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ISSN: 2278-4772

Ayurpharm Int J Ayur Alli Sci., Vol. 5, No. 4 (2016) Pages 52 – 58

Research Article

ANALYTICAL STUDY ON DIFFERENT SAMPLES OF GUDA (JAGGERY) COLLECTED FROM THRISSUR, KERALA

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Received: 17-03-2016; Revised: 20-04-2016; Accepted: 26-04-2016

Abstract

Jaggery is widely used in pharmaceutics and easily available in the markets. There are many forms of jaggery available in the market. Agmark standards are available for jaggery as a whole. Purity and quality of jaggery must be ensured on public health ground as it is a popular food item and used as sweetening agent based on the therapeutic purposes in Ayurvedic medicine. To attain the purpose of quality, standards should be set to all varieties of guda (jaggery) from sugarcane that is sold in the market. This study was taken up as a stepping stone in this regard to analyse 4 samples of jaggery collected from Thrissur, middle zone of Kerala market and compare with the Agmark specification of jaggery.

Key words: Guda; Jaggery; Sugarcane.

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Cite This Article

Rajesh CK, Shajahan MA, Shahul Hameed A. Analytical study on different samples of Guda (Jaggery) collected from Thrissur, Kerala. Ayurpharm Int J Ayur Alli Sci. 2016;5(4):52-58.

www.ayurpharm.com
ISSN: 2278-4772
Ayurpharm Int J Ayur Alli Sci., Vol. 5, No. 4 (2016) Pages 52 – 58

INTRODUCTION

Guda (jaggery) is a traditional product of sugarcane.[1] It is used as a media for the preparation of different Ayurvedic formulations such as Asava, Arishtas, Lehya, Gula etc. It is also used as an important anupana (vehicle) during administration of drugs. Now a day, Ayurvedic drug industries face some problems regarding the quality of medicinal products like asava, arishta, guda etc. and its standards. These problems directly points towards the quality of jaggery. Moreover the society needs awareness about the types of jaggery in the markets, different sources, methods of preparation, quality of jaggery, any standard measures for the purity of jaggery etc. Hence in the present study 4 samples of jaggery were collected from middle zone i.e. Thrissur market of Kerala and analysed to compare with agmark standards.

MATERIAL AND METHODS

Method of sample collection

Four samples of jaggery were collected from a jaggery shop at Ariyangadi market of Thrissur, the middle zone of Kerala. Different samples from Thrissur market are Acchusarkara (rectangle shaped), Undasarkara (round shaped), Pana or karippatisarkara (prepared from palm) and Thenginsarkara (prepared from coconut).

METHODOLOGY

Organoleptic characters and Phytochemical evaluation of jaggery samples i.e. Determination of moisture, sugar content, reducing sugar content, sucrose , total ash, acid insoluble ash, sulphur dioxide were analysed. The organoleptic characters include color, taste, smell, consistency and texture of a drug or a material.

Moisture content

The moisture content was determined by using Dean and Stark's apparatus. 5 g of the jaggery was taken into a round bottom flask and xylene was added to cover the jaggery. Connect the round bottom flask to Dean and Stark's apparatus, which was connected to a water condenser. It was heated within an electric mantle for about one hour. The moisture in the jaggery gets evaporated and get condensed and collected into the graduated tube of the apparatus. The heating was continued till the level of the water remains constant, the level of water content in the graduated tube. Reading is taken through lower meniscus. The percentage of water content in the jaggery was calculated by dividing the water content by the weight of the original sample taken and multiplying it by 100.

Determination of sugar content

5 g of the jaggery was weighed and transferred into a 250 ml RB flask, 100 ml of distilled water was added & refluxed for one hour. After cooling, the solution is filtered into a conical flask. Filtrate is transferred to a measuring flask & made up into 100ml transfer the made up 100ml filtrate into conical flask and add 2ml of lead acetate solution. A precipitate is formed if tannin is present. Again filter the solution into a conical flask and add sufficient amount of sodium oxalate. A slight excess of sodium oxalate was added to remove excess lead acetate. After filtering, the solution is ready for testing sugar content.

