

Effect of Addition Dates “Hayani” on Yield, Chemical Composition and Sensory Evaluation of Ice Cream

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Abstract

Damietta Governorate is famous for its production of dates especially "Hayani" dates, are producing large amounts of it in short time. "Hayani" dates gives high output and exposed to rapid deterioration during the marketing of dates, where doesn't stay more than 3 - 4 days at room temperature and become unfit for consumption, this leads to significant loss of production and not to take advantage of it so was the idea to drying the dates and stored to use throughout the year. The main idea in this search are the production of ice cream with "Hayani" dates. The objective of this research was to determine the effect of increasing Date fruits added to the ingredients on chemical composition, organoleptic properties and yield of ice cream. Six treatments of ice cream were made by adding 0, 5, 10, 15, 20 and 25% date fruit "Hayani" to the ingredients. Resultants ice cream was examined for chemical composition and organoleptic properties as follows: Ice cream treatment with 15% Dates was adjudged as the best treatment in appearance (18.13 ± 1.40), while, significant differences were recorded between treatment by 15% Dates with treatments by 5% Dates, 10% Dates and control treatment ($p < 0.05$, $p < 0.001$ and $p < 0.05$, respectively) in odor of ice cream. Ice Cream treatment with 15% Dates was coupled by the best color estimate (18.26 ± 0.88) points out of 20. Higher estimate for Ice Cream texture was in treatment with 15% Dates (18.13 ± 0.83) followed by treatment with 20% (17.33 ± 3.26) and 25% Dates (17.26 ± 1.79) points out of 20, on the other Hand, significant differences were shown between treatments with 5%, 10%, 15% and 20% Dates with control treatment ($p < 0.05$, $p < 0.01$, $p < 0.001$ and $p < 0.01$, respectively) and between treatments with 5% and 10% Dates with treatment with 15% Dates ($p < 0.001$) in appearance of ice cream. Concerning treatments with 20% and 25% Dates, they showed significant differences with treatment with 15% Dates ($p < 0.001$) in the Ice Cream overrun. In the end, the treatment of ice cream with 15% dates found the best ingredients.

Keywords

Ice Cream, Dates, Sensory Evaluation, Chemical Composition

1. Introduction

The fruit of date palm (*Phoenix dactylifera* L.), can be considered as an ideal food that provides a wide range of essential nutrients with many potential health benefits [1]. Dates are consumed in a variety of ways. They are mainly consumed as fresh (30%–40%) or in the dried form (60%–70%) at Rutab (semiripe) and Tamar (fully ripe) stages with

little or no processing [2]. These stages of maturity are traditionally described by changes in color, texture, taste, and flavor [3]. Dates are usually taken as such or with Arabian coffee, milk, or yoghurt. In the processed form, they are consumed as paste, syrup, pickles, jams, jellies, and are used in many bakery or confectionary products together with chocolate, coconut, honey, vinegar, and others [2, 4, 5, 6]. The consumption of dates reaches its peak in the Muslim's holy month of fasting “Ramadan” when dates are commonly taken

to break the fast. The consumption of dates by younger population is less as compared to the older population [7]. Date is a delicious fruit with a sweet taste and a fleshy mouth feel. The major component of dates are carbohydrates (mainly the sugars; sucrose, glucose, and fructose), which may constitute about 70%. The sugars in dates are easily digested and can immediately be moved to the blood after consumption and can quickly be metabolized to release energy for various cell activities. Dates are also a good source of fiber, and contain many important vitamins and minerals, including significant amounts of calcium, iron, fluorine, and selenium [3, 8, 9, 10, 11, 12]. Dates have also been shown to contain antioxidant and antimutagenic properties. Recent studies have shown that dates and their aqueous extracts have demonstrated the free radical scavenging activity, inhibition of free radical-mediated macromolecular damages, antimutagenic, and immunomodulatory activities [13, 14, 15, 16]. Further research is required to explore the health benefits of date fruit and date pits as well as the use of their functional components in the development of various value-added food products and supplements.

