

Relations between infant feeding practices and anthropometrical traits in Latvia

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Background. Breast milk is the only true natural product for the feeding of infants. World Health Organization suggests breastfeeding exclusively during the first six months of life. The new standards are based on the breastfed child as the norm for growth and development. Thus, the aim of our research was to find the influence of the feeding mode on anthropometrical parameters of the newborns and infants in Latvia.

Material and methods. The longitudinal study method was used in the Riga Maternity Hospital from December 2004 until January 2007. 503 healthy, term newborns were measured (head and chest circumference, height, weight) during visit. Ponderal index and body mass index were calculated. Detailed information on feeding patterns was collected from parents. Data were processed by the means of SPSS/PCT software.

Results. BMI for 12-month-old boys correlated with PI of newborn boys statistically significantly. For girls, the correlation was not found. A statistically significant difference was observed between breastfed and formula-fed boy-babies in weight, BMI and head circumference at one month. At 3 months, there was no difference seen between anthropometric measurements of breastfed or formula-fed newborns. At 6 months, the difference appeared for girls in height and for boys in BMI depending on the way of feeding. At 9 months, height differed between breastfed boys and formula-fed boys. At 12 months there was no difference observed between the genders.

Conclusions. Evidence shows that breastfed and formula-fed infants grow differently, although generally there is no statistically significant influence of the feeding mode on the anthropometry in the first year of life.

Key words: breastfeeding, formula-feeding, infant, anthropometry, body mass index, ponderal index

INTRODUCTION

Breast milk is the only true natural product of infant feeding and the best nutritional choice for the first year of life. World Health Organization (WHO) suggests breastfeeding exclusively for the first six months of life (1, 2). In 1992, United Nations Children's Fund (UNICEF) started a global campaign called Baby Friendly Hospital Initiative (BFHI), whose main idea was to implement 10 specific steps in maternity units to start and maintain breastfeeding. The reason for the initiation of BFHI was a marked decrease of breastfeeding rates in the world.

Similar problems are faced in Latvia as well: according to the data of the Latvian Society "Save Children", the rate of breastfeeding in Latvia in 1992 was only 20 % (3). In the last years, the breastfeeding issues have been strongly addressed, and the number of Latvian children who are breastfed for a longer period of time is gradually increasing (4).

Evidence shows that breastfed and artificially fed infants grow differently, and that the growth pattern of breastfed children better reflects the physiological growth (5).

The new WHO growth reference standards are based on the data of breastfed children (6).

The aim of our research was to compare the influence of different feeding patterns on the dynamics of anthropological parameters of infants in Latvia. What are the breast-feeding rates in Latvia now? Is ponderal index (PI) at the time of birth comparable in different groups; is the 1st year dynamics of body mass index (BMI) significantly different between groups of breastfed and formula-fed infants? (7).

MATERIAL AND METHODS

The longitudinal study was carried out in the Riga Maternity Hospital from December 2004 until January 2007. The study included anthropometric measurements of the same group of infants at different ages: 503 babies 12–36 hours after delivery (256 girls and 247 boys), 406 infants at

1 month of age, 393 at 3 months, 382 at 6 months, 379 at 9 months and 375 infants at 12 months of age. Most of the in-

fants were from singleton pregnancies, there were only 2 pairs of twins. 63.3% of infants were born in the 1st delivery, 29.9% in the 2nd delivery, 4.9% in the 3rd delivery, 1.7% in the 4th and 0.2% (1 infant) in the 5th delivery of the mother. Almost 75% commitment to one year study was a real success for the research team. During each visit the following anthropological measurements were provided: head circumference, chest circumference and body height (length) in centimetres, body weight in grams. The results were documented in an inquiry form. The electronic scales were yearly re-calibrated by metrological authorities.

