

## GROWTH ACCELERATION IN THE NOVI SAD PUPILS

V. Božić-Krstić and Dj. Radovanović

Institute of Biology, University of Novi Sad; Faculty of Physical Culture, University of Novi Sad, Novi Sad, Yugoslavia

*Abstract: It is well known that in our century stature and body weight of children of the same age tend to increase progressively. On the basis of the above statement, the present research was designed to analyze acceleration of somatic growth of pupils from Novi Sad.*

*Data on stature and body mass of 7.095 pupils aged between 7–15 years are presented according to sex and age and compared with the results of anthropometric measurements of analogous groups of the Novi Sad pupils obtained 14 years ago.*

*A significant increase of stature and body weight in all age groups of both boys and girls is found. When average values of stature of boys and girls are compared, it is evident that the period when girl stature values exceeded those of boys is advanced to an earlier ages and that it is shorter. Summarily, in the Novi Sad pupils of both sexes adolescence rise takes place earlier, i.e. the development tempo is faster.*

*Key words: Acceleration; Stature; Body weight; Novi Sad pupils.*

### Introduction

Investigations in many countries and also in this country have demonstrated that body height and weight of children of the same age tend to be greater progressively (Ljung et al. 1974, Prebeg 1978, Chinn and Rona 1984, Ivanović 1985, Tomazo-Ravnik 1986). The acceleration is manifested via two aspects: tempo of growth, as well as adult stature have increased. In certain populations however, the acceleration trend has been ceased (Tanner 1973).

### Material and Method

The anthropometric studies were conducted according to the instructions given in the International Biological Programme, during 1981–1982. Investigations included measurements of 3.563 boys and 3.532 girls over the age range 6.5 to 15 years, selected at random from all city primary schools. Age of children was calculated according to birth date at the day of measuring while age groups were determined during half a year interval. Stature and body weight averages were calculated for each age group of boys and girls. Basic parameteres such as obtained were compared with the anthropometric data of analogous groups of the Novi Sad children of both sexes examined during 1967–1965 (Vuković, 1970).

### Results

Average *height* of children measured in the period 1981–1982 in all age groups analyzed was significantly greater than in children of the same age measured in 1967–1968. The greatest difference (6 cm) was obtained with the oldest children (Table 1). Boys measured in 1981–1982 reached the same average height a half a year earlier up to the age of 10, than those measured in 1967–1968. In older children however, a greater shift was observed towards younger ones.

**Table 1. Average height (cm) of Novi Sad boys measured in 1967/68 and 1981/82**

Age	Generation 1967/68			Generation 1981/82			Increase $x_2 - x_1$	t-test
	N	$x_1$	SD	N	$x_2$	SD		
6.5	132	121.55	6.50	33	123.85	4.09	2.30	2.53 <sup>xx</sup>
7	400	122.40	6.65	205	124.24	5.52	1.84	3.61 <sup>x</sup>
7.5	426	124.70	6.20	259	128.05	5.61	3.35	7.27 <sup>xx</sup>
8	376	127.45	6.45	225	129.80	5.99	2.35	4.53 <sup>xx</sup>
8.5	441	130.50	6.50	153	132.50	5.83	2.00	3.55 <sup>xx</sup>
9	392	132.20	6.55	215	135.25	6.36	3.05	5.60 <sup>xx</sup>
9.5	410	135.55	8.20	204	138.85	6.47	3.30	5.44 <sup>xx</sup>
10	423	139.00	6.85	239	141.35	6.98	2.35	4.19 <sup>xx</sup>
10.5	410	140.30	6.25	170	143.90	6.69	3.60	6.01 <sup>xx</sup>
11	434	141.55	7.35	206	146.85	7.14	5.30	8.70 <sup>xx</sup>
11.5	439	145.10	7.10	221	148.50	7.00	3.40	5.86 <sup>xx</sup>
12	498	147.35	7.95	239	152.10	8.08	4.75	7.52 <sup>xx</sup>
12.5	497	150.23	9.30	171	154.55	8.25	4.30	5.69 <sup>xx</sup>
13	517	152.90	8.70	201	153.05	8.84	5.15	7.04 <sup>xx</sup>
13.5	559	156.35	9.05	194	161.70	9.51	4.75	6.59 <sup>xx</sup>
14	529	159.65	9.05	219	165.25	8.13	5.60	8.30 <sup>xx</sup>
14.5	467	162.80	9.60	279	167.54	8.56	4.54	5.95 <sup>xx</sup>
15	193	163.00	7.90	230	169.00	8.77	6.00	7.40 <sup>xx</sup>

Significance <sup>x</sup>p < 0.05, <sup>xx</sup>p < 0.01

On the average, the girls measured in 1981–1982 were found to be remarkably taller than those of the same age measured in 1967–1968 (Table 2). An absolute increase in stature during a 14 year interval was found to be smaller than in boys and ranges from 1.39 cm (7-year old) to 4.31 cm (12-year old girls).

