

FAT COMPOSITION FOR FOAMING CREAM AND FOAMING CREAM

Technical Field

The present invention relates to a whipped cream
5 (foaming cream) for use in the decoration of bread and
cakes and the like, and a fat composition for the whipped
cream used as the fat component of the whipped cream.

Background Art

10 Fats that are formulated into whipped creams can be
generally classified into fats made only from milk fat,
mixtures of milk fat with other fats, and fats other than
milk fat. Examples of fats other than milk fat include
15 lauric-type oils such as coconut oil and palm kernel oil,
plants oils such as palm oil and rapeseed oil, and hardened
oils, fractionated oils and ester-exchanged oils from these
oils, and furthermore mixtures thereof and the like.

Among the fats for the three aforementioned types of
whipped cream, whipped creams that are blended from milk
20 fat alone are superior from the flavor perspective, but in
the pre-foamed (whipped) state (liquid cream) these have
poor emulsion stability and readily undergo considerable
viscosity increases or solidification (commonly referred to
as "bote") when the product temperature increases, or due
25 to vibrations during transport. Moreover, there are

disadvantages with whipped creams that are blended from a fat that is milk fat alone, such as after whipping the range of the end point is narrowed for an optimum whipped cream, moreover the shape retention of whipped cream is insufficient, and the product costs will be high since milk fat is a relatively expensive fat.

The fats other than milk fat that are used for a whipped cream are generally lauric-type fats represented by coconut oil and palm kernel oil; palm-type fats usually containing palmitic acid; hardened vegetable oils from soybean and rapeseed with C_{18} or larger fatty acids as the main component. While a whipped cream that uses lauric-type fats have good meltability in the mouth, the cream that have large quantities thereof blended in have lower emulsion stability, and moreover a stiff appearance (referred to as "shimari") readily occurs over time after foaming.

Hardened vegetable oils from soybean and rapeseed are used extremely often in a whipped cream due to their preferable emulsion stability and workability, resistance to change over time and change with temperature, and from the flavor perspective, they can also impart a milk taste. However, such hardened oils contain trans-acids (trans-unsaturated fatty acids) as isomers from the hydrogenation.

In recent years, research results have been obtained

that the risk of heart diseases such as arteriosclerosis is increased when too much trans-unsaturated fatty acid is taken in, and awareness thereof has been promoted among consumers in Western countries. For example, the obligation
5 to display the trans-unsaturated fatty acid content on product labels has been in effect in the US since January, 2006, and in Denmark furthermore it is forbidden to market processed fats that contain 2% or more of trans-unsaturated fatty acids.

10 Since the amounts of trans-unsaturated fatty acids ingested in the past have been lower than in Europe and the US, the perspective in Japan is that there is no particular health problem at the present time, but fats still lower in trans-unsaturated fatty acid would be desirable.

15 Likewise, a whipped cream that contains the least possible trans-unsaturated fatty acid would be desirable.

Taking account of the foregoing, various studies were carried out on whipped cream fat compositions.

In Patent Document 1, a fat for a cream is proposed,
20 where the fat contains 25 % or more of SUS-type triglyceride and 5-60 % of lauric-type fats therein with 50 % or more of SFC at 5 °C and 40 % or more at 15 °C. In Patent Document 2, there is a fat composition for a whipped cream containing 20-70 wt% of fat (A) described below and
25 30-80 wt% of fat (B) described below. Fat (A): a fat that

is an ester-exchanged oil that is a glyceride with fatty acids randomly ligated at the 1-, 2- and 3-positions, where the fat having a fatty acid composition in which the aforementioned fatty acids include 20 wt % or more of the total amount as C_8 - C_{14} saturated fatty acid including lauric acid together with 15 wt % or more of palmitic acid, and the combined amount of the aforementioned lauric acid and palmitic acid is 40-55 wt%, and the fatty acid composition includes 5 wt % or more of trans fatty acid. Fat (B): a hardened oil containing 85 wt % or more of a C_{18} fatty acid is proposed.

Further, in Patent Document 3, whipped oil-in-water emulsions are proposed, where the oil-in-water emulsions contain fats, proteins, emulsifiers and water, and the fats contains 75 wt % or more of lauric-type fats and/or ester-exchanged oils which contain lauric-type fats as the main component and 2 to 25 wt % of SUS-type triglycerides (S means C_{16} - C_{22} saturated fatty acids, U means C_{16} - C_{22} unsaturated fatty acids). In Patent Document 4, a fat for used in oil-in-water emulsions are proposed, wherein the fat has SFC of 17 to 50 % at 10 °C, SFC of 4 to 30 % at 20 °C, and SFC of 3 to 10 % at 30 °C, and is characterized in that no solid-liquid separation takes place and crystallization is occur uniformly even if an oil mixture obtained by mixing 70 parts by mass of a liquid oil, based

on 30 parts by mass of the fat is allowed to stand from 60 °C to 25 °C.

Nevertheless, in any case, suitably satisfactory emulsion stability, and meltability in the mouth and milk taste while eating cannot be achieved.

Patent Document 1: JP 5-219887 A

Patent Document 2: JP 11-225671 A

Patent Document 3: JP 2000-41609 A

Patent Document 4: JP 2006-254805 A

Disclosure of the Invention

Problem to be Solved by the Invention

An object of the present invention is to provide a whipped cream and a fat composition for the whipped cream to obtain said cream that has good emulsion stability as a whipped cream, and has superior workability, foamability and external appearance when whipped, good shape retention and resistance to water separation, and has meltability in the mouth, milk taste and texture while eating that is similar to milk fat though derived from plant oils.

Furthermore, another object of the present invention is to provide the fat composition containing the least possible trans-unsaturated fatty acids.

Means for Solving the Problem

The present inventors have intensively studied and have found that a combination of a specific ester-exchanged fat with a lauric-type fat has been effective, and the present invention has been accomplished.

A first aspect of the present invention is a fat composition for a whipped cream, comprising; Fat A that is an ester-exchanged oil from a lauric-type fat and a palm-type fat, and a lauric-type fat.

Second aspect is the fat composition for the whipped cream of the first aspect, wherein [the Fat A/(the Fat A + the lauric-type fat)] value is in the range of 0.1 to 0.95.

Third aspect is the fat composition for the whipped cream of the first or second aspect, wherein a trans-unsaturated fatty acid is 10% or less of the fatty acid component of the fat composition.

Forth aspect is a whipped cream, comprising; the fat composition for the whipped cream of any one of the first to third aspect, a non-fat milk solid content and water.

Fifth aspect is the whipped cream of forth aspect, wherein the fat content is in the range of 15-49 wt%.

Sixth aspect is the whipped cream of forth aspect, wherein the non-fat milk solid content is in the range of 2-15 wt%.

Seventh aspect is the whipped cream of forth aspect,

wherein the total solid content is in the range of 20-54 wt%.

Eighth aspect is the whipped cream of forth aspect, further comprising milk fat.

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Effect of the Invention

It is possible to provide a whipped cream and a fat composition for the whipped cream to obtain said cream that has good emulsion stability as a whipped cream, and has superior workability, foamability and external appearance when whipped, good shape retention and resistance to water separation, and has meltability in the mouth, milk taste and texture while eating that is similar to that of milk fat though derived from plant oils.

10 Furthermore, said fat composition containing the least possible trans-unsaturated fatty acids can be provided.

Best Mode for Carrying Out the Invention

A fat composition for a whipped cream of the present invention must contain Fat A that is ester-exchanged oils from a lauric-type fat and a palm-type fat, and a lauric-type fat.

The Fat A of the present invention is obtained by ester-exchanging a palm-type fat and a lauric-type fat, examples of the palm-type fat include palm oil, and a

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fractionated oil such as palm stearin and palm olein obtained from fractionation of palm oil, as well as a hardened oil thereof and the like, for example, and one type or two or more types can be selected therefrom for use, and in particular from the perspective of imparting shape retention to the whipped one, the palm-type fat is preferably palm oil, palm stearin, or an mixed oil of palm oil and palm stearin.

Examples of the lauric-type fat include, for example, coconut oil and palm kernel oil, and a fractionated oil obtained therefrom by fractionation such as palm kernel olein and palm kernel stearin, and a hardened oil thereof and the like, and one type or two or more types can be selected therefrom for use, and in particular from the perspective of the emulsion stability of the whipped cream, coconut oil, palm kernel oil, and palm kernel olein are preferred.

Blending ratios for such palm-type fat and lauric-type fat to obtain the Fat A of the present invention are preferably 30-70 wt% of palm-type fat and 30-70 wt% of lauric-type fat. Provided that this range is satisfied, a fat other than these can also be used. For example, plant oils such as soybean oil, sunflower seed oil, cottonseed oil, peanut oil, rice bran oil, corn oil, safflower oil, olive oil, kapok oil, sesame oil and evening primrose oil,

as well as animal fats such as beef tallow and lard, and a medium-chain fatty acid triglyceride can be exemplified, where the abovementioned types of the fats individually or as mixed oil, or the hardened oils, fractionated oils, 5 hardened fractionated oils or fractionated hardened oils thereof, as well as processed fats thereof such as where ester exchange or the like has been carried out can be used. Preferable aspect of the Fat A is an ester-exchanged form of a (40-60 wt%)/(60-40 wt%) blend of the palm-type fat and 10 the lauric-type fat.

As ester exchange, the methods are divided into methods wherein only the fatty acids bonded to the 1-position and 3-position of the triglyceride are selectively exchanged (1,3-selective ester exchange) using an enzyme 15 (lipase), and methods of random exchange (random ester exchange) regardless of the bonded position using an enzyme or metal catalyst (for example, sodium methylate). Any method can be adopted for ester exchange in the present invention according to a type of fat of the raw material.

20 In the present invention, the amount of the Fat A contained in the fat is preferably 10-95 wt%, more preferably 20-90 wt%, and furthermore preferably 60-90 wt%. When there is little of the Fat A, the resistance to water separation is weaker, the meltability in the mouth is too 25 good, and a suitable milk taste is not obtained. When there

is much of the Fat A, the viscosity is high, the "bote" is shorter, and the emulsion stability worsens.

Examples of the lauric-type fat of the invention not being defined as the Fat A that is the ester-exchanged oil include coconut oil and palm kernel oil, or a oil which is hydrogenated, fractionated or ester-exchanged thereof. The palm kernel oil, or the oil which is hydrogenated, fractionated or ester-exchanged thereof is preferable. In the present invention, the amount of this lauric-type fat contained in the fat is preferably 5-90 wt%, and more preferably 10-80 wt%, and furthermore preferably 10-40 wt%. When there is little the lauric-type fat, the viscosity is high, the "bote" is shorter, and the emulsion stability worsens. When there is much the lauric-type fat, the resistance to water separation is weaker, the meltability in the mouth is too good, and a suitable milk taste is not obtained.

In the present invention, the fat composition for the whipped cream contains the Fat A which is the ester-exchanged oils from the lauric-type fat and the palm-type fat, and the lauric-type fat, the $[\text{Fat A}/(\text{Fat A} + \text{the lauric-type fat})]$ value is in the range of 0.1-0.95, and preferably 0.2-0.9, and furthermore preferably 0.6-0.9. If this value is too small, the resistance to water separation is weaker, the meltability in the mouth is too good, and a

suitable milk taste is not obtained, and if the value is too large, the viscosity is high, the "bote" is shorter, and the emulsion stability worsens.

5 In the present invention, the trans-unsaturated fatty acid can easily be 10% or less of the fatty acid component in the fat composition for the fat composition used in the whipped cream, and it can also be 3% or less, preferably 2% or less, and furthermore preferably 1% or less.

