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THE PHYSICAL CHARACTERISTICS OF PRESCHOOL CHILDREN AND SCHOOLCHILDREN IN RELATION TO THE TYPE OF NUTRITION IN INFANCY

ABSTRACT: *We assessed the selected physical characteristics of 216 (108 boys and 108 girls) breastfed and 175 (84 boys and 91 girls) non-breastfed children aged 5, 9 and 14 years old. The measured characteristics were body height, body weight, selected circumferences (the right arm circumference, waist circumference, gluteal circumference and right thigh circumference) and skinfolds (the skinfold over the musculus triceps brachii, subscapular skinfold, suprailiacal skinfold and skinfold over the musculus quadriceps femoris). The Body Mass Index (BMI) and the sum of all four skinfolds were calculated as well. The results showed that the differences in mean values between breastfed and non-breastfed boys and girls are statistically insignificant (rated by Student's *t*-test and Mann–Whitney *U* test).*

KEY WORDS: *Breastfeeding – Obesity – BMI – Skinfolds – Schoolchildren*

INTRODUCTION

The effect of nutrition on a developing child is an important issue for reducing mortality and morbidity from infectious diseases (FAO *et al.* 2018, IPCC 2019). Current research is particularly concentrated on human milk composition and its effect on the innate immune system (Bode *et al.* 2014, Cacho, Lawrence

2017, Le Doare *et al.* 2018) and on the child's growth (Paulová *et al.* 2008, Vignerová *et al.* 2015, Horta *et al.* 2015, Azad *et al.* 2018).

Obesity obviously has roots in early life (Symonds *et al.* 2009, Kopecký 2016). Rapid weight gain in infancy has been acknowledged as an obesity risk factor (Monteiro, Victora 2005) and excess body weight can be tracked from infancy into childhood

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(Roy *et al.* 2016) and adulthood (Simmonds *et al.* 2015). While breastfeeding has well-known benefits for maternal and child health, its impact on obesity differs among studies (see, e.g., Owen *et al.* 2005 vs. Horta *et al.* 2015).

The aim of our research was to evaluate differences in the fundamental physical characteristics of children aged 5, 9 and 14 years old, who differed in being either breastfed with milk from the breast or non-breastfed (formula milk from a bottle) in infancy.

MATERIAL AND METHODS

The study was conducted between October 2017 and December 2018 at 24 randomly selected schools (10 primary schools, 14 secondary schools) in South Bohemia (Czech Republic). At each school, the parents or legal guardians of the children were informed about the objective and methodology of the study and were asked to provide express written consent to the examination of their children. Feeding was reported by the children's mothers and children were measured by the anthropologists (Lenka Ťoupalová, Iveta Vašková, Denisa Rejtharová), all reliability coefficients (anthropometric measurement errors) were calculated over 0.95 as recommended (Hermanussen *et al.*, 2013). All children in our research gradually introducing complementary foods from 4 to 6 months of age. The groups of breastfed children included boys (BB) and girls (BG) with exclusive breastfeeding from a breast (a) for at least 4 months, (b) with the child continuing breastfeeding up to the age of 1 year or longer. The groups of non-breastfed children included boys (BN) and girls (GN) with milk formula from the first month of life. Healthy children born between the 38th and 42nd weeks of pregnancy were included in the study. The requirement

of gradually introducing complementary food between 4 and 6 months of age corresponded to the recommendation of the European Society for Paediatric Gastroenterology, Hepatology, and Nutrition (Fewtrell *et al.* 2017).

The study encompassed Czech children aged 5, 9 and 14 years old. A total of 391 children were examined (Table 1). The lower numbers of non-breastfed boys and girls are caused by the low incidence of non-breastfed children in the randomly selected schools. The percentage of non-breastfed children corresponds with the result of the nationwide study in the Czech Republic (ca 4 %, LL 2019).

The anthropometric data were collected according to the standard (Martin-Saller's) method (Knussmann 1992). The accuracy of the measurement (anthropometer, a Luxa brand mechanical personal scale, a Harpenden skinfold calliper) was verified before each data collection.

