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PHYSICAL DEVELOPMENT OF CHILD AND ADOLESCENT: RESULTS OF THE 1999 SURVEY

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Abstract. In 1999 a study on physical development of children between 0-18 years of age was performed. Present investigation is a 8th stage of the national study which begun in 1950. The authors present the results of physical examination of over 53,000 children and adolescents living in 7 districts from the eastern Romania: the average levels of the anthropometrical indices by age, gender, residence area, the distribution by physical development, comparative aspects with previous stage made in 1992. The paper conclusions discuss the opportunity to continue this longitudinal study with its limits and value and recommendation in order to improve the methodology for the subsequent stages.

Key words: child, adolescent, physical development indices, loco-regional developmental standards, longitudinal study, trend of physical development

Rezumat. În anul 1999 s-a desfăşurat a 8-a secvenţă anuală a studiului de cunoaştere a dezvoltării fizice a copiilor 0-18 ani iniţiat la nivel naţional în 1950. Lucrarea prezintă rezultatele investigării dezvoltării fizice a peste 53.000 copii şi adolescenţi din 7 judeţe din estul României: nivele medii ale indicatorilor antropometrici pe vârste, sexe, medii urban/rural, distribuţia după diagnosticul de dezvoltare fizică, aspecte comparative cu secvenţa anterioară din 1992. Studiului discută oportunitatea continuării studiului longitudinal, cu valoarea şi limitele acestuia şi recomandări pentru ameliorarea metodologiei pentru etapele ulterioare.

Cuvinte cheie: copil, adolescent, indici de dezvoltare fizică, standarde de dezvoltare loco-regională, studiu longitudinal, tendinţa dezvoltării fizice

INTRODUCTION

The population health status is a complex biological and social phenomena requiring the use of multitude indicators for its assessment.

Among the direct, positive indicators of health is the physical development of children; given their peculiar features – demographic, anatomic, functional, morbidity and adaptation – children and adolescents are an important group of population and their health is a true "barometer" of general health (1-3).

As health itself, the physical development is governed by general rules and influenced by a multitude of factors (4).

Growth from birth to adolescence has some district patterns: the first, second and third weight growth (1-4; 8-10 and 15-20 years, respectively), the first and second height growth (5-7 and 11-15 years, respectively) and puberty –

related growth spurt (during the semester preceding puberty). Early puberty of girls *vs.* boys causes an earlier pre-puberty spurt with two crossing of the height and weight curves; meaning that for a while, weight and height in girls than in boys (4-6).

Global assessments of physical developments of children and adolescents have been conducted periodically (every seven years) since 1950.

The areas designed for investigations have been classified in four categories (7-9) according to the number of inhabitants: urban I-towns with over 200,000 inhabitants; urban II-towns with over 50,000-200,000 inhabitants; urban III-less than 50,000 inhabitants; rural.

In this paper, the results of the eight phase of the longitudinal survey - in Moldavia districts are compared with the previous results - 1992 (10,11).

SUBJECTS AND METHOD

With respect to the criteria of a prospective study, the sample, designed areas and examinations' records were previously established taking into account the number of inhabitants (7,8).

Three urban areas of category I, II, III each and 21 villages were selected throughout Moldova territory.

In each area, the sample is a multiple of 2,200 subjects with the following age and sex structure:

- newborns: 50 boys and 50 girls …….. 100
- 1-12 months: 12 monthly groups of 30 children each (15 boys and 15 girls)..…360
- 15-36 months: 8 quarterly groups of 30 children each (15 boys and 15 girls).…240
- 4-18 years: 15 annual groups of 100 children each (50 boys and 50 girls)…...1,500

Total: 2,200 subjects (1,100 boys and 1,100 girls)

The size of sample of the Moldavian districts ranged from 4,400 subjects (Botosani and Vrancea) to 17,600 subjects (Iasi and Suceava) according to total inhabitants.

The geographical distribution of selected areas is indicated in fig. 1.

53,041 subjects (74.3%) have been examined during 1999 and the following data have been recorded:

- personal, social and family history
- anthropometric indices: weight, height, head and thorax circumferences
- physiometric indicators: pulse, blood pressure, vital capacity
- dental and pubertal maturity

In this study have been analyzed the variation of two anthropometrics indices used for the physical development assessment, namely weight and height.

