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(54) **Title:** FRUIT AND VEGETABLE-BASED EDIBLE PRODUCTS AND PROCESS FOR THEIR MANUFACTURE

(57) **Abstract:** Cheese-like and cold cut slice edible products comprise: a) casein; b) homogeneously dispersed fruit and/or vegetable matter; c) oil; d) starch; e) at least one emulsifier; f) seasoning; and, g) optionally, water. A process for the manufacture of the edible products is also described.

FRUIT AND VEGETABLE-BASED EDIBLE PRODUCTS AND PROCESS FOR THEIR MANUFACTURE

Field of the Invention

The present invention relates to the field of food products. Particularly, the invention relates to a firm cheese-like or cold cut slice edible product based mostly on casein, vegetable oil and fruit/vegetable matter.

Background of the Invention

Various types of cheeses are produced and consumed world wide. In general, the consumption of milk products, including cheeses has been rising steadily over the past few years due to published scientific results relating to the unhealthy effects meat products have on the human body. Consequently, people have been turning to milk products as an alternative, healthier, source of protein. In addition, milk products contain a high percentage of calcium necessary for the development and preservation of bones.

Various types of firm cheeses (sometimes also referred to as "semifirm" cheeses) are commonly used, their main advantage being their long shelf life and the percentage of calcium in them. Cheddar, the most popular aged firm cheese in the USA, is just one of many firm aged cheeses. Firm cheeses

are popular for cooking food such as macaroni & cheese, fondue, French onion soup, and of course pizza, and for eating with crisp apples and pears. Because cheeses dehydrate as they age, firm cheeses are more concentrated sources of calcium than softer ones.

However, many scientific studies have shown that while there are many healthy factors in firm cheese, the amount of cholesterol in them may be problematic for many people. Therefore, patients suffering from, or in high risk of suffering from, cardiovascular conditions, will be advised by their physicians to lower their intake of cholesterol, hence such people must refrain from eating firm cheeses.

In order to solve the high cholesterol problem of firm cheese, such cheese may be manufactured by replacing the animal fat present in milk with healthier vegetable oils. Such cheeses could have a comparatively low percentage of fat and furthermore, they contain no cholesterol.

Nevertheless, as consumers are more and more interested in healthy diets, it would be highly desirable to increase the nutrient value of firm cheeses containing low percentages of fat and no cholesterol even further.

Other widely consumed products are cold cut slices. However, such products are not suitable for various diets.

Fruits and vegetables are known to be a very good source for many nutrients essential for a healthy diet. A medium ripe tomato, for example, has a mere 25 calories, but provides a good dose of both vitamin A and C and nutritional fibers. Moreover, tomatoes contain lycopene - a powerful antioxidant compound with cancer protecting benefits. However, many people, especially children have a very low intake of fruits and vegetables in their diet. For example, most children will eat a cheese or pastrami sandwich, though will refrain from eating it if it contains slices of vegetables such as tomatoes. Adding slices of tomatoes to sandwiches causes the sandwich to be soggy, and therefore unappealing. Attempts to add pieces of vegetables, such as tomato and olives to firm cheeses have been made. However, the result is a low amount of beneficial materials in the cheese, coupled with an uneven and unattractive appearance of the cheese. The presence of pieces of vegetable within the firm cheese also results in a non-uniform taste. A similar situation exists with respect to cold cut slices, which do not incorporate vegetables well, resulting in a non-homogeneous product. Therefore, such attempts have not attained noticeable commercial success.

It would therefore be highly desirable to be able to produce firm cheese-like and/or cold cut slice edible products comprising a low percentage of fat, no

cholesterol, and large percentages of nutrients derived from fruit and/or vegetables.

Furthermore, it would be highly desirable to produce firm cheese-like and cold cut slice edible products which would be not only nutritious, but also appealing, especially to children, thereby enabling mothers to provide their children with a healthy diet of food the children enjoy eating. Additional attractive factors are the red color, when tomato is employed, as well as the pizza-like combination of cheese and tomato.

