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Lipid content and fatty acid composition in foods commonly consumed by nursing Congolese women: incidences on their essential fatty acid intakes and breast milk fatty acids*

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The fat content and fatty acid (FA) composition of nearly 40 foods, currently consumed by 102 nursing Congolese mothers living in Brazzaville, were determined to assess their impact on mothers' essential fatty acid (EFA) intakes and breast milk FA. Data on mothers' milk FA and dietary habits which allowed food selection were recently published (Rocquelin *et al.*, 1998). Most foods were locally produced. Food samples were collected at local markets, bleached if necessary to avoid microbial degradation, and stored at +4°C or −20°C. They were lyophilized upon their arrival in the laboratory before lipid analyses. FA composition of food lipids was determined by capillary gas chromatography. Staple diets included low-fat, high-carbohydrate foods (processed cassava roots, wheat bread) and high-polyunsaturated fatty acid (PUFA) foods: soybean oil (high in 18 : 2 n-6 and α-18 : 3 n-3), bushbutter (*dacryodes edulis*), peanuts, avocado (high in fat and 18 : 2 n-6), freshwater and salt-water fish (high in LC n-3 and/or n-6 PUFA), and leafy green vegetables (low in fat but very high in α-18 : 3 n-3). Their frequent consumption by nursing mothers provided enough EFA to meet requirements due to lactation. It also explains why mothers' breast milk was rich in C8–C14 saturated FA (26% of total FA) and in n-6, n-3 PUFA (respectively 15.0% and 2.4% of total FA) highly profitable for breastfed infants' development. From this point of view, dietary habits of Congolese mothers have to be sustained for they are more adequate than most Western-type diets.

Introduction

In a recent work (Rocquelin *et al.*, 1998), we reported that mature breast milk of Congolese mothers (n = 102) nursing 5-month-old infants and living in a suburban district of Brazzaville (the capital of the Congo) had a highly valuable fatty acid (FA) composition profitable for breast fed infants' development. It was particularly high in C8–C14 saturated FA (~26.0% of total FA), and total n-6 and n-3 polyunsaturated FA (PUFA, respectively 15.0% and 2.4% of total FA), the latter being implied in infants' optimum growth and development, particularly

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neurodevelopment and visual acuity (Birch *et al.*, 1992; Crawford, 1993; Guesnet & Alessandri, 1995). These values were comparable to or higher than those currently found in human milk in various developed or developing countries (Jensen *et al.*, 1995). Also, no *trans* 18 : 1 could be detected in breast milk and the average 18 : 2 n-6/18 : 3 n-3 ratio was low (= 12.2), near the range of recommended values (5–10) ensuring an equilibrated conversion of essential fatty acids (EFA) precursors into long-chain n-6 and n-3 PUFA by the breastfed infant (FAO/WHO, 1994). In the same study, we also showed that the content of docosahexaenoic acid (DHA, 22 : 6 n-3) in breast milk lipids significantly increased when fish (i.e. horse mackerel) was frequently consumed by nursing mothers.

Breast milk FA are of direct or indirect dietary origin. For instance, it has been established for a long time (Insull *et al.*, 1958) that biosynthesis of C8–C14 saturated FA in the mammary gland is enhanced when high-carbohydrate, low-fat diets are consumed by the nursing mother. It is the case in the Congo where processed cassava roots and wheat bread are staple foods (Massamba & Trèche, 1995). On the other hand, n-6 or n-3 PUFA (precursors or long-chain metabolites) can be provided by various foods of animal or vegetable origin (meat, eggs, fish, high-fat fruits, oilseeds, vegetable oils) and readily transported into breast milk, or, for the long-chain PUFA, *in situ* biosynthesized from dietary EFA precursors (18 : 2 n-6 and 18 : 3 n-3). Our data collected from food frequency questionnaries (FFQ) showed that nursing mothers did frequently consume various fish species, frozen chicken or beef, peanuts, avocado, bushbutter (= safou, *dacryodes edulis*), soybean oil, and leafy green vegetables, all potent dietary n-6 or n-3 PUFA suppliers.

