

Recent advances in ice cream industry and plant management

Ice milk as defined by the FDA is the food prepared from the same ingredients and in the same manner as prescribed for ice cream, However its milk fat content is more than 2 per cent but not more than 7 per cent, MSNF content not less than 4 per cent, total milk solids content not less than 11 per cent, and it may contain added caseinates; it shall contain not less than 156 g food solids per liter.

Low fat ice cream (i.e. ice milk) may be frozen hard, or sold in the form of a soft serve product, as practiced in the US. In spite of its reduced fat content, it is expected to taste like normal ice cream. Therefore, the formulation in terms of total solids content, and emulsification and stabilization must be such that the resulting product has body and texture characteristics similar to those of ice cream. To be able to be served directly on drawing from the freezer, **the low fat product should have dry appearance, and stiff body** which necessitates that the right kind of emulsifier system be used in the mix formulation.

The soft serve product usually has a lower sugar content (e.g. 13 per cent with 30-34 per cent TS) as compared to the hard frozen product (15 per cent with 35-38 per cent TS). A good quality low fat ice cream contains 6.0 per cent fat, and 12.5 per cent MSNF, can be obtained by using 0.35 per cent stabilizer (a 70:30 blend of Isabgul husk and guar gum) and 0.08 per cent tween 80 as emulsifier and ageing the mix for 16h. A soft serve ice milk composition has reported to include 1 per cent Lecithin, 0.15 per cent pectin and 0.1 per cent xantan gum and/or locust bean gum.

While formulating a low fat ice cream, those ingredients which can make up for the reduced fat content with regard to the mouth feel of the product get special considerations.

Fat sparing or fat substituting ingredients include microcrystalline cellulose, malto – dextrin's, sodium caseinate, whey protein concentrate, preparations containing egg white, soy proteins etc. Milk protein isolates may be sought to impart the desired sensory attributes, but the quality of ice milk has been found to be more dependent on stabilizer /emulsifier. Often standard ice milk is cultured with suitable starter culture to produce frozen yoghurt.

The ever increasing demand of health conscious consumers to lower the daily fat intake has prompted change in many food products, and a **recent trend in ice cream formulation has been to reduce the calorific contribution of fat in the mix. Ice cream made with 25 percent fat or less fat than the reference ice cream is labelled on reduced fat, where as a light version is also available (i.e.) 50 per cent less fat than the reference ice cream.**

Two more products with even lower fat contents are also marketed:

- a)** Low– fat with not more than 3.0 g of fat per serving and
- b)** Non– fat with less than 0.5 g of fat per serving.

Low fat ice creams are manufactured with fat substitutes like protein mimetic (e.g. Simplesse) carbohydrates (sucrose polyester) etc.

The international ice cream association has proposed new standard of identity for ice cream related products to FDA as follows:

New standards of identity for ice cream and related products:

Product	Fat content
Ice cream	10%
Reduced fat or light	2 – 7 %
Low – fat	0.5 – 2 %
Non – fat	< 0.05%

Low Calorie, Diabetic and Dietetic Ice Cream and Frozen Desserts:

Replacing the high calorie yielding ingredients such as fat and sugars that are present in the ice cream and other frozen desserts with artificial sweeteners, fat replacers and low – calorie ingredients yields a final product with low or least calories that are required by diabetic and obese persons.

Numerous low – fat dairy desserts have been introduced over the past decade. During 1989 – 1990, 56 different ice cream lines or extensions, over 260 flavours were introduced. More than one third of these were marketed as low – fat ice milk and frozen desserts.

In mid – 1991, the first sugar free, low – fat frozen dessert, ‘simple pleasures height’, was introduced.

Low calorie, diabetic and dietetic ice cream can be manufactured using the following ingredients

- a) Intense sweeteners /artificial sweeteners/sugar substitutes**
- b) Fat substitutes**

Probiotic Ice Cream and Frozen Desserts:

In line with the probiotic yoghurt, probiotic ice cream and frozen desserts have been introduced and well accepted by the health conscious consumers. In such products the basic ice cream mix remains the same, however about 1.5 to 2.0% of an established probiotic microorganism (*Bifidobacterium bifidum*, *Lactobacillus acidophilus*, *Lactobacillus reuteri*, etc.) with or without a prebiotic (oligofructose, inulin etc.) is inoculated in the ice cream mix (preferably without sugar which can be added at a later stage) incubated for few hours, aged and frozen as for regular ice cream. Such product is implicated to improve gut health, retard the level of triglycerides and cholesterol in human subjects. Such product is already launched by AMUL.

Intense Sweetners /Artificial Sweetners /Sugar Substitutes

These are the important components of low-calorie foods. Sugar substitutes may be either caloric or non – caloric, depending on their metabolism in the body. High – intensity nutritive

or calorie sugar substitutes do not contribute significant calories to the products they sweeten because very small quantities of the substance are required to impart sweetener. For example, aspartame provides the same number of calories as sucrose gram for gram, but because it is approximately 200 times sweeter than sucrose, it may be used in very small quantities, thereby contributing negligible calories to the products it sweetens.

Fat substitutes

Fat substitutes or fat replaces can be classified into 3 groups

- (1) Protein based substitutes – e.g. Simplesse
- (2) Oil compounds
- (3) Carbohydrate based substitutes

Some of the fat substitutes that can be used in low– calorie foods are

- a) Sucrose polyesters
 - b) Synthetic oil compounds
- e.g. Triolein polyoxytricalcylate (TATCA); Esterified propoxylated glycerol (EPG); Raffinose polyesters (RPE’s); Olestrin and Prolestra

Formulas for Diabetic and Dietetic Frozen Foods

Diabetic and dietetic frozen dairy foods are special preparations for persons on restricted diets. Diabetic frozen dairy foods are made in resemblance of ice cream or ice milk using no caloric sweeteners. The ideal fat level for diabetic frozen dairy foods is 6 per cent. The ideal butterfat content for dietetic frozen dairy foods is 3-4 per cent and should be made free from substitute sweeteners. Sugar substitutes for diabetic frozen dairy foods include hexahydric alcohols, sucaryl (sodium and calcium), and saccharine.

- The hexahydric alcohols are classified as sugar alcohols and are made commercially principally from corn sugar and are available as Sorbo (70 per cent of sorbitol and 30% Mannitol). Mannitol has 2 kcal /g and Sorbo has 2.8 kcal/g as compared to 4 kcal/g for sugar. The hexahydric alcohols have about half the sweetening value of sucrose and they affect the freezing point and contribute to the TS as do sugars.
- Sucaryl products are non-caloric sweetening agents. Sucaryl sodium is most often used within the rate of 0.8 per cent. Sucaryl has a relative sweetness value approximately 30-50 times that of sucrose.
- Saccharine is a non-caloric sweetening agent. It has a relative sweetness of 300- 500 times the sweetness of sucrose. It is used at the approximate rate of 31 g per 100 kg of mix.

Diabetic base products are available commercially to build solids when substitute sweeteners are used. The following formulations are examples of diabetic and dietetic products.

Constituents	Diabetic medium fat product	Diabetic full fat product	Diabetic product	Low fat high protein
Fat	6.0	10.0	3.00	2.0

MSNF	10.5	9.0	12.00	13.50
Sucrose	0	0	13.00	13.00
Mannitol (95% TS)	8.0	8.0	-	-
Sorbo (70% TS)	8.0	8.0	-	-
Sucaryl (Na or Ca salt)	0.016 – 0.021	-	-	-
High protein base or diabetic base	3.0	3.0	3.0	3.0
Stabilizer	0.3	0.3	0.35	0.35
TS	33.0	25.5	31.35	31.35