10 A non-fat milk solid content of the present invention is the component where the milk fat content is removed from the total solids content of cow milk, and can be exemplified by raw materials derived from milk such as raw milk, cow milk, defatted milk, raw cream, concentrated milk, unsweetened condensed milk, sweetened condensed milk, whole
15 milk powder, defatted milk powder, buttermilk powder, whey protein, casein and casein sodium, and non-fat milk solids content of 2-15 wt% is preferred, and more preferably 3-12 wt%, and most preferably 4-10 wt%. If the non-fat milk solids content is less, the emulsion stability of the
20 whipped cream worsens, and there is less milk taste and the flavor worsens. When there is more, the viscosity of the whipped cream is higher, and the costs are also higher, and it is difficult to achieve an effective balance of the quantities.

25 The whipped cream of the present invention preferably

has a total solids content of 20-54 wt%, and preferably 30-54 wt%, and more preferably 35-52 wt%. If the total solids content is too low, there is also too little milk taste and the flavor worsen, and if it is too high, the viscosity is higher and the emulsion stability worsen.

Of course, for the whipped cream of the present invention to have a fortified milk flavor, it is preferable for additional milk fat to be contained, and the milk fat of the present invention can certainly be milk-derived milk fat such as cow milk, raw cream and butter, and can also be material that contains butter oil obtained by the processing of such raw materials.

Being able to impart a milk taste with a plant oil is at the core of the present invention, but being able to fortify the milk taste by including milk fat, the texture becomes closer to that of milk fat.

In the whipped cream of the present invention, suitable selective use can be made of the emulsifying agents generally used when preparing whipped creams. For example, these can be exemplified by synthetic emulsifying agents such as lecithin, monoglycerides, sorbitan fatty acid esters, propylene glycol fatty acid esters, polyglyceryl fatty acid esters, polyoxyethylene sorbitan fatty acid esters and sucrose fatty acid esters, and one type or two or more types can be selected from among these

for suitable use.

Various salts can be used in the whipped cream of the present invention. The use of hexametaphosphate, secondary phosphate, sodium citrate, polyphosphate, baking soda or
5 the like, individually or as mixtures of two or more are preferred as the salt. Additionally, sugars, stabilizing agents, flavors, coloring agents, preservatives and the like can be used if desired.

As a method for manufacturing the whipped cream of the
10 present invention, it can be performed by mixing the main raw materials which include the fat composition for the whipped cream, not-fat milk solids content, emulsifying agent and water, and after mixing the raw materials, pre-emulsifying, pasteurizing or sterilization-treating, and
15 homogenization-treating. A sterilization treatment is preferred from the perspective of the stability of the whipped cream. Specifically, after the various raw materials are pre-emulsified at 60-70 °C for 20 minutes (a Homomixer as the emulsification apparatus), depending on
20 the requirements, homogenization is carried out under conditions of 0-250 kg/cm² (a homogenizer as the emulsification apparatus). Next, after undergoing ultra-high temperature (UHT) flash sterilization treatment, homogenization is carried out once again under conditions
25 of 0-300 kg/cm², and after cooling, aging is performed over

a period of approximately 24 hours.

There are 2 types of ultra-high temperature (UHT) sterilization, an indirect heating method and a direct heating method, and an apparatus for the indirect heating treatment is exemplified by APV plate-type UHT treatment apparatus (manufactured by APV Co., Ltd.), CP-UHT sterilizer (manufactured by Climaty Package Co., Ltd.), Stork tubular-type sterilization apparatus (manufactured by Stork Co., Ltd.), Contherm scraping-type UHT sterilization apparatus (manufactured by Tetra Pak Alfa Laval Co., Ltd.) and the like, with no particular bound to these. Moreover, an apparatus for the direct heating treatment is exemplified by UHT sterilization units such as ultrahigh temperature sterilization apparatus (manufactured by Iwai Kikai Kogyo Co., Ltd.), uperization sterilization apparatus (manufactured by Tetra Pak Alfa Laval Co., Ltd.), VTIS sterilization apparatus (manufactured by Tetra Pak Alfa Laval Co., Ltd.) , Lagear UHT sterilization apparatus (manufactured by Lagear Co., Ltd.), Paralizador (manufactured by Pash and Silkeborg Co., Ltd.) and the like, and any of these apparatuses can be used.

The overrun for the whipped cream of the present invention is 40-150%, and preferably 60-140%, and more preferably 60-120 %. When the overrun is too high, the texture is too light, and there is a tendency for the

flavor to be thin. When the overrun is too low, the texture is too heavy, and it is difficult to obtain a desirable flavor or meltability in the mouth.

5 Examples

The present invention will be described more specifically by way of examples, which are not construed to limit the scope of the present invention. All percentages and parts used in the Examples are based on weight.

10 In particular, it is needless to say that the order of addition of the additives or the order of emulsification such as the addition of the oil phase to the aqueous phase or the addition of the aqueous phase to the oil phase are not limited in any way to the examples given below.
15 Moreover, the results were evaluated by the methods described below.

(Method to measure a trans-unsaturated fatty acid in a fat composition)

20 The trans-unsaturated fatty acid (trans acid) content was analyzed by the method shown in Standard Methods for the Analysis of Fats and Oils 2.4.2.2.

(Method for evaluating a whipped cream)

25 The emulsion stability (viscosity, "bote" time), whipping time, overrun, shape retention and water separation at 5 °C, shape retention and water separation at

20 °C, meltability in the mouth, milk taste, and texture of the whipped cream were evaluated by the methods described below.

* Viscosity: measured by using a B-type viscometer
5 (manufactured by Toki Sangyo Co., Ltd., VISCOMETER TV-10) with a No. 2 rotor.

* "Bote" time: the time until solidification was occurred when stirring was applied after the whipped cream was incubated at 20 °C for 2 hours. The longer the time,
10 the higher the emulsion stability.

* Whipping time: 80 g of granulated sugar was added to 1 kg of the whipped cream and whipped with a Hobart mixer (manufactured by HOBART CORPORATION, MODEL N-5) at the third gear (300rpm), and the time until achieving the
15 optimum whipping conditions was measured.

* Overrun: $[(\text{weight of a defined volume of an oil-in-water emulsion}) - (\text{weight of a defined volume of whipped product after whipping})] \div (\text{weight of a defined volume of whipped product after whipping}) \times 100$

20 * Shape retention: the fineness of a flower shaped whipped product is investigated after stored for 24 hours at 5 °C and 20 °C. In the order of superiority, it was evaluated out of 5 points on a 5-point scale;

5: unchanged from the time of forming flower shape;

25 4: slight settling while mostly unchanged from the

time of flower shape;

3: slight settling but still at the problem-free level;

2: a settled shape remains;

1: gone slack.

5 * Water separation: the degree of water separation of the flower shape whipped product is investigated after having been stored for 24 hours at 5 °C and 20 °C. In the order of superiority, it was evaluated out of 5 points on a 5-point scale;

10 5: no water separation;

4: hardly any water separation;

3: water separation on one-quarter of the bottom surface;

2: water separation on one-half of the bottom surface;

15 1: water separation on the entire bottom surface.

* Property of whipped product was evaluated as meltability in the mouth, milk taste, and texture. Evaluations by 10 expert panelists were averaged, and the resulting value was rounded off after the decimal point.

20 (1) Meltability in the mouth: evaluated on a 5-point scale

5: good

4: slightly good

3: normal

2: slightly bad

25 1: bad

(2) Milk taste: evaluated on a 5-point scale

5: strong

4: slightly strong

3: normal

5 2: slightly weak

1: weak

(3) Texture: evaluated on a 3-point scale

3: close to that of milk fat

2: somewhat close to that of milk fat

10 1: not close to that of milk fat.

Experimental example 1 (preparation of ester-exchanged oil A-1)

To the fat obtained by mixing 50 parts of palm oil and 10 parts of palm stearin obtained by fractionation of palm oil and 40 parts of palm kernel olein obtained by fractionation of palm kernel oil were added 0.3 part of metal catalyst (sodium methyrate), and random ester exchange was carried out under a vacuum at 80 °C for 60 minutes. The fat obtained was purified according to the usual methods to give ester-exchanged Fat A-1.

Experimental example 2 (preparation of ester-exchanged oil A-2)

To the fat obtained by mixing 30 parts of palm oil and 30 parts of palm stearin obtained by fractionation of palm oil and 40 parts of palm kernel olein obtained by

fractionation of palm kernel oil were added 1,3-specific lipase for an enzyme ester-exchange reaction, giving ester-exchanged Fat A-2.

Example 1

5 To 15 parts of ester-exchanged Fat A-1 and 5 parts of hardened palm kernel oil (melting point 38 °C) are added and mixed 0.25 part of lecithin and 0.16 part of glyceryl fatty acid ester, and the mixture is melted to give an oil phase. Separately, an aqueous phase is prepared by
10 dissolving 15 parts of defatted milk powder, 0.12 part of sucrose fatty acid ester (HLB 5), 0.02 part of baking soda, 0.15 part of sodium metaphosphate, 0.2 part of xanthan gum, and 0.2 part of guar gum into 63.90 parts of water. After the abovementioned oil phase and aqueous phase were pre-
15 emulsified by stirring with a Homomixer at 70 °C for 15 minutes, a sterilization treatment was carried out by the direct heating method at 144 °C for 4 seconds using an ultrahigh temperature sterilization apparatus (manufactured by Iwai Kikai Kogyo Co., Ltd.), after which homogenization
20 was effected at a homogenization pressure of 30 kg/cm², followed by immediate cooling to 5 °C. After cooling, this was aged for 24 hours to give a whipped cream. When this whipped cream was evaluated according to the abovementioned methods, emulsion stability was good, and workability,
25 foamability and external appearance during whipping were

excellent, but shape retention and resistance to water separation at 20 °C were somewhat weak. It had good meltability in the mouth, milk taste and the texture being close to that of milk fat while eating.

5 Example 2

To 20 parts of ester-exchanged Fat A-1 and 5 parts of hardened palm kernel oil (melting point 38 °C) are added and mixed 0.25 part of lecithin and 0.15 part of glyceryl fatty acid ester, and the mixture is melted to give an oil
10 phase. Separately, an aqueous phase is prepared by dissolving 4.5 parts of defatted milk powder, 0.22 part of sucrose fatty acid ester (HLB 5), 0.02 part of baking soda, 0.15 part of sodium metaphosphate, 0.1 part of xanthan gum, and 0.1 part of guar gum into 69.51 parts of water. After
15 the abovementioned oil phase and aqueous phase were pre-emulsified by stirring with a Homomixer at 70 °C for 15 minutes, a sterilization treatment was carried out by the direct heating method at 144 °C for 4 seconds using an ultrahigh temperature sterilization apparatus (manufactured
20 by Iwai Kikai Kogyo Co., Ltd.), after which homogenization was effected at a homogenization pressure of 30 kg/cm², followed by immediate cooling to 5 °C. After cooling, this was aged for 24 hours to give a whipped cream. When this whipped cream was evaluated according to the abovementioned
25 methods, emulsion stability was good, and workability,

foamability and external appearance during whipping were excellent, but shape retention and resistance to water separation at 20 °C were somewhat weak. It had good meltability in the mouth, milk taste and the texture being close to that of milk fat while eating.

