

STUDY ON THE SENSORY CHARACTERISTICS OF MILK CANDY AMONG DIFFERENT AGED GROUP CONSUMERS OF BANGLADESH

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Abstract: Milk candy contains calcium with other essential nutrients, which make it a potential food supplement for adults and children. The present study was designed to characterize the sensory properties of flavored milk candies. A trained panelist evaluated three milk candies (plain, chocolate, and coffee) using a 15-cm line scale. Three hundred and thirty five adult consumers evaluated the acceptability of three types flavored milk candy on the basis of appearance, shape, texture, aroma, flavor, sweetness, and overall liking. Ninety two children evaluated the acceptability on the basis of overall liking of chocolate and plain flavored milk candies. Evaluations of the flavored milk candies revealed that they were different, based on descriptive sensory attributes. Buttery aroma and caramel aroma were considerer's discriminating attributes, while sweet and cooked flavors were considerer's least discriminating. Taste, specific flavor, overall liking and aroma were the critical factors for acceptability of the products. Children liked the chocolate flavored milk candy better than the plain one. There were no significant differences between evaluation by children and adults for chocolate and plain milk candy respectively. It was observed that the consumers accepted the calcium enriched flavored milk candies.

Key words: Candy, sensory evaluation, aroma, flavor and acceptance

Introduction

Dairy products are the major source of calcium as well as other important nutrients, in human diet. Even though calcium is so important for human health, it is one of the nutrients most likely to be consumed in low amounts by children and adults. Data obtained from the 2007 to 2010 through Continuing Survey of Food Intakes by Individuals revealed that 80% of 6 to 11 years old girls and 75% of similar aged boys did not meet 100% of the recommended daily intake of calcium. Ninety five percent females and 68% males between the ages of 12 to 19 years did not meet 100% of the calcium recommendation of 1,200 mg/day. In addition, adult females failed to meet the recommended dietary allowance of calcium. The consumption of fluid milk among young children has decreased by 16% since the late 70's¹⁻⁵. One of the reasons for this decrease in calcium intake may be due to the competition from other beverages, particularly soft drinks, fruit drinks and flavored teas. Children and adolescents have increased their

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intake of soft drinks, fruit drinks and fruit-flavored drinks at the expense of milk. New value-added milk products are entering the market. Some examples are milks fortified with calcium, curd, sweet yogurt and flavored milks with mango, and chocolate flavors, new ready-to-drink blends of pasteurized milk. Milk powder has been used mainly as a food ingredient, but there is still a gap in the food market, which leads to the opportunity to arrive with a new food product of which milk powder could constitute the major proportion. A natural milk candy, composed mainly of milk powder, and rich with calcium and other nutrients, is not being commercially sold in the Bangladesh market yet. The milk candy represents a great in-between meal dietary snack. The flavored milk candy contains calcium, phosphorus, iron and other essential nutrients, which makes it a potential food supplement for adults and children. It can be flavored with chocolate, milk and other vanilla flavors. Sensory tests, such as descriptive analysis and consumer affective tests are regularly used to study food ingredient effects, processing variables and storage changes on the perceived sensory properties of food products. Sensory analysis provides marketers with an understanding of food product quality, directions for product quality, profiles of competing products, and evaluations of product reformulations from a consumer perspective.

This objective of the study was to determine the consumer's responses to flavored milk candies. Quantification of overall appearance, size, texture, aroma, taste, specific flavor, sweetness, and overall liking differences of the three flavored milk candies, as well as understanding their effects on consumer acceptability.

Materials and Methods

Materials

The milk candy composed of 20% milk powder, 40% sugar, 10% butter and 30% liquid glucose with 100 ppm milk flavor and 100 ppm SiO₂ as color. The plain (without added flavor), chocolate (chocolate flavor added), and coffee (coffee flavor added) milk candies were evaluated. Each candy tablet weighs 3 gram and the product is packaged in an aluminum pouch for protection from light, humidity and foreign odors.