It is an object of the present invention to provide firm cheese-like and cold cut slice edible products having a low percentage of fat, no cholesterol, and a high percentage of the nutrients existing in fruits and vegetables.

It is another object of the present invention to provide a process by which such cheese-like and cold cut slice edible products can be manufactured.

Further purposes and advantages of this invention will appear as the description proceeds.

Summary of the Invention

In one aspect the invention is directed to a firm cheese substitute consisting of a cheese-like edible product comprising:

a. casein;

b. homogeneously dispersed fruit and/or vegetable matter;

c. oil;

d. starch;

e. at least one emulsifier;

f. seasoning;

g. optionally, water.

According to a preferred embodiment of the invention the vegetable matter is selected from the group consisting of:

a. Ordinary tomato concentrate;

b. High Brix(50-65) Tomato concentrate;

c. Tomato juice;

d. Pizza flavoured and spiced tomato sauce; and

e. Ketchup flavoured and spiced tomato sauce.

According to another preferred embodiment of the invention the vegetable matter is selected from:

a. Orange juice or concentrate;

b. Grapefruit juice or concentrate;

c. Apple juice or concentrate.

In a preferred embodiment of the invention the firm cheese substitute of claim 4, comprises:

a) 1% to 15%, preferably 4% to 8%, of tomato concentrate; and

b) 1% to 5%, preferably 2% to 4%, of apple concentrate.

More preferably, but non-limitatively, the tomato concentrate is High Brix (60) tomato concentrate and the apple concentrate is 70 Brix apple concentrate.

In another aspect the invention is directed to a cold cut slice edible product comprising:

a. casein;

b. homogeneously dispersed fruit and/or vegetable matter;

c. oil;

d. starch;

e. at least one emulsifier;

f. seasoning;

g. optionally, water.

The difference between a cheese-like product and a cold cut slice product lies essentially in the seasoning added to the product. The skilled person will easily select a seasoning more in tune with cold cut slice products or with cheese-substitute products, as the case may be.

In a further aspect the invention is directed to a process for the manufacture of a firm cheese substitute and/or of a cold cut slice product, comprising the steps of:

a. preparing a mixture comprising casein; homogeneously dispersed fruit and/or vegetable matter; oil; starch; at least one emulsifier; seasoning and, optionally, water;
b. pasteurizing said mixture with mixing at approximately 85^{0}C;
c. cooling said mixture.

According to a preferred embodiment of the invention the vegetable matter is derived from tomato. In an illustrative preferred process the mixture comprises about 20% casein, about 5% to about 20% vegetable oil, about 5% corn starch, about 1% salt, about 1% emulsifiers, about 3% flavoring additives, about 45% tomato juice.

The tomato juice can be replaced by various concentrations of tomato concentrate and water and the amount of tomato solids can be increased by various concentrations of tomato concentrates. Thus, for instance, according to yet another preferred embodiment of the invention the vegetable matter is derived from tomato. In an illustrative preferred process the mixture comprises about 20% casein, about 5% to about 20% vegetable oil, about 5% corn starch, about 1% salt, about 1% emulsifiers, about 3% flavoring

additives, about 35% to about 42% water, about 5% to about 10% of a 28/30 Brix concentrate and about 3% to about 10% of a 60 Brix concentrate.

All the above and other characteristics and advantages of the invention will be further understood through the following illustrative and non-limitative description of preferred embodiments thereof.

Brief description of drawings

Fig. 1 shows a flowchart describing the process for producing the edible products according to the present invention.

Detailed Description of Preferred Embodiments

The present invention relates to a firm cheese-like edible product that has a low percentage of fat and no cholesterol in addition to many of the nutrients present in fruits and vegetables. Throughout the following description, whenever reference is made to "cheese", "cheese substitute" or "cheese alternative", unless otherwise stated it is meant to refer to the firm cheese-like edible products of the invention.

