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COMPLETE SPECIFICATION

Vitamin-enriched cereals and a process for the manufacture thereof.

We, HOFFMANN-LA ROCHE & Co., AKTIE-
NGESELLSCHAFT, a Swiss Company of 124-
184 Grenzacherstrasse, Basle, Switzerland,
do hereby declare the invention, for which
5 we pray that a patent may be granted to
us, and the method by which it is to be per-
formed, to be particularly described in and
by the following statement:

The present invention is concerned with
10 vitamin-enriched cereals and a process for
the manufacture thereof.

Various processes for the vitamin supple-
mentation of cereal foodstuffs, particularly
rice, are known. For the most part, however,
15 certain disadvantages have been found to
be present in the known processes. For ex-
ample, whilst a number of known processes
are relatively simple to carry out, their use-
fulness is greatly diminished by the fact
20 that the supplemental vitamins are washed
out of the final product when it is placed in
water. Certain known processes have obvi-
ated, or at least minimised, this undesir-
able feature. A majority of such processes
25 use some form of coating technique to pro-
tect the product against vitamin losses. To a
large extent, however, coating techniques
have proved to be commercially impractical
since they are time-consuming and require
30 the use of expensive apparatus. On many
occasions the cost of coating the vitamins
exceeded the value of the vitamins them-
selves.

It has now been found in accordance with
35 the present invention that improved vitamin-
enriched cereals can be manufactured by
adding to a cereal grains a vitamin supple-
ment comprising (1) a vitamin or a mixture
of vitamins and (2) a farinaceous material
40 as a carrier for said vitamins; said supple-
ment being in a form resembling a cereal
grain in size, shape and appearance.

Accordingly, in one of its aspects, the
invention is concerned with vitamin-en-
45 riched cereals which contain a vitamin sup-

plement comprising (1) a vitamin or a mix-
ture of vitamins and (2) a farinaceous mat-
erial as a carrier for said vitamins; said
supplement being in a form resembling a
cereal grain in size, shape and appearance. 50

The vitamin supplement used in this in-
vention resembles cereal grains in appear-
ance, shape and size. The vitamin supple-
ment is produced by distributing a vitamin
or a mixture of vitamins throughout a paste
55 produced by mixing water and a farinaceous
product derived, for example, from wheat or
rice. The paste-like mass is transformed, for
example, into tubular-like strings of desired
diameter or elongated strips of desired width
60 and thickness by means of conventional
equipment and apparatus (e.g. a pasta
press), following which the strings or strips
are cut to the desired length and dried. The
form in which the paste is extruded (e.g. 65
strings or strips) is adjusted so that, when
cut as to provide the final dry product, the
product resembles the cereal foodstuff which
is to be supplemented with the added vita-
mins.

In general, any vitamin can be used in
this invention. For example, one can use a
fat-soluble vitamin such as vitamin-A and
vitamin-E. If desired, a mixture of fat-sol-
75 ule vitamins can be used. When the fat-
soluble vitamins are used, they are provided
in a form in which they are readily dis-
persible in water. In the preferred embodi-
ment of the invention, however, a water-
soluble vitamin, particularly vitamin-B₁, vita-
80 min-B₂, vitamin-B₆, niacinamide or a mix-
ture thereof, is used. Furthermore, the in-
vention also includes the production of pro-
ducts which contain a mixture of one or
more fat-soluble vitamins and one or more 85
water-soluble vitamins. Moreover, the in-
vention includes products which contain
other active ingredients in addition to fat-
soluble vitamins and/or water-soluble vita-
mins. Such other active ingredients include, 90

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for example, iron and amino acids (e.g. methionine and lysine). If desired, other edible (i.e. non-toxic) adjuvants can be incorporated into the products. For example, 5 agents which enhance the heat stability of the product and/or which further decrease the possibility that the active ingredient may be washed out of the product when placed in contact with water (e.g. partial glycerides 10 such as mixtures of glyceryl monostearate and glyceryl distearate, and proteins such as albumen) can be incorporated into the products.

As mentioned earlier, an edible (i.e. non-toxic) farinaceous product rich in starch, 15 particularly one derived from wheat or rice, is used in this invention. These products are commercially available and are generally provided in the form of meal or grits. Especially well suited for use in the invention are 20 products produced from Durum wheat in the form of meal or grits.

