Long-Chain Polyunsaturated Fatty Acid Concentrations in Breast Milk from Chinese Mothers: Comparison with Other Regions

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Abstract: Long-chain polyunsaturated fatty acids (LC-PUFA), especially linoleic acid (LA), arachidonic acid (AA), alpha-linolenic acid (ALA), eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA), are essential to infant growth and development during early life. Up till now, there is only limited number of studies with large sample size on LC-PUFA in breast milk in China. In order to better understand the LC-PUFA levels in Chinese women, we report an analysis that included 44 studies of 3815 subjects from the latest 10-year peer-reviewed papers of breast milk studies of fatty acid profiles from China and other regions: Asia (excluding China), Europe, America and Africa. The results showed that Chinese women had significantly higher LA and ALA levels in the breast milk than European and other Asian women. The DHA level in the breast milk of Chinese women meets the Chinese and international recommended intake for young infants. This review provides comprehensive investigation on the LC-PUFA levels in the mature milk of Chinese women in most recent publications and server as a reference for further studies on human milk in China.

Keywords: Human milk, long-chain polyunsaturated fatty acid, review, China, maternal diet.

INTRODUCTION

Long-chain polyunsaturated fatty acids (LC-PUFAs) are a group of polyunsaturated fatty acids (PUFA) with 18-20 or more carbons, and include the two families of the omega-3 (n-3) and omega-6 (n-6), which differ in the position of the first double bond from the methyl end group of the fatty acid [1]. Researches on the role of LC-PUFAs in early life focused on the development of the nervous system. LC-PUFAs, especially DHA and AA, accumulate richly in the central nervous system during late pregnancy through about 2 years postnatal [2]. The fast increase in brain size during the early postnatal months requires high accretion of LC-PUFAs into neural membranes [3].

LC-PUFAs are converted endogenously from the precursors ALA and LA *via* a series of desaturation and chain elongation steps present in the omega-3 and omega-6 pathways; ALA is finally converted into DHA, while LA becomes AA after successive reactions in plants [4]. Mammals are unable to synthesize ALA and LA, and the conversion efficiency of LA and ALA into AA, DHA and EPA are low; hence dietary intake of LC-PUFA, which is more effective, becomes more important especially for infants [5]. ALA can be synthesized from LA in plants [4], but not in animals including humans [6]. Consequently, the LA to ALAratio in diet will determine the relative amount of LC-PUFAs in the brain [7]. The value of AA to DHA proportion indicates the n-6 and n-3 PUFA balance desired for optimal health [8].

It is generally accepted that breast milk is the optimal choice for infant LC-PUFA supply [9]. Breast milk LC-PUFAs concentrations vary by many factors such as diet and nutritional status. Asians used to have higher intake of preformed EPA and DHA because of their tradition of regular fish and seafood consumption. However, with meat consumption surpassing fish consumption in Asia recently, decreased intake of DHA and EPA and increase in AA intake have been resulted [10]. Similarly, Chinese dietary habits have changed markedly as a result of striking economic development [11]. Until now, there is limited data review on the LC-PUFA levels in Chinese breast milk. Although a systematic review on the DHA and AA concentration in human milk worldwide including China was conducted in 2007 [12], only 3 studies from Beijing were listed as representative data. More studies on Chinese human breast milk have been performed in the past 10 years. It is meaningful to review the LC-PUFA concentrations in Chinese breast milk and make a comparison with other regions including Asia, America and Africa.

Our goal is to establish the distribution of LC-PUFAs concentrations in mature breast milk from lactating mothers. Our strategy was to identify all the articles in the peer-reviewed literature that report LC-PUFA

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concentrations in the breast milk from mothers of full-term infants. The mothers must have consumed their normal diets with no dietary intervention. We included selection criteria for data collection in the review. Summary statistics were performed between values from China and those from Asia and non-Asian regions.

SUBJECTS AND METHODS

PubMed searches were performed with the keywords “breast milk / human milk” and “fatty acid” from May to July, 2015. The papers published after January 1, 2005 were included in this study. The most recent paper was published in March 2015. China Academic Journals (CAJ) full-text database searches were also performed with the above keywords in Chinese to search publications in Chinese. The literature search is outlined in Figure **1**. All data were from mothers of full-term infants in good health who consumed free-living or control diets during the intervention studies.

