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Production and Sensory Evaluation of Ice Cream from Sesame Milk

إنتاج وتقييم حسي لإيسكريم لبن السمسم

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قال تعالي:

اقْرَأْ بِاسْمِ رَبِّكَ الَّذِي خَلَقَ ﴿١﴾ خَلَقَ الْإِنسَانَ مِنْ عَلَقٍ ﴿٢﴾ اقْرَأْ وَرَبُّكَ الْأَكْرَمُ ﴿٣﴾ الَّذِي عَلَّمَ بِالْقَلَمِ ﴿٤﴾ عَلَّمَ الْإِنسَانَ مَا لَمْ يَعْلَمْ ﴿٥﴾

صدق الله العظيم

سورة العلق الآيات (1-5)

Dedication

To our beloved

Mothers and fathers for their support and encouragements, to our brothers and sisters

And all our friends

To all our teachers in all education levels

Acknowledgement

Special praise and thanks to Almighty ALLAH who has led us in my educational career, and for innumerable bounties.

I would like to express our gratitude and deep appreciation and recognition to my supervisor **Prof. Dr. / Yousif Mmhamed Ahmed Idris** who has provided continuous support, guidance and criticism.

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Abstract

The aim of this study is to produce ice cream from sesame milk, determain chemical composition of sesame milk and sesame ice cream, and evaluate sensory properties of ice cream. Sesame milk was produce by sesame seeds washed with water, steeped at room temperature .soaked seeds were spreated from water, then blended with water using high speed blender for 2 minutes, the resulting homogenate was filtrated and the filtrate (sesame milk) was cooled. Then sesame milk was used to produce ice cream, where dry ingredients were mixed with each other and deep frozen for 6 hours at -18C Vanilla ,Strawberry and Nescafe were used as flavor for the ice cream. Sesame milk and seame ice cream were analyzed for Protein, Fat, Moisture, pH, T.S.S, and Ash. Sensory properties of ice cream were evaluated by 20 panelists. Physiochemical analysis of sesame milk showed the following results: protein 3.89% Fat 3.84 Moisture 86.5% Ash 1.44 % pH 6.7% and free lactose. And the Physiochemical analysis of ice cream as following: Protein 9.3% Fat 12.1% Moisture: 57.5% Brix 42% T.S.S 54.4% .the results of sensory evaluation by the consumers in sesame ice cream showed acceptable but lower than others samples contain flavors this may be due to acids (in sesame seeds) epically that sample with Nescafe flavor is most preference. From the result we obtained it could be conducted that sesame milk ice cream can be produced and it is good and acceptable as cow milk ice cream. we recommend the use of sesame ice cream as it is lactose – free especially for those who suffer from lactose intolerance (Hypersensitivity) of cow milk.

ملخص الدراسة

الهدف من الدراسة انتاج ايسكريم من لبن السمسم، ومعرفة التركيب الكيميائي للبن السمسم وايسكريم لبن السمسم ثم التقييم الحسي للايسكريم المنتج. تم انتاج لبن السمسم عن طريق غسل الحبوب اولا ثم نقعها في ماء في درجة حرارة الغرفة ثم خلطها بواسطة خلاط سرعتة عالية لمدة دقيقتين ثم بعد ذلك الترشيح والمعاملة الحرارية لمدة 15 دقيقة علي حرارة ْ75م ثم يبرد الناتج .يتم استخدام الحليب المنتج في صناعة الايسكريم حيث تم خلط المكونات الجافة مع بعضها البعض، ثم عملية الخفق للكريمة والتبريد لمدة 6 ساعات علي درجة -ْ18م، الفانيليا والفراولة والنسكافي استخدمت كنكهات للمنتج .اجريت تحاليل للبروتين، والدهن، والرطوبة، والرماد،نسبة السكريات لعينة لبن السمسم والايسكريم المنتج وتم التقييم الحسي بواسطة20 من المستهللكين ولقد اظهرت نتائج التحاليل احتواء لبن السمسم علي بروتين 3.89 % ودهن 3.84% ورطوبة 86.5% ورماد 0.51% والاس الهيدروجيني 6.7% اما اللاكتوز فكان بنسبة معدومة .اما ايسكريم لبن السمسم احتوى علي بروتين 9.3% ودهن نباتي 12.1% ورطوبة 57.3% ، الجوامد الصلبة الكلية الذائبة 54.5% نسبة السكريات 42%.كما اظهرت نتائج التقييم الحسي بواسطة المستهلك في عينة ايسكريم لبن السمسم قبولا ولكن بدرجة اقل من العينات الاخري المحتوية علي نكهات ويرجع السبب في ذلك للحوضة الموجودة قشرة السمسم الخاجية،كما ان نكهة النسكافى كانت الاكثر قبولا لدي المستهلك . بذلك يمكن نتوصل الي نتيجة ان ايسكريم لبن السمسم يمكن انتاجة كما ان المنتج يكون جيد و بدرجة مقبولة لدي المستهلك مثل الايسكريم المنتج من اللبن الطبيعي . لذي نوصى باستخدام الايسكريم المنتج من لبن السمسم لانة خالي من اللاكتوز خاصة للاشخاص اللذين يعانون من حساسية اللاكتوز من اللبن الطبيعي .

CHAPTER ONE

INTRODUCTION

Ice cream is sweetened frozen food typically eaten as a snack or dessert, it is usually made from dairy product, such as milk and cream and often combined with fruits or other ingredient and flavors, and it have high consumption for all people, especially in children (Abuzaid, 2007). Ice cream considered an excellent source for heat energy for its content of fat ,protein ,sugar(lactose)which made it desirable to consumers for all ages specially children and help them growing, it also useful in over weight programmers to control their weight (Goff,2006). There a lot of individual suffering from allergic reaction to lactose (difficulty in digestion the lactose due to lack of lactase enzyme) so there are a lot of dairy food not fit with them and there must be alternative food for them A lot of research and studies headed to find an alternative source from dairy plant such as: soybean, peanuts, sesame.Recently, much attention has been directed toward exploring the utilization of oilseed in general and sesame seed in special, sesame seed can supply us with nutritious, functional and healthy meals with relatively low cost .(Jihad,2009).The production of sesame–based dairy products can overcome the problems that limit consumption of soy-based dairy products and other vegetable milk. (El kier,2008). So idea of this research production sesame milk and chemical analysis of milk product and then produce ice cream from sesame milk with high quality and specifications better than ice cream from cow milk

Objectives:

1- To produce ice cream from sesame milk.
2- To determine Chemical composition of sesame milk and sesame ice cream.
3- To evaluate sensory properties of sesame ice cream.

