

n-6 and *n*-3 PUFA intakes of pre-school children in Flanders, Belgium

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In this study, the intake of *n*-6 and *n*-3 PUFA of pre-school children in Flanders, Belgium, was evaluated, and recommendations to address the very low intake of long-chain PUFA are presented. Food consumption data (based on parentally reported 3 d dietary records obtained from October 2002 to February 2003) of 661 children (338 boys, 323 girls) between 2.5 and 6.5 years of age and the PUFA concentrations obtained from various food composition databases were used. The actual PUFA intake levels were compared to Belgian, European and American recommendations. Only the intake of linoleic acid (LA) fell within the recommended ranges. Margarine, bread, biscuits and chocolate products contributed most to LA intake. The intake of α -linolenic acid (LNA) was low compared to the recommendations and was obtained mostly from the consumption of margarines and fatty sauces. This resulted in a high LA/LNA ratio. The intake of all long-chain PUFA was far below the recommended levels. Meat and meat products were the most important sources of arachidonic acid. Consumption of fish and other seafood was very low, though these were the most important sources of long-chain *n*-3 PUFA. In conclusion, Flemish pre-school children should consume more *n*-3-rich products in order to increase their LNA intake and decrease their LA/LNA ratio. Furthermore, the replacement of meat products rich in SFA by poultry would increase the arachidonic acid intake. As well, fatty fish consumption needs to be increased, as it is a rich source of long-chain *n*-3 PUFA.

n-3: *n*-6: Polyunsaturated fatty acids: Pre-school children

There are many health benefits related to the intake and plasma level of *n*-6 and, in particular, *n*-3 PUFA. Thus, an adequate PUFA intake is very important throughout life. In the last trimester of pregnancy and in the first postnatal months, a sufficient supply of DHA (22:6*n*-3) and arachidonic acid (AA; 20:4*n*-6) is important for the development of the central nervous system and the brain^{1,2}. During the first years of life, a sufficient intake of essential PUFA linoleic acid (LA; 18:2*n*-6) and α -linolenic acid (LNA; 18:3*n*-3) and long-chain (LC) *n*-6 and *n*-3 PUFA is crucial for brain development, photoreception and reproductive system development^{3,4}. Moreover, there is increasing evidence that LC PUFA imbalances are associated with childhood developmental and psychiatric disorders, including attention-deficit hyperactivity disorder, dyslexia, dyspraxia and autistic spectrum disorders^{5,6}. In addition, an adequate intake of LC *n*-3 PUFA counteracts the atherosclerotic process, which is known to begin in youth⁷. During adulthood, the intake of *n*-3 PUFA continues to be crucial, given that many fundamental, clinical and

epidemiological studies have confirmed the relationship between *n*-3 PUFA and several chronic diseases, in particular cardiovascular and inflammatory diseases^{1,8–10}. Moreover, several observational studies have reported that clinical depression, depressed mood and postpartum depression may be accompanied by low *n*-3 PUFA levels in the blood or adipose tissue^{1,11}.

Despite all the favourable health effects, it has been repeatedly reported that modern diets in developed countries are very low in *n*-3 PUFA^{4,12}. The diet in developed countries has evolved from a diet rich in LNA and LC PUFA to a modern Western diet in which LA is the main PUFA^{1,11,13}. This is mainly due to optimized agricultural production processes and the increased consumption of margarines and food items containing vegetable oils that are rich in LA. A result of this dietary evolution has been an increased *n*-6/*n*-3 ratio, which has been shown to promote the pathogenesis of many diseases, including cardiovascular, inflammatory and autoimmune diseases¹².

Abbreviations: AA, arachidonic acid; DPA, docosapentaenoic acid; E%, percentage of the total energy intake; EDR, estimated diet record; FA, fatty acid; FCDB, food composition database; LA, linoleic acid; LC, long-chain; LNA, α -linolenic acid.