Breast milk is the exclusive food for breast-fed infants in their first 4-6 months of life and the WHO recommends babies should be breastfed for at least the first 6 months of their live. Thus, studies on mature human milk from 1-6 months were included in this analysis. Data from experimental groups who had special diets or consumed LC-PUFA supplements were excluded. Studies with subject number fewer than six were also excluded.

Studies meeting these criteria were split into 5 groups according to their region of investigation: Mainland of China, Asia excluding Mainland of China, Europe, America and Africa. Fatty acids concentrations are most often reported as a percentage of the total fatty acids, by weight (wt:wt, or wt for wt). Studies that reported the fatty acid concentrations as mg/100ml or mol% without sufficient information for converting to percentage of the total fatty acids were excluded in this analysis.

All the articles analyzed in the current paper are listed in Table **1**. Forty-four articles providing 65 mean values from 3815 subjects are included in this analysis.

Data are expressed as means ± standard deviation in Tables **2** & **3**. Analyses were carried out using SPSS 12.0 for Windows. Data were analyzed by one-way ANOVA followed by post hoc Dunnett’s tests to compare the mean values between the Chinese group and other groups. Differences were considered significant at $p < 0.05$.

RESULTS

The linoleic acid (LA), arachidonic acid (AA), alpha-linolenic acid (ALA), eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA) concentration in breast milk, as well as the ratio of AA/DHA and LA/ALA, total polyunsaturated fatty acids (PUFA), n-6 PUFA and n-3 PUFA concentration in breast milk were identified in the literatures and shown in Table **1**. These data are expressed as wt% of total fatty acids in breast milk. The overall data were split into five groups according to their region of investigation: Mainland of China, Asia (excluding Mainland of China), Europe, America and

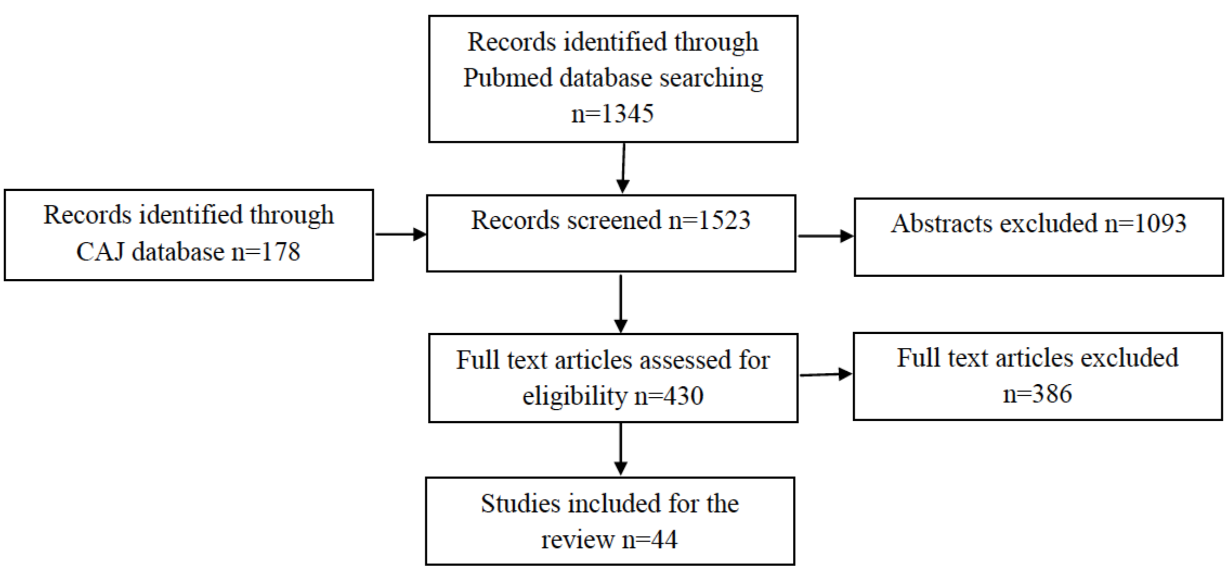

Figure 1: Flowchart of the search strategy used in this review. The number of relevant papers at each point is provided.