Methods

Affective Test with adult

Panelists for sensory evaluation were recruited from Narshingdi area near to PRAN Factory. Selection criteria were healthy, time availability, no allergy to dairy, chocolate and coffee products, any aversion to dairy products and willingness to participation. Panelists had agreed on a list of eight clearly defined terms, the appropriate reference standards and their intensities on the 15-cm intensity line scale. They worked in partitioned booths, with positive airflow, free from distracting noises and odors. They were provided with normal fresh drinking water, unsalted crackers and an expectoration cup to cleanse their palate. A total of seven consumer sessions were carried out from 10:00- 11:30 am and 2:30-4:30 pm during 3 days. Consumers were instructed the procedures to be followed. They were informed that each sample was randomly coded with a 3-digit number. These numbers corresponded to those appearing on each of the three pages of the questionnaire. Prior to the product evaluation, participants were asked

to complete a demographic and socioeconomic survey, which included questions regarding age, gender, race, ethnicity, education level, employment status, and household income. Three milk candy tablets of the plain, chocolate and coffee flavor were tasted at room temperature in a random 3-digit number coded in a sequential, monadic presentation tasted.

Participants were told to chew at least half of the tablet and to evaluate the three samples for acceptability of overall appearance, size and shape, texture, taste, aroma, specific flavor, sweetness and overall liking using a 9-point hedonic scale (1=dislike extremely, 5= neither like, nor dislike, and 9=like extremely) ¹⁴⁻¹⁸. Consumers were also asked to rate the specific flavor of each milk candy (milk for the plain one, “chocolate” for the chocolate flavored one, and “coffee” for the coffee flavored one) on a 3-point “just about right” (JAR) scale with “just about right”= 2, “too weak”=1, and “too strong”=3. Participants evaluated acceptance of the product using a yes/no scale ¹⁵.

Affective Test with Children

Pre-teenagers (n = 50) were recruited from the local primary school. The screening criteria were: consent from parents or legal guardian, in the range of 10-12 years old, not allergic to milk, chocolate and/or coffee products, and available with positive interest in participating in the particular testing date and time. Children were instructed about the taste procedures to follow. Prior to the product evaluation, children were asked to complete a demographic questionnaire, which included questions regarding age, gender and grade they were currently in. Three samples of each of the plain and chocolate flavored milk candies were served at room temperature in a plastic tray in a sequential, monadic presentation. Consumers were seated in their classrooms with controlled lighting. They were instructed to chew at least half of a candy sample and to evaluate the two samples for acceptability of overall liking, using a combination of Kroll & Pilgrim scale and facial scale (1=super bad, 5= not good no bad and 9 = super good) with a facial scale ¹⁹.

Product Evaluation

The panelists evaluated plain, chocolate and coffee flavored milk candies using the developed lexicon, which included four aroma and four flavor attributes. They were seated in a conference-type table to facilitate communication. Samples were placed in a plastic tray; three candies were served for each sample. The panelists evaluated three samples once during a 60-minutes session and the evaluation was repeated two more times. The three evaluation sessions were separated by at least one hour to eliminate flavor carryover and fatigue effects. Panelists worked in partitioned booths, with positive air flow, free from noise and odors, and under red light in order to mask different colors of the three samples, and therefore, to prevent bias. The panelists were instructed not to swallow the samples, and were asked to rinse their palate well with water between samples. Panelists recorded the intensities of the attributes on the 15-cm scale, where zero indicates the absence of intensity, which corresponds to an extreme intensity.

Data Analysis

Analysis of Variance (ANOVA, SAS version 8.2, 2001)²⁰ was performed to determine significant effects of the attribute intensities in each of the three flavored milk candies. A significant F-ratio ($\alpha < 0.05$) from the ANOVA indicated that an attribute was used to determine differences among the three milk candies, expressed in terms of mean vectors of the eight sensory attributes (buttery aroma, cheesy aroma, caramel aroma, cooked aroma, cooked flavor, sweet flavor, buttery flavor, and caramel flavor).