Firm cheeses substitutes of the prior art, with a low percentage of fat and no cholesterol, are usually manufactured using approximately (as an illustrative example) 20% casein, 50% water, 9-22% vegetable oil, 5% corn starch, 1% salt, 1% emulsifiers, and 0.5% flavoring additives. The above

ingredients are mixed together, pasteurized at approximately 85°C, cooled and packaged. Optionally, before packaging, the cheese substitute may be sliced.

In order to produce the firm cheese substitute of the present invention that comprises nutrients from fruits and/or vegetables, the water referred to hereinabove is replaced by fruit and/or vegetable concentrates or juices. A particular example of a suitable vegetable concentrate is tomato and apple concentrate (the composition of which is well known to the person skilled in the art of food products and, therefore, is not discussed herein in detail, for the sake of brevity). Fig. 1 illustrates the process for producing the edible products according to the present invention.

According to a preferred embodiment, the vegetable matter used is tomato concentrate or tomato juice.

An illustrative procedure for producing a tomato juice suitable for the purposes of the present invention, includes the following steps:

1. washing the tomatoes,
2. grating the tomatoes and removing any rotten/green/foreign matter,
3. crushing the tomatoes at approximately 80-100°C, thereby to produce a tomato mash,

4. filtering the mash through a double butterfly filter, the first filter comprising holes having a diameter of 2-4 mm, and the second comprising holes having a diameter 1.5-3 mm,
5. pasteurizing;
6. packing the juice, optionally aseptically.

The tomato concentrate employed in the present invention may be either regular tomato concentrate 28-36 Brix, or High Brix(50-65) Tomato concentrate, containing mainly tomato serum. Regular tomato concentrate is used when the desired color of the cheese product produced is red, and High Brix(50-65) Tomato concentrate is used for producing yellow-orange cheese substitute.

Customary tomato concentrate may be produced, for instance, using the following steps:

1. washing the tomatoes,
2. grating the tomatoes and removing any rotten/green/foreign matter,
3. crushing the tomatoes at approximately 80-100^{0}C, thereby to produce a tomato mash,
4. filtering the mash through a double butterfly filter, the first filter comprising holes having a diameter of 2-4 mm, and the second comprising holes having a diameter 1.5-3 mm,
5. concentrating the mash to a Brix of 28-36;

6. pasteurizing; and
7. packing the concentrate, optionally aseptically.

As is well known to the skilled person, the Brix value is the value on the hydrometer scale used to measure the approximate soluble solids content of tomato juice or concentrate.

High Brix(50-65) Tomato concentrate may be produced by:

1. washing the tomatoes;
2. grating the tomatoes and removing any rotten/green/foreign matter;
3. crushing the tomatoes at approximately 40-80^{0}C, thereby producing a tomato mash;
4. filtering the mash through a sieve;
5. separing pulp from serum using a series of centrifuges and decanters;
6. concentrating the serum to a Brix of 50-65;
7. pasteurizing;
8. packing the concentrate, optionally aseptically;
9. optionally, freezing the concentrate.

According to another preferred embodiment of the invention, the fruit/vegetable matter used in the process of preparing the cheese substitute of the present invention may be seasoned with various types of seasonings, thereby producing cheeses with an assortment of flavors. For example, the

tomato concentrate may be substituted with pizza flavored and spiced tomato sauce.

As will be appreciated by the skilled person, the invention permits to incorporate nutrient materials into the cheese-like edible product, which cannot be incorporated in the course of the production of regular cheese, because its manufacturing process does not permit it. Additionally, and very surprisingly, the addition of the vegetable matter (the term "vegetable" referring to fruit as well as other vegetables), does not impair the smooth feel of the cheese. Traditionally, cheese substitutes exhibit an unpleasant off flavor. Even more surprisingly, tasting tests have shown that the addition of the vegetable matter, particularly (but not solely) the tomato and apple combination, improves the taste of the finished product. Most surprisingly, however, the cheese-like product preserves the melting properties of the firm cheese and, therefore, can be used to prepare a variety of foods that, to date, necessitated the use of the relatively unhealthy firm cheeses.