Table 1: Studies Included in the Analysis[1]

Reference	Site	Infant Age	Subject	LA	AA	ALA	EPA	DHA	AA/DHA	LA/ALA
		month	n	% of total fatty acids[3]					ratio	ratio
Mainland of China										
Lin Q, *et al.*, 2014[2] [26]	Fuzhou	1.4	101	14.01	0.2	0.51	0.03	0.12	1.67	26.24
Chen A, *et al.*, 2014[2] [27, 28]	Hohhot	1.4	38	21.09	0.52	1.99	0.09	0.19	2.93	14.28
	Changchun		25	30.82	0.58	2.12	0.08	0.28	2.26	15.96
	Chongqing		31	18.4	0.53	1.88	0.08	0.29	2.14	10.86
	Shanghai		31	27.62	0.43	1.42	0.1	0.41	1.46	23.36
	Guangzhou		31	20.82	0.61	0.79	0.1	0.41	0.82	33.44
Urwin HJ, *et al.*, 2013 [29]	Jurong, Jiangusu Province (River/lake)	1	42	16.68	0.76	1.84	0.06	0.5	1.52	9.07
	Rizhao, Shandong Province (coastal)		42	22.79	0.71	1.25	0.04	0.55	1.29	18.23
	Xushui, Hebei Province (inland)		41	21.43	0.7	0.92	0.03	0.27	2.59	23.29
Gao Y, *et al.*, 2011[2] [30]	Jurong (freshwater river/lake)	1	47	16.34	0.72	1.48	0.06	0.41	1.76	11.04
	Rizhao (coastal)		50	20.8	0.63	1.12	0.08	0.47	1.34	18.57
	Xushui (inland)		46	20.82	0.63	0.9	0.03	0.24	2.63	23.13
Shi YD, *et al.*, 2011 [31]	Inner Mongolia	0.7-6	66	16.97	NR	3.29	NR	NR	NR	NR
Wan ZX, *et al.*, 2010 [32]	rural north	2.1-2.8	52	17.73	0.3	1.03	NR	0.19	1.56	17.22
Li J, *et al.*, 2009 [33]	Guangzhou	1	25	16.58	0.54	0.94	0.09	0.39	1.38	17.64
	Shanghai		25	19.82	0.56	1.48	0.06	0.42	1.33	13.39
	Nanchang		25	17.58	0.63	1.38	0.04	0.35	1.80	12.74
	Harbin		11	23.7	0.73	2.18	0.06	0.51	1.43	10.87
	Hohhot		11	16.79	0.54	2.68	0.03	0.29	1.86	6.26
Xu L, *et al.*, 2008[2] [34]	Shanshui, Hebei Province	0.7-1.8	10	13.38	NR	0.93	NR	0.22	NR	14.39
Xiang M, *et al.*, 2007 [35]	Beijing	1-3	33	22.08	0.57	NR	NR	NR	NR	NR
Xiang M, *et al.*, 2005 [36]	Beijing (rural area)	3	23	22.69	0.51	1.19	0.02	0.18	2.83	19.07
Yuhas R, *et al.*, 2006 [18]	China	1-12	50	14.88	0.49	2.02	0.07	0.35	1.48	7.62
Zhang M, *et al.*, 2006[2] [37]	Zhoushan islands, Zhejiang Province	1-3	15	20	0.56	2.5	NR	0.67	0.84	8.00
Zhang W, *et al.*, 2004 [38]	Shanghai Urban	1-3	60	27.3	0.6	2.55	NR	0.42	1.43	10.71
	Shanghai suburb		40	20.18	0.61	2.6	NR	0.42	1.45	7.76
	Zhoushan islands, Zhejiang Province		41	19.75	0.57	2.49	NR	0.68	0.84	7.93
Asia excluding Mainland of China										
Huang HL, *et al.*, 2013 [39]	Kinmen Island, Taiwan	1.4	42	22.8	0.93	1.46	0.26	0.98	0.95	15.62
Wu TC, *et al.*, 2010 [40]	Taipei and Kaohsiung, Taiwan	0.7-1.5	76	22.41	0.7	1.63	0.23	1.13	0.62	13.75

(Table 1). Continued.

