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TNO report

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**Anticipated intake of starch ingredient and consequences
for intake of dietary fat and fat-soluble vitamins**

Simulation studies on dietary intake data

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Summary

AVEBE has developed a new food starch ingredient. This starch ingredient can be applied as fat replacer in products like yoghurt, yoghurt drinks, ice cream, mousse, and curd.

By order of AVEBE, TNO Quality of Life estimated the intake of this ingredient when used in yoghurt, yoghurt drinks, ice cream, mousse, and curd, both for the total Dutch population as for the users in this population only. Moreover, the subsequent impact on fat intake and the intake of the fat-soluble vitamins A and D was estimated by simulations. For these purposes, the data of the third Dutch National Food Consumption Survey (DNFCS-3, 1997/98) were used. In DNFCS-3, a diary method was used to obtain information about consumption of all foods eaten and drunk by survey participants (n=6,250) on two consecutive days.

For these calculations assumptions were made by AVEBE regarding the fat percentage of the products before and after simulation, and the concentration of application of the starch ingredient. A worst-case approach was taken as start for formulating the scenarios. For the total population and subgroups mean values, standard deviations (SD) and the percentile values P10, P25, P50 (median), P75, P90, P95, and P97.5 were calculated.

The mean intake of the starch ingredient in the total population was estimated at 2.8 g/d, with a range of 2.3 to 3.6 g/d in subgroups of the population. The variation in this intake was considerable. For the total population, the anticipated intake of the starch ingredient on average level was 2.2% of the total starch intake. This percentage ranged from 1.5% for men 19 years and older to 4.6% for children 1-3 years.

Application of the starch ingredient had implications for the total fat intake. If it is assumed that all products in the five food groups are consumed with the maximum amount of fat ('the worst case-approach'), the decrease in fat consumption per day would be 6.1% on average (range 4.4-10.6%). If the consumption of the original DNFCS-3 population is used as reference, the decrease in fat consumption would be 1.6% (range 1.2-2.5%). The latter approach is the more realistic scenario. Therefore, it can be concluded that the decrease of fat intake on population level is small. However, for specific groups or individuals this decrease can be much greater, and consequently this decrease in fat intake could have positive health implications on the long run. The subgroup where reduction of dietary fat intake is not welcomed, are children till 1 year of age.

Based on the current simulations it can be concluded that the impact on the mean intake of the vitamins A and D is small, i.e. around 1%. It is concluded that for the general population a decrease of this magnitude is of no concern.

In conclusion, based on the simulation studies performed, application of the starch ingredient seems to have little impact on the total fat intake and the intake of fat-soluble vitamins for the population on an average level.

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1 Introduction

AVEBE has developed a new food starch ingredient. This starch ingredient can be applied in food products with the purpose of thermoreversible gel forming. Moreover, in products like yoghurt, yoghurt drinks, ice cream, mousse, and curd this ingredient can be applied as a fat replacer.

By order of AVEBE, TNO Quality of Life estimated the intake of this ingredient when used in a number of specified food groups, both for the total population as for the users in the population only. Moreover, the nutritional impact of using this ingredient was estimated by performing simulation studies on dietary intake data.

First, the anticipated impact on fat intake was explored. Second, the consequences on the intake of the fat-soluble vitamins A and D were studied. A worst-case approach was taken as start for formulating the scenarios.

The dietary intake data used for this study were the data of the third Dutch National Food Consumption Survey (DNFCS-3, 1997/98).

In Chapter 2 the data and methods used to estimate intake and nutritional impact are described. In Chapter 3, the results are presented both for the total Dutch population as for subgroups of this population. In Chapter 4, the main results are summarized and concluding remarks are made.

2 Data and methods

2.1 Dutch National Food Consumption Survey

For estimation the intake of the starch ingredient and the anticipated impact on intake of dietary fat and fat-soluble vitamins, data of the Dutch National Food Consumption Survey (DNFCS-3) were used. In DNFCS-3, a diary method was used to obtain information about consumption of all foods eaten and drunk by survey participants (n=6,250) on two consecutive days. Food consumption data were collected from April 1997 to March 1998, and evenly distributed over the seasons and the days of the week. During (public) holidays no data collection took place.

The design of the DNFCS and data collection has been extensively reported elsewhere (Hulshof & van Staveren, 1991). The main results of the DNFCS-3 are published ('Zo eet Nederland' (What the Dutch eat), 1998).

2.2 Methods and calculations

AVEBE asked TNO to perform calculations for the situation that the starch ingredient would be applied as fat replacer in yoghurt, yoghurt drinks, ice cream, mousse, and curd. For these calculations the following assumptions were made by AVEBE:

- All yoghurts consumed in the DNFCS-3 contain 8% fat. After application of the starch ingredient (in a concentration of 3.5%), the percentage of fat in all yoghurts will be 0%.
- All yoghurt drinks consumed in the DNFCS-3 contain 1.7% fat. After application of the starch ingredient (in a concentration of 1.5%), the percentage of fat in all yoghurt drinks will be 0%.
- All ice cream (water ice excluded) consumed in the DNFCS-3 contains 8% fat. After application of the starch ingredient (in a concentration of 3%), the percentage of fat in ice cream will be 2%.
- All mousse (fruit puree excluded) consumed in the DNFCS-3 contains 10% fat. After application of the starch ingredient (in a concentration of 5.5%), the percentage of fat in mousse will be 2%.
- All curd consumed in the DNFCS-3 contains 8.1% fat. After application of the starch ingredient (in a concentration of 5.5%), the percentage of fat in mousse will be 4.05%.

In Table 1 all these assumptions are summarized.

Table 1: Summary of assumptions made for calculations

	Fat percentage before simulation	Concentration of starch ingredient	Fat percentage after simulation
Yoghurt	8	3.5	0
Yoghurt drinks	1.7	1.5	0
Ice cream	8	3	2
Mousse	10	5.5	2
Curd	8.1	5.5	4.05

In Appendix A these five food groups and the food items they contain are described with their fat content in the different scenarios.

Because assumptions about fat percentage were the same for all food items within a food group, hereby overestimating the effect, the followed approach can be seen as a worst case-approach.

To answer the research questions the following calculations were made:

- 1) Estimation of the anticipated intake of the starch ingredient following the assumptions stated in Table 1 for:
 - a. The application of this ingredient in all five food categories (yoghurt, yoghurt drinks, ice cream, mousse, and curd) combined;
 - b. The application of this ingredient per food category.

These anticipated intakes are calculated both for the total population as for the users of one or more of the five food groups only.

The anticipated intake of the starch ingredient will be placed next to the starch intake based on the total food intake in the DNFC3-3. This comparison gives an idea about the level of the anticipated intake of the starch ingredient.
- 2) Impact on dietary fat intake after application of the starch ingredient
 - a. First, the dietary fat intake based on the total food intake of the Dutch population in the DNFC3-3, is given. This intake is already known ('Zo eet Nederland' (What the Dutch eat), 1998). This level of dietary fat intake is the starting point of the simulation studies. This is called Scenario A.
 - b. Second, the dietary fat intake based on the total food intake in the DNFC3-3 was calculated on the basis of the assumed fat percentages of the five food products before simulations (see Table 1). This is called Scenario B.
 - c. Third, the dietary fat intake based on the total food intake in the DNFC3-3 after simulation with the starch ingredient as fat replacer in the five food groups was calculated. For this calculation, the assumed fat percentages after simulation were used (see Table 1). This is called Scenario C.
- 3) Impact on intake of fat-soluble vitamins (vitamin A and vitamin D) after application of the starch ingredient
 - a. First, the intake of the fat-soluble vitamins, vitamin A and D, based on the total food intake of the Dutch population in the DNFC3-3, are given. This is already known ('Zo eet Nederland' (What the Dutch eat), 1998). This level of vitamin intake is the starting point of the simulation studies. This is called Scenario A.
 - b. Second, the intake of fat-soluble vitamins, vitamin A and D, based on the total food intake in the DNFC3-3 after simulation with the starch ingredient as fat replacer in the five mentioned food groups was calculated. This is called Scenario C.

