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THE WEIGHT AND LENGTH GAIN OF INFANTS AS INFLUENCED BY BREAST FEEDING OR ARTIFICIAL FEEDING AND BY THE EDUCATIONAL LEVEL OF THE MOTHER

R. Ágfalvi, K. Joubert, S. M. Darvay, and *V. H. Lukács*

National Institute of Infants' and Children Health, Budapest, Hungary; Demographic Research Institute of the Central Statistical Office, Budapest, Hungary

Abstract: *The physical growth of 5428 infants, born in Hungary during the period Juni 30, 1980 – Juni 30, 1983, was studied. Some results of growth and development of this complex longitudinal survey on a nation-wide scale, with the title "Health and Demographic Study of Pregnant Women and Infants" are presented in this paper. There is a significant difference in the mean weight and length gains of those being exclusively breast-fed or artificially fed up till the first three months. The means of those having artificial feedings only are significantly greater. Breast-feeding was most prevailing among mothers of Group A (0–7 grades, i.e. uncompleted elementary school) and the weight and length growth are lowest in this Group.*

Key words: *Breast-fed; Artificially fed; Growth; Educational level of the mother.*

Introduction

In 1979 we have launched a complex longitudinal survey on a nation-wide scale, with the title "Health and Demographic Study of Pregnant Women and Infants". The project, its range, selection criteria and research techniques were already introduced in Pécs, at the IVth International Symposium of Human Biology, in 1986 (Joubert et al. 1986).

The survey is not yet completed and we have started to elaborate its demographic, anthropometric, health and socio-cultural aspects. We have prepared the reference figures of weight and length gains among infants from birth to 24 months. The reference data are filed among the documentation of children's health in Hungary.

Material and Methods

Table 1 shows you the breakdown of infants studied by sex and birth weight. The feeding practice of infants from birth to 6 months are shown in Table 2.

The proportion of infants with normal or low birth weight is also indicated, grouped according to feeding practice (that is, exclusively breast-fed, partially breast-fed of artificially fed.) 72.7% of infants with normal birth weight were exclusively breast-fed in the first month; 12% were given artificial complements while being breast-fed. The proportion of those being fed by artificial means is only 15%.

On the other hand, it is only 57.4% of the infants with low birth weight who were exclusively breast-fed. 22.9% among them were breast-fed for only a short time, that is, less than a month. At the age of 3 months, it is only 22% of the full term and 15% of the preterm infants who were exclusively breast-fed. The proportion of those partially breast-fed is 30% in both groups.

In a statistical analysis process we have used the incidence (N), mean ($\bar{x}$) and SD values of the reference data. The difference between the mean values was measured by significance levels.

Table 1. **The division of infants under study according to sex and birth weight***

Age	Reference data (2500-4499 g)			Low birth weight (< 2500 g)		
	Together	Boys	Girls	Together	Boys	Girls
Birth	6589	2996	2693	415	186	229
1 year	5300	2813	2487	361	160	201
2 years	4889	2591	2298	321	143	178

* The infants of high birth weight ad/or those with disease, together with the unestimated data were excluded from the present study

Table 2. **Distribution of infants studied according to feeding practice***

Age (month)	Together	Ref.	LBW	Exclusively breast-fed		Partially breast-fed		Artificially fed	
		together		Ref.	LBW	Ref.	LBW	Ref.	LBW
Incidence									
1	5799	5428	371	3946	213	658	73	824	85
2	5778	5408	370	2649	137	1026	88	1733	145
3	5755	5370	385	1155	60	1630	1o9	2585	216
4	5707	5326	381	154	13	1821	104	3351	264
5	5652	5272	380	27	1	1359	71	3886	308
6	5487	5111	376	11	1	855	48	4245	327
Percentage									
1	100	93.61	6.39	72.69	57.41	12.12	19.67	15.18	22.82
2	100	93.59	6.41	48.98	36.05	18.97	25.78	32.05	38.17
3	100	93.31	6.69	21.52	15.58	30.35	28.31	48.13	56.11
4	100	93.32	6.68	2.89	3.42	34.19	27.29	62.82	68.29
5	100	93.28	6.72	0.51	0.26	25.77	18.68	73.72	81.06
6	100	93.15	6.85	0.21	0.26	18.32	12.77	81.46	86.97

* National survey, 1980: 34.5% of infants are exclusively breast-fed up till 3 months of age; National survey, 1981: 36.0% of infants are exclusively breast-fed up till 3 months of age. – Abbreviations: Ref. – reference; LBW – low birth weight

Results

The growth of breast-fed and artificially fed infants

Table 3 indicates the mean weight and length gains of infants with a normal birth weight, from birth to 24 months (and SD). There is a significant difference in the mean weight and length gains of those being exclusively breast-fed or artificially fed up till the first three months (Table 4). The means of those having artificial feedings only are significantly greater.

