**ISSN:** Applied

**International Journal of**
**Research in Basic and Advanced Sciences**
Vol 1, No 1 (2019), pp. 13-24

# Development of technology for fruit based frozen sherbet

**Aishwariya M.,[1] Geeta P.,[1] Vijaya Geeta V.,[2] Aravindakshan P.[2], Jayaraj Rao K.[2*]**

[1]SRM University, Kattankulathur, Kancheepuram district of Tamil Nadu, India.
[2]Dairy Technology Section, ICAR- National Dairy Research Institute (Southern Regional Station), Adugodi, Bengaluru – 560 030, India.

## Abstract

Frozen sherbets are products similar to ice cream, but differ from it by having a higher fruit acid content, a much lower overrun, a higher sugar content between 25 and 35% which gives a lower melting point, a coarser texture, a greater cooling characteristic while being consumed and an apparent lack of richness due to lower milk solids content. Keeping in view demand of these products in summer, a technology was developed for the manufacture of orange flavored frozen sherbet. The effect of various ingredients like squash level, milk, sugar, stabilizer, emulsifier and citric acid level was studied and their levels optimized. The optimized parameters for orange frozen sherbet were (for a four litre batch): orange squash 500 gm, milk 1.5 lit, sugar 650 gm, sodium alginate 8.5 gm, GMS 5 gm and citric acid 7.5 gm. The method of preparation included selection of ingredients, mixing of milk, squash, stabilizer, citric acid and emulsifiers in a vessel, heating the mix to 80°C, cooling to about 5°C, ageing the mix at 5°C for 24hrs, freezing the aged mix in a batch freezer to a freezing point of about -5°C, packing in 100 ml capacity polystyrene cups and hardening at – 15°C.

**Key words**: Stabilizer, emulsifier, physiochemical, whole milk, orange squash

## Introduction

The word ‘sherbet’ has been in the English language for several centuries (it was first recorded in the year 1603) and it came into English from Ottoman Turkish ‘sherbet’ or Persian ‘sharbat’, both going back to Arabic ‘arba’ i.e. "drink." In India, the word sherbet connotes a chilled liquid beverage popularly consumed during summer months because of its cooling and soothing effects. However, sherbet can also be frozen like an ice cream incorporating air into it. In that case, it is called as frozen sherbet. Frozen sherbet is made from sugar, water, fruit acid, color, fruit or fruit flavoring, stabilizer, and a small amount of milk solids added in the form of skim milk, whole milk, condensed milk, or ice cream mix. According to Marshall and Arbuckle [1], frozen sherbet is a frozen product containing water, nutritive sweeteners, fruit juice or fruit flavorings, fruit acid, milk solids, stabilizer, and colorings. It is used for direct consumption as well as in fruit salads. Frozen sherbets differ from ice cream in many ways. They have a much higher fruit acid content resulting in a tart sensation. Citric acid is the most commonly used acid in sherbet

**Corresponding Author:**
Jayaraj Rao K.,
Email: jaysharm@yahoo.com
**DOI**: http://dx.doi.org/10.37283/ijrbas.2019.1.1.2

formulations. The amount used depends on the fruit used, sugar content, and consumer preferences. For instance, some consumers prefer a sherbet that is sweeter and less sour than normal. As a general rule, the titratable acidity should be 0.36% at 25-30% sugar and should be increased by about 0.01% for each 1% increase in sugar above 30% [1]. Sherbets are differentiated from ice cream by the following characteristics: A higher fruit acid content, minimum of 0.35% which produces a tart flavor; a much lower overrun, usually 25-40%; a higher sugar content between 25 and 35% which gives a lower melting point; a coarser texture; a greater cooling characteristic while being consumed, due to their coarser texture and lower melting; and an apparent lack of richness due to lower milk solids content. Frozen yoghurts are similar products but with higher overrun than frozen sherbets.