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From a public health perspective, dietary unbalances need to be addressed, starting in childhood. In order to develop appropriate interventional strategies at the population level, it is important first to quantify the differences between current dietary intakes and recommendations⁷. Therefore, in the present study, the dietary PUFA intake of pre-school children was evaluated and compared with Belgian, European and American recommendations^{14–16}. An overview of these recommendations is given in Table 1. Furthermore, the food sources that contribute to the various PUFA intakes were identified, and potential ways to bridge the gaps between current intakes and recommended levels were explored. To the best of the authors' knowledge, this is the first paper that has described individual PUFA dietary intakes of pre-school children in Europe. In the past, only individual PUFA intake data of Australian, Canadian and Chinese children have been published^{13,17,18}.

Methods

Study population

The target population for the present study included pre-school children living in Flanders, which is the northern, Dutch-speaking region of Belgium that includes approximately 60% of the total Belgian population. Representative samples of Flemish pre-school children aged 2.5–6.5 years were selected on the basis of random cluster sampling at the school level, stratified by province and age. Details about the sampling strategy and the representativeness of the study sample have been described by Huybrechts *et al.*^{19,20}. A total of 2095 children were enrolled in the present study. Their parents were asked to complete a FFQ, a structured 3 d estimated diet record (EDR), and a general questionnaire on socio-demographic background, family composition and child characteristics. Only the EDR data were used to assess the PUFA intake, since the FFQ was developed to assess calcium intake¹⁹.

Overall, 1052 subjects returned an EDR completed between October 2002 and February 2003. Only EDR containing sufficiently detailed descriptions of the food products and

the portion sizes consumed were used for analysis. The EDR of twenty-six children were excluded due to missing data. Of the 1026 remaining subjects, 696 completed 3 d diaries, 208 completed 2 d diaries and 122 completed only a 1 d diary^{19,20}. In the present study, only the data of children for whom 3 d diaries were available were used, since data from 1 or 2 d do not provide an accurate picture of usual intake on the individual level, due to within-subject diet variation²¹. Since gender or age information was missing for thirty-five children, the EDR of 661 children (338 boys and 323 girls) were included in the analyses. None of the children took supplements containing PUFA. Additional information about the study population has been previously presented by Huybrechts *et al.*^{19,20}.

Food composition databases

The total fat content of the foods was obtained from the Belgian and Dutch food composition database (FCDB)^{22,23}. In total, 726 of the 936 food items consumed contained fat. To determine the PUFA concentration of the food items, a specific FCDB was developed that included the concentrations of LA (18:2n-6), LNA (18:3n-3), AA (20:4n-6), EPA (20:5n-3), docosapentaenoic acid (DPA, 22:5n-3) and DHA (22:6n-3). Eight previously developed FCDB were used, and, in order of the number of items that were used, they were: the Dutch FCDB²⁴ (*n* 457); an extended French FCDB²⁵ (*n* 78); the USDA National Nutrient Database²⁶ (*n* 43); the British McCance & Widdowson's FCDB²⁷ (*n* 42); the Finnish FCDB²⁸ (*n* 13); the Danish FCDB²⁹ (*n* 4); the Canadian Nutrient File³⁰ (*n* 3); and the German FCDB³¹ (*n* 1). Furthermore, food composition information was obtained from food producers for forty food items, mostly for specific types of margarine, cheese and dressings. For forty-five composite food items, the fatty acid (FA) composition was calculated using local recipes describing the different ingredients and their proportions, as well as the FA composition of the ingredients as found in one of the FCDB. Detailed FA profiles of the fat-containing food items were then calculated by applying the proportional share of

Table 1. National and international recommendations for PUFA intake in children as a percentage of total energy intake (E%) and in g/d

	Belgian Health Council, 2003	Scientific Committee for Food (EU), 1993				Institute of Medicine (USA), 2005			
	All children	1–3 years old*		4–6 years old*		1–3 years old*		4–6 years old*	
	E%	E%	g/d	E%	g/d	E%	g/d	E%	g/d
LA	2–6	–	–	–	–	7	–	–	10
LNA	0.45–1.50	–	–	–	–	0.7	–	–	0.9
AA	0.10–0.25	–	–	–	–	–	–	–	–
EPA	0.05–0.15	–	–	–	–	–	–	–	–
DHA	0.10–0.40	–	–	–	–	–	–	–	–
<i>n</i> -6 PUFA†	–	3	4	2	4	5–10‡	–	5–10‡	–
<i>n</i> -3 PUFA†	–	0.5	0.7	0.5	1	0.6–1.2‡	–	0.6–1.2‡	–
<i>n</i> -6/ <i>n</i> -3 ratio§	–	6	4	4	–	–	–	–	–

AA, arachidonic acid; DPA, docosapentaenoic acid; LA, linoleic acid; LNA, α -linolenic acid.