Moisture and total solids were (13.2-14.1%) and (85.9-86.8%), respectively. Ash and crude fibers contents were (2.13-2.18%) and (6.05-6.9%), respectively. The dates were rich in carbohydrate (51.8–55.0% dry weight), while they contained low concentrations of protein and lipid (2.0–2.2% and 0.12–0.72%, respectively). Dates represented little amounts of vitamin-A (0.7-1.2 mg %) and vitamin-C (0.7-0.9 mg %). High source of energy, as 100gm of date flesh can provide an average between (226.49-241.79) kcal. 11 minerals were determined from dates by Atomic Absorption Spectrophotometer. The predominant mineral was potassium (460-680 mg %). They contained low content of sodium (0.6-1.0 mg %). Rich source of calcium (51-60 mg %), phosphorus (52-60 mg %), magnesium (48-53 mg %) were found. Good source of iron (0.79-0.90 mg %), manganese (0.85-1.1 mg %), zinc (0.69-0.72 mg %), copper (0.32-0.36 mg %), chromium (0.36-0.42 mg %) and selenium (0.22-0.31 mg %) [17]. The date palm, *P. dactylifera* including its fruit and seed are rich with antioxidant properties and other nutrients [18].

This study investigated the nutritional, anti-nutritional factors, functional properties, mineral and amino acid contents of *Phoenix dactylifera* L. fruits using standard analytical methods. The results revealed that date palm (*P. dactylifera* L.) contain some percentage crude protein (1.21±0.02%), crude fat (1.73±0.46%), crude fibre (2.26±0.07%), ash (1.88±0.03%), moisture contents (1.16±0.16%), carbohydrate (91.76±0.06%), and calorific values (1621.50±0.12 kg/100g) respectively. The anti-nutrient composition for oxalate, tannins, saponins, alkaloids, cyanide, and flavonoids were 7.57±0.04, 5.25±0.04, 1.89±0.12, 5.20±0.46, 0.80±0.01 and 34.29±3.49% respectively; these result indicated that the sample is free of toxic substance which might cause harm to the body. The non-essential amino acids which give rise to about 62% make the plant more desirable since non-essential amino acid play important role in the body structure of a human. Though,

both essential and non-essential amino acid present were there to complement each other. The elemental analysis of the fruit in mg/kg indicated that the fruit contained appreciable levels of K (11105 mg/kg), Na (913 mg/kg), Mg (799 mg/kg) and P (793 mg/kg). This showed that the fruit can serve as good source of minerals [19].

Egypt is at the second place in the world concerning the production of dates. Date palm cultivation is cultivated in most of the Egyptian Governorates with total area 73.653 thousand feddan and about 14 million cultivated dates Palm area with palm trees currently 73.653 thousand acres, or about 6.32% of the total cultivated fruit total area (FAO, 2002) and represents annual production of dates 1,113,270 million tons of dates (FAO, 2002) which currently represent approximately 13.91% of the total fruit production in Egypt produces about 10,378,355 million Palm fruitful [20]. The production in Damietta 27.310 ton fruits at 364.956 palm trees during the growth season (May to October) with an average daily temperature of less than 25 Celsius. The fresh of the fruit of these cultivars at the stage at which they are eaten, had a high moisture content (over 50%). The dates could not be kept at ambient conditions for a long time since they usually deteriorate and ferment. The majority of their sugars are inverted. The fruits are usually of an oblong shape and they differ in colour. They are consumed fresh as in Hayani, Zagloul and Samani [21].

Ice cream is a delicious, wholesome, nutritious frozen dairy food. It is made of milk, sweet cream, skim milk, condensed milk or other concentrated dairy products or a combination of these with added sugar, flavoring and stabilizer with or without color and with incorporation of air during the freezing process [22]. Ice cream is undoubtedly one of most popular and favorite food product in Bangladesh among children and adults especially during summer season. Several brands of ice cream in variety of flavors have been marketed here. Quality of ice cream depends on both extrinsic factors that include manufacture procedure, and intrinsic factors that include proportion of ingredients used [23]. So that the objective of this study was to added the date fruits (Hayani) on ingredients of ice cream manufacture and determine any influences on the chemical composition and sensory properties of the resulting ice cream with Dates.

2. Materials and Methods

2.1. Materials

2.1.1. Dates Fruits Source

Date fruits (*Phoenix dactylifera* L) were purchased from the popular market for food in Damietta.

2.1.2. Cream

Cream 40% was obtained from El-domiattia from dairy and Food Company, Damietta, Egypt.

2.1.3. Sugar

Sugar “Baladna”, produced by Al Marwa Food Packaging & Distribution Company, Damietta was used.

2.1.4. Emulsifier

Emulsifier packed by El-Borg for food industries Co., Borg El-Arab city, Alexandria, was used.

2.1.5. Skim Milk Powder

Spray non-fat dry milk powder, low heat, of USA and Poland Origin was used during the course of this work. Imported by the Egyptian Company for Trade, industry "zahran" "Alex".