In the US, sherbets and ices account for 6.5% of total frozen dessert production. These are in greatest demand during summer months. Popular flavours are orange, pineapple, raspberry and lemon [2]. A 1995 survey showed that orange was the most popular flavor for sherbets commanding 29% of sales in the USA [3]. de Oliviera *et al.,* [4] reported a frozen sherbet using mangaba fruit sherbt. Soares *et al.,* [5] worked on jambolan fruit sherbet. Fresh aloe gel incorporated frozen sherbet [6] and cranberry pulp incorporated sherbets [7] were also reported. Not much literature exists on frozen sherbet because of sparse studies carried out on the product. Reichart as early as 1956 [8] studied influence of dasher speed of freezer on the overrun of frozen sherbet and reported an overrun of 30 – 40% in frozen sherbet as desirable. He also stated that it is difficult to control overrun in frozen sherbet than in ice cream. Walker [3] worked and submitted thesis on development of low-fat sugar-free orange sherbet containing soy protein.

The present work has been conducted to develop technology for the manufacture of orange flavoured frozen sherbet and to study the physico-chemical characteristics of orange flavoured frozen sherbet so that dairies can manufacture frozen sherbets during summer months.

## Materials and Methods

### Ingredients

Milk- Fresh cow milk was collected from the Cattle Yard of NDRI, Bangalore. Squash-Good quality fruit squash (Orange- Mapro Brand) was purchased from the local supermarket. Crystalline refined sugar, stabilizer (sodium alginate), emulsifier such as GMS (Glyceryl Monostearate), citric acid and packaging materials were purchased from the local market.

### Instruments and equipments

**pH meter**: Mark VI: Systronics, Bangalore; Electronic balance: Sartorius, 0.1 mg accuracy; Batch freezer: Kunal International, Bangalore; Oven: Apollo Scientific Surgicals, Bangalore; Deep freeze: LG make. After the completion of freezing, the product was filled in 100 ml plastic cups and kept in deep freeze at -20°C for hardening; Milk cooker: Bharat Industries, Chennai: the mix was boiled in the milk cooker to avoid the burnt flavor in the product.

**Preparation of the mix**

**Mixing of ingredients**: The base mix is the complete mixture of all the ingredients used to prepare sherbet. The sherbet was prepared by mixing milk and water and heating it up to 40˚C in a milk cooker to avoid the burnt flavor. At this temperature sugar, sodium alginate and GMS were added.

**Pasteurizing the mix**: After the addition of the sodium alginate and GMS, it was heated to about 80°C for 5 min. Then the mix was filtered through a sieve and transferred in a stainless-steel vessel. The mix was allowed to cool at room temperature for some time. The objectives of pasteurization are: to kill all pathogenic bacteria, dissolve and blend the ingredients of the mix, improve the flavor, improve the keeping quality and to make a more uniform product.

**Cooling and ageing of mix**: Ageing refers to holding the mix at a low temperature for a definite time before freezing. The mix was held at temperature not more than 5ºC overnight. Ageing was required for complete hydration of ingredients.

**Freezing**: To the aged mix, fruit squash and citric acid were added and made up to four litre volume with potable water before freezing in a batch freezer. It was taken out at semi- liquid stage and packed in 100 ml polystyrene plastic cups and stored in deep freeze at -20°C for hardening. Freezing is one of the most important operations in the making of frozen sherbet for upon it depends the quality, palatability and yield of the finished product.

Parameters studied and optimized: The following levels of ingredients were studied for a four lit batch:

Orange squash: 250, 375 and 500 g
Milk (toned milk): 1.0, 1.5 and 2.0 lit
Sugar: 500, 650 and 750 g
Sodium alginate: 6.0, 8.5 and 11.0 g
GMS: 2.5, 5.0 and 7.5 g
Citric acid: 5.0, 7.5 and 10.0 g

**Analytical studies**

**Sensory analysis**: The organoleptic quality of sherbet was evaluated by a panel of judges, on 9-Point Hedonic Scale [9].

**Physical analysis**: The physical analysis included pH, specific gravity and viscosity of the mix; and melting resistance and overrun of the frozen product.

**pH**: The electrode assembly of a digital pH meter was calibrated against standard buffer of pH 7.0 and 4.0. 100g of sample was taken in clean 100 ml beakers and electrode was inserted directly into the sample. Then the pH of the samples was determined using the calibrated digital pH meter.

