

Effect of type of flavor on sensory characteristics of Ice Cream from Factories and Machines

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Abstract: This study was conducted to compare sensory characteristics of factory and machine ice cream produced in Khartoum State. Ten untrained panelists evaluated machine and factory ice cream purchased from Khartoum North groceries and supermarkets. Results of the panel tests for sensory evaluation showed that, factory ice cream was found to be superior to machines ice cream in texture, flavor, taste and overall acceptability ($p < 0.001$), while color was found to show non significant differences. The sensory characteristics of flavor postulated non significant differences in all ice cream samples except for flavor ($p < 0.05$). The results of sensory characteristics of machines and factory ice cream revealed significant differences ($p > 0.05$) for texture and ($p > 0.1$) for flavor and a non significant results for color, taste and overall acceptability. This study is the first to define sensory characteristics of ice cream in Sudan and the results may be used to produce high quality ice cream with increased consumer liking.

Key words: Machine ice cream, Factory ice cream, Chocolate, Vanilla, Coconut, Strawberry, Mango, Khartoum State, Sudan.

INTRODUCTION

Ice cream is a milk product, which contain a variety of ingredients in addition to milk, cream, and sugar Elhai *et al.* (2002). Frozen desserts are among the most popular desserts eaten in or out the home. These include, ice cream, sherbets, and mousses (Peckham 1974). Locally made type ice milk in Sudan is called *Dandorma*, is well known in urban areas, distributed by ice cream vendors in push carts (El Owni and Khater, 2009). Recently, in 1978 factory Ice Cream was manufactured by the Modern Ice Cream and Sweets Factory in Khartoum State. This was followed by El gaith Dairy Products Company in 2006. By the beginning of the 21st century bulk Ice Cream sales were common in confectionary and sweets shops.

Ice cream has a general formula, which can be added to or slightly modified to create the desired product. The major constituents in the ice cream formula back bone are milk fat, milk solids not fat, sweetener, stabilizer and/or emulsifiers, water and air (Varnam and Sutherland, 1994). Flavor is a sensation which is derived from odor. Ice cream owes its variety and popular appeal to many pleasing flavoring materials which can be used in its manufacture. The flavors are added directly into the mix when powders or purees are used (Desrosier, 1977). The fact that ice cream comes in many flavors and types leads a person to believe that ice cream is a complex and confusing product (Varnam and Sutherland, 1994). Flavorings are added to ice cream in the form of extract, fruit, nuts, spices, chocolate, or coffee and only in amounts that will impart a mild, pleasant flavor (Peckham, 1974). Thanh *et al.* (1992) reported that interactions among volatile aroma substances and non volatile compounds depend on the physicochemical properties of the compound and on the binding that may occur among them. Moreover butter fat is one of the chief factors affecting the flavor of ice cream (Bennion, 1975). Non significant differences ($p > 0.05$) in all chemical components due to flavor except total solids between machine and factory ice cream in Khartoum State, Sudan were reported by El Owni and Khater, (2009).

The objective of the present study is to evaluate the chemical quality and effect of flavors on sensory characteristics of factory and machines ice cream.

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MATERIAL AND METHODS

Hundred ice cream samples were collected from machines and factory, fifty samples from each ice cream producer in Khartoum State. The study was conducted during the period from September 2003 to March 2004, in the Laboratory of Dairy Production Department, Faculty of Animal Production, U of K. Machines ice cream samples were purchased from vendor's while factory samples were bought from supermarket. The flavors added to the samples were chocolate, vanilla, coconut, strawberry and mango.

Ten untrained panelists were chosen to Judge on the quality of ice cream in terms of color, flavor, texture, taste and overall acceptability.

Statistical analysis were performed using the Statistical Package for Social Science (SPSS:10.5) to determine the variation between machines and factory ice cream flavored with chocolate, vanilla, coconut, strawberry and mango. Moreover, the flavor ingredients analyzed to test their effect on the sensory characteristics (color, texture, flavor, taste and overall acceptability) of ice cream. Means were separated using Duncan's Multiple Range Test.