CHAPTER TWO

LITERATURE REVIEW

2-1 Milk

2-1-1Historical background

There is no historical book about milk history in Europe or the near East in any language of the region, as far as I know but this remarkable, because one can find books about a lot of foods, especially the basic foods such as bread ,meat , fish and vegetables.

Milk has become a basic food in northern Europe only since the last 60 to 70 years. Before there was aural milk –production nearly everywhere, but only with the main intent to produce butter and some cheese from the sour-milk.(Maria,2007).

Since the upcoming of liquid milk consumption in the late 19^{th} century, scientific milk research was established in Germany.

There is actually no milk history which is worth telling milk has never been a basic food in Europe, only 150years ago liquid milk consumption started. Was used to get fat (butter) and cheese (Maria,2007).

2-1-2 Definition of milk

Milk is an opaque white or bluish –white liquid secreted by the mammary glands of female mammals, serving for the nourishment of their young.)(Chandan,2006).

Fluid milk products There are a variety of fluid milk products available on the US market. These include the Whole, reduced-fat (2%), low-fat (1%), and fat-free (skim) milk .The percentage of milk fat is adjusted in

the milks by cream separation and standardization processes, providing these fluid milk varieties. All of the reduced-fat milks are fortified with vitamins these vitamins are fat soluble.(Chandan,2006).

2-1-3 Composition of milk

A colloidal dispersion of liquid droplets in another liquid phase (Dickinson and Stainsby 1988).is description for milk in which milk fat is stabilized as globules and dispersed in the aqueous .of the major milk components with the most structure impact on fluid milk are fat and protein specifically casein however whey protein ,lactose and salts participate in a Varity of structural transformation by their ability to aggregate and from bonds or bridges as well as controlling PH and ionic strength of emulsion (Kalab and Caris,1990). In general, the composition of cow's milk is 87,7%water 4,9%lactose(carbohydrate) 3,4% fat 3,3%protein and,7% minerals (referred to as ash). Milk composition varies depending on the species (cow, goat, sheep) breed, the animals feed and stage of lactation (Braka,2014).

2-1-4 Milk constituents

2-1-4-1 Fat

Milk fat is approximately 3,9 g 100g of whole raw milk and partitioned into globules ranging in size from, (2 to 15MI m) (Michalski*et al* ,2004) the fat globules is structurally and compositionally complex .milk fat globules 98% is triacylglycerol with a substantial amount of short chain fatty acids and only a smallamount of long chain polyunsaturated fatty acids and more than 200 triglycerides isomers (Iopez,2005).

Milk fat is secreted as fat globule surrounded by a milk fat globule membrane, which maintains fat the integrity of globule and maintains fat

as emulsion .Milk contain high concentration of saturated fatty acid (62%) followed by lower concentration of monounsaturated (29%) and polyunsaturated fatty acids(4%). Most of fat globule size about (0,2-15Mm) (Baraka,2015)

2-1-4-2 Protein

The protein in milk is primarily caseins (80%) and whey protein (20%).casein is define as those proteins in milk that precipitate at above PH=4,5.

The casein micelles contain in excess of 20,000 individual protein hydrated with 3-4g of water per g of protein (Dalgleish,2011)

2-1-4- 3 Salt

Milk salts include organic and inorganic salts. The inorganic salts include Na,K,Ca,Mg,Cl,SO4.organic salts include amines, citrate ,carboxylic acid and phosphoric esters .salt in milk can be present in dissolved and un dissolved (colloidal) form, the dissolved salts play an important role in milk protein stability. The total concentration is less than1% mineral salts occur in solution in milk serum (Haug *et al*., 2007)

2-1-4-4 Milk Enzymes

Milk enzymes are found in,or associated with variour casein micelles ,milk fat globule membrane. These milk enzymes can be used as indices of animals health or thermal history the milk, they can result in quality deterioration or induce desirable changes in milk and dairy products or they may also offer productive effects. Important indigenous milk enzyme eg.plasmin, lipoprotein, lipase,alkaline phosphatase and lacto peroxidase(Tamime,2009).

2-1-4-5 Lactose

Lactose is primary carbohydrate in milk .it is disaccharide of galactose and glucose unit, linked by (B1-4 glycosidic bond). Lactose is a reducing sugar and exists as a and Banomies in solution the a and B forms vary in solubility, crystal shape, size. Mutation of lactose depend on temperature and pH.

Lactose crystallizes much faster than other sugar like sucrose. crystallization of lactose lead to formation of large crystals which are associated with sandy texture defect in sweetened condensed milk and ice cream. (Chandan,2006)

Lactose in milk has comparatively lower glycemic index compared to glucose or sucrose making it suitable for diabetic people (Adolfson, 2004)

lactose is a reducing sugar and exists as(a) and(b) in solution lactose undergoes mutarotation Between(a) and(b) forms, mutarotion of lactose depends on temperature and PH., the(a) and(b) vary in solubility

The(a) lactose crystallizes as a monohydrate and(a anhydrous forms, while(b) lactose crystallize into b- anhydrous form .it also helps in the absorption of calcium and magnesium and is less carcinogenic compared to others sugars.

Lactose is reducing sugar and react with amines (lysine and N-terminal amines)to form Schiff base adducts, which subsequently undergo a series of non-enzymatic reactions leading to browning and caramelization.

lactose prevent infection by stimulating bifidobacterium in the colon improving colon health (Adolfson,2004)

Chemically lactose is composed of one molecule each of glucose and galactose lactose fermenting by bacteria produce lactic acid with make souring (Kutty, 2004)

The lactose content of goat milk is slightly lower than cow's milk .lactose is a milk sugar and is a carbohydrate nutrient in milk.(Kutty,2004)

Since some people have difficulty digesting the lactose in milk, goat milk is less likely to cause this problem than cow's milk (Adolfson,2004)

This condition is called lactose intolerance or lactose maldigestion, where people are unable to produce b-galactosidase.

