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***The growth phase in the light of the analysis of somatometric features***

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**Faza dorastania w świetle analizy cech somatometrycznych**

In the available literature we have not come across an attempt to determine the length of growth phase in the development of a human. It is well known that it starts after reaching sexual maturity that is after finishing "pubertal spurt", so generally with girls being from 13 to 17 years old. It finishes, however, from the age of 20 to 25. With boys the examined phase starts about two years later [1-4] and lasts from the age of 20 to 29.

The aim of the study is an attempt to determine the age at which there is a transition from pubertal spurt phase to growth phase as well as to determine the age at which the growing processes end.

**MATERIAL AND METHODS**

The material for the research makes up children from secondary schools in Wrocław and students of Wrocław Medical University. The research was conducted in semi longitudinal way. The number of the material is presented in table 1.

The following somatometric traits were analyzed: body height, trunk length, lower limb length, shoulder width, pelvis width, thorax width and body mass.

The length of growth phase was analyzed on the basis of growth rate of the analyzed traits. There was estimated the significance of differences between the growth during the following years of studies by means of t-Student test. The age at which statistically insignificant differences between the following stages of growth took place was adopted as the beginning of the phase. The lack of progress in the growing process determined the end of the phase.

**Table 1. The number of studied material**

age	♂	♀	age	♂	♀	age	♂	♀
13	132	127	17	102	87	21	142	141
14	126	123	18	94	85	22	131	127
15	119	116	19	158	162	23	101	114
16	113	101	20	152	150	24	87	111

**RESULTS**

1. Body height (B-v) - fig. 1. Statistically insignificant growth was stated with men at the age of 16, which according to the adopted assumption in this study, is the beginning of growth phase for the feature. The end of growing process was observed at the age of 23. In the group of examined women puberty ended with 15-year-old girls, and the end of growth processes was observed at the age of 20.

Fig. 1 The variability of increase values of body height with both sexes

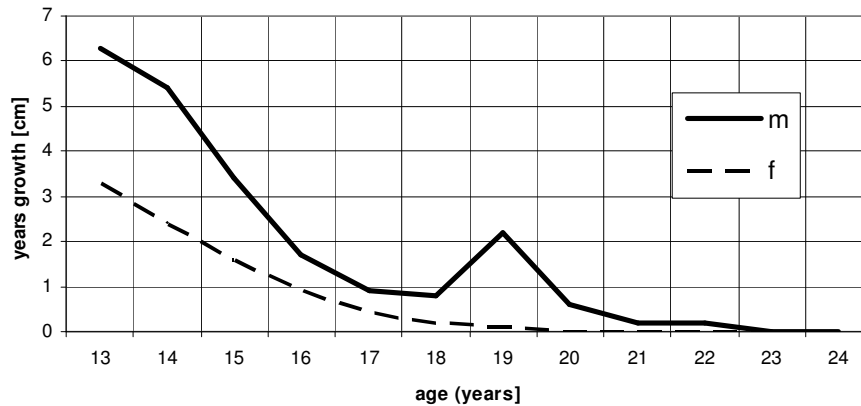
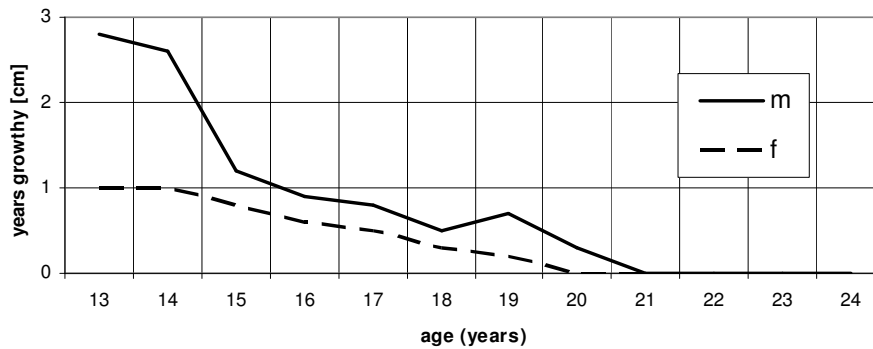
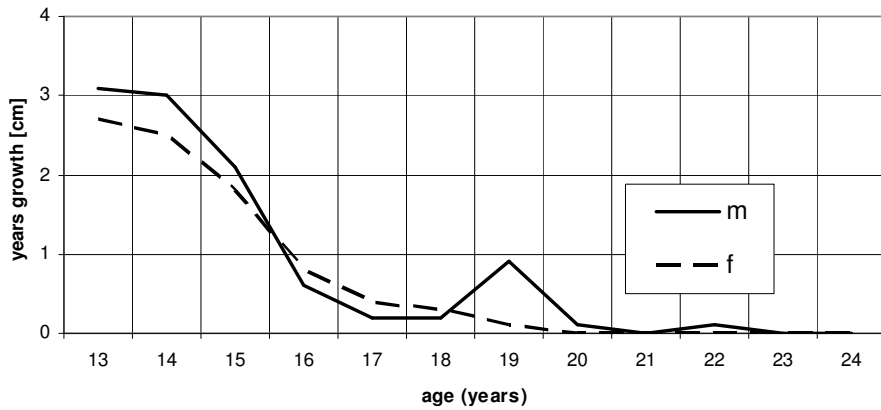