Ponderal index of a newborn was calculated according to the formula $PI = \text{body weight in grams} \times 100 / (\text{body length in cm})^3$. BMI was calculated using the following formula: $BMI = \text{body weight in kilograms} / \text{body height (length) in meters}^2$ (8–10). From the data acquired percentile diagrams of PI of newborn infants and BMI of 1 year old infants for both genders were created. Low PI and BMI values were defined below the 10th percentile, whereas the high ones, above the 90th percentile. Correlation of BMI at the age of 1 year with PI at birth was evaluated by the means of analysis of dispersion (ANOVA).

Detailed information on feeding patterns was collected from parents during each visit. By surveying mothers we found out for how many months the baby was exclusively breastfed. Till the age of 6 months exclusively breastfed infants received only breast milk, after 6 months of age the infants were classified as exclusively breastfed in the cases when supplementary feeding did not include breast milk replacement, i. e. infant formula. Supplementary feedings (not infant formula) were given to all the infants from the 7th month of age. Comparison of anthropometrical data was performed between exclusively breastfed and other infants, divided by gender.

The data were processed by the means of SPSS / PCT software. Normal distribution of all the data was confirmed by

Kolmogorov-Smirnov test, they were compared by independent t-test; the significance level of 0.05 was considered to be valid.

The study was approved by the Ethical Committee of the Riga Stradiņš University.

RESULTS

324 newborns (64.4%) were breastfed already in the delivery room, 475 newborns (94.4%) in the maternity ward, only 12 babies were formula-fed since birth.

Ponderal index for newborn boys: low – 11%; N – 76.8%; high – 12.2%; for newborn girls: low – 8.9%; N – 82.5%; high – 8.6%.

Body mass index at the age of 12 months for boys: low (16.89 ± 1.06); N (17.54 ± 1.40); high (17.50 ± 1.39); for girls: low (16.62 ± 1.24); N (16.84 ± 1.33); high (16.82 ± 1.32).

PI of newborn boys statistically significantly ($p = 0.042$) correlated with BMI at 12 months of age; for newborn girls it was not statistically significant ($p = 0.874$) (Figs. 2, 3). At the age of 1 month, breastfed boys had statistically significantly higher body weight ($p = 0.01$), BMI ($p = 0.006$) and head circumference ($p = 0.0447$) in comparison with the formula-fed ones. At the age of 3 months there was no difference in any of the anthropometric measurements between any of the study groups. At the age of 6 months formula-fed girls were statistically significantly taller than breastfed girls ($p = 0.024$); breastfed boys had higher BMI than formula-fed boys ($p = 0.005$). At 9 months, the height of boys statistically significantly differed from those that had been breastfed and the formula-fed ones ($p = 0.03$). At 12 months no difference appeared either for boys ($p = 0.928$), or for girls ($p = 0.371$).