Total Sugar

20 ml of the filtrate was pipette out into another beaker and was hydrolysed by adding 2 ml of 6N HCl. Boiled and cooled. It was neutralized with anhydrous Sodium carbonate and up to 100ml by adding 50ml Fehling's solution (prepared by mixing 25ml of

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ISSN: 2278-4772
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Fehling's solution A & B) 28ml distilled water. It was heated and boiled for 4min. The hot solution was filtered through a sintered crucible. The precipitated, cuprous oxide was collected and filtrate was discarded.

A hot solution of 25ml ferric alum & sufficient 4 n H_2SO_4 (20 ml) was added into the G4 crucible. The solution was collected in the filtering flask. The crucible was washed with distilled water and the washing was collectedalong with the filtrate. The resulting solution was triturated against standard $KMnO_4$.

Determination of Total Reducing Sugars

Pipette an aliquot of 50 ml of the clarified, de-leaded filtrate to a 100 ml volumetric flask. Add 5 ml of conc. HCl and allow standing at room temperature for 24 hours. Neutralize with conc. NaOH solution followed by 0.1N NaOH. Make up to volume and transfer to 50 ml burette having an offset tip and perform the titration of Fehlings solution similar to the procedure described in determination of reducing sugars.

Determination of Factor (for Invert Sugar) of Fehling Solution

Accurately weigh around 4.75 g of jaggery. Transfer to 500 ml volume flask with 50 ml distilled water. Add 5 ml cone. HC1 and allow standing for 24 hours. Neutralize with NaOH solution and make up to volume. Mix well and transfer 50 ml to a 100 ml volumetric flask and make up to volume. Transfer to a burette having an offset tip. Perform the titration of Fehling solution following the similar procedure as above:

Determination of Sucrose

Take an aliquot of 100 ml in a 500 ml volumetric flask and add 10 ml of HCl and let stand for 1½ days at 25°C and above. Dilute to 500 ml. Transfer an aliquot of 100 ml to a 250 ml volumetric flask, neutralize with NaOH and make up to volume and mix. Take this solution in a burette having an offset tip. Proceed with the titration against Fehling A and B.

Calculation

Sucrose % = [Total reducing sugar % - Reducing sugars %] (0.95)

Determination of total ash

Incinerate about 2g accurately weighed jaggery, in a previously weighed silica crucible, until free from carbon, cooled and weighed. If a carbon free ash cannot be obtained by this way, exhaust the charred mass with hot water, collect the residue on an ash less filter paper, add the filtrate, evaporate to dryness and ignite at a temperature hot exceeding 450degC. Calculate the percentage of ash with reference to the air dried jaggery.

Determination of acid insoluble ash value

Proceed as per the steps mentioned in the procedure for determination of total ash value of drug. After that the ash was washed from the dish used for total ash, into a 100ml beaker, using 25ml of dilute HCl. Boil it for five minutes. Filter through an ash less filter paper; wash the residue with hot water until it is free from acid. It is confirmed by litmus paper test. Put the filter paper and residue together into a crucible, heat gently until vapours cease to be evolved and then more strongly until all carbon has been removed. Cool it. Weight the residue and calculate acid insoluble ash of the jaggery with reference to air dried sample of the jaggery.

Determination of Sulphur dioxide

A fixed amount of jaggery is mixed with 50 ml of water and distilled to collect around 40 ml. This 40 ml is titrated with 0.1 N NaOH to find the dissolved H2SO4 content equivalent.

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RESULTS AND OBSERVATION

Nature of jaggery samples were firm in consistency, not sticky and well dried. It had its characteristic taste and flavour. (Table 1) Jaggery was clean and free from insect infestations, live or dead insects, mould or mites. It was free from dirt or soil, musty odour, fermented odour, from natural or synthetic colors. No fungal or bacterial contaminations in the samples. The samples were kept in an air tight plastic cover.

Values of phytochemical studies of different jaggery samples are tabulated in Table 2 and Table 3.

Moisture content

Moisture content percentage according to Agmark is 5% for special, 7% for standard, 10% for general. Thengin samples, Pana or Karipatty and Acchu variety samples contain 8%, 6%, 4% respectively. Grading of market samples of jaggery according to Agmark standards on the basis of moisture content are special grade jaggery includes Acchu variety, standard grade jaggery includes Panasarkara samples. General grade jaggery includes Kumbu and Thenginsakara samples.