2.2. Methods

2.2.1. Chemical Analysis

All the samples were washed thoroughly in running tap water and then air dried. The fruits were cut, deseeded and the pulp portion was homogenized in blender for analysis.

Samples were chemically analyzed for Moisture according to the official methods of analysis described by the [24]. These methods rely on measuring the mass of water in a known mass of sample before and after the water is removed by evaporation.

$$\text{Moisture (\%)} = \frac{W_1 - W_2}{W_1} \times 100$$

Where; W_1 = Weight (g) of sample before drying, W_2 = Weight (g) of sample after drying.

The basic principle of this technique is that water has a lower boiling point than the other major components within foods, e.g., lipids, proteins, carbohydrates and minerals. Sometimes a related parameter, known as the total solids, is reported as a measure of the moisture content.

Thus, %Total solids = (100 - %Moisture). To obtain an accurate measurement of the moisture content or total solids of a food using evaporation methods it is necessary to remove all of the water molecules that were originally present in the food, without changing the mass of the food matrix.

2.2.2. Preparation of Date Fruits

Dates fruits have been drying in the sun, then added a similar amount to the size of water and leave it until the morning absorbed then add it to the mix.

2.2.3. Manufacture of Ice Cream with Dates

The manufacture of ice cream was carried out as described by [25] with some modifications. The detailed ingredients blends and formulations for six ice cream treatments are indicated in Table (1).

Table 1. Ice cream formulation.

Ingredients %	Control (without Date)	Treatments				
		5%	10%	15%	20%	25%
Cream 40%	200 gm	200 gm	200 gm	200 gm	200 gm	200 gm
Milk	550 gm	550 gm	550 gm	550 gm	550 gm	550 gm
Sugar	150 gm	150 gm	150 gm	150 gm	150 gm	150 gm
Emulsifier	5 gm	5 gm	5 gm	5 gm	5 gm	5 gm
SMP	100 gm	100 gm	100 gm	100 gm	100 gm	100 gm
Vanillia	20 mL	--	--	--	--	--
Date fruit	--	50 gm	100 gm	150 gm	200 gm	250 gm

SMP: Skim milk powder, gm: Gram

2.2.4. Ice Cream Was Made as Follows

Cream 40%, milk, sugar, emulsifier, skim milk powder, vanillia and date fruit were fed into electric mincer to convert them into finally minced ice cream. Each formulation of blends was placed in a vat double jacket, heated at a temperature of 65-70°C for 30 minutes, and cooled at 5°C, then transport from soft ice cream machine (Bmeqile, MQ – L22 ST, Importer: Mecca Al-Mokarama for Import and Export, 28 Amir Al-Geosh El-Goany Street, Al-Gamalia, Cairo). The resultant ice cream of all treatments were filled in

120 g glasses. The ice cream were chemically and organoleptically analyzed.

2.2.5. Chemical Analyses

Total solids (TS), fat and total protein contents according to [26]. The pH values were estimated using a pH meter type CG 710. Ice cream was analyzed for total solids (TS), pH, and fat contents according to [26].

2.2.6. Overrun in Ice Cream

Overrun % can be calculated as follows:

$$\text{Overrun \%} = \frac{\text{Weight of a given volume of mix} - \text{weight of same volume of ice cream}}{\text{Weight of same volume of ice cream}} \times 100$$

2.2.7. Judging of Samples

The samples were judged separately by a panel expert of judges to evaluate appearance, color, odor, and overall characteristics, using a standard score card for judging ice cream. For scoring sensory characteristics hedonic scales were used in which scores 19-20 = Excellent; 16-18 = Good;

12-15 = Fair, 9-11 = Marginal acceptable; 7-8 = Unacceptable; 0-6 = Bad. For each of the characteristic, the maximum score given was 20 points. The total scores marked thus for the five characteristic parameter was 100 points [27].

2.2.8. Statistical Analysis

The obtained results were statistically analyzed using a

software package [28] based on analysis of variance. When F-test was significant, least significant difference (LSD) was calculated according to [29] for the comparison between

means. The data were presented, in the Tables, as the mean (\pm standard deviation) of 3 replicate experiments.

3. Results and Discussion

3.1. Chemical Composition of Ice Cream with Dates

Table 2. Chemical composition of ingredients used in Ice cream.