In producing the vitamin supplements aforesaid, the vitamin or the mixture of vitamins can be added in powdered form to the 25 milled or crushed carrier (e.g. to the wheat meal or grits) either before or while the carrier is mixed with water to form the desired paste. Alternatively, the vitamin or 30 mixture of vitamins, while dissolved or dispersed in water, can be added to and mixed with the carrier. In such instance the water in which the vitamin or mixture of vitamins is dissolved or dispersed is used to form the 35 paste. The paste is thereafter extruded, for example, into tubular strings of desired diameter or into elongated strips of desired width and thickness. The strings, strips, etc are then cut to the desired length and dried.

40 The quantity of vitamin material and the quantity of paste-forming carrier used in the invention is variable within rather wide limits. Normally, however, the vitamin supplements, in dry condition, contain from 45 0.2% to 20.0% by weight of vitamin material. The preferred vitamin supplements contain, in dry condition, from 1.0% to 10.0% by weight of vitamin or mixture of vitamins. Where, however, active ingredients 50 in addition to the vitamins (for example, amino acids or calcium salts) are present, the active components can comprise up to 30% of the weight of the dry vitamin supplement.

55 The quantity of vitamin supplement which is incorporated into the cereal foodstuff is variable. In general, the amount of supplement which is used in any particular instance will be governed by the level of vitamin or mixture of vitamins to be achieved 60 in the final product. The quantity of supplement needed to achieve such level of vitamin supplementation will depend upon the vitamin content of the supplement. 65 Under ordinary circumstances, however, a

ratio of 1 part of the vitamin supplement will be used for each 50 to 500 parts by weight of cereal foodstuff to be supplemented. In the preferred embodiment of the invention, a ratio of 1 part by weight of the 70 vitamin supplement will be used for each 100 to 200 parts by weight of the cereal foodstuff to be supplemented. Where, however, a supplement contains active ingredients other than vitamins (for example, 75 where it contains amino acids or calcium salts), a ratio of 1 part by weight of the supplement for up to each 20 parts by weight of the cereal foodstuff to be supplemented can be used. 80

The vitamin supplements are prepared in a physical form which resembles the cereal foodstuff to be fortified. In a preferred embodiment, the supplements are prepared as 85 to resemble rice grains and they are used to supplement rice with vitamins. The vitamin supplements are incorporated into the cereal foodstuff in a conventional manner. They are simply added to and mixed with the 90 cereal foodstuff. Special manufacturing equipment is not required. The latter feature is a distinct advantage over presently known processes for the vitaminisation of cereal foodstuffs such as rice.

In addition to ease of manufacture, both 95 of the vitamin supplements and the vitamin-enriched cereals, the present invention provides other distinct advantages. For example, in certain of the known processes, vitaminisation of rice is carried out by adding rice 100 grains which are highly vitaminised to rice grains which are not vitamin supplemented. When vitamin-B₂ is present in the vitaminised rice, the rice grains have a distinctive yellow discolouration. This is attributable to the 105 fact that the vitamin is concentrated in the outer layers of the rice. When the vitaminised rice grains and the non-vitaminised rice grains are mixed, the two types of grains are clearly distinguishable. This creates the 110 distinct possibility that the consumer will reject the product in the belief that the discoloured grains are impure or at least inferior in quality. The present invention eliminates or at least minimises the discolouration 115 problem. In the present products, the vitamins are especially uniformly distributed throughout the farinaceous carrier with the result that little or no discolouration due to the vitamin-B₂ content can be observed. 120 Known processes recognised and sought to solve the problem by coating the grains with a pigment. The products of the present invention can be coloured if desired. However, 125 unlike the known processes where pigmentation is accomplished by coating the grains which requires the use of costly apparatus, pigmentation of the products of the present invention is readily carried out simply by adding the pigment to the paste from which 130

the vitamin supplements are produced.