These indicators were processed as:

⇨ mean value by age, gender and residence area, in order to establish standards of physical development for children and adolescents from Moldavia territory;

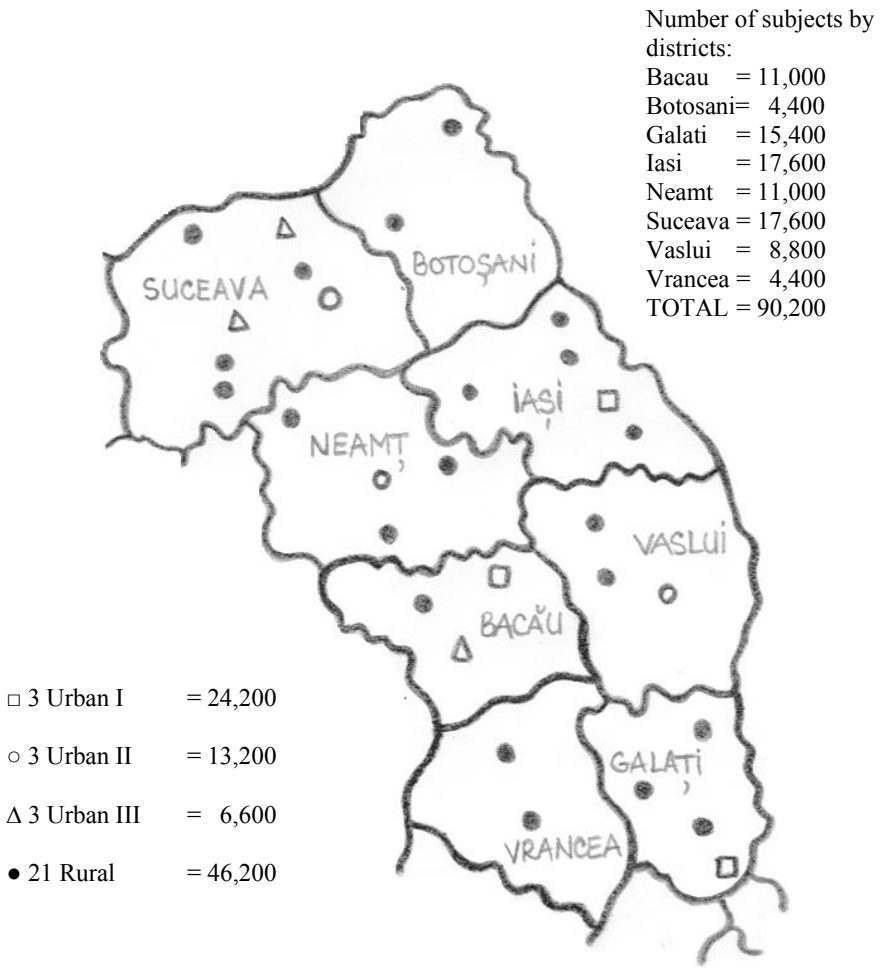


Fig. 1 The geographical distribution of selected locations and subjects number

⇨ individually diagnosis of physical development taking into account:

- harmonious physical development (HPD) – the child's weight and height lie in the same SD (mean ± 1-3 SD):
  m ± 1 SD – harmonious with medium indices;
  m + 2 SD – harmonious with high indices;
  m + 3 SD – harmonious with very high indices;
  m - 2 SD – harmonious with low indices;
  m - 3 SD – harmonious with very low indices.
- disharmonious physical development (DPD) (with plus or minus of weight) – the child' weight and height are separated by at least 1 SD.

⇨ harmonious/disharmonious physical development frequencies by age, gender and residence area.

⇨ annual rates of weight and height growth.

RESULTS AND DISCUSSION

Size of sample by category of residence area and sex distribution, are shown in Table 1.

