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Studies on sugar free shrikhand prepared by using stevia (*Stevia rebaudiana Bertoni*) powder

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The present investigation on studies on sugar free shrikhand prepared by using stevia (*Stevia rebaudiana Bertoni*) powder was conducted at Department of Animal Husbandry and Dairy Science, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola. An effort was made to standardize the optimum level of stevia powder in the preparation of shrikhand, with main objects to evaluate the product by sensory evaluation, determination of chemical composition and to calculate cost of production. In view of above objectives present study was carried out with five treatments including control T_1 and shrikhand prepared from cow milk chakka with different level of stevia powder *i.e.* 0.5, 1.0, 1.5 and 2.0 per cent in treatment T_2, T_3, T_4 and T_5, respectively. From the investigation it was observed that, Treatment T_4 (1.5% Stevia powder) secured highest overall acceptability score (95.99) over other treatments. In respect to chemical composition of shrikhand *i.e.* total solids, SNF and ash significantly increased with increase the level of stevia powder while fat, protein, moisture and titratable acidity were decreased with increased level of stevia powder in shrikhand preparation. Cost of production was increased with increased in the rate of addition of stevia powder. Though the cost of production is increased with addition of stevia powder, it can be compensated with the enjoyment of product taste for the diabetic patient who are prohibited for sugar.

Key Words : Cow milk, Chakka, Stevia, Shrikhand, Sensory evaluation, Chemical composition, Cost of production

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INTRODUCTION

Consumption of fermented milk containing *Lactobacilli* has indicated that improved lactose digestion which aids lactose intolerant individuals. *Lactobacilli* and dairy products cultured with *Lactobacilli* have been shows to posses anti carcinogenic properties. These bacteria get implanted in the intestinal tract and displace the unwanted, harmful or foreign bacteria and restore normal balance of micro-organism in intestine with therapeutic benefits to the consumer. Shrikhand has typical semi solid consistency showing a characteristics firmness and palatability contributing to its suitability for consumption with "Puri" or "Bread". The consistency is influenced to great extent by the moisture, fat and sugar levels in shrikhand (Singh, 2006).

The increasing demands for natural sweeteners have driven the farmers in India towards large-scale stevia cultivation. Diterpene glycosides are the groups of natural sweeteners that have been extracted from stevia. The leaves of wild stevia plants contain 0.3 per cent dulcoside,

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0.6 per cent rebaudioside C, 3.8 per cent. rebaudioside A and 9.1 per cent stevioside (Alaam, 2007). Stevia is a small perennial shrub that has been used for centuries as a bio-sweetener and for other medicinal uses such as to lower blood sugar. Its white crystalline compound (stevioside) is the natural herbal sweetener with no calories (Goyal *et al*., 2010). Sugar free shrikhand prepared from stevia fulfill the demands of health conscious consumers of market. Diabetic patients also enjoy the taste of nutritious shrikhand blended with stevia as a sugar free dairy sweetener.

METHODOLOGY

Fresh, clean, whole cow milk was procured for every trial from Livestock Instructional Farm of Department of Animal Husbandry and Dairy Science, Post Graduate Institute, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola. Cow milk was received and standardized at 4 per cent fat level before preparation of chakka. The freeze-dried culture of *Streptococcus lactis* was procured from National Culture Collection Unit, N.D.R.I., Karnal (Haryana) and was used @ 1 per cent. Shrikhand was prepared as per method suggested by Aneja *et al.* (1977) and De (2016) with slight modification. Clean crystalline cane sugar and Stevia powder was procured from local market and used as per requirement of treatments. present study was carried out with five treatments including control T_1 and shrikhand prepared from cow milk chakka with different level of stevia powder *i.e.* 0.5, 1.0, 1.5 and 2.0 per cent in treatment T_2, T_3, T_4 and T_5, respectively.

Sensory evaluation of shrikhand:

The samples of fresh product were subjected to for sensory evaluation in respect of flavour, body and texture, colour and appearance by offering 100 point numeric score card as prescribed by Pal and Gupta (1985) for shrikhand.