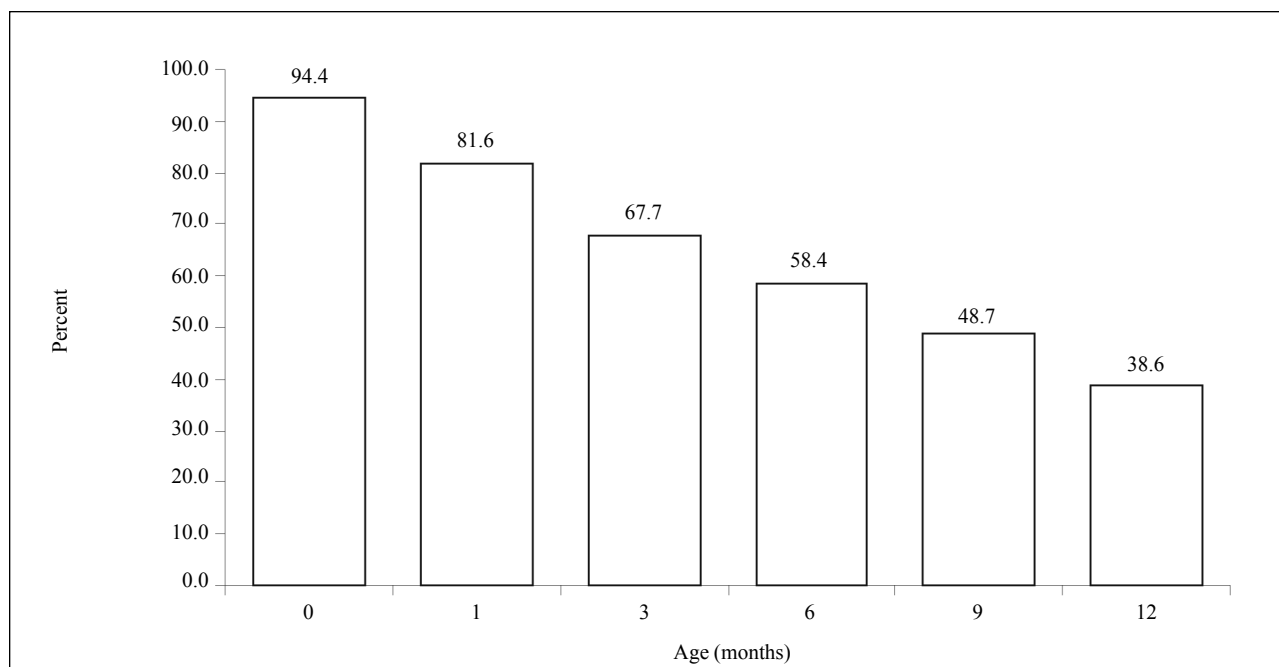


Fig. 1. Breastfeeding rates in the first year of life