Example 3

To 20 parts of ester-exchanged Fat A-1 and 5 parts of hardened palm kernel oil (melting point 38 °C) are added and mixed 0.25 part of lecithin and 0.15 part of glyceryl fatty acid ester, and the mixture is melted to give an oil phase. Separately, an aqueous phase is prepared by dissolving 10 parts of defatted milk powder, 0.22 part of sucrose fatty acid ester (HLB 5), 0.02 part of baking soda, 0.15 part of sodium metaphosphate, 0.1 part of xanthan gum, and 0.1 part of guar gum into 64.01 parts of water. After the abovementioned oil phase and aqueous phase were pre-emulsified by stirring with a Homomixer at 70 °C for 15 minutes, a sterilization treatment was carried out by the direct heating method at 144 °C for 4 seconds using an ultrahigh temperature sterilization apparatus (manufactured by Iwai Kikai Kogyo Co., Ltd.), after which homogenization was effected at a homogenization pressure of 30 kg/cm², followed by immediate cooling to 5 °C. After cooling, this was aged for 24 hours to give a whipped cream. When this whipped cream was evaluated according to the abovementioned

methods, emulsion stability was good, and workability, foamability and external appearance during whipping were excellent, but shape retention and resistance to water separation at 20 °C were somewhat weak. It had good
5 meltability in the mouth, somewhat strong milk taste and the texture being close to that of milk fat while eating.

Example 4

To 5 parts of ester-exchanged Fat A-1, 20 parts of palm kernel oil and 5 parts of hardened palm kernel oil
10 (melting point 38 °C) are added and mixed 0.25 part of lecithin and 0.15 part of glyceryl fatty acid ester, and the mixture is melted to give an oil phase. Separately, an aqueous phase is prepared by dissolving 4.5 parts of defatted milk powder, 0.22 part of sucrose fatty acid ester
15 (HLB 5), 0.02 part of baking soda, 0.15 part of sodium metaphosphate, 0.01 part of xanthan gum, and 0.01 part of guar gum into 64.69 parts of water. After the abovementioned oil phase and aqueous phase were pre-emulsified by stirring with a Homomixer at 70 °C for 15
20 minutes, a sterilization treatment was carried out by the direct heating method at 144 °C for 4 seconds using an ultrahigh temperature sterilization apparatus (manufactured by Iwai Kikai Kogyo Co., Ltd.), after which homogenization was effected at a homogenization pressure of 30 kg/cm²,
25 followed by immediate cooling to 5 °C. After cooling, this

was aged for 24 hours to give a whipped cream. When this whipped cream was evaluated according to the abovementioned methods, emulsion stability was good, and workability, foamability and external appearance during whipping were
5 excellent. It had good meltability in the mouth, milk taste and the texture being close to that of milk fat while eating.

The formulations and evaluations of Examples 1 to 4 were summarized in Table 1.

[Table 1]

	Example 1	Example 2	Example 3	Example 4
<u>Oil phase</u>				
Ester-exchanged fat A-1 from a palm-type fat and a lauric-type fat	15	20	20	5
Ester-exchanged fat A-2 from a palm-type fat and a lauric-type fat	—	—	—	—
Palm kernel oil	—	—	—	20
Hardened palm kernel oil (m.p. 34 °C)	—	—	—	—
Hardened palm kernel oil (m.p. 36 °C)	—	—	—	—
Hardened palm kernel oil (m.p. 38 °C)	5	5	5	5
Coconut oil	—	—	—	—
Hardened soybean and palm mixed oil (m.p. 31 °C)	—	—	—	—
Hardened rapeseed and palm mixed oil (m.p. 31 °C)	—	—	—	—
Butter oil	—	—	—	—
Lecithin	0.25	0.25	0.25	0.25
Glyceryl fatty acid ester	0.16	0.15	0.15	0.15
Content of fat composition for cream	20	25	25	30
Fat A / (fat A + lauric-type fat)	0.8	0.8	0.8	0.2
Trans-unsaturated fatty acid content	<1%	<1%	<1%	<1%
<u>Aqueous phase</u>				
Water	63.9	69.51	64.01	64.69
Defatted milk powder	15	4.5	10	4.5
Sucrose fatty acid ester (HLB 5)	0.12	0.22	0.22	0.22
Baking soda	0.02	0.02	0.02	0.02
Sodium citrate	—	—	—	—
Sodium metaphosphate	0.15	0.15	0.15	0.15
Xanthan gum	0.2	0.1	0.1	0.01
Guar gum	0.2	0.1	0.1	0.01
<u>Whipped cream</u>				
Oil content	20.4	25.4	25.4	30.4
Non-fat milk solids content	14.9	4.5	9.9	4.5
Total solids content	36.1	30.5	36.0	35.3
Viscosity (cP)	120	80	100	150
"Bote" time (min:sec)	≥5:00	≥5:00	≥5:00	≥5:00
Whipping time (min:sec)	5:30	5:00	4:30	3:30
Overrun (%)	130	140	120	120
After 1 day at 5 °C				
Shape retention	3	3	3	3
Water separation	3	3	3	5
After 1 day at 20 °C				
Shape retention	2	2	2	3
Water separation	2	2	2	3
Meltability in the mouth	5	5	4	4
Milk taste	3	3	4	3
Texture	3	3	3	3

Example 5

To 5 parts of ester-exchanged Fat A-1, 5 parts of hardened palm kernel oil (melting point 38 °C) and 20 parts of coconut oil are added and mixed 0.25 part of lecithin and 0.15 part of glyceryl fatty acid ester, and the mixture is melted to give an oil phase. Separately, an aqueous phase is prepared by dissolving 4.5 parts of defatted milk powder, 0.22 part of sucrose fatty acid ester (HLB 5), 0.02 part of baking soda, 0.15 part of sodium metaphosphate, 0.01 part of xanthan gum, and 0.01 part of guar gum into 64.69 parts of water. After the abovementioned oil phase and aqueous phase were pre-emulsified by stirring with a Homomixer at 70 °C for 15 minutes, a sterilization treatment was carried out by the direct heating method at 144 °C for 4 seconds using an ultrahigh temperature sterilization apparatus (manufactured by Iwai Kikai Kogyo Co., Ltd.), after which homogenization was effected at a homogenization pressure of 30 kg/cm², followed by immediate cooling to 5 °C. After cooling, this was aged for 24 hours to give a whipped cream. When this whipped cream was evaluated according to the abovementioned methods, emulsion stability was good, and workability, foamability and external appearance during whipping were excellent, but resistance to water separation at 20 °C were somewhat weak. It had good meltability in the mouth and the texture being somewhat close to that of milk fat, but milk taste was

somewhat weak, while eating.

Example 6

To 5 parts of ester-exchanged Fat A-1, 10 parts of palm kernel oil, 13 parts of hardened palm kernel oil (melting point 34 °C) and 5 parts of hardened palm kernel oil (melting point 38 °C) are added and mixed 0.25 part of lecithin and 0.06 part of glyceryl fatty acid ester, and the mixture is melted to give an oil phase. Separately, an aqueous phase is prepared by dissolving 4.5 parts of defatted milk powder, 0.1 part of sucrose fatty acid ester (HLB 5), 0.02 part of baking soda, 0.15 part of sodium metaphosphate, 0.1 part of xanthan gum, and 0.1 part of guar gum into 61.72 parts of water. After the abovementioned oil phase and aqueous phase were pre-emulsified by stirring with a Homomixer at 70 °C for 15 minutes, a sterilization treatment was carried out by the direct heating method at 144 °C for 4 seconds using an ultrahigh temperature sterilization apparatus (manufactured by Iwai Kikai Kogyo Co., Ltd.), after which homogenization was effected at a homogenization pressure of 30 kg/cm², followed by immediate cooling to 5 °C. After cooling, this was aged for 24 hours to give a whipped cream. When this whipped cream was evaluated according to the abovementioned methods, emulsion stability was good, and workability, foamability and external appearance during whipping were

excellent. It had good meltability in the mouth, milk taste and the texture being close to that of milk fat while eating.

Example 7

5 To 20 parts of ester-exchanged Fat A-1, 5 parts of palm kernel oil, 4 parts of hardened palm kernel oil (melting point 34 °C) and 4 parts of hardened palm kernel oil (melting point 38 °C) are added and mixed 0.25 part of lecithin and 0.06 part of glyceryl fatty acid ester, and
10 the mixture is melted to give an oil phase. Separately, an aqueous phase is prepared by dissolving 4.5 parts of defatted milk powder, 0.1 part of sucrose fatty acid ester (HLB 5), 0.02 part of baking soda, 0.15 part of sodium metaphosphate, 0.1 part of xanthan gum, and 0.1 part of
15 guar gum into 61.72 parts of water. After the abovementioned oil phase and aqueous phase were pre-emulsified by stirring with a Homomixer at 70 °C for 15 minutes, a sterilization treatment was carried out by the direct heating method at 144 °C for 4 seconds using an
20 ultrahigh temperature sterilization apparatus (manufactured by Iwai Kikai Kogyo Co., Ltd.), after which homogenization was effected at a homogenization pressure of 30 kg/cm², followed by immediate cooling to 5 °C. After cooling, this was aged for 24 hours to give a whipped cream. When this
25 whipped cream was evaluated according to the abovementioned

methods, emulsion stability was good, and workability, foamability and external appearance during whipping were excellent. It had good meltability in the mouth, strong milk taste and the texture being close to that of milk fat while eating.

Example 8

To 10 parts of ester-exchanged Fat A-1, 20 parts of palm kernel oil and 5 parts of hardened palm kernel oil (melting point 38 °C) are added and mixed 0.25 part of lecithin and 0.05 part of glyceryl fatty acid ester, and the mixture is melted to give an oil phase. Separately, an aqueous phase is prepared by dissolving 4.5 parts of defatted milk powder, 0.22 part of sucrose fatty acid ester (HLB 5), 0.02 part of baking soda, 0.15 part of sodium metaphosphate, 0.01 part of xanthan gum, and 0.01 part of guar gum into 59.79 parts of water. After the abovementioned oil phase and aqueous phase were pre-emulsified by stirring with a Homomixer at 70 °C for 15 minutes, a sterilization treatment was carried out by the direct heating method at 144 °C for 4 seconds using an ultrahigh temperature sterilization apparatus (manufactured by Iwai Kikai Kogyo Co., Ltd.), after which homogenization was effected at a homogenization pressure of 30 kg/cm², followed by immediate cooling to 5 °C. After cooling, this was aged for 24 hours to give a whipped cream. When this

whipped cream was evaluated according to the abovementioned methods, emulsion stability was good, and workability, foamability and external appearance during whipping were excellent. It had good meltability in the mouth, milk taste
5 and the texture being somewhat close to that of milk fat while eating.

The formulations and evaluations of Examples 5 to 8 were summarized in Table 2.