The skilled person will appreciate that the product of the invention has the added advantage that it preserves the vegetable fibers found in the juice or concentrate, e.g., in tomato or orange juice or other vegetable juices and concentrates, as well as other beneficial materials, e.g., the lycopene found in tomatoes. Another unexpected advantage of the invention is the drastic reduction of materials in the final product, due to the addition of tomato

and/or fruit material. The final content of fat in all the examples to follow was below 5% (i.e., 4.6-4.9%). It should be appreciated that regular firm cheese has a fat content of at least 9% and, therefore, this result is remarkable.

The invention will be further illustrated with reference to the following illustrative examples, which are not intended to limit the scope of the invention in any manner. All percentages used herein are by weight.

Example 1

A firm cheese substitute was manufactured using 20% casein, 20% vegetable oil, 5% corn starch, 1% salt, 1% emulsifiers, 3% flavoring additives, 45% tomato juice. The above ingredients were mixed together, pasteurized at approximately 85^{0}C and cooled to provide a solid, firm cheese-like material, with yellow-red color. The product was tested and passed the taste comparison and the melting tests.

Example 2

Using the process of Example 1, two additional cheese substitutes of increasingly darker red color were prepared, using the ingredients detailed in Table I. Both products were tested and passed the taste comparison and the melting tests.

Table I

Content	Sample # 2 % (by weight)	Sample # 3 % (by weight)	Sample # 4 %(by weight)
Caseine	20	20	20
Vegetable Oil	9	5	5
Corn starch	5	5	1
Emulsifiers and stabilizers (disodium phosphate, tri-sodium citrate, citric acid 0.5%)	1	1	1
Salt	1	1	1
Spices (pepper, onion, oregano)	3	3	3
Ordinary Tomato Concentrate 28/30 Brix	10	10	5
High Brix Tomato Concentrate 60 Brix	5	10	3
Water	46	45	42

Example 3

Using the process of Example 1, seven cheese substitutes were prepared, containing different amounts of either apple or orange concentrate, together with the tomato concentrate, and one containing orange concentrate only, as

detailed in Table II. All products were tested and passed the taste comparison and the melting tests.

Table II

Sample No.	*Tomato Concentrate 28/30 Brix (%)*	*Tomato Concentrate 60 Brix (%)*	*Apple Concentrate (%)*	*Orange Concentrate (%)*
Sample No.	*Tomato Concentrate 28/30 Brix (%)*	*Tomato Concentrate 60 Brix (%)*	*Apple Concentrate (%)*	*Orange Concentrate (%)*
1	7.4	7.4	2.85	
2	12.5	5.6	3%	
3	6	6		
4	10.9			
5	10			
6	12	5.4	3	
7	7.6	7		3
8				9.8

Example 4

Yellow Cheese Substitute

Using the process of Example 1, a yellow cheese substitute was prepared, containing different amounts of 70 Brix apple concentrate, together with High Brix (50-65) tomato concentrate. This mixture yields a product that was defined surprisingly tasty in tasting experiments, while being entirely

devoid of any unusual background taste or odor. Thus, this particularly preferred product, based on the combination of the tomato concentrate and 70 Brix apple concentrate, results in an outstanding yellow firm cheese substitute.

The amounts of High Brix (50-65) tomato concentrate used were in the range of 0.1-1.0%, with a range of 0.4-0.8 being preferred. Similarly, the range of 70 Brix apple concentrate employed was in the range of 1-5%, with a range of 2-4% being found to be the most preferred in the tasting experiments.

Example 5

Cold cut slices

Using the process of Example 1 and replacing the spices of pepper, onion and oregano with 2.5% salami seasoning obtained from Frutarom, Ltd., Israel. The resulting product is similar in taste and appearance to cold cut slices.

Although embodiments of the invention have been described by way of illustration, it will be understood that the invention may be carried out with many variations, modifications, and adaptations, without departing from its spirit or exceeding the scope of the claims.