Milk treated to be reduced in lactose or free of lactose can be a strategy for living with this condition. It is also protein isolate,whole milk protein isolate or vegetable protein such that the product does not contain lactose such recombined milks do not have a standard of identity specified by the F D A. (Adolfson,2004)

Lactose content of milk varies between 3.6 and 5.5% , lactose is attacked by lactic acid bacteria, these bacteria contain an enzyme called lactase which attacks lactose from the lactic acid bacteria then attacks glucose and galactose converting them into various acids of which lactic acid is the most important ,this is what happens when milk gose sour.

2-1-4-5-1 Lactose intolerance

Lactose intolerance is due to not enough of the enzyme lactase in small intestines to break lactose down into glucose and galactose. There are four types: primary, secondary, developmental, congenital. These people who suffer from lactose cannot consume all dairy products contining lactose, there for it was necessary to provide alternative food not containing lactose.

The symptoms my include abdominal pain, bloating, diarrhea, gas and nausea. (Adolfson, 2004)

2-1-5 Vitamins in milk

Vitamins are organic substances which occur in very small concentration in both plants and animal milk contain many vitamins among the best known are A,B 1,B2, C and D vitamins A and B are soluble in fat or fat solvent ,while the others are soluble in water ,these vitamin are fond fresh whole milk and in various milk products. Milks is good source of vitamin.

2-1-6 Milk and Cream Processing

The processing steps in producing cream involve cream separation, homogenization, and pasteurization. The pasteurization temperatures for cream are higher than for milk as the higher fat content is known to offer protection to microorganisms appropriate terms have to be added to the product cream are sweetened or flavored.

2-2 Sesame

Sesame (*Sesamumindicum* L.), known as sesamum or benniseed, member of thefamily *Pedaliaceae*, is one of the most ancient oilseeds crop known to mankind. Sesame playsan important role in human nutrition. Most of the sesame seeds are used for oil extraction and the rest are used for edible purposes (El Khier,2008).

Sesame is grown primarily for its oil-rich seeds. Before seeds were appreciated for their ability to add nutty flavour orgarnish foods, they were primarily used for oil and wine (Ghandi, 2009). After the extraction of oil, the cake is mostly used for livestock feed or often as manure. Its colour varies fromcream-white to charcoal-black but it is mainly white or

black. Other colours of some sesameseed varieties include, yellow, red or brown.In Nigeria, the notablecolours for sesame seed are white, yellow and black (Farikue*t al*., 2007). The lighter varieties of sesame which are considered to be of higher quality are generally more valued in the West and Middle East, while both the pale and black varieties are prized in the Far East.

The major world producers include India, Sudan, China and Burma (who contribute about60% of the total world production) (El Khier *et al*, 2008). It is also one of main commercial crops in Nigeria, Sudan and Ethiopia (www. nutrition and you). Sesame is an important crop to Nigerian agriculture: it is quite extensively cultivated especially in Northern Nigeria.

It yields in relatively poor climatic conditions, and it is widely used within Nigeria. Moreso, it is an important component of Nigeria's agricultural exports (Chemonics, 2002).

Sesame seed is rich in fat, protein, carbohydrates, fiber and some minerals. The oil seed is renowned for its stability because it strongly resists oxidative rancidity even after long exposure to air (Elleuch *et al.*, 2007).

The seed is rich in protein and the protein has disable amino acid profile with good nutritional value similar to soybean ,The chemical composition of sesame shows that the seed is an important source of oil (44-58%), protein (18-25%), and carbohydrate(13.5%) and ash (5%) Sesame seed is approximately 50 percent oil (Ghandi, 2009; Hansen, 2011).

Sesame seeds are small, almost oblate in shape and have a mild and delicious aroma andtaste.

2-2-1 History

Sesame seeds are the seeds of the tropical annual *Sesamumindicum*. The species has a long

history of cultivation, mostly for its yield of oil. The oil plant has been grown since the beginning of arable cultivation, and originates from the dry bush savannah of tropical Africa,and spread from there to India and China, where it is still widely cultivated. (Naturl and, 2002).

Archeological recordsindicate that it has been known and used in India for more than 5,000 years and is recorded asa crop in Babylon and Assyria some 4,000 years ago (Borchani *et al*., 2010).

Sesame was cultivated during the Indus valley civilization and was the main oil crop. It wasprobably exported to Mesopotamia around 2500 BCE.

Assyrians used sesame oil as a food, salve, andmedication, primarily by the rich, as the difficulty of obtaining it made it expensive. Hindusused it in votive lamps and considered the oil sacred.

2-2-2 Production of sesame seed

Global production of sesame seed is estimated by FAO at 3,15mn tones per year (2001)having risen from 1,4mn tones in the early 1960.however only a small proportion of the global sesame harvest enters international trade .for the most part the oil is expressed locally and used locally for cooking or the seed themselves are eaten .particularly after being fried. Sesame is grown in many parts of the world on over 5 million acres, (Borchani *et al*., 2010).

2-2-3 Chemical compositions of sesame seeds

The chemical composition of sesame seed rich in oil and protein, the seed contain (4,50 -11%) moisture,(84 -56%) fat ,(19.1-26%) protein(2-

5,59%)Ash (2,50-3,90%) fiber (10,1-17,90 %) carbohydrate. The composition of sesame sesame seed is depending on genetic, environmental factors variety cultivation, climate ripening stage, harvesting time of seeds and analytical method used.,(Borchani*et al*., 2010).

2-2-4 Characteristicof sesame protein

Sesame protein have been classified in four class of protein based on Osborne sequential extraction and different solubility the water soluble albumins the salt soluble globulins the prolamins soluble in alcohol-water.

The most of the proteins in sesame flour were 8,6% albumin 67,3% globulin 1,4% prolamin and 6,9% glutelin.,(Borchani *et al*., 2010).

2-2-5 Decorticated sesame seeds

Have the following composition :45-63% oil ,19-31%protein ,14% carbohydrate,3% Ash.