**Viscosity**: It is defined as the resistance of the flow due to internal friction between molecules as they shear each other. The viscosity of sherbet mix was determined using the principle of falling ball viscometer. The method was based on frictional force offered by a liquid to a moving sphere. When an object falls through a column of liquid, it is subjected to downwards force of gravity and an upward thrust which is equal to the weight of the liquid displaced by the object. Fifty ml capacity burette was filled almost up to the brim with distilled water and fixed to a stand vertically. A steel ball (86 mm dia) was dropped from the top and when the bottom end of the sphere touched 'zero' mark on the burette, stop watch was started. When the ball touched '50 ml' mark, the stop watch was stopped. The time elapsed was noted down. The water was replaced with sherbet mix and the procedure repeated. The density of the steel ball used was 7.78 (g/cc). The viscosity at about 28°C was determined using the following formula:

$$\eta_S/\eta_W = t_S(d - d_S)/t_W(d - d_W)$$

$\eta_S$- Viscosity of sample
$\eta_W$- Viscosity of water
$t_W$- Time taken by water (s)
$d_W$- Density of water
$t_S$- Time taken by sample (s)
$d_S$- Density of sample
d- Density of steel ball (g/cc)

**Specific gravity**: Specific gravity of the sherbet mix was determined using 50 ml capacity volumetric flask. The flask was filled with distilled water to the mark and the weight (g) of the flask + water recorded up to 0.1 mg accuracy. The flask was then emptied and filled with the sherbet mix to the mark and again the weight of the flask + mix was recorded. The specific gravity of the mix was calculated as follows [10]:

Specific gravity = weight of the mix (g)/ weight of water (g)

**Overrun**

Overrun (OR) is defined as the volume of sherbet obtained in excess to the volume of the mix. It is usually expressed in percentage. Aged sherbet mix was taken up to the brim of 100 ml capacity polystyrene cup and weight was recorded. After freezing, the frozen sherbet was taken up to the brim of the cup and the weight recorded. The overrun was determined by the following formula:

$$OR\% = \frac{\text{Weight of the sherbet mix} - \text{Weight of the frozen sherbet}}{\text{Weight of the sherbet mix}} \times 100$$

**Melting resistance**: Determination of melting resistance aids in the product evaluation like sensory score for meltability of frozen sherbet. Frozen sherbet due to its foam structure provides resistance to melting as the foam provides insulation (thermal). A 250 ml measuring cylinder was taken and stem part of a glass funnel was placed into it and over the funnel a wire mesh was placed. Then 50g of the frozen sherbet was placed on the mesh and the stop watch started. The volume of sherbet which melted (at about 30°C) was noted after 1 hour. Then a graph was plotted with time on x- axis and volume on y-axis using MS office Excel. From the curve obtained, the slope was computed by linear regression analysis. Melting resistance was expressed as slope value of the graph. The higher the slope value, the lower is the melting resistance.

**Chemical analysis**

**Lactose, sucrose, total solids and ash**: Lactose, sucrose, total solids and ash contents of sherbet sample were determined as per BIS procedure [11] mentioned for condensed milk, but with slight modifications.

**Fat**: Fat in milk and cream was determined by Gerber method and the fat content of sherbet was determined using Mojonnier fat-extraction method according to the method detailed in BIS [11].

**Protein**: The protein content of sherbet samples was determined by micro-Kjeldahl method using Kjeldahl digestion unit and KjelPlus distillation unit of Gerhardt Instruments [12].

## Results and Discussion

The major considerations in sherbet quality are body arid texture, acidity, flavor, and color. The frozen sherbet was prepared in orange flavour and the optimization of varying squash, milk, sugar, stabilizer, emulsifier and citric acid levels was carried out and the effect on sensory acceptance, physical properties of sherbet mix and frozen sherbet was studied.

**Optimization of levels of various ingredients**

Optimisation of various ingredients was based on their effect on the sensory quality of frozen sherbet. The levels which yielded maximum sensory score were chosen. The ingredients level was optimized step by step i.e. changing the level of one ingredient at a time and keeping the level of other ingredients constant.

**Orange squash level**

Orange is a popular flavour in frozen products, so the same was used in frozen sherbet in the form of squash. The frozen sherbet was prepared with varying level of squash per batch viz. 250g, 375g and 500g and effect of orange squash on physico-chemical properties of mix and frozen sherbet was studied.

