Comparative Study on the Different Nutritive Values of Locally Developed Improved Varieties of Cane sugar in Bangladesh

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Abstract

The present study was designed to investigate the nutritive values of the recommended **locally developed improved varieties** of cane sugar, collected from Bangladesh Sugarcane Research Institute (BSRI), Ishurdi, Pabna. The nutritive value of the released / registered varieties were analysed for moisture, ash, protein, total lipid, crude fibre, carbohydrate, and calorie content. Besides, total sugar and reducing sugar contents were also analysed for this purpose. Proximate mean values of analysis indicated ISD-25, ISD-19, ISD-28, ISD-18 had the highest percentage of 0.82% protein, 0.15% fat, 23.49% carbohydrate and 93 Kcal respectively; ISD-24 and ISD-18 had the lowest percentage of 0.16% protein and 0.03% fat respectively; both 17.49% carbohydrate and 19 Kcal of calorie contents were found low in ISD-30; Total sugar and reducing sugar contents were found 7.66%, 3.98% respectively higher both in ISD-24, and 5.14%, 2.72% respectively lower both in ISD-26. Moisture contents were high because of cane sugar juice and trace amounts of crude fibre found due to filtration according to the method. The results suggest that, more attention should be given to those varieties for yield and production of cane sugar in large scale which contain highest percentage of nutritive values especially, ISD-18, ISD-19, ISD-25 and ISD-28.

Key Words : Cane sugar, Improved Varieties, Nutritive Values

Introduction

Cane sugar (*Saccharum officinarum* Linn.), the principal and industrial cash-crop for the production and supply of essential sugar needed for Bangladesh, is cultivated from Mid October to Mid December (Early) and

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Mid January to Mid March (Late)[1]. At present, the country's area under cane sugar is 0.19 million hectare which accounts for approximately 2% of the total cultivated land and provides 6.88 million metric tons of cane sugar with an average yield of around 41.32 ton per hectare (TCH) and the production of sugar 0.22 million metric tons. But the country's annual requirement of sugar production has been estimated at 0.30 million metric tons. To achieve a production target by the end of the century, at an average recovery of 9.0% sugar, the country needs to annually produce 16.80 million metric tons of cane (5million metric tons for sugar). According to FAO, Bangladesh needs 1.71 million metric tons of sugar annually for the 132 million population on the basis of 36 grams sugar per head. Whereas, at present the total annual consumption of sugar in Bangladesh is 0.58 million metric tons that is 19.95 grams per capita per head (12.41 grams per capita per head sugar, plus, 7.54 grams per capita per head gur)[2]. Besides, according to the present population, the overall population density of the country is about 755 per square kilometers and 85% of the population live in rural area and 47.53% of them live below the "food-based" poverty line/absolute poverty (consuming less than the minimum energy intake of 2,122 Kcal/capita/day), while one quarter of them (25.06%) subsist in extreme poverty/hard-core poverty (consuming less than 1,805 Kcal/capita/day)[3,4]. As a result of over population and widespread poverty, the land area of the country becoming limited and the people are deprived from the calorie intake respectively[5]. To overcome this situation, country's cane sugar yield should be increased. Cane sugar production of the country can be increased by adopting two ways. One is to extend the present area under cane sugar and the other is to increase the yield per unit area. But as a result of the shrinkage of cultivable land area, these two ways seem not feasible. Recently in Bangladesh, a continuous and dynamic research has been going on in the field of Agriculture. The researchers have paid considerable efforts to develop disease/insect/pest/ drought resistant/fertilizer responsive and high yielding varieties within the same species in order to receive higher productivity in limited land and same land areas; cane sugar is one of them. Bangladesh Sugarcane Research Institute (BSRI), Ishurdi, Pabna has released some locally developed improved varieties of cane sugar at farmer's level which produce maximum tonnage with satisfactory sugar recovery[6]. Minimum 8.00% recovery containing cane sugar

variety is recommend for the production of sugar and other processes (verbal information from BSRI, Ishurdi, Pabna).

The present study was undertaken to determine the proximate composition namely moisture, ash, protein, fat, crude fibre, carbohydrate and calorie contents and also total sugar and reducing sugar of those selective varieties of cane sugar. And also to suggest the best varieties for production in large scale and sale in the local market of Bangladesh at lower price.

Materials and Methods

A research work was carried out at Food Analysis Laboratory, Institute of Nutrition and Food Science, University of Dhaka during November 1999 to February 2000. Till now, BSRI, Ishurdi, Pabna, has breed twenty eight (28) improved varieties of cane sugar, out of which introduced twenty two (22) are ISD-2/54, Latari Jaba C (LJC), ISD-16, ISD-18, ISD-19, ISD-20, ISD-21, ISD-22, ISD-24, ISD-25, ISD-26, ISD-27, ISD-28, ISD-29, ISD-30, ISD-31, Amrita, Co 208, Co 419, Co 527, Misrimala, Q 69. Among these (22 varieties), available twelve (12) i.e. ISD-16, ISD-18, ISD-19, ISD-20, ISD-22, ISD- 24, ISD-25, ISD-26, ISD-28, ISD-29, ISD-30 and ISD-31 were collected from there for the analytical works of present study.