Sesame is rich in sulfer-containing amino acid and limited in lysine and contains significant amount of oxalic (2,5%) phytic acids(5%).

Carbohydrate in sesame seed are compose from :3,2%glucose -2,6% fructose and,2% sucrose.,(Borchani *et al*., 2010).

2-2-6 Sesame milk

Much attention has been given to soymilk and soy protein beverages as they are considered to be nutritious and healthy food. In addition to soymilk potential production of other vegetable milks was investigated in other oil seeds and legumes: Bambara, chik peas, black graw, mungpeascoconut, sunflower.

Recently much attention has been directed toward the utilization of oil seeds in general and sesame seed in special .because of their functional

properties of sesame seeds :can supply us with nutritious ,functional and healthy meals, with low cost.,(Jihad, 2009).

The production of sesame based dairy product can overcome the problem that limit consumption of soy based dairy product and other vegetable milk.

2-2-6-1Basic steps of sesame milk preparation

First decorticated sesame seed and tap water were weight to give the desired sesame seed percentage (12%),sesame seed was transferred to the blender vessel and small protein of the weight water was added to facilitate the mixing proses. the blender was operated at high speed for 10 min after finishing the proses the remaining quantity of water was added and mixed thoroughly and the resulted sesame desperation was homogenized for 5 min using lab homogenizer. The temperature riched du to homogenization.

For pasteurization sesame milk was filled in beaker and heated in boiling water bath with stirring.

Storage at refrigerated at 4C.for sensory analysis 2%sucrose was added to sesame milk before heat treatment.

2-3-Ice Cream

2-3-1Historical background

Ice cream history involved king Charles of England, who hosted banquet for many of his friends and family. The meal, consisting of a delicious variety of food .ice cream became popular luxury food, but almost all it was made at home until 1851.and became national favorite during the early 1900,s(Mariani,1999).

Ice cream was declared an essential foodstuff .by 1919 Americans were eating 230million gallons of ice cream a year and it became known as an

"American typical food "like hamburgers and hotdogs.(Mariani,1999).

2-3-2 Definition

(Ice cream is sweetened frozen food typically eaten as a snack or dessert, it is usually made from dairy product, such as milk and cream and often combined with fruits or other ingredient and flavors, and it have high consumption for all people, especially children) (Abuzaid,2007).

2-3-3 The nutritive value of ice cream

Ice cream considered an excellent source for heat energy for its content of fat, protein, sugar(lactose) which made it desirable to consumers for all ages specially children and help them growing, it also useful in over weight‘s programmers to control their weight one liter content 900-1000 calorie (Goff, 2006).

2-3-4 Introduction

Ice cream (originally iced cream) is a frozen dessert made from dairy products, such as milk and cream, combined with flavorings and sweeteners, such as sugar. This mixture is stirred slowly while cooling to prevent large ice crystals from forming, which results in a smoothly textured ice cream. Frozen custard, frozen yogurt, sorbet, gelato, and other similar products are sometimes informally called ice cream, but governments generally regulate the commercial use of these terms based on quantities of ingredients American federal labeling standards require ice cream to contain a minimum of 10% milk fat (about 7 grams (g) of fat per 1/2 cup serving) and 20% total milk solids by weight.(Goff, 2006).

2-3-5 Ice cream ingredient

In addition to dairy products, ice cream contains sugar, stabilizers, and emulsifiers, flavouring materials, water and air.

The various ingredients are received ,weighed in and analyzed in the raw material reception department ,which is usually divided into asection for drying redients and one of for liquid ingredients.

In ice cream fat make s up about 12% of the volume of it , and it may be take form of whole milk cream ,butter or butter oil in the former case(Hassan,2009).

2-3-5-1 Fat

Milk fat complex arrangement of triglycerides ,is primary determinant of the texture or body of ice cream ,which forms the structured network. Milk fat containing at least 10% and no more than 20%, is an ingeredient of major importance in ice cream because its correct use is vital not only to balance properly the mix but also to satisfy legal stands. The effect of milk fat in icecream dependent on several factors including the type and level of fat,the amount of non fat milk solids and sugars,as well as variety of flavour compounds used in ice cream (Hamed,2016).

Milk fat have effects textural attribute such as viscosity, tenderness, elasticity, emulsification, ice crystallization and other desirable attributes such as richness, smoothness.

During the freezing process, milk fat globules concentrate toward the surface of air cells to support the air cells structures as air incorporated into the mix and are surrounded by casein subunits absorbed as fat water interface .excessive milk fat decreases whipping ability and result in excessive richness as well as high caloric value (Hamed,2016).

2-3-5-2 Solid non fat

The nonfat protein of milk ,called nonfat milk solids (NMS)is composed of approximately 55%lactose, 37%protein,8%minerals and others such as vitamins, acids and enzymes. The amount of NMS in ice cream mixes rang from 9-12% and usually varies inversely with the fat content,NMS are critical for texture and body of ice cream.

According to US standers of ice cream,most milk and non fermented milk products are permitted in ice cream,but there are some specific limits in some ingredients.For example,amount of whey solids or modified whey solids are limited to 25% of the NMS content .there are several reason for the limitation,including:the higher lactose content in whey solids increases the potential of crystallization of the sugar the high concentration of lactose and minerals results in lowered freezing point,protein content is decreased in ice cream (Marshall and Goff,2003).The added amount of NMS to an ice cream mix is primary factor for improving the quality of ice cream.Overall NMS can lower the freezing point ,so the rate of melting and increase the amount of unfrozen materials by adding dissolved serum solids (Hamed,2016).

2-3-5-3 Sweeteners

Sweeteners control in ice cream is very important in order to achieve maximum comsumer acceptance and minimum production cost.Many kind of sweeteners,such as cane and beet sugars, many types of corn sweeteners, maple syrup, honey, invertaed sugar,fructose and malt syrup have been used in ice cream mixes (Stogo,2001;Salama,2004).in ice cream formulated normally with sweetenes equivalent to 13-15% sucrose content, with 25%or more of the sweetness provided by corn-based

sweeteners and high fructose corn syrup are principle sweeteners used in ice cream.