Reference	Site	Infant age	Subject	LA	AA	ALA	EPA	DHA	AA/DHA	LA/ALA
Thakkar SK *et al.*, 2013 [41]	Singapore	1-2	100	14.10	0.42	0.99	0.13	0.52	0.82	14.20
Lee PS *et al.*, 2013 [42]	Sri Lanka	1.4-2.8	136	5.59	0.38	0.32	0.12	0.56	0.68	17.47
Roy S, *et al.*, 2013 [43]	India	NR	217	14.60	0.6	3.64	0.59	0.74	0.81	5.34
Jirapinyo P, *et al.*, 2008 [44]	Thailand	1	140	15.57	1.23	0.40	0.15	0.56	2.19	39.19
Golfetto I, *et al.*, 2007 [45]	Thailand	1-2	78	7.915	0.485	0.48	0.17	0.53	0.92	16.49
	Korea	3	12	14.57	0.87	0.75	0.17	0.96	0.91	19.43
Yuhas R, *et al.*, 2006 [18]	Japan	1-12	51	12.66	0.4	1.33	0.26	0.99	0.51	9.94
	Philippines		54	7.9	0.39	0.43	0.15	0.74	0.62	19.51
Saphier O, *et al.*, 2013 [46]	Israel	1.9-2.8	29	20	0.44	2		0.17	2.59	10.00
Al-Tamer YY, *et al.*, 2006 [47]	Iraq	4-6	65	10.80	0.22	0.21	0.08	0.12	1.83	52.27
Bahrami G, *et al.*, 2005 [48]	Iran	1.5-4.5	52	13.8	1.4	1.1	0.2	NR	NR	12.55
Europe										
Mihályi K, *et al.*, 2015 [49]	Hungary	1.4	61	15.37	0.53	0.6	0.03	0.14	3.79	25.62
Weiss GA, *et al.*, 2013 [50]	Switzerland	1	7	18.43	1.48	1.82	0.07	0.56	2.64	10.13
Pedersen L, *et al.*, 2012 [51]	Denmark	0.4-1.6	281	NR	NR	NR	0.11	0.46	NR	NR
Antonakou A, *et al.*, 2012 [52]	Greece	1-6	127	14.95	0.88	0.12	0.10	0.51	1.74	53.68
Urwin HJ, *et al.*, 2012 [53]	UK	1	22	12.6	0.53	1.4	0.07	0.32	1.66	9.00
Mäkelä J, *et al.*, 2012 [54]	Finland	3	49	11.1	0.39	2	0.18	0.46	0.85	5.55
Martysiak-Żurowska D, *et al.*, 2011 [55]	Poland	1-3	93	10.37	0.41	1.20	0.06	0.27	1.53	8.67
Moltó-Puigmartí C, *et al.*, 2010 [56]	Spain	1	23	15.24	0.49	0.6	0.08	0.35	1.81	27
Samur G, *et al.*, 2009 [57]	Turkey	2.8-4	50	24.31	0.46	0.59	NR	0.15	3.07	41.20
Scholtens S, *et al.*, 2009 [58]	Netherlands	3	244	15.07	0.37	1.02	0.05	0.20	1.90	14.83
Rist L, *et al.*, 2007 [59]	Netherland	1	186	13.73	0.53	1.05	NR	0.42	1.26	13.08
Jørgensen, MH, *et al.*, 2006 [60]	Denmark	1-2	33	10.71	0.515	1.4	0.13	0.46	1.12	7.65

(Table 1). Continued.