Total sugar

Total sugar percentage according to Agmark is 94% for special grade, 92% for standard grade, 90% for general grade. Acchu, Kumbu, Pana or Karipatty variety of Thrissur contains 87.1%, 85.5%, 80.8% of total sugar respectively. Sucrose content according to Agmark standard, 80% of sucrose for the special grade, 70% for standard, 65% for the general grade. Acchu, Kumbu, Pana or Karipatty and Thengin variety contains 78%, 76.2%, 70.2% % and 68.7 of sucrose respectively.

Total Ash

The percentage of Total ash content mentioned in the Agmark standard for special is 1%, 2.5% for standard, 4% for general. Acchu, Kumbu, and Pana or Karipatty have 1.3%, 1.9%, 1.7% respectively and 2.9% for Thengin variety.

Acid insoluble ash content

According to Agmark standards, the percentage values of special grade is 0.1%, for standard is 0.2%, for general it is 0.5%. Unda, Acchu, Pana or Karipatty variety of Thrissur has 2%, 1.2%, 0.5% respectively. All the varieties are coming under General grade.

Extraneous matters

According to Agmark standards the percentage value of extraneous matters in Special is 0.2%, for standard 1% and general has 2%. Acchu, Unda, Pana and Thengu variety have 1.3%, 1.6%, 1.8% respectively.

Sulphur dioxide

According to Agmark standards the percentage value of Sulphur dioxide in Special is 60 ppm, for standard 70 ppm and general has 70ppm.Acchuvariety contain 5 ppm and in other samples sulphur dioxide was nil.

DISCUSSION

The quality of jaggery prepared with the commonly used chemical clarificants such as hydros, sodium carbonate, sodium bi-carbonate, super phosphate, alum etc not only has temporary improvement in color, salty taste and poor storability but excess use may result in harmful residues such as sulphur dioxide beyond prescribed limit.

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ISSN: 2278-4772
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Table 1: Organoleptic characters of each sample from Thrissur market

Characters	Acchusarkara	Kumbusarkara	Pana or Karipattisarkara	Thenginsarkara
Colour	Whitish yellow and reddish white	Yellowish white	Dark brown	Blackish
Smell	Pleasant	Pleasant	Pleasant	Pleasant
Taste	Sweet	Sweet	Sweet	Sweet
Consistency & texture	Solid & cube shaped	Solid & circular	Solid & saucer shaped	Solid & irregular shaped

Table 2: Phytochemical values of Thrissur samples

	Moisture	Total sugar	Sucrose % By mass	Total ash	Acid insol. Ash	Extraneous matters	Sulphur Dioxide %
Acchu	4%	87.32%	78.01%	1.3%	1.2%	1.3%	5ppm
Unda	8%	85.54%	77.6%	1.9%	0.3%	1.6%	Ml
Pana	6%	80.82%	70.2%	1.7%	0.5%	1.8%	Ml
Thengu	8%	79.04%	68.7%	2.9%	4.3%	2.2%	Ml

Table 3: Comparison with Agmark grades

Analyses	Three grades of jiggery			Acchu	Unda	Pana	Thengu
	Special	Standard	General				
Moisture	= or<7	7-<10	=or>10	4	8	6	8
Total sugar	= or>94	= or<92	= or<90	87.3	85.5	80.8	79.04
Sucrose	= or >80	= or<70	= or <65	78.01	77.6	70.2	68.7
Total ash	^of <1.0	= or <2.5	= or>4.0	1.3	1.9	1.7	2.9
Acid insoluble ash	= or<0.10	= or <0.20	= 0r>0.50	1.2	0.3	0.5	0.3
Extraneous matters	= or <0.2	= or<1.0	= or>2.0	1.3	1.6	1.8	2.2
Sulphur dioxide	= or <60 ppm	= or <70 ppm	>70ppm	5ppm	Nil	Nil	Nil

As the jaggery contains hygroscopic substances such as reducing sugars, minerals like chlorides, sodium, potassium, makes the jaggery liable for moisture absorption and microbial degradation, particularly during monsoon periods when the Relative Humidity values exceed more than 55 to 60%. Hence packing the jaggery cubes in appropriate containers assumes importance. When packed with tin foil covered with hessian cloth or packed with tin foil covered with polythene sheet or plastic containers was found to be good with respect to less change in sucrose reduction, changes in shape and size and also in maintaining the hardness of jaggery during storage. Plastic containers were better for storage of jaggery. Packaging materials should preferably be chosen from biodegradable and recyclable sources. [2]

Discussion about the results from different samples of jaggery

Reasons for the increase in moisture content compared with Agmark values may be production in the monsoon season, Relative humidity value more than 55-60% in the environment during the preparation and the jaggery contains hygroscopic substances such as reducing sugars, minerals like chlorides, sodium, potassium etc making the jaggery liable for moisture absorption. In a small scale industry of jaggery, the storage is by means palm leaves and then covered with the plastic cover. Excess use of chemical clarificants may be a reason for increase in moisture.