Results

The model used for the analysis of the descriptive sensory evaluation was a randomized block design, in which panelists were considered as blocks.

Table 1: Flavor attribute terminologies and corresponding reference standards used by the trained panelist

Parameters	Terminologies	Intensity	Intensity
Sweet	Taste on the tongue stimulated by sugars and high potency sweeteners.	-16% sucrose solution	15.0
		-10% sucrose solution	10.0
		-8% sucrose solution	8.0
		-5% sucrose solution	5.0
Caramel	Sweet aromatic associated with characteristic of brown sugars and caramelized sweetened milk.	- Caramelized condensed milk Starship (cooked in water bath at 100°C for 2.30 hrs)	15.0
		-20% caramelized condensed milk Starship (cooked in water bath at 100°C for 2.30 hrs) in 1% fat milk solution	13.0
		- Caramel candy PRAN	11.0
		- 10% caramelized condensed milk Starship (cooked in water bath at 100°C for 2.30 hrs) in 1% fat milk solution	5.0
Cooked	Aroma associated with heated milk, UHT milk, burnt milk	-UHT 2% fat milk PRAN microwaved 30 sec	10.0
		- UHT 2% fat milk PRAN	6.0
Buttery	Aroma associated with fresh butterfat, sweet cream	-Fresh	8.0
		-Butterfat	6.0
		-Sweet cream	4.0

Table 2: Means, standard deviations and analysis of variance for aroma and flavor attributes of three flavored milk candies

Attribute	Flavored milk candies			Pr>F
	Plain	Chocolate	Coffee	
Buttery Aroma	6.6 ± (2.9)a	4.9 ± (3.2)b	3.9 ± (2.3)b	0.0006
Cooked Aroma	5.9 ± (3.2)a	4.9 ± (2.7)a	4.8 ± (3.3)a	0.2
Caramel Aroma	3.6 ± (3.0)a	6.3 ± (2.7)b	3.9 ± (3.0)	0.0002
Cooked Flavor	8.7 ± (2.1)a	7.3 ± (2.3)b	7.0 ± (2.3)b	0.005
Buttery Flavor	5.2 ± (2.4)a	3.8 ± (2.2)b	4.2 ± (2.4)ab	0.03
Sweet Flavor	7.7 ± (1.8)a	7.8 ± (1.7)a	8.0 ± (2.5)a	0.8
Caramel Flavor	7.1 ± (3.2)a	9.8 ± (2.0)b	8.4 ± (3.2)ab	0.007

a Means in each row having different superscripts are significantly different ($P < 0.05$)

Table 2 shows that the means, standard deviations and Pr> F values for the intensities of each of the attributes evaluated in each of the three flavored milk candies. The buttery aroma (P = 0.0006), caramel aroma (P = 0.0002), cooked flavor (P = 0.005), caramel flavor (P = 0.007), and buttery flavor (P = 0.03) showed significant differences in their intensities among the three milk candies. Cooked aroma (P=0.2) and sweet flavor (P = 0.8) were not significant different among the three samples. The test indicated that buttery aroma and caramel aroma had different intensities in the plain milk candy compared with the chocolate and the coffee flavored milk candies. Cooked aroma and sweet flavor were not different among the three milk candies. Caramel aroma intensities were different among the plain, chocolate and coffee candies. Buttery flavor and caramel flavor had different intensities when comparing plain milk candy with chocolate and coffee samples.