Claims:

1. A firm cheese substitute consisting of a cheese-like edible product comprising :

    a. casein;

    b. homogeneously dispersed fruit and/or vegetable matter;

    c. oil;

    d. starch;

    e. at least one emulsifier;

    f. seasoning;

    g. optionally, water.

2. The firm cheese substitute of claim 1, wherein the vegetable matter is selected from the group consisting of:

    a. Ordinary tomato concentrate;

    b. High Brix(50-65) Tomato concentrate;

    c. Tomato juice; and

    d. Pizza flavoured and spiced tomato sauce.

3. The firm cheese substitute of claim 1, wherein the vegetable matter is selected from:

    a. Orange juice and concentrate;

    b. Grapefruit juice and concentrate;

    c. Apple juice and concentrate.

4. The firm cheese substitute of claim 4, comprising:

a) 1% to 15% tomato concentrate; and

b) 1% to 5% apple concentrate.

5. The firm cheese substitute of claim 5, comprising:

a) 4% to 8% tomato concentrate; and

b) 2% to 4% apple concentrate.

6. The firm cheese substitute of claim 4 or 5, wherein the tomato concentrate is High Brix (50-65) tomato concentrate and the apple concentrate is 70 Brix apple concentrate.

7. A firm cheese substitute according to claim 1, which is a yellow cheese substitute, containing apple concentrate, tomato concentrate.

8. The yellow firm cheese substitute of claim 7, comprising 0.1-1.0% of High Brix (50-65) tomato concentrate and 1-5% of 70 Brix apple concentrate.

9. The yellow firm cheese substitute of claim 8, comprising 0.4-0.8% of High Brix (50-65) tomato concentrate and 2-4% of 70 Brix apple concentrate.

10. A cold cut slice edible product comprising:

a. casein;

b. homogeneously dispersed fruit and/or vegetable matter;

c. oil;

d. starch;

e. at least one emulsifier;

f. seasoning;

g. optionally, water.

11. The cold cut slice edible product of claim 10, wherein the vegetable matter is selected from the group consisting of:

a. Ordinary tomato concentrate;

b. High Brix(50-65) Tomato concentrate;

c. Tomato juice; and

d. Pizza flavoured and spiced tomato sauce.

12. The cold cut slice edible product of claim 10, wherein the vegetable matter is selected from:

a. Orange juice and concentrate;

b. Grapefruit juice and concentrate;

c. Apple juice and concentrate.

13. The cold cut slice edible product of claim 12, comprising:

a) 1% to 15% tomato concentrate; and

b) 1% to 5% apple concentrate.

14. The cold cut slice edible product of claim 13, comprising:

a) 4% to 8% tomato concentrate; and

b) 2% to 4% apple concentrate.

15. The cold cut slice edible product of claim 12 or 13, wherein the tomato concentrate is High Brix (50-65) tomato concentrate and the apple concentrate is 70 Brix apple concentrate.

16. The cold cut slice edible product of claim 15, comprising 0.1-1.0% of High Brix (50-65) tomato concentrate and 1-5% of 70 Brix apple concentrate.

17. The cold cut slice edible product of claim 16, comprising 0.4-0.8% of High Brix (50-65) tomato concentrate and 2-4% of 70 Brix apple concentrate.

18. Process for the manufacture of a firm cheese substitute and/or or a cold cut slice product, comprising the steps of:

a. preparing a mixture comprising casein; homogeneously dispersed fruit and/or vegetable matter; oil; starch; at least one emulsifier; seasoning and water;

b. pasteurizing said mixture with mixing at approximately 85^{0}C;

c. cooling said mixture.

19. A process according to claim 18, wherein the vegetable matter is derived from tomato.

20. A process according to claim 18, wherein the mixture comprises about 20% casein, about 5% to about 20% vegetable oil, about 5% corn starch, about 1% salt, about 1% emulsifiers, about 3% flavoring additives, about 35% to about 45% tomato juice.