RESULTS AND DISCUSSION

Table (1) shows the mean sensory score of ice cream made from factory. The color shows a non significant ($p>0.05$) results with the highest score in ice cream made by machines (6.73 ± 0.69) compared with factory ice cream (6.58 ± 0.77). The highest mean of texture, flavor, taste and overall acceptability ($P<0.001$) were obtained in factory ice cream (6.26 ± 1.34 , 6.29 ± 0.73 , 6.68 ± 0.72 and 6.56 ± 0.69 , respectively), while the lowest means were obtained in machines ice cream (3.39 ± 1.52 , 4.57 ± 1.15 , 5.06 ± 1.23 and 5.15 ± 1.17 , respectively). The present results were, in agreement with the findings of Roland *et al.* (1999) who concluded that the sensory response to the ice cream samples was affected by the variation in fat content. The present data (Table 1) were also in agreement with the findings of Zheng (1997) who reported that fat is important in food for sensory qualities such as flavor, color, texture and mouth feel. The present results were, in agreement with the findings of Noakes *et al.* (1996) who observed slightly color differences in dairy products (milk, butter, cheese and ice cream) with a higher unsaturated fatty acid content.

Table (2) shows mean sensory scores of ice cream made from different types of flavors. The color and overall acceptability of ice cream ($p>0.05$), showed the best result in ice cream made from mango flavor (6.87 ± 0.65 and 6.18 ± 1.10) respectively, and the poorest color scores were in ice cream made from vanilla (6.24 ± 0.70) and acceptability, in coconut (5.44 ± 1.18). The best texture score was found in ice cream made from strawberry (4.78 ± 2.00), while the lowest score was found in coconut ice cream (4.27 ± 2.07). Ice cream made from coconut scored the highest significant ($P<0.01$) score in flavor. While, the chocolate ice cream scored the highest taste 6.28 ± 1.31 . However, the lowest scores of flavor and taste were in strawberry (4.71 ± 1.52 and 5.43 ± 1.28). The results were consistent with the findings of Parikh (1977) who mentioned that ice cream should have a delicate, attractive color suggest or is reading associated with the flavor. Moreover almost all flavors of ice cream should be slightly colored, with respect to sensory characteristics (Arbuckle, 1986).

Table (3) shows mean sensory scores of ice cream made from different types of flavors. The best color, texture, flavor, taste and overall acceptability scores of ice cream made by machine were in ice cream made from chocolate 6.95 ± 0.56 , chocolate 4.15 ± 1.92 , vanilla 5.22 ± 1.30 , chocolate 5.85 ± 1.50 and chocolate 5.38 ± 1.32 respectively. The poorest color, texture, flavor, taste and overall acceptability scores in ice cream made by machine were found in vanilla 6.13 ± 0.70 , coconut 2.73 ± 0.71 , strawberry 3.67 ± 0.91 , vanilla 4.50 ± 0.70 and strawberry (4.78 ± 0.96) respectively in machine ice cream.

The best color, texture, flavor, taste and overall acceptability scores of ice cream made by factory were in ice cream made from strawberry 6.87 ± 0.70 , vanilla 6.88 ± 0.68 , coconut 6.60 ± 0.73 , vanilla 7.18 ± 0.67 and vanilla 6.93 ± 0.63 respectively. The poorest color, texture, flavor, taste and acceptability scores of ice cream made by factory were in ice cream made from chocolate 6.28 ± 1.06 , chocolate 5.00 ± 2.11 , vanilla 6.15 ± 0.92 , strawberry 6.28 ± 0.81 and coconut (6.25 ± 0.80) respectively.

Ice cream made from coconut scored the highest significant ($P<0.01$) score in flavor 6.60 ± 0.73 . While, the chocolate ice cream scored the highest taste 6.28 ± 1.31 . However, the lowest flavor and taste scores were in strawberry 3.67 ± 0.91 and 4.50 ± 0.70 . The results were consistent with the findings of Parikh (1977) who mentioned that ice cream should have a delicate, attractive color suggest or is reading associated with the flavor. Moreover almost all flavors of ice cream should be slightly colored, with respect to sensory characteristics (Arbuckle, 1986).