Table 3: Means, standard deviations and analysis of variance for acceptability attributes of three flavored milk candies

Attributes	Plain	Chocolate	Coffee	Pr> F
Appearance	5.9± (1.8) a	5.7± (1.7) ab	5.5 ± (1.6) bc	<0.0001
Size/Shape	6.2± (1.6) a	6.1± (1.6) ab	5.9± (1.6) bc	<0.0001
Texture	6.0± (1.9)a	5.9± (1.7)a	5.5± (1.8)b	<0.0001
Taste	5.8± (2.2)a	6.2± (1.8)b	4.5± (2.1)c	<0.0001
Aroma	5.0± (1.9)a	5.7± (1.7)b	4.5± (1.8)c	<0.0001
Sweetness	6.1± (1.9)a	6.0± (1.6)a	5.2± (1.9)b	<0.0001
Overall Liking	5.8± (2.0)a	6.1± (1.7)a	4.5± (2.1)b	<0.0001

The mean scores and ANOVA results for the acceptability of overall appearance, size and shape, texture, taste, aroma, specific flavor, sweetness and overall liking of plain, chocolate and coffee milk candies. The analysis of variance and a post-hoc test indicated an existence of differences in acceptability of appearance, size and shape, aroma, taste, specific flavor, sweetness, and overall liking of the three flavored milk candies. Acceptability of overall appearance for plain milk candy is highest with a score of 5.9, while the lowest score was observed for coffee milk candy (5.5). Plain milk candy got 6.2 score in size and shape which was higher than that of the coffee flavored candy. Plain and chocolate milk candies were not different in acceptability of their texture (6.0 and 5.9), while coffee (with a mean score of 5.5) was different when compared to the two. Chocolate milk candy was most accepted when consumers evaluated taste and aroma attributes with hedonic scores of 6.2 and 5.7, respectively. Coffee flavored milk candy was least accepted with the scores for taste, aroma, specific flavor, and sweetness attributes of 4.5, 4.5, 4.6 and 5.2, respectively. The chocolate flavored milk candy was the most accepted when participants estimated overall liking, with a score of 6.1, followed by the plain milk candy with a score of 5.8. The coffee milk candy had again the lowest score, with 4.5 (5= neither like nor dislike), indicating significant lower in acceptability when compared with the other two samples (chocolate and plain). (Table 3, 4, 5 and Figure 1&2)

