

ICE-CREAM & FROZEN DESSERTS



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Module 11. Legal standards, microbial aspects of ice cream and safety aspects

Lesson 30

LEGAL STANDARDS, MICROBIOLOGICAL AND SAFETY ASPECTS OF ICE CREAM

30.1 Introduction

Food poisoning is defined as an illness caused by the consumption of food or water contaminated with bacteria and / or their toxins, parasites, virus, or chemicals. Food poisoning outbreaks may be broadly discussed under two periodical heads:-

I. Historical outbreaks

II. Recent outbreaks.

30.2 Historical Disease Outbreaks

In UK there were several outbreaks of food poisoning before the IInd World war, as there was no heat treatment requirement at that time. Consumption of ice cream was a major cause for two historical outbreaks of one in the year 1945 and another in 1947.

In 1945, the food poisoning outbreak was due to *Staphylococcus* spp. which were introduced into batches of ice cream mix after the ingredients have been cooked. The mix was allowed to cool slowly overnight and was frozen 26-30hrs later. Around 700 people were affected by staphylococcal toxin, which developed during the period.

In 1947, a major outbreak of typhoid fever occurred during the summer of 1947 in Aberystwyth, soon after ice cream manufacture was allowed again after several years of being prohibited during the war. About 210 cases were reported, including 4 deaths, and ice cream from one particular source appeared to be the common factor. Investigation revealed that the source of pathogen (*Salmonella typhi*) in ice cream was urine.

Other food poisoning cases reported were a paratyphoid incident at a North Devon holiday resort, which had its source from *S. paratyphi* on the hands of the ice cream vendor and his wife. A case of *Shigella* poisoning characterized by dysentery in a child who had consumed ice cream licked by monkey in a pet corner of a store. *Shigella* was isolated from the stool samples of the ill child.

Between 1950 & 1955, there were 11 outbreaks of food borne disease in UK due to consumption of ice cream and ice lollies involving *Salmonellae*, two including *Staphylococci* and mix of unknown cause.

Since 1955, only few outbreaks were reported from ice cream and it is certainly due to the fact that the heat treatment regulations introduced in 1947, became effective from 1950.

30.3 Recent Disease Outbreaks

In the last 3 decades most serious outbreaks of food – borne infections from ice cream were due to *Salmonella Enteritidis* in US.

Table 30.1 Outbreaks of food borne disease caused by the consumption of ice cream

Carbohydrate	Average molecular weight	FPDF	Relative Sweetness
Sucrose	342	1.0	1.0
Glucose syrup 42 DE	445	0.8	0.3
HFCS (42% Fructose)	190	1.8	1.0
Fructose	180	1.9	1.7
Invert sugar	180	1.9	1.3
Lactose	342	1.0	0.2
Sorbitol	182	1.9	0.5
Glycerol	92	3.7	0.8
Ethanol	46	7.4	-
Saccharin			300-400
Aspartame			160-200
Acesulfame-K			200
Sucralose			600-800

Epidemiologist from the Minnesota Department of Health calculated that 29,100 Minnesotans became ill after eating ice cream and up to approximately 224,000 people in US were infected. Investigations revealed that the cross contamination of a pasteurized ice cream premix occurred during transport in tanker trailer that had previously handled non pasteurized liquid eggs containing *S. enteritidis*.

Two out of 20 outbreaks associated with the consumption of milk & dairy product between 1992 & 1996 in England & Wales were associated with ice cream. *S. enteritidis* was the cause in both the cases.

A sporadic case of listeriosis has been reported in Belgium.

30.4 Legal Standards

30.4.1 FSSA standards

30.4.1.1 Dairy based desserts/confections

30.4.1.1.1 Ice Cream, Kulfi, Chocolate Ice Cream or Softy Ice Cream (hereafter referred to as the said product) means the product obtained by freezing a pasteurized mix prepared from milk and /or other products derived from milk with or without the addition of nutritive sweetening agents, fruit and fruit products, eggs and egg products, coffee, cocoa, chocolate, condiments, spices, ginger and nuts and it may also contain bakery products such as cake or cookies as a separate layer and/or coating. The said product may be frozen hard or frozen to a soft consistency; the said product shall have pleasant taste and smell free from off flavour and rancidity; the said product may contain food additives permitted in these regulation including Appendix A; the said product shall conform to the microbiological requirements specified in Appendix B; the said product shall conform to the following requirements, namely:—

Table 30.2 Standards for ice cream, kulfi, chocolate ice cream or spfty ice cream