Juice from each selected sample (cane sugar) was obtained from their varieties, mixed thoroughly and filtered through muslin cloth[7]. The nutritive values of filtered samples were analysed with appropriate methods in triplicate analysis. Moisture content was determined through Direct Heating Method (100°-105°c) described by Pearson[8]; ash content was determined through Straight Combustion Method (550°-600°c) described by Tribold-Aurand[9]; protein content was determined by Kjeldahl Method as mentioned in AOAC[10]; total lipid (fat) content was determined through Evaporating Method described by Bligh-Dyer[11]; crude fibre content was determined by ICMR[7]; carbohydrate content was determined by subtracting the sum of the total value (per 100g) for moisture, ash, protein, fat and crude fibre from 100 according to ICMR[7]; calorie content was determined multiplying the total value (per 100g) of carbohydrate, protein and lipid by Atwater factors i.e. 4, 4 and 9 respectively described by Osborne and Voogt[12]; reducing sugar content was determined through Dinitrosalicylic Acid Method described by Miller[13]; and total sugar

content was determined through Anthrone Method described by Jayaraman[14]. Mean values of these variety were calculated from the triplicate results.

Results and Discussion

Some information from BSRI i.e. cultivated area, cane yield, recovery percent, sugar production, maturity status and special characters with release/ registration year of analysed twelve recommended varieties of locally developed improved cane sugar were indicated in **Table-1**. Among the twelve high yielding varieties are ISD-16, ISD-18, ISD-19, ISD-25, ISD-26, ISD-28, ISD-29, ISD-30; high sugar (11.00-12.40% recovery) varieties ISD-16, ISD-22, ISD-26,

Table 1. Information on BSRI breed released/registered improved varieties of selective analysed cane sugar

Variety	Year of release/ registration	Area (ha) 1999	Cane yield (TCH)	Recovery (%)	Sugar production (TSH/ha)	Maturity status	Special character(s)
ISD-16	1981	13913	102	11.44	11.67	EM	Excellent for Gur, Erect
ISD-18	1988	2934	97	10.09	9.79	MM	Good Ratooner & Erect
ISD-19	1988	591	97	10.87	10.54	MM	Semi dwarf & Erect
ISD-20	1990	5789	93	11.00	10.23	MM	Potential Ratooner, Highly tolerant to WLC and Drought condition
ISD-22	1993	134	87	11.34	9.87	EM	Good for Gur, tolerant to WLC, Flood & Drought
ISD-24	1993	931	89	10.98	9.77	EM	Good for Chewing, Flood and Drought tolerant
ISD-25	1993	1262	97	10.05	9.75	MM	Fast growing & tolerant to Flood
ISD-26	1995	1169	97	11.80	11.45	EM	Excellent for Gur & tolerant to WLC
ISD-28	1996	3398	90	11.30	10.17	MM	First growing, potential Ratooner, highly tolerant to WLC & Drought
ISD-29	1998	2440	93	10.87	10.11	MM	Erect, highly tolerant to Flood & Drought
ISD-30	2000 (Registered)	n.a	110	10.39	11.43	EM	Semi dwarf & highly tolerant to WLC
ISD-31	2000 (Registered)	n.a	113	10.21	11.54	MM	Fast growing & tolerant to Flood, WLC & Drought condition

Abbreviations used : EM = early maturity; MM = mid maturity; WLC = water logged condition; TCH = ton cane per hectare; TSH = ton sugar per hectare; n.a = not available

Source : Bangladesh Sugarcane Research Institute (BSRI), Ishurdi, Pabna.

ISD-28; early maturing / short duration varieties i.e. ISD-16, ISD-22, ISD-24, ISD-26, ISD-30; mid maturing i.e. ISD-18, ISD-19, ISD-20, ISD-25, ISD-28, ISD-29, ISD-31 varieties; special characters i.e. dwarf type ISD-19, ISD-30 and potential ratooner ISD-20, ISD-28 varieties; stress tolerant i.e. water logging and flood tolerant varieties ISD-20, ISD-22, ISD-24, ISD-25, ISD-28, ISD-29, and drought tolerant ISD-20, ISD-22, ISD-24, ISD-28, ISD-29, ISD-31 varieties; ISD-24 is chewing variety.