Reference	Site	Infant age	Subject	LA	AA	ALA	EPA	DHA	AA/DHA	LA/ALA
Yuhas R, *et al.*, 2006 [18]	United Kingdom	1-12	44	10.45	0.36	1.22	0.11	0.24	1.62	8.95
Xiang M, *et al.*, 2005 [36]	Sweden	3	19	10.93	0.38	1.6	0.06	0.25	1.52	6.83
America										
Nishimura RY, *et al.*, 2013 [61]	Brazil	1.2 - 3.3	47	20.96	0.48	1.54	0.08	0.09	5.33	13.61
Berenhauser AC, *et al.*, 2012 [62]	Brazil	>0.5	10	18.09	0.36	NR	0.01	0.03	12.00	NR
Glew RH, *et al.*, 2008 [63]	US/New Mexico	1-6	29	NR	0.44	1.23	0.08	0.11	4.00	NR
Friesen R, *et al.*, 2006 [64]	Canada	1	87	12.87	0.4	1.4	0.1	0.27	1.50	9.19
Yuhas R, *et al.*, 2006 [18]	Canada	1-12	48	11.48	0.37	1.22	0.08	0.17	2.35	9.89
	Chile		50	17.75	0.42	1.14	0.09	0.43	1.04	17.85
	Mexico		46	16.05	0.42	1.05	0.07	0.26	2.01	16.91
	United States		49	14.78	0.45	1.05	0.07	0.17	3.16	15.44
Torres AG, *et al.*, 2006 [65]	Brazil	1-4	33	16.6	0.47	1.16	0.071	0.22	2.14	14.31
Marin MC, *et al.*, 2005 [66]	Argentina	1-4	21	16.61	0.45	0.47	0.09	0.13	3.46	35.34
Bopp M, *et al.*, 2005 [67]	US	2.3-3.3	26	15.83	0.40	1.09	0.35	0.32	1.23	14.59
Africa										
Nyuar KB, *et al.*, 2013 [68]	Sudan	0.8-1	32	14.7	0.6	0.28	0.04	0.1	6.00	52.50
Kuipers RS, *et al.*, 2012 [69]	Tanzania (sub-Saharan population)	0.5-2	34	15.8	0.55	0.52	0.09	0.53	1.04	30.38

[1]LA, Linoleic acid; AA, Arachidonic acid; ALA, Alpha- linolenic acid; EPA, Eicosapentaenoic acid; DHA, Docosahexaenoic acid. NR, not reported.
[2]Articles in Chinese.
[3]By weight.

Table 2: Essential Fatty Acid Concentrations in Different Regions[1]

Group	n[3]	N[4]	LA	ALA	LA/ALA
China	1012	13	20.04±4.12	1.67±0.72	15.24±6.82
Asia[2]	1052	11	14.06±5.36*	1.13±0.93*	18.90±12.83
Europe	1239	14	14.10±3.96*	1.12±0.54*	17.86±14.95
America	446	8	16.10±2.68*	1.14±0.28	16.35±7.68
Africa	66	2	15.25±0.78	0.40±0.17*	41.44±15.64*

[1]Fatty acid concentrations are expressed as mean ± Standard Deviation %wt of total fatty acids.
*Significant difference compared to Chinese Group according to Dunnett's test ($p < 0.05$).
LA, Linoleic acid; ALA, Alpha- linolenic acid.
[2]Asia excluding Mainland of China.
[3]n: Subject numbers.
[4]N: Reference numbers.

Table 3: Other Long-Chain Unsaturated Fatty Acid Concentrations in Different Regions[1]

Group	n[3]	N[4]	AA	EPA	DHA	AA/DHA
China	1012	13	0.57±0.13	0.06±0.03	0.37±0.15	1.69±0.60
Asia[2]	1052	11	0.65±0.36	0.21±0.13*	0.67±0.32*	1.12±0.69
Europe	1239	14	0.56±0.31	0.09±0.04	0.34±0.14	1.89±0.82
America	446	8	0.42±0.39	0.10±0.09	0.20±0.11	3.47±3.10*
Africa	66	2	0.58±0.04	0.07±0.04	0.32±0.30	3.52±3.51
Mean worldwide[5]			0.47±0.13		0.32±0.22	

[1]Fatty acid concentrations are expressed as mean ± Standard Deviation %wt of total fatty acids.
*Significant difference compared to Chinese Group according to Dunnett's test ($p < 0.05$).
AA, Arachidonic acid; EPA, Eicosapentaenoic acid; DHA, Docosahexaenoic acid.
[2]Asia excluding Mainland of China
[3]n: Subject numbers
[4]N: Reference numbers
[5]The mean of AA and DHA concentrations in human milk worldwide [12].