Chemical analysis of shrikhand:

Percentage of fat was determined as per the procedure recommended in I.S.I. Hand Book of Food Analysis, Dairy Products, Part 1 (1980). Protein was determined as per method prescribed by Indian Standard Institute in I.S.I. Handbook of Food Analysis, Dairy Products, Part 1 (1980). Ash content of shrikhand was determined as per the procedure recommended in Handbook of Food Analysis Dairy Product in SP: 18 part XI (1981). Moisture per cent of shrikhand was calculated by deducting per cent of total solids content from 100, as per the procedure recommended in I.S.I. Hand Book of Food Analysis, Dairy Products, Part 1 (1980). Total solids were determined as per IS 1479 (part-II) 1961 procedure. The solids not fat (SNF) percentage of shrikhand was determined by using formula *i.e.* total solids – fat = solids not fat. The titratable acidity percentage of shrikhand was determined as per the procedure recommended in BIS Handbook of Food Analysis of Dairy Products in SP: 18 (Part-XI) 1981.

Cost of production:

Cost of production of lassi was calculated by considering the prevailing rates of raw material, labour charges, gas and electricity and other miscellaneous charges, etc.

Statistical analysis:

The data was analyzed as per the Completely Randomized Design (C.R.D.) using 'Analysis of variance' with 5 treatments and 4 replications by Amble (1975).

OBSERVATIONS AND ASSESSMENT

The results obtained from the present investigation as well as relevant discussion have been summarized under following heads :

Sensory evaluation of shrikhand:

The shrikhand was judged by panel of judges for flavour, colour and appearance, body and texture and taste by 100 point numerical scale and the observations recorded were tabulated and presented in Table 1.

It is reveled form Table 1, it was clear that the variation in colour and appearance, flavour, body and texture and overall acceptability score due to treatments was observed to be statistically significant. The treatment T_4 was significantly superior over T_1, T_2, T_3 and T_5 treatments for all attributes of sensory evaluation. It was observed from above finding that 1.5 per cent stevia powder blended shrikhand given good colour and appearance, rich flavour, body and texture and also overall acceptability while the lowest score was recorded for shrikhand prepared with 2 per cent stevia powder.

These results were also supported by Deshmukh *et al.* (2014) noted that ice cream containing 2.25 per cent

of stevia powder had more overall acceptability. Tawade (2015) studied on stevia liquid burfi and reported highest score for overall acceptability in treatment T_5 (5.4) containing 10 per cent stevia liquid and lowest score in treatment T_2 (4.2) containing 2.5 per cent stevia liquid. Mane (2017) reported that overall acceptability of burfi was significantly affected due to addition of stevia powder. The significantly highest score was obtained in burfi prepared with 6 per cent fat in milk in addition of 0.5 per cent stevia powder in T_5 treatment.

Chemical composition of stevia powder shrikhand:

Stevia powder shrikhand was subjected to chemical analysis for fat, protein, moisture, solids not fat, total solids, ash and titratable acidity. The results obtained were tabulated and presented in Table 2.

Fat content of stevia powder shrikhand:

The perusal of data from Table 2 revealed that addition of stevia powder had significantly affected the fat content of shrikhand. It was observed that adding of stevia powder decreased the fat content of shrikhand. Fat content in stevia blended shrikhand was more than that of control, this is due to addition of more quantity of sugar (@45%), which share maximum quantity in final product *i.e.* shrikhand and reduced fat content percentage, which already present in base product *i.e.* chakka, as compare to this, in other treatments 0.5 to 2.0 per cent stevia was added in same chakka, where we observed maximum fat content in T_2 but then after when stevia levels were increased it adversely affect fat content. This results were comparable with the findings of following research workers, Tawade (2015) reported fat content in stevia liquid burfi. It was observed that, 100:0 (T_1) 97.5:2.5 (T_2), 95:5 (T_3), 92.5:7.5 (T_4) and 90:10 (T_5) khoa to stevia liquid were 18.92, 17.49, 16.23, 15.17 and 14.28 per cent, respectively. Mane (2017) reported fat content was highest in burfi prepared from khoa with 6 per cent fat in milk and addition of 0.5 per cent stevia powder (T_5). Fat content in burfi was decreased as increases in the proportion stevia powder in the burfi.