However the highest scores of texture, flavor, taste and overall acceptability were found in strawberry (6.88±0.69), coconut (6.60±0.73), vanilla (7.18±0.67) and vanilla (6.93±0.63) respectively in ice cream produced by factory. The highest significant texture (P< 0.01) and flavor scores (P< 0.001) were in factory ice cream made with vanilla and coconut respectively. However, ice cream made with coconut and strawberry flavors, revealed the lowest significant (P< 0.01) and (P< 0.001) results in ice cream produced by machine. The above results were generally, in agreement with the findings of BFuria (1972) who proposed that flavor is the combination of taste, feeling and odor on receptors in the mouth and the nose. Our results were also in agreement with the findings of Arbuckle (1986) who showed the body and texture characteristics are closely associated and are important in influencing consumer acceptance of ice cream and related products.

Table 1: Sensory characteristics of ice cream samples from factory and Machines in Khartoum State, Sudan

Sensory characteristics	machines	factory	Sig. level
Color	6.73±0.69 ^a	6.58±0.77 ^a	NS
Texture	3.39±1.52 ^b	6.26±1.34 ^a	***
Flavor	4.57±1.15 ^b	6.29±0.73 ^a	***
Taste	5.06±1.23 ^b	6.68±0.72 ^a	***
Overall acceptable	5.15±1.17 ^b	6.56±0.69 ^a	***

In this and the following tables means within each row bearing similar superscripts are not

* significantly different (P> 0.05)

** significantly different (P> 0.01)..

***: Highly significant: at (P< 0.001).

Table 2: Sensory characteristics of flavored ice cream

Sensory characteristics	Chocolate	Vanilla	Coconut	Strawberry	Mango	Sig. level
Color	6.68±0.84 ^a	6.24±0.70 ^a	6.74±0.64 ^a	6.81±0.64 ^a	6.87±0.65 ^a	NS
Texture	4.49±1.99 ^a	4.46±2.34 ^a	4.27±2.07 ^a	4.78±2.00 ^a	4.68±1.84 ^a	NS
Flavor	5.39±1.06 ^{ab}	5.59±1.26 ^{ab}	5.67±1.12 ^a	4.71±1.52 ^{bc}	4.92±1.40 ^{ab}	*
Taste	6.28±1.31 ^a	5.57±1.51 ^a	5.55±1.19 ^a	5.43±1.28 ^a	5.70±1.24 ^a	NS
Overall acceptable	5.77±1.24 ^a	5.71±1.35 ^a	5.44±1.18 ^a	5.48±1.18 ^a	6.18±1.10 ^a	NS

Table 3: Sensory characteristics of ice cream samples from factory and machine in Khartoum State Sudan

Sensory characteristics	machine					factory					Sig. level
	Chocolate	Vanilla	Coconut	Strawberry	Mango	Chocolate	Vanilla	Coconut	Strawberry	Mango	
Color	6.95±0.56 ^a	6.13±0.70 ^a	6.82±0.65 ^a	6.83±0.64	6.93±0.58 ^a	6.28±1.06	6.43±0.63 ^a	6.63±0.65 ^a	6.78±0.70 ^a	6.70±0.78 ^a	NS
Texture	4.15±1.92 ^a	2.85±1.40 ^{bc}	2.73±0.71 ^{bc}	3.60±1.58 ^{ab}	3.60±1.45 ^{ab}	5.00±2.11 ^{bc}	6.88±0.68 ^a	6.58±0.84	6.55±1.00	6.30±0.95 ^{ab}	**
Flavor	4.87±0.98 ^{ab}	5.22±1.30 ^a	5.05±0.87 ^{ab}	3.67±0.91 ^{bc}	4.05±0.88 ^{ab}	6.18±0.60 ^{ab}	6.15±0.92 ^{bc}	6.60±0.73 ^a	6.28±0.51 ^{ab}	6.23±0.9	*
Taste	5.85±1.50 ^a	6.23±0.92 ^{ab}	4.90±1.05 ^a	4.87±1.24 ^a	5.18±1.26 ^a	6.93±0.63 ^a	7.18±0.67 ^a	6.53±0.54 ^a	6.28±0.81	6.48±0.73 ^a	NS
Overall acceptability	5.38±1.32 ^a	4.90±1.00 ^a	4.90±1.09 ^a	4.78±0.96 ^a	5.80±1.26 ^a	6.35±0.89 ^a	6.93±0.63 ^a	6.25±0.80 ^a	6.75±0.53 ^a	6.75±0.45 ^a	NS