The amount of sweeteners added to ice cream is very important .besides creating desirable flavourproperties ,sweeteners also are the major ingredients to lower the freezing point which is one of the influential factors for quality of ice cream mixes, when sweeteners content about 16% or higher,ice cream tends to become too soft ot too dense and chewy, depending on types of sweeteners used in excess due to lowering the freezing point. In other words, hardness of ice cream dependent upon the sugars and others materials .(Hamed,2016).

2-3-5-4 Emulsifiers

Mono-,diacylglycerides and sorbitant esters, especially polysorbate 80,are usually used in ice cream as the emulsifiers (Marshall *et al.*,2003),and they are supplied to manufacturers as blends with stabilizers .the normal requirement in ice cream ingredient for emulsifiers are between, 1%-,5%.emulsifiers added to ice cream have several important functions ,including that they lower the fat and water interfacial tension in the ice cream mix so that they cause protein displacement from the fat globule surface,which in turn reduces the stability of fat globule causing it to partial coalesce during the whipping and freezing process promot nucleation of fat during aging of milk,thus reducing the time needed to age mixes before freezing decrease tenderness for shrinkage and lower the rate of melting cause a high amount of agglomeration of the fat during freezing .therefore the surfaces of the fat globules must have a relatively high concentration of emulsifiers. (Hamed, 2016).

2-3-5-5 Stabilizer

The Stabilizer usually is a kind of poloysaccharide such as gelatins, gums ,egg yolk solids and seaweed, the amount used in regular ice cream may range from 0-0,5%, the stabilizer contributes several functions ice cream: it can increase the viscosity of products decreasing water migration, maintain homogeneity and control ice crystal growth during the freezing process. stabilizer in ice cream cause a slight increase in melting rate. During storage stabilizers play a role in resisting structural changes during,,heat shock,, which is the inevitable temperature –cycling during storage that creates ice crystal growth and other types of deterioration due to structural changes, During stabilizers provide uniform meltdown, mouthfeel and texture. However, too much stabilizer can make the mix too viscose, making the ice cream heavy and soggy. In short, stabilizer added to ice cream is to control ice crystal growth during hardening and storage, especially during temperature fluctuations,to give body and stiffness during freezing for air Corporation and to impart smoothness in body and texture, The sensory quality and overall acceptability of ice cream with various stabilizers has been reported (Hamed,2016).

2-3-5-6 Flavourings

Flavour is the important positive attribute of ice cream. Vanilla, chocolate and strawberry flavour are among the mostpreferrd ice cream products (Marshall *et al*.,2003). The type and intensity of flavour in ice cream are the two important flavour characteristic Flavours should only be intense enough to be recognized easily and to present a delicate pleasing taste .too much or too little flavouring, unnatural or atypical flavouring , and too much or too little sweeteness could cause important defects in ice cream (Hamed,2016)

2-3-5-6-1Flavoring materials

The acceptance of the ice milk products because of its delicious multiple taste, and its nutritive value, they add to improve the organoleptic properties.

There are many different flavoring materials classified to:-

1-Artificail

2-Natural

The most popular are:-

1-Vanil

Extract from vanilla seeds and it could be artificial ,the tasted with vanilla represend 7.5% for its easy usage with small amount for big quantities .

Vanilla exist in powder, concentrated liquid the component of flavor is vanilla (Hassan,2009).

2- Cocoa and chocolate:

The second favorite flavor after vanilla ,it is used as powder and or liquid. It is extracted from cocoa seeds .in ice milk production used the cocoa (20-25%) chocolate(50-53%)or mixture of both (36-40%)the popular recipe in ice cream mixture 3%cocoa (dry powder)or 4%of cocoa and chocolate 1,5-2,5 respectively (Hassan,2009).

2-3-5-7Colouring matter

Colouring matter is added to the mix to give ice cream an attractive appearance and to enhance the colour of the fruit flavoring additives the colouring matter is added in the form of power or paste which is mixed with water and boiled .the colouring solution is usually added in a dosage

10-20 ml per 100 of mix .sodium benzoate is added as sterilant. Only approved dyes and sterilantsbe used.(Hassan,2009).

2-3-6 Reception

Dry products which are used in comparatively small quantities as whey powder , stabilizers emulsifiers and cocoa powder are usually delivered in bags ,while sugar and milk powder are normally delivered in containers the other liquid products like milk, cream, condensed milk liquid glucose and vegetable fats are delivered by tankers milk product are chilled to about 5C before begin placed in storage, while sweetened condensed milk, glucose and vegetables fat must be storage at a fairly high temp(30-50C) to keep the viscosity low enough for pumping ,milk fat is delivered in the form of butter oil or blocks of butter which are melted and pumped to storage tanks .(Hassan, 2009).

2-3-7 Manufacturing of ice cream

Once selected the ingredients are weighted and blended together to allow the dry products to be hydrated by the moist ingredient the others commercial processing steps in the manufacture of ice cream include pasteurization, homogenization, aging, freezing and hardening.

The following flow chart and materials explain the steps involved in the commercial production of ice cream.(Hassan,2009).

2-3-7-1 Mixing

The batched ingredients are blended in special mixing tanks equipped with agitators. The order of additions of the various ingredients is determined by the temp and solubility, during the mixing process the ingredients are circulated through a plate heat exchanger which heats the mix and also contributes to the mixing effect. when homogeneous mix

with a temp 50-60C has been obtained, it process to pasteurization (Teknish,1982)..

2-3-7-2 Pasteurization

After being homogenized the mix is returned to the plate heat exchanger and pasteurized at 83-85 with a hold of about 15 seconds .after this the pasteurized milk is regenerative cooled and then chilled with cold water and ice water to about 5 C before begin pumped to the ripening tanks (Teknish,1982).

2-3-7-3 Homogenization

The ice cream mix is passed through filter to float hopper and pumped from there to plate heat exchangers where is preheated to 73-75C the mix is then homogenized at high pressure 14-20Mpa.the homogenization treatment plays a large part in determining the consistency of the end product so the correct choice of temp and pressure is important .(Teknish, 1982).

2-3-7-4 Ripening

The mix is held in the ripening tanks for 3-6 Hours this is to give time for the fat to crystallize and protein and stabilizers to bind water. All of which contributes to the consistency of the ice cream.