Table 1. Age and residence area distribution of subjects

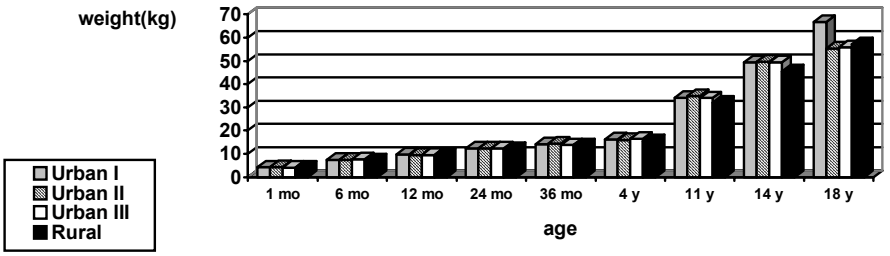
Age group	Residence area				Total	
	Urban I	Urban II	Urban III	Rural	No	%
1-12 months	1455	1132	368	2211	5166	9.73
15-36 months	985	832	521	3228	5566	10.49
4-18 years	8748	8442	3101	22018	42309	79.76
Total subjects	11188	10406	3990	27457	53041	100
					26159 boys	49.32
					26882 girls	50.68

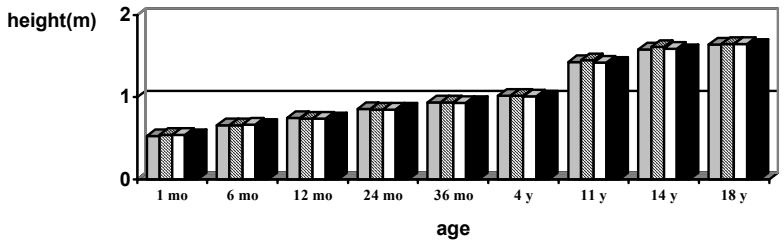
The percentage of examined subjects between different districts ranged from 60 to over 90: Suceava 59.9; Iasi 64.6; Vaslui 75.5; Botosani 83.3; Neamt 87.2; Bacau 88.8 and Vrancea 91.0 (Galati county excluded).

The height and weight average values for girls of all ages and boys over 4 years age have been lower in rural areas, as are indicated in fig. 2.

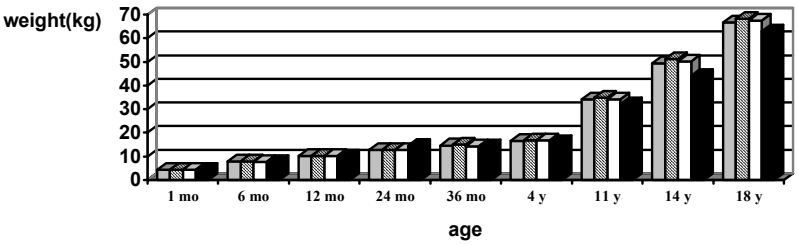
The annual rate of height growth trends to decrease with age; periods of accelerated growth alternate with periods of slower growth and pre-puberty spurt is evident (fig. 3).

Girls





Boys



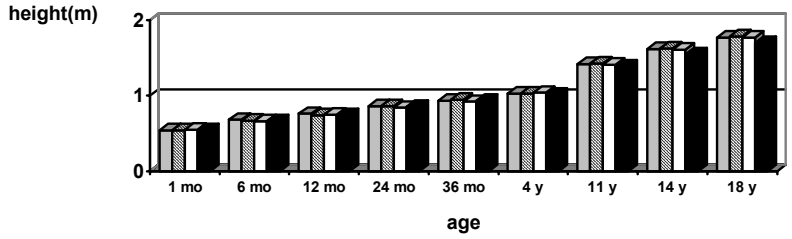
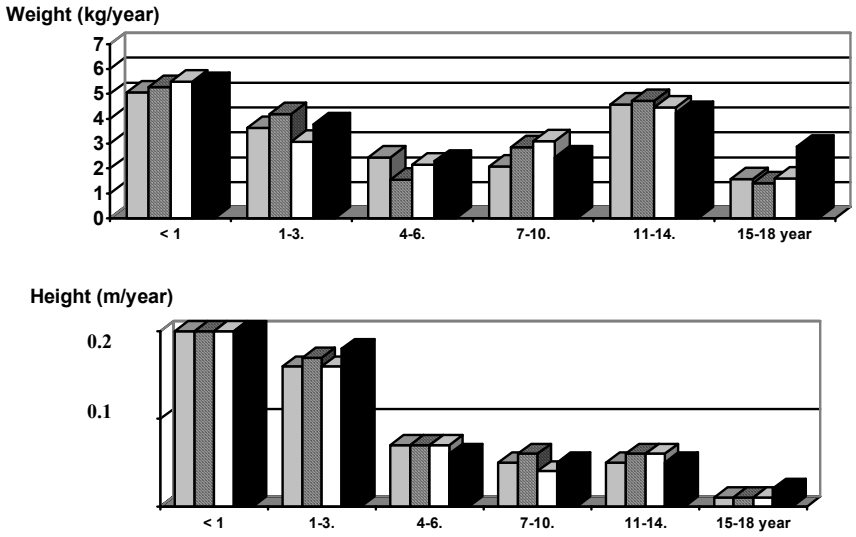


