

FAT CONTENT AND ESSENTIAL FATTY ACID (EFA) COMPOSITION OF CONGOLESE MATURE BREAST MILK ARE INFLUENCED BY MOTHERS' NUTRITIONAL STATUS

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ABSTRACT

Breast milk samples of Congolese women (n=102) nursing 5 mo-old infants and living in Talangaï, a suburban district of Brazzaville, were collected and analyzed for their fat content and fatty acid (FA) composition. Mothers were questioned on their dietary habits. Compared with breast milk from various developed or developing countries, Congolese mature breast milk was low in fat (28.7 ± 11.33 g/L) but rich in 8:0-14:0 FAs (25.97 ± 8.17% of total FAs) and in polyunsaturated FAs (PUFAs), particularly n-3 PUFAs (2.39 ± 0.68% of total FAs, mainly 18:3 and 22:6). No 18:1 trans was detected. This was associated with the frequent consumption by the mothers of high-carbohydrate foods (processed cassava roots, wheat bread, doughnuts) known to enhance 8:0-14:0 FA biosynthesis, and with that of foods providing n-6 and n-3 EFAs such as freshwater and saltwater fish, vegetable oils, green leafy vegetables, and high-fat fruit (peanuts, avocado, safo). These foods were traditionally and locally produced. Milk fat content was negatively related with mothers' BMI (body mass index) and varied with the frequency of consumption of certain foods corresponding to distinct dietary patterns. (Supported by the French Ministry of Research, and INRA).

INTRODUCTION

This study was part of a larger survey which aimed at evaluating the essential fatty acid (EFA) status of infants living in a suburban district of Brazzaville, the Capital of The Republic of Congo. EFA status of infants depends on dietary EFA supplies, i.e. only from breast milk if infants are exclusively breastfed, or from breast milk and complementary foods if they are partially breastfed. Fat content and FA composition of human milk (particularly EFA) partly depend on mothers' nutritional status. The present work reports data on nutritional status of Congolese mothers nursing 5 mo-old infants and their impact on fat content and FA composition of breast milk.

SUBJECTS AND METHODS

Characteristics and dietary habits of Congolese mothers

One hundred and two apparently healthy Congolese mothers nursing 5-mo-old infants were included in this study. Their dietary habits were identified through food frequency questionnaires (FFQ). For each food known to be commonly consumed by the urbanized Congolese people each woman gave her frequency of consumption during the week preceding the interview (every day, > twice a week, once a week, or seldom or never).

Milk and food sampling

Mothers expressed a small volume of breast-milk (1-5 mL) from each breast into a sterile container. Two samples were collected, one in the mid-morning, and the other in the mid-afternoon, with a minimum interval of 4 h between collections. The 2 samples were pooled, and, in the same evening, a 1 mL aliquot of milk was pipetted into a glass vial containing 2 mL of dichloromethane-methanol (2:1, v/v).

Food samples (a few g to a few tens of g) were collected into sterile, waterproof, polyethylene 60 mL bags in local food markets or near-by food stores. To avoid microbial or oxidative degradation of highly perishable foods (e.g. fresh meat or fish) bleaching was done prior storage in the cold.

Samples (milks and foods) were stored at +4°C or -20°C until air transportation to the laboratory for lipid analyses. All foods except visible fats and oils were lyophilized upon arrival in the laboratory.

Lipid analyses

Total lipids (milks and foods) were extracted according to Folch et al. and quantified gravimetrically. FA were separated by GLC as methyl esters on a DB-23 bonded fused-silica capillary column (30 m x 0.25 mm I.D.).

Data processing and statistical analyses

The anthropometric, dietary, and socio-economic data were processed using Epi-Info version 5. The SAS System, release 6.09 for Unix, was used for further data management and statistical analyses. ANOVA was used to compare milk fat content of mothers grouped according to their frequency of consumption of individual foods. Multivariate dietary profiles, including simultaneously the frequency of consumption of various foods, were assessed with two methods: correspondence analysis on the frequencies of consumption, and hierarchical clustering (Ward criterion) on the principal coordinates.

Permissions

Permission to conduct the study was obtained from the Congolese Ministry of Research. Parents were informed in local languages about the study and gave their consent.

CONCLUSIONS

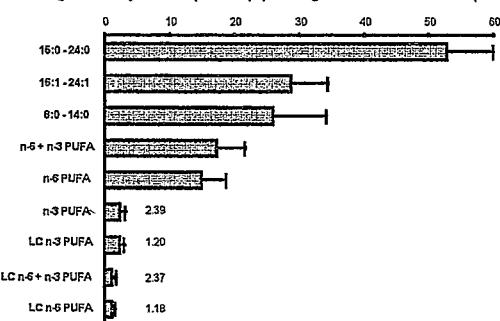
The average FA composition of breast milk of Congolese mothers, particularly the n-6, n-3 PUFA composition, was remarkable. It was strongly dependent on traditional dietary habits (i.e. frequent consumption of high-carbohydrate foods, leafy green vegetables, fish, high-fat fruit or seeds, and vegetable oils) leading to breast milk enrichment in PUFAs and other nutritionally important FAs either by direct FA incorporation or after *de novo* biosynthesis and mobilization. From this point of view the present Congolese diet was more adequate than most Western diets. Unfortunately, the breast milk fat content was low but interestingly enough negatively related with mother's BMI. This can be due to differences in fat and/or carbohydrate contents of mothers' diets.