The ripening tanks are equipped with agitators for gentle stirring and double jackets for ice water chilling to 2-3C during ripening.

Addition of flavorings and colouring matter:

At the end of ripening the mix is pumped to the continues freezers .if flavorings and colouring matter is to be added , this can be done either in

surge tanks or by direct injection into line ahead of the freezers. (Teknish,1982).

2-3-7-5 Continuous freezing

The continuous freezing has two functions:

- To whip a controlled amount of air into the mix

-To freeze the water content in the mix in the form of a large number of small ice crystals.

The mix is pumped into a cylinder,which is refrigerated by an ammonia jaket. The freezing process is very rapid,the layer of frozen mix on the cylinder wall is regularly scraped off and replaced by new mix which in turn is frozen and scraped off. the scraping is done with rotating knife – equipped mutator inside the cylinder.

The requisite amount of air is supplied continuously while the ice cream is being worked in the freezer ,so that air is worked into the mix at the same time .this gives ice cream the desirable texture before it is fed out of the freezer through a pipe to forming or filling machine .ice cream should have a temperature of 1-9 C at the outlet from the freezer. (Teknish,1982).

2-3-8 Ice cream shelf life

The shelf life of ice cream is mainly dependant on the storage conditions. The ice cream could last as long as one year, or as litter as two weeks. The finished product will have self life of about 12-18 months if kept at around -20 C TO -25.

In order to maintain shelf life ,some factors must be taken into consideration, including proper formulation of the ice cream such as

addition of stabilizer and sugar, freezing the ice cream quickly ,hardening the ice cream rapidly and avoiding temperature fluctuation during storage and distribution (Hamed,2016).

2-3-9 Ice cream defects

Ice cream defects can be classified into many different categories including: flavor defects, body defects and texture defects, melting quality characteristics, colour defects body and shrinkage defects.(Hassan,2009).

2-3-9-1Flavour defects

Can be classified in five different ways. This includes the flavouring system, which is that lacks flavouring or the flavouring is too high or that the flavour is unnatural (Goff and Davidson, 1992). The sweetening system is measured by wheter the ice cream is too sweet or is not sweet enough. The processing _ related flavor defects measure the cooking of the ice cream. The dairy ingredient flavour defects include acid, salty, old ingredient, oxidized \metallic, rancid, or whey flavours Smith and Goff et.al (1999). The most commonly used system in flavour assessment for ice cream is the ingredient flavoursystem , .(Hassan ,2009).

2-3-9-2 Body and texture defects

Include coarse, icy texture, which is due to the of ice cream crystals of such a size that they are noticeable when the ice cream is eaten, (Goff *etal* , 1999).

1- A crumbly body or a flaky, snowy characteristic in ice cream is caused by low stabilizer or emulsifier, low total solids, or coarse air cells.

2- A fluffy texture is a spongy characteristic that is caused by incorporation of large amounts of air as large air cells, low total solids, or low stabilizer content .
3- A gummy body defect is the opposite of crumby in that it imparts a pasty or putty – like body Goff and Davidson (1992).
4- A sandy texture is the easiest to detect. It is caused by lactose crystals, which do not dissolve readily and produce a rough or gritty sensation in the mouth. Because lactose crystals do not melt in your mouth m, this defect can be easily distinguished from iciness.(Hassan,2009).

2-3-9-3 Melting quality characteristic defects

Include curdy meltdown, which is due to coagulation of the milk proteins. Another melting quality defect is the ice cream does not melt, or there is wheying off. The main cause of these defects is a mistake in the ingredient formulation. (Hassan,2009).

2-3-9-4 Colour Defects

1- Colour Uneven:

   Applies usually to ice cream in which colour has been used , but may be noticed in vanilla ice cream under some circumstances .
2- Colour Unnatural:

   -Wrong shade of color used for flavoured ice cream

   -Too much yellow colouring used in vanilla ice cream

   - Grayish colour due to neutralization .(Hassan ,2009).

2-3-10 Shrinkage

This defect shows up in hardened ice cream and manifests itself in reduced volumes of ice cream, usually by pulling away from the top, Structurally, it is caused by a loss of Spherical air bubbles to be associated with the defect. Freeing and hardening at low temperatures both low and high storage temperatures appear to contribute:

-Type of container

-Partially de – stabilized protein

-Some emulsifiers seem to enhance shrinkage

-Ultra –smooth ice cream as can be produced in a continuous freezer

-Season of the year –more shrinkage, winter month

-Methods of handling in grocery store cabinets,(Hassan,2009).

CHAPTER THREE

MATERIALS AND METHODS

3-1-Materials:

Sesame seeds collected from ALfasher state (Saif seller) (.**July ,2017)**

3-1-1 Sesame milk:

Fresh sesame milk treated with batch pasteurization , sesame milk sample was brought to refregrater in 4C until use.

3.2 Methods:

3-2-1Method of sesame milk production

400 gram of sesame seeds were washed with tap water ,then steeped in 1.5 liter of water for 8 hours at room temperature, soaked seeds were separated from water and then 250g mixed with one liter of water in a blender for 2 minutes at high speed. The homogenate was filtered with steel mesh then with cotton cloth .The filtrated was then heat treated at 73C for 15 minutes then cooled for 1 hours in deep freeze -18C