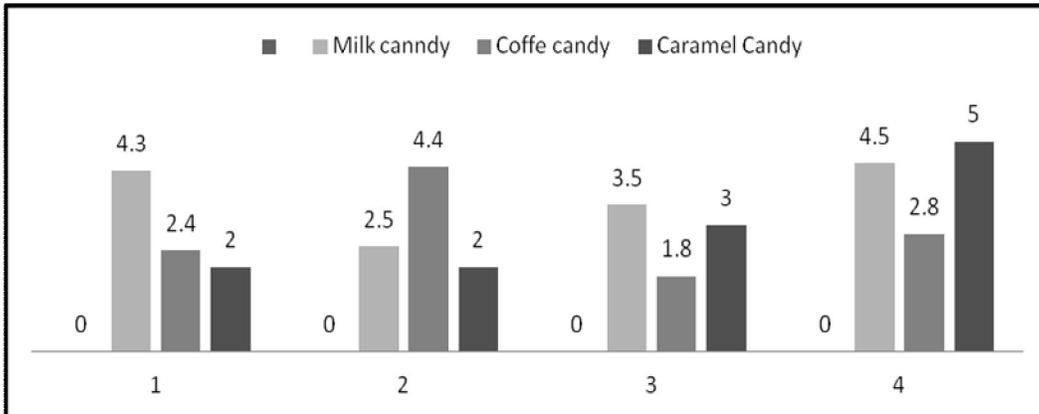


Figure 1: Ranking of candy samples using Hedonic Scale

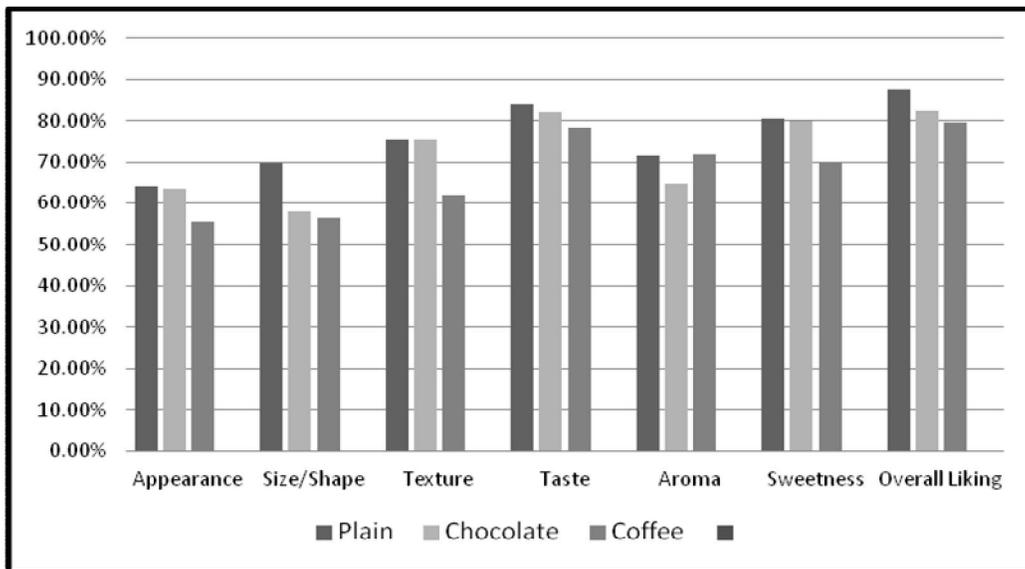


Figure 2: Classification results from Predictive Discriminate Analysis (PDA) - % Rate for acceptability of three flavored milk candies evaluated by adults

Table 4: Means, standard deviations and ANOVA results for overall liking of two flavored milk candies evaluated by 10-12 years old children

Milk candy	Girls	Girls Boys	Combined
Chocolate	6.0 ± (2.2)	5.4 ± (2.3)	5.7 ± (2.3)
Plain	4.0 ± (0.0)	3.5 ± (2.1)	3.6 ± (2.1)
Pr> F	< 0.0001	0.0002	< 0.0001

Table 5: Means, standard deviations and ANOVA results for overall liking of two flavored milk candies, evaluated by children and adult consumers

Milk candy	Adults	Children	Pr> F
Chocolate	6.0 ± (1.7)	5.7 ± (2.3)	0.17
Plain	5.8 ± (2.0)	3.6 ± (2.1)	<0.0001