Ingredients	pH	TS%	Fat%	Protein%	SNF%
Cream	5.60	47.75	40	3.20	5.4
Milk	6.65	70.00	6.50	4.50	7.85
Skim milk powder	--	--	0.10	36.20	96.2
Sugar	--	99.98	0	0	--
Date fruit	--	74.80	0.25	1.75	--

Table 3. Chemical composition of ingredients used in Ice cream.

Treatments	pH	Fat%	TS%	Overrun
Treat 1	6.53 ^a \pm 0.03	4.55 ^a \pm 0.05	40.12 ^a \pm 0.12	85.0 ^a \pm 0.4
Treat 2	6.48 ^{ab} \pm 0.02	4.02 ^b \pm 0.02	38.05 ^b \pm 0.05	83.0 ^b \pm 0.1
Treat 3	6.45 ^{ab} \pm 0.01	3.90 ^c \pm 0.02	36.99 ^c \pm 0.05	83.0 ^b \pm 1.0
Treat 4	6.41 ^b \pm 0.01	3.75 ^d \pm 0.03	34.82 ^d \pm 0.01	82.0 ^b \pm 0.03
Treat 5	6.40 ^b \pm 0.1	3.55 ^e \pm 0.05	32.65 ^e \pm 0.04	82.0 ^b \pm 0.5
Treat 6	6.21 ^c \pm 0.01	3.45 ^f \pm 0.02	31.85 ^f \pm 0.03	80.0 ^c \pm 1.0
P-Value	<0.0001	<0.0001	<0.0001	<0.0001

Treat 1: Control "without Dates", Treat 2: Ice cream with 5% Dates, Treat 3: Ice cream with 10% Dates, Treat 4: Ice cream with 15% Dates, Treat 5: Ice cream with 20% Dates and Treat 6: Ice cream with 25% Dates.

Compositional analyses of ingredients in Table (2). An increase in date palm fruits added to the ice cream ingredients caused a proportional decrease in the final pH values of the ice cream. Changes in pH depend on change in total solids (lactose, protein and fat) in ice cream.

The chemical composition of ice cream is presented in

Table (3). It is observed that pH, fat, TS % and overrun of ice cream gradually decreased during increase the date palm fruit in ingredients. As it is expected, by increasing concentrations of date palm added to ice cream formula, pH, fat, TS % and overrun of resultant ice cream significantly ($p < 0.001$) decreased.

3.2. Ice Cream with Dates Sensory Properties

Table 4. Organoleptic properties of ice cream made from different percentage of Date palm fruits.

Treatments	Appearance (Mean \pm SD.)	Odor (Mean \pm SD.)	Color (Mean \pm SD.)	Texture (Mean \pm SD.)	Overrun (Mean \pm SD.)
Treat 1	15.60 \pm 3.31	16.66 \pm 1.98	16.00 \pm 2.61	16.00 \pm 2.26	14.93 \pm 3.08
Treat 2	16.37 \pm 2.39	16.25 \pm 1.65	16.00 \pm 2.52	16.62 \pm 1.74	16.37 \pm 1.5a*
Treat 3	18.13 \pm 1.40a***b*	16.73 \pm 1.79	17.86 \pm 1.76a*b*	16.80 \pm 2.90	16.93 \pm 1.66a**
Treat 4	18.66 \pm 1.23a***b**	18.06 \pm 1.09a*b**c*	18.26 \pm 0.88a***b**	18.13 \pm 0.83a***b*	19.20 \pm 1.01a***b***c***
Treat 5	17.60 \pm 1.35a**	17.13 \pm 1.99	17.60 \pm 2.64a*b*	17.33 \pm 3.26	16.53 \pm 1.59a**d***
Treat 6	16.13 \pm 2.19c**d**	16.40 \pm 2.22d**	15.53 \pm 3.35c**d**e*	17.26 \pm 1.79	16.06 \pm 1.38d***

Treat 1: Control "without Dates", Treat 2: Ice cream with 5% Dates, Treat 3: Ice cream with 10% Dates, Treat 4: Ice cream with 15% Dates, Treat 5: Ice cream with 20% Dates and Treat 6: Ice cream with 25% Dates.

a: Significant differences vs. Treat 1. b: Significant differences vs. Treat 2.

c: Significant differences vs. Treat 3. d: Significant differences vs. Treat 4

e: Significant differences vs. Treat 5

(*: $p < 0.05$; **: $p < 0.01$ and ***: $p < 0.001$).