* 1–3 years old = 12–48 months; 4–6 years old = 49–72 months.

† Individual PUFA that are included are not specified.

‡ Approximately 10% of the total intake can come from longer-chain *n*-3 or *n*-6 PUFA.

§ Calculated based on the recommended *n*-6 and *n*-3 PUFA intakes.

each FA in the newly compiled database to the total fat content of the food as listed in the particular FCDB^{22,23}.

Statistical methods

The average PUFA intakes were calculated as the mean of the 3 d period and expressed in absolute amounts (mg/d) as the percentage of the total energy intake (E%). The usual PUFA intakes were computed using the NUSSER-method, a statistical method developed at Iowa State University, based on the advice of the American Institute of Medicine with respect to the need to determine the distribution of usual nutrient intakes when assessing diets of population groups in relation to the recommended levels¹⁶. The NUSSER-method estimates the usual intake distributions by accounting for within-individual variation in nutrient intakes, while requiring relatively few days of intake data per individual³². C-side software (Iowa State University, 2006) was used for the NUSSER-method.

The statistical analyses were done using SPSS software version 12.0 (SPSS Inc., Chicago, IL, USA). Normality was tested using the Kolmogorov–Smirnov test ($P < 0.01$). A non-parametric Mann–Whitney U test was used to determine differences in PUFA intakes between boys and girls, as well as between different age groups ($P < 0.01$).

Percentages of individual PUFA provided by the different foods were calculated as population proportions, as defined by Krebs-Smith *et al.*³³. The population proportion is calculated by summing the amount of a FA from a certain food item for all individuals and then dividing this number by the sum of that FA from all food items for all individuals. The food items were grouped in thirty-six subgroups and eight major groups, according to Astorg *et al.*²⁵.

Results

Table 2 shows the individual PUFA intakes, the LA/LNA ratios, and the $n-6/n-3$ PUFA ratio for all children and for two different age groups, 2.5–3-year-olds (30–48 months) and 4–6.5-year-olds (49–78 months). The NUSSER-method was useful only for LA, LNA, the sum of LA and AA (referred to as $\Sigma n-6$ PUFA), and the sum of LNA, EPA, DPA and DHA (referred to as $\Sigma n-3$ PUFA), but not for individual LC PUFA (AA, EPA, DPA and DHA). This was due to the fact that, in many children, the intake of these PUFA over the 3 d was zero, resulting in a skewed distribution, as reflected by the small differences between the mean intake and the 75th percentile. Other than for LA expressed in E%, the intakes of no other PUFA were normally distributed (in mg/d or in E%). No significant differences in the calculated intakes were found between boys and girls and between children younger and older than 4 years of age. The results of the present study are compared to those of other studies in Table 3.

Fig. 1 shows the dietary sources of the different PUFA for Flemish pre-school children. It is remarkable that the contribution of *sweet products* (including *biscuits*, *chocolate products*, *pastry & desserts*, and *sugar & sweets*) to the LA intake was as high as the contribution of *fats & oils* (including *fatty sauces*, *margarines*, *vegetable oils*, and *mixed fats*). Within the group of *sweet products*, the most important contributor was *chocolate products* (11.6%), followed by *biscuits*

Table 2. Flemish pre-school children's PUFA intakes for the whole group and by separate age groups