The physical properties of the sherbet mix studied were specific gravity and viscosity for the varying level of squash. It was observed that squash level showed some effect on the specific gravity and considerable effect on the viscosity. The specific gravity of the 250g squash containing mix was 1.075 and that of 375g squash mix was 1.081. Further increase in squash to 500g had little effect on the specific gravity. The viscosity of the mix containing 250 g squash was 1.726 cP which increased to 1.891 and 2.491 cP when the squash level in the mix was increased to 375 and 500 g respectively (Table 1). Addition of orange squash to sherbet mix resulted in incorporation of more solids, hence the specific gravity of the mix also increased with increasing squash level. The physical properties for frozen sherbet studied were pH, melting resistance and overrun. The increased squash level decreased the pH significantly. The melting resistance slope values of the frozen sherbet were 0.76, 0.71 and 0.72, respectively for the three levels of orange squash used. Incorporation of squash showed some impact on the overrun. Squash incorporation slightly decreased the overrun. The frozen sherbet containing different levels of orange squash was evaluated sensorily and the average scores awarded are presented in Fig. 1. From the results presented in Fig. 1 it was seen that orange squash at 500 g per batch level produced better quality frozen sherbet than other levels.

**Optimization of milk level**

The toned milk due to its easy availability was used in the preparation of frozen sherbet. The frozen sherbet was prepared with varying level of milk per batch viz. 1.0, 1.5 and 2.0 lit and the effect of milk level on physico-chemical properties of mix and frozen sherbet was studied. It was observed that milk level had some effect on the specific gravity and considerable effect on the viscosity. The specific gravity of the 1.0lit milk containing mix was 1.077, which for 1.5 lit milk mix was 1.082. Further increase in milk to 2.0 lit had little effect on the specific gravity. The viscosity of the mix containing 1.0 lit of milk was 1.77 cP which increased to 2.403 and 2.491 cP when the milk level in the mix was increased to 1.5 lit and 2.0 lit, respectively (Table 1). Addition of milk to sherbet mix resulted in incorporation of more milk solids, hence the specific gravity of the mix also increased with increasing milk level. For the same reason, the viscosity also increased indicating that the mix became more viscous with increase in squash level. The pH of 1.0 lit - milk mix was not significantly different from that of 1.5 lit containing one, whereas 1.5 lit and 2.0 lit -milk mixes were significantly different from each other. The melting resistance values of the frozen sherbet were 0.71, 0.72 and 0.72 respectively for the three levels of milk used (Table 1). As the milk level increased, overrun also increased which may be attributed to good emulsifying properties of milk proteins [13]. Twigg [7] suggested using 2 to 5 per cent total milk solids depending on the type of body and texture desired. It is a common practice among many ice cream manufacturers to use ice cream mix because of its availability in all ice cream plants. Whey solids can also be used.

The frozen sherbet containing different levels of milk was evaluated and the average scores awarded are displayed in Fig. 1. From the results presented in Fig. 1, it was seen that milk at 1.5 lit per batch level produced better quality frozen sherbet in terms of flavor and body than other levels, though the milk level showed its influence on the physical properties of sherbet mix and frozen sherbet. Hence, for further trials, 1.5 lit level of milk was used.

**Optimization of sugar level**

The frozen sherbet was prepared with varying level of sugar per batch viz. 500g, 650g, 750g and effect of sugar on physico-chemical properties of mix and frozen sherbet was studied. The specific gravity of the 500g of sugar containing mix was 1.072 and that of 650g sugar mix was 1.082. The viscosity for 500g, 650g and 750g of sugar levels were significantly different from each other. The viscosity of the mix containing 500 g sugar was 1.191 cP which increased to 2.403 and 2.350cP when the sugar level in the mix was increased to 650 and 750 g respectively (Table 1). The pH of 500g, 650g and 750g of sugar level were 3.7, 3.3 and 3.5, respectively. The melting resistance values of the frozen sherbet were 0.81, 0.81 and 0.82 ml per min respectively for the three levels of sugar used. Regarding overrun, it was observed that at 650g level, overrun was maximum and at other two levels overrun reduced. This may be because at 650 g level of sugar, the mix might have had optimum viscosity to hold more air. However, contrary to the observation made in this study, Arbuckle [2] stated that sugar has a decreasing effect on whipping ability of ice cream mix. It may be noted that the composition of ice cream mix and sherbet is drastically different. According to Arbuckle [2], in making good frozen sherbet, it is necessary to control the sugar content and the overrun. An excess of sugar results in soft product. From the results presented in Fig 1, it was seen that sugar at 650g per batch level produced better quality frozen sherbet than other levels, though the sugar level showed its influence on the physical properties of sherbet mix and frozen sherbet. Hence, for further trials, 650g level of sugar was used.