Occurrence of *trans* FA in human milk reflects mothers' consumption of animal fats (e.g. butter) or processed foods (e.g. partially hydrogenated fats and oils as in margarines). In the Congo, these foods are imported and we showed they were not often consumed by mothers.

The present study reports the lipid content and FA composition of ~40 foods commonly consumed by nursing Congolese mothers, in order to estimate their incidence on mothers' EFA intakes and to assess our findings on breast milk FA.

Probands and methods

Healthy Congolese mothers (n = 102) were nursing 5-month-old infants representative of the infant population of this age living in Talangaï, a suburban district of Brazzaville. Mothers were questioned on their dietary habits using FFQ. Nearly 40 foods known to be commonly consumed by the urbanized Congolese people (Delpeuch, 1986; UNICEF, 1992) were listed and for each of them mothers were asked to give a frequency of consumption during the week preceding the interview. They had to choose between four frequencies: every day, ≥ twice a week, once a week, and seldom or never. Portion sizes were not recorded. Results from FFQ were published elsewhere (Rocquelin *et al.*, 1998).

Foods to be analyzed were selected from FFQ data and samples (a few g to a few tens of g) were collected in Talangaï food markets or near by food stores into sterile, waterproof, polyethylene 60 ml bags (Whirl-Pak) to be analyzed for fat content and FA composition. To avoid microbial or oxidative degradation of some highly perishable foods (e.g. fresh meat or fish) bleaching was done prior to storage in the cold. All foods were stored at +4°C or −20°C until air transportation to the laboratory for lipid analyses. All of them except visible fats and oils were lyophilized upon arrival in the laboratory.

Total lipids were extracted from thoroughly homogenized food samples using dichloromethane/methanol (2 : 1 v/v) as extracting solvent and according to Folch *et al.* (1957). Briefly 0.5 to 1 g of food sample was dispersed in 10–20 ml solvent for 30 sec at 24000 rpm in a dispersing instrument (Ultra-Turrax T8, IKA Labortechnick, Staufen, Germany), filtered through a fritted glass funnel under slight vacuum then poured in a 60 ml separatory funnel. The process was repeated once. Deionized water containing 0.73% NaCl (w/w) was added to the organic phase with thorough shaking. Once clear, the organic layer was collected. Lipids were quantified gravimetrically after complete solvent evaporation under nitrogen stream at 40°C. Fatty acid methyl esters (FAME) were obtained by transmethylation of total lipid aliquots (~50 mg) with 1 ml of borontrifluoride in methanol (7% w/v), for 10 min in a shaking water bath heated at 90°C.

FAME were extracted twice with 1 ml of hexane, washed twice with 1 ml of deionized water to neutral pH. Solvent was removed at 40°C under gentle nitrogen stream. Care was taken not to reach complete dryness when FAME were concentrated, so as to limit losses of volatile C8–C14 FA when present. FAME were separated on a Di 200 gas chromatograph (Delsi-Nermag Instruments, Argenteuil, France) equipped with a split (50 : 1) injector, a flame ionization detector, and a DB-23 bonded fused-silica capillary column (30 m × 0.25 mm ID with a 0.25 μm film thickness, Alltech, Deerfield, USA). This column provided a good separation of *cis/trans* FAME isomers as well as of n-6, n-3 PUFAME. Helium at a 1–2 ml/min flow rate was the carrier gas. For most FAME analyses, column temperature was kept at 190°C for 20 min, then programmed from 190°C to 200°C with a rise of 5°C/min and kept at this temperature for 15 min. When C8–C14 FA were known or suspected to be present in food fat, column temperature was first kept at 140°C for 10 min, then programmed from 140°C to 190°C with a rise of 5°C/min, kept at this temperature for 14 min, programmed again from 190°C to 200°C with a rise of 5°C/min and finally kept at 200°C for 24 min. These chromatographic conditions allowed rapid elution and correct separation of all FAME from C8 to C24 including C20–C22 long-chain PUFAME. The injection port was maintained at 230°C, and the detector at 250°C. FAME were identified by comparison of their relative retention times with appropriate commerical standards (Alltech, Deerfield, USA and Cayman Chemical, Ann Arbor, USA) chromatographed in the same conditions. FAME were quantified with an Enica 31 integrator (Delsi-Nermag Instruments, Argenteuil, France). Fatty acid composition of foods were expressed as a percentage of total FA (w/w).