[Table 2]

	Example 5	Example 6	Example 7	Example 8
<u>Oil phase</u>				
Ester-exchanged fat A-1 from a palm-type fat and a lauric-type fat	5	5	20	10
Ester-exchanged fat A-2 from a palm-type fat and a lauric-type fat	—	—	—	—
Palm kernel oil	—	10	5	20
Hardened palm kernel oil (m.p. 34 °C)	—	13	4	—
Hardened palm kernel oil (m.p. 36 °C)	—	—	—	—
Hardened palm kernel oil (m.p. 38 °C)	5	5	4	5
Coconut oil	20	—	—	—
Hardened soybean and palm mixed oil (m.p. 31 °C)	—	—	—	—
Hardened rapeseed and palm mixed oil (m.p. 31 °C)	—	—	—	—
Butter oil	—	—	—	—
Lecithin	0.25	0.25	0.25	0.25
Glyceryl fatty acid ester	0.15	0.06	0.06	0.05
Content of fat composition for cream	30	33	33	35
Fat A / (fat A + lauric-type fat)	0.2	0.2	0.6	0.3
Trans-unsaturated fatty acid content	<1%	2%	1%	<1%
<u>Aqueous phase</u>				
Water	64.69	61.72	61.72	59.79
Defatted milk powder	4.5	4.5	4.5	4.5
Sucrose fatty acid ester (HLB 5)	0.22	0.1	0.1	0.22
Baking soda	0.02	0.02	0.02	0.02
Sodium citrate	—	—	—	—
Sodium metaphosphate	0.15	0.15	0.15	0.15
Xanthan gum	0.01	0.1	0.1	0.01
Guar gum	0.01	0.1	0.1	0.01
<u>Whipped cream</u>				
Oil content	30.4	33.3	33.3	35.3
Non-fat milk solids content	4.5	4.5	4.5	4.5
Total solids content	35.3	38.3	38.3	40.2
Viscosity (cP)	160	100	130	180
"Bote" time (min:sec)	≥5:00	≥5:00	≥5:00	≥5:00
Whipping time (min:sec)	3:20	3:00	3:40	3:15
Overrun (%)	100	95	100	110
After 1 day at 5 °C				
Shape retention	4	3	3	3
Water separation	5	5	5	5
After 1 day at 20 °C				
Shape retention	3	3	3	3
Water separation	2	3	3	3
Meltability in the mouth	5	3	4	4
Milk taste	2	3	5	3
Texture	2	3	3	2

Example 9

To 10 parts of ester-exchanged Fat A-1, 5 parts of hardened palm kernel oil (melting point 38 °C) and 20 parts of coconut oil are added and mixed 0.25 part of lecithin and 0.05 part of glyceryl fatty acid ester, and the mixture is melted to give an oil phase. Separately, an aqueous phase is prepared by dissolving 4.5 parts of defatted milk powder, 0.22 part of sucrose fatty acid ester (HLB 5), 0.02 part of baking soda, 0.15 part of sodium metaphosphate, 0.01 part of xanthan gum, and 0.01 part of guar gum into 59.79 parts of water. After the abovementioned oil phase and aqueous phase were pre-emulsified by stirring with a Homomixer at 70 °C for 15 minutes, a sterilization treatment was carried out by the direct heating method at 144 °C for 4 seconds using an ultrahigh temperature sterilization apparatus (manufactured by Iwai Kikai Kogyo Co., Ltd.), after which homogenization was effected at a homogenization pressure of 30 kg/cm², followed by immediate cooling to 5 °C. After cooling, this was aged for 24 hours to give a whipped cream. When this whipped cream was evaluated according to the abovementioned methods, emulsion stability was good, and workability, foamability and external appearance during whipping were excellent, but shape retention and resistance to water separation at 20 °C were somewhat weak. It had good meltability in the mouth, but milk taste was somewhat weak, and the texture was not

close to that of milk fat and stiff, while eating.

Example 10

To 8 parts of ester-exchanged Fat A-1, 17 parts of palm kernel oil, 5 parts of hardened palm kernel oil (melting point 38 °C) and 5 parts of butter oil are added and mixed 0.25 part of lecithin and 0.05 part of glyceryl fatty acid ester, and the mixture is melted to give an oil phase. Separately, an aqueous phase is prepared by dissolving 4.5 parts of defatted milk powder, 0.22 part of sucrose fatty acid ester (HLB 5), 0.02 part of baking soda, 0.15 part of sodium metaphosphate, 0.01 part of xanthan gum, and 0.01 part of guar gum into 59.79 parts of water. After the abovementioned oil phase and aqueous phase were pre-emulsified by stirring with a Homomixer at 70 °C for 15 minutes, a sterilization treatment was carried out by the direct heating method at 144 °C for 4 seconds using an ultrahigh temperature sterilization apparatus (manufactured by Iwai Kikai Kogyo Co., Ltd.), after which homogenization was effected at a homogenization pressure of 30 kg/cm², followed by immediate cooling to 5 °C. After cooling, this was aged for 24 hours to give a whipped cream. When this whipped cream was evaluated according to the abovementioned methods, emulsion stability was good, and workability, foamability and external appearance during whipping were excellent. It had good meltability in the mouth, somewhat

strong milk taste and the texture being close to that of milk fat while eating.

Example 11

To 5 parts of ester-exchanged Fat A-1, 15 parts of
5 palm kernel oil, 5 parts of hardened palm kernel oil
(melting point 38 °C) and 10 parts of butter oil are added
and mixed 0.25 part of lecithin and 0.05 part of glyceryl
fatty acid ester, and the mixture is melted to give an oil
phase. Separately, an aqueous phase is prepared by
10 dissolving 4.5 parts of defatted milk powder, 0.22 part of
sucrose fatty acid ester (HLB 5), 0.02 part of baking soda,
0.15 part of sodium metaphosphate, 0.01 part of xanthan gum,
and 0.01 part of guar gum into 59.79 parts water. After the
abovementioned oil phase and aqueous phase were pre-
15 emulsified by stirring with a Homomixer at 70 °C for 15
minutes, a sterilization treatment was carried out by the
direct heating method at 144 °C for 4 seconds using an
ultrahigh temperature sterilization apparatus (manufactured
by Iwai Kikai Kogyo Co., Ltd.), after which homogenization
20 was effected at a homogenization pressure of 30 kg/cm²,
followed by immediate cooling to 5 °C. After cooling, this
was aged for 24 hours to give a whipped cream. When this
whipped cream was evaluated according to the abovementioned
methods, emulsion stability was good, and workability,
25 foamability and external appearance during whipping were

excellent. It had good meltability in the mouth, somewhat strong milk taste and the texture being close to that of milk fat while eating.

Example 12

5 To 5 parts of ester-exchanged Fat A-1, 5 parts of hardened palm kernel oil (melting point 38 °C) and 25 parts of butter oil are added and mixed 0.25 part of lecithin and 0.05 part of glyceryl fatty acid ester, and the mixture is melted to give an oil phase. Separately, an aqueous phase
10 is prepared by dissolving 4.5 parts of defatted milk powder, 0.22 part of sucrose fatty acid ester (HLB 5), 0.02 part of baking soda, 0.15 part of sodium metaphosphate, 0.01 part of xanthan gum, and 0.01 part of guar gum into 59.79 parts of water. After the abovementioned oil phase and aqueous
15 phase were pre-emulsified by stirring with a Homomixer at 70 °C for 15 minutes, a sterilization treatment was carried out by the direct heating method at 144 °C for 4 seconds using an ultrahigh temperature sterilization apparatus (manufactured by Iwai Kikai Kogyo Co., Ltd.), after which
20 homogenization was effected at a homogenization pressure of 30 kg/cm², followed by immediate cooling to 5 °C. After cooling, this was aged for 24 hours to give a whipped cream. When this whipped cream was evaluated according to the abovementioned methods, emulsion stability was good, and
25 workability, foamability and external appearance during

whipping were excellent. It had good meltability in the mouth, strong milk taste and the texture being close to that of milk fat while eating.

The formulations and evaluations of Examples 9 to 12
5 were summarized in Table 3.

[Table 3]

	Example 9	Example 10	Example 11	Example 12
<u>Oil phase</u>				
Ester-exchanged fat A-1 from a palm-type fat and a lauric-type fat	10	8	5	5
Ester-exchanged fat A-2 from a palm-type fat and a lauric-type fat	—	—	—	—
Palm kernel oil	—	17	15	—
Hardened palm kernel oil (m.p. 34 °C)	—	—	—	—
Hardened palm kernel oil (m.p. 36 °C)	—	—	—	—
Hardened palm kernel oil (m.p. 38 °C)	5	5	5	5
Coconut oil	20	—	—	—
Hardened soybean and palm mixed oil (m.p. 31 °C)	—	—	—	—
Hardened rapeseed and palm mixed oil (m.p. 31 °C)	—	—	—	—
Butter oil	—	5	10	25
Lecithin	0.25	0.25	0.25	0.25
Glyceryl fatty acid ester	0.05	0.05	0.05	0.05
Content of fat composition for cream	35	30	25	10
Fat A / (fat A + lauric-type fat)	0.3	0.3	0.2	0.5
Trans-unsaturated fatty acid content	<1%	<1%	<1%	<1%
<u>Aqueous phase</u>				
Water	59.79	59.79	59.79	59.79
Defatted milk powder	4.5	4.5	4.5	4.5
Sucrose fatty acid ester (HLB 5)	0.22	0.22	0.22	0.22
Baking soda	0.02	0.02	0.02	0.02
Sodium citrate	—	—	—	—
Sodium metaphosphate	0.15	0.15	0.15	0.15
Xanthan gum	0.01	0.01	0.01	0.01
Guar gum	0.01	0.01	0.01	0.01
<u>Whipped cream</u>				
Oil content	35.3	35.3	35.3	35.3
Non-fat milk solids content	4.5	4.5	4.5	4.5
Total solids content	40.2	40.2	40.2	40.2
Viscosity (cP)	200	200	200	240
"Bote" time (min:sec)	≥5:00	≥5:00	≥5:00	≥5:00
Whipping time (min:sec)	3:00	3:25	3:35	3:00
Overrun (%)	95	110	105	95
After 1 day at 5 °C				
Shape retention	4	3	3	3
Water separation	5	5	5	5
After 1 day at 20 °C				
Shape retention	2	3	3	3
Water separation	2	3	3	3
Meltability in the mouth	5	4	4	4
Milk taste	2	4	4	5
Texture	1	3	3	3

Example 13

To 10 parts of ester-exchanged Fat A-1, 15 parts of palm kernel oil and 15 parts of hardened palm kernel oil (melting point 34 °C) are added and mixed 0.25 part of lecithin and 0.05 part of glyceryl fatty acid ester, and the mixture is melted to give an oil phase. Separately, an aqueous phase is prepared by dissolving 4.5 parts of defatted milk powder, 0.22 part of sucrose fatty acid ester (HLB 5), 0.02 part of baking soda, 0.15 part of sodium metaphosphate, 0.005 part of xanthan gum, and 0.005 part of guar gum into 54.80 parts of water. After the abovementioned oil phase and aqueous phase were pre-emulsified by stirring with a Homomixer at 70 °C for 15 minutes, a sterilization treatment was carried out by the direct heating method at 144 °C for 4 seconds using an ultrahigh temperature sterilization apparatus (manufactured by Iwai Kikai Kogyo Co., Ltd.), after which homogenization was effected at a homogenization pressure of 30 kg/cm², followed by immediate cooling to 5 °C. After cooling, this was aged for 24 hours to give a whipped cream. When this whipped cream was evaluated according to the abovementioned methods, emulsion stability was good, and workability, foamability and external appearance during whipping were excellent. It had good meltability in the mouth and milk taste, but the texture was not close to that of milk fat, while eating.

Example 14

To 10 parts of ester-exchanged Fat A-1, 10 parts of palm kernel oil, 10 parts of hardened palm kernel oil (melting point 36 °C) and 10 parts of butter oil are added and mixed 0.25 part of lecithin and 0.05 part of glyceryl fatty acid ester, and the mixture is melted to give an oil phase. Separately, an aqueous phase is prepared by dissolving 4.5 parts of defatted milk powder, 0.22 part of sucrose fatty acid ester (HLB 5), 0.02 part of baking soda, 0.15 part of sodium metaphosphate, 0.005 part of xanthan gum, and 0.005 part of guar gum into 54.80 parts of water. After the abovementioned oil phase and aqueous phase were pre-emulsified by stirring with a Homomixer at 70 °C for 15 minutes, a sterilization treatment was carried out by the direct heating method at 144 °C for 4 seconds using an ultrahigh temperature sterilization apparatus (manufactured by Iwai Kikai Kogyo Co., Ltd.), after which homogenization was effected at a homogenization pressure of 30 kg/cm², followed by immediate cooling to 5 °C. After cooling, this was aged for 24 hours to give a whipped cream. When this whipped cream was evaluated according to the abovementioned methods, emulsion stability was good, and workability, foamability and external appearance during whipping were excellent. It had good meltability in the mouth, milk taste, and the texture being somewhat close to that of milk fat

while eating.