**Optimization of stabilizer level**

The stabilizer i.e. sodium alginate was used in the preparation of frozen sherbet. The frozen sherbet was prepared with varying level of stabilizer per batch viz. 6g, 8.5g, 11g and effect of stabilizer on physico-chemical properties of mix and frozen sherbet was studied. It was observed that stabilizer level had some effect on the specific gravity and considerable effect on the viscosity. The specific gravity for 6g of stabilizer mix was not significantly different from that of 8.5g containing one, whereas 8.5g and 11g of stabilizer mixes were significantly different from each other.

The viscosity for 6g, 8.5g and 11g of stabilizer level were significantly different from each other. The viscosity of the mix containing 6g stabilizer was 1.565cP which increased to 2.403 and 2.422cP when the stabilizer level in the mix was increased to 8.5g and 11g respectively (Table 1). There was no significant difference in pH values of the mix prepared using the three levels of stabilizer. The melting resistance values of the frozen sherbet were 0.75, 0.74 and 0.73 respectively for the three levels of stabilizer used (Table 1). Stabilisers along with emulsifiers facilitate air incorporation (overrun) [14] which was also observed in the present study. This is because the stabilizer solution has the capacity to retain more air which in turn is enhanced by the presence of milk proteins. There was a significant rise in overrun as stabilizer content increased. Stabilizers assist in the formation of a smooth texture and firm body, and aid in controlling overrun. It has also been reported that a good, well-balanced stabilizer protects the sherbet against body and texture changes. The use of inadequate amounts of stabilizer may result in a coarse, brittle or crumbly body; however, a soggy or sticky body and poor melting qualities are usually due to an excessive use of stabilizer. Because of the greater amount of water in sherbet as compared with ice cream, and the lower content of fat and serum solids, stabilizers are more important in sherbet than in ice cream. Sherbet stabilizers are usually manufactured by combining two or more of the basic stabilizers in order to utilize the merits of each. de Oliveira *et al.,* [4] used guar gum at a concentration of 0.2 – 0.5% in frozen sherbet. Arbuckle [2] suggested various stabilizers like gelatin, CMC, pectin, algin products and locust bean gum. In the present study, however, only one stabilizer i.e. sodium alginate was used.

**Table 1:** Effect of various parameters on physical properties of frozen orange sherbet

| Parameters | Quantity | Physical properties | | | | |
|---|---|---|---|---|---|---|
| | | Specific gravity | Viscosity | pH | Melting resistance, slope value | Overrun |
| Squash, gm | 250 | $1.075^a$ | $1.726^a$ | $4.4^c$ | $0.76^b$ | $25.15^b$ |
| | 375 | $1.081^b$ | $1.891^b$ | $4.3^b$ | $0.71^a$ | $20.57^a$ |
| | 500 | $1.085^b$ | $2.491^c$ | $3.1^a$ | $0.72^a$ | $22.23^a$ |
| Milk, lit | 1.0 | $1.077^a$ | $1.77^a$ | $3.4^a$ | $0.71^a$ | $18.60^a$ |
| | 1.5 | $1.082^b$ | $2.403^b$ | $3.3^a$ | $0.72^a$ | $22.40^b$ |
| | 2.0 | $1.084^b$ | $2.491^c$ | $4.3^b$ | $0.72^a$ | $23.57^b$ |
| Sugar gm | 500 | $1.072^a$ | $1.191^a$ | $3.7^a$ | $0.81^a$ | $18.44^b$ |
| | 650 | $1.082^b$ | $2.403^b$ | $3.3^a$ | $0.81^a$ | $22.57^c$ |
| | 750 | $1.084^b$ | $2.350^c$ | $3.5^a$ | $0.82^a$ | $13.68^a$ |
| Stabiliser gm | 6.0 | $1.076^a$ | $1.565^a$ | $3.2^a$ | $0.75^c$ | $20.09^a$ |
| | 8.5 | $1.082^a$ | $2.403^b$ | $3.3^a$ | $0.74^b$ | $25.40^c$ |
| | 11.0 | $1.072^b$ | $2.422^c$ | $3.3^a$ | $0.73^a$ | $22.57^b$ |
| Emulsifier, gm | 2.5 | $1.079^a$ | $1.143^a$ | $3.1^a$ | $0.80^a$ | $22.17^a$ |
| | 5.0 | $1.082^a$ | $2.491^b$ | $3.1^a$ | $0.72^a$ | $25.57^b$ |
| | 7.5 | $1.080^a$ | $2.469^b$ | $3.2^a$ | $0.79^b$ | $27.33^b$ |