Vitamin A intake is expressed in retinol equivalents. This means that also the pro-vitamin A is taken into account. Fruits and vegetables are a good source of pro-vitamin A, also called beta-carotene.

For this calculation the vitamin A and D level was reduced in agreement with the assumed fat percentages after simulation (Table 1). For instance, when the fat content of a food item was assumed to be 0, the corresponding vitamin A and D levels of these foods were assumed to be 0 too. However, because the level of vitamin A and D differs per food product, and the combination of food products eaten is unique for a person, there is no linear association between (decline in) fat percentage and (decline in) vitamin intake.

These calculations were performed for the total DNFCs-3 sample (n=6,250), and for the following subgroups:

- Children aged 1-3 years
- Children aged 4-12 years
- Boys aged 13-18 years
- Girls aged 13-18 years
- Men 19 years and older
- Women 19 years and older, including pregnant women

For the total population and the given subgroups mean values, standard deviations (SD) and the percentile values P10, P25, P50 (median), P75, P90, P95, and P97.5 were calculated using SAS VEVES, a food consumption survey computing system developed by TNO Quality of Life.

3 Results

3.1 Anticipated intake of starch ingredient

In Table 2 the anticipated intake of the starch ingredient after replacement of (part of) the fat content in all five product categories is given. This intake was estimated for the **total population** (n=6,250) and for subgroups of this population. The total population consists of both users and non-users of these food groups. The mean of the estimated intake of this starch ingredient in the total population was 2.8 g/d. The highest mean intake was found among children aged 4-12 years (3.6 g/d), while this intake was lowest among men 19 years and older (2.3 g/d). The variation in intake was considerable, looking at the standard deviation and the percentile values.

Also the anticipated intake among users of one or more of the five food products was calculated (Table 3). Non-users of these food groups are not taken into account in this calculation. The mean intake of the starch ingredient of users of these products was 4.7 g/d. This intake was highest in boys 13-18 years of age (5.1 g/d) and lowest in children 1-3 years old (4.5 g/d).

The anticipated intake of the starch ingredient is also calculated for the situation that this ingredient is applied in only one of the five food groups. These results are given in Appendix B (Table B.01-B.10); for all five food groups, for both the total population as well as for the population of users only. The highest mean intake of the starch ingredient in the total population is reached by the intake of yoghurt (2.0 g/d), followed by yoghurt drinks (0.4 g/d), curd (0.2 g/d), ice cream (0.2 g/d), and mousse (<0.1 g/d). The contribution of these food groups to the intake of the starch ingredient on the average level in the total population, i.e. 2.8 g/d, is 70, 14, 8, 7 and 1%, respectively.

Also among the users, yoghurt is the major dietary source of the starch ingredient (4.6 g/d), followed by curd (3.9 g/d), yoghurt drinks (3.3 g/d), mousse (2.5 g/d), and ice cream (1.4 g/d). Yoghurt is also the group with the highest number of users (n=2,665 (43% of the total population)). Curd, yoghurt drinks, mousse and ice cream were used by 360 (6%), 718 (11%), 41 (1%), and 922 (15%) persons, respectively, on one or both days they recorded their dietary intake.

Table 2. Anticipated intake of the starch ingredient (g/d) for the total population and subgroups

	N	Mean	SD	P10	P25	P50	P75	P95	P97.5
Total population	6250	2.8	3.5	0	0	1.7	4.4	9.4	12.1
Children 1 – 3 yrs	254	3.4	3.5	0	0.6	2.6	5.2	8.9	11.2
Children 4 – 12 yrs	750	3.6	3.6	0	0.5	2.8	5.4	10.3	12.7
Boys 13 – 18 yrs	279	3.0	4.0	0	0.0	1.5	4.4	11.8	14.0
Girls 13 – 18 yrs	256	3.2	3.6	0	0.0	2.2	4.6	11.4	12.6
Men 19 yrs and older	2117	2.3	3.3	0	0.0	0.6	4.0	8.6	10.2
Women 19 yrs and older	2594	2.8	3.6	0	0.0	1.8	4.5	9.6	12.3

Table 3. Anticipated intake of the starch ingredient (g/d) for the total population and subgroups for users of one or more of the five food products only

	N	Mean	SD	P10	P25	P50	P75	P95	P97.5
Total population	3714	4.7	3.5	1.3	2.3	4.0	6.1	11.4	13.9
Children 1 – 3 yrs	192	4.5	3.4	1.3	2.1	3.7	5.9	10.1	13.1
Children 4 – 12 yrs	574	4.7	3.4	1.3	2.4	4.0	6.2	11.8	14.0
Boys 13 – 18 yrs	163	5.1	4.1	1.4	2.2	4.0	6.9	13.5	14.7
Girls 13 – 18 yrs	178	4.6	3.5	1.1	2.1	3.6	5.9	12.1	15.3
Men 19 yrs and older	1083	4.5	3.4	1.2	2.2	3.9	5.9	9.9	13.2
Women 19 yrs and older	1524	4.8	3.5	1.5	2.5	4.1	6.2	11.5	14.0

In Table 4, the total starch intake based on the total food intake in the original DNFC3-3 population is given. For the total population, the mean intake is 125.0 g/d. The average intake is lowest in the children 1-3 years of age, i.e. 73.8 g/d, and highest in the boys 13-18 yrs, i.e. 162.8 g/d. The variation in this intake was considerable.

In Table 5, the percentages are given of the mean of the anticipated intake of the starch ingredient (Table 2) in relation to the mean of the total starch intake (Table 4). For the total population, the anticipated intake on average level of the starch ingredient is 2.2% of the total starch intake in the original DNFC3-3 population. This percentage ranges from 1.5% for men 19 years and older to 4.6% for children 1-3 years.

Table 4. Intake of starch (g/d) in the original DNFC3-3 population for the total population and subgroups

	N	Mean	SD	P10	P25	P50	P75	P95	P97.5
Total population	6250	125.0	47.3	70.4	91.1	119.6	151.7	214.2	237.6
Children 1 – 3 yrs	254	73.8	25.3	45.8	58.2	69.6	84.3	127.7	145.1
Children 4 – 12 yrs	750	106.0	34.8	65.6	80.2	102.0	127.1	167.1	183.7
Boys 13 – 18 yrs	279	162.8	50.7	104.0	131.2	155.7	191.9	250.6	270.7
Girls 13 – 18 yrs	256	125.6	35.3	79.4	100.4	122.7	148.8	186.4	196.0
Men 19 yrs and older	2117	148.9	49.3	88.6	113.5	144.6	177.8	239.8	255.4
Women 19 yrs and older	2594	111.9	38.1	67.2	85.2	107.8	135.5	177.4	196.9

Table 5. Intake of starch ingredient in relation to the total starch intake of the original DNFCS-3 population in percentages, on the average level

	N	Starch ingredient (mean in g/d)	Total starch (mean in g/d)	Starch ingredient (% vs total starch intake)
Total population	6250	2.8	125.0	2.2
Children 1 - 3 yrs	254	3.4	73.8	4.6
Children 4 - 12 yrs	750	3.6	106.0	3.4
Boys 13 - 18 yrs	279	3.0	162.8	1.8
Girls 13 - 18 yrs	256	3.2	125.6	2.5
Men 19 yrs and older	2117	2.3	148.9	1.5
Women 19 yrs and older	2594	2.8	111.9	2.5

3.2 Anticipated intake of dietary fat

The impact on the dietary fat intake (g/d) after application of the starch ingredient can be looked at three steps.

First, the dietary fat intake based on the original data of the DNFCS-3 is given (Scenario A). This intake is already known ('Zo eet Nederland' (What the Dutch eat), 1998). As next step the intake based on a maximum assumed fat content of the five food groups before simulation is presented (Scenario B), and then the intake after reduction of the fat content by application of the starch ingredient in these food items is given (Scenario C).