	All children (n 661)			2.5–3 years old (n 197)*			4–6.5 years old (n 464)*		
	mg/d			mg/d			mg/d		
	Mean	25th–75th percentile	E%	Mean	25th–75th percentile	E%	Mean	25th–75th percentile	E%
LA†	6913	5500–8100	4.18	6667	5100–7900	4.03	7018	5600–8200	4.25
LNA†	874	67–1020	0.52	798	600–950	0.48	904	700–1060	0.54
AA	17	5–22	0.01	17	5–21	0.01	18	5–23	0.01
EPA	25	1–21	0.02	22	1–19	0.01	26	2–21	0.02
DPA	10	2–10	0.01	10	2–9	0.01	10	2–10	0.01
DHA	47	5–46	0.03	43	5–39	0.03	49	5–50	0.03
$\Sigma n-6$ PUFAs††	6926	5500–8100	4.19	6685	5100–8000	4.05	7030	5600–8200	4.25
$\Sigma n-3$ PUFAs††	941	730–1100	0.57	885	670–1050	0.53	963	750–1120	0.58
LA/LNA	9.1	7.6–10.2		9.1	7.5–10.3		9.1	7.8–10.1	
$n-6/n-3$ §	8.5	7.3–9.5		8.5	7.1–9.7		8.5	7.3–9.5	

AA, arachidonic acid; DPA, docosapentaenoic acid; LA, linoleic acid; LNA, α -linolenic acid.

*2.5–3 years-old = 30–48 months; 4–6 years-old = 49–78 months.

† Results using the NUSSER-method (see Methods) to assess the usual intake.

†† Sum of LA and AA.

§ Sum of LNA, EPA, DPA and DHA.

Table 3. Pre-school children's PUFA intakes in various studies*

	LA (g/d)	LA (E%)	LNA (g/d)	LNA (E%)	AA (mg/d)	AA (E%)	EPA (mg/d)	DPA (mg/d)	DHA (mg/d)	DHA (E%)	LA/LNA
Flemish, 2-5-3 years†	6.71	4.29	0.81	0.51	17	0.01	22	10	43	0.03	9.1
Flemish, 4-6-5 years†	7.12	4.27	0.86	0.51	18	0.01	26	10	49	0.03	9.1
Australian, 2-3 years‡	6.10	-	0.68	-	16	-	10	5	24	-	-
Australian, 4-7 years‡	7.50	-	0.81	-	22	-	19	10	47	-	-
Canadian, 2 years§	9.04	-	2.02	-	260	-	57	-	95	-	5.2
Canadian, 3-5 years§	9.39	-	1.72	-	226	-	60	-	96	-	6.6
Chinese, 1-3 years	2.08	2.9	0.28	0.4	55	0.08	-	-	34	0.05	-
Chinese, 4-5 years	2.27	2.5	0.34	0.4	50	0.06	-	-	23	0.02	-

AA, arachidonic acid; DPA, docosapentaenoic acid; E%, percentage of total energy intake; LA, linoleic acid; LNA, α -linolenic acid.

* Since the values expressed as E% were not reported in other studies for EPA and DPA, these are not included in the table.

† Present study.

‡ Meyer *et al.*, 2001¹⁷.

§ Innis *et al.*, 2001¹⁸.

|| Barbarich *et al.*, 2006¹³.

(8.3%). Two other important LA contributors were *cereal products* (with *bread* as the most important contributor) and *meat, poultry & eggs*. For LNA, the contribution pattern of the different food groups was similar to that found for LA, with almost one-third of the LNA intake coming from the consumption of *fats & oils*, with *margarines* being the most important subgroup (Fig. 1). The AA intake was mainly obtained from *meat, poultry & eggs* (32.6% by *poultry* and 34.3% by *meat & meat dishes*). The second important contributor to AA intake was *fish & seafood* (11.1% from *lean fish* and 7.4% from *molluscs & crustaceans*). For the LC *n*-3 PUFA, *fish & seafood* were the major source, with *fatty fish* being the most important subgroup (contributing 53.4, 42.8 and 48.1% for EPA, DPA and DHA, respectively). A substantial part of DPA intake came from *poultry* (23.5%) and *meat & meat dishes* (18.1%). Given that *margarines* are fortified and that *eggs* are used in the preparation of certain *sweet products* and *snacks*, these products also

contributed to LC *n*-3 PUFA intake; *sweet products* contributed 1.2, 0.1 and 1.3% of EPA, DPA and DHA, respectively, and *snacks* contributed 1.5, 0.5 and 1.9% of EPA, DPA and DHA, respectively.