Results

Data on fat content and FA composition of foods were grouped into three separate tables according to food origin: vegetable (Table 1), animal (Table 2), and visible fats and oils (Table 3). Identified FA, because there were often too many to be individually listed into easy-to-read tables, were grouped in FA families whenever possible. Foods in tables were listed in decreasing order of consumption frequency.

Vegetable foods

The fat content of vegetable foods went from very low to very high values (i.e. foufou = 0.24 g/100 g edible portion, dried peanuts = 49.5 g/100 g). Oilseeds or fatty fruits (peanut, pumpkin, bushbutter, avocado) were high in linoleic acid (18 : 2 n-6). Occurrence of noticeable amounts of 18 : 2 n-6 and α-linolenic acid (18 : 3 n-3) in doughnuts and deep-fried plantain was not due to the main food ingredient itself (wheat flour or plantain) but to soybean oil used as frying oil. Lipids of leafy green vegetable (endive, spinach, bari, saka-saka) commonly found in many Congolese dishes were high in 18 : 3 n-3. Although green leaves had a low fat content, 100 g of edible portion brought ~120 mg (endive) to 660 mg (saka-saka) of 18 : 3 n-3. Moreover, leaves also contained C12–C14 saturated FA, some LC n-6 and n-3 PUFA, and unidentified FA mainly 14C–16C chains. Coconut and palmnut are high-fat fruits containing major amounts of C8–C14 saturated FA but they were infrequently consumed.

Animal foods

These were mainly dairy products, fish, and occasionally fresh game meat (e.g. monkey). Fat contents vary from one food to another, palmtree worm and fresh sheat being respectively the fattiest and the leanest ones. Palmtree worms are not often consumed but sheat is a common food. Consumption of chicken or beef was also frequent but, in this study, samples of these foods were not collected for analysis because of too great a heteroginicity of meat cuts (i.e. fat content) sold on the local markets. They obviously represented a significant source of animal fat.

Fish in general are excellent sources of LC PUFA and this was confirmed for fish consumed by Congolese mothers. Many fish species are caught, either in the Congo River or in the Atlantic Ocean along the Congolese coast, but only those most frequently consumed (i.e. horse mackerel, sheat, cod, and sole) were reported in Table 2. Percentages of LC n-3 PUFA (mainly 20 : 5 and 22 : 6) in salt-water fish (horse makerel, cod, and sole) were higher than in freshwater fish (sheat) whereas the reverse was observed for 18 : 2 n-6 and LC n-6 PUFA (mainly 20 : 4 n-6). Smoked sheat being the fattiest fish had the highest concentrations in n-6 and n-3 PUFA.

Table 1. Fat content (g/100 g edible portion) and fatty acid (FA) composition (%) of vegetable foods