The measured characteristics were body height (BH), body weight (BW), selected circumferences (the right arm circumference – ACR, waist circumference – WTC, hip circumference – HPC and right thigh circumference – TCR) and the values of selected skinfolds (the skinfold on the right arm over the musculus triceps brachii – SF triceps, subscapular skinfold – SF subscapular, suprailiacal skinfold – SF suprailiacal and skinfold on the right thigh over the musculus quadriceps femoris – SF quadriceps). The skinfold is lifted with the thumb and the index finger of the left hand pressing against each other: the skin is palpated and pinched to form a double layer of skin and the subcutaneous connective and adipose tissues. The calliper is held typically with the right hand. The measuring tips are then applied about 1 cm away from the fingers towards the fold base. The axis running through the calliper tips is perpendicular to the axis of the lifted skinfold; the callipers are applied flatwise

TABLE 1: Study group broken down into age and sex categories.

Sex	Age category (years)			Total
	5.00–5.99 y. Number (%)	9.00–9.99 y. Number (%)	14.00–14.99 y. Number (%)	
Boys: Breastfed (BB)	36 (9.2 %)	36 (9.2 %)	36 (9.2 %)	108 (27.6 %)
Boys: Non-breastfed (BN)	20 (5.1 %)	36 (9.2 %)	28 (7.2 %)	84 (21.5 %)
Girls: Breastfed (GB)	36 (9.2 %)	36 (9.2 %)	36 (9.2 %)	108 (27.6 %)
Girls: Non-breastfed (GN)	36 (9.2 %)	28 (7.2 %)	27 (6.9 %)	91 (23.3 %)
Total	128	136	127	391

TABLE 2: Physical characteristics of boys breastfed (BB) and boys non-breastfed (BN) aged 5, 9 and 14 years and their comparison. BMI – the Body Mass Index, ACR – the right arm circumference, WTC – the waist circumference, HPC – the hip circumference, TCR – the right thigh circumference, SF triceps – the skinfold on the right arm over the musculus triceps brachii, SF subscapular – the subscapular skinfold, SF suprailiacal – the suprailiacal skinfold, SF quadriceps – the skinfold on the right thigh over the musculus quadriceps femoris, SF Sum – the sum of all measured skin folds, WHR – the Waist-to-Hip Ratio.

Age category 5.00–5.99 y.	BB		BN		t-test	U-test
	Mean	SD	Mean	SD	<i>p</i>	<i>p</i>
Height (cm)	118.1	3.7	119.1	5.6	0.442	0.527
Weight (kg)	22.5	2.4	22.7	3.7	0.829	0.561
BMI (kg/m ²)	16.1	1.6	15.9	1.8	0.669	0.238
ACR (cm)	17.9	1.5	18.0	1.9	0.914	0.608
WTC (cm)	56.2	4.0	56.4	4.8	0.877	0.778
HPC (cm)	61.2	4.1	61.7	5.0	0.694	0.952
TCR (cm)	32.3	3.0	32.1	3.0	0.834	1.000
SF triceps (mm)	12.0	2.6	11.7	3.6	0.722	0.499
SF subscapular (mm)	6.0	1.2	6.8	2.5	0.136	0.483
SF suprailiacal (mm)	5.2	1.8	6.1	3.4	0.225	0.555
SF quadriceps (mm)	14.3	3.6	14.8	3.8	0.640	0.831
SF Sum (mm)	37.5	8.1	39.3	12.6	0.525	0.911
WHR (i.u.)	91.8	3.7	91.2	3.8	0.558	0.620

Age category 9.00–9.99 y.	BB		BN		t-test	U-test
	Mean	SD	Mean	SD	<i>p</i>	<i>p</i>
Height (cm)	141.0	7.6	141.0	6.5	0.987	0.924
Weight (kg)	33.6	7.2	35.6	8.0	0.275	0.158
BMI (kg/m ²)	16.8	2.9	17.7	2.3	0.169	0.024*
ACR (cm)	20.6	3.4	21.5	2.9	0.242	0.067
WTC (cm)	62.7	7.5	65.8	8.9	0.108	0.080
HPC (cm)	74.9	6.5	76.8	8.1	0.282	0.290
TCR (cm)	36.5	4.8	38.1	5.0	0.151	0.078
SF triceps (mm)	11.1	4.5	10.7	3.1	0.722	0.875
SF subscapular (mm)	6.2	2.4	6.8	3.1	0.350	0.543
SF suprailiacal (mm)	5.6	2.9	6.8	3.9	0.151	0.209
SF quadriceps (mm)	13.5	3.7	12.5	2.5	0.180	0.405
SF Sum (mm)	36.4	11.3	36.8	11.2	0.868	0.937
WHR (i.u.)	83.6	4.8	85.6	4.8	0.078	0.038*