Requirement	Ice Cream	Medium Fat Ice Cream	Low Fat Ice Cream
(1)	(2)	(3)	(4)
Total Solid	Not less than 36.0 %	Not less than 30.0 %	Not less than 26.0 %
Wt/Vol (g/l)	Not less than 525	Not less than 475	Not less than 475
Milk Fat	Not less than 10.0 %	More than 2.5 % but less than 10.0 %	Not more than 2.5%
Milk Protein (N x 6.38)	Not less than 3.5 %	Not less than 3.5 %	Not more than 3.0 %

Note: In case where Chocolate, Cake or similar food coating, base or layer forms a separate part of the product only the Ice Cream portion shall conform to the requirements given above. The type of ice-cream shall be clearly indicated on the label otherwise standard for ice-cream shall apply.

30.4.1.1.2 Dried Ice Cream Mix/ Dried Frozen Dessert/ Confection (hereafter referred to as the said product) means the product in a powder form which on addition of prescribed amount of water shall give a product conforming to the requirements of the respective products, namely - ice cream, medium fat ice-cream, low fat ice-cream as prescribed under regulation 2.1.7 (1) and frozen confection, medium fat frozen confection and low fat frozen confection as prescribed under regulation 2.1.7 (3) of these regulations except the requirement of weight/volume for both the products. The moisture content of the product shall not be more than 4.0 percent. It may contain food additives permitted in these regulation including Appendix A. It shall conform to the microbiological requirements prescribed in Appendix B.

30.4.1.1.2.1 Frozen Dessert / Frozen Confection (hereafter referred to as the said product) means the product obtained by freezing a pasteurized mix prepared with milk fat and / or edible vegetable oils and fat having a melting point of not more than 37.0 degree C in combination and milk protein alone or in combination / or vegetable protein products singly or in combination with the addition of nutritive sweetening agents e.g. sugar, dextrose, fructose, liquid glucose, dried liquid glucose, maltodextrin, high maltose corn syrup, honey, fruit and fruit products, eggs and egg products coffee, cocoa, chocolate, condiments, spices, ginger, and nuts. The said product may also contain bakery products such as cake or cookies as a separate layer/or coating, it may be frozen hard or frozen to a soft consistency. It shall have pleasant taste and flavour free from off flavour and rancidity and may contain food additives permitted in Appendix A. It shall conform to the microbiological requirements prescribed in Appendix B. It shall conform to the following requirements:—

Table 30.3 Standards for Frozen Desserts/Frozen Confection

Requirement	Frozen Dessert / Frozen Confection	Medium Fat Frozen Dessert / Frozen Confection	Low Fat Frozen Dessert / Frozen Confection
(1)	(2)	(3)	(4)
Total Solid	Not less than 36.0 %	Not less than 30.0 %	Not less than 26.0 %
Wt/Vol (g/l)	Not less than 525	Not less than 475	Not less than 475
Total Fat	Not less than 10.0 %	More than 2.5 % but less than 10.0 %	Not more than 2.5 %
Total Protein (N x 6.25)	Not less than 3.5 %	Not less than 3.5 %	Not less than 3.0 %

Note: In case where Chocolate, Cake or similar food coating, base or layer forms a separate part of the product only the frozen dessert/ confection portion shall conform to the requirements given above. The type of frozen confection shall be clearly indicated on the label otherwise, standards of frozen dessert / frozen confection shall apply and every package of Frozen Dessert / Frozen Confection shall bear proper label declaration under regulation 2.4.5 (41) of Food Safety and Standards (Packaging and Labeling) Regulations, 2011.

30.4.1.1.3 Milk Ice or Milk Lolly (here after referred to as the said product) means the product obtained by freezing a pasteurized mix prepared from milk and/or other products derived from milk with or without the addition of nutritive sweetening agents, fruit and fruit products, eggs and egg products, coffee, cocoa, chocolate, condiments, spices, ginger and nuts; the said product may also contain bakery products such as cake or cookies as a separate layer and/or coating; the said product shall have pleasant taste and smell free from off flavour and rancidity. It may contain food additives permitted in Appendix A; the said product shall conform to the microbiological requirements prescribed in Appendix B; the said product shall also conform to the following requirements, namely :

- (1) Total solids (m/m) Not less than 20.0 percent
- (2) Milk Fat (m/m) Not more than 2.0 percent
- (3) Milk Protein (Nx6.38) Not less than 3.5 percent

30.4.1.2 Ice Lollies or Edible Ices

30.4.1.2.1 "ICE LOLLIES OR EDIBLE ICES" means the frozen ice produce which may contain sugar, syrup, fruit, fruit juices, cocoa, citric acid, permitted flavours and colours. It may also contain permitted stabilizers and/or emulsifiers not exceeding 0.5 per cent by weight. It shall not contain any artificial sweetener.