The weight difference of boys with normal birth weight from 3 to 8 months and at the age of 15 months is especially apparent; in the case of girls, both weight and length measurements show a significant difference from the age of 3 months up till 2 years. This observation coincides with various studies on infant feeding and growth of different countries. They show that the difference is especially great in a population where breast-feeding is prevailing up till the age of 9–12 months (Hitchcock et al. 1981).

Table 3. **Gains in weight and length in certain period of study**

Age (months)	Boys						Girls					
	Breast-fed for 90 days			Artificially fed			Breast-fed for 90 days			Artificially fed		
	N	$\bar{x}$	SD	N	$\bar{x}$	SD	N	$\bar{x}$	SD	N	$\bar{x}$	SD
Weight (g)												
birth	548	3.308.5	421.7	468	3.312.1	415.0	582	3.182.7	390.4	337	3.215.0	425.7
1	552	4.131.1	495.3	475	4.108.0	510.1	586	3.925.4	432.8	350	3.882.4	451.4
2	556	5.075.7	561.9	473	5.104.3	586.8	582	4.741.1	474.7	342	4.751.6	513.4
3	560	5.882.6	628.0	462	5.989.4	676.4	591	5.439.7	562.4	336	5.569.0	576.7
4	551	6.588.5	705.8	467	6.747.5	764.6	583	6.092.6	610.9	335	6.302.6	636.0
5	545	7.141.1	745.3	457	7.315.2	811.1	573	6.612.0	651.9	331	6.878.8	703.4
6	544	7.741.1	800.3	452	7.889.3	860.3	567	7.168.0	713.2	328	7.411.4	748.3
8	532	8.551.1	878.8	443	8.681.7	975.0	564	7.940.4	810.7	321	8.143.7	839.0
10	528	9.280.1	999.7	445	9.375.2	1.026.1	560	8.635.3	902.2	314	8.845.0	910.4
12	533	9.928.3	1.072.4	447	10.019.5	1.092.8	558	9.286.0	969.4	317	9.509.9	1.024.4
15	507	10.437.4	1.125.4	414	10.818.2	1.197.4	520	9.964.6	1.069.3	292	10.324.1	1.103.7
18	504	11.326.0	1.218.1	415	11.443.1	1.258.2	516	10.717.6	1.159.1	289	10.954.3	1.251.5
21	495	11.994.5	1.315.5	415	12.060.0	1.357.9	512	11.349.9	1.293.5	282	11.607.8	1.342.8
24	503	12.563.4	1.404.8	421	12.645.6	1.408.1	524	12.009.9	1.413.0	294	12.251.4	1.440.8
Length (cm)												
birth	546	50.72	2.15	468	51.00	2.21	582	49.96	2.00	337	50.27	2.19
1	552	54.01	2.23	475	54.20	2.23	586	53.26	2.08	350	53.35	2.15
2	556	57.37	2.31	473	57.58	2.41	582	56.39	2.14	342	56.52	2.31
3	560	60.58	2.42	461	60.88	2.43	591	59.26	2.25	336	59.63	2.27
4	545	63.31	2.44	456	63.63	2.52	573	61.90	2.26	331	62.41	2.33
5	551	65.85	2.47	465	66.22	2.62	583	64.22	2.32	335	64.77	2.27
6	544	67.97	2.39	451	68.27	2.67	567	66.26	2.41	328	66.89	2.42
8	532	70.72	2.40	442	71.11	2.83	563	69.00	2.45	321	69.69	2.36
10	528	73.33	2.53	444	73.60	2.74	559	71.61	2.54	314	72.39	2.55
12	507	76.02	2.67	414	76.31	2.81	520	74.27	2.66	292	75.15	2.67
15	533	79.37	2.84	447	79.42	3.10	558	77.56	2.91	317	78.43	3.15
18	504	82.25	3.07	415	82.23	3.29	518	80.62	3.02	289	81.39	3.32
21	495	85.13	3.34	415	85.00	3.61	513	83.60	3.37	282	84.47	3.47
24	503	87.87	3.70	421	87.71	3.65	525	86.41	3.65	292	87.13	3.71