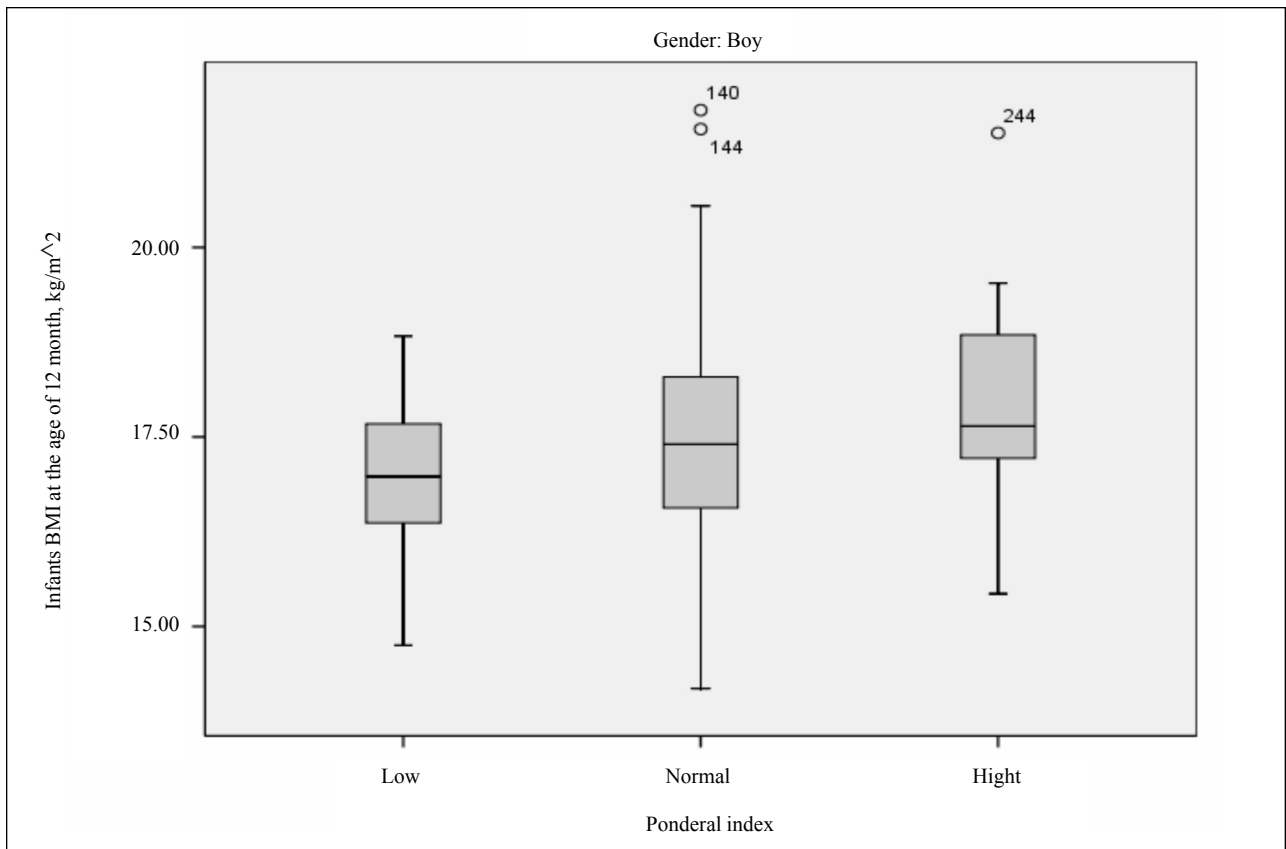


Fig. 2. Correspondence of BMI in boys at the age of 12 months with ponderal index at birth