3.2.1. Appearance

Ice cream treatment with 15% Dates was adjudged as the best treatment in appearance (18.13 \pm 1.40). Highly significant differences were observed between treatments by 10%, 15% and 20% Dates with control treatment ($p < 0.001$, $p < 0.001$ and $p < 0.01$, respectively), also highly significant differences were showed between treatments by 10% and 15% Dates with

treatment by 25% Dates ($p < 0.01$). For treatment by 5% Dates, it showed significant differences with treatments by 10% and 15% Dates ($p < 0.05$, $p < 0.01$, respectively) as recorded in Table 4 and Figure 1.

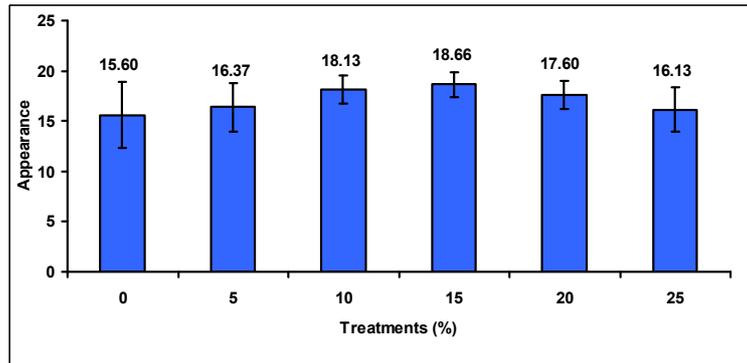


Figure 1. The values of appearance in Ice Cream treatments.

3.2.2. Odor

The odor estimates of Ice Cream treated by Dates were at range from 18.06 ± 1.09 (15% dates) to 16.66 ± 1.98 (control treatment). Significant differences were recorded between treatment by 15% Dates with treatments by 5% Dates, 10% Dates and control treatment ($p < 0.05$, $p < 0.001$ and $p < 0.05$, respectively). For treatment by 25% Dates, it showed significant difference with treatment by 15% Dates ($p < 0.001$) (Table 4 and Figure 2).

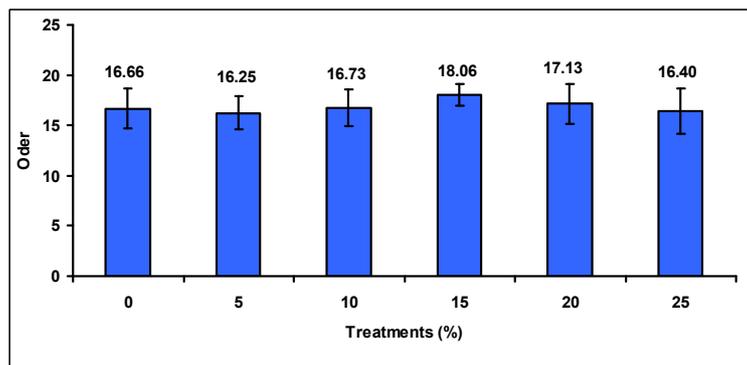


Figure 2. The values of odor in Ice Cream treatments.

3.2.3. Color

The results in Table 4 and Figure 3 clearly demonstrative that the Ice Cream treatment by 15% Dates was coupled by the best color estimate (18.26 ± 0.88). Significant differences were observed between treatments with 10%, 15% and 20% Dates with control treatment ($p < 0.05$, $p < 0.001$ and $p < 0.05$, respectively) and treatment with 5% Dates ($p < 0.05$, $p < 0.001$ and $p < 0.05$, respectively). Regarding treatment with 25% Dates, it showed significant differences with treatments with 10%, 15% and 20% Dates ($p < 0.01$, $p < 0.01$ and $p < 0.05$, respectively).

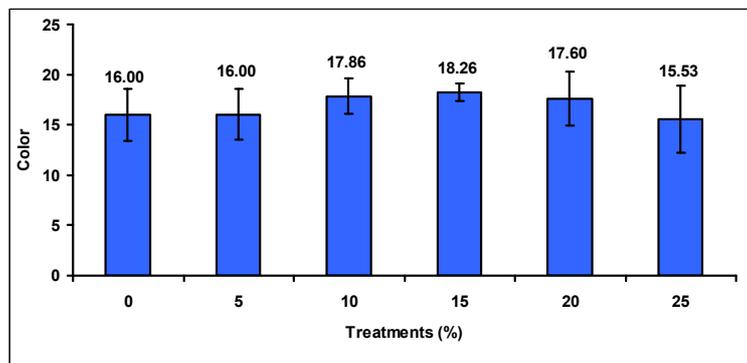


Figure 3. The values of color in Ice Cream treatments.