Protein content of stevia powder shrikhand:

Addition of stevia powder had significantly affected the protein content of shrikhand. It was observed that adding of stevia powder decreased the protein content

Table 1: Sensory evaluation of sugar free shrikhand prepared by using stevia (*Stevia rebaudiana bertoni*) powder

Treatments (% Stevia powder)	Mean values of scores obtained for five replications (Score/Marks)			
	Colour and appearance (20)	Flavour (45)	Body and texture (35)	Overall acceptability (100)
T_1 (control)	16.96	41.68	31.93	90.57
T_2 (0.5)	16.38	40.57	31.03	87.99
T_3 (1.0)	17.57	42.66	32.81	93.03
T_4 (1.5)	18.69	43.76	33.55	95.99
T_5 (2.0)	15.80	39.44	30.34	85.58
'F' test	Sig.	Sig.	Sig.	Sig.
S.E. ±	0.15	0.30	0.20	0.46
C.D. (P=0.05)	0.47	0.90	0.61	1.36

Table 2 : Effect on chemical composition of sugar free shrikhand prepared by using stevia *(Stevia rebaudiana bertoni*) powder

Treatments (% Stevia powder)	Mean values of five replications in per cent						
	Fat	Protein	Moisture	Total solids	Solid not fat	Ash	Acidity
T_1 (control)	12.15	9.32	44.69	55.31	43.16	0.86	1.49
T_2 (0.5)	17.53	13.49	59.86	40.14	22.61	0.88	1.52
T_3 (1.0)	17.44	13.47	59.74	40.26	22.82	0.95	1.45
T_4 (1.5)	17.36	13.46	59.49	40.51	23.15	1.18	1.40
T_5 (2.0)	17.29	13.45	59.25	40.75	23.46	1.34	1.38
'F' test	Sig.	Sig.	Sig.	Sig.	Sig.	Sig	Sig.
S.E. ±	0.014	0.009	0.012	0.013	0.026	0.013	0.014
C.D. (P=0.05)	0.042	0.028	0.037	0.039	0.076	0.038	0.041

of shrikhand. The average trends of protein in the present investigation was in accordance with the dada reported by, Goyal and Samsher (2015) reported the protein content in herbal burfi, it observed increase the levels of stevia powder in burfi with decrease the protein content in burfi *i.e.* 14.77, 13.03, 12.03 per cent T_1, T_2, T_3, respectively. Protein content significantly decreased with increased the level of stevia powder. Mane (2017) reported protein content was significantly higher in treatment T_1 (20.15) which milk used for khoa preparation containing 4 per cent fat and lowest in treatment T_6 (18.80 %) which the milk used for khoa preparation containing 6 per cent fat. The addition of stevia powder had significantly decreased the protein content in burfi.

Moisture content of stevia powder shrikhand:

It was observed that adding of stevia powder decreased the moisture content of shrikhand. These differences might be due to less moisture content of sugar and stevia powder than chakka. Same trends were also observed in the results noted by various researchers in respect to use of stevia powder in preparation of other product like burfi, ice-cream, Basundi, etc. Tawade (2015) reported moisture content in stevia liquid burfi it was observed that, 100:0 (T_1) 97.5:2.5 (T_2), 95:5 (T_3), 92.5:7.5 (T_4), and 90:10 (T_5) khoa and stevia liquid were 11.71, 13.96, 15.79, 17.38 and 19.03 per cent, respectively. The increased level of stevia liquid increases the moisture content in burfi. Mane (2017) reported moisture content of burfi were 21.28, 21.13, 22.45, 22.86, 23.40 and 23.81 per cent in treatment T_1, T_2, T_3, T_4, T_5 and T_6, respectively. The moisture per cent increased with increase in the fat and stevia powder level. The results obtained were also comparable with that of Aneja *et al.* (1977); Boghra and Mathur (2000) and Shukla (2007).

Total solids content of stevia powder shrikhand:

It was observed that adding of stevia powder increased the total solids content of shrikhand. Lowest total solids content in shrikhand was observed in T_2 *i.e.* 40.14 per cent, shrikhand prepared from addition of 0.5 per cent stevia powder. These differences might be due to more total solids content of sugar and stevia powder and its rate of addition in chakka. From the table it was observed that treatment differences were statistically significant at 5 per cent level of significance indicating that there was significant increased in total solid content of shrikhand due to increase in level of stevia powder. Same trends were also reported by Goyal and Samsher (2015) Tawade (2015) in preparation of stevia burfi.

