



Original Research Article

Effect of Level Maltodextrin on Microbial Quality of Dietetic Soft Serve Ice Cream

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ABSTRACT

Keywords

Ice-cream,
Maltodextrin,
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quality

Present investigation was carried out to study the microbiological quality of dietetic soft-serve Ice-cream prepared by using different levels of maltodextrin as fat replacer. Four different combinations of maltodextrin T₁, T₂, T₃, and T₄ were evaluated along with the control T₀. Ice-cream samples were studied to determine the bacterial and fungal load as well as to detect the presence of certain bacteria according to the FDA standards. It is concluded that the ice-cream sample T₃ having 30% maltodextrin was superior microbial analysis than the other combinations.

Introduction

Ice cream mix is an oil-in-water (O/W) emulsion with fat globules dispersed in a continuous serum phase. (Goff HD. 2007.). Significance of ice-cream in human nutrition is both in positive and negative senses. Current interests towards lowering fat content in food products and producing healthier and safer foods have convinced ice-cream manufacturers to substitute milk fat in ice cream with either carbohydrate or protein based fat replacers. (E. Mahdian, and R. Karazhian, 2013). Nowadays, consumers have directed their interest towards reduced or low-fat products as they associate them with a reduced risk of obesity and coronary heart diseases (Akalın et al., 2008). Hence, in recent years, the dairy industry has

developed a variety of low-fat and fat-free ice cream products (Adapa et al., 2000). Typically, ice cream contains 10–16% fat that is the main component affecting flavour and textural properties of the product. Milk fat interacts with other ingredients to develop the texture, mouth feel, creaminess, and overall sensation of lubricity. The challenge in working with low fat ice cream is related to the fact that the fat globule network would either be disrupted or absent and this could seriously impact flavour and texture of the product Aime et al., (2001).

Devereux et al. (2003) reported that texture was more important than flavour in determining overall acceptability of the low-fat foods. Removal of fat causes such body

and textural problems as coarseness and iciness, crumbly body, shrinkage and flavour defects (Berger1990; Marshal and Arbuckle, 1996).

Ice cream is a nutritious food for human and also an excellent medium for growth of many microorganisms. Ice-cream has been implicated as a vehicle for the transmission of microbial intestinal pathogen like salmonella found in unpasteurized mix. Also, microorganisms decrease the nutritive value of food. Microbial growth in Ice cream is determined by series of intrinsic, extrinsic, and implicit factors. Intrinsic or interior factors are inherent to the composition of ice-cream ingredients in mixes, acidity (pH), water activity (aw) redox potential (Eh), presences of natural antimicrobial substances. Exterinsic or external factors are the properties of the environment in which the Ice-cream is stored i.e. temperature, relative humidity and the presence of some gases. Outbreaks of intestinal diseases like cholera, Typhoid, through ice-cream are reported. Contaminated ice-cream causes several outbreaks of gastrointestinal diseases in number of countries in Asia, Europe and North America (Dijuretic etal, 1997, Chung 1947). Many food poisoning cases associated with the consumption of ice creams have been reported. (M E-Elahi et al, 2002).

Microbial contents in ice-cream whether or not manufacturer employ proper sanitary procedure in production process and potential risk of acquiring food borne pathogens on their consumption.

Keeping view of above therefore the study was undertaken to prepare and standardize the dietetic softy Ice-cream with respect to the effect of substitution of milk fat with maltodextrin on sensory and microbial attributes determine the microbiological

quality of ice-cream prepared and to determine potential risk to public health.

Materials and Methods

Preparation of Softy Ice-cream

The materials required for formulations were procured from sources as follows, Buffalo milk (Natural), Cream (Amul), Maltodextrin (High media< = 20DE), Skim Milk Powder (SMP-Murali Brand-Haryana), Cane Sugar Powder, Guargum (vegetable origin guar beans). Five suitable softy ice cream samples were formulated in different proportions with proper mixing.

Formulation of softy ice cream

An experiment was performed to develop low calorie dietetic soft-serve (softy) ice-cream using carbohydrate based fat replacer. Attempts have been made to replace milk fat in softy ice-cream by incorporation of maltodextrin at the rate of 10, 20, 30 and 40 %.For this investigation five different combinations of maltodextrin such as control (without maltodextrin), T₁ (26.06gm), T₂ (52.12gm), T₃ (78.18gm) and T₄ (104.24gm).

The milk and cream used in the manufacture of the softy Ice cream were analyzed for their composition, i.e. fat, total solids, Milk Solid Not Fat and titratable acidity. The quantity of milk, cream, skim milk powder, sucrose, , Guar gum (vegetable origin guar beans) and other ingredients maltodextrin DE<=20%, etc. required for a batch i.e.1, 3.5 and 5 kg of softy ice cream mix respectively . The required quantities of various ingredients for each treatment were weighed, mixed and blended thoroughly. Skim milk powder and other dry ingredients were mixed with a part of sugar and added to avoid lump formation before the temperature of the mix reached 50° C. The

calculated amount of stabilizer was admixed with sugar and maltodextrin (by weight) and added only when the temperature of the mix reached 65° C. The mixes were further heated to 80° C, homogenized in a clean and sanitized double stage homogenizer at 100 kg/cm² and 35 kg/ cm² pressure in the first and second stage respectively and again pasteurized by holding the mix at 80°C for 25 sec. The pasteurized mixes were then immediately cooled to about 3-4°C and aged at this temperature for 12hrs.