3.2.4. Texture

Non-significant differences were observed between different treatments except those between treatment with 5% dates and control treatment with treatment with 15% Dates ($p < 0.05$, $p < 0.01$, respectively). Higher estimate for Ice Cream texture was in treatment with 15% Dates (18.13 ± 0.83) followed by treatment with 20% (17.33 ± 3.26) and 25% Dates (17.26 ± 1.79) as showed in Table 4 and Figure 4.

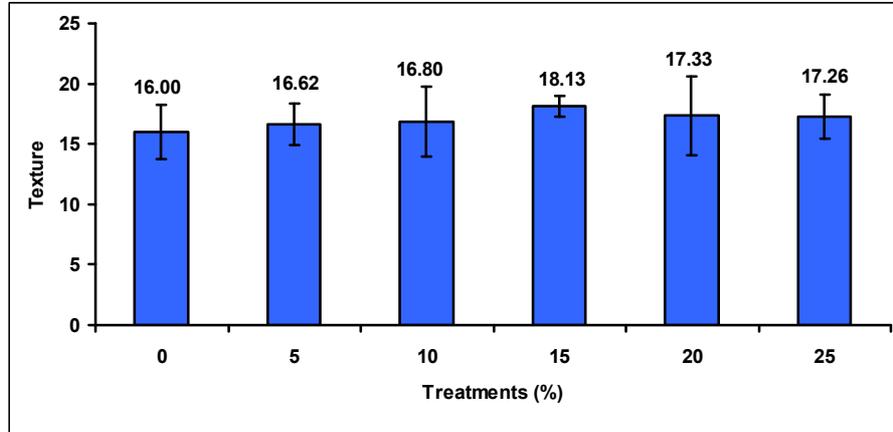


Figure 4. The values of Texture in Ice Cream treatments.

3.2.5. Overrun

Results in Table 4 and Figure 5 indicated that the Ice Cream overrun was in ascending odor with adding different percentages from Dates [5% (16.37 ± 1.5) up to 15% (19.20 ± 1.01)] then decreased to be 16.53 ± 1.59 and 16.06 ± 1.38 for treatment with 20% and 25% Dates, respectively. Significant differences were showed between treatments with 5%, 10%, 15% and 20% Dates with control treatment ($p < 0.05$, $p < 0.01$, $p < 0.001$ and $p < 0.01$, respectively) and between treatments with 5% and 10% Dates with treatment with 15% Dates ($p < 0.001$). Concerning treatments with 20% and 25% Dates, they showed significant differences with treatment with 15% Dates ($p < 0.001$).

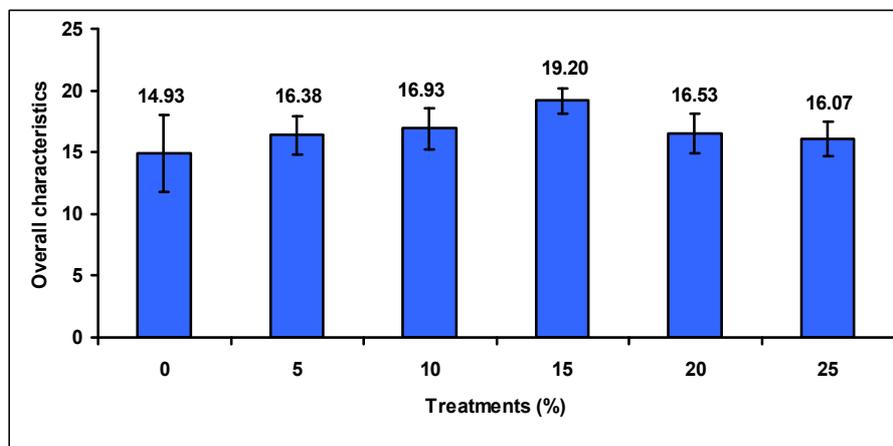


Figure 5. The values of overrun in Ice Cream treatments.

4. Conclusions

Levels of added date palm fruit when increased in the blend have a direct impact on chemical composition and sensory properties of ice cream. This study indicates that adding 15% date palm fruits to blend of ice cream improves sensory properties of the resultant ice cream by improving appearance, odor, color and texture. Also, increasing amount of date palm fruits added to an ingredients in ice

cream increase yield and so reduce costs and raised net profit.

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