A. Total fat intake in the original DNFCS-3 data base

Table 6. Total fat intake (g/d) in the original DNFCS-3 population for the total population and subgroups (Scenario A)

	N	Mean	SD	P10	P25	P50	P75	P95	P97.5
Total population	6250	88.3	35.3	47.4	63.3	83.3	108.1	153.4	170.2
Children 1 – 3 yrs	254	47.4	16.9	27.1	35.4	46.0	57.3	79.3	85.0
Children 4 – 12 yrs	750	70.7	26.0	41.7	52.5	67.3	84.5	119.2	132.0
Boys 13 – 18 yrs	279	106.6	37.1	67.5	79.0	102.1	125.6	174.5	193.2
Girls 13 – 18 yrs	256	84.6	26.7	53.9	67.0	82.1	101.4	129.1	142.0
Men 19 yrs and older	2117	105.6	36.1	64.7	80.5	101.2	127.5	170.5	184.8
Women 19 yrs and older	2594	81.6	30.2	45.9	60.6	78.6	99.4	136.4	151.0

The mean total fat intake based on the original DNFCS-3 data was 88.3 g/d. This mean intake ranged from 47.4 g/d in children 1-3 years old till 106.6 g/d in boys 13-18 years of age. The ranges in intake per subgroup were broad (Table 6).

B. Intake of total fat (g/d) in the DNFCS-3 data base based on the assumed fat percentages in the products in all five product groups

When the assumed fat content percentages were used for all food items of the five product groups (see Table 1), the total fat intake was somewhat higher (Table 7): the mean daily total fat intake of the whole population was 92.5 g (in stead of 88.3 g). In all subgroups of the population the mean intakes were also higher, in the range of 4-5 grams. This means that the assumed fat content per food group before simulation was mostly an overestimation of the real fat content percentages. However, the differences were relatively small.

Table 7. Total fat intake (g/d) on basis of the assumed fat content in the products; for all five food groups combined, for the total population and subgroups (Scenario B)

	N	Mean	SD	P10	P25	P50	P75	P95	P97.5
Total population	6250	92.5	35.2	51.7	68.1	87.9	112.4	157.3	174.0
Children 1 – 3 yrs	254	51.7	17.3	29.7	38.6	50.2	62.5	82.9	88.9
Children 4 – 12 yrs	750	75.3	25.7	46.9	56.3	72.0	89.8	122.7	134.9
Boys 13 – 18 yrs	279	111.2	37.2	72.4	84.1	104.5	133.6	177.3	196.2
Girls 13 – 18 yrs	256	88.9	27.1	56.5	69.7	87.1	104.6	136.2	155.2
Men 19 yrs and older	2117	109.1	36.4	67.3	83.3	104.9	130.4	174.5	188.8
Women 19 yrs and older	2594	86.2	30.2	51.0	65.8	83.2	103.6	140.1	156.7

In Appendix C, the total daily fat intake for the DNFCS-3 population is given taken into account only the assumed fat percentage of one of the five food groups (in the other four food groups the original fat content was used). These calculations were made for all five food groups (Tables C.01-C.05). Comparing the tables in Appendix C with Table 7 reveals that the mean total fat intake in the situation that only the assumed fat percentage for yoghurt is applied (i.e. Table C.01), differs least from the mean total fat intake in the situation that the assumed fat percentages for all five food groups were applied (Table 7) (all five food groups 92.5 g/d, only yoghurt 92.1 g/d). In other words, the highest contribution to the difference between Table 6 and 7 was due to yoghurt. This is as expected, because the consumption of yoghurt was the highest of the five food groups and so, having the greatest impact on overall values. The mean fat intake for the total population had the biggest difference when only the assumed fat percentage for ice cream (Table C.03) was used (88.1 g/d vs 92.5 g/d).

C. Intake of total fat (g/d) in the DNFCS-3 data base after replacement of (a part of) the fat content in the five food groups by the starch ingredient

Table 8. Total fat intake (g/d) after replacement of (a part of) the fat content in all five food groups, for the total population and subgroups (Scenario C)

	N	Mean	SD	P10	P25	P50	P75	P95	P97.5
Total population	6250	87.0	35.0	46.4	62.3	82.2	106.8	151.5	168.4
Children 1 - 3 yrs	254	46.2	16.7	26.0	34.7	44.7	55.5	78.6	82.7
Children 4 - 12 yrs	750	69.2	25.9	39.7	50.7	64.9	82.8	118.7	129.9
Boys 13 - 18 yrs	279	105.3	36.9	66.3	77.5	100.1	123.4	171.9	192.2
Girls 13 - 18 yrs	256	82.8	26.5	52.0	66.8	80.7	98.7	126.2	141.8
Men 19 yrs and older	2117	104.3	35.7	62.9	79.4	99.5	126.0	168.4	183.8
Women 19 yrs and older	2594	80.4	29.9	44.8	59.6	77.1	98.0	134.6	148.5

Table 9. Total fat intake in the three scenarios (A, B, and C) and the differences in total fat intake (g/d) after replacement of (a part of) the fat content in all five food groups, for the total population and subgroups

	N	Scenario A (g/d)	Scenario B (g/d)	Scenario C (g/d)	Scenario B-C (g/d)	Scenario B-C %	Scenario A-C (g/d)	Scenario A-C %
Total population	6250	88.3	92.5	86.9	5.5	6.1	1.3	1.6
Children 1 - 3 yrs	254	47.4	51.7	46.2	5.5	10.6	1.2	2.5
Children 4 - 12 yrs	750	70.7	75.3	69.2	6.1	8.1	1.6	2.1
Boys 13 - 18 yrs	279	106.6	111.2	105.3	5.9	5.3	1.3	1.2
Girls 13 - 18 yrs	256	84.6	88.9	82.8	6.1	6.9	1.8	2.1
Men 19 yrs and older	2117	105.6	109.1	104.3	4.7	4.4	1.3	1.2
Women 19 yrs and older	2594	81.6	86.2	80.4	5.9	6.7	1.2	1.5

In Table 9 the differences in the total daily fat intake on average level after fat replacement were given; both with scenario B (using the assumptions made for fat percentages on food group level) as scenario A (real situation) as reference. If taken scenario B as reference, the total fat intake decreased on average by 6.1%, with a range of 4.4-10.6% for the given subgroups. If taken scenario A as a reference, the differences were much smaller, i.e., on average 1.6% with a range of 1.2 – 2.5%.

The comparison of Scenario B and C is the worst case scenario.

The anticipated intake of total dietary fat if fat replacement is only done in one of the five food groups, is given in Appendix D; for all five food groups. The mean total fat intake decreased most by the replacement in the group yoghurt (to 87.6 g/d (Table

D.01)), followed by ice cream (to 87.7 g/d (Table D.03)), mousse (to 88.3 g/d (Table D.04)), yoghurt drinks (to 88.3 g/d (Table D.02)), and curd (to 88.3 g/d (Table D.05)).

3.3 Anticipated intake of the fat-soluble vitamins

The impact on the intake of fat-soluble vitamins after application of the starch ingredient can be looked at in two steps:

First, the intakes of the fat-soluble vitamins A and D based on the original data of the DNFCS-3 are given (Scenario A). These intakes are already known ('Zo eet Nederland' (What the Dutch eat), 1998). Since a reduction of the fat content of a food item in the selected food groups will be accompanied by a lower level of vitamin A and D, secondly, the intakes of these vitamins were also calculated after simulation with the starch ingredient as fat replacer in the five mentioned food groups (Scenario C).