The following Examples illustrate the invention:

EXAMPLE 1

5 2.0 g of thiamine hydrochloride, 3.5 g of sodium riboflavin 5'-phosphate and 25.0 g of niacinamide were dissolved in 50.0 g of distilled water. The solution thus obtained was diluted with an additional 725 g of
10 water, then added to, and mixed with, 2.5 kg of hard wheat grits in a band mixer. A paste-like mass thus obtained. The paste-like mass was thereafter charged into a pasta press. Elongated tubular strings resembling spaghetti
15 hetti and having a diameter of 2.5 mm were obtained. The strings were cut to lengths of ca 6 mm and allowed to dry. There was thus obtained a grain-like product which resembled rice grains in appearance, size and
20 shape.

The foregoing grain-like product was added to rice in a ratio of 1 part by weight of the vitamin supplement (i.e. grain-like product) for each 200 parts by weight of
25 rice. Each 100 g of the resulting vitamin-supplemented rice contained 0.4 mg of vitamin-B₁, 0.6 mg of vitamin-B₂ and 5.0 mg of niacinamide.

EXAMPLE 2

30 2.0 g of thiamine hydrochloride, 2.7 g of pyridoxine hydrochloride, 4.35 g of sodium riboflavin 5'-phosphate and 25.0 g of niacinamide were dissolved in 50.0 g of distilled water. The solution thus obtained was further
35 diluted with 510 g of water and added to, and mixed with, 1.65 kg of hard wheat grits in a band mixer. A paste-like mass was thus obtained. The paste-like mass was compressed in a pasta press to form elongated tubular
40 strings resembling spaghetti. These strings, which had a diameter of ca 2.5 mm, were cut to lengths of 6 mm and dried. There was thus obtained a grain-like product resembling rice grains in appearance, size and
45 shape.

1 kg of the vitamin supplement (i.e. grain-like product) was added to, and mixed with, 300 kg of rice to give a vitamin-supplemented rice, each 100 g of which contained 0.4
50 mg of vitamin-B₁, 0.6 mg of vitamin-B₂, 0.53 mg of vitamin-B₆ and 5.0 mg of niacinamide.

EXAMPLE 3

2.0 g of thiamine hydrochloride, 3.0 g of riboflavin, 25.0 g of niacinamide and 50.0 g
55 of dry vitamin-A powder containing 500,000 International Units of vitamin-A per g were added to, and mixed with, 2420 kg of wheat flour in a band mixer (a wheat flour derived from Durum wheat, a type of flour conventionally used in the production of spaghetti,
60 was employed). 775.0 g of water were added to the resulting mixture and a paste-like mass was obtained. The paste-like mass was charged into a pasta press and extruded in the
65 form of tubular strings having a diameter of

ca 2.5 mm and resembling spaghetti. These strings were cut into lengths of ca 6 mm and dried. There was thus obtained a vitamin supplement which resembled rice grains in appearance, size and shape.

The foregoing vitamin supplement was mixed with rice in a ratio of 1 part by weight of vitamin supplement for each 200 parts by weight of rice. Each 100 g of the resulting
70 of vitamin-B₁, 0.6 mg of vitamin-B₂, 5.0 mg of vitamins-B₁, 0.6 mg of vitamin-B₂, 5.0 mg of niacinamide and 5,000 International Units of vitamin-A.

EXAMPLE 4

2.0 g of thiamine hydrochloride, 3.0 g of
80 riboflavin, 25.0 g of niacinamide, 50.0 g of dry vitamin-A powder containing 500,000 International Units of vitamin-A per g and 250 g of methionine were added to, and mixed with, 2170 kg of wheat meal. The resulting mixture was mixed with 680 g of
85 water to form a paste-like mass. The paste-like mass was charged into a pasta press and extruded in the form of tubular strings having a diameter of ca 2.5 mm and resembling spaghetti. The strings were cut into lengths
90 of ca 6 mm and dried. There was thus obtained a vitamin supplement which resembled rice grains in appearance, shape and size.

The foregoing vitamin supplement was mixed with rice in a ratio of one part by weight of vitamin supplement for each 200 parts by weight of rice. Each 100 g of the
100 resulting vitamin-supplemented rice contained 0.4 mg of vitamin-B₁, 0.6 mg of vitamin-B₂, 5.0 mg of niacinamide, 5,000 International Units of vitamin-A and 50 mg of methionine.