Fig. 2. The distribution of mean values of physical development by age, sex and residence area

Girls



Boys

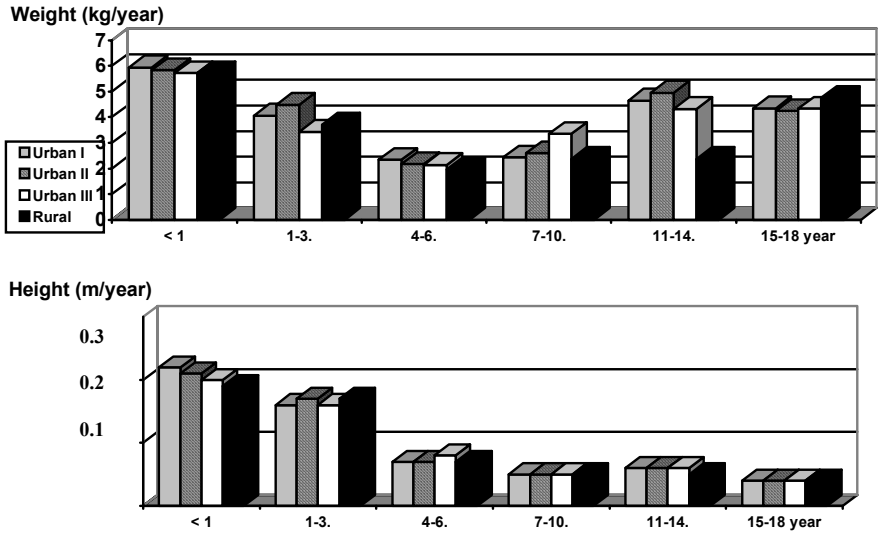


Fig. 3 The mean annual rate of weight and height growth by gender and residence area

So, the physiological timing of the two crossing curves of height evidently appeared earlier both in urban I and II areas, as shown table 2 data.

Table 2. Residence area related to weight and height crossing curves

Residence area	Age (years) of the first crossing for: weight	height	Age (years) of the second crossing for: weight	height
Urban I	11	11	14	14
Urban II	11	11	14	14
Urban III	13	12	14	14
Rural	11	15	14	15

The distribution of examined subjects by their physical development shown in fig. 4, reveals that 65% of them have had an harmonious development.

The subjects living in rural areas has a higher frequencies of harmonious development (fig. 5).

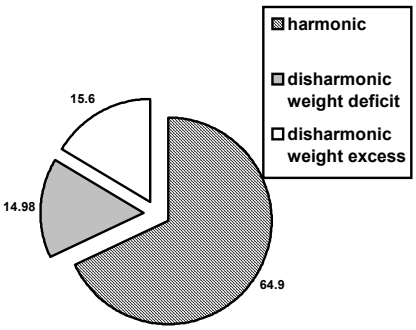


Fig. 4 Distribution of the subjects according to the physical development (%)

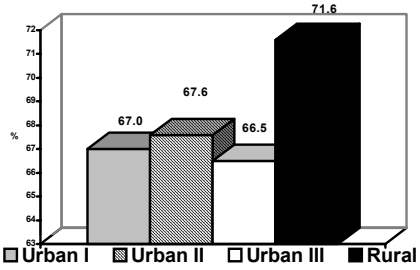


Fig. 5 Frequencies of children with harmonious development in Moldavia territory - 1999

The frequencies of harmonious development at decisive moments of subject's physical development, by residence area and its trend are indicated in table 3.

A downward trend is evident in the urban areas and the whole nord-eastern territory, whereas in rural zone a upward trend could be see.

Table 3. The frequencies of harmonious physical development by ages and residence areas

Age (years)	Urban I	Urban II	Urban III	Rural	Moldova
1	69.8	68.0	67.7	62.6	65.8
2	69.1	65.7	69.2	67.9	67.9
3	64.6	67.1	67.1	66.1	66.1
6	54.5	66.5	72.4	68.3	65.3
10	69.0	68.5	61.5	73.5	71.3
15	64.0	65.3	69.4	72.7	69.2
18	62.3	62.6	54.7	66.8	62.7
Trend	y=68.80-1.01x	y=68.47-0.56x	y=72.31-1.58x	y=69.04+1.06x	y=67.11-0.05x

The harmonious physical development indices had a Gaussian distribution (fig. 6).