A. Intake of fat-soluble vitamins in the original DNFCS-3 data base

Table 10. Intake of vitamin A (in retinol equivalents) ($\mu\text{g/d}$) in the original DNFCS-3 data base for the total population and subgroups (Scenario A)

	N	Mean	SD	P10	P25	P50	P75	P95	P97.5
Total population	6250	885	912	276	414	632	1029	2331	3190
Children 1 – 3 yrs	254	597	598	194	253	391	724	1655	2142
Children 4 – 12 yrs	750	652	612	204	300	458	764	1752	2558
Boys 13 – 18 yrs	279	877	783	318	457	660	1051	2145	3219
Girls 13 - 18 yrs	256	740	682	250	392	518	820	2394	2733
Men 19 yrs and older	2117	1106	1180	365	520	777	1281	3025	3814
Women 19 yrs and older	2594	814	737	281	404	605	957	2039	2783

Table 11. Intake of vitamin D ($\mu\text{g/d}$) in the original DNFCS-3 data base for the total population and subgroups (Scenario A)

	N	Mean	SD	P10	P25	P50	P75	P95	P97.5
Total population	6250	3.66	2.22	1.42	2.16	3.26	4.66	7.55	9.05
Children 1 – 3 yrs	254	2.11	1.65	0.84	1.24	1.73	2.43	4.62	6.94
Children 4 - 12 yrs	750	2.79	1.48	1.22	1.82	2.56	3.50	5.34	6.56
Boys 13 – 18 yrs	279	4.26	2.08	1.87	2.65	3.95	5.39	8.14	9.38
Girls 13 - 18 yrs	256	3.29	1.72	1.52	2.10	3.04	4.07	6.11	7.38
Men 19 yrs and older	2117	4.60	2.58	1.99	2.95	4.20	5.63	9.16	10.59
Women 19 yrs and older	2594	3.27	1.83	1.32	2.02	2.96	4.14	6.53	7.59

B. Intake of fat-soluble vitamins based on the total food intake in the DNFC3-3 data base after simulation with the starch ingredient as fat replacer in the five mentioned food groups

Table 12. Intake of vitamin A (in retinol equivalents) (µg/d) after fat replacement in all food groups for the total population and subgroups (Scenario C)

	N	Mean	SD	P10	P25	P50	P75	P95	P97.5
Total population	6250	875	912	268	405	623	1019	2325	3190
Children 1 - 3 yrs	254	589	598	190	243	387	722	1655	2138
Children 4 - 12 yrs	750	641	611	196	292	447	752	1738	2556
Boys 13 - 18 yrs	279	866	784	294	448	656	1051	2145	3219
Girls 13 - 18 yrs	256	729	683	233	375	508	804	2391	2719
Men 19 yrs and older	2117	1097	1179	357	513	765	1273	2982	3814
Women 19 yrs and older	2594	805	736	275	393	594	947	2032	2750

Table 13. Intake of vitamin D (µg/d) after fat replacement in all food groups for the total population and subgroups (Scenario C)

	N	Mean	SD	P10	P25	P50	P75	P95	P97.5
Total population	6250	3.62	2.21	1.39	2.12	3.22	4.62	7.53	8.92
Children 1 - 3 yrs	254	2.08	1.65	0.82	1.23	1.72	2.40	4.60	6.94
Children 4 - 12 yrs	750	2.75	1.49	1.16	1.75	2.53	3.45	5.26	6.54
Boys 13 - 18 yrs	279	4.21	2.08	1.79	2.65	3.89	5.36	8.08	9.38
Girls 13 - 18 yrs	256	3.24	1.73	1.47	2.06	2.97	4.03	6.02	7.35
Men 19 yrs and older	2117	4.56	2.58	1.94	2.90	4.17	5.60	9.11	10.49
Women 19 yrs and older	2594	3.23	1.83	1.28	1.98	2.93	4.08	6.47	7.59

Table 14. Mean daily intake of fat-soluble vitamins A and D in the two scenarios (A and C) and the differences in intake ($\mu\text{g/d}$ and %) after replacement of (a part of) the fat content in all five food groups, for the total population and subgroups

	N	Mean Vit A (Scenario A) ($\mu\text{g/d}$)	Mean Vit A (Scenario C) ($\mu\text{g/d}$)	Mean Vit D (Scenario A) ($\mu\text{g/d}$)	Mean Vit D (Scenario C) ($\mu\text{g/d}$)	Mean Vit A (A-C) ($\mu\text{g/d}$) %		Mean Vit D (A-C) ($\mu\text{g/d}$) %	
Total population	6250	885	875	3.66	3.62	10	1.1	0.04	1.1
Children 1 - 3 yrs	254	597	589	2.11	2.08	8	1.3	0.03	1.4
Children 4 - 12 yrs	750	652	641	2.79	2.75	11	1.7	0.04	1.4
Boys 13 - 18 yrs	279	877	866	4.26	4.21	11	1.3	0.05	1.2
Girls 13 - 18 yrs	256	740	729	3.29	3.24	11	1.5	0.05	1.5
Men 19 yrs and older	2117	1106	1097	4.6	4.56	9	0.8	0.04	0.9
Women 19 yrs and older	2594	814	805	3.27	3.23	9	1.1	0.04	1.2

In Table 14 the differences in intake of vitamin A and vitamin D on average level after fat replacement were given. After fat replacement in all five food groups, vitamin A decreased on average with 1.1%, with a range of 0.8-1.7% in the subgroups. Also for vitamin D, the decreases were small: 0.9-1.5%, and 1.1% in the total population.

The anticipated intake of the fat-soluble vitamins vitamin A and vitamin D if fat replacement is only done in one of the five food groups, is given in Appendix E (Tables E.01-E.10); for all five food groups.

4 Discussion

The mean intake of the starch ingredient in the total population was estimated at 2.8 g/d, with a range of 2.3 to 3.6 g/d in subgroups of the population. The variation in this intake was considerable. For the total population, the anticipated intake of the starch ingredient on average level was 2.2% of the total starch intake. This percentage ranged from 1.5% for men 19 years and older to 4.6% for children 1-3 years. The variation in total starch intake in the original DNFC3-3 population showed also a considerable variation.

On average population level, starch intake forms around half of the total carbohydrate intake. The other 50 percent are the mono- and disaccharides ('Zo eet Nederland' (What the Dutch eat), 1998).

Application of the starch ingredient had implications for the total fat intake. If it is assumed that all products in the five food groups are consumed with the maximum amount of fat ('the worst case-approach'), the decrease in fat consumption per day would be 6.1% on average (range 4.4-10.6%). If the consumption of the original DNFC3-3 population is used as reference, the decrease in fat consumption would be 1.6% (range 1.2-2.5%). The latter approach is the more realistic scenario. Therefore, it can be concluded that the decrease of fat intake on population level is small. However, for specific groups or individuals this decrease can be much greater, and consequently this decrease in fat intake could have positive health implications on the long run. The subgroup where reduction of dietary fat intake is not welcomed, are children till 1 year of age. This age category was, however, not part of the DNFC3-3 survey.

A decrease in fat intake is expected to be accompanied with a decrease in intake of the fat-soluble vitamins, i.e. vitamin A and vitamin D. Based on the current simulations it can be concluded that the impact on the mean intake of these vitamins is small, i.e. around 1%. It is concluded that for the general population a decrease of this magnitude is of no concern.

The starch ingredient is used as a fat replacer. As applied in the food groups yoghurt, yoghurt drinks, ice cream, mousse and curd, it is mainly replacing milk fat. In general, milk fat is high in saturated fat. From a public health view, it is recommended to lower fat intake, and especially the intake of saturated fat.

Moreover, according to AVEBE, the starch ingredient is also applicable as replacer of gelatin in low-fat spreads. Because gelatin is of animal origin, replacement of this protein by the starch ingredient makes such products acceptable for vegetarians. Due to the absence of tryptophan the protein quality of gelatin is poor. Therefore, replacement of gelatin by the starch ingredient will not have a negative consequence on the nutritional value of the diet.

5 Conclusion

In conclusion, based on the simulation studies performed, application of the starch ingredient seems to have little impact on the total fat intake and the intake of fat-soluble vitamins for the population on an average level.

The anticipated intake of the starch ingredient was 2.8 g/d on average, with a range of 2.3 to 3.6 g/d in subgroups of the population.

6 References

Hulshof KFAM, van Staveren WA. The Dutch National Food Consumption Survey: Design, methods and first results. Food Policy 1991;16:257-60.

Zo eet Nederland 1998 (What the Dutch eat 1998). Results of the Dutch National Food Consumption Survey 1997/98 (in Dutch). Voedingscentrum, The Hague, 1998. Order number 757.