Food	Fat content	MCSFA[1] (8:0 + 10:0)	ICSFA (12:0–14:0)	LCSFA (15:0–24:0)	MUFA (16:1–24:1)	18:2 n-6	LC n-6 PUFA (18:3 n-6)	18:3 n-3	LC n-3 PUFA (18:4–22:5)	Other FA[5]
Foufou[2]	0.24	–	1.94	33.38	32.38	22.48	–	9.02	–	0.80
Endive[3]	0.42	–	4.93	36.68	12.42	8.37	0.19	28.80	0.08	8.53[6]
Spinach[3]	0.40	0.03	1.97	25.46	14.25	17.11	0.19	34.26	1.17	4.70[6]
Bari[3]	0.85	0.18	4.69	26.33	10.38	14.31	0.22	34.40	3.30	6.05[6]
Saka-saka[3,4]	1.64	0.05	2.57	24.76	9.01	15.81	0.19	40.53	0.41	6.57[6]
Bushbutter (dried pulp)	40.07	–	0.26	54.02	21.50	21.90	–	2.00	–	0.32
Peanut paste	46.71	–	0.04	20.73	42.75	36.31	–	0.06	–	0.11
Palmnut juice	11.47	–	1.22	48.55	38.40	10.68	–	0.85	–	0.30
Roasted peanuts	43.21	–	–	17.53	48.42	33.15	–	0.39	–	0.51
Dried peanuts	49.49	–	–	19.53	42.61	37.75	–	0.09	–	0.02
Plain doughnut	7.70	–	0.28	15.59	22.60	53.47	0.31	6.22	–	1.53
Doughnut with banana	11.65	–	0.06	15.87	22.39	54.00	0.36	7.10	–	0.22
Avocado	19.12	–	0.11	34.35	50.78	13.66	–	1.01	–	0.09
Rice	0.87	0.56	0.79	29.25	31.69	36.00	–	1.15	0.11	0.45
Pumpkin paste	44.87	–	0.10	22.02	13.41	64.02	–	0.33	–	0.12
Deep-fried plantain	3.94	–	0.19	18.56	21.20	50.88	0.35	8.75	–	0.07
Biscuits	11.90	–	1.58	53.15	29.96	14.21	–	0.50	–	0.60
Coconut	45.60	12.18	68.40	11.06	5.84	1.83	–	0.19	–	0.50
Palmnut	46.49	5.82	63.76	11.40	15.39	3.10	–	0.17	–	0.36

[1]SFA = saturated fatty acids; MC = medium chain; IC = intermediary chain; LC = long chain; MU = monounsaturated; PU = polyunsaturated.
[2]Processed cassava roots.
[3]Local given names of leafy green vegetable: endive = *Brassica oleracea*; spinach = Spinacia oleracea; bari; = Amaranthus hybridus.
[4]Bleached cassava leaves without oil.
[5]Minor or unidentified FA.
[6]Mostly 14–16C FA (could be branched FA).

Table 2. Fat content (g/100 g edible portion) and fatty acid (FA) composition (%) of animal foods

Food	Fat content	*MCSFA*[1] *(8:0 + 10:0)*	*ICFSA (12:0–14:0)*	*LCSFA (15:0–24:0)*	*MUFA (14:1–24:1)*	*18:2 n-6*	*LC n-6 PUFA (18:3–22:4)*	*18:3 n-3*	*LC n-3 PUFA (18:4–22:6)*	*Other FA*[2]
Condensed milk (Gloria)[3]	7.43	5.51	14.60	42.26	26.21	1.41	0.09	0.59	1.11	6.49
Condensed milk (Nestle)[3]	7.79	5.77	16.85	44.86	21.30	1.31	0.06	0.71	0.56	6.56
Frozen horsemackerel	3.15	–	7.20	27.65	20.40	0.96	1.44	0.27	24.85	4.56
Smoked sheat	17.85	–	1.69	30.58	32.68	10.80	6.75	1.48	8.00	1.47
Fresh sheat	1.75	–	4.87	33.58	17.89	5.15	7.32	5.83	7.27	11.90
Salted cod	2.14	0.25	1.43	30.12	18.41	1.18	1.49	0.53	43.68	0.82
Garlic sausage	26.49	1.71	2.01	37.46	43.38	9.42	0.37	0.73	0.31	1.59
Fresh monkey meat	4.57	0.09	1.55	36.58	32.95	15.95	3.67	2.71	2.44	0.61
Salted sole	2.25	0.34	1.79	31.30	26.59	0.98	1.24	0.34	30.14	1.11
Home-made yoghurt	3.65	5.99	16.04	44.34	25.25	1.72	0.12	0.39	0.66	3.65
Melted cheese	28.64	6.16	14.99	42.86	26.95	2.19	0.20	0.58	0.78	3.87
Palmtree worm	30.23	–	2.53	41.63	48.12	3.34	–	0.78	0.15	0.24

[1]SFA = saturated fatty acids; MC = medium chain; IC = intermediary chain; LC = long chain; MU = monounsaturated; PU = polyunsaturated.
[2]Minor or unidentified FA.
[3]Added to tea mainly.