Ice Candy means the product obtained by freezing a pasteurized mix prepared from a mixture of water, nutritive sweeteners e.g. sugar, dextrose, liquid glucose, dried liquid glucose, honey, fruits and fruit products, coffee, cocoa, ginger, nuts and salt. The product may contain food additives permitted in these Regulations and Appendices. It shall conform to the microbiological requirements prescribed in Appendix B. It shall conform to the following requirement: — Total sugars expressed as Sucrose ... Not less than 10.0 percent.

APPENDIX A

Table 30.4 List of food additives for use in ice cream & frozen desserts

Sr. No.	Name of Additive	Ice Cream , Kulfi, Dried Ice Cream Mix, Frozen Dessert, Milk Ice, Milk
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		Lolly, Ice Candy
A	Stabilizers and emulsifiers singly or in combination expressed as anhydrous substance	
2	Carrageenan	10g/kg max.
6	Pectins	10g/kg max.
7	Sodium carboxymethyl cellulose	10g/kg max.
8	Agar	10g/kg max.
9	Guar gum	10g/kg max.
10	Xanthan gum	10g/kg max.
13	Furcellaran	10g/kg max.
14	Propylene glycol alginate	10g/kg max.
15 (c)	Polyoxyethylene sorbitan tristearate	10g/kg max.
16	Mono and di glycerides of fatty acids	10g/kg max.
17	Methyl cellulose	10g/kg max.
21	Any other emulsifying and stabilizing agents listed in regulation 3.1.6 suitable for these products	40g/kg max.
B.	Thickner and modifying agent singly or in combination	
1	Microcrystalline cellulose	10 g/kg max
C	Modified Starch Singly or in Combination	
1	Acid Treated Starch	30 g/kg max subject to declaration
2	Alkali Treated Starch	100 ppm max. (only in flavoured & fruit yoghurt)
3	Bleached Starch	100 ppm max. (only in flavoured & fruit yoghurt)
4	Distarch adipate acetylated	100 ppm max. (only in flavoured & fruit yoghurt)
5	Distarch glycerol	100 ppm max. (only in flavoured & fruit yoghurt)
		100 ppm max. (only in

6	Distarch glycerol, acetylated	flavoured & fruit yoghurt)
7	Distarch glycerol, hydroxypropyl	100 ppm max. (only in flavoured & fruit yoghurt)
8	Distarch phosphate	100 ppm max. (only in flavoured & fruit yoghurt)
9	Distarch phosphate, acetylated	100 ppm max. (only in flavoured & fruit yoghurt)
10	Distarch phosphate, hydroxypropyl	100 ppm max. (only in flavoured & fruit yoghurt)
11	Monostarch phosphate	100 ppm max. (only in flavoured & fruit yoghurt)
12	Oxidised starch	100 ppm max. (only in flavoured & fruit yoghurt)
13	Starch acetate	100 ppm max. (only in flavoured & fruit yoghurt)
14	Starch hydroxypropyl	100 ppm max. (only in flavoured & fruit yoghurt)
D	Flavours	
4	Natural flavours and natural flavouring substances/ Nature Identical flavouring substances/ Artificial flavouring substances	GMP subject to declaration
E	Colours (Natural: singly or in combination)	
1	Curcumin	100 ppm max.
2	Riboflavin	50 ppm max.
4	Beta Carotene	100 ppm max.
6	Annatto extract on Bixin/Nor bixin basis (50:50 ratio)	100 ppm max.
7	Beta apo-8 carotenal	100 ppm max.
8	Methyl ester of beta apo-8 Carotenoic acid	100 ppm max.
10	Canthaxanthan	100 ppm max.
11	Caramel colours (Plain)	GMP

12	Caramel colours (Ammonium Sulphite process)	3.0 g/kg max.
E	Colours (Synthetic: singly or in combination	
13 (a)	Ponceau 4R	100 ppm max.
13 (b)	Carmoisine	100 ppm max.
13 (c)	Erythrosine	100 ppm max.
13 (d)	Tartrazine	100 ppm max.
13 (e)	Sunset yellow FCF	100 ppm max.
13 (f)	Indigo carmine	100 ppm max.
13 (g)	Brilliant blue FCF	100 ppm max.
13 (h)	Fast green FCF singly or in combination	100 ppm max.
J	Acidifying Agents singly or in combination	
6	Malic acid (DL-)	GMP
7	L-(+ Tartaric acid & Sodium/Potassium salts)	1 g/kg max.
8	Sodium hydrogen carbonate	GMP
9 (a)	Sodium/Potassium/Calcium orthophosphate expressed as P_2O_5	2 g/kg max. singly or in combination with as P_2O_5
9 (b)	Sodium/Potassium polyphosphate expressed as P_2O_5	
N	Miscellaneous	
1	Glycerol	50 g/kg max.