Table 4. **Significance level of differences between weight and length means of infants breast-fed (b.f.) for 90 days or artificially fed (a.f.)**

Age (months)	Boys				Girls			
	Weight		Length		Weight		Length	
	b.f.	a.f.	b.f.	a.f.	b.f.	a.f.	b.f.	a.f.
birth				*				
1								
2								
3		**		*		***		*
4		***		*		***		**
5		***		*		***		***
6		**				***		***
8		*		*		***		***
10						**		***
12						**		***
15		***				***		***
18						**		**
21						**		***
24						*		**

* = $p < 0.05$ ** = $p < 0.01$ *** = $p < 0.001$

Figures 1 and 2 show a diagram of weight and length gains for boys and girls separately, as measured month by month, or, after the age of 18 months, every second or third months. We find that during the first year boys precede girls in growth. However, after this age girls are ahead of boys both in weight and in length gains, among children with normal birth weight.

The educational level of the mother and the weight and length gain of the infant

Table 5 shows the grouping of children included in the study, according to the educational level of the mother. We have made four groups of education, dependig on the grades finished by the mother: Group A 0–7 grades, Group B 8 grades, i.e. elementary school finished, Group C 9–12 grades, and Group D 13–18 grades.

Table 5. **Distribution of infants studied of the mother according to the educational level of the mother**

Educational level		Reference			Low birth weight		
		Together	Boys	Girls	Together	Boys	Girls
Incidence							
A 0–7	grades	340	189	151	62	27	35
B 8	grades	2633	1392	1241	200	98	102
C 9–12	grades	1869	993	903	89	32	57
D 13–18	grades	559	283	276	20	10	10
Together		5428	2857	2571	371	167	204
Percentage							
A 0–7	grades	6.26	6.61	5.87	16.73	16.17	17.16
B 8	grades	48.51	48.70	48.27	53.93	58.68	50.00
C 9–12	grades	34.94	34.75	35.12	23.95	19.16	27.94
D 13–18	grades	10.29	9.94	10.74	5.39	5.90	4.90
Together		100	100	100	100	100	100