Africa. The mean value and standard deviation of the fatty acid concentrations in breast milk were calculated for different groups and shown in Tables **2** & **3**.

The results showed that Chinese mothers had significantly higher LA level in their breast milk than their counterparts in America, Europe and other Asian regions ($p < 0.05$; Table **2**). Chinese mothers also had significantly higher ALA level in their breast milk than their counterparts in Africa, Europe and other Asian regions ($p < 0.05$; Table **2**). Chinese mothers had significantly lower LA/ALA ratio than African mothers ($p < 0.05$; Table **2**).

There were no significant differences in the AA level in the breast milk among different groups. Chinese mothers had significantly lower EPA and DHA levels in the breast milk than other Asian mothers ($p < 0.05$; Table **3**). The regions with high EPA and DHA levels in the breast milk in the Asian group (excluding Mainland of China) were Taiwan, Korea, Japan and the Philippines (Table **1**). Chinese mothers had significantly lower AA/DHA ratio in their breast milk than American mothers ($p < 0.05$; Table **3**) due to the relatively low concentration of DHA in the breast milk of the latter.

DISCUSSION

The LC-PUFAs are essential to infant growth and development during early life and are considered to affect disease risk in later life [13]. It has been shown that prenatal LC-PUFAs availability could affect the cardiometabolic disease risk at childhood [13]. There are only a few studies on the LC-PUFA levels in breast milk of Chinese mothers with large sample size. A systematic review on the DHA and AA concentrations in human breast milk worldwide was conducted in 2007 [12]. 65 studies were included in that review, and among them only 3 studies mostly from Beijing representing data from China. Thus, there is a need to review the recent studies on LC-PUFA levels in breast milk of Chinese mothers since 2007. This study reviewed and analyzed data on LC-PUFA concentrations in human mature milk from 1-6 months in articles published in the last 10 years (from 2005-2015). The results showed that Chinese mothers had significantly higher LA and ALA levels in their breast milk than their counterparts in Europe and other Asian regions ($p < 0.05$; Table **2**). On the other hand, Chinese mothers had significantly lower EPA and DHA level in the breast milk than other Asian mothers ($p < 0.05$; Table **3**).

There are three sources of fatty acids in human breast milk: diet, mammary gland synthesis and tissue mobilization from maternal storage [14]. It is generally believed that human breast milk fatty acid composition worldwide is subjected to inter-individual biological variation mainly due to different maternal diets [15-17]. This study showed that Chinese mothers had significant higher levels of LA and ALA in their breast milk than other Asian and European mothers ($p < 0.05$; Table **2**). The essential fatty acids LA and ALA cannot be synthesized by the human body and therefore must be obtained from dietary sources. It is reported that about 30% of LA in milk is directly transferred from the maternal diet, and LA level in human breast milk is significantly correlated with the maternal dietary intake of LA [18, 19]. Mothers from some cities in China such as Changchun, Beijing and Shanghai had significant higher LA Level. The high level of LA concentrations in Chinese may be related to the high usage of vegetable oil such as soybean oil, corn oil, sunflower seed oil and peanut oil which are high in LA. There are regional differences in the types of vegetable oil consumed by the Chinese populations. Northern Chinese prefer soybean oil which contains higher levels of ALA. North-western Chinese and people living in the Yangzi River region prefer canola oil and rapeseed oil which are also high in ALA. Southern Chinese and people from Shandong Province prefer peanut oil which is low in ALA, but they consumed a lot of seafood, which provides abundant ALA, as they live near the sea. There were no significant differences in the ratio of LA/ALA between Chinese mothers and mothers from other regions except those in Africa. The recommended ratio of LA/ALA is 5-15 by the European Society for Pediatric Gastroenterology and Nutrition (ESPGAN). Most mother except those in Africa generally meet this criterion.