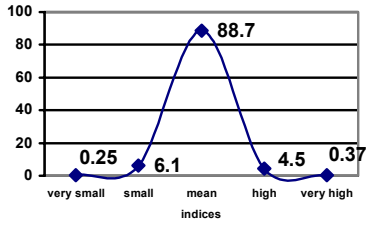


Fig. 6. Distribution (%) of subjects with harmonious development

The results of this survey phase were used to formulate the residence area – related standards of physical development of boys and girls aged 1 month to 18 years. As an example Table 4 (A and B) indicates the standards of both indices of girls living in rural areas, which will be used for the next 7 years, in Moldova territory.

Table 4.

PHYSICAL DEVELOPMENT OF CHILD AND ADOLESCENT

RURAL - girls

A. Weight (kg)

Age	n	m	SD	m - 3SD	m - 2SD	m -1SD	m ^ 1SD	m ^ 2SD	m ^ 3SD
1 month	76	4.06	0.64	2.14	2.78	3.42	4.70	5.34	5.97
2 month	99	4.86	0.83	2.38	3.21	4.03	5.69	6.52	7.35
3 month	90	5.59	0.82	3.14	3.96	4.77	6.41	7.23	8.05
4 month	93	6.15	0.90	3.46	4.36	5.26	7.05	7.94	8.84
5 month	77	6.76	0.98	3.82	4.80	5.78	7.74	8.72	9.70
6 month	81	7.29	0.89	4.61	5.51	6.40	8.19	9.08	9.98
7 month	65	8.13	1.07	4.91	5.98	7.05	9.20	10.28	11.35
8 month	89	8.34	1.11	5.00	6.12	7.23	9.46	10.57	11.68
9 month	89	8.67	1.09	5.40	6.49	7.58	9.76	10.85	11.94
10 month	79	8.97	1.19	5.40	6.59	7.78	10.16	11.35	12.54
11 month	95	9.03	1.06	5.85	6.91	7.97	10.09	11.15	12.21
12 month	151	9.48	1.21	5.86	7.07	8.28	10.69	11.89	13.10
15 month	223	10.01	1.17	6.50	7.67	8.84	11.18	12.34	13.51
18 month	192	11.24	1.63	6.36	7.99	9.61	12.87	14.49	16.12
21 month	171	11.84	1.65	6.89	8.54	10.19	13.49	15.13	16.78
24 month	197	12.10	1.63	7.21	8.84	10.47	13.73	15.36	16.99
27 month	173	12.25	1.64	7.33	8.97	10.61	13.89	15.53	17.17
30 month	151	12.93	1.72	7.76	9.48	11.21	14.65	16.37	18.09
33 month	133	13.37	1.73	8.19	9.92	11.65	15.10	16.83	18.56
36 month	386	13.77	1.84	8.25	10.09	11.93	15.61	17.46	19.30
4 year	578	15.40	2.15	8.96	11.11	13.26	17.55	19.70	21.85
5 year	676	17.33	3.05	8.19	11.24	14.28	30.37	23.42	26.46

6 year	648	18.90	2.53	11.31	13.84	16.37	21.44	23.97	26.50
7 year	746	21.28	3.45	10.92	14.38	17.83	24.73	28.19	31.64
8 year	825	23.35	3.78	12.00	15.78	19.56	27.13	30.91	34.69
9 year	873	25.84	4.35	12.80	17.15	21.49	30.19	34.53	38.88
10 year	1017	28.61	5.13	13.23	18.36	23.49	33.74	38.87	43.99
11 year	990	32.13	5.72	14.97	20.69	26.41	37.85	43.57	49.29
12 year	1023	36.05	6.95	15.22	22.16	29.11	43.00	49.95	56.89
13 year	907	40.98	7.40	18.78	26.18	33.58	48.38	55.78	63.18
14 year	939	45.51	8.10	21.22	29.32	37.41	53.61	61.71	69.81
15 year	866	49.84	8.64	23.92	32.56	41.20	58.47	67.11	75.75
16 year	444	53.18	7.20	31.57	38.77	45.97	60.38	67.58	74.78
17 year	434	55.41	7.37	33.31	40.68	48.04	64.78	70.15	77.52
18 year	331	57.06	7.93	33.27	41.20	49.13	64.99	72.92	80.85