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RESULTS

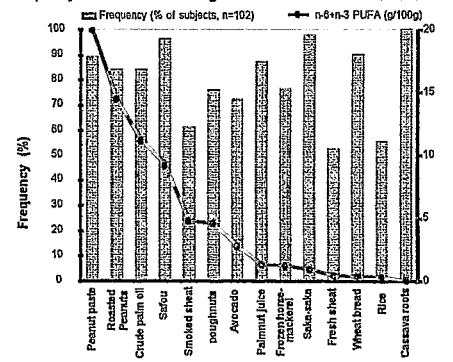
► Breast milk FA (Figure 1): amounts of 8:0 - 14:0 FA (~ 26% of total FA) and n-6, n-3 PUFA (17.3% of total FA) in Congolese breast milk were among the highest ones.

Figure 1: Fatty acid composition (%) of Congolese mature breast milk (n=102)



► FFQ data and lipid analyses of foods (Figure 2): foods most currently consumed by Congolese mothers were either high-carbohydrate, low-fat foods (cassava roots, rice, doughnuts, wheat bread), or high-fat and / or high-EFA foods (peanut, safo, fish, green leaves (e.g. saka-saka)).

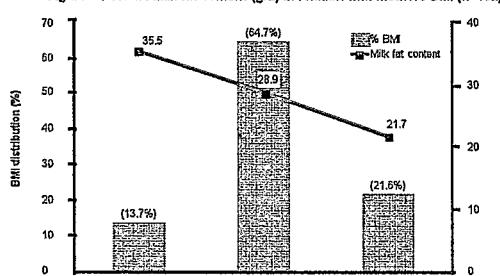
Figure 2: Frequency of mothers consuming foods at least once a week and PUFA content of foods



► High intakes of high-carbohydrate, low-fat foods are known to enhance endogenous 8:0 - 14:0 FA biosynthesis in the mammary gland during lactation. It explains why Congolese breast milks were so rich in 8:0 - 14:0 FA. Moreover, frequent consumption of fish, fatty fruit or seeds, green leaves, and vegetable oils provides noticeable amounts of n-6, or n-3 PUFA which contribute to the enrichment of Congolese breast milks in these functionally important PUFA.

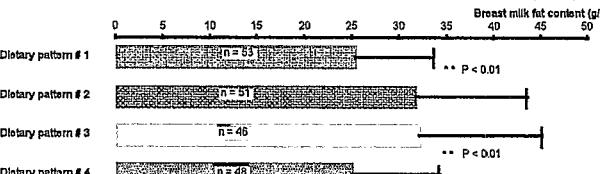
► Breast milk fat content was notably low (28.7 g/L) but related to mothers' BMI (Figure 3) and dietary habits (Figure 4):

Figure 3: Breast milk fat content (g/L) in relation with mothers' BMI (n=102)



► Underweight mothers (BMI < 18.5) had a higher milk fat content than average and overweight mothers ($P < 0.01$). The negative correlation between the BMI and the milk fat content probably reflects an effect of mothers' diets on milk fat content. More information is needed about how external factors (nutritional, seasonal, and socio-economic) and metabolic mechanisms regulate maternal lactational performance in developing countries.

Figure 4: Influence of mothers' dietary habits on breast milk fat content (n=102)



► Dietary pattern #1 = Frequent consumption (> once a week) of horse-mackerel linked with infrequent intakes of peanuts, butter, biscuits, mayonnaise, margarine, eggs, smoked freshwater fish.

► Dietary pattern #2 = Frequent consumption (> once a week) of locally made ice cream linked with more butter, mayonnaise, biscuits, eggs, frozen chicken, deep-fried plantain.

► Dietary pattern #3 = Reverse of dietary pattern #1

► Dietary pattern #4 = Reverse of dietary pattern #2

► Frequent consumption (> once a week) of horse-mackerel by 53% of mothers was related with a lower fat content in breast milk, whereas consumption of ice cream (> once a week) by 51% of mothers had an opposite effect ($P < 0.01$). The multivariate analysis of dietary profiles showed that consumption of horse-mackerel and ice cream each corresponded to a dietary pattern (DP). Horse-mackerel consumption (DP #1) was linked with infrequent intakes of peanuts, butter, biscuits, mayonnaise, margarine, eggs, and smoked freshwater fish, whereas that of ice cream (DP #2) was associated with more butter, biscuits, mayonnaise, eggs, frozen chicken, and deep-fried plantain. Apparently, DP #1 looks lower in fat and carbohydrate than DP #2 so it might lead to low breast milk fat content.



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