Microbiological assessment of softy Ice-cream

Total viable count of bacteria

Aerobic bacterial counts were determined by pour plate technique using nutrient agar medium. Diluted samples of molten ice-cream were added to the sterile petri plates and mixed with the sterile molten agar medium under aseptic condition. Serial dilutions were used from 10⁻² to 10⁻⁵. The plates were allowed to set, and then incubated at 37⁰C for 24 hrs. Plates showing colonies between 30 to 300 were used to determine the aerobic bacterial counts.

Determination of coli form count

Coliform counts of the ice cream samples were determined by colony count technique. Diluted samples of molten ice-cream as above, were added to the sterile petri plates and mixed with the sterile molten MacConkey's agar medium under aseptic condition. MacConkey's agar plates were incubated at 37⁰C for 24 hrs to obtain colonies. The plates were observed for typical pink coloured lactose fermenting colonies.

Detection of pathogens

Presence of *Escherichia coli*, *Staphylococcus aureus*, *Salmonella typhi*,

Pseudomonas aeruginosa was tested by enrichment method. Lactose bile broth, mannitol salt broth, sodium azide broth and tetrathionate broth were used as enrichment media for above bacteria. 1ml of molten samples were inoculated in 5 ml of the medium and incubated at 37⁰C. for 24 hours. After incubation the broths were observed for turbidity and colour change.

Results and Discussion

Microbiological assessment of softy ice-cream samples:

As per the below table it is resulted that as compare to T₀ TVC increases in T₃ but it is very low as compare to FDA standard and other microbial result are same as T₀ in T₃

Ice-cream, a milk-based product, is a good media for microbial growth due to high nutrient value, almost neutral pH value (pH ~6-7) and long storage duration of ice-cream. However, pasteurization, freezing and hardening steps in the production can eliminate most of the microbiological hazards. According to the Frozen Confections Regulation, ice-cream must be heat-treated during the production process. Pasteurization is most commonly applied heat treatment in the dairy industry. This can destroy almost all pathogenic bacteria in milk. The subsequent process that subjects the mixtures to freezing temperature can also inhibit the growth of any remaining flora. Automatic machines are used now-a-days for ice-cream making in dairy industry, which reduce the chance of contamination through direct hand manipulation.

Nevertheless, there are some steps in the production of ice-cream that can lead to the microbiological hazards. Heat treatment by pasteurization can destroy most of the

specific pathogens that pose risk to public health. However, the potential microbiological hazards found in the final products can still be introduced after pasteurization through adding contaminated ingredients and improper handling procedures (Bureau of Indian Standards (BIS). This is especially important in the

preparation of soft ice-cream as its final stage of the production is carried out at point of sale. Some pathogens that can survive in food even at low temperature include *Salmonella* spp., *Staphylococcus* spp., *Listeria monocytogenes*, *Campylobacter* spp. and *Yersinia* spp.

Table (1)

Sr. No.	Test	Medium	Observation Of T ₀	Inference Of T ₀	Observation Of T ₃	Inference Of T ₃
01	TVC of aerobic mesophilic bacteria	Nutrient Agar	15 colonies/ml of 10 ⁻⁴ dilution	15,000 bacteria/gm of sample	18 colonies/ml of 10 ⁻⁴ dilution	1,80,000 bacteria/gm of sample
02	TVC of coli form	Macconkys Agar	1 colony/ml of 10 ⁻⁴ dilution	10,000 coli form/gm of sample	4 colony/ml of 10 ⁻⁴ dilution	40,000 coli form/gm of sample
03	Presence of <i>E. coli</i>	Endo Agar	No colony with Green metallic sheen	<i>E. coli</i> absent	No colony with Green metallic sheen	<i>E. coli</i> absent
04	Presence of <i>Staphylococcus aureus</i>	Mennitol salt agar	Colonies with yellow zone	<i>Staphylococcus aureus</i> absent	Colonies with yellow zone	<i>Staphylococcus aureus</i> Present
05	Presence of <i>Salmonella typhi</i>	Wilson and Blair Agar	No colony	<i>Salmonella typhi</i> Absent	No colony	<i>Salmonella typhi</i> Absent
06	Presence of Yeast	Yeast Extract Malt Extract Agar	Large Mucoïd Colonies	Yeast Present	Large Mucoïd Colonies	Yeast Present
07	Presence of Fungi	Potato Dextrose Agar	No Mycelial Growth	Fungi absent	No Mycelial Growth	Fungi absent
08	Presence of anaerobes	Skimmed Milk	No blowing Of Milk	Anaerobes absent	No blowing Of Milk	Anaerobes absent
09	TVC of aerobic Psychrophilic Bacteria (Incubation Temp-4 °C)	Nutrient Agar	No growth	Zero Psychrophylic bacteria/ gm of sample	No growth	Zero Psychrophylic bacteria/ gm of sample

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