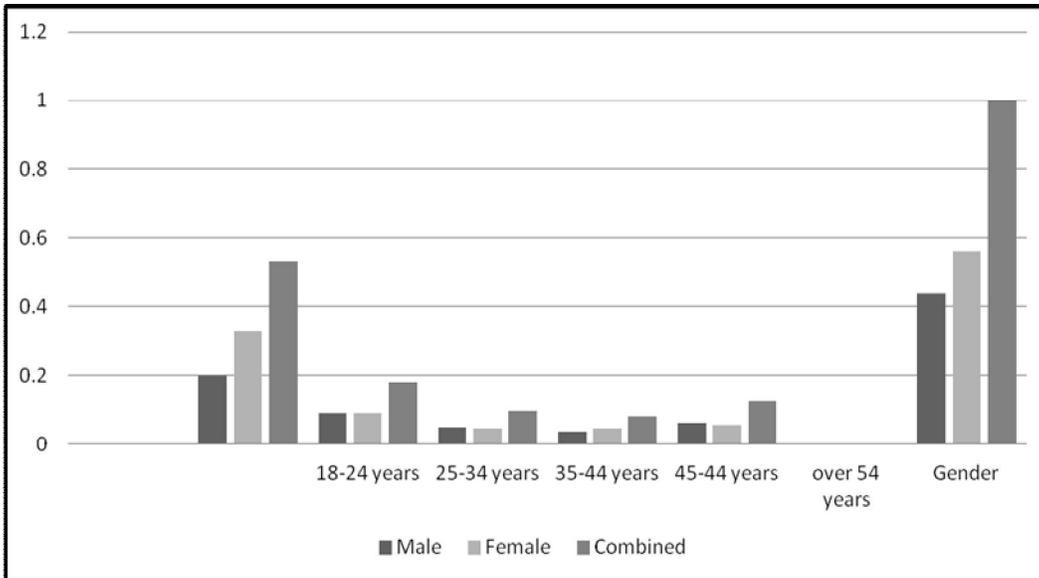


Figure 3: Age Distribution among the participants of sensory evaluation

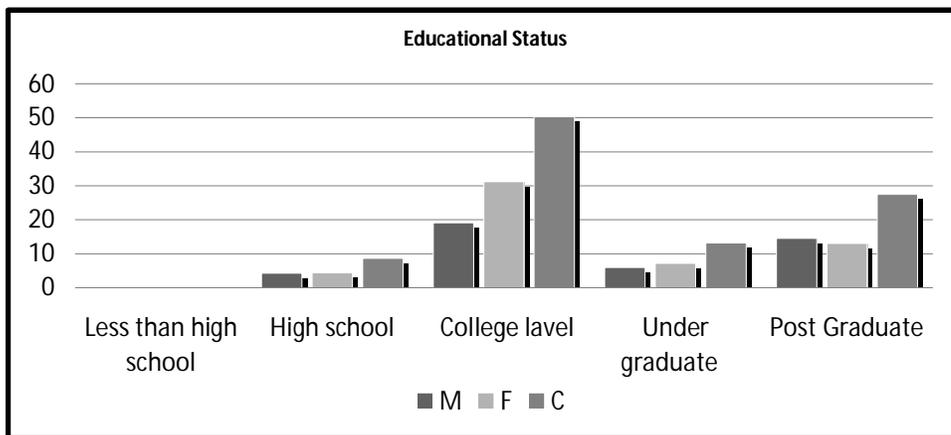


Figure 4: Demographic and socioeconomic information

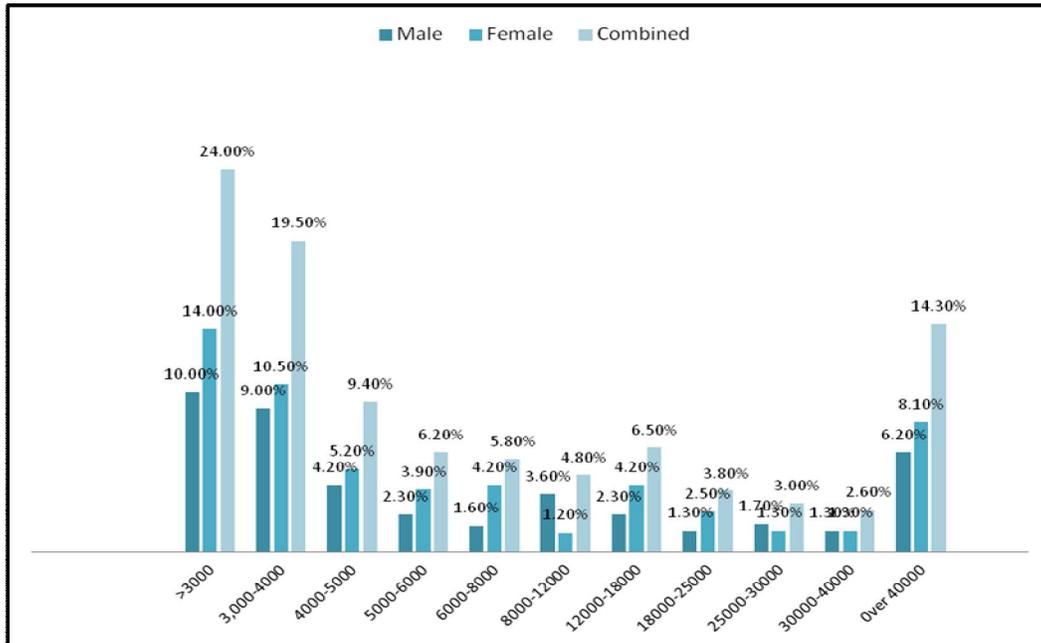


Figure 5: Data for Income status of the participants

Demographic information is detailed in Figure 3, 4 &5. The majority of the participating consumers was in the age range of 18-34 years old (71%); followed by consumers in the range of 35-44 years old (17.5%). The lowest percentage of participants (12.5%) was 54 years old or older. Of the total, 56 % of subjects were female and 44% were male. A greater proportion of their education level was divided into college (50%), graduate level (27.5 %), completed college (13.2%), high school (8.7%), and less than high school (0.3%). About 65% of the consumers had household annual incomes of less than Tk.50, 000.00 and 35% had annual household income of Tk.150, 000.00 or higher.

A large percentage of consumers (82.5%) answered that they have not seen a flavored milk candy in the form of tablet in the local market. Ninety two percent of them said they knew about the health benefits of calcium. A higher percentage of women (93.5%) answered that they were aware of health benefits of calcium, compared to men (90.3%), About 84% of the consumers declared that they were willing to purchase a flavored milk candy enriched with vitamins and minerals. Again, female consumers responded in a higher percentage(88 %) when compared to males (79%). These results may be influenced by the fact that females are more aware of the important role of calcium intake in reducing the risk of osteoporosis during post menopause.(Table 6)

Table 6: Consumer product information about flavored milk candies

Question	Gender		
	Male	Female	Combined
Have you ever seen a flavored milk candy in the form of tablet in the Bangladesh market?			
YES	17.2%	17.8%	17.5%
NO	82.8%	82.2%	82.5%
Are you aware of the health benefits of calcium?			
YES	90.3%	93.5%	92.1%
NO	9.7%	6.5%	7.9%
Would you buy a milk flavored milk candy enriched with calcium and vitamins/minerals?			
YES	79.2%	88.1%	84.2%
NO	20.8%	11.9%	15.8%

Discussion