Exploratory calculations were done to assess the amount of seafood that should be consumed to achieve the recommended amount of LC *n*-3 PUFA. Based on the Belgian nutrient recommendations for EPA and DHA intake, as well as a mean energy intake of 6543 kJ for boys and 5757 kJ for girls^{19,20}, the EPA intake has to be 608–1824 mg/week in boys and 535–1605 mg/week in girls, and the DHA intake has to be 1216–4865 mg/week for boys and 1070–4281 mg/week for girls. Based on the food composition data, it was calculated that two 50 g fatty fish (e.g. mackerel, sardines, salmon) portions per week are needed to fulfil the requirements, assuming that seafood is the only source of EPA and DHA. This recommended level of seafood consumption was

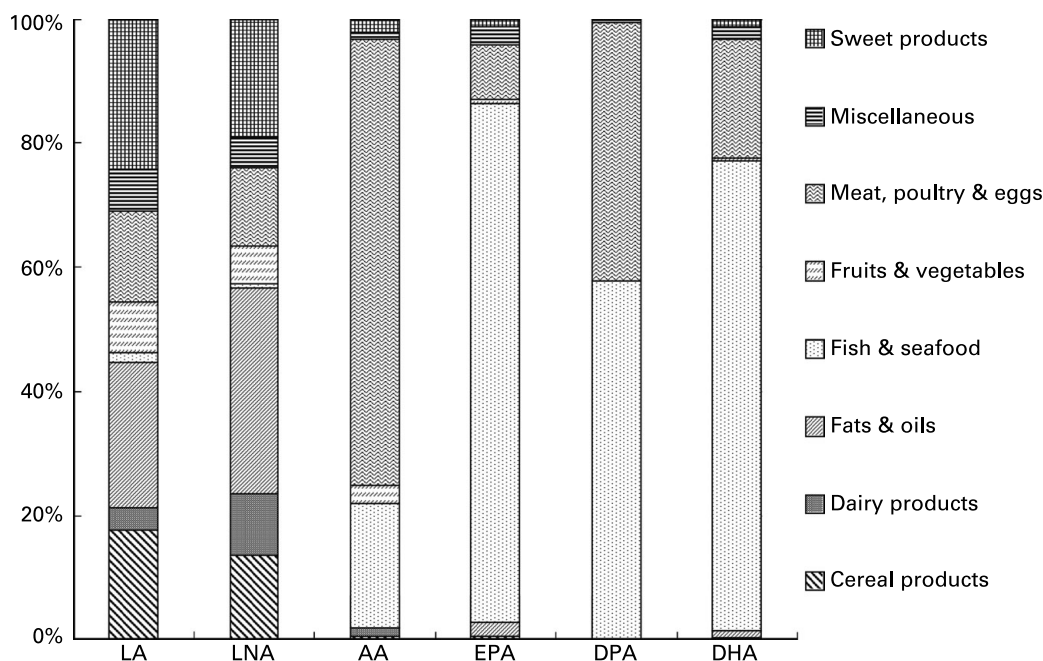


Fig. 1. Food sources of the different PUFA of Belgian pre-school children. AA, arachidonic acid; DPA, docosapentaenoic acid; LA, linoleic acid; LNA, α -linolenic acid.

compared with the current seafood consumption of the pre-school children. On the basis of the 3 d EDR, it was found that only 207 of the 661 children consumed seafood, and only fifty children consumed fatty fish (salmon being the most important species). The mean seafood consumption over the 3 d was 8.6 g/d for the total sample and 27.4 g/d for the subsample who consumed seafood.

Discussion

Comparison with dietary recommended intakes and previous studies

The PUFA intakes calculated in the present study were compared to the results from other studies: (1) Canadian children (n 84; 1.5–5 years), based on a FFQ; (2) Australian children (2–3 years (n 383) and 4–7 years (n 799)), based on one 24 h recall; and (3) children in rural China (n 196; 1–5 years) based on three 24 h recalls (Table 3). Without doubt, different food composition data and different methodologies used to collect food consumption data were used in the various studies, which hampers the comparability of the data. Nevertheless, it is worth comparing the results to evaluate the PUFA intake data of Flemish pre-school children in an international context.