7 Signature

BUSINESS UNIT FOOD & CHEMICAL RISK ANALYSIS

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A The five food groups and the food items they contain

	Code	Product name	cat	Real fat content g/100g ¹	Assumed		Fat content after application g/100g
					fat content g/100g	Ingredient conc. g/100g	
Yoghurt	278	Yogurt whole milk	1	3.0	8	3.5	0
	284	Yogurt low fat with fruit	1	1.7	8	3.5	0
	300	Yogurt whole milk Bulgarian	1	4.5	8	3.5	0
	301	Yogurt low fat	1	0.1	8	3.5	0
	863	Yogurt whole milk with fruit -Mona-	1	2.5	8	3.5	0
	916	Yogurt low fat Bulgarian -Mona-	1	0.5	8	3.5	0
	1502	Yogurt half fat	1	1.5	8	3.5	0
	1504	Yogurt dessert light with artificial sweetener	1	0.14	8	3.5	0
	1721	Yogurt vanilla flavoured half fat	1	1.4	8	3.5	0
	1825	Yoghurt Fisiq skimmed	1	0	8	3.5	0
	1826	Yoghurt Fisiq skimmed with fruit	1	0	8	3.5	0
	1829	Yoghurt Vifit naturel	1	3.0	8	3.5	0
	1830	Yoghurt Vifit with fruit	1	2.5	8	3.5	0
	1833	Yoghurt low-fat with fruit without sugar	1	0	8	3.5	0
Yoghurt drinks	657	Yogurt flavoured drink	2	0.1	1.7	1.5	0
	1827	Yoghurt drink Fisiq naturel	2	0	1.7	1.5	0
	1828	Yoghurt drink Fisiq with fruit	2	0	1.7	1.5	0
	1831	Yoghurt drink Vifit low-fat	2	1.5	1.7	1.5	0
	1832	Yoghurtdrink Vifit with fruit	2	1.5	1.7	1.5	0
	1834	Yoghurt drink with fruitjuice without sugar	2	0.7	1.7	1.5	0
	9603	Fris & Fit	2	0	1.7	1.5	0
	9651	Fruitality drinkyoghurt	2	0	1.7	1.5	0
Ice cream	302	Ice cream non-dairy	3	10.6	8	3	2
	303	Ice cream	3	9.1	8	3	2
	485	Ice cream 14% fat -Conotop-	3	14.0	8	3	2
	926	Ice cream without sugar -Ton Puts-	3	11.0	8	3	2
	996	Ice cream without sugar -Cor Nelis-	3	16.0	8	3	2
	1002	Ice cream non-dairy -DeLight Line Ton Puts-	3	5.0	8	3	2
	9654	Multivit ice cream + vitamins	3	11.2	8	3	2
Mousse	767	Mousse chocolate	5	15.2	10	5.5	2
Curd	305	Curd low fat	4	0.6	8.1	5.5	4.05
	306	Curd half fat	4	4.6	8.1	5.5	4.05
	307	Curd full fat	4	11.4	8.1	5.5	4.05
	720	Curd low fat with fruit -Mona-	4	1.0	8.1	5.5	4.05
	917	Curd half fat with fruit -Jacky-	5	5.0	8.1	5.5	4.05
	931	Curd low fat with fruit	4	1.2	8.1	5.5	4.05

¹ NEVO-tabel 2001.

B Anticipated intake of the starch ingredient per food group

1. Yoghurt

Table B.01 Anticipated intake of the starch ingredient (g/d) for the **total population** and subgroups; for the food group yoghurt

	N	Mean	SD	P10	P25	P50	P75	P95	P97.5
Total population	6250	2.0	3.0	0	0	0	3.4	7.9	9.5
Children 1 – 3 yrs	254	1.5	2.6	0	0	0	2.5	5.9	8.4
Children 4 - 12 yrs	750	1.6	2.5	0	0	0	2.8	6.4	7.8
Boys 13 - 18 yrs	279	2.1	3.5	0	0	0	3.1	8.9	13.9
Girls 13 - 18 yrs	256	2.0	2.8	0	0	0	3.5	7.3	9.6
Men 19 yrs and older	2117	1.8	2.9	0	0	0	3.1	7.5	8.8
Women 19 yrs and older	2594	2.3	3.3	0	0	0	3.9	8.8	10.5

Table B.02 Anticipated intake of the starch ingredient (g/d) for the total population and subgroups for **users only**; for the food group yoghurt

	N	Mean	SD	P10	P25	P50	P75	P95	P97.5
Total population	2665	4.6	3.1	1.8	2.6	3.9	5.8	10.0	13.0
Children 1 - 3 yrs	115	3.3	3.0	1.1	1.8	2.6	3.9	8.4	8.9
Children 4 - 12 yrs	325	3.8	2.4	1.5	2.4	3.2	4.7	7.9	8.8
Boys 13 - 18 yrs	111	5.2	3.8	2.2	2.6	3.9	6.7	14.0	15.8
Girls 13 - 18 yrs	116	4.4	2.5	1.9	2.7	3.7	5.3	9.8	12.1
Men 19 yrs and older	796	4.6	3.0	1.8	2.6	4.0	5.9	9.1	12.6
Women 19 yrs and older	1202	4.9	3.2	2.0	2.6	4.2	6.1	10.9	13.7

2. Yoghurt drinks

Table B.03 Anticipated intake of the starch ingredient (g/d) for the **total population** and subgroups; for the food group yoghurt drinks

	N	Mean	SD	P10	P25	P50	P75	P95	P97.5
Total population	6250	0.4	1.3	0	0	0	0	3	4.5
Children 1 – 3 yrs	254	1.3	2.3	0	0	0	1.7	6.3	7.3
Children 4 - 12 yrs	750	1.5	2.4	0	0	0	2.5	6.8	8.3
Boys 13 - 18 yrs	279	0.6	1.6	0	0	0	0.0	4.3	6.0
Girls 13 - 18 yrs	256	0.8	1.8	0	0	0	0.0	5.3	6.6
Men 19 yrs and older	2117	0.1	0.7	0	0	0	0.0	0.0	1.7
Women 19 yrs and older	2594	0.1	0.7	0	0	0	0.0	0.0	1.8

Table B.04 Anticipated intake of the starch ingredient (g/d) for the total population and subgroups for **users only**; for the food group yoghurt drinks

	N	Mean	SD	P10	P25	P50	P75	P95	P97.5
Total population	718	3.3	2.4	1.3	1.5	2.6	4.4	7.9	9.8
Children 1 - 3 yrs	102	3.3	2.5	1.1	1.5	2.5	4.8	7.5	8.3
Children 4 – 12 yrs	316	3.6	2.5	1.4	1.5	2.9	4.5	8.7	9.8
Boys 13 - 18 yrs	51	3.2	2.6	1.5	1.5	1.9	4.4	9.4	10.5
Girls 13 - 18 yrs	60	3.3	2.3	1.3	1.5	2.9	4.5	7.6	7.9
Men 19 yrs and older	74	3.2	2.4	1.2	1.6	2.3	3.9	7.5	8.8
Women 19 yrs and older	115	2.8	1.9	1.2	1.5	1.9	3.4	6.7	8.5

3. Ice cream

Table B.05 Anticipated intake of the starch ingredient (g/d) for the **total population** and subgroups; for the food group ice cream

	N	Mean	SD	P10	P25	P50	P75	P95	P97.5
Total population	6250	0.2	0.6	0	0	0	0	1.5	2.0
Children 1 – 3 yrs	254	0.1	0.4	0	0	0	0	1.1	1.5
Children 4 - 12 yrs	750	0.3	0.6	0	0	0	0	1.5	2.1
Boys 13 - 18 yrs	279	0.2	0.6	0	0	0	0	1.5	2.0
Girls 13 - 18 yrs	256	0.3	0.6	0	0	0	0	1.5	2.1
Men 19 yrs and older	2117	0.2	0.6	0	0	0	0	1.5	2.3
Women 19 yrs and older	2594	0.2	0.6	0	0	0	0	1.5	2.0

Table B.06 Anticipated intake of the starch ingredient (g/d) for the total population and subgroups for **users only**; for the food group ice cream