Age category 14.00–14.99 y.	BB		BN		t-test	U-test
	Mean	SD	Mean	SD	<i>p</i>	<i>p</i>
Height (cm)	173.0	8.9	173.4	6.9	0.845	0.855
Weight (kg)	62.1	14.0	65.1	9.1	0.341	0.112
BMI (kg/m ²)	20.6	3.5	21.7	3.1	0.209	0.084
ACR (cm)	25.4	3.4	25.4	2.3	0.983	0.490
WTC (cm)	75.4	9.6	75.8	7.7	0.860	0.695
HPC (cm)	92.0	8.8	92.7	6.1	0.699	0.386
TCR (cm)	48.8	5.3	49.2	4.1	0.775	0.405
SF triceps (mm)	11.3	4.8	11.9	4.6	0.603	0.405
SF subscapular (mm)	9.7	4.0	11.0	4.5	0.246	0.103
SF suprailiacal (mm)	10.2	5.1	10.4	3.3	0.843	0.211
SF quadriceps (mm)	16.6	5.7	16.9	5.1	0.848	0.834
SF Sum (mm)	47.8	17.9	50.2	17.5	0.593	0.304
WHR (i.u.)	81.9	5.4	81.7	5.1	0.862	0.612

relative to the surface of the body. The skinfold thickness is read on the calliper scale (Kopecký *et al.* 2014). In addition, the sum of all measured skinfolds (SF Sum), the Body Mass Index (BMI; [kg/m²]) and the Waist-to-Hip Ratio (WHR; i.u.) were calculated.

Fundamental statistical values (mean values and standard deviations) are presented in tables. Our data on breastfed and non-breastfed children were compared (Statistica v. 12) in view of Shapiro-Wilk test' results using parametric Student's t-test: $\alpha = 0.05$ (* $p < 0.05$) and $\alpha = 0.01$ (** $p < 0.01$), respectively and non-parametric Mann-Whitney U test: $\alpha = 0.05$ (* $p < 0.05$) and $\alpha = 0.01$ (** $p < 0.01$), respectively.

RESULTS

Physical characteristics of breastfed and non-breastfed boys

Mean values (Mean), standard deviations (SD), p values of Student's t-test and p values of Mann-Whitney U test in boys aged 5, 9 and 14 years old are presented in Table 2.

The differences in the mean values of the anthropometric characteristics and indexes in breastfed (BB) and non-breastfed (BN) boys were insignificant.

Physical characteristics of breastfed and non-breastfed girls

The mean values (Mean), standard deviations (SD), p values of Student's t-test and p values of Mann-Whitney U test in girls aged 5, 9 and 14 years are presented in Table 3.

The differences of mean values of anthropometric characteristics and indexes in breastfed (GB) and non-breastfed (GN) girls were insignificant, with the p value sometimes very close to the significance limit (rated by Student's t-test and Mann-Whitney U test).

Classification into BMI-categories

BMI-categories were determined using age- and gender-specific BMI cut-off points from 5th Nationwide Anthropological Survey (NAS) 1991 recommended for contemporary Czech population aged 0–18 years (Vignerová *et al.*, 2006). The results are presented in Table 4.

Classification into BMI-categories showed the influence of socio-economic changes in the Czech Republic from 1991 to 2018 but not significantly different numbers of probands in BMI-categories of breastfed and non-breastfed children.

Comparison of fundamental physical characteristics

Comparison of fundamental physical characteristics (body height, body weight and BMI) with the results of 6th NAS 2001 (Vignerová *et al.*, 2006) are presented in Table 5.

The differences of mean values of fundamental anthropometric characteristics in breastfed and non-breastfed children were predominantly insignificant. The results in our children aged 5 years could correspond to the secular trend shift to younger age groups in body height and weight. This phenomenon were predicted in e.g. Vignerová *et al.* 2006.