Example 15

To 5 parts of ester-exchanged Fat A-1, 10 parts of hardened palm kernel oil (melting point 34 °C), 10 parts of hardened palm kernel oil (melting point 38 °C) and 15 parts of butter oil are added and mixed 0.25 part of lecithin and 0.05 part of glyceryl fatty acid ester, and the mixture is melted to give an oil phase. Separately, an aqueous phase is prepared by dissolving 4.5 parts of defatted milk powder, 0.22 part of sucrose fatty acid ester (HLB 5), 0.02 part of baking soda, 0.15 part of sodium metaphosphate, 0.005 part of xanthan gum, and 0.005 part of guar gum into 54.8 parts of water. After the abovementioned oil phase and aqueous phase were pre-emulsified by stirring with a Homomixer at 70 °C for 15 minutes, a sterilization treatment was carried out by the direct heating method at 144 °C for 4 seconds using an ultrahigh temperature sterilization apparatus (manufactured by Iwai Kikai Kogyo Co., Ltd.), after which homogenization was effected at a homogenization pressure of 30 kg/cm², followed by immediate cooling to 5 °C. After cooling, this was aged for 24 hours to give a whipped cream. When this whipped cream was evaluated according to the abovementioned methods, emulsion stability was good, and workability, foamability and external appearance during whipping were excellent. It had good meltability in the

mouth, somewhat strong milk taste, and the texture being close to that of milk fat while eating.

Example 16

To 5 parts of ester-exchanged Fat A-1, 10 parts of
5 palm kernel oil, 5 parts of hardened palm kernel oil
(melting point 38 °C) and 20 parts of butter oil are added
and mixed 0.25 part of lecithin and 0.05 part of glyceryl
fatty acid ester, and the mixture is melted to give an oil
phase. Separately, an aqueous phase is prepared by
10 dissolving 4.5 parts of defatted milk powder, 0.22 part of
sucrose fatty acid ester (HLB 5), 0.02 part of baking soda,
0.15 part of sodium metaphosphate, 0.005 part of xanthan
gum, and 0.005 part of guar gum into 54.8 parts of water.
After the abovementioned oil phase and aqueous phase were
15 pre-emulsified by stirring with a Homomixer at 70 °C for 15
minutes, a sterilization treatment was carried out by the
direct heating method at 144 °C for 4 seconds using an
ultrahigh temperature sterilization apparatus (manufactured
by Iwai Kikai Kogyo Co., Ltd.), after which homogenization
20 was effected at a homogenization pressure of 30 kg/cm²,
followed by immediate cooling to 5 °C. After cooling, this
was aged for 24 hours to give a whipped cream. When this
whipped cream was evaluated according to the abovementioned
methods, emulsion stability was good, and workability,
25 foamability and external appearance during whipping were

excellent. It had good meltability in the mouth, strong milk taste, and the texture being close to that of milk fat while eating.

The formulations and evaluations of Examples 13 to 16
5 were summarized in Table 4.

[Table 4]

	Example 13	Example 14	Example 15	Example 16
<u>Oil phase</u>				
Ester-exchanged fat A-1 from a palm-type fat and a lauric-type fat	10	10	5	5
Ester-exchanged fat A-2 from a palm-type fat and a lauric-type fat	—	—	—	—
Palm kernel oil	15	10	—	10
Hardened palm kernel oil (m.p. 34 °C)	15	—	10	—
Hardened palm kernel oil (m.p. 36 °C)	—	10	—	—
Hardened palm kernel oil (m.p. 38 °C)	—	—	10	5
Coconut oil	—	—	—	—
Hardened soybean and palm mixed oil (m.p. 31 °C)	—	—	—	—
Hardened rapeseed and palm mixed oil (m.p. 31 °C)	—	—	—	—
Butter oil	—	10	15	20
Lecithin	0.25	0.25	0.25	0.25
Glyceryl fatty acid ester	0.05	0.05	0.05	0.05
Content of fat composition for cream	40	30	25	20
Fat A / (fat A + lauric-type fat)	0.3	0.3	0.2	0.3
Trans-unsaturated fatty acid content	2%	2%	2%	<1%
<u>Aqueous phase</u>				
Water	54.8	54.8	54.8	54.8
Defatted milk powder	4.5	4.5	4.5	4.5
Sucrose fatty acid ester (HLB 5)	0.22	0.22	0.22	0.22
Baking soda	0.02	0.02	0.02	0.02
Sodium citrate	—	—	—	—
Sodium metaphosphate	0.15	0.15	0.15	0.15
Xanthan gum	0.005	0.005	0.005	0.005
Guar gum	0.005	0.005	0.005	0.005
<u>Whipped cream</u>				
Oil content	40.3	40.3	40.3	40.3
Non-fat milk solids content	4.5	4.5	4.5	4.5
Total solids content	45.2	45.2	45.2	45.2
Viscosity (cP)	270	305	250	210
"Bote" time (min:sec)	≥5:00	4:30	4:30	4:30
Whipping time (min:sec)	2:20	2:05	2:25	2:40
Overrun (%)	100	90	100	105
After 1 day at 5 °C				
Shape retention	5	5	5	5
Water separation	5	5	5	5
After 1 day at 20 °C				
Shape retention	4	4	4	4
Water separation	4	4	4	4
Meltability in the mouth	3	3	3	4
Milk taste	3	3	4	5
Texture	1	2	3	3

Example 17

To 5 parts of ester-exchanged Fat A-1, 5 parts of hardened palm kernel oil (melting point 38 °C) and 30 parts of butter oil are added and mixed 0.25 part of lecithin and 0.05 part of glyceryl fatty acid ester, and the mixture is melted to give an oil phase. Separately, an aqueous phase is prepared by dissolving 4.5 parts of defatted milk powder, 0.22 part of sucrose fatty acid ester (HLB 5), 0.02 part of baking soda, 0.15 part of sodium metaphosphate, 0.005 part of xanthan gum, and 0.005 part of guar gum into 54.8 parts of water. After the abovementioned oil phase and aqueous phase were pre-emulsified by stirring with a Homomixer at 70 °C for 15 minutes, a sterilization treatment was carried out by the direct heating method at 144 °C for 4 seconds using an ultrahigh temperature sterilization apparatus (manufactured by Iwai Kikai Kogyo Co., Ltd.), after which homogenization was effected at a homogenization pressure of 30 kg/cm², followed by immediate cooling to 5 °C. After cooling, this was aged for 24 hours to give a whipped cream. When this whipped cream was evaluated according to the abovementioned methods, emulsion stability was good, and workability, foamability and external appearance during whipping were excellent. It had good meltability in the mouth, strong milk taste, and the texture being close to that of milk fat while eating.

Example 18

To 10 parts of ester-exchanged Fat A-1, 15 parts of palm kernel oil and 20 parts of hardened palm kernel oil (melting point 34 °C) are added and mixed 0.25 part of lecithin, and the mixture is melted to give an oil phase.

5 Separately, an aqueous phase is prepared by dissolving 4.5 parts of defatted milk powder, 0.22 part of sucrose fatty acid ester (HLB 5), 0.02 part of baking soda, 0.15 part of sodium metaphosphate, 0.005 part of xanthan gum, and 0.005 part of guar gum into 49.85 parts of water. After the
10 abovementioned oil phase and aqueous phase were pre-emulsified by stirring with a Homomixer at 70 °C for 15 minutes, a sterilization treatment was carried out by the direct heating method at 144 °C for 4 seconds using an ultrahigh temperature sterilization apparatus (manufactured
15 by Iwai Kikai Kogyo Co., Ltd.), after which homogenization was effected at a homogenization pressure of 30 kg/cm², followed by immediate cooling to 5 °C. After cooling, this was aged for 24 hours to give a whipped cream. When this whipped cream was evaluated according to the abovementioned
20 methods, emulsion stability was good, and workability, foamability and external appearance during whipping were excellent. It had good meltability in the mouth and milk taste, but the texture was not close to that of milk fat, while eating.

25 Example 19

To 40 parts of ester-exchanged Fat A-1 and 5 parts of palm kernel oil are added and mixed 0.25 part of lecithin, and the mixture is melted to give an oil phase. Separately, an aqueous phase is prepared by dissolving 5.5 parts of defatted milk powder, 0.22 part of sucrose fatty acid ester (HLB 5), 0.02 part of baking soda and 0.12 part of sodium citrate into 48.89 parts water. After the abovementioned oil phase and aqueous phase were pre-emulsified by stirring with a Homomixer at 70 °C for 15 minutes, a sterilization treatment was carried out by the direct heating method at 144 °C for 4 seconds using an ultrahigh temperature sterilization apparatus (manufactured by Iwai Kikai Kogyo Co., Ltd.), after which homogenization was effected at a homogenization pressure of 30 kg/cm², followed by immediate cooling to 5 °C. After cooling, this was aged for 24 hours to give a whipped cream. When this whipped cream was evaluated according to the abovementioned methods, emulsion stability was good, and workability, foamability and external appearance during whipping were excellent. It had good meltability in the mouth, strong milk taste, and the texture being somewhat close to that of milk fat while eating.

Example 20

To 30 parts of ester-exchanged Fat A-1 and 15 parts of palm kernel oil are added and mixed 0.25 part of lecithin,

and the mixture is melted to give an oil phase. Separately, an aqueous phase is prepared by dissolving 5.5 parts of defatted milk powder, 0.22 part of sucrose fatty acid ester (HLB 5), 0.02 part of baking soda and 0.12 part of sodium citrate into 48.89 parts of water. After the abovementioned oil phase and aqueous phase were pre-emulsified by stirring with a Homomixer at 70 °C for 15 minutes, a sterilization treatment was carried out by the direct heating method at 144 °C for 4 seconds using an ultrahigh temperature sterilization apparatus (manufactured by Iwai Kikai Kogyo Co., Ltd.), after which homogenization was effected at a homogenization pressure of 30 kg/cm², followed by immediate cooling to 5 °C. After cooling, this was aged for 24 hours to give a whipped cream. When this whipped cream was evaluated according to the abovementioned methods, emulsion stability was good, and workability, foamability and external appearance during whipping were excellent. It had good meltability in the mouth, strong milk taste, and the texture being somewhat close to that of milk fat while eating.

The formulations and evaluations of Examples 17 to 20 were summarized in Table 5.