| | | | | | | |
|---|---|---|---|---|---|---|
| | 5.0 | 1.077$^{a}$ | 1.255$^{a}$ | 3.5$^{c}$ | 0.77$^{b}$ | 20.41$^{a}$ |
| **Citric acid, gm** | 7.5 | 1.082$^{a}$ | 2.491$^{c}$ | 3.2$^{b}$ | 0.72$^{a}$ | 22.57$^{a}$ |
| | 10.0 | 1.075$^{a}$ | 2.400$^{b}$ | 3.0$^{a}$ | 0.79$^{c}$ | 23.21$^{b}$ |

Note: Values with different superscripts in a column within a parameter are significantly different ($p<0.05$)

From the results obtained, it was seen that stabilizer level at 8.5g per batch level produced better quality frozen sherbet than other levels (Fig. 1), though the stabilizer level showed its influence on the physical properties of sherbet mix and frozen sherbet.

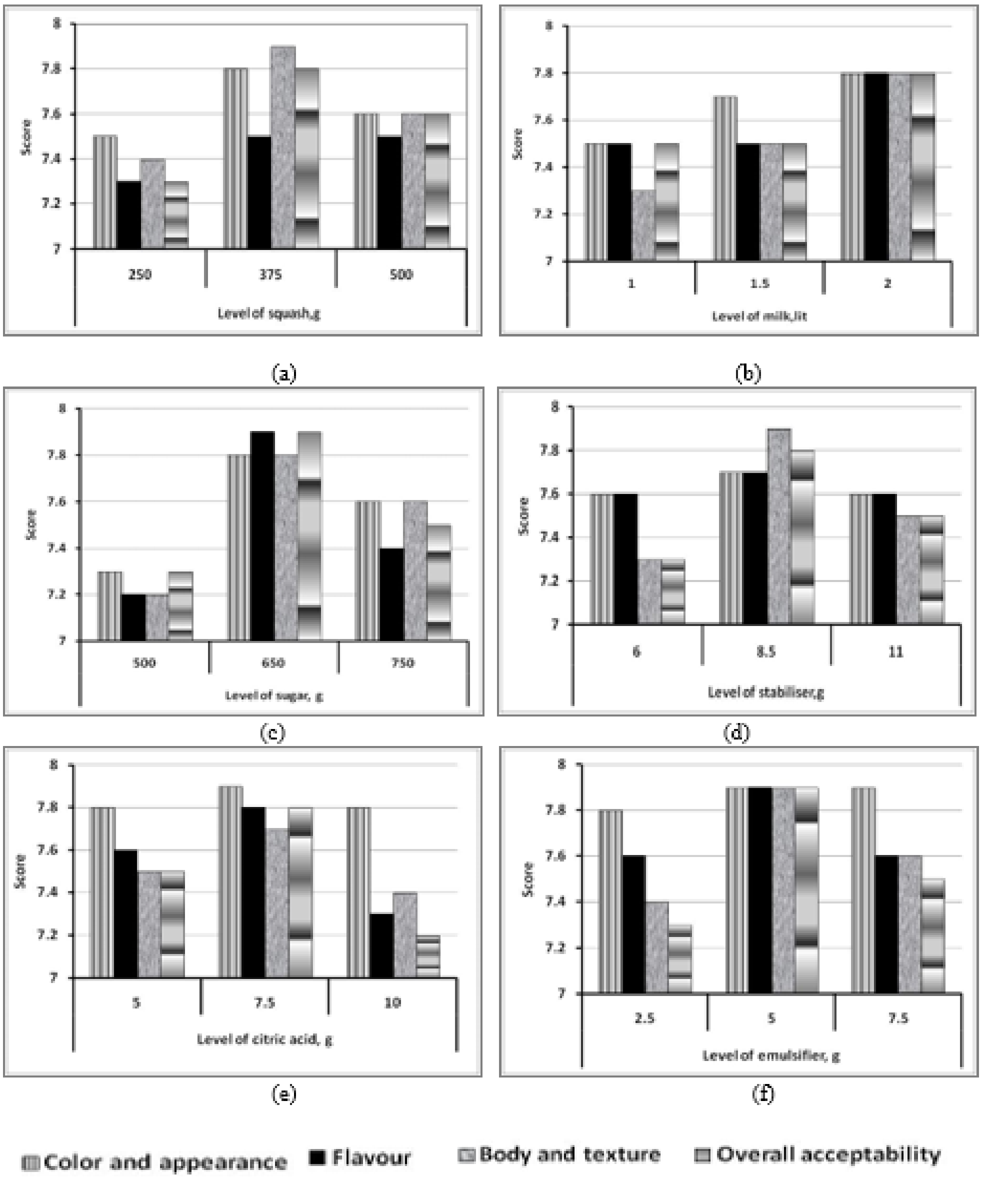


**Figure 1:** Effect of various parameters on sensory acceptance of frozen sherbet (a) level of orange squash (b) level of milk (c) level of sugar (d) level of stabilizer (e) level of citric acid and (f) level of emulsifier

**Optimization of emulsifier level**

The emulsifier GMS was used in the preparation of frozen sherbet. The frozen sherbet was prepared with varying level of emulsifier per batch viz. 2.5g, 5g, 7.5g and effect of emulsifier on physico-chemical properties of mix and frozen sherbet was studied

The specific gravity of the 2.5g of emulsifier containing mix was 1.079, that of 5g emulsifier mix was 1.082 and 7.5g emulsifier mix was 1.080. The viscosity for 2.5g emulsifier of mix was significantly different from 5g containing one, whereas 5g and 7.5g of emulsifier levels were not significantly different from each other. The pH of all the three levels of emulsifier was not significantly different from each other. Melting resistance of frozen products is important from the standpoint of consumer acceptance. The melting resistance values of the frozen sherbet were 0.80, 0.72 and 0.79, respectively for the three levels of emulsifier used (Table 1). Increasing emulsifier content enhanced the