Solids not fat content of stevia powder shrikhand:

The data of solids not fat (SNF) content of stevia powder shrikhand under different treatment combinations was showed statistically significant. It was further observed that addition of stevia powder increased the solids not fat content of blended shrikhand. The result indicated that, the addition of stevia powder into cow milk chakka for preparation of shrikhand increased the SNF contain thereby the nutritive value of shrikhand. In stevia powder contain very less amount of fat and other components was more observed due to that SNF contain was increased in stevia powder shrikhand. The results of the study were more or less comparable with that of

Table 3 : Cost of production of stevia powder blended shrikhand

Sr. No.	Particulars	Treatments				
		T_1	T_2	T_3	T_4	T_5
1.	Quantity of milk used in lit. Cow milk (1 lit = 250 g chakka)	1	1	1	1	1
2.	Cost of milk required as per treatment cost of milk Rs. 40/lit.	40	40	40	40	40
3.	Weight of chakka obtained (g)	250	250	250	250	250
4.	Cost of sugar Rs. 40/kg	5.00	0	0	0	0
5.	Stevia powder required as per treatment (g)	0	1.25	2.50	3.75	5.00
6.	Cost of stevia powder (cost of stevia powder Rs. 200/100 g)	0	2.50	5.00	7.50	10.00
7.	Fuel charges LPG (g) Rs. 791/14.2 kg	3	3	3	3	3
8.	Electricity charges @Rs. 5/Unit	2	2	2	2	2
9.	Total weight of shrikhand (g)	362.0	251.2	252.5	253.7	255.0
10.	Total cost of production of final product (Rs.).	50.00	47.50	50.00	52.50	55.00
11.	Total cost of production / kg (Rs.).	138.12	189.09	198.01	206.93	215.68

recorded by Ghatak and Dutta (1998); Phate (2004); Shukla (2007) and Mane (2017).

Ash content of stevia powder shrikhand:

The data presented in Table 2 indicates that addition of stevia powder in preparation of shrikhand significantly affected the ash content of shrikhand. The ash content in treatment T_5 was highest (1.34%) among all the treatments. The lowest ash content in T_1 (0.86%) was observed in shrikhand prepared without stevia powder (control) for shrikhand preparation. These results are comparable with the findings of Mehrotra *et al.* (2014) reported ash content in low calorie high protein shrikhand prepared using stevia leaf powder was increased with increase in the amount of stevia leaf powder varies 0.59 to 0.66 per cent. Tawade (2015) and Mane (2017) who reported that ash content of burfi increased with increased level of stevia.

Titratable acidity content of stevia powder shrikhand:

The titratable acidity content was higher in treatment T_2 *i.e.* 1.52 per cent. Shrikhand prepared from cow milk with addition of 0.5 stevia powder. Lowest titratable acidity content in shrikhand was observed in treatment T_5 (1.38 %) *i.e.* shrikhand prepared from cow milk with 2 per cent stevia powder. The titratable acidity was decrease in stevia powder shrikhand with increase in stevia powder blended with cow milk chakka. This effect was due to negligible acidic content of stevia than the chakka used for preparation of shrikhand. The trends found in the present investigations were more or less similar with that of recorded by Ghatak and Dutta (1998); Phate (2004) and Shukla (2007).

Cost of production of stevia powder blended shrikhand:

Cost of stevia powder blended shrikhand was worked out and presented in Table 3.

While estimating the cost of finished product, the cost of the ingredient used in the preparation of stevia powder blended shrikhand calculated per prevailing market price. From Table 3 it is observed that, cost of production of stevia powder shrikhand (per kg) for treatment T_1, T_2, T_3, T_4 and T_5 were Rs. 138.12, Rs. 189.09, Rs. 198.01, Rs. 206.93 and Rs. 215.68, respectively. Stevia powder blending with cow milk chakka proportionally increased the cost of production. The cost of production of plain shrikhand T_1 (control) was considered to be less than the shrikhand prepare with stevia powder. Increased level of stevia powder showed slight increased in cost of production of shrikhand. This difference was occurs due to the addition of stevia powder, which was available at higher cost. Lower cost of production was observed in case of treatment T_1. However, the best treatment selected by judges was T_4 (where addition of 1.5 per cent stevia powder to shrikhand was done) and the cost of production of shrikhand in this treatment was founded to be Rs. 206.93 per kg. As the level of stevia powder increased cost of production is also increased but this can be compensated because the person suffering from diabetics not preferred sugar, they can use stevia blended shrikhand for enjoy the taste. Tawade (2015) and Mane (2017) reported same trends in preparation of stevia burfi.

Conclusion:

On the basis of data obtained in the present investigation it is concluded that, Good quality shrikhand can be prepared with blending 1.5 per cent stevia powder as a sweetening agent. In respect to chemical composition of shrikhand *i.e.* total solids, SNF and ash significantly increased while fat, protein, moisture and titratable acidity were decreased with increased in the rate of addition of stevia powder in shrikhand preparation. Cost of production was increased with increased in the rate of addition of stevia powder.

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