The study conclude that processing techniques affected the quality of the ice cream, the best score values of texture; flavor, taste and overall acceptability were found in ice cream made by factory, while the lowest values were found in machines samples. The highest and lowest score values of color were found in machines samples. Color, texture, taste and overall acceptability were not significantly affected. Hence, these results indicates that machine ice cream is of low quality compared to factory ice cream.

We recommend that machine ice cream operators need training about ice cream mix preparation and processing practice to improve chemical composition and flavor of ice cream. Close supervision and firm enforcement of SSMO standards governing ice cream production, distribution and handling are needed in this country. Future work is needed to study various flavor ingredients in ice cream formulations and to evaluate their effects on sensory characteristics.

REFERENCES

- Arbuckle, W.S., 1986. Ice cream, 4th ed. Avi publishing Co. Inc., West Port, Connecticut. S. A.
- Bennion, M., 1975. Introductory foods, 6th ed. Macmillan Publishing Co. Inc., New York and Collier Macmillan Publishers London.
- BFuria, Th. E., 1972. Handbook of food additives, 2nd ed. Published by CRC Pressing Inc., New York.
- Desrosier, N.W., 1977. Elements of Food Technology. AVI Publishing Co., West Port., Connecticut, USA.
- Elahi, A.T.M.M.E., S. Habab, M.M. Rahman, G.I. Rahman and M.J.U. Bhuiyan, 2002. Sanitary quality of commercially produced ice cream sold in the retrial stores. Pak. J. of Nutr., 1(2): 93-94.
- El Owni, O.A.O. and Z.K.O. Khater, 2009. Chemical composition of ice cream produced in Khartoum State, Sudan. Pakistan Journal of Nutrition, 8(2): 158-160.

Noakes, M., Nestel, P.J. and P.M. Clifton, 1996. Modifying the fatty acid profile of dairy products through feedlot technology lowers plasma cholesterol of humans consuming the products. *Am. J. Clin. Nutr.*, 63: 42-46.

Parikh, J.V., 1977. Technology of dairy products. Small Business Publications, P. B. No. 2131, 4/45, Roop Nagar, Delhi 110007.

Peckham, Peckham, G., 1974. Foundations of food preparation, 3rd ed. Macmillan Publishing Co., Inc. New York and London.

Roland, A.M., L.G. Phillips and K.J. Boor, 1999. Effect of fat content on the sensory properties, melting, color and hardness of ice cream. *J. Dairy Sci.*, 82(1): 32-38.

Thanh, M.L., L.A. Thibeau, M.A. Thibaut and A. Voilley, 1992. Interactions between volatile and non volatile compounds in the presence of water. *Food Chem.*, 43: 129.

SSMO (Sudanese Standards and Metrological Organization), Ministry of Cabinet of Ministers, Sudan Government. Monetary Printing Press Co. Sudan.

Varnam, A.H. and J.P. Sutherland, 1994. Milk and Milk products: Technology, chemistry and microbiology. Chapman and Hall. London, U.K.

Zheng, Li., R. Marshall, H. Heymann and L. Fernando, 1997. Effect of milk fat content on flavor perception of vanilla ice cream. *J. Dairy Sci.*, 80(12): 3133-3141.