B. Height (m)

Age	m	SD	m - 3SD	m - 2SD	m -1SD	m ^ 1SD	m ^ 2SD	m ^ 3SD
1 month	0.53	0.04	0.40	0.45	0.49	0.58	0.62	0.66
2 month	0.56	0.04	0.43	0.48	0.52	0.60	0.65	0.69
3 month	0.59	0.04	0.46	0.50	0.55	0.64	0.68	0.72
4 month	0.62	0.04	0.48	0.53	0.57	0.66	0.71	0.75
5 month	0.64	0.05	0.48	0.53	0.59	0.69	0.74	0.79
6 month	0.65	0.04	0.52	0.57	0.61	0.70	0.74	0.79
7 month	0.67	0.05	0.53	0.57	0.62	0.71	0.76	0.81
8 month	0.69	0.05	0.54	0.59	0.64	0.74	0.79	0.84
9 month	0.70	0.05	0.56	0.61	0.65	0.75	0.79	0.84
10 month	0.71	0.05	0.58	0.62	0.67	0.76	0.81	0.85
11 month	0.72	0.04	0.58	0.63	0.67	0.76	0.81	0.85
12 month	0.73	0.05	0.59	0.64	0.69	0.78	0.83	0.88
15 month	0.75	0.05	0.59	0.64	0.70	0.81	0.86	0.91
18 month	0.80	0.06	0.62	0.68	0.74	0.86	0.92	0.98
21 month	0.83	0.06	0.63	0.70	0.76	0.89	0.95	1.02
24 month	0.85	0.06	0.67	0.73	0.79	0.91	0.97	1.02
27 month	0.85	0.06	0.68	0.74	0.80	0.91	0.97	1.02
30 month	0.89	0.07	0.69	0.76	0.82	0.96	1.02	1.09
33 month	0.90	0.07	0.70	0.77	0.83	0.97	1.03	1.10
36 month	0.93	0.06	0.74	0.80	0.87	0.99	1.06	1.12

4 year	1.00	0.08	0.77	0.84	0.92	1.08	1.16	1.24
5 year	1.07	0.08	0.82	0.90	0.99	1.15	1.24	1.32
6 year	1.12	0.06	0.94	1.00	1.06	1.19	1.25	1.32
7 year	1.18	0.09	0.92	1.01	1.10	1.27	1.36	1.44
8 year	1.24	0.08	1.06	1.08	1.16	1.32	1.39	1.47
9 year	1.29	0.08	1.06	1.13	1.21	1.37	1.45	1.53
10 year	1.34	0.09	1.07	1.16	1.25	1.43	1.52	1.61
11 year	1.40	0.10	1.11	1.21	1.30	1.50	1.60	1.70
12 year	1.46	0.09	1.19	1.28	1.37	1.55	1.64	1.73
13 year	1.52	0.10	1.23	1.33	1.42	1.61	1.71	1.81
14 year	1.56	0.10	1.24	1.35	1.45	1.66	1.76	1.87
15 year	1.59	0.10	1.30	1.40	1.50	1.69	1.79	1.89
16 year	1.61	0.09	1.33	1.42	1.51	1.70	1.79	1.88
17 year	1.62	0.07	1.42	1.49	1.56	1.69	1.76	1.83
18 year	1.63	0.07	1.43	1.50	1.56	1.70	1.76	1.83

A comparison of the results reported in 1992 and 1999, reveals both common features and dissimilarities.
In 1992, the survey was carried out in all 8 Moldavian counties, while in 1999 in only 7 (Galati excluded); 75.08% and 74.3% of the designed sample were surveyed in 1992 and 1999.

- children under 1 year age and adolescents aged 17-18 were poorly represented: the sample size designed in 1950 no longer reflects the present demographic structure of the population and the administrative territorial organization of Romania;
- in both phases, the mean values of the 2 indices (weight and height) were lower in the rural area; higher mean values were recorded in 1999 especially for boys age group of 15-36 month, living in urban I and II areas.