Table 3. Lipid content (g/100 g edible portion) and fatty acid (FA) composition (%) of visible fats and oils

Fat or oil	*Fat content*	*MCSFA[1] (8:0 + 10:0)*	*ICSFA (12:0 + 14:0)*	*LCSFA (15:0–22:0)*	*16:1 trans*	*16:1[2]*	*16:1 n-7 cis*	*18:1 trans*	*18:1[2]*	*18:1 n-9 cis*	*18:2 trans*	*18:2 n-6 cis*	*18:3 n-3 cis*	*20:1[2]*	*22:1[2]*	*Other FA[3]*
Refined oil (Remia)	99.73	–	0.11	14.86	–	–	–	–	–	21.69	–	55.64	7.14	–	–	0.56
Refined oil (RC-USA)	ND[4]	–	0.08	14.98	–	–	0.40	–	–	18.91	0.10	56.40	8.56	–	–	0.57
Crude palm oil	99.21	–	0.97	51.18	–	–	–	0.38	–	36.25	–	10.84	0.36	–	–	–
Margarine (Coaster)	83.18	0.14	4.36	42.41	–	–	1.89	2.16	1.42	34.07	0.51	8.70	1.26	0.25	–	2.31
Margarine (Romi)	ND	–	5.37	40.60	0.44	–	2.00	3.70	1.70	26.33	–	9.75	1.45	3.39	2.16	2.45
Margarine (Remia)	84.50	0.29	10.11	38.13	–	13.25	–	–	17.14	–	0.14	6.64	0.95	8.00	3.44	1.90
Margarine (Victoria)	ND	0.29	11.80	38.43	–	12.97	–	–	19.90	–	0.25	7.00	3.36	2.13	3.36	0.59
Mayonnaise (Lesieur)	96.88	–	–	11.79	–	–	–	–	–	23.62	–	64.57	–	–	–	–
Mayonnaise (Amora)	ND	–	–	13.30	–	0.15	–	–	–	21.98	–	64.26	0.31	–	–	–

[1]SFA = saturated fatty acids; MC = medium chain; IC = intermediary chain; LC = long chain.
[2]Mixture of unidentified cis/trans FA isomers (see figure 1)
[3]Minor FA.
[4]ND = not determined.

Visible fats and oils
Except crude palm oil, all fats and oils used in Congolese diets were imported. Refined vegetable oils (Remia and RC-USA) were sold unnamed, most of the time in various sized recycled glass bottles, but FA composition (i.e. 18 : 2 n-6 and 18 : 3 n-3, in particular) revealed both were soybean oils. Soybean oil was also used as dressing oil or frying oil. Four margarine brands were currently consumed by mothers in Talangaï district as spreads on bread for breakfast. Two margarine brands (Remia and Victoria) had comparable FA composition showing high amounts of positional and/or *trans* 16 : 1, 18 : 1, 20 : 1, and 22 : 1 isomers. It means that partially hydrogenated fish oils were major constituents in both products. The other two margarines (Coaster and Romi) also had similar FA profiles and might also have contained some partially hydrogenated fish oils but to a lesser extent for their total percentages of *cis/trans* monounsaturated fatty acid