**Table 2. Average height (cm) of Novi Sad girls measured in 1967/68 and 1981/82**

Age	Generation 1967/68			Generation 1981/82			Increase $x_2 - x_1$	t-test
	N	$x_1$	SD	N	$x_2$	SD		
6.5	119	120.00	5.95	35	123.29	4.13	3.29	3.71 <sup>xx</sup>
7	371	122.20	6.55	199	123.59	5.31	1.39	2.74 <sup>xx</sup>
7.5	418	123.20	6.00	231	126.58	5.54	3.38	7.22 <sup>xx</sup>
8	344	125.45	5.85	227	127.60	5.64	2.15	4.40 <sup>xx</sup>
8.5	370	128.50	5.60	187	133.07	6.54	4.57	8.16 <sup>xx</sup>
9	428	132.25	5.75	197	135.25	6.58	3.00	5.50 <sup>xx</sup>
9.5	394	134.50	6.66	220	138.20	6.04	3.70	7.01 <sup>xx</sup>
10	367	136.85	7.80	202	140.37	7.61	3.52	5.23 <sup>x</sup>
10.5	394	140.80	7.45	208	142.64	6.83	1.84	3.04 <sup>xx</sup>
11	389	143.15	8.05	181	147.49	8.79	4.35	5.64 <sup>xx</sup>
11.5	464	146.70	8.50	234	149.60	7.08	3.10	5.03 <sup>xx</sup>
12	477	149.05	8.10	209	153.66	7.11	4.61	7.48 <sup>xx</sup>
12.5	441	153.20	7.90	204	155.12	7.58	1.92	2.95 <sup>xx</sup>
13	489	154.57	7.60	206	158.01	7.83	3.44	5.33 <sup>xx</sup>
13.5	526	156.95	7.40	189	158.90	6.10	1.95	3.55 <sup>xx</sup>
14	480	158.80	7.75	202	161.68	6.80	2.88	4.84 <sup>xx</sup>
14.5	419	159.35	6.60	183	161.99	6.07	2.04	4.78 <sup>xx</sup>
15	157	158.15	7.10	218	162.32	6.64	4.17	5.77 <sup>xx</sup>

Significance <sup>x</sup>p < 0.05, <sup>xx</sup>p < 0.01



**Table 3. Average body mass (kg) of Novi Sad boys measured in 1967/68 and 1981/82**

Age	Generation 1967/68			Generation 1981/82			Increase $x_2 - x_1$	t-test
	N	$x_1$	SD	N	$x_2$	SD		
6.5	132	23.30	7.80	33	25.00	3.00	1.70	2.00 <sup>xx</sup>
7	400	23.85	1.80	205	25.05	4.03	1.20	4.14 <sup>xx</sup>
7.5	426	24.90	4.05	259	27.15	4.85	2.25	6.08 <sup>xx</sup>
8	376	26.35	6.00	225	28.70	5.36	2.35	5.00 <sup>xx</sup>
8.5	441	27.30	5.40	153	29.54	5.70	2.24	4.23 <sup>xx</sup>
9	392	28.35	4.50	215	30.60	5.89	2.25	4.89 <sup>xx</sup>
9.5	410	30.05	6.90	204	33.24	6.36	3.19	5.60 <sup>xx</sup>
10	423	31.40	6.55	239	35.42	7.04	4.02	7.18 <sup>x</sup>
10.5	410	33.65	8.30	170	36.32	7.45	2.67	4.24 <sup>xx</sup>
11	434	34.35	8.55	206	39.08	7.65	4.73	7.06 <sup>xx</sup>
11.5	439	36.60	7.55	221	39.55	7.73	2.95	5.46 <sup>xx</sup>
12	498	39.55	7.30	239	42.72	9.70	3.17	4.46 <sup>xx</sup>
12.5	497	40.36	8.65	171	44.30	8.67	3.95	5.13 <sup>xx</sup>
13	517	41.50	11.45	201	46.67	8.94	5.17	6.38 <sup>xx</sup>
13.5	559	45.60	9.55	194	50.75	8.75	5.15	6.96 <sup>xx</sup>
14	529	46.35	10.25	219	52.74	9.81	4.39	5.49 <sup>xx</sup>
14.5	467	51.45	10.15	179	56.03	9.76	4.58	5.26 <sup>xx</sup>
15	193	52.25	9.25	230	57.61	10.45	5.36	5.64 <sup>xx</sup>