overrun, but after 7.5 g level, overrun did not increase significantly. Emulsifier, along with stabilizer plays an important role on overrun which in turn controls the body of frozen sherbet. It may also be observed that the colour and appearance of all the three levels of emulsifier was not significantly different. Other parameters were significantly higher for 5 g emulsifier level. It is a well-known fact that it is easy to obtain a large overrun in freezing sherbet, while only a moderate overrun is desired. Under ordinary circumstances, an overrun of between 30 and 40 per cent gives most satisfactory results, because of the better body of the frozen product [8].

**Optimization of citric acid level**

The frozen sherbet was prepared with varying level of citric acid per batch viz. 5g, 7.5g, 10g and the effect of citric acid on physico-chemical properties of mix and frozen sherbet was studied. From the results presented, it was seen that citric acid level at 7.5g per batch level produced better quality frozen sherbet than other levels (Fig.1), though the citric acid level showed its influence on the physical properties of sherbet mix and frozen sherbet. Sherbets are most commonly made from acid fruits which will vary a great deal in the acidity conferred to the sherbet by the fruit itself. For example, fresh cranberries have an acidity of 2.40 per cent calculated as citric, whereas oranges contain approximately half that amount [15]. It is therefore a common practice to standardize this acid through the addition of other acids. The acids available for sherbets are generally citric, tartaric, lactic, and phosphoric, Citric acid is frequently used to reinforce the acidity of sherbets and is common to many of the fruit juices used for flavoring. Thus, sherbets which contain low milk solids will have a lower pH at any given titratable acidity than sherbets with higher milk solids content and will taste more acid.