Figure 7 shows the mean weight of urban area I boys in 1999 as compared with 1992;

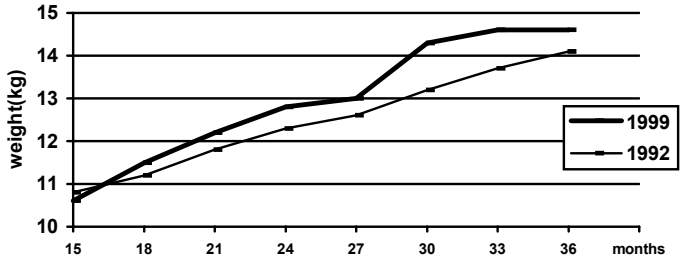


Fig.7. Comparative values of physical development indices of examined subjects in 1999 and 1992 (mean weight in urban I, boys)

- the two crossing of weight and height curves occurred at older ages in the rural area, proving an earlier puberty in urban areas;
- a lower percentage of subjects with harmonious development was found in 1999 survey (table 7).

Table 7. Comparative percentage of subjects with harmonious physical development in the last two surveys

Residence areas		1992	1999
Urban I		70.6	67.0
Urban II		74.5	67.6
Urban III		69.1	66.5
Rural		76.1	71.6
Gender	Boys	74.1	70.4
	Girls	72.9	68.3

The authors sustain the necessity of national survey continuation, one of the few made in the world, because the anthropometry remains: "*the most mobile, simple and less expensive non-invasive method of assessing the body mass that reflects health and nutrition, and is a predictive element of health and survival*" (12).

CONCLUSIONS

The 8th cross – sectional phase of the longitudinal survey proved to be necessary for the following reasons:

- provide the continuity of the assessment of physical development of the population 0-18 years age;
- the patterns of growth and development were verified on a large sample of subjects;
- the outcomes established new loco-regional standards of physical development which will replace those elaborated in 1992; these new standards should be used by primary and specialized health care services; this being the more so imperative as the 1992 standards

had been only partially update, at national level;

- the sampling methodology accepted half century ago, must be revised due to the new territorial administrative structure as well as significant demographic changes.

REFERENCES

1. Enăchescu D., Marcu M. - *Sănătate publică şi management sanitar*. Edit. ALL, Bucureşti, 1995.
2. Rugină V. - *Medicină socială*. UMF Iaşi, 1986.
3. Vasilov M., Damaschin F. - *Sănătatea copiilor - indicator de sănătate al comunității*. Ed. Comandor, Constanța, 1999.
4. Tănăsescu Gh. - *Igiena copilului şi adolescentului*. În Tratat de Igienă (red. Mănescu S.), Ed. Medicală, 1986.
5. Vlaicu B. - *Dinamica dezvoltării fizice şi aspecte comportamentale la şcolari*. Edit. Signata Timişoara, 1994.
6. Vlaicu B., Vasilov M. - *Adolescența - particularități antropometrice în Banat şi Moldova*. Edit. Eurobit, Timişoara, 1998.
7. Tănăsescu Gh. - *Contribuții la o ştiință a dezvoltării: 35 de ani de cercetări asupra dezvoltării fizice şi psihologice a copiilor şi adolescenților*. Ses.Şt. ASM, Bucureşti, 1985.
8. Tănăsescu Gh., Arbore E., Vasilov M. - *Evoluția nivelului somatometric în România în perioada 1950-1985 – dezvoltarea fizică a copiilor şi tinerilor*. Rev. de Igienă, Nr. 1, 1993, 15-22.
9. Arbore E., Nistorescu F., Vasilov M. ş.c. - *Dezvoltarea fizică a copiilor şi adolescenților din România - mediul urban, etapa 1992*. Rev. Medicală Națională, Vol.1, Nr.3, 1997, 59-61.
10. Vasilov M. - *Dezvoltarea fizică a copiilor şi tinerilor (0-18 ani) din județele Moldovei – Rezultatele anchetei medicale pe eşantion, secvența anului 1999. Ed. Fundației Altius Academi, iaşi, 2001*.
11. Vasilov Marieta - *Studiul longitudinal al dezvoltării fizice a copiilor şi tinerilor - secvența transversală 1992. Rezultate în cele 8 județe ale Moldovei*. Bul.inform IPSMP Bucureşti, seria II, noiembrie, 1994.
12. Gorştein J. - *Utilisation de l'anthropometrie pour évaluer l'état nutritionel*. Rap. tr. stat. san. mond. 41, 2, 1988.