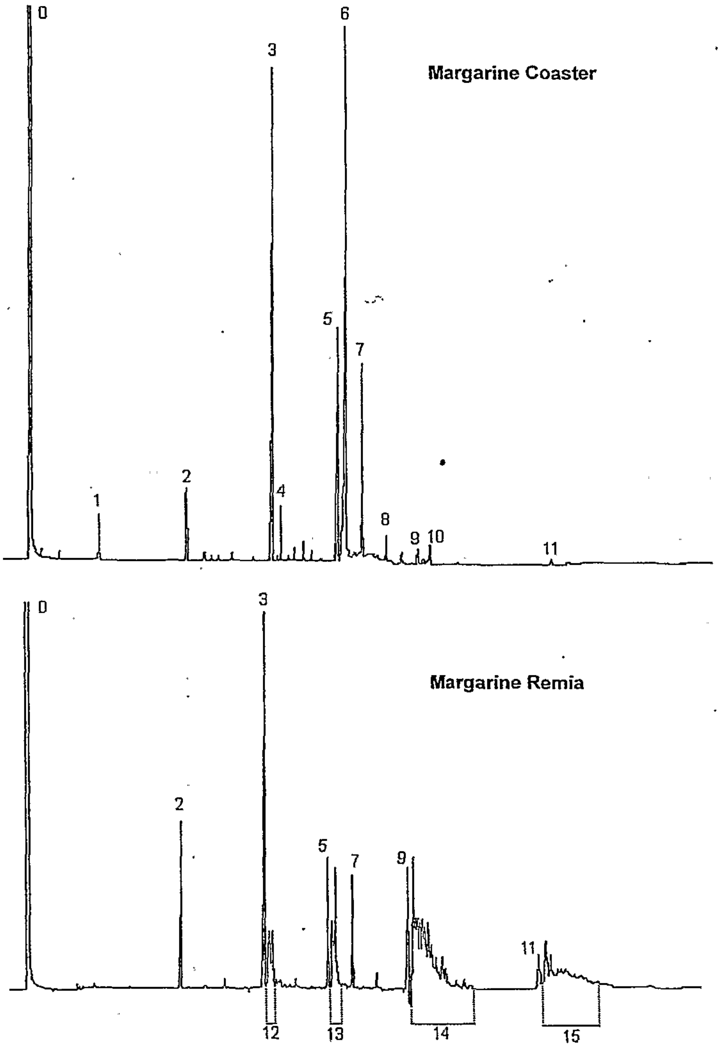

Figure 1. Fatty acid methyl ester chromatograms of two commercial margarines (Coaster and Remia). Peaks are: 0 = solvent; 1 = 12 : 0; 2 = 14 : 0; 3 = 16 : 0; 4 = 16 : 1 *cis*; 5 = 18 : 0; 6 = 18 : 1 n-9 *cis*; 7 = 18 : 2 n-6 *cis-cis*; 8 = 18 : 3 n-3 *cis-cis-cis*; 9 = 20 : 0; 10 = 20 : 1 n-9 *cis*; 11 = 22 : 0; 12 = 16 : 1 *cis* + *trans*; 13 = 18 : 1 *cis* + *trans*; 14 = 20 : 1 *cis* + *trans*; 15 = 22 : 1 *cis* + *trans*.