Based on the Belgian recommendations, it was found that a large proportion of the studied population had an LA intake that was within the recommended range. This confirmed the abundance of LA sources in the modern Western diet¹¹. Previous PUFA intake assessments in other subgroups of the Flemish population (adolescents and women of child-bearing age) showed that they also have a sufficient LA intake^{34,35}. Therefore, it can be concluded that no dietary changes are required to increase the current LA intake. However, based on the American adequate intakes for LA, the mean LA intake of the pre-school children was low; this demonstrates that any overall conclusions depend on the recommendations that are used. Overall, the intake of Flemish pre-school children was similar to the intake of Australian, lower than that of Canadian, but much higher than that of Chinese children (Table 3).

For LNA, only 56.5% of the sample had an intake within the Belgian recommended range; the others did not reach the lower level of the recommended intake. Previously, a similar result was found for Flemish women and adolescents^{36,37}. The food sources of LA and LNA are quite similar (Fig. 1); thus, a general shift in the consumption of a certain food group to increase the LNA intake will simultaneously have an effect on the LA intake. Therefore, a shift between foods within a certain food group is required to address the low LNA intake. The consumption of LNA-rich foods by the Flemish population should be encouraged, specifically by encouraging the consumption of food items with a lower LA/LNA ratio (rapeseed oil, linseed oil, soyabean oil and walnut oil). This can be achieved either by direct consumption of these foods or by increased use of these ingredients in processed foods, such as margarines and biscuits, which can be implemented in new and highly developed food manufacturing techniques. With respect to margarine, the food industry must keep the trans-FA concentration of their products as low as possible, since these FA are known to increase the risk of CHD^{38,39}. This is in line with the American Heart Association

statement that it is crucial for the growth and development of healthy children that foods and beverages must fulfil nutritional requirements⁷. The intakes of Flemish pre-school children seem to be quite similar to the American adequate intakes for LNA. Just as was found for the LA intake, the LNA intake of Flemish pre-school children was comparable to that of Australian, but much lower than that of Canadian children. The LNA intake of Chinese children appears very low when expressed in g/d, but only slightly lower than the Flemish intakes when expressed in E%, due to the low energy intake of rural Chinese children.

The rather high LA intake and the excessively low LNA intake of Flemish pre-school children resulted in a high LA/LNA ratio that was much higher than that of Canadian children. This confirms that the consumption of food items with a lower LA/LNA ratio by Flemish pre-school children (and by the Flemish population in general) should be encouraged, and that food industries must be encouraged to lower the LA/LNA ratio of their products, if possible.

All Flemish pre-school children had an AA intake that was lower than the recommended lower limit. Different possible explanations or influencing factors can be put forward: the overall diet truly contains very little AA; the recommended AA intake range set by the Belgian Health Council is too high; or the AA concentrations in the foods consumed were underestimated in the FCDB that were consulted. Considering the second explanation, neither the EU nor the American Institute of Medicine has given specific AA recommendations, which hampers any comparison. However, the American Institute of Medicine has indicated that 5–10 E% should come from n -6 PUFA, with approximately 10% from LC n -6 PUFA. The literature is equivocal on the issue of AA concentration estimation in FCDB. An Australian study stated that AA values in their FCDB are too high, which leads to an overestimation of the AA intake⁴⁰. In contrast, an American study concluded that AA values in the American FCDB (version HB-8) were significantly lower compared to the analytical results⁴¹.

The AA intakes of Flemish and Australian pre-school children were comparable. The AA intakes of Chinese children were more than two times higher, while those of Canadian children were more than 10 times higher (for many of the Canadian children, chicken was the major source of dietary AA). One possible way to increase the current AA intake of Flemish children would be to increase the consumption of poultry meat. However, any recommendation to increase meat consumption should ensure that the overall SFA intake is not increased.