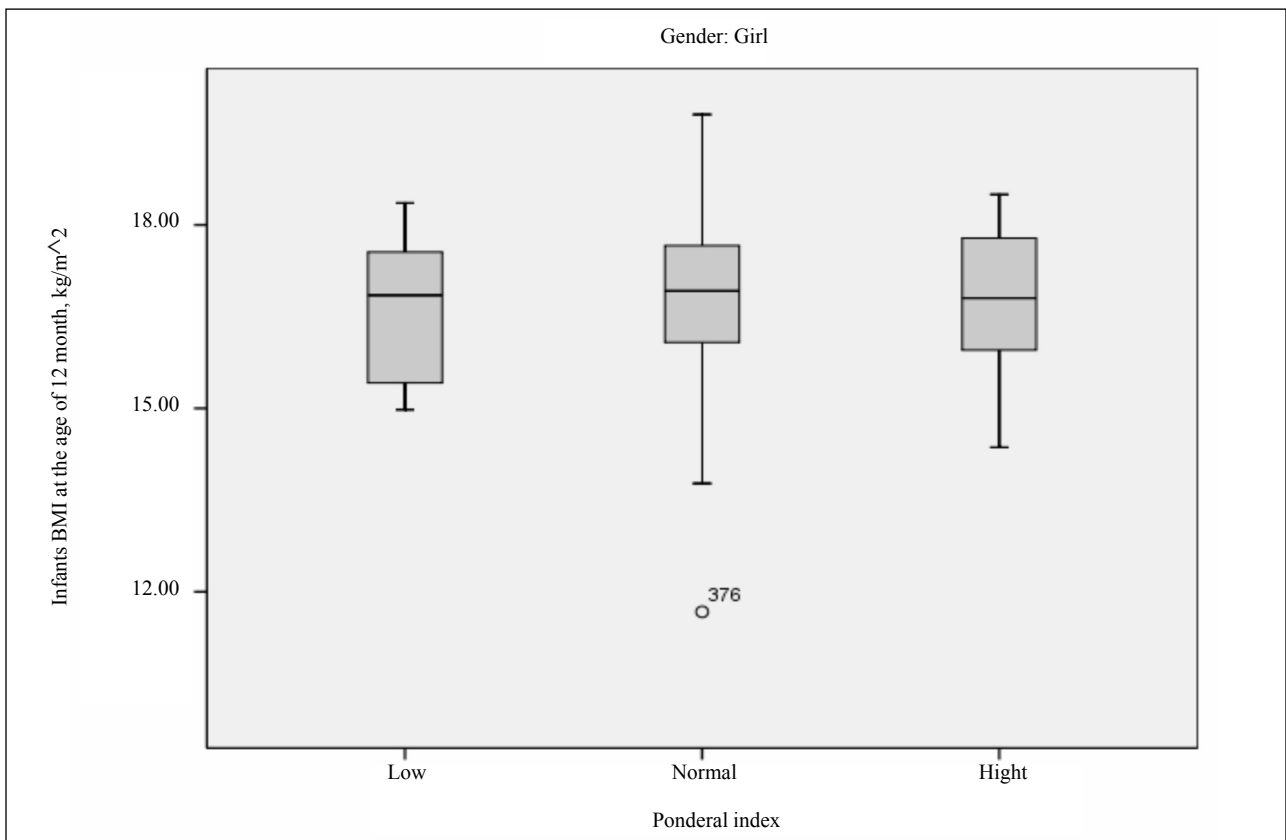


Fig. 3. Correspondence of BMI in girls at the age of 12 months with ponderal index at birth

Table 1. Relations between feeding practices and body weight

Gender	Age (in months)	Breast feeding			Infant formula			T	P
		N	M	SD	N	M	SD		
Boy	1	184	4.73	0.59	14	4.30	0.72	2.609	0.010
	3	157	6.64	0.72	34	6.39	0.64	1.839	0.067
	6	128	8.42	0.87	56	8.23	0.88	1.377	0.170
	9	86	9.62	1.00	76	9.72	0.97	-0.683	0.495
Girl	12	60	10.47	1.20	70	10.65	1.12	-0.923	0.358
	1	190	4.37	0.50	18	4.27	0.56	0.779	0.437
	3	157	6.00	0.58	45	6.00	0.73	-0.005	0.996
	6	128	7.68	0.80	70	7.89	0.96	-1.714	0.088
	9	89	8.86	0.97	84	8.91	0.94	-0.332	0.741
	12	50	9.65	0.97	91	9.89	1.06	-1.328	0.186