DISCUSSION

The impact of breastfeeding on the body composition of children and adults is controversial. Previous observational studies demonstrated that breastfeeding was inversely associated with infant growth velocity (Johnson *et al.* 2014, Monteiro, Victora 2005), weight gain velocity and Body Mass Index in infancy (Azad *et al.* 2018). Azad *et al.* (2018) showed that these associations are partially diminished when breast milk was fed from a bottle and they are also dose-dependent. The main result of the study was that preventing obesity was associated with getting breast milk directly from the breast. An infant who is directly fed does not tend to be overfed. When children are full, they stop sucking, or switch to a "comfort" kind of sucking that does not produce milk. On the contrary, when infants are fed from bottles, parents and caregivers are more likely to force them to receive the amount given by the schedule (Azad *et al.* 2018, McCarthy 2018, Sun *et al.* 2016). A child's learning to stop eating when he or she is full is an important skill in preventing obesity. Prevention of overweight and obesity is a health challenge that young parents face worldwide (Ezzati *et al.* 2017). They should respond to the cues of infants and children of both being hungry and being full. In this context organisations like the European Society for Paediatric Gastroenterology, Hepatology, and Nutrition (Fewtrell *et al.* 2017) and the American Academy of Pediatrics (AAP 2019) have encouraged parents to learn and use "responsive feeding".

Ideas concerning the influence of breastfeeding and non-breastfeeding are gradually being redefined. Though breastfeeding has established benefits for maternal health (Victoria *et al.* 2016), positive preventive health effects of breastfeeding for mothers is only detected when

TABLE 3: Physical characteristics of girls breastfed (GB) and girls non-breastfed (GN) aged 5, 9 and 14 years and their comparison. BMI – the Body Mass Index, ACR – the right arm circumference, WTC – the waist circumference, HPC – the hip circumference, TCR – the right thigh circumference, SF triceps – the skinfold on the right arm over the musculus triceps brachii, SF subscapular – the subscapular skinfold, SF suprailiacal – the suprailiacal skinfold, SF quadriceps – the skinfold on the right thigh over the musculus quadriceps femoris, SF Sum – the sum of all measured skin folds, WHR – the Waist-to-Hip Ratio.

	GB		GN		t-test	U-test
	Mean	SD	Mean	SD	<i>p</i>	<i>p</i>
Height (cm)	117.8	4.8	116.7	3.5	0.285	0.149
Weight (kg)	22.0	4.7	22.1	4.6	0.900	0.960
BMI (kg/m ²)	15.7	2.5	16.2	2.8	0.480	0.417
ACR (cm)	17.7	1.9	18.2	2.5	0.401	0.525
WTC (cm)	55.1	7.1	56.6	6.2	0.341	0.159
HPC (cm)	61.8	5.9	62.5	5.3	0.643	0.644
TCR (cm)	32.9	3.1	33.4	3.9	0.499	0.714
SF triceps (mm)	11.3	2.9	12.2	3.4	0.245	0.207
SF subscapular (mm)	6.9	3.1	7.8	3.1	0.238	0.112
SF suprailiacal (mm)	5.9	3.2	6.8	3.2	0.231	0.037*
SF quadriceps (mm)	14.4	3.8	16.1	3.4	0.046*	0.044*
SF Sum (mm)	38.5	11.6	42.9	11.4	0.110	0.044*
WHR (i.u.)	88.3	4.4	90.4	3.4	0.035*	0.093

Age category 9.00-9.99 y.						
	GB		GN		t-test	U-test
	Mean	SD	Mean	SD	<i>p</i>	<i>p</i>
Height (cm)	137.4	6.0	139.6	7.2	0.181	0.273
Weight (kg)	31.7	6.4	34.1	11.4	0.291	0.469
BMI (kg/m ²)	16.7	2.7	17.1	3.5	0.565	0.766
ACR (cm)	20.8	2.7	21.3	3.5	0.606	0.908
WTC (cm)	62.6	8.8	65.0	10.8	0.229	0.327
HPC (cm)	73.3	6.9	75.0	9.2	0.398	0.520
TCR (cm)	38.5	4.1	39.6	5.8	0.377	0.631
SF triceps (mm)	11.9	4.0	10.5	4.4	0.169	0.030*
SF subscapular (mm)	7.2	2.7	8.1	4.3	0.296	0.444
SF suprailiacal (mm)	7.5	3.2	7.5	2.9	0.989	0.844
SF quadriceps (mm)	14.3	4.1	13.1	4.4	0.270	0.102
SF Sum (mm)	40.9	11.1	39.1	14.5	0.592	0.357
WHR (i.u.)	84.6	7.8	86.5	6.1	0.293	0.340