The EPA and DHA intakes of Flemish pre-school children were low compared to the Belgian recommendations. Low seafood consumption was probably the main cause of this deficit. Canadian children had the largest LC n -3 PUFA intake; it was twice as high as the intake of Flemish children (Table 3). Preliminary calculations showed that encouraging fatty fish consumption among Flemish pre-school children would be a possible solution to increase their intakes to recommended levels. Nevertheless, there are various barriers to recommending increased seafood consumption. First, there are concerns that higher fatty fish consumption could impact on the intake of pollutants, such as dioxins and heavy metals. Currently, an increasing number of studies have found that the

potential benefits from *n*-3 PUFA outweigh the risk of exposure to toxicological levels of contaminants^{1,7,40}. Second, the food choice of young people is mostly driven by taste, smell and convenience; seafood does not have a high preference rate⁴¹. Furthermore, parents and school catering services must decide whether seafood will be regularly placed on the menu. Although parents' food consumption decisions are shaped by personal norms or moral obligation to serve their children a nutritious meal, children's preferences and their compliance with these play a role in food consumption⁴². Moreover, recent empirical evidence suggests that the presence of young children in a family acts as an important barrier to increased seafood consumption, particularly in countries with a relatively weak seafood consumption tradition, such as Belgium³⁵. The presence of young children in Belgian households has been associated with a lower impact of external social norms, that is the parents' interest and willingness to take into account advice from external information sources in their social environment, such as medical sources, in determining seafood consumption⁴³. Last but not least, Belgian adults have a rather limited awareness of the fact that seafood is an important dietary source of *n*-3 PUFA, and the fact that these PUFA have a potential beneficial impact on human health⁴⁴.

Methodological issues and limitations

The first methodological limitation is due to the fact that a 3 d EDR does not necessarily reflect individuals' usual intake and likely leads to more extreme high and low intake estimations, especially for nutrients abundantly present in foods that are not consumed on a daily basis, such as seafood²¹. Though the NUSSEER-method was used to assess usual PUFA intake, it was inapplicable for PUFA for which a substantial part of the population had a zero intake. Nevertheless, the mean nutrient intake on the population level, based on 3 d EDR, did not differ much from the usual nutrient intake estimates derived from the NUSSEER-method. This might be due to the rather small within-individual variation of the consumption pattern of young children.

The second limitation is related to the food composition data. On a regular basis, new (highly processed) food items become available. As a result of this variety, it was not possible to find the PUFA composition for some of the foods consumed. Eight different FCDB were used to determine the PUFA composition; this is not ideal, since they can all be based on different protocols. Furthermore, in some individual foods, PUFA, in particular the LC PUFA, are present in small amounts, but accumulate to significant levels of biological importance given the whole diet. For most foods, these low values are often rounded down to zero when the values are reported to a single decimal place in FCDB. Thus, it is likely that PUFA concentrations are consistently underreported, which would lead to an underestimation of the PUFA intake⁴⁵.

The third methodological issue is related to the dietary recommended intakes. In most cases, the dietary recommended intake of a nutrient is expressed as the RDA. RDA are set to meet the needs of almost all (97 or 98%) individuals in a group. Due to a lack of information on biochemical markers for *n*-3 PUFA status, the American dietary recommended intakes for PUFA are provided as adequate intakes based on

the observed median intakes in the USA¹⁶. Nevertheless, no detailed information is available about the background of the other dietary recommended intakes reported in Table 1, which makes a proper comparison difficult.

Conclusions

The intake of LA fell within the recommended range, the intake of LNA was rather low, and, as a result, the mean LA/LNA ratio was high. Therefore, Flemish pre-school children would benefit from a higher consumption of LNA-rich foods, which could be accomplished by replacement of *n*-6-rich oils by *n*-3-rich oils, such as linseed and rapeseed oils, in food formulations. Moreover, dietary changes are necessary to increase intakes of LC *n*-6 and *n*-3 PUFA to recommended levels. Regular replacement of meat products rich in SFA by poultry meat would be a possible solution to increase the AA intake. Fatty fish consumption should be encouraged because it is a rich source of LC *n*-3 PUFA whose current intakes are far below recommended levels.

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