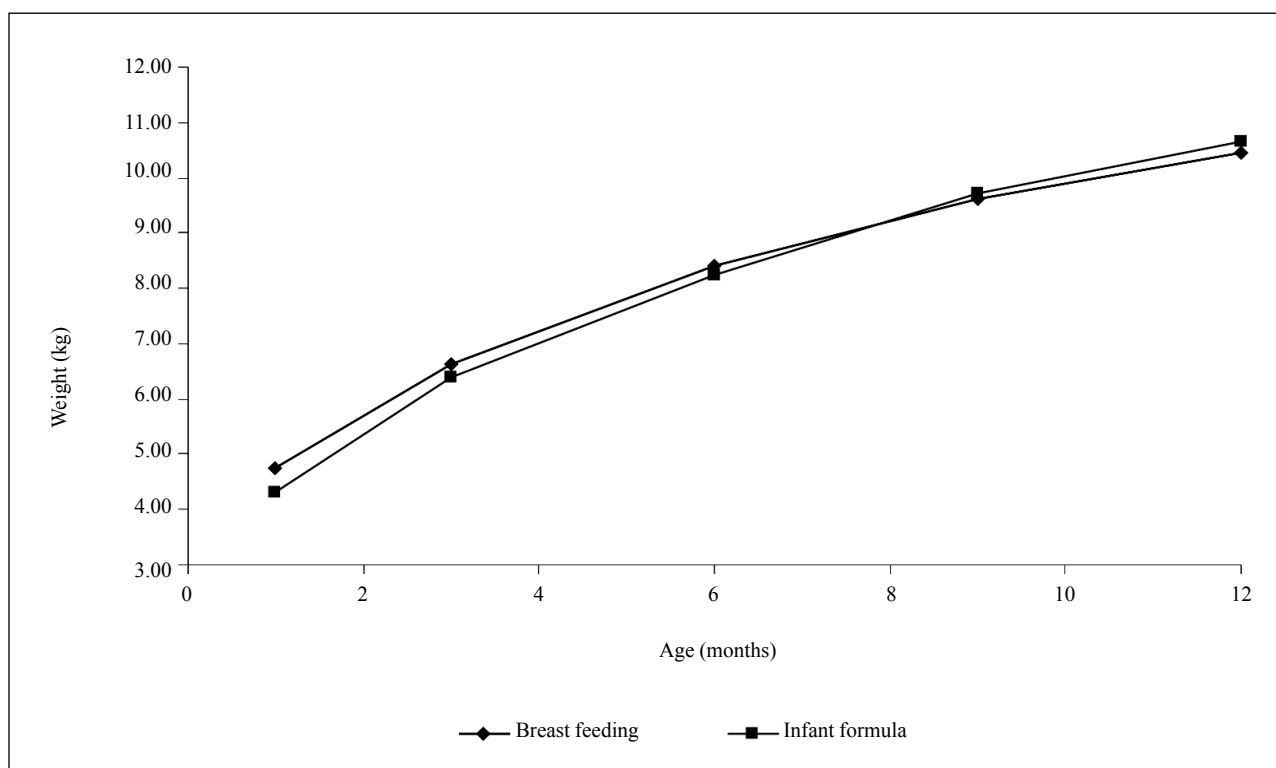


Fig. 4. Body weight dynamics in the first year of life

Table 2. Relations between feeding practices and body height (length)

Gender	Age (months)	Breast feeding			Infant formula			T	P
		N	M	SD	N	M	SD		
Boy	1	184	56.12	2.09	14	55.27	3.28	1.401	0.163
	3	157	62.97	2.09	34	62.44	2.52	1.271	0.205
	6	128	69.17	2.16	56	69.67	2.40	-1.377	0.170
	9	86	73.22	2.40	76	74.04	2.34	-2.186	0.030
Girl	12	60	77.28	2.67	70	77.94	2.70	-1.397	0.165
	1	190	55.08	1.89	18	54.77	2.33	0.648	0.518
	3	157	61.50	1.92	45	61.13	1.80	1.144	0.254
	6	128	67.39	1.93	70	68.10	2.37	-2.270	0.024
	9	89	72.01	2.14	84	72.30	2.49	-0.822	0.412
	12	50	76.05	2.88	91	76.42	2.59	-0.761	0.448

Table 3. Relations between feeding practices and head circumference

Gender	Age (months)	Breast feeding			Infant formula			T	P
		N	M	SD	N	M	SD		
Boy	1	184	38.41	1.16	13	37.74	1.35	2.000	0.047
	3	157	41.52	1.11	33	41.16	1.14	1.702	0.090
	6	128	44.35	1.07	56	44.34	1.17	0.089	0.930
	9	86	46.19	1.23	76	46.42	1.15	-1.230	0.221
Girl	12	60	47.35	1.25	70	47.57	1.18	-1.009	0.315
	1	187	37.36	1.12	18	37.01	1.16	1.276	0.203
	3	156	40.24	1.31	45	40.25	0.98	-0.051	0.960
	6	128	42.96	1.11	70	43.20	1.40	-1.330	0.185
	9	89	44.96	1.28	84	44.96	1.26	-0.013	0.990
	12	50	46.35	1.28	91	46.27	1.22	0.377	0.706

Table 4. Relations between feeding practices and chest circumference

Gender	Age (months)	Breast feeding			Infant formula			T	P
		N	M	SD	N	M	SD		
Boy	1	184	37.60	1.76	13	36.88	1.88	1.407	0.161
	3	157	41.87	1.76	33	41.65	1.98	0.651	0.516
	6	128	45.45	1.77	56	44.91	1.77	1.922	0.056
	9	86	47.57	1.77	76	47.91	1.80	-1.213	0.227
Girl	12	60	49.15	2.11	70	49.65	1.91	-1.411	0.161
	1	187	36.70	1.58	18	36.32	1.92	0.972	0.332
	3	156	40.44	1.53	45	40.72	2.04	-1.014	0.312
	6	128	43.72	1.66	70	44.12	1.86	-1.563	0.120
	9	89	46.03	2.16	84	46.04	1.59	-0.028	0.978
	12	50	47.48	2.15	91	48.02	2.05	-1.471	0.144