Age category 14.00-14.99 y.						
	GB		GN		t-test	U-test
	Mean	SD	Mean	SD	<i>p</i>	<i>p</i>
Height (cm)	163.5	6.6	163.2	5.8	0.861	0.973
Weight (kg)	56.7	7.8	55.8	9.1	0.665	0.829
BMI (kg/m ²)	21.3	3.0	20.9	2.9	0.637	0.670
ACR (cm)	25.6	2.2	24.1	2.9	0.029*	0.057
WTC (cm)	71.3	7.1	70.4	8.1	0.664	0.665
HPC (cm)	93.5	6.4	90.1	8.7	0.077	0.074
TCR (cm)	51.5	4.4	50.1	4.9	0.354	0.642
SF triceps (mm)	17.5	3.2	16.2	5.1	0.234	0.043*
SF subscapular (mm)	12.1	3.7	11.9	3.7	0.856	0.995
SF suprailiacal (mm)	13.6	4.0	13.4	4.9	0.901	0.670
SF quadriceps (mm)	22.5	4.2	20.8	4.7	0.139	0.038*
SF Sum (mm)	65.7	12.4	61.6	16.5	0.261	0.226
WHR (i.u.)	76.2	4.9	78.7	8.5	0.149	0.221

TABLE 4: Classification into BMI-categories of boys breastfed (BB), boys non-breastfed (BN), girls breastfed (GB) and girls non-breastfed (GN) aged 5, 9 and 14 years according to 5th NAS from 1991 (Vignerová *et al.* 2006).

Age category 5.00–5.99 y.		BB		BN		GB		GN	
Percentile range		N	%	N	%	N	%	N	%
97 ≤		3	8	1	5	1	3	5	14
<90–97)		4	11	1	5	2	6	2	6
<75–90)		6	17	5	25	8	22	8	22
<25–75)		18	50	11	55	13	36	14	39
<10–25)		3	8	2	10	6	17	5	14
<3–10)		2	6	0	0	6	17	2	6
< 3		0	0	0	0	0	0	0	0
Total		36	100	20	100	36	100	36	100

Age category 9.00–9.99 y.		BB		BN		GB		GN	
Percentile range		N	%	N	%	N	%	N	%
97 ≤		4	11	3	8	1	3	1	4
<90–97)		2	6	2	6	4	11	5	18
<75–90)		3	8	11	31	4	11	4	14
<25–75)		15	42	15	42	15	42	9	32
<10–25)		9	25	2	6	8	22	9	32
<3–10)		3	8	3	8	4	11	0	0
< 3		0	0	0	0	0	0	0	0
Total		36	100	36	100	36	100	28	100

Age category 14.00–14.99 y.		BB		BN		GB		GN	
Percentile range		N	%	N	%	N	%	N	%
97 ≤		3	8	4	14	3	8	1	4
<90–97)		4	11	5	18	5	14	4	15
<75–90)		6	17	6	21	7	19	6	22
<25–75)		15	42	10	36	17	47	11	41
<10–25)		6	17	1	4	2	6	3	11
<3–10)		1	3	1	4	2	6	1	4
< 3		1	3	1	4	0	0	1	4
Total		36	100	28	100	36	100	27	100

breastfeeding women are adequately fed and allowed to space their pregnancies (Kennedy 1994). Current scientific research does not support the prior general assumption that breastfeeding has a positive effect on the quality of the mother–child relationship (Jansen *et al.* 2008). Breastfeeding also has clear short term benefits for child health via reducing mortality and morbidity from infectious diseases (Owen *et al.* 2005) that have been manifested in worldwide growth studies (WHO 2003, De Onis *et al.* 2006). However, the evidence of an association between breastfeeding and health benefits in

later life was only shown in decreasing the odds of type-2 diabetes (Horta *et al.* 2015), blood cholesterol levels (Owen *et al.* 2002), in the potential to protect against allergic diseases (Lucas *et al.* 1990), and improved neural and psychosocial development (Makrides *et al.* 1995, Fergusson, Woodward 1999). It has been noted that the results of the same characteristic often differ significantly among studies, and possibly they are rather related to socioeconomic status.

Our data on breastfed and non-breastfed pre-school and schoolchildren correspond to the results reported

TABLE 5: Comparison of fundamental physical characteristics of boys breastfed (BB), boys non-breastfed (BN), girls breastfed (GB) and girls non-breastfed (GN) aged 5, 9 and 14 years with 6th NAS from 2001 (Vignerová *et al.* 2006).