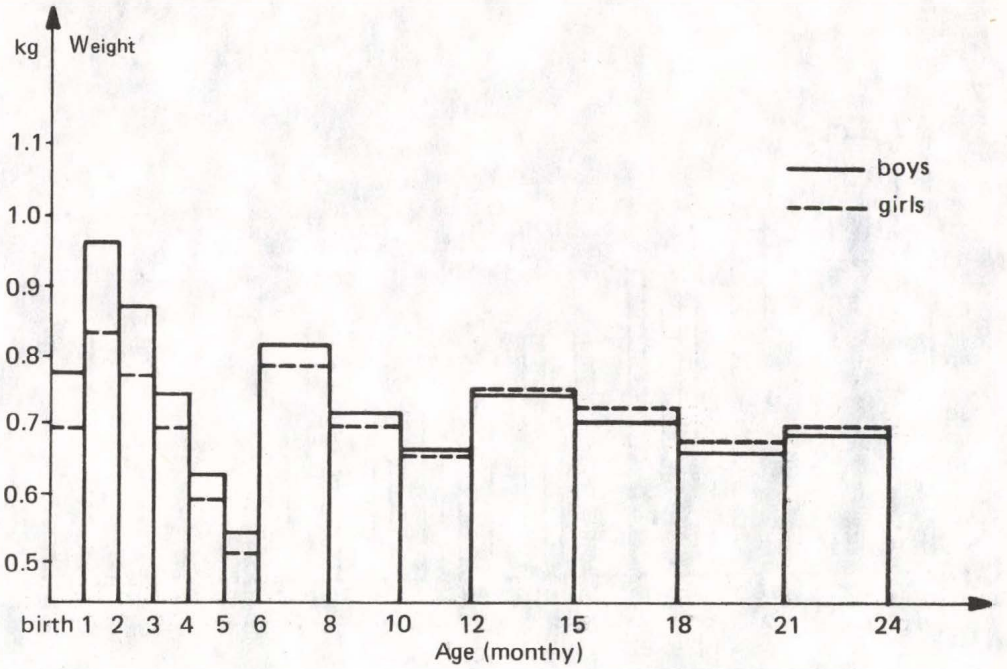

Figure 1: Mean weight gains in different periods of boys and girls

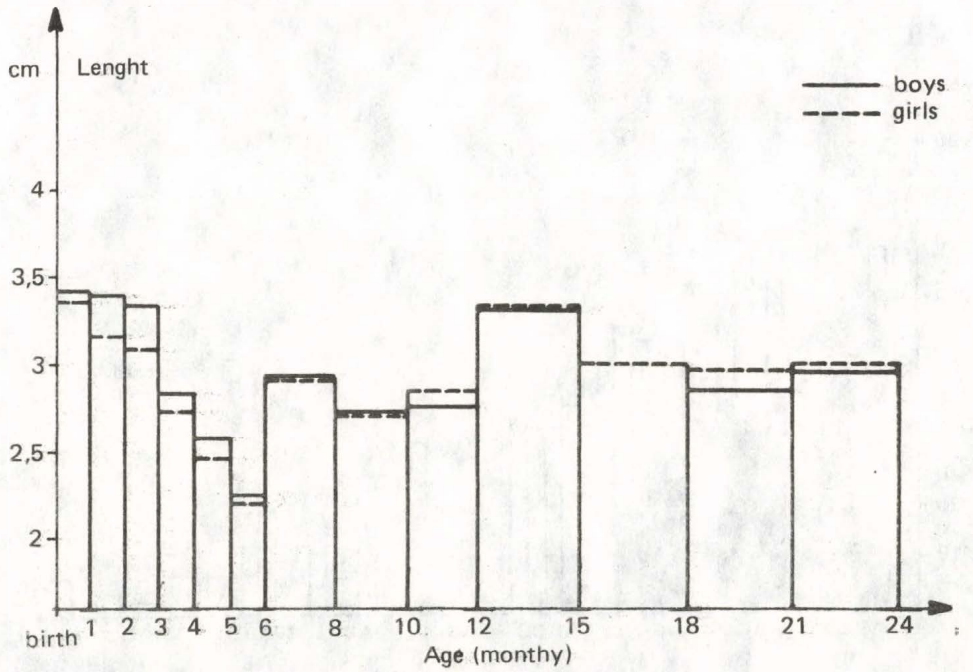

Figure 2: Mean length gains in different periods of boys and girls

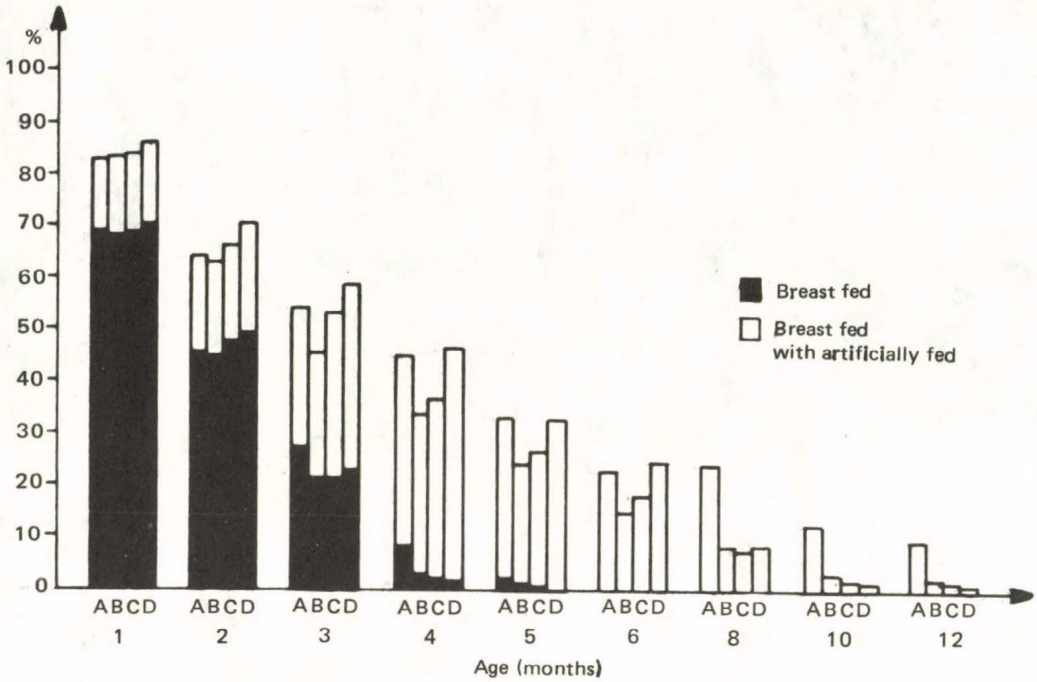

Figure 3: Feeding practice according to the educational level of the mothers (birth weight 2500–4499 g). A = uncompleted general school; B = completed general school; C = secondary school; D = high school