[Table 5]

	Example 17	Example 18	Example 19	Example 20
<u>Oil phase</u>				
Ester-exchanged fat A-1 from a palm-type fat and a lauric-type fat	5	10	40	30
Ester-exchanged fat A-2 from a palm-type fat and a lauric-type fat	—	—	—	—
Palm kernel oil	—	15	5	15
Hardened palm kernel oil (m.p. 34 °C)	—	20	—	—
Hardened palm kernel oil (m.p. 36 °C)	—	—	—	—
Hardened palm kernel oil (m.p. 38 °C)	5	—	—	—
Coconut oil	—	—	—	—
Hardened soybean and palm mixed oil (m.p. 31 °C)	—	—	—	—
Hardened rapeseed and palm mixed oil (m.p. 31 °C)	—	—	—	—
Butter oil	30	—	—	—
Lecithin	0.25	0.25	0.25	0.25
Glyceryl fatty acid ester	0.05	—	—	—
Content of fat composition for cream	10	45	45	45
Fat A / (fat A + lauric-type fat)	0.5	0.2	0.9	0.7
Trans-unsaturated fatty acid content	<1%	3%	<1%	<1%
<u>Aqueous phase</u>				
Water	54.8	49.85	48.89	48.89
Defatted milk powder	4.5	4.5	5.5	5.5
Sucrose fatty acid ester (HLB 5)	0.22	0.22	0.22	0.22
Baking soda	0.02	0.02	0.02	0.02
Sodium citrate	—	—	0.12	0.12
Sodium metaphosphate	0.15	0.15	—	—
Xanthan gum	0.005	0.005	—	—
Guar gum	0.005	0.005	—	—
<u>Whipped cream</u>				
Oil content	40.3	45.3	45.3	45.3
Non-fat milk solids content	4.5	4.5	5.4	5.4
Total solids content	45.2	50.2	51.1	51.1
Viscosity (cP)	230	230	420	405
"Bote" time (min:sec)	4:00	4:00	1:00	1:30
Whipping time (min:sec)	2:30	2:40	1:35	3:05
Overrun (%)	95	100	90	98
After 1 day at 5 °C				
Shape retention	5	5	5	5
Water separation	5	5	5	5
After 1 day at 20 °C				
Shape retention	4	5	5	5
Water separation	4	5	5	5
Meltability in the mouth	4	3	3	3
Milk taste	5	3	5	5
Texture	3	1	2	2

Example 21

To 30 parts of ester-exchanged Fat A-2 and 15 parts of palm kernel oil are added and mixed 0.25 part of lecithin, and the mixture is melted to give an oil phase. Separately, an aqueous phase is prepared by dissolving 4.5 parts of
5 defatted milk powder, 0.22 part of sucrose fatty acid ester (HLB 5), 0.02 part of baking soda and 0.12 part of sodium citrate into 48.89 parts water. After the abovementioned oil phase and aqueous phase were pre-emulsified by stirring with a Homomixer at 70 °C for 15 minutes, a sterilization
10 treatment was carried out by the direct heating method at 144 °C for 4 seconds using an ultrahigh temperature sterilization apparatus (manufactured by Iwai Kikai Kogyo Co., Ltd.), after which homogenization was effected at a homogenization pressure of 30 kg/cm², followed by immediate
15 cooling to 5 °C. After cooling, this was aged for 24 hours to give a whipped cream. When this whipped cream was evaluated according to the abovementioned methods, emulsion stability was good, and workability, foamability and external appearance during whipping were excellent. It had
20 good meltability in the mouth, strong milk taste, and the texture being close to that of milk fat while eating.

Example 22

To 10 parts of ester-exchanged Fat A-1, 10 parts of palm kernel oil, 10 parts of hardened palm kernel oil
25 (melting point 36 °C) and 10 parts of butter oil are added

and mixed 0.25 part of lecithin, and the mixture is melted to give an oil phase. Separately, an aqueous phase is prepared by dissolving 4.5 parts of defatted milk powder, 0.22 part of sucrose fatty acid ester (HLB 5), 0.02 part of baking soda and 0.15 part of sodium metaphosphate, 0.005 part of xanthan gum, and 0.005 part of guar gum into 49.85 parts of water. After the abovementioned oil phase and aqueous phase were pre-emulsified by stirring with a Homomixer at 70 °C for 15 minutes, a sterilization treatment was carried out by the direct heating method at 144 °C for 4 seconds using an ultrahigh temperature sterilization apparatus (manufactured by Iwai Kikai Kogyo Co., Ltd.), after which homogenization was effected at a homogenization pressure of 30 kg/cm², followed by immediate cooling to 5 °C. After cooling, this was aged for 24 hours to give a whipped cream. When this whipped cream was evaluated according to the abovementioned methods, emulsion stability was good, and workability, foamability and external appearance during whipping were excellent. It had good meltability in the mouth and milk taste, but the texture was not close to that of milk fat, while eating.

Example 23

To 10 parts of ester-exchanged Fat A-1, 10 parts of palm kernel oil, 10 parts of hardened palm kernel oil (melting point 36 °C) and 15 parts of butter oil are added

0.25 part of lecithin, and the mixture is melted to give an oil phase. Separately, an aqueous phase is prepared by dissolving 4.5 parts of defatted milk powder, 0.22 part of sucrose fatty acid ester (HLB 5), 0.02 part of baking soda and 0.15 part of sodium metaphosphate, 0.005 part of xanthan gum, and 0.005 part of guar gum into 49.85 parts of water. After the abovementioned oil phase and aqueous phase were pre-emulsified by stirring with a Homomixer at 70 °C for 15 minutes, a sterilization treatment was carried out by the direct heating method at 144 °C for 4 seconds using an ultrahigh temperature sterilization apparatus (manufactured by Iwai Kikai Kogyo Co., Ltd.), after which homogenization was effected at a homogenization pressure of 30 kg/cm², followed by immediate cooling to 5 °C. After cooling, this was aged for 24 hours to give a whipped cream. When this whipped cream was evaluated according to the abovementioned methods, emulsion stability was good, and workability, foamability and external appearance during whipping were excellent. It had good meltability in the mouth, milk taste, and the texture being somewhat close to that of milk fat while eating.

Example 24

To 5 parts of ester-exchanged Fat A-1, 5 parts of palm kernel oil, 15 parts of hardened palm kernel oil (melting point 36 °C) and 20 parts of butter oil are added and mixed

0.25 part of lecithin, and the mixture is melted to give an oil phase. Separately, an aqueous phase is prepared by dissolving 4.5 parts of defatted milk powder, 0.22 part of sucrose fatty acid ester (HLB 5), 0.02 part of baking soda and 0.15 part of sodium metaphosphate, 0.005 part of xanthan gum, and 0.005 part of guar gum into 49.85 parts of water. After the abovementioned oil phase and aqueous phase were pre-emulsified by stirring with a Homomixer at 70 °C for 15 minutes, a sterilization treatment was carried out by the direct heating method at 144 °C for 4 seconds using an ultrahigh temperature sterilization apparatus (manufactured by Iwai Kikai Kogyo Co., Ltd.), after which homogenization was effected at a homogenization pressure of 30 kg/cm², followed by immediate cooling to 5 °C. After cooling, this was aged for 24 hours to give a whipped cream. When this whipped cream was evaluated according to the abovementioned methods, emulsion stability was good, and workability, foamability and external appearance during whipping were excellent. It had good meltability in the mouth, somewhat strong milk taste, and the texture being close to that of milk fat while eating.

The formulations and evaluations of Examples 21 to 24 were summarized in Table 6.

[Table 6]

	Example 21	Example 22	Example 23	Example 24
<u>Oil phase</u>				
Ester-exchanged fat A-1 from a palm-type fat and a lauric-type fat	—	10	10	5
Ester-exchanged fat A-2 from a palm-type fat and a lauric-type fat	30	—	—	—
Palm kernel oil	15	10	10	5
Hardened palm kernel oil (m.p. 34 °C)	—	—	—	—
Hardened palm kernel oil (m.p. 36 °C)	—	15	10	15
Hardened palm kernel oil (m.p. 38 °C)	—	—	—	—
Coconut oil	—	—	—	—
Hardened soybean and palm mixed oil (m.p. 31 °C)	—	—	—	—
Hardened rapeseed and palm mixed oil (m.p. 31 °C)	—	—	—	—
Butter oil	—	10	15	20
Lecithin	0.25	0.25	0.25	0.25
Glyceryl fatty acid ester	—	—	—	—
Content of fat composition for cream	45	35	30	25
Fat A / (fat A + lauric-type fat)	0.7	0.3	0.3	0.2
Trans-unsaturated fatty acid content	2%	2%	2%	3%
<u>Aqueous phase</u>				
Water	48.89	49.85	49.85	49.85
Defatted milk powder	5.5	4.5	4.5	4.5
Sucrose fatty acid ester (HLB 5)	0.22	0.22	0.22	0.22
Baking soda	0.02	0.02	0.02	0.02
Sodium citrate	0.12	—	—	—
Sodium metaphosphate	—	0.15	0.15	0.15
Xanthan gum	—	0.005	0.005	0.005
Guar gum	—	0.005	0.005	0.005
<u>Whipped cream</u>				
Oil content	45.3	45.3	45.3	45.3
Non-fat milk solids content	5.4	4.5	4.5	4.5
Total solids content	51.1	50.2	50.2	50.2
Viscosity (cP)	350	250	200	180
"Bote" time (min:sec)	1:20	4:30	4:30	4:00
Whipping time (min:sec)	3:15	2:30	3:00	3:20
Overrun (%)	90	110	105	110
After 1 day at 5 °C				
Shape retention	5	5	5	5
Water separation	5	5	5	5
After 1 day at 20 °C				
Shape retention	5	5	5	5
Water separation	5	4	4	4
Meltability in the mouth	3	3	3	4
Milk taste	5	3	3	4
Texture	3	1	2	3

Example 25

To 5 parts of ester-exchanged Fat A-1, 10 parts of hardened palm kernel oil (melting point 38 °C) and 30 parts of butter oil are added and mixed 0.25 part of lecithin, and the mixture is melted to give an oil phase. Separately, an aqueous phase is prepared by dissolving 4.5 parts of defatted milk powder, 0.22 part of sucrose fatty acid ester (HLB 5), 0.02 part of baking soda, 0.15 part of sodium metaphosphate, 0.005 part of xanthan gum, and 0.005 part of guar gum into 49.85 parts of water. After the abovementioned oil phase and aqueous phase were pre-emulsified by stirring with a Homomixer at 70 °C for 15 minutes, a sterilization treatment was carried out by the direct heating method at 144 °C for 4 seconds using an ultrahigh temperature sterilization apparatus (manufactured by Iwai Kikai Kogyo Co., Ltd.), after which homogenization was effected at a homogenization pressure of 30 kg/cm², followed by immediate cooling to 5 °C. After cooling, this was aged for 24 hours to give a whipped cream. When this whipped cream was evaluated according to the abovementioned methods, emulsion stability was good, and workability, foamability and external appearance during whipping were excellent. It had good meltability in the mouth, strong milk taste, and the texture being close to that of milk fat while eating.

The formulation and evaluations of Example 25 were

summarized in Table 7.

[Table 7]

	Example 25
<u>Oil phase</u>	
Ester-exchanged fat A-1 from a palm-type fat and a lauric-type fat	5
Ester-exchanged fat A-2 from a palm-type fat and a lauric-type fat	—
Palm kernel oil	—
Hardened palm kernel oil (m.p. 34 °C)	—
Hardened palm kernel oil (m.p. 36 °C)	—
Hardened palm kernel oil (m.p. 38 °C)	10
Coconut oil	—
Hardened soybean and palm mixed oil (m.p. 31 °C)	—
Hardened rapeseed and palm mixed oil (m.p. 31 °C)	—
Butter oil	30
Lecithin	0.25
Glyceryl fatty acid ester	—
Content of fat composition for cream	15
Fat A / (fat A + lauric-type fat)	0.3
Trans-unsaturated fatty acid content	<1%
<u>Aqueous phase</u>	
Water	49.85
Defatted milk powder	4.5
Sucrose fatty acid ester (HLB 5)	0.22
Baking soda	0.02
Sodium citrate	—
Sodium metaphosphate	0.15
Xanthan gum	0.005
Guar gum	0.005
<u>Whipped cream</u>	
Oil content	45.3
Non-fat milk solids content	4.5
Total solids content	50.2
Viscosity (cP)	220
"Bote" time (min:sec)	3:00
Whipping time (min:sec)	3:05
Overrun (%)	100
After 1 day at 5 °C	
Shape retention	5
Water separation	5
After 1 day at 20 °C	
Shape retention	5
Water separation	4
Meltability in the mouth	4
Milk taste	5
Texture	3

Comparative Example 1

To 8 parts of ester-exchanged Fat A-1 and 4 parts of hardened palm kernel oil (melting point 38 °C) are added and mixed 0.25 part of lecithin and 0.16 part of glyceryl fatty acid ester, and the mixture is melted to give an oil phase. Separately, an aqueous phase is prepared by dissolving 4.5 parts of defatted milk powder, 0.12 part of sucrose fatty acid ester (HLB 5), 0.02 part of baking soda, 0.15 part of sodium metaphosphate, 0.2 part of xanthan gum, and 0.2 part of guar gum into 82.4 parts of water. After the abovementioned oil phase and aqueous phase were pre-emulsified by stirring with a Homomixer at 70 °C for 15 minutes, a sterilization treatment was carried out by the direct heating method at 144 °C for 4 seconds using an ultrahigh temperature sterilization apparatus (manufactured by Iwai Kikai Kogyo Co., Ltd.), after which homogenization was effected at a homogenization pressure of 30 kg/cm², followed by immediate cooling to 5 °C. After cooling, this was aged for 24 hours to give a whipped cream. When this whipped cream was evaluated according to the abovementioned methods, emulsion stability was good, but it could not be whipped.