Data obtained from consumer affective tests represents key information in studies of product development, quality control, food product acceptance, and food service evaluation¹⁰⁻¹³. Consumer acceptance of a food product can be defined as the experience characterized by a positive attitude toward the product; and actual utilization of food by consumers¹⁶. An increasing awareness of the role of diet and appropriate nutrition to maintain and improve health, as well as to prevent diseases has been emerging in the Bangladesh. An alternative for consumers to meet the recommended daily allowance of calcium are taking food supplements, such as multivitamin supplements containing calcium or deposited candies enriched with elevated percentages of calcium. Calcium represents the most abundant mineral in the body, 99% is found in bones and teeth, while 1% is found in cells, blood, and other tissues⁶⁻⁹. Recent studies recommended that the consumption of calcium could contribute to the weight loss. Researcher²¹ had suggested that high calcium diets apparently inhibit lipogenesis. Phosphorus is considered to be closely associated with calcium, as both are present in bones. This mineral is involved in all the functioning of the metabolic machinery. The milk candy is a versatile product. It can be produced to have a broad spectrum of target consumers. Moreover, the milk candy can be enriched with different additional essential nutrients, making it an advantageous and competitive functional food product.

Conclusion

Descriptive Sensory evaluations of the three flavored milk candies revealed that they were different among one another. Buttery aroma and caramel aroma were discriminating attributes. Sweet flavor and cooked aroma were least discriminating. Plain milk candy was characterized by buttery aroma, cooked aroma, cooked flavor and buttery flavor notes. Caramel aroma and flavor aroma notes characterized chocolate milk candy. Coffee milk candy obtained low intensities scores for discriminating attributes. Determination of the product sensory characteristics presented in each of the milk flavored milk candies provide in depth understanding of the product quality. Chocolate and coffee flavors may be used to mask strong undesirable cheesy and cooked flavor and aroma notes, and consequently it may increase product acceptability.