All samples are included under general grade on the basis of Total Sugar content in

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ISSN: 2278-4772
Ayurpharm Int J Ayur Alli Sci., Vol. 5, No. 4 (2016) Pages 52 – 58

comparison with Agmark standards. Reasons for lower content of Total sugar in the market samples of jaggery are Jaggery prepared from a low yielding variety of sugarcane and not harvested when it is in its peak maturity. Placing of canes in the open sunlight causes depletion in the total sugar level. Above samples might have been prepared during monsoon or rainy season and without proper removal of suspended impurities from the juice causes reduction in the sugar content. Due to adding of top few internodes part, which contains more of non sugars than sugars. Due to improper proper storage and Jaggery produced from soils of high salinity and pH. Jaggery samples made from the canes affected with diseases like Red rot, Orange, rust etc and without proper preservation of samples during the study period.

All samples were included under standard grade of Agmark on the basis of Sucrose content. Reasons for lower content of Sucrose in the market samples may be Jaggery from low yielding variety of sugarcane. Due to lateness in extraction of juice i.e. more than 24 hrs after harvest, because of that inversion of sucrose into glucose, fructose and other harmful substances produced in jaggery. So there is a chance of depletion of sucrose. Above samples may be prepared during monsoon or rainy season. Without proper removal of suspended impurities from the juice causes reduction in the sugar content. Due to adding of top few intemodes, which contain more of non sugars than sugars and due to without proper storage may be a Reasons for lower content of Sucrose. Jaggery produced from soils of high salinity and pH. Jaggery samples made from the canes were affected with diseases like Red rot, Orange rust etc and without proper preservation of samples during study period.

Grading of market samples of jaggery according to standards on the basis of Total Ash content - Acchu, Kumbu, Pana varieties are under standard Agmark grade. Thengu variety was under general grade include. Reasons for increased Ash values in the market samples of jaggery may be due to non removal of attached green or dry leaves and roots at the time of crushing. Due to the presence of any organic waste material during boiling of cane juice and if there is any organic waste in the collecting vessel. Presence of weeds during cutting phase and improper preservation during the study period may alter the ash value.

Grading of market samples of jaggery according to Agmark standards on the basis of Acid Insoluble Ash content - All the varieties are coming under General grade. Reasons for the increased Acid insoluble ash content in the Market samples may be due to crushing of Canes without proper washing, Presence of soil particles or silica in the cane, Presence of soil particles or impurities in the collecting vessels, Impurities in the boiling pan, Storage of jaggery in a plastic pack without proper cleaning, Due to the exposure of jaggery in the open markets and no proper preservation of samples during study period.

Grading of market samples of jaggery according to Agmark standards on the basis of Extraneous Matters content - No samples are included in special grade. Standard grade include Acchu, Kumbu, Pana and General grade include Thengu variety.

Reasons for the increased Extraneous matters content in the market samples are due to presence of plant materials other than the stalks during cutting procedure. The presence of any mineral materials like soil particles and stones during harvesting, loading, and transportation increases the extraneous matters. Due to the presence of materials in crushing machine and collecting vessels and intentional addition of soils or stones for getting more weight may be the reason. All market samples were under special grade on the basis of Sulphur dioxide content.

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ISSN: 2278-4772
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Reasons for the low content of Sulphur dioxide in the market samples may be due to the usage of lower quantity of chemical clarificants such as hydros, Sodium carbonate, Sodium bisulphite, lime etc.

CONCLUSION

On the basis of these studies, all the 4 samples of jaggery from different markets are under one or the other grade of Agmark standards. All the samples attained special grade in comparing the values of Sulphur dioxide.

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Source of Support: Nil Conflict of Interest: None Declared