21. A firm cheese substitute, essentially as described and illustrated and with particular reference to the examples.

22. A process for manufacturing a firm cheese substitute, essentially as described and illustrated and with particular reference to the examples.

23. A cold cut slice product, essentially as described and illustrated and with particular reference to the examples.

24. A process for manufacturing a cold cut slice product, essentially as described and illustrated and with particular reference to the examples.

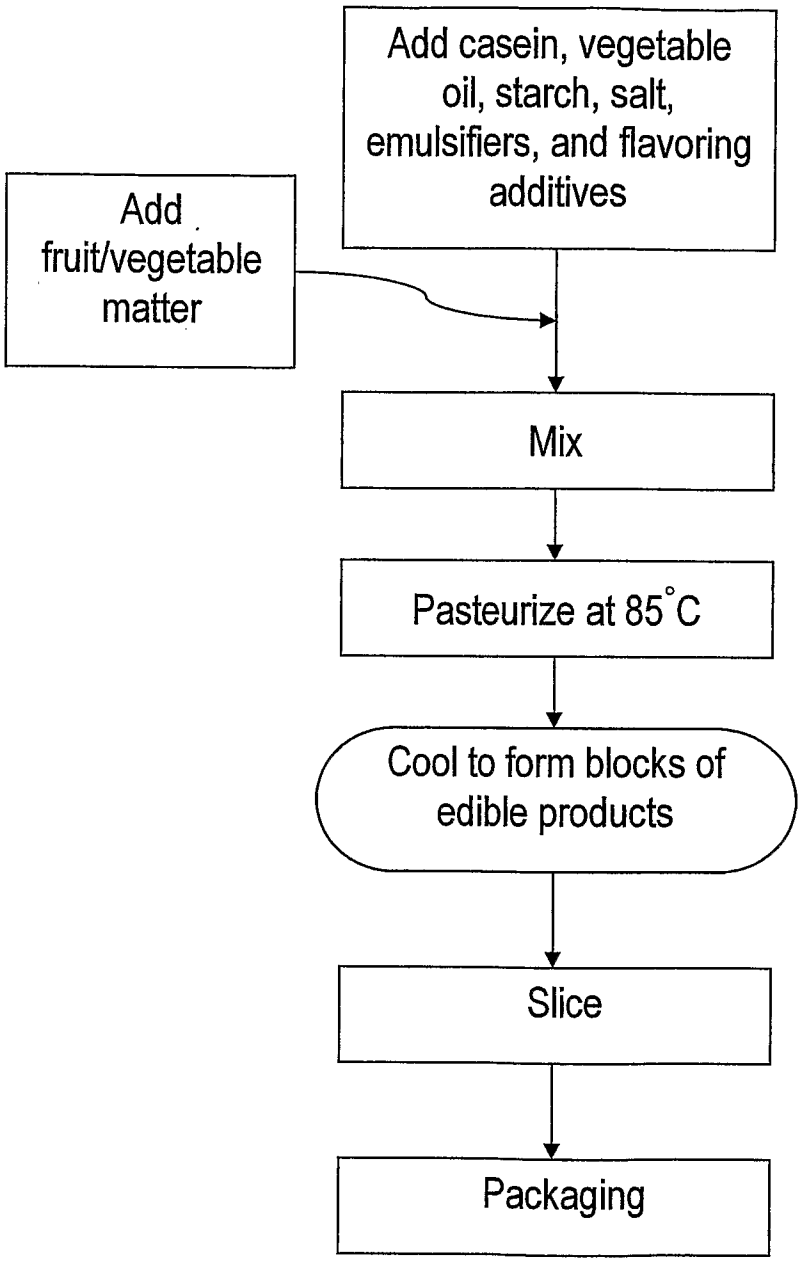

Add casein, vegetable oil, starch, salt, emulsifiers, and flavoring additives
Add fruit/vegetable matter
Mix
Pasteurize at 85°C
Cool to form blocks of edible products
Slice
Packaging

Fig. 1