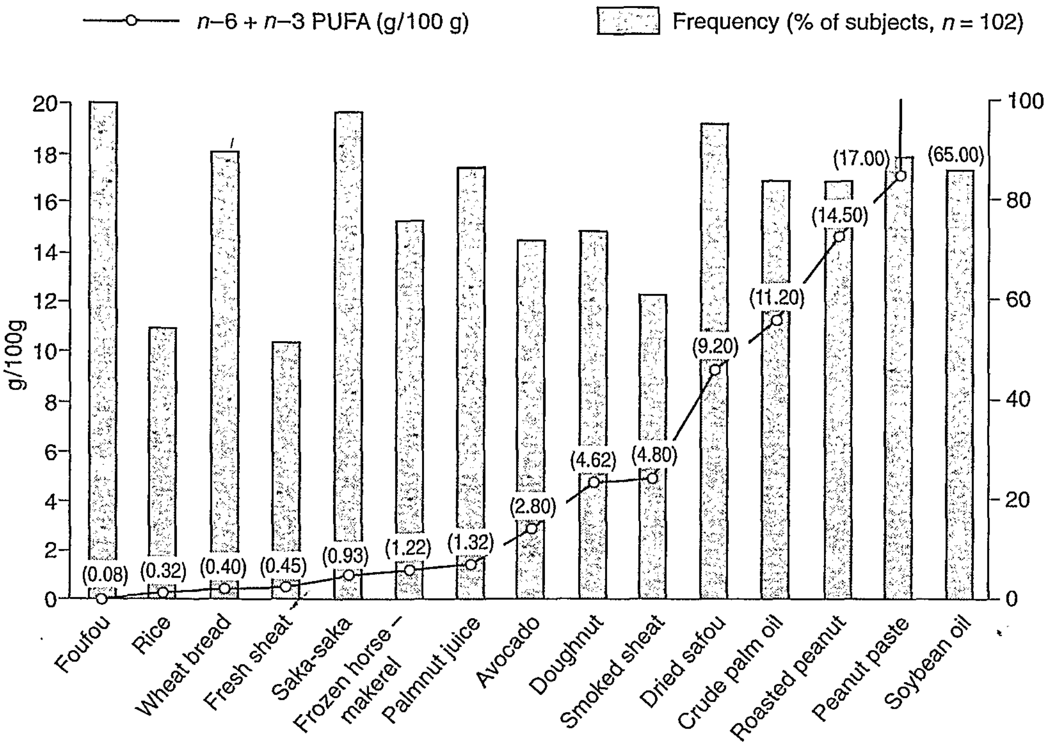

Figure 2. N-6 + n-3 PUFA contents (g/100 g edible portion) of foods currently consumed (≥ once a week) by more than 50% of Congolese mothers.

(MUFA) isomers were much lower. Figure 1 illustrates differences in FA profiles between high-*trans* and low-*trans* margarines. Chromatogram of low-*trans* margarine Coaster is much 'cleaner' than that of high-*trans* Remia, in areas where MUFA isomers were eluted. In the latter, original *cis* MUFA (16 : 1, 18 : 1, 20 : 1, 22 : 1) as they were in unhydrogenated oils are hardly distinguishable from several other peaks. They were too numerous to be satisfactorily resolved and identified even with the capillary column we used. However, the total amount of positional and/or *trans* isomers in margarine Remia was estimated ~45% of total FA. It is very high. Two mayonnaises (Lesieur and Amora) were consumed. They were made of pure sunflower oil as shown by their FA composition.

Figure 2 summarizes data on n-6 + n-3 PUFA concentration (g/100 g edible portion) of 15 foods currently consumed (≥ once a week) by more than 50% of mothers. Most foods are potent EFA suppliers.

Discussion

Most foods currently consumed by nursing Congolese mothers were traditionally and locally produced. Some were imported (soybean oil, rice, salted cod, frozen meat, margarine, mayonnaise, condensed milk, and melted cheese). Food selling prices had increased after the 1994 devaluation of the CFA franc, and at the time of our survey (1995) money was also scarce because of irregularly paid salaries. Household socio-economic status was precarious (Rocquelin *et al.*, 1998). Mothers said they spent less on expensive imported foods than they did before devaluation and went back to cheaper local and traditional foods.

There are very few data on fat content and FA composition of Congolese foods in the literature and thus hardly comparable with ours. Some foods collected in Brazzaville were already analyzed by Kinkela and Bézard (1993). Their results on fatty fruits (bushbutter), oilseeds (pumpkin, peanut), sole, and palmtree worm are similar to ours. They somewhat differ as for freshwater fish fat content but analyzed species were different. Bushbutter is a popular fruit that is well appreciated in the Gulf of Guinea region but its fat content and FA composition greatly varies from one area to another (Omoti & Okiy, 1987; Silou, 1996).

Some foods among those we analyzed were also reported in the food composition table of Souci *et al.* (1994). However, care should be taken when comparing data since geographical origins of foods can be different. For example, in the Congo, frozen horse mackerel had a fat content similar to that of unknown origin reported in Souci's table, but a higher concentration of LC n-3 PUFA. Also, Congolese fresh sheat, although six to seven times leaner than that in Souci's table, showed similar concentrations (i.e. mg/100 g edible portion) of 18 : 3 n-3 and LC n-6 PUFA. It has been known for a long time (Sébédio, 1992) that, within the same fish species, fat content and FA composition vary according to many factors (e.g. season and area of catching, type of muscle) which can account for aforementioned differences. In particular, the substantial levels of LC n-6 PUFA we found in sheat flesh can be due to the fact that this species lives in the warm waters of the Congo river (25–32°C). This result was already seen in other fish species caught in the Southern hemisphere, particularly in warm waters near the equator (Sinclair *et al.*, 1986), suggesting that such waters provide high supplies of n-6 PUFA for fish nutrition.