**Composition**

Composition of the sherbet mix is given in Table 2. It may be seen that TS content was 32% out of which sugar content was 12.5%. Remaining solids come from fat, protein and squash solids. Thus, the frozen sherbet may be considered as low fat, low protein, low calorie delicacy that can be consumed along with fruits.

**Table 2:** The chemical composition of orange sherbet mix

| | |
|---|---|
| Sugar | 12.5% |
| Fat | 0.8% |
| Protein | 0.30% |
| Ash | 0.40% |
| TS | 32% |

## Conclusion

Frozen sherbet is one of the frozen products consumed much like ice cream and used in several desserts. In this project, a method has been standardized for the preparation of orange flavored frozen sherbet. Various ingredients levels, namely, orange squash of 500g, sugar 650 g, milk 1.5 lit, citric acid 7.5 g, stabilizer 8.5 g and emulsifier 5g per 4 lit batch have been optimized.

## References

1. Marshall, R. T. and Arbuckle, W. S. (1996) Ice cream, 5th edn., Chapman & Hall, New York http://dx.doi.org/10.1007/978-1-4613-0477-7.

2. Arbuckle, W.S. (2013) Ice cream, Springer Science and Business media, New York, USA. pp. 48,289

3. Walker, J.A. (2002) Development of low-fat sugar-free orange sherbet containing soy protein. Master's Thesis, Louisiana State University and Agricultural and Mechanical College, USA.

4. de Oliviera, A.L., da Silva, M.G.F., Sobral, P.J.A., de Oliveira, C.A.F. and Ana Mônica Quinta Barbosa, A.M.Q. (2005) Physical properties of Mangaba sherbet blends. Brazilian Agril Res., 40(6): 581-586.

5. Soares, J.C., Garcia, M.C., Garcia, L.G.C., Caliari, M. and Soares, M.S. (2018) Jambolan sherbets overrun, color, and acceptance in relation to the sugar, milk, and pulp contents in formulation. *Food Sci. Technol.,* 38(3): 1-6.

6. Srisukh, V., Tungrugsasut, W., Bunyapraphatsara, N., Khuwattanasil, S. and Wongpoomchai, S. (2008) Aloe ice cream and sherbet. *Thai Journal of Phytopharmacy*, 13(2): 1-12.

7. Twigg, K.W. (1956) Sherbet studies using orange and cranberry concentrate. M.Sc. Thesis submitted to Oregon State College, USA.

8. Reichart, E.L. (1931) Speed of dasher and scraper as affecting the quality of ice cream and sherbet. 14(2): 107-115.

9. Amerine, M. A., Pangborn, R. M. and Roessler, E. (1965) *Principles of sensory evaluation of food*. Academic Press, New York.

10. Bradley, R.L. (2014) Moisture and total solids analysis. In “Food analysis” (ed. Nielsen, S.), Springer Science & Business Media, New York, USA, p.97-98.

11. BIS (1981) Handbook of food analysis, Part XI: Dairy products. Indian Standards Institution, New Delhi.

12. AOAC (2005) Official methods of analysis of AOAC International, 18$^{th}$Edn., Washington D.C.

13. Dickinson, E (2003) Interfacial, Emulsifying and Foaming Properties of Milk Proteins. In: “Advanced dairy chemistry-1: Proteins” (P. F. Fox, P.F. and McSweeney, P.L.H., Eds.), Springer, Boston, USA., pp. 1229-1260.

14. Anonymous (2019) How to produce ice cream with high overrun. https://www.palsgaard.com/.../ ice-cream/.../how-to-produce-ice-cream-with-high-over...

15. Braverman, J. (2018) The pH levels of apple, orange, grape and cranberry fruit juices. https://healthyeating.sfgate.com/ph-levels-apple-orange-grape-cranberry-fruit-juices-120.