (aphrodisiac).[16]
- *Khaand* (brown sugar) is *Madhura* (sweet in taste), *Sheeta* (having cooling effect), *Vrishya* (aphrodisiac), *Chakshushya* (healthy for eyes), *Brimhana* (nourishing property), *Vatapittashamaaka* (alleviate *Vata* and *Pitta Dosha)*, *Balya* (enhances strength), *Snigdha* (unctuous), *Chhardihara* (prevents vomiting).[17]
- *Sharkara* (white sugar) is *Madhura* (sweet in taste), *Vatapittaraktashamaaka* (alleviate *Vata* and *Pitta Dosha* and *Rakta*), *Chhardihara* (prevents vomiting), *Vrishya* (aphrodisiac), *Murchhajwarahara* (beneficial in unconsciousness and fever).[18]

CONCLUSIONS

- White sugar, jaggery and other items like brown sugar or *Khaand* are more or less equal in terms of safety, if the sugar industries follow the standards.
- Jaggery and brown sugar have some nutritive addition to sugar due to presence of molasses but that is too insignificant to meet the daily demands.
- Jaggery does not raise the blood sugar instantly, therefore can be the alternative to satisfy the sweet tooth of diabetics but has no mega difference in terms of glycaemic index.
- Natural brown sugar is devoid of sulfur but the one more available in market is commercial brown sugar having sulfur.
- Use of *Guda*, brown sugar and white sugar should be done using the principles of *Ayurveda*.

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