References

1. Aguilar C, Hollender R, Ziegler G. Sensory Characteristics of Milk Chocolate with Lactose from Spray-Dried Milk Powder. *Journal of Food Science* 1994; 59(6):1239-1243.
2. Bantivoglio KA, Tepper BJ. The Use of Trained Sensory Panels in Flavor and Texture Profiling. *American Laboratory* 1998; 30 (6):19-25
3. Chen AE, Resurreccion AVA, Paguio LP. Age Appropriate Hedonic Scales to Measure Food Preferences of Young Children. *Journal of Sensory Studies* 1996; 11: 141-163.
4. Claassen MR, Lawless HTA. Comparison of Descriptive Terminology Systems for the Sensory Analysis of Flavor Defects in Milk. *Journal of Food Science* 1992; 57: 596-600,621.
5. Dijksterhuis G. Multivariate Data Analysis in Sensory and Consumer Science: An Overview of Developments. *Trends in Food Science and Technology* 1995;6 (6):206- 211.
6. Early R. *The Technology of Dairy Products*. 2nd Edition. Blackie Academic and Professional. London, U.K. 1998; 446pp.
7. Guinard JX. Sensory and Consumer Testing with Children. *Trends in Food Science and Technology* 2001; 11: 273-283.
8. Heaney RP, Recker RR, Hinders S. Variability of Calcium Absorption. *American Journal of Clinical Nutrition*. 1988; 47:262-264.
9. Hough G, Bractchell N, Wakeling I. Consumer preference of Dulce de Leche Among Students in the United Kingdom. *Journal of Sensory Studies* 1992; 7: 119-132.
10. Kroll, B. Evaluating Rating Scales for Sensory Testing with Children, *Food Technology* 1990; 44 (11): 78- 80, 82, 84 and 86.
11. McEwan JA, Hunter EA., Van Gemert LJ, Lea P. Proficiency Testing for Sensory Profile Panels: Measuring Panel Performance. *Food Quality and Preference* 2002; 13:181-190.
12. Meilgaard M, Civille GV, Carr BT. *Sensory Evaluation Techniques*. 3rd Edition, CRC Press, Boca Raton, Florida. 1999; 387pp.
13. O'Mahony, M. *Sensory Evaluation of Food*. Marcel Dekker, Inc. New York, NY.1986; 487pp,
14. Piggot JR. *Sensory Analysis of Foods*. Elsevier Applied Science New York. 1988; 426pp.
15. Peryam RD, Pilgrim FJ. Hedonic Scale Method of Measuring Food Preference. *Food Technology* 1957; 11(9):9-14.
16. Powers JJ. Using General Statistical Programs to Evaluate Sensory Data. *Food Technology* 1984;38 (6):74-82, 84
17. Resurreccion AV. *Consumer Sensory Testing for Product Development*. Aspen Publishers, Inc. Gaithersburg, Maryland, 1998, 254pp.
18. Rodriguez NC. Developing Products for Children: A Sensory Approach. *Food Product Design* 2001;1:71-
19. Sune F, Lacroix P, Huon de Kermadec FA Comparison of Sensory Attribute Use by Children and Experts to Evaluate Chocolate. *Food Quality and Preference* 2002; 13:545-553.
20. Weller JN, Stanton KJ. The Establishment and Use of QC Analytical/Descriptive/ Consumer Measurement Model for the Routine Evaluation of Products at Manufacturing Facilities. *Food Quality and Preference* 2002; 13:375-383.
21. Zemel MB, Shi H, Greer B, DiRienzo D, Zemel PC. Regulation of Adiposity by Dietary Calcium. *Journal of the Federation of American Societies for Experimental Biology* 2000; 14:1132-1138.