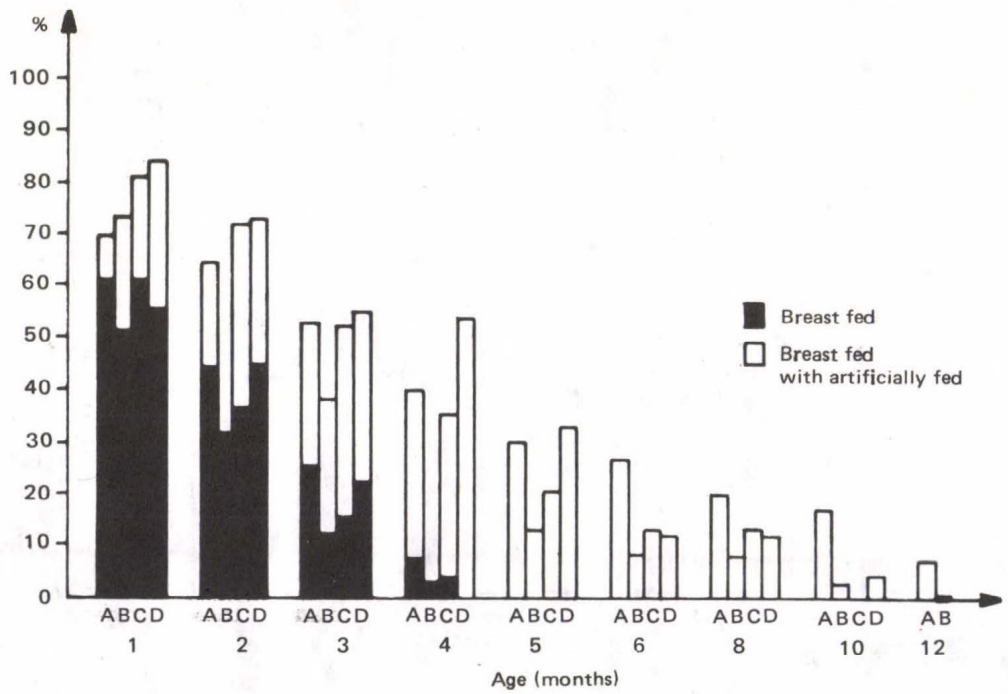

Figure 4: Feeding practice according to the educational level of their mothers (birth weight < 2500 g) A = uncompleted general school; B = completed general school; c = secondary school; D = high school

Figures 3 and 4 indicate feeding methods of mothers of various educational level, among infants with normal and low birth weights, up till the age of 12 months. Breast-feeding was most prevailing among mothers of Group A. Exclusive breast-feeding up to 3 months of age was highest in Goups A and D; however, mothers kept on partial breast-feeding for a longer period. Among infants of low birth weight, those in Group B get the lowest amount of breast milk, compared to the others.

The weight and length growth are lowest in Group A. On the other hand, Group D shows significantly great gains, especially in length.

Discussion

We may conclude that there is a significant difference in the mean weight and length gains of those being exclusively breast-fed or artificially fed up till the first three months. The means of those having artificial feedings only are significantly greater. In Hungary, 37% of the children are exclusively breast-fed up to 3 months of age, whereas one month later, that is, during the fourth month, only 6.5% of them get breast milk exclusively. That means that owing to low incidence we have no proper data about the way longer breast-feeding affects weight and length gains later on.

Breast-feeding was most prevailing among mothers of Group A (0–7 grades, uncompleted elementary school) and the weight and length growth are lowest in Group A. We would also like to deal with other, external factors influencing growth and support our observations with some correlatives.

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Mailing address: Dr. Ágfalvi Rózsa
Országos Csecsemő- és Gyermekegészségügyi Intézet
Budapest IX., Tűzoltó u. 7–9.
H–1094 Hungary