Age category 5.00–5.99 y.									
	6 th NAS			BB		t-test	BN		t-test
	N	Mean	SD	Mean	SD	<i>p</i>	Mean	SD	<i>p</i>
Height (cm)	955	114.9	5.4	118.1	3.7	0.000**	119.1	5.6	0.001**
Weight (kg)	954	20.8	3.4	22.5	2.4	0.003**	22.7	3.7	0.014*
BMI (kg/m ²)	954	15.7	1.8	16.1	1.6	0.189	15.9	1.8	0.623
Age category 9.00–9.99 y.									
	6 th NAS			BB		t-test	BN		t-test
	N	Mean	SD	Mean	SD	<i>p</i>	Mean	SD	<i>p</i>
Height (cm)	1367	138.9	6.3	141.0	7.6	0.050	141.0	6.5	0.046*
Weight (kg)	1367	33.6	7.0	33.6	7.2	1.000	35.6	8.0	0.099
BMI (kg/m ²)	1367	17.3	2.7	16.8	2.9	0.293	17.7	2.3	0.355
Age category 14.00–14.99 y.									
	6 th NAS			BB		t-test	BN		t-test
	N	Mean	SD	Mean	SD	<i>p</i>	Mean	SD	<i>p</i>
Height (cm)	1447	171.0	8.6	173.0	8.9	0.171	173.4	6.9	0.144
Weight (kg)	1446	58.8	10.7	62.1	14.0	0.067	65.1	9.1	0.002**
BMI (kg/m ²)	1446	20.0	2.8	20.6	3.5	0.200	21.7	3.1	0.002**
Age category 5.00–5.99 y.									
	6 th NAS			GB		t-test	GN		t-test
	N	Mean	SD	Mean	SD	<i>p</i>	Mean	SD	<i>p</i>
Height (cm)	938	114.1	5.3	117.8	4.8	0.000**	116.7	3.5	0.004**
Weight (kg)	937	20.1	3.2	22.0	4.7	0.001**	22.1	4.6	0.000**
BMI (kg/m ²)	937	15.4	1.8	15.7	2.5	0.335	16.2	2.8	0.011*
Age category 9.00–9.99 y.									
	6 th NAS			GB		t-test	GN		t-test
	N	Mean	SD	Mean	SD	<i>p</i>	Mean	SD	<i>p</i>
Height (cm)	1284	138.4	6.4	137.4	6.0	0.364	139.6	7.2	0.312
Weight (kg)	1284	32.7	6.7	31.7	6.4	0.358	34.1	11.4	0.297
BMI (kg/m ²)	1284	17.0	2.6	16.7	2.7	0.467	17.1	3.5	0.795
Age category 14.00–14.99 y.									
	6 th NAS			GB		t-test	GN		t-test
	N	Mean	SD	Mean	SD	<i>p</i>	Mean	SD	<i>p</i>
Height (cm)	1495	164.6	6.5	163.5	6.6	0.323	163.2	5.8	0.281
Weight (kg)	1495	54.6	8.6	56.7	7.8	0.134	55.8	9.1	0.473
BMI (kg/m ²)	1495	20.1	2.8	21.3	3.0	0.014*	20.9	2.9	0.142

for adults breastfed and non-breastfed during infancy (Peneau *et al.* 2014, Pirila *et al.* 2012) but differ from the results obtained in the study of toddlers breastfed and non-breastfed during infancy (Van Rossem *et al.* 2011, Durmus *et al.* 2012) and infants (Azad *et al.*

2018). Breastfeeding appears to have only a short-term effect on adiposity.

Our data on breastfed and non-breastfed pre-school and schoolchildren predominantly correspond to the results of 6th NAS (Vignerová *et al.* 2006).

The present study was limited in its relatively small sample size, which could have led to insufficient statistical power for detecting existing differences in the mean values. Thus, our results might not be generalizable about all types of populations and need to be replicated in different contexts.

CONCLUSION

Breastfeeding has established benefits for child health (both reducing mortality and morbidity from infectious diseases and its effect on the innate immune system). Our results in children aged 5, 9 and 14 years showed that the impact of breastfeeding on obesity and adiposity at a later age is rather controversial. Breastfeeding appears to have a short-term effect on adiposity in infants and toddlers, not a long-term effect on adiposity for preschool children and schoolchildren. The differences in the mean values of height, weight, BMI, skinfolds and circumferences between breastfed and non-breastfed preschool children and schoolchildren were statistically insignificant.

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