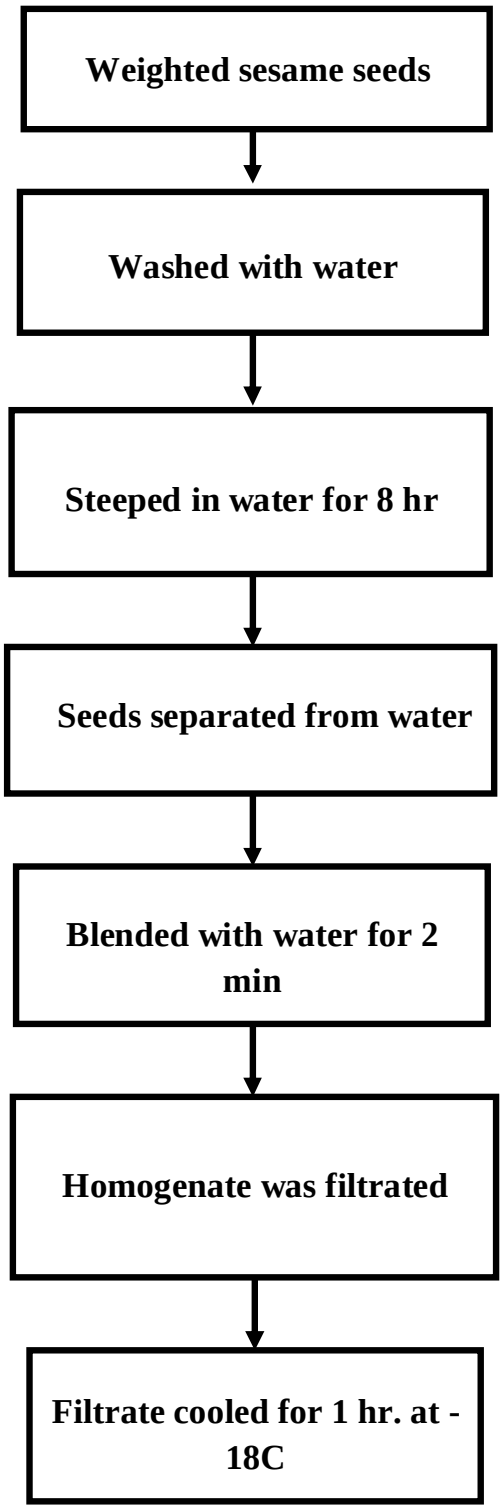

Figure 1. Sesame milk preparation

3.3. Method of sesame milk ice cream production:

Ingredient:

Table (3.1) the calculate ingredient of ice cream

Sesame milk	2kg
Cream	0.52 kg
Starch	0.42kg
Sugar	0.56kg
Pectin	0.02kg
Vanilla , Strawberry	3droplets
Cacao	17.5g
Nescafe	17.5g

3-4 Ice cream manufacturing:

3-4 -1 Blending:

The sesame milk was added to the mix tank ,and homogenized with rapid blending .the amount of sugar was added to the sesame milk and blending till it dissolve ,while blending the others dry ingredient were added (starch- pectin) and cream was blended with ice water .

And added to the mix, it was blended rapidly to incorporate air and to avoid the crumply, and then flavours was added such as (Vanilla, Nescafe, strawberry ,cacao). This is ingredient blended together produce what is known (ice cream mix).

3-4 -2 Ripening:

The mix is held in the freezer for 4-6 Hours this is to give time for the fat to crystallize and protein and stabilizers to bind water and then blending and transfer to freezer for aging.

3-4 -3 Aging:

The mix was then aged about 10-12 in a freezer at -18 C .this ice cream 3become ready for consumption .

3-5 Physiochemical analysis:

Some chemicals reagents and materials were obtained from industrial consulting center and others from capo factory

3.5.1 Acidity:

Sesame milk is acid to phenolphthalein alkaline to methyl orange , but amphoteric to litmus due to the presence of phosphates , the PH is usually between 6,4 and 6, 6 .the total acidity of freshly drawn milk is usually about 0,14 per cent (as lactic acid). on storage , the acidity increases duo to the action of microorganisms, and a sour taste is perceptible when the this reaches about 0,3 per cent it curdles at ordinary sour at 0,4 per cent and when the acidity reaches 0,6 per cent it curdles at temperatures . A different spoilage pattern is set up in heat treated milk duo to the change in the microbial flora.

3.5.2 Protein determination:

The protein content was determined with kjeldahl method according to Bradstreet (1965)

The procedure:

1\Digestion :

The sample were weighted (0,2gm) in kjeldahl digestion tube then 3-5ml of sulphuric acid (0,4 N) were added ,catalyst (sodium sulphate +copper sulphate) was added .the tube was transferred to the heating unit and heated slowly for 2-3 hours till the mixture became colourles.

2\ Distillation:

The distillation unit was used rinsed the unit with distill water , the sample was put in the apparatus and NaOH were added ,the boiling water of the unit was stopped by closing the valve ,and ammonia gas was received in 10ml of 10% boric acid .

3.5.3 pH value:

pH was determined by an electric pH meter. 10ml of milk were pipette into the tube, then the PH meter was adjusted with distill water, the sample was placed into PH meter and reading was directly read.

3.5.4 Total solids:

The total solids were determined with Refract meter rang from (0-50).

The procedure:

The glass of refract meter was cleaned with distill water small amount of sample was put in it and total solids were read directly .

3.5.5 Fat content:

Fat content was determining using Gerber method.

The procedure:

10gram of sesame milk was pipette into Gerber tube and 10ml of sulphuric acid were added carefully in the side of tube without shaking and then 1ml of amyl alcohol was add the Gerber tube was plugged with rubber stopper the content was mixed and centrifuged at 1100 rpm for 4 minutes . Gerber tube was transfer to water –bath at 65 C and was left for 3 min percentage of fat was read directly.

3.5.6 Moisture content:

The procedure:

2gram sample were weighed and put in the dry clean dish.(W1) then the dish was transferred to moistuwe oven at 105C .and was left for 8 houres then was removed and it was put in a desiccator for30 min ,the sample was weighted and placed ,again in the oven for 30min ,the procedure was repeated three times till constant weighet was obtained (W2) .the deffrent between weighting was calculated .

Moisture%=w1-w2x100\w1

Where:

W1=weigh of sample before drying

W2=weigh of sample after drying

3.5.7 Ash determination:

Ash content was carried out according to Bradley *et al* (1992).

The procedure :

2 gm of sample were weighed in the clean flash (w1) , the sample was transferred into the muffle furnace at 550 c and left for 2-4 hours and then the sample was taken out and placed in desiccators , the procedure repeated (w2).

The calculation :

Crude ash % =(W1- W2) x100\W1

Where :

W1 = weight of sample

W2=weight after burning

Bradley (1992).

- Washing the seeds of sesame seeds

- Soaking in water (1:2)/(seeds:water) for 8 hours .

-Mixing with warm water (1:4) (seeds : water)

- Filtration

-Pasteurization in 73 C 15 minute.

-Extracted sesame milk.