Table 2. Proximate values of improved varieties of cane sugar juice

Sample (Code)	Moisture (%)	Ash (%)	Protein (%)	Fat (%)	Crude fibre (%)	Carbohydrate (%)	Calorie (Kcal/100g)
Cane sugar (ISD - 16)	79.53 ± 0.07	0.50 ± 0.07	0.28 ± 0.07	0.13 ± 0.04	tr*	19.56	81
Cane sugar (ISD - 18)	76.47 ± 0.14	0.25 ± 0.02	0.21 ± 0.03	0.03 ± 0.02	tr	23.04	93
Cane sugar (ISD - 19)	77.61 ± 0.04	0.27 ± 0.02	0.24 ± 0.06	0.15 ± 0.05	tr	21.73	89
Cane sugar (ISD - 20)	76.96 ± 0.08	0.36 ± 0.03	0.22 ± 0.04	0.14 ± 0.02	tr	22.32	91
Cane sugar (ISD - 22)	78.46 ± 0.08	0.23 ± 0.02	0.33 ± 0.04	0.14 ± 0.04	tr	20.84	23
Cane sugar (ISD - 24)	80.24 ± 0.04	0.24 ± 0.02	0.16 ± 0.02	0.05 ± 0.04	tr	19.31	20
Cane sugar (ISD - 25)	79.08 ± 0.11	0.64 ± 0.02	0.82 ± 0.09	0.14 ± 0.03	tr	19.32	24
Cane sugar (ISD - 26)	77.78 ± 1.63	0.34 ± 0.03	0.33 ± 0.02	0.12 ± 0.08	tr	21.43	24
Cane sugar (ISD - 28)	75.83 ± 0.06	0.30 ± 0.01	0.26 ± 0.03	0.12 ± 0.06	tr	23.49	26
Cane sugar (ISD - 29)	77.76 ± 0.04	0.38 ± 0.02	0.37 ± 0.05	0.05 ± 0.03	tr	21.44	23
Cane sugar (ISD - 30)	81.94 ± 0.09	0.29 ± 0.04	0.21 ± 0.05	0.07 ± 0.04	tr	17.49	19
Cane sugar (ISD - 31)	77.54 ± 0.38	0.26 ± 0.04	0.31 ± 0.02	0.04 ± 0.02	tr	21.85	24

*Mean ± SD, n = 3 (except carbohydrate and calorie), * tr = trace*

Table-2 shows the mean of triplicate values of moisture, ash, protein, fat, crude fibre, carbohydrate and calorie contents of locally developed improved varieties of cane sugar juice. The highest percentage of protein content was found in ISD-25 (0.82%) and ISD-24 (0.16%) had the lowest percentage. On the other hand, fat content was found higher in ISD-19 (0.15%) and ISD-18 (0.03%) had the lowest. Carbohydrate content was found highest percentage

Table 3. Total and reducing sugar of improved varieties of cane sugar juice

Sample (Code)	Total sugar (%)	Reducing sugar (%)
Cane sugar (ISD – 16)	6.30 ± 0.07	3.82 ± 0.14
Cane sugar (ISD – 18)	7.51 ± 0.08	3.95 ± 0.08
Cane sugar (ISD – 19)	5.22 ± 0.04	2.90 ± 0.04
Cane sugar (ISD – 20)	7.57 ± 0.05	3.93 ± 0.04
Cane sugar (ISD – 22)	7.36 ± 0.03	3.91 ± 0.02
Cane sugar (ISD – 24)	7.66 ± 0.11	3.98 ± 0.05
Cane sugar (ISD – 25)	6.48 ± 0.04	3.49 ± 0.09
Cane sugar (ISD – 26)	5.14 ± 0.08	2.72 ± 0.03
Cane sugar (ISD – 28)	5.34 ± 1.60	3.41 ± 0.05
Cane sugar (ISD – 29)	6.54 ± 0.10	3.50 ± 0.10
Cane sugar (ISD – 30)	7.54 ± 0.04	3.88 ± 0.08
Cane sugar (ISD – 31)	5.45 ± 0.19	2.90 ± 0.05

Mean ± SD, n = 3

in ISD-28 (23.49%) and the lowest had in ISD-30 (17.49%). In ISD-18 (93 Kcal) the calorie content was found highest and ISD-30 (19 Kcal) had the lowest. Moisture contents were found higher because the analysis was done from the juice of samples. Besides, trace amount of crude fibre contents were found due to filtration through muslin cloth according to the method; as a result all the soluble fibre of samples were passed-out and some of insoluble fibre left in.

The proximate mean of triplicate values of total sugar and reducing sugar contents of improved varieties of cane sugar juice are shown in **Table-3**. ISD-24 (7.66%) had the highest percentage of total sugar content with the lowest in ISD-26 (5.14%). The highest reducing sugar content was found in ISD-24 (3.98%) and the lowest was in ISD-26 (2.72%).

The obtained highest results of mean values of protein, fat, carbohydrate and calorie contents of ISD-25, ISD-19, ISD-28, ISD-18 respectively from **Table-2** agreed with the data available from the findings of and INFS[15] and also the highest results of total sugar and reducing sugar contents of ISD-24 from **Table-3** agreed with Mathur[16].

It is mentioned that sugar comes from cane sugar juice. During refining of sugar the protein and fat contents become low than the values in cane sugar juice. If cane sugar is chewed / drink in the form of juice, people will get not only calorie but also recieve some protein and fat additionally. So, to know such nutrient contents i.e. protein and fat in the juice, those nutrients were analysed in the present study.

The overall results suggest that, ISD-18, ISD-19, ISD-25 and ISD-28 varieties should be given more attention for the yield and production of cane sugar. And also suggest these recommended varieties for sale in local market at lower price.

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