	N	Mean	SD	P10	P25	P50	P75	P95	P97.5
Total population	922	1.4	0.8	0.6	0.8	1.2	1.8	3.0	3.8
Children 1 - 3 yrs	34	1.1	0.5	0.6	0.8	0.9	1.5	1.8	2.1
Children 4 - 12 yrs	155	1.2	0.7	0.6	0.7	1.1	1.5	2.3	2.9
Boys 13 - 18 yrs	34	1.5	0.8	0.8	1.1	1.5	1.9	3.8	3.8
Girls 13 - 18 yrs	54	1.3	0.8	0.6	0.8	1.1	1.5	3.0	3.3
Men 19 yrs and older	300	1.5	0.8	0.7	1.0	1.5	1.8	3.1	3.8
Women 19 yrs and older	345	1.5	0.9	0.7	0.8	1.3	1.8	3.3	3.8

4. Mousse

Table B.07 Anticipated intake of the starch ingredient (g/d) for the **total population** and subgroups; for the food group mousse

	N	Mean	SD	P10	P25	P50	P75	P95	P97.5
Total population	6250	<0.1	0.2	0	0	0	0	0	0
Children 1 – 3 yrs	254	0.0	0.0	0	0	0	0	0	0
Children 4 - 12 yrs	750	<0.1	0.2	0	0	0	0	0	0
Boys 13 - 18 yrs	279	<0.1	0.3	0	0	0	0	0	0
Girls 13 - 18 yrs	256	<0.1	0.2	0	0	0	0	0	0
Men 19 yrs and older	2117	<0.1	0.2	0	0	0	0	0	0
Women 19 yrs and older	2594	<0.1	0.2	0	0	0	0	0	0

Table B.08 Anticipated intake of the starch ingredient (g/d) for the total population and subgroups for **users** only; for the food group mousse

	N	Mean	SD	P10	P25	P50	P75	P95	P97.5
Total population	41	2.5	1	1.7	2.1	2.1	2.9	4.1	5.5
Children 1 - 3 yrs	0
Children 4 - 12 yrs	2	3.9	2.3	2.2	2.2	3.9	5.5	5.6	5.5
Boys 13 - 18 yrs	2	3.0	0.0	3.0	3.0	3.0	3.0	3.0	3.0
Girls 13 - 18 yrs	3	2.1	0.0	2.1	2.1	2.1	2.1	2.1	2.1
Men 19 yrs and older	17	2.5	1.1	1.7	2.1	2.1	2.9	5.5	5.5
Women 19 yrs and older	17	2.3	0.8	1.7	2.1	2.1	2.8	4.1	4.1

5. Curd

Table B.09 Anticipated intake of the starch ingredient (g/d) for the **total population** and subgroups; for the food group curd

	N	Mean	SD	P10	P25	P50	P75	P95	P97.5
Total population	6250	0.2	1.1	0	0	0	0	1.4	3.4
Children 1 – 3 yrs	254	0.4	1.1	0	0	0	0	2.8	3.7
Children 4 - 12 yrs	750	0.2	0.9	0	0	0	0	1.4	2.8
Boys 13 - 18 yrs	279	0.1	0.8	0	0	0	0	0.0	2.1
Girls 13 - 18 yrs	256	0.1	0.7	0	0	0	0	0.0	2.8
Men 19 yrs and older	2117	0.2	1.2	0	0	0	0	0.0	4.1
Women 19 yrs and older	2594	0.2	1.2	0	0	0	0	1.7	3.8

Table B.10 Anticipated intake of the starch ingredient (g/d) for the total population and subgroups for **users** only; for the food group curd

	N	Mean	SD	P10	P25	P50	P75	P95	P97.5
Total population	360	3.9	2.8	1.4	1.9	3.3	5.5	9.1	11.8
Children 1 – 3 yrs	41	2.5	1.7	1.4	1.4	2.3	3.3	5.5	5.5
Children 4 - 12 yrs	55	2.6	2.0	1.4	1.4	2.2	2.8	5.5	11.0
Boys 13 - 18 yrs	10	3.9	2.2	1.4	1.7	3.7	5.5	6.9	6.9
Girls 13 - 18 yrs	9	3.3	1.6	1.4	2.8	2.8	3.6	6.5	6.5
Men 19 yrs and older	98	4.7	3.4	1.3	2.7	4.1	5.5	11.2	13.8
Women 19 yrs and older	147	4.3	2.7	1.6	2.4	3.4	5.5	9.1	12.4

C Total fat intake (g/d) based on the assumed fat percentages per food group when only one food group is taken into account

1. Yoghurt

Table C.01 Total fat intake (g/d) based on the assumed fat percentages per food group when only one food group is taken into account for the total population and subgroups; the food group yoghurt

	N	Mean	SD	P10	P25	P50	P75	P95	P97.5
Total population	6250	92.1	35.4	51.1	67.6	87.5	112.1	157.7	174.5
Children 1 – 3 yrs	254	50.3	17.2	29.3	37.3	48.8	61.4	82.9	87.7
Children 4 - 12 yrs	750	73.8	25.9	44.9	55.1	70.8	88.4	121.3	135.8
Boys 13 - 18 yrs	279	110.6	37.2	72.4	83.0	103.7	131.2	177.3	196.1
Girls 13 - 18 yrs	256	88.3	27.0	56.7	69.0	84.8	104.0	135.9	150.3
Men 19 yrs and older	2117	109.0	36.5	67.3	83.0	104.5	130.5	174.8	188.7
Women 19 yrs and older	2594	86.1	30.3	50.9	65.4	82.8	103.7	140.4	156.7

2. Yoghurt drinks

Table C.02 Total fat intake (g/d) based on the assumed fat percentages per food group when only one food group is taken into account for the total population and subgroups; the food group yoghurt drinks

	N	Mean	SD	P10	P25	P50	P75	P95	P97.5
Total population	6250	88.7	35.1	48.1	64.2	83.7	108.3	153.6	170.5
Children 1 – 3 yrs	254	48.8	17.2	28.1	36.5	46.9	58.7	80.3	87.6
Children 4 - 12 yrs	750	72.3	25.9	43.2	54.0	69.0	87.0	119.2	132.0
Boys 13 - 18 yrs	279	107.2	37.0	67.5	79.5	102.5	125.6	174.5	193.2
Girls 13 - 18 yrs	256	85.4	26.8	54.2	67.3	82.7	101.4	129.1	148.5
Men 19 yrs and older	2117	105.8	36.1	64.7	80.6	101.5	127.5	170.5	184.8
Women 19 yrs and older	2594	81.7	30.3	46.0	60.8	78.7	99.5	136.4	151.0

3. Ice cream

Table C.03 Total fat intake (g/d) based on the assumed fat percentages per food group when only one food group is taken into account for the total population and subgroups; the food group ice cream

	N	Mean	SD	P10	P25	P50	P75	P95	P97.5
Total population	6250	88.1	35.2	47.3	63.2	83.1	108.0	152.6	170.2
Children 1 - 3 yrs	254	47.2	16.8	27.1	35.4	45.9	56.8	78.8	85.0
Children 4 - 12 yrs	750	70.5	25.9	41.4	52.3	66.8	84.5	119.2	132.0
Boys 13 - 18 yrs	279	106.5	37.1	67.5	78.9	101.9	125.6	173.9	193.2
Girls 13 - 18 yrs	256	84.3	26.7	53.7	67.0	82.0	101.4	129.1	142.0
Men 19 yrs and older	2117	105.4	36.0	64.5	80.3	101.1	127.3	170.5	184.8
Women 19 yrs and older	2594	81.4	30.2	45.8	60.5	78.4	99.2	136.3	151.0

4. Mousse

Table C.04 Total fat intake (g/d) based on the assumed fat percentages per food group when only one food group is taken into account for the total population and subgroups; the food group mousse