Comparative Example 2

To 20 parts of ester-exchanged Fat A-1 and 5 parts of hardened palm kernel oil (melting point 38 °C) are added

and mixed 0.25 part of lecithin and 0.15 part of glyceryl fatty acid ester, and the mixture is melted to give an oil phase. Separately, an aqueous phase is prepared by dissolving 1 part of defatted milk powder, 0.22 part of sucrose fatty acid ester (HLB 5), 0.02 part of baking soda, 0.15 part of sodium metaphosphate, 0.1 part of xanthan gum, and 0.1 part of guar gum into 73.01 parts of water. After the abovementioned oil phase and aqueous phase were pre-emulsified by stirring with a Homomixer at 70 °C for 15 minutes, a sterilization treatment was carried out by the direct heating method at 144 °C for 4 seconds using an ultrahigh temperature sterilization apparatus (manufactured by Iwai Kikai Kogyo Co., Ltd.), after which homogenization was effected at a homogenization pressure of 30 kg/cm², followed by immediate cooling to 5 °C. After cooling, this was aged for 24 hours to give a whipped cream. However, oil separation occurred after aging.

Comparative Example 3

To 20 parts of ester-exchanged Fat A-1 and 5 parts of hardened palm kernel oil (melting point 38 °C) are added and mixed 0.25 part of lecithin and 0.15 part of glyceryl fatty acid ester, and the mixture is melted to give an oil phase. Separately, an aqueous phase is prepared by dissolving 16 part defatted milk powder, 0.22 part of sucrose fatty acid ester (HLB 5), 0.02 part of baking soda,

0.15 part of sodium metaphosphate, 0.1 part of xanthan gum, and 0.1 part of guar gum into 58.01 parts of water. After the abovementioned oil phase and aqueous phase were pre-emulsified by stirring with a Homomixer at 70 °C for 15 minutes, a sterilization treatment was carried out by the direct heating method at 144 °C for 4 seconds using an ultrahigh temperature sterilization apparatus (manufactured by Iwai Kikai Kogyo Co., Ltd.), after which homogenization was effected at a homogenization pressure of 30 kg/cm², followed by immediate cooling to 5 °C. After cooling, this was aged for 24 hours to give a whipped cream. When this whipped cream was evaluated according to the abovementioned methods, the viscosity was high, "bote" time was short, and workability during whipping was poor as it readily became stiff. During eating, there was a powdery and poor meltability in the mouth, but the milk taste was strong. The texture was somewhat close to that of milk fat.

Comparative Example 4

To 20 parts of palm kernel oil and 10 parts of hardened palm kernel oil (melting point 38 °C) are added and mixed 0.25 part of lecithin and 0.15 part of glyceryl fatty acid ester, and the mixture is melted to give an oil phase. Separately, an aqueous phase is prepared by dissolving 4.5 parts of defatted milk powder, 0.22 part of sucrose fatty acid ester (HLB 5), 0.02 part of baking soda,

0.15 part of sodium metaphosphate, 0.01 part of xanthan gum, and 0.01 part of guar gum into 64.69 parts of water. After the abovementioned oil phase and aqueous phase were pre-emulsified by stirring with a Homomixer at 70 °C for 15 minutes, a sterilization treatment was carried out by the direct heating method at 144 °C for 4 seconds using an ultrahigh temperature sterilization apparatus (manufactured by Iwai Kikai Kogyo Co., Ltd.), after which homogenization was effected at a homogenization pressure of 30 kg/cm², followed by immediate cooling to 5 °C. After cooling, this was aged for 24 hours to give a whipped cream. When this whipped cream was evaluated according to the abovementioned methods, emulsion stability was good, and workability, foamability and external appearance during whipping were excellent, but it had scarce resistance to heat and shape retention at 20 °C. While it had good meltability in the mouth, the milk taste was weak, and the texture was not close to that of milk fat, while eating.

The formulations and evaluations of Comparative Examples 1 to 4 were summarized in Table 8.

[Table 8]

	Compara tive Example 1	Compara tive Example 2	Compara tive Example 3	Compara tive Example 4
<u>Oil phase</u>				
Ester-exchanged fat A-1 from a palm-type fat and a lauric-type fat	8	20	20	—
Ester-exchanged fat A-2 from a palm-type fat and a lauric-type fat	—	—	—	—
Palm kernel oil	—	—	—	20
Hardened palm kernel oil (m.p. 34 °C)	—	—	—	—
Hardened palm kernel oil (m.p. 36 °C)	—	—	—	—
Hardened palm kernel oil (m.p. 38 °C)	4	5	5	10
Coconut oil	—	—	—	—
Hardened soybean and palm mixed oil (m.p. 31 °C)	—	—	—	—
Hardened rapeseed and palm mixed oil (m.p. 31 °C)	—	—	—	—
Butter oil	—	—	—	—
Lecithin	0.25	0.25	0.25	0.25
Glyceryl fatty acid ester	0.16	0.15	0.15	0.15
Content of fat composition for cream	12	25	25	30
Fat A / (fat A + lauric-type fat)	0.7	0.8	0.8	—
Trans-unsaturated fatty acid content	<1%	<1%	<1%	<1%
<u>Aqueous phase</u>				
Water	82.4	73.01	58.01	64.69
Defatted milk powder	4.5	1	16	4.5
Sucrose fatty acid ester (HLB 5)	0.12	0.22	0.22	0.22
Baking soda	0.02	0.02	0.02	0.02
Sodium citrate	—	—	—	—
Sodium metaphosphate	0.15	0.15	0.15	0.15
Xanthan gum	0.2	0.1	0.1	0.01
Guar gum	0.2	0.1	0.1	0.01
<u>Whipped cream</u>				
Oil content	12.4	25.4	25.4	30.4
Non-fat milk solids content	4.5	1.0	15.8	4.5
Total solids content	17.6	27.0	42.0	35.3
Viscosity (cP)	40	—	500	150
"Bote" time (min:sec)	≥5:00	separated	0:10	≥5:00
Whipping time (min:sec)	not whipped	—	2:10	4:00
Overrun (%)	—	—	90	130
After 1 day at 5 °C	—	—	—	—
Shape retention	—	—	5	3
Water separation	—	—	5	4
After 1 day at 20 °C	—	—	—	—
Shape retention	—	—	2	2
Water separation	—	—	2	1
Meltability in the mouth	—	—	1	5
Milk taste	—	—	5	1
Texture	—	—	2	1

Comparative Example 5

To 10 parts of hardened palm kernel oil (melting point 38 °C) and 20 parts of coconut oil are added and mixed 0.25 part of lecithin and 0.15 part of glyceryl fatty acid ester, and the mixture is melted to give an oil phase. Separately, an aqueous phase is prepared by dissolving 4.5 parts of defatted milk powder, 0.22 part of sucrose fatty acid ester (HLB 5), 0.02 part of baking soda, 0.15 part of sodium metaphosphate, 0.01 part of xanthan gum, and 0.01 part of guar gum into 64.69 parts of water. After the abovementioned oil phase and aqueous phase were pre-emulsified by stirring with a Homomixer at 70 °C for 15 minutes, a sterilization treatment was carried out by the direct heating method at 144 °C for 4 seconds using an ultrahigh temperature sterilization apparatus (manufactured by Iwai Kikai Kogyo Co., Ltd.), after which homogenization was effected at a homogenization pressure of 30 kg/cm², followed by immediate cooling to 5 °C. After cooling, this was aged for 24 hours to give a whipped cream. When this whipped cream was evaluated according to the abovementioned methods, emulsion stability was good, and workability, foamability and external appearance during whipping were excellent, but it had scarce resistance to heat and shape retention at 20 °C. While it had good meltability in the mouth, the milk taste was weak, and the texture was not

close to that of milk fat, while eating.

Comparative Example 6

To 35 parts of ester-exchanged Fat A-1 is added and mixed 0.25 part of lecithin and 0.05 part of glyceryl fatty acid ester, and the mixture is melted to give an oil phase. Separately, an aqueous phase is prepared by dissolving 4.5 parts of defatted milk powder, 0.22 part of sucrose fatty acid ester (HLB 5), 0.02 part of baking soda, 0.15 part of sodium metaphosphate, 0.01 part of xanthan gum, and 0.01 part of guar gum into 59.79 parts of water. After the abovementioned oil phase and aqueous phase were pre-emulsified by stirring with a Homomixer at 70 °C for 15 minutes, a sterilization treatment was carried out by the direct heating method at 144 °C for 4 seconds using an ultrahigh temperature sterilization apparatus (manufactured by Iwai Kikai Kogyo Co., Ltd.), after which homogenization was effected at a homogenization pressure of 30 kg/cm², followed by immediate cooling to 5 °C. After cooling, this was aged for 24 hours to give a whipped cream. When this whipped cream was evaluated according to the abovementioned methods, the viscosity was high, "bote" time was short, and during whipping it readily became stiff. During eating, there was a good meltability in the mouth, somewhat strong milk taste, and the texture being somewhat close to that of milk fat.

Comparative Example 7

To 40 parts of ester-exchanged Fat A-1 is added and mixed 0.25 part of lecithin and 0.05 part of glyceryl fatty acid ester, and the mixture is melted to give an oil phase.

5 Separately, an aqueous phase is prepared by dissolving 4.5 parts of defatted milk powder, 0.22 part of sucrose fatty acid ester (HLB 5), 0.02 part of baking soda and 0.12 part of sodium citrate into 54.84 parts of water. After the abovementioned oil phase and aqueous phase were pre-
10 emulsified by stirring with a Homomixer at 70 °C for 15 minutes, a sterilization treatment was carried out by the direct heating method at 144 °C for 4 seconds using an ultrahigh temperature sterilization apparatus (manufactured by Iwai Kikai Kogyo Co., Ltd.), after which homogenization
15 was effected at a homogenization pressure of 30 kg/cm², followed by immediate cooling to 5 °C. After cooling, this was aged for 24 hours to give a whipped cream. When this whipped cream was evaluated according to the abovementioned methods, the viscosity was high, "bote" time was short, and
20 during whipping it readily became stiff. During eating, there was a good meltability in the mouth, somewhat strong milk taste, and the texture being somewhat close to that of milk fat.