WHAT WE CLAIM IS:—

1. Vitamin-enriched cereals containing a vitamin supplement comprising (1) a vitamin or a mixture of vitamins and (2) a farinaceous material as a carrier for said vitamins; said supplement being in a form resembling a cereal grain in size, shape and appearance.

2. Cereals as set forth in claim 1, wherein the vitamin supplement contains from 0.2% to 20% by weight of active material.

3. Cereals as set forth in claim 1 or claim 2, wherein the supplement contains vitamin-B₁, vitamin-B₂, vitamin-B₆ and/or niacinamide.

4. Cereals as set forth in Claim 1, claim 2, or claim 3, wherein the supplement also contains amino acids.

5. Cereals as set forth in any one of claims 1 to 4 inclusive, wherein the farinaceous material is derived from wheat or rice.

6. Cereals as set forth in any one of claims 1 to 5 inclusive, wherein the cereal is rice grains and wherein the vitamin supplement is present in the form of rice grains.



the vitamin supplements are produced.

The following Examples illustrate the invention:

EXAMPLE 1

5 2.0 g of thiamine hydrochloride, 3.5 g of sodium riboflavin 5'-phosphate and 25.0 g of niacinamide were dissolved in 50.0 g of distilled water. The solution thus obtained was diluted with an additional 725 g of
10 water, then added to, and mixed with, 2.5 kg of hard wheat grits in a band mixer. A paste-like mass thus obtained. The paste-like mass was thereafter charged into a pasta press. Elongated tubular strings resembling spaghetti
15 hetti and having a diameter of 2.5 mm were obtained. The strings were cut to lengths of *ca* 6 mm and allowed to dry. There was thus obtained a grain-like product which resembled rice grains in appearance, size and
20 shape.

The foregoing grain-like product was added to rice in a ratio of 1 part by weight of the vitamin supplement (i.e. grain-like product) for each 200 parts by weight of
25 rice. Each 100 g of the resulting vitamin-supplemented rice contained 0.4 mg of vitamin-B₁, 0.6 mg of vitamin-B₂ and 5.0 mg of niacinamide.

EXAMPLE 2

30 2.0 g of thiamine hydrochloride, 2.7 g of pyridoxine hydrochloride, 4.35 g of sodium riboflavin 5'-phosphate and 25.0 g of niacinamide were dissolved in 50.0 g of distilled water. The solution thus obtained was further
35 diluted with 510 g of water and added to, and mixed with, 1.65 kg of hard wheat grits in a band mixer. A paste-like mass was thus obtained. The paste-like mass was compressed in a pasta press to form elongated tubular
40 strings resembling spaghetti. These strings, which had a diameter of *ca* 2.5 mm, were cut to lengths of 6 mm and dried. There was thus obtained a grain-like product resembling rice grains in appearance, size and
45 shape.

1 kg of the vitamin supplement (i.e. grain-like product) was added to, and mixed with, 300 kg of rice to give a vitamin-supplemented rice, each 100 g of which contained 0.4
50 mg of vitamin-B₁, 0.6 mg of vitamin-B₂, 0.53 mg of vitamin-B₆ and 5.0 mg of niacinamide.

EXAMPLE 3

2.0 g of thiamine hydrochloride, 3.0 g of riboflavin, 25.0 g of niacinamide and 50.0 g
55 of dry vitamin-A powder containing 500,000 International Units of vitamin-A per g were added to, and mixed with, 2420 kg of wheat flour in a band mixer (a wheat flour derived from Durum wheat, a type of flour conventionally used in the production of spaghetti,
60 was employed). 775.0 g of water were added to the resulting mixture and a paste-like mass was obtained. The paste-like mass was charged into a pasta press and extruded in the
65 form of tubular strings having a diameter of

ca 2.5 mm and resembling spaghetti. These strings were cut into lengths of *ca* 6 mm and dried. There was thus obtained a vitamin supplement which resembled rice grains in appearance, size and shape.

The foregoing vitamin supplement was mixed with rice in a ratio of 1 part by weight of vitamin supplement for each 200 parts by weight of rice. Each 100 g of the resulting
70 of vitamin-B₁, 0.6 mg of vitamin-B₂, 5.0 mg of vitamins-B₁, 0.6 mg of vitamin-B₂, 5.0 mg of niacinamide and 5,000 International Units of vitamin-A.