	N	Mean	SD	P10	P25	P50	P75	P95	P97.5
Total population	6250	88.3	35.3	47.4	63.3	83.2	108.1	153.3	170.2
Children 1 - 3 yrs	254	47.4	16.9	27.1	35.4	46.0	57.3	79.3	85.0
Children 4 - 12 yrs	750	70.7	26.0	41.7	52.5	67.3	84.5	119.2	131.5
Boys 13 - 18 yrs	279	106.6	37.0	67.5	79.0	102.1	125.6	173.9	193.2
Girls 13 - 18 yrs	256	84.5	26.7	53.9	67.0	82.1	100.5	129.1	142.0
Men 19 yrs and older	2117	105.6	36.1	64.7	80.5	101.2	127.5	170.3	184.8
Women 19 yrs and older	2594	81.6	30.2	45.9	60.6	78.6	99.4	136.3	151.0

5. Curd

Table C.05 Total fat intake (g/d) based on the assumed fat percentages per food group when only one food group is taken into account for the total population and subgroups; the food group curd

	N	Mean	SD	P10	P25	P50	P75	P95	P97.5
Total population	6250	88.4	35.3	47.6	63.5	83.6	108.3	153.5	170.5
Children 1 - 3 yrs	254	47.6	16.9	27.7	35.5	46.0	57.4	79.3	85.6
Children 4 - 12 yrs	750	70.8	26.0	41.8	52.6	67.3	84.5	119.2	132.0
Boys 13 - 18 yrs	279	106.7	37.1	68.0	79.0	102.1	127.8	174.5	193.2
Girls 13 - 18 yrs	256	84.6	26.7	53.9	67.0	82.4	101.4	129.1	144.3
Men 19 yrs and older	2117	105.8	36.1	64.9	80.7	101.5	127.5	170.7	185.4
Women 19 yrs and older	2594	81.8	30.2	46.1	61.0	78.7	99.5	136.4	151.4

D Total fat intake (g/d) after replacement of fat by the starch ingredient per food group

1. Yoghurt

Table D.01 Total fat intake (g/d) after replacement of fat by the starch ingredient in the food group yoghurt, for the total population and subgroups

	N	Mean	SD	P10	P25	P50	P75	P95	P97.5
Total population	6250	87.6	35.3	46.8	62.7	82.8	107.4	152.7	170.1
Children 1 - 3 yrs	254	46.8	16.9	26.6	34.9	45.1	56.6	79.3	82.9
Children 4 - 12 yrs	750	70.1	26.1	41.0	51.6	66.3	84.0	119.0	131.9
Boys 13 - 18 yrs	279	105.9	37.0	66.4	77.7	101.9	124.8	174.5	192.2
Girls 13 - 18 yrs	256	83.8	26.8	52.9	67.0	81.6	99.6	127.9	141.8
Men 19 yrs and older	2117	105.0	36.0	63.4	79.7	100.2	127.1	170.1	184.4
Women 19 yrs and older	2594	80.9	30.2	45.0	60.0	77.8	98.7	136.1	150.7

2. Yoghurt drinks

Table D.02 Total fat intake (g/d) after replacement of fat by the starch ingredient in the food group yoghurt drinks, for the total population and subgroups

	N	Mean	SD	P10	P25	P50	P75	P95	P97.5
Total population	6250	88.3	35.3	47.3	63.3	83.2	108.1	153.4	170.2
Children 1 - 3 yrs	254	47.3	16.9	27.1	35.4	45.9	57.3	79.1	84.9
Children 4 - 12 yrs	750	70.6	26.0	41.5	52.4	67.2	84.4	119.2	132.0
Boys 13 - 18 yrs	279	106.6	37.1	67.5	79.0	102.1	125.6	174.5	193.2
Girls 13 - 18 yrs	256	84.5	26.7	53.7	67.0	82.1	101.2	129.1	141.8
Men 19 yrs and older	2117	105.6	36.1	64.7	80.5	101.2	127.5	170.5	184.8
Women 19 yrs and older	2594	81.6	30.2	45.9	60.6	78.6	99.4	136.4	151.0

3. Ice cream

Table D.03 Total fat intake (g/d) after replacement of fat by the starch ingredient in the food group ice cream, for the total population and subgroups

	N	Mean	SD	P10	P25	P50	P75	P95	P97.5
Total population	6250	87.7	35.1	47.1	62.8	82.9	107.3	152.0	169.7
Children 1 - 3 yrs	254	46.9	16.7	27.0	35.2	45.2	56.8	78.8	85.0
Children 4 - 12 yrs	750	70.0	25.8	41.0	51.8	66.0	84.4	119.2	130.2
Boys 13 - 18 yrs	279	106.1	37.0	66.8	78.7	101.7	125.0	173.9	193.2
Girls 13 - 18 yrs	256	83.8	26.6	52.1	67.0	81.2	100.5	127.5	142.0
Men 19 yrs and older	2117	105.0	35.9	64.1	80.0	100.8	126.8	168.5	184.7
Women 19 yrs and older	2594	81.0	30.0	45.7	60.4	77.9	98.7	136.0	149.0

4. Mousse

Table D.04 Total fat intake (g/d) after replacement of fat by the starch ingredient in the food group mousse, for the total population and subgroups

	N	Mean	SD	P10	P25	P50	P75	P95	P97.5
Total population	6250	88.2	35.3	47.3	63.3	83.2	108.1	153.2	170.0
Children 1 - 3 yrs	254	47.4	16.9	27.1	35.4	46.0	57.3	79.3	85.0
Children 4 - 12 yrs	750	71.0	26.0	41.7	52.5	67.3	84.5	119.2	131.5
Boys 13 - 18 yrs	279	106.6	37.0	67.5	79.0	102.1	125.6	173.9	193.2
Girls 13 - 18 yrs	256	84.5	26.7	53.9	67.0	82.1	100.5	129.1	142.0
Men 19 yrs and older	2117	105.6	36.1	64.7	80.5	101.2	127.3	169.7	184.8
Women 19 yrs and older	2594	81.5	30.2	45.9	60.6	78.6	99.4	136.3	151.0

5. Curd

Table D.05 Total fat intake (g/d) after replacement of fat by the starch ingredient in the food group curd, for the total population and subgroups

	N	Mean	SD	P10	P25	P50	P75	P95	P97.5
Total population	6250	88.3	35.3	47.4	63.4	83.3	108.2	153.4	170.2
Children 1 - 3 yrs	254	47.3	16.9	27.2	35.2	46.0	57.3	79.3	84.6
Children 4 - 12 yrs	750	70.7	26.0	41.7	52.5	67.3	84.5	119.2	132.0
Boys 13 - 18 yrs	279	106.6	37.1	68.0	79.0	102.1	127.8	174.5	193.2
Girls 13 - 18 yrs	256	84.5	26.7	53.9	67.0	82.1	100.5	129.1	141.8
Men 19 yrs and older	2117	105.6	36.1	64.7	80.5	101.2	127.3	170.1	184.7
Women 19 yrs and older	2594	81.6	30.2	45.9	60.8	78.6	99.4	136.4	151.0

E Intake of fat-soluble vitamins after replacement of fat by the starch ingredient per food group

1. Yoghurt

Table E.01 Intake of vitamin A (in retinol equivalents) (µg/d) after fat replacement by the starch ingredient in the food group yoghurt, for the total population and subgroups

	N	Mean	SD	P10	P25	P50	P75	P95	P97.5
Total population	6250	878	911	270	407	627	1020	2325	3190
Children 1 - 3 yrs	254	591	598	190	248	390	722	1655	2142
Children 4 - 12 yrs	750	645	612	199	296	454	756	1752	2558
Boys 13 - 18 yrs	279	869	783	304	448	660	1051	2145	3219
Girls 13 - 18 yrs	256	732	682	247	378	510	807	2393	2720
Men 19 yrs and older	2117	1099	1179	360	516	768	1277	2982	3814
Women 19 yrs and older	2594	807	736	278	395	597	949	2036	2750

Table E.02 Intake of vitamin D (µg/d) after fat replacement by the starch ingredient in the food group yoghurt, for the total population and subgroups