Comparative Example 8

25 To 45 parts of ester-exchanged Fat A-1 is added and

mixed 0.25 part of lecithin, and the mixture is melted to give an oil phase. Separately, an aqueous phase is prepared by dissolving 4.5 parts of defatted milk powder, 0.22 part of sucrose fatty acid ester (HLB 5), 0.02 part of baking soda and 0.12 part of sodium citrate into 49.89 parts of water. After the abovementioned oil phase and aqueous phase were pre-emulsified by stirring with a Homomixer at 70 °C for 15 minutes, a sterilization treatment was carried out by the direct heating method at 144 °C for 4 seconds using an ultrahigh temperature sterilization apparatus (manufactured by Iwai Kikai Kogyo Co., Ltd.), after which homogenization was effected at a homogenization pressure of 30 kg/cm², followed by immediate cooling to 5 °C. After cooling, this was aged for 24 hours to give a whipped cream. When this whipped cream was evaluated according to the abovementioned methods, the viscosity was quite high, "bote" time was short, and during whipping it somewhat readily became stiff. It had poor meltability in the mouth, but a somewhat strong milk taste while eating. The texture was stiff, and not close to that of milk fat.

The formulations and evaluations of Comparative Examples 5 to 8 were summarized in Table 9.

[Table 9]

	Compara tive Example 5	Compara tive Example 6	Compara tive Example 7	Compara tive Example 8
<u>Oil phase</u>				
Ester-exchanged fat A-1 from a palm-type fat and a lauric-type fat	—	35	40	45
Ester-exchanged fat A-2 from a palm-type fat and a lauric-type fat	—	—	—	—
Palm kernel oil	—	—	—	—
Hardened palm kernel oil (m.p. 34 °C)	—	—	—	—
Hardened palm kernel oil (m.p. 36 °C)	—	—	—	—
Hardened palm kernel oil (m.p. 38 °C)	10	—	—	—
Coconut oil	20	—	—	—
Hardened soybean and palm mixed oil (m.p. 31 °C)	—	—	—	—
Hardened rapeseed and palm mixed oil (m.p. 31 °C)	—	—	—	—
Butter oil	—	—	—	—
Lecithin	0.25	0.25	0.25	0.25
Glyceryl fatty acid ester	0.15	0.05	0.05	—
Content of fat composition for cream	30	35	40	45
Fat A / (fat A + lauric-type fat)	—	1.0	1.0	1.0
Trans-unsaturated fatty acid content	<1%	<1%	<1%	<1%
<u>Aqueous phase</u>				
Water	64.69	59.79	54.84	49.89
Defatted milk powder	4.5	4.5	4.5	4.5
Sucrose fatty acid ester (HLB 5)	0.22	0.22	0.22	0.22
Baking soda	0.02	0.02	0.02	0.02
Sodium citrate	—	—	0.12	0.12
Sodium metaphosphate	0.15	0.15	—	—
Xanthan gum	0.01	0.01	—	—
Guar gum	0.01	0.01	—	—
<u>Whipped cream</u>				
Oil content	30.4	35.3	40.3	45.3
Non-fat milk solids content	4.5	4.5	4.5	4.5
Total solids content	35.3	40.2	45.2	50.1
Viscosity (cP)	160	300	500	1500
"Bote" time (min:sec)	≥5:00	0:45	0:20	0:10
Whipping time (min:sec)	3:40	2:00	2:20	1:40
Overrun (%)	110	105	100	96
After 1 day at 5 °C				
Shape retention	4	5	5	5
Water separation	4	5	5	5
After 1 day at 20 °C				
Shape retention	1	4	5	5
Water separation	1	3	4	5
Meltability in the mouth	5	3	3	2
Milk taste	1	4	4	4
Texture	1	2	2	1

Comparative Example 9

To 10 parts of ester-exchanged Fat A-1, 15 parts of palm kernel oil, 5 parts of hardened palm kernel oil (melting point 34 °C) and 20 parts of butter oil are added and mixed 0.25 part of lecithin, and the mixture is melted to give an oil phase. Separately, an aqueous phase is prepared by dissolving 4.5 parts of defatted milk powder, 0.22 part of sucrose fatty acid ester (HLB 5), 0.02 part of baking soda and 0.15 part of sodium metaphosphate into 44.86 parts of water. After the abovementioned oil phase and aqueous phase were pre-emulsified by stirring with a Homomixer at 70 °C for 15 minutes, a sterilization treatment was carried out by the direct heating method at 144 °C for 4 seconds using an ultrahigh temperature sterilization apparatus (manufactured by Iwai Kikai Kogyo Co., Ltd.), after which homogenization was effected at a homogenization pressure of 30 kg/cm², followed by immediate cooling to 5 °C. When it was aged for 24 hours after cooling, the cream was solidified.

Comparative Example 10

To 45 parts of hardened soybean and palm mixed oil (melting point 31 °C) is added and mixed 0.25 part of lecithin, and the mixture is melted to give an oil phase. Separately, an aqueous phase is prepared by dissolving 5.5 parts of defatted milk powder, 0.22 part of sucrose fatty

acid ester (HLB 5), 0.02 part of baking soda and 0.12 part of sodium citrate into 48.89 parts of water. After the abovementioned oil phase and aqueous phase were pre-emulsified by stirring with a Homomixer at 70 °C for 15 minutes, a sterilization treatment was carried out by the direct heating method at 144 °C for 4 seconds using an ultrahigh temperature sterilization apparatus (manufactured by Iwai Kikai Kogyo Co., Ltd.), after which homogenization was effected at a homogenization pressure of 30 kg/cm², followed by immediate cooling to 5 °C. After cooling, this was aged for 24 hours to give a whipped cream. When this whipped cream was evaluated according to the abovementioned methods, emulsion stability was good, and workability, foamability and external appearance during whipping were excellent. It had good meltability in the mouth, somewhat strong milk taste and the texture being close to that of milk fat while eating. Analysis of the quantity of trans-unsaturated fatty acid in the fat showed 26%.

Comparative Example 11

To 45 parts of hardened rapeseed and palm mixed oil (melting point 31 °C) is added and mixed 0.25 part of lecithin, and the mixture is melted to give an oil phase. Separately, an aqueous phase is prepared by dissolving 5.5 parts of defatted milk powder, 0.22 part of sucrose fatty acid ester (HLB 5), 0.02 part of baking soda and 0.12 part

of sodium citrate into 48.89 parts of water. After the abovementioned oil phase and aqueous phase were pre-emulsified by stirring with a Homomixer at 70 °C for 15 minutes, a sterilization treatment was carried out by the direct heating method at 144 °C for 4 seconds using an ultrahigh temperature sterilization apparatus (manufactured by Iwai Kikai Kogyo Co., Ltd.), after which homogenization was effected at a homogenization pressure of 30 kg/cm², followed by immediate cooling to 5 °C. After cooling, this was aged for 24 hours to give a whipped cream. When this whipped cream was evaluated according to the abovementioned methods, emulsion stability was good, and workability, foamability and external appearance during whipping were excellent. It had good meltability in the mouth, somewhat strong milk taste and the texture being close to that of milk fat while eating. Analysis of the quantity of trans-unsaturated fatty acid in the fat showed 26%.

Comparative Example 12

To 45 parts of butter oil is added and mixed 0.25 part of lecithin, and the mixture is melted to give an oil phase. Separately, an aqueous phase is prepared by dissolving 5.5 parts of defatted milk powder, 0.22 part of sucrose fatty acid ester (HLB 5), 0.02 part of baking soda and 0.12 part of sodium metaphosphate into 48.89 parts of water. After the abovementioned oil phase and aqueous phase were pre-

emulsified by stirring with a Homomixer at 70 °C for 15 minutes, a sterilization treatment was carried out by the direct heating method at 144 °C for 4 seconds using an ultrahigh temperature sterilization apparatus (manufactured by Iwai Kikai Kogyo co., Ltd.), after which homogenization was effected at a homogenization pressure of 30 kg/cm², followed by immediate cooling to 5 °C. After cooling, this was aged for 24 hours to give a whipped cream. When this whipped cream was evaluated according to the abovementioned methods, the viscosity was somewhat high, "bote" time was short, and it somewhat readily became stiff and workability had poor during whipping. It had good meltability in the mouth, strong milk taste and the texture being close to that of milk fat while eating. Analysis of the quantity of trans-unsaturated fatty acid in the fat showed 5 %.

The formulations and evaluations of Comparative Examples 9 to 12 were summarized in Table 10.

[Table 10]

	Compara tive Example 9	Compara tive Example 10	Compara tive Example 11	Compara tive Example 12
<u>Oil phase</u>				
Ester-exchanged fat A-1 from a palm-type fat and a lauric-type fat	10	—	—	—
Ester-exchanged fat A-2 from a palm-type fat and a lauric-type fat	—	—	—	—
Palm kernel oil	15	—	—	—
Hardened palm kernel oil (m.p. 34 °C)	5	—	—	—
Hardened palm kernel oil (m.p. 36 °C)	—	—	—	—
Hardened palm kernel oil (m.p. 38 °C)	—	—	—	—
Coconut oil	—	—	—	—
Hardened soybean and palm mixed oil (m.p. 31 °C)	—	45	—	—
Hardened rapeseed and palm mixed oil (m.p. 31 °C)	—	—	45	—
Butter oil	20	—	—	45
Lecithin	0.25	0.25	0.25	0.25
Glyceryl fatty acid ester	—	—	—	—
Content of fat composition for cream	30	—	—	—
Fat A / (fat A + lauric-type fat)	0.3	—	—	—
Trans-unsaturated fatty acid content	2%	26%	26%	—
<u>Aqueous phase</u>				
Water	44.86	48.89	48.89	48.89
Defatted milk powder	4.5	5.5	5.5	5.5
Sucrose fatty acid ester (HLB 5)	0.22	0.22	0.22	0.22
Baking soda	0.02	0.02	0.02	0.02
Sodium citrate	—	0.12	0.12	0.12
Sodium metaphosphate	0.15	—	—	—
Xanthan gum	—	—	—	—
Guar gum	—	—	—	—
<u>Whipped cream</u>				
Oil content	50.3	45.3	45.3	45.3
Non-fat milk solids content	4.5	5.4	5.4	5.4
Total solids content	55.1	51.1	51.1	51.1
Viscosity (cP)		250	250	300
"Bote" time (min:sec)	solidi fied	1:15	1:00	0:40
Whipping time (min:sec)	—	3:00	3:10	1:00
Overrun (%)	—	100	95	70
After 1 day at 5 °C				
Shape retention	—	5	5	5
Water separation	—	5	5	5
After 1 day at 20 °C				
Shape retention	—	5	5	3
Water separation	—	4	4	2
Meltability in the mouth	—	3	3	3
Milk taste	—	4	4	5
Texture	—	3	3	3

Industrial Applicability

The present invention relates to a whipped cream for use in the decoration of bread and cakes and the like, and a whipping cream fat composition for use as the fat
5 component of a whipping cream.

CLAIMS

1. A fat composition for a whipped cream, comprising;
a Fat A that is ester-exchanged oils from a lauric-
5 type fat and a palm-type fat, and
a lauric-type fat.

2. The fat composition for the whipped cream according
to Claim 1, wherein [the Fat A/(the Fat A + the lauric-type
10 fat] value is in the range of 0.1 to 0.95.

3. The fat composition for the whipped cream according
to Claim 1 or 2, wherein a trans-unsaturated fatty acid is
10% or less of the fatty acid component of the fat
15 composition.

4. A whipped cream, comprising;
the fat composition for the whipped cream according to
any one of Claims 1 to 3,
20 a non-fat milk solid content and
water.

5. The whipped cream according to claim 4, wherein the
fat content is in the range of 15-49 wt%.

6. The whipped cream according to claim 4, wherein the non-fat milk solid content is in the range of 2-15 wt%.

7. The whipped cream according to claim 4, wherein the
5 total solid content is in the range of 20-54 wt%.

8. The whipped cream according to claim 4, further comprising milk fat.