EXAMPLE 4

2.0 g of thiamine hydrochloride, 3.0 g of
80 riboflavin, 25.0 g of niacinamide, 50.0 g of dry vitamin-A powder containing 500,000 International Units of vitamin-A per g and 250 g of methionine were added to, and mixed with, 2170 kg of wheat meal. The resulting mixture was mixed with 680 g of
85 water to form a paste-like mass. The paste-like mass was charged into a pasta press and extruded in the form of tubular strings having a diameter of *ca* 2.5 mm and resembling spaghetti. The strings were cut into lengths of *ca* 6 mm and dried. There was thus obtained a vitamin supplement which resembled rice grains in appearance, shape and
90 size.

The foregoing vitamin supplement was mixed with rice in a ratio of one part by weight of vitamin supplement for each 200 parts by weight of rice. Each 100 g of the resulting vitamin-supplemented rice contained 0.4 mg of vitamin-B₁, 0.6 mg of vitamin-B₂, 5.0 mg of niacinamide, 5,000 International Units of vitamin-A and 50 mg of methionine.
95

WHAT WE CLAIM IS:—

1. Vitamin-enriched cereals containing a vitamin supplement comprising (1) a vitamin or a mixture of vitamins and (2) a farinaceous material as a carrier for said vitamins; said supplement being in a form resembling a cereal grain in size, shape and appearance.
100

2. Cereals as set forth in claim 1, wherein the vitamin supplement contains from 0.2% to 20% by weight of active material.
105

3. Cereals as set forth in claim 1 or claim 2, wherein the supplement contains vitamin-B₁, vitamin-B₂, vitamin-B₆ and/or niacinamide.
110

4. Cereals as set forth in Claim 1, claim 2, or claim 3, wherein the supplement also contains amino acids.
115

5. Cereals as set forth in any one of claims 1 to 4 inclusive, wherein the farinaceous material is derived from wheat or rice.
120

6. Cereals as set forth in any one of claims 1 to 5 inclusive, wherein the cereal is rice grains and wherein the vitamin supplement is present in the form of rice grains.
125

7. Cereals as set forth in any one of claims 1 to 6 inclusive, wherein from 50 to 500 parts by weight of cereal grains are present for each part by weight of vitamin supplement.

8. A process for the manufacture of vitamin-enriched cereal, which process comprises adding to cereal grains a vitamin supplement composed of (1) a vitamin or a mixture of vitamins and (2) a farinaceous material as a carrier for said vitamins; said supplement being in a form resembling cereal grains in size, shape and appearance.

9. A process as set forth in claim 8, wherein a vitamin supplement containing from 0.2% to 20% by weight of active material is used.

10. A process as set forth in claim 8 or claim 9, wherein a vitamin supplement containing vitamin-B₁, vitamin-B₂, vitamin-B₆ and/or niacinamide is used.

11. A process as set forth in claim 8, claim 9 or claim 10, wherein a vitamin supplement which also contains amino acids is used.

12. A process as set forth in any one of claims 8 to 11 inclusive, wherein a vitamin supplement in which the farinaceous material is derived from wheat or rice is used.

13. A process as set forth in any one of

claims 8 to 12 inclusive, wherein a vitamin supplement in the form of rice grains is added to rice grains.

14. A process as set forth in any one of claims 8 to 13 inclusive, which comprises the steps of (a) mixing (1) a vitamin or a mixture of vitamins, (2) a farinaceous material and (3) a quantity of water sufficient to form a paste therewith, (b) extruding said paste through an orifice of desired shape and size to form an elongated paste-like mass, (c) cutting said mass to desired length, (d) drying the cut particles thus obtained, and (e) adding said dried particles to cereal grains; there being used a quantity of ingredient (1) to provide a dry vitamin supplement containing from 0.2% to 20% by weight of said ingredient (1).

15. A process as set forth in any one of claims 8 to 13 inclusive, wherein one part by weight of the vitamin supplement is added to from 50 to 500 parts by weight of cereal grains.

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for

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