	N	Mean	SD	P10	P25	P50	P75	P95	P97.5
Total population	6250	3.63	2.21	1.40	2.13	3.23	4.64	7.53	9
Children 1 - 3 yrs	254	2.09	1.65	0.82	1.23	1.72	2.41	4.60	6.94
Children 4 - 12 yrs	750	2.76	1.49	1.19	1.77	2.54	3.45	5.34	6.56
Boys 13 - 18 yrs	279	4.22	2.08	1.81	2.65	3.89	5.36	8.08	9.38
Girls 13 - 18 yrs	256	3.26	1.73	1.51	2.07	3.00	4.03	6.02	7.35
Men 19 yrs and older	2117	4.57	2.58	1.95	2.92	4.19	5.61	9.12	10.49
Women 19 yrs and older	2594	3.24	1.83	1.29	1.99	2.94	4.10	6.48	7.59

2. Yoghurt drinks

Table E.03 Intake of vitamin A (in retinol equivalents) (µg/d) after fat replacement by the starch ingredient in the food group yoghurt drinks, for the total population and subgroups

	N	Mean	SD	P10	P25	P50	P75	P95	P97.5
Total population	6250	884	912	276	413	631	1028	2331	3190
Children 1 - 3 yrs	254	595	598	192	248	390	724	1655	2138
Children 4 - 12 yrs	750	650	612	203	298	457	762	1738	2556
Boys 13 - 18 yrs	279	876	783	318	457	660	1051	2145	3219
Girls 13 - 18 yrs	256	739	682	250	390	518	819	2392	2733
Men 19 yrs and older	2117	1106	1180	365	520	776	1281	3025	3814
Women 19 yrs and older	2594	814	737	281	404	605	957	2039	2783

Table E.04 Intake of vitamin D (µg/d) after fat replacement by the starch ingredient in the food group yoghurt drinks, for the total population and subgroups

	N	Mean	SD	P10	P25	P50	P75	P95	P97.5
Total population	6250	3.66	2.22	1.42	2.16	3.26	4.66	7.55	9.05
Children 1 - 3 yrs	254	2.11	1.65	0.84	1.24	1.73	2.43	4.62	6.94
Children 4 - 12 yrs	750	2.79	1.48	1.22	1.82	2.56	3.50	5.34	6.56
Boys 13 - 18 yrs	279	4.26	2.08	1.87	2.65	3.95	5.39	8.14	9.38
Girls 13 - 18 yrs	256	3.29	1.72	1.52	2.10	3.04	4.07	6.11	7.38
Men 19 yrs and older	2117	4.60	2.58	1.99	2.95	4.20	5.63	9.16	10.59
Women 19 yrs and older	2594	3.27	1.83	1.32	2.02	2.96	4.14	6.53	7.59

3. Ice cream

Table E.05 Intake of vitamin A (in retinol equivalents) ($\mu\text{g/d}$) after fat replacement by the starch ingredient in the food group ice cream, for the total population and subgroups

	N	Mean	SD	P10	P25	P50	P75	P95	P97.5
Total population	6250	882	912	275	412	630	1027	2331	3190
Children 1 - 3 yrs	254	596	598	194	252	389	724	1655	2142
Children 4 - 12 yrs	750	650	612	203	299	457	764	1745	2558
Boys 13 - 18 yrs	279	875	783	308	454	657	1051	2145	3219
Girls 13 - 18 yrs	256	739	683	245	391	518	818	2394	2733
Men 19 yrs and older	2117	1103	1180	362	517	772	1279	3023	3814
Women 19 yrs and older	2594	812	737	280	400	602	954	2038	2783

Table E.06 Intake of vitamin D ($\mu\text{g/d}$) after fat replacement by the starch ingredient in the food group ice cream, for the total population and subgroups

	N	Mean	SD	P10	P25	P50	P75	P95	P97.5
Total population	6250	3.65	2.22	1.4	2.15	3.25	4.65	7.54	9.01
Children 1 - 3 yrs	254	2.10	1.65	0.84	1.24	1.73	2.41	4.62	6.94
Children 4 - 12 yrs	750	2.78	1.48	1.19	1.81	2.55	3.50	5.30	6.54
Boys 13 - 18 yrs	279	4.25	2.08	1.82	2.65	3.95	5.37	8.14	9.38
Girls 13 - 18 yrs	256	3.28	1.73	1.49	2.08	3.03	4.07	6.02	7.38
Men 19 yrs and older	2117	4.59	2.58	1.96	2.93	4.19	5.61	9.15	10.59
Women 19 yrs and older	2594	3.26	1.83	1.30	2.01	2.95	4.13	6.52	7.59

4. Mousse

Table E.07 Intake of vitamin A (in retinol equivalents) ($\mu\text{g/d}$) after fat replacement by the starch ingredient in the food group mousse, for the total population and subgroups

	N	Mean	SD	P10	P25	P50	P75	P95	P97.5
Total population	6250	884	912	276	414	632	1029	2331	3190
Children 1 - 3 yrs	254	597	598	194	253	391	724	1655	2142
Children 4 - 12 yrs	750	652	612	204	300	458	764	1752	2558
Boys 13 - 18 yrs	279	877	783	318	457	660	1051	2145	3219
Girls 13 - 18 yrs	256	740	682	250	392	518	820	2394	2733
Men 19 yrs and older	2117	1106	1180	365	520	777	1281	3025	3814
Women 19 yrs and older	2594	814	737	281	404	605	957	2039	2783

Table E.08 Intake of vitamin D ($\mu\text{g/d}$) after fat replacement by the starch ingredient in the food group mousse, for the total population and subgroups

	N	Mean	SD	P10	P25	P50	P75	P95	P97.5
Total population	6250	3.66	2.22	1.42	2.16	3.26	4.65	7.55	9.05
Children 1 - 3 yrs	254	2.11	1.65	0.84	1.24	1.73	2.43	4.62	6.94
Children 4 - 12 yrs	750	2.79	1.48	1.22	1.82	2.56	3.50	5.34	6.56
Boys 13 - 18 yrs	279	4.26	2.08	1.87	2.65	3.95	5.39	8.14	9.38
Girls 13 - 18 yrs	256	3.29	1.72	1.52	2.08	3.04	4.07	6.11	7.38
Men 19 yrs and older	2117	4.60	2.58	1.99	2.94	4.19	5.63	9.16	10.59
Women 19 yrs and older	2594	3.27	1.83	1.32	2.02	2.96	4.14	6.53	7.59

5. Curd

Table E.09 Intake of vitamin A (in retinol equivalents) ($\mu\text{g}/\text{d}$) after fat replacement by the starch ingredient in the food group curd, for the total population and subgroups

	N	Mean	SD	P10	P25	P50	P75	P95	P97.5
Total population	6250	885	912	277	414	633	1029	2331	3190
Children 1 - 3 yrs	254	597	598	194	253	391	724	1655	2142
Children 4 - 12 yrs	750	652	612	204	300	458	764	1752	2558
Boys 13 - 18 yrs	279	877	783	318	457	660	1051	2145	3219
Girls 13 - 18 yrs	256	740	682	250	393	518	820	2394	2733
Men 19 yrs and older	2117	1106	1180	365	520	777	1281	3025	3814
Women 19 yrs and older	2594	815	737	281	404	604	957	2039	2783

Table E.10 Intake of vitamin D ($\mu\text{g}/\text{d}$) after fat replacement by the starch ingredient in the food group curd, for the total population and subgroups

	N	Mean	SD	P10	P25	P50	P75	P95	P97.5
Total population	6250	3.66	2.22	1.42	2.16	3.26	4.66	7.56	9.05
Children 1 - 3 yrs	254	2.11	1.65	0.84	1.24	1.73	2.43	4.62	6.94
Children 4 - 12 yrs	750	2.79	1.48	1.22	1.82	2.56	3.50	5.34	6.56
Boys 13 - 18 yrs	279	4.26	2.08	1.87	2.65	3.95	5.39	8.14	9.38
Girls 13 - 18 yrs	256	3.29	1.72	1.52	2.10	3.04	4.07	6.11	7.38
Men 19 yrs and older	2117	4.60	2.58	1.99	2.95	4.20	5.63	9.16	10.59
Women 19 yrs and older	2594	3.27	1.83	1.32	2.02	2.96	4.14	6.53	7.59