3-6 Sensory Evaluation

The evaluation of sensory properties and acceptance was done by 15person, their ages ranged between 20-30years. from different environments (students from Sudan university of Science and Technology and Housewives.

THE EVALUATION was done for four sensory properties which were:

Taste , texture, flavour and colour as in follows statement .

Choose one of the degrees bellow the table.

Sample no	Sample code	Texture	Taste	Flavour	Colour
1	A				
2	B				
3	C				
4	D				

1=Excellent. 2= very good. 3= good. 4= acceptable.

5= unacceptable

3-7 Statistical analysis:

Data generated was subjected to statistical Analysis system (SAS) one factor completely Randomized Design (**ANOVA**) was used to analyze data ,then means were separated using Duncan's multiple Range test (DMRT) refrred to sendecor and Cochran (1997).

CHAPTER FOUR

RESULTS AND DISCUSSION

From chemical analysis was done for sesame milk and sesame ice cream we can observe:

From the results we found that fat content ranged from 3.48% to 3.84% with mean value 3.64%,this mean value is lower than that of Alfa – Laval(1985) 4.00% for cow milk and near to that reported by Salma (2013)3.55% for cow milk and higher than soya milk 0.9% reported by Salma (2013).the high percentage of fat in milk may be due the amount of fat in the sesame seeds . also protein content varied between 3.2% to 3.5% with mean v alue 3.8% this range is similar to that reported by Alfa – Laval (1985) 3.8% and cloth to that reported by Salma (2013) 3.35% for cow milk and higher than soya milk by Salma (2013) 3.7%.In addation Ash content range between 0.4 % to 0.5 % with mean value 0.4%this percentage is nearly equal that reported by salma (2013) 0.6% for cow milk and 0.7% reported by Elfadial (2015) for cow milk, but lower than that reported by Salma (2013) 1.55% for soya milk. also lactose is absent in sesame milk but it is found in a high percentage in cow 4.52% milk and less in soy milk1.02 % that reported by Salma (2013). Acidity content of sesame milk is range between 1.30% to 1.44% with mean value 1.36% this is higher than that reported by Elfdial (2015) 0.17% for cow milk and Salma (2013) 0.26% for soy milk .the high percentage may be due to high of organic acids in sesame seeds . In addition of that fiber content is range between0.5 % to 0.6 %with mean value 0.6% in sesame milk this fiber give the milk special properties such as advantages for Gut function and help digestion. Also the fat percentage in sesame ice cream is higher than cow milk ice cream but absent in soya

milk ice cream ,main carbohydrate in cow milk ice cream is lactose ,while lactose is absent in sesame milk ice cream and soya milk ice cream. In other aspect in statistical analysis of consumer acceptance Sample D was the most preferred one for the taste with 9 of the panelist choose excellent degree and 5 of them choose very good and good degree, for B 5 of the panelist considered it excellent in taste and 6 of them choosed very good while the remaining of panelist choose good, 4panelist choosed excellent degree and 3of them choosed very good, sample C was the same in taste A with 4 found it excellent in taste ,while 7 of them found it very good . the same in performance .with regard of flavours sample D was the best one ,then C and B same in flavor .and in the evaluation of colour C was the most acceptable ,followed by A,B and D .The result of taste were showing that: five panelist were sense a bitter in sample A this bitterness could be due to the bran of un decorticated of sesame seeds (concentrated of sesamol in the bran of the seeds).while most of the panelist found that sample C was perfect sweetness ,sample D was most preferred . For body and texture all the samples were t. All this Results are showed in tables blow.

Table 4.1: Chemical and Physiochemical characteristic of sesame milk:

Characteristic	**Mean ± SD**
Moisture%	86 ±0.60
Fat %	3.64 ±0.18
Protein %	3.5± 0.31
Ash %	3.53 ± 0,04
pH %	6.5 ± 0.17
S.N.F%	2.20 ± 0.72
Acidity%	1.36 ±0.07
Density%	1.06± 0.00
Fiber %	0.61± 0.02

Table 4.2:Chemical and Physiochemical characteristic of ice cream:

Characterizes	**Sesame ice cream**
Protein	9.3± 0.1
Fat	12.1± 0.2
Moisture	57.3± 0.2
T.S.S	55± 2.2
Brix	41.1± 0.7

Table 4.3: Sensory evaluation of ice cream:

Samples	Flavour	Texture	Colour	Taste	Over all
A	2.1±1.09 [b]	2.3±1.44 [b]	1.9±0.99 [b]	2.7±1.49 [b]	2.5±1.16 [a]
B	2.07±1.2 [b]	2.5±1.15 [b]	1.8±0.86 [b]	1.9±0.91 [a]	1.8±0.94 [a]
C	1.7±0.9 [a]	1.8±1.02 [a]	1.4±0.51 [a]	1.9±0.73 [a]	1.7±0.82 [a]
D	1.5±1.1 [a]	1.6±.74 [a]	2.07±1.14 [b]	1.9±1.32 [a]	1.5±0.93 [a]

Mean +SD values bearing different superscript letters in colum (for each quality attribute) are significantly different $P<0.05$.

Keys :

A=Sesame flavour

B=Vanilla flavour

C= Strawberry flavour

D= Nescafe flavor

CHAPTER FIVE

CONCLUSIONS AND RECOMMENDATIONS

5-1 Conclusions:

From results obtained in this study we can conclude that:

1- Sesame milk ice cream can be produced and it is good and acceptable as cow milk ice cream.
2- The nutritive value of sesame milks ice cream is high, it content amount of calcium and fiber.
3- The recipe of sesame milk ice cream has the most acceptability.
4- The usage of sesame milk in the production of ice cream is good and it gives an excellent results.

5-2 Recommendations:

1- It is recommended to use sesame ice cream because it is lactose-free especially for those who suffer from lactose hypersensitivity of cow milk.
2- Develop the formula and recipes of ice cream from sesame milk and perform sesame milk standards.
3- Produce ice cream from sesame milk as it has low cost.

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Appendices

Figure 2. Sesame Plant

Figure 3.Sesame milk

Figure 4. Sesame milk ice cream

Figure 5. Food scan

Figure 6. Food scan