Table 5. Relations between feeding practices and BMI

Gender	Age (months)	Breast feeding			Infant formula			T	P
		N	M	SD	N	M	SD		
Boy	1	184	14.99	1.36	14	13.97	0.90	2.760	0.006
	3	157	16.73	1.48	34	16.39	1.25	1.274	0.204
	6	128	17.58	1.46	56	16.94	1.38	2.818	0.005
	9	86	17.91	1.40	76	17.73	1.49	0.818	0.415
Girl	12	60	17.49	1.42	70	17.52	1.39	-0.129	0.898
	1	190	14.36	1.20	18	14.21	1.43	0.508	0.612
	3	157	15.86	1.20	45	16.03	1.49	-0.798	0.426
	6	128	16.88	1.38	70	16.99	1.63	-0.513	0.608
	9	89	17.06	1.37	84	17.02	1.25	0.214	0.831
	12	50	16.69	1.49	91	16.90	1.22	-0.905	0.367

DISCUSSION

Although the study did not show strongly correlative growth pattern differences between the study groups, statistically significant and even statistically insignificant differences at different points helped to reveal growth trends of the groups. Breastfed infants tended to have higher body weight, head circumference and BMI in the first months of life (statistically significant for

boys, insignificant for girls), with an opposite trend thereafter (statistically insignificant). Body height showed similar correlations: during the first months of life the breastfed children were longer (insignificant correlation), afterwards the formula-fed infants grew faster and overcame the breastfed ones (statistically significant). In comparison, a study from Brazil showed comparatively higher body weight of formula-fed infants and no differences in body height (11). A study from Italy showed similar

results with higher body parameters (weight, body length, BMI) for breastfed infants in the first months of age, with more rapid growth of formula-fed infants during the following months of life (12). Michael S. Kramer et al. from Canada analyzed body weight of breastfed infants and found faster gain of weight in this group of infants in the first months of life; during the following months, the formula-fed infants developed more rapid weight gain (13). Although breastfed infants had lower weight gain in the last months of infancy, they did not develop weight deficit problems till the age of 12 months. A study from Turkey found larger head circumference of breastfed infants at the age of 6 months (14). Our study did not show statistical significance, and head circumference in groups (formula-fed and breastfed) was almost equal both for girls and boys.

Vignerova from Czech Republic in 2006 and antracheewathorn from Thailand in 2005 compared anthropological measurements of breastfed and formula-fed infants with the national growth references. In both studies results showed similar growth of breastfed and formula-fed infants till 6 months of age. Those values correlated with national growth references. After 6 months of age the formula-fed infants had more rapid growth in comparison with the breastfed ones. National growth references revealed the growth of breastfed infants (15, 16). As Latvia does not have national growth references, such a comparison was not made.

CONCLUSIONS

Feeding patterns have certain impacts on the dynamics of anthropometric parameters of infants. The study showed that, on average, breastfed infants had higher body parameters in the first months of age and lesser total growth parameters (weight gain, height) during the second half of the first year of life. Trend changes occurred sooner among girls (1–3 months of age) than boys (6–9 months of age). However, there is no statistically significant influence of feeding mode on anthropometric parameters in the first year of life.

BMI of boys at the age of 1 year was significantly higher in the cases of high newborn PI at birth. BMI of girls did not show significant correlation with PI at birth. Evidence seems to suggest that the impact of many other factors such as, for instance, genetics, environmental and eating habits influence anthropometrical parameters more than the researched different modes of feeding (17).

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