LC-PUFAs, especially AA and DHA, are the main components of the phospholipids in the brain and retina. These LC-PUFAs are in great demand by the infant during the 3rd trimester of pregnancy and the first 2 years postpartum which is the rapid developmental period for the brain [12]. The DHA concentration in breast milk is greatly affected by the maternal diet, whereas the AA contents are less affected by it [12, 20]. This study showed that there were no significant differences in the AA level in the breast milk among the different groups but Chinese mothers had significantly lower DHA level in their breast milk than other Asian mothers (p < 0.05; Table **3**). There were also no significant differences in the AA/DHA ration in the breast milk of Chinese mothers and that of other Asian mothers. The mean AA and DHA concentrations in the breast milk of Chinese mothers (0.57±0.13%, 0.37±0.15%) is slightly higher than mean worldwide (0.47±0.13%, 0.32±0.22%) [12]. Mothers from some island countries and regions such as Japan (0.99%), Korean (0.96%) and Taiwan (0.98%, 1.13%) accounted for the high levels of DHA concentrations in the breast milk of Asian mothers (Table **1**). Chinese mothers had significantly lower AA/DHA ratio in their breast milk than American mothers (p < 0.05; Table **3**) due to the lower DHA level in the breast milk of the latter. Women from Brazil and the US had lower levels of DHA in breast milk. Maternal seafood consumption may increase the DHA level in breast milk and may show beneficial effect on the neurodevelopmental outcomes in childhood [21, 22]. Chinese mothers living in coastal cities such as Rizhao, Zhoushan Islands, and Shanghai (0.51%, 0.68% and 0.42%) had higher DHA concentrations in breast milk than those living in inland cities such as Hohhot and Xushui (0.03% and 0.03%). This suggests lactating women from inland cities should have more fish intake or n-3 fatty acid intake from supplements or other food sources such as algae to increase the DHA levels in their breast milk.

The FAO report in 2010 indicates that DHA is synthesized limitedly in infants from 0-6 months old, and DHA is regarded as a conditional essential fatty acid for infants [23]. The average DHA concentration worldwide from the systematic review in 2007 was 0.42% [12], which is equivalent to 84 mg/d. The recommended DHA intake by 0-6 month infants is 58 mg – 104 mg/d by the same report [23]. The adequate intake (AI) of DHA in Chinese is 100 mg/d for 0-6 month infants [24], which is consistent with the recommendation by EFSA2010 [25]. From the literature review [24], we assume the fat concentration in the breast milk is 36.5 g/L, and about 96% of the total fat is fatty acids. The average daily milk secretion by human is around 750 mL from 0-6 months. The mean DHA level in the breast milk of Chinese mothers in this study is 0.37%, which is equivalent to 97 mg/d (36.5 g/L × 0.75L/d × 96% × 0.37% = 0.097 g/d). Thus, the mean DHA level in the breast milk of Chinese mothers meets the Chinese, FAO and EFSA recommended intake of DHA for 0-6 month infants.

Chinese mothers had significantly lower EPA level in their breast milk than mothers from other regions in Asia (0.06±0.03% *vs*. 0.21±0.13%, p < 0.05; Table **3**). Japanese (0.26%), Taiwanese (0.25%) and Indian (0.59%) mothers had higher EPA level in their breast milk. Their high fish consumption may correlate with their high levels of EPA in the breast milk. However, the low level of EPA in the breast milk of Chinese mothers even in some coastal cities may suggest other contributing factors such as genetics.

Maternal diet structure may have great impact on the concentrations of LC-PUFA in the breast milk which in turn may affect the development of infants with long-term consequences [22]. We reviewed studies on the LC-PUFA concentrations in the breast milk of mothers in China and other regions published in the last 10 years. Generally, Chinese mothers tended to have higher levels of essential fatty acids (LA and ALA) in the breast milk than mothers in other regions. Although Chinese mothers have significantly lower EPA and DHA levels than those Asian mothers from island regions, the DHA level in the breast milk of Chinese mothers still meets the Chinese and international recommended DHA intake for infants. This study may serve as a reference for further study on LC-PUFA in the breast milk of Chinese mothers.

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