APPENDIX B

Table 30.5 Microbiological parameters for ice cream mix, ice cream, frozen desserts, milk lolly, ice candy milk products

Sl. No.	Requirements	Sampling Plan	Ice Cream Mix (Max. cfu/g)	Ice Cream , Frozen Dessert, Milk Lolly, Ice Candy (Max. cfu/g)
1	Total Plate Count	m	40,000/g	2,00,000/g
		M	50,000/g	2,50,000/g
2	Coliform Count	m	10/g	50/g
		M	50/g	100/g
3	<i>E. coli</i>	m	Absent/g	Absent/g
4	Salmonella	M	Absent/25g	Absent/25g
5	<i>S. aureus</i> (Coagulase positive)	m	-	-
		M	Less than 10/g	Less than 10/g
6	Yeast and mold count	m	-	-
		M	-	Less than 10/g
7	Spore count			
8	(a) Aerobic (<i>B. cereus</i>)	m	100/g	-
		M	1000/g	-
9	(b) Anaerobic (<i>Clostridium perfringens</i>)	m	10/g	-
		M	100/g	-
10	<i>Listeria monocytogenes</i>	M	Absent/g	Absent/g

m = Represents an acceptable level and values above it are marginally acceptable in terms of the sampling plan.

M = A microbiological criterion which separates marginally acceptable quality from unsatisfactory/potentially hazardous quality. Values above M are unacceptable in terms of the sampling plan and detection of one or more samples exceeding this level would be cause for rejection of the lot.

Table 30.6 BIS requirements for ice cream (BIS:2802-1964)

Sl.No	Characteristics	Requirement	
		Ice cream	Fruits, Nuts and Chocolate Ice-cream
1	Weight in g per lit. (Min)	525	540
2	Total solids % by weight (Min)	36.0	36.0
3	Milk fat % (Min)	10.0	8.0
4	Acidity % as lactic acid (max)	0.25	----
5	Sucrose % by Weight (max)	15.0	15.0
6	SPC per gram (max)	2,50,000	2,50,000
7	Coliform count (max)	100/g	10/g
8	Phosphatase test	Negative	Negative
9	Odour and Flavour:	The product shall have a pleasant odour and flavour	
10	Texture and appearance:	The product shall be attractive in appearance, smooth in texture and of a uniform consistency and shall have no apparent ice or lactose crystals and as far as possible free from butter fat granules.	
11	Free from dirt	The product shall be free from dirt and such other foreign material.	
12	No fat other than milk fat shall be present in the product with the exception of that derived from eggs, cocoa, nuts and emulsifiers.		

B. Kulfi (BIS:10501-1983)

- Kulfi means the frozen product obtained from cow or buffalo milk or a combination thereof or from any other milk products with or without the addition of cane sugar, dextrose, liquid glucose and dried liquid glucose, eggs, fruits, fruit Juices, preserved fruits, nuts, chocolates, edible flavours and permitted food colours.
- Odour and flavours: The product shall have a pleasant agreeable aroma and taste.
- Texture and appearance: The product shall be attractive In appearance, uniform In consistency free from big sized ice-crystals and coagulated milk particles.
- Free from dirt: The product shall be free from dirt and such other foreign materials.

No fat other than milk fat shall be present in the product with the exception

of that derived from eggs,cocoa, nuts and emulsifiers.

Table 30.7 BIS requirements for kulfi (BIS: 10501-1983)

Sl.No	Characteristics	Requirement	
		Ice-cream	Fruits, nuts and Chocolate Ice-cream
1	Total solids % by mass (min)	35.0	30.0
2	Milk fat % by mass (min)	8.0	6.0
3	Protein % by mass (min)	3.5	3.5
4	Acidity % by mass (Max) (as lactic acid)	0.3	0.3
5	Sucrose % by mass (Min)	13.0	13.0
6	SPC (Max) per gram	2,50,000	2,50,000
7	Coliform count per gm. (Max)	100	100
8	Phosphatase test of mix	Negative	Negative
9	Presence of starch	Negative	Negative

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