Green leaves consumed in the Congo had fat content values within the range of those reported for the South Pacific Region (Bailey, 1992). They are rich sources of α-linolenic acid (120 to 660 mg/100 g) comparable to or even higher than purslane considered so far by Simopoulos *et al.* (1992) as the richest source of this PUFA. These authors also claimed that purslane was the only plant to produce eicosapentaenoic acid (EPA, 0.01 mg/g fresh protion) which is no longer true since our findings showed that bari leaves (*Amaranthus hybridus*) contained 1.4 mg/100 g edible portion (1.64% of total FA) as EPA.

Food intakes by Congolese mothers were not measured in this study, preventing us from knowing precisely the daily FA supply from the diet. Nonetheless, looking at previous surveys on Congolese dietary habits (Massamba & Trèche, 1995) as well as at our own findings on lipid composition of staple foods, it is likely that diets provided enough FA (particularly EFA, as shown in Figure 2) to meet mothers' requirements during their lactation (FAO/WHO, 1994) and to ensure an adequate FA composition of their milk.

Consumption of processed cassava roots (foufou and chickwangue) in the Congo, although it is slightly diminishing, remains by far the first staple food consumed by the Congolese people (Trèche, 1995). Indeed, the daily intake of cassava roots in this country is ~800 g, i.e. 35% of total energy intake, the second highest in the world. Wheat bread tends to replace processed cassava roots at breakfast and its consumption in Brazzaville is increasing (Massamba & Trèche, 1995). However, both foods are low-fat, high-carbohydrate products and if one also takes consumption of other high-carbohydrate foods as doughnuts or fried plantain into account, it is easily conceivable that such high intakes of carbohydrates readily enhance *de novo* C10–C14 saturated FA biosynthesis in the mammary gland. As a matter of fact, the average amount of C8–C14 FA we found in breast milk of Congolese mothers (26.0% of total FA, Rocquelin *et al.*, 1998) was one of the highest known so far in human milk (Jensen *et al.*, 1995).

High values of n-6 and n-3 PUFA found in breast milk have to be related to the frequent consumption by mothers of high-PUFA foods: soybean oil (high in 18 : 2 n-6 and 18 : 3 n-3), bushbutter, peanuts, avocado (high in fat and 18 : 2 n-6), fish (high in LC n-3 or n-6 PUFA), and leafy green vegetables (low in fat but very high in 18 : 3 n-3). Consumption of processed cassava roots in the Congo is traditionally accompanied with that of leaves and fish (Massamba & Trèche, 1995), so the daily 18 : 3 n-3 and LC n-6, n-3 PUFA intakes were probably noticeable. Consumption of foods rich in 18 : 2 n-6 and/or 18 : 3 n-3 results either in direct incorporation of these two FA in adipose tissues and their subsequent mobilization into milk lipids, or in their metabolic conversion into LC n-6 or n-3 PUFA, these in turn being incorporated into milk lipids. On the other hand, dietary LCPUFA provided by fish, meat, and leaves can be incorporated unchanged into milk lipids.

High-*trans* margarine intakes by Congolese mothers were probably low, since we could not detect *trans* MUFA isomers in breast milk lipids. It was fortunate for breastfed infants since *trans* isomers are to be avoided as much as possible in human diets (FAO/WHO, 1994). However, if the socio-economic situation in the Congo were becoming more favourable, consumption of imported processed foods as margarines might increase, leading to incorporation of *trans* isomers into breast milk and their subsequent undesirable intake by breastfed infants. Consequently, high-*trans* margarines such as those found today in Congolese food markets should be withdrawn.

It can be concluded that the current dietary habits of Congolese mothers based on more local foods than imported products provided enough EFA to meet mother's requirement for lactation and had a favourable impact on FA composition of breast milk, particularly n-6, n-3 PUFA, highly profitable to breastfed infants. From this point of view, traditional Congolese-type diets have to be sustained for they are more adequate than most Western-type diets.

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