Significance <sup>x</sup>p < 0.05, <sup>xx</sup>p < 0.01

**Table 4. Average body mass (kg) of Novi Sad girls measured in 1967/68 and 1981/82**

Age	Generation 1967/68			Generation 1981/82			Increase $x_2 - x_1$	t-test
	N	$x_1$	SD	N	$x_2$	SD		
6.5	119	23.05	1.35	35	23.55	4.89	2.50	2.98 <sup>xx</sup>
7	371	23.20	1.35	199	24.62	3.75	1.42	5.26 <sup>xx</sup>
7.5	418	24.40	7.15	231	26.26	4.91	1.86	3.96 <sup>xx</sup>
8	344	24.85	4.50	227	28.15	6.85	3.30	6.35 <sup>xx</sup>
8.5	370	26.35	5.95	187	29.97	6.67	3.62	6.35 <sup>xx</sup>
9	428	28.95	8.30	197	30.36	5.69	1.41	2.43 <sup>xx</sup>
9.5	394	30.00	5.60	220	32.07	6.48	2.07	3.91 <sup>xx</sup>
10	367	31.15	7.40	202	34.48	7.30	3.33	5.20 <sup>x</sup>
10.5	394	34.25	8.95	208	36.56	7.31	2.31	3.40 <sup>xx</sup>
11	389	35.50	8.50	181	39.14	8.00	3.54	4.85 <sup>xx</sup>
11.5	464	38.36	8.15	234	42.18	7.63	3.93	6.34 <sup>xx</sup>
12	477	40.55	8.50	209	43.90	8.73	3.35	4.72 <sup>xx</sup>
12.5	441	48.40	8.40	204	45.96	8.89	2.56	3.46 <sup>xx</sup>
13	489	45.40	9.85	206	48.03	9.43	2.63	3.33 <sup>xx</sup>
13.5	526	47.80	8.35	189	49.71	8.91	1.91	4.06 <sup>xx</sup>
14	480	50.20	8.25	202	51.86	8.12	1.66	2.41 <sup>xx</sup>
14.5	419	50.95	7.20	183	53.39	7.63	2.44	3.70 <sup>xx</sup>
15	157	51.10	7.65	218	54.33	8.64	3.23	3.85 <sup>xx</sup>

Significance <sup>x</sup>p < 0.05, <sup>xx</sup>p < 0.01

By comparing average height of boys to that of girls of the same generations it seems likely that the period in which girls overtook boys was shorter in younger age group.

In the generation analyzed in 1967–1968, average height of both boys and girls was equalized at age 10.5, between age 11 and 13 girls were significantly than boys, at age 13.5 they were equalized again, and after age 14.5, significant sex differences were exhibited.

In children measured in 1981–1982, the growth curves of average height of boys and girls intersected at the age between 10.5 and 11, from 11 to 12.5 years girls were taller, and then crossing of the curves was obtained again at the age between 12.5 and 13, whereas at the age of 13.5 boys were significantly taller than girls. The finding suggests an earlier onset of adolescent growth spurt in younger generation of school children (boys).

Average *body weight*, as dependent upon age, increase remarkably in both sexes in a 14 ear period (Table 3, Table 4). Curves indicating average body weight of boys of both generations were almost parallel, where only an average increase of 2–3 kg in younger generation was obtained. In girls average weight was 3–3.5 kg greater than in those measured in 1967–1968.

### Discussion

On the average, a remarkable growth of body height and weight of primary school children in Novi Sad measured in 1981–1982 when compared with children of the same age measured in 1967–1968 was found. In a 14-year interval, average height of boys aged between 6.5 and 9.5 years increased by 2–3 cm while average weight by 1–3 kg. In boys beyond the age of 10, greater differences amounting 4–6 cm and 3–5 kg, respectively, were recorded. In girls, at the age between 6.5 and 15, average height was greater by 1–5 cm while weight by 1–4 kg. Average growth of body height and weight, per decade, was 2.7 cm and 2.43 kg in boys, and 2.21 cm and 1.86 kg in girls, respectively.

Growth of stature and weight in the children groups analyzed was found to be greater than in analogous groups in Western Europe (Ljung et al. 1974, Chinn and Rona 1984). With regard to the secular trend, however, similar results were obtained in the Yugoslavian populations of the same age (Prebeg 1978, Ivanović 1985, Tomazo-Ravnik 1986).

The growth acceleration in the Novi Sad school children is possibly conditioned by changes in the way of life and living standard since growth acceleration during body development is highly affected by the environmental factors (Tanner 1988). In Vojvodina Province, per capita income in the period of investigations increased app. two times according to 1972 prices (from app. 18227 in 1967 to app 37298 Millions Dinars in 1981). By comparing per capita income at birth in the oldest children investigated of both groups, it was found that per capita income increased app. four times (from app. 4705 in 1952 to app. 18382 Millions Dinars in 1966) (Savezni zavod za statistiku, 1980). A greater acceleration of body height in boys than in girls in the period considered was possibly due to a greater sensivity of males of the influence of the environmental factors during body growth and development.



## Conclusion

On the basis of the results on body height and weight of primary school children in Novi Sad ranging in age from 6.5 to 15 years which were measured in 1981–1982 and compared with the analogous groups of children measured in 1967–1968 one may conclude that a progressive growth of stature and body weight was established.

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*Mailing address:* Dr. Verica Božić-Krstić  
Institute of Biology, University of Novi Sad  
Ilije Djurcica 6  
21000 Novi Sad, Yugoslavia