Fig. 2 The variability of increase values of thorax length with both sexes



2. Thorax length (sst-sy) - fig. 2. The beginning of growth with men was stated with 16-year-olds, and with women with 14-year-olds. The end of thorax growth with men took place at the age of 21, and with women at the age of 20.
3. The length of lower limbs (B-sy) - fig. 3. Lower limbs show similar developmental regularity for both sexes. The growing process started at the age of 16 and finished at the age of 20 with women and at the age of 22 with men.
4. Shoulder width (a-a) - fig. 4. This trait shows clear developmental dimorphism. With men under 16, intensive growth of this feature connected to "pubertal spurt" can be observed. Only with 17-year-olds annual growth is not statistically significant and it lasts until the end of studied period of ontogenesis, that is until the age of 24. With women growing process starts already at the age of 14, finally the growth ends with females at the age of 20.
5. Pelvis width (ic-ic) - fig. 5. The trait is characterized by smaller value of annual growth with men than with women. The beginning of the growth phase with both sexes is determined at the age of 16. With men the phase lasts until the age of 20, whereas with women statistically insignificant growth was still stated with 22-year-olds.

**Fig. 3 The variability of increase values of the length of lower limbs with both sexes**

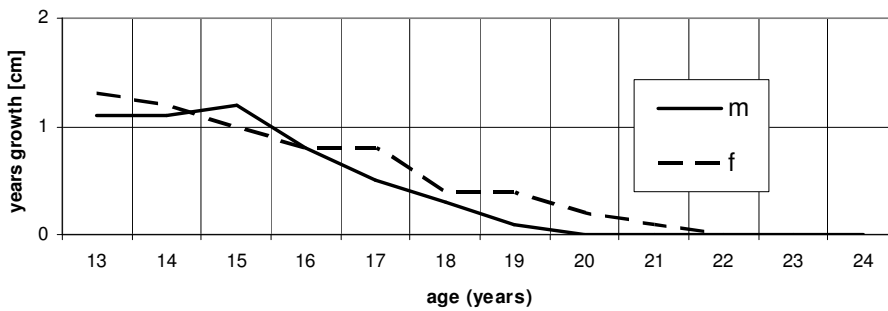


**Fig. 4. The variability of increase values of shoulder width with both sexes**



6. Thorax width (tl-tl) - fig. 6. The described trait changes in a similar way to strongly correlated shoulder width. For men the growing process starts at the age of 17 years old and ends at the age of 23. For women statistically insignificant annual growth was stated already at the age of 13, and at the age of 16 the growing process of this trait ends for females.
7. Body mass - fig. 7. Body mass is a trait which is strongly dependent on the factors of widely understood environment. It can be approximately assumed that the phase lasts from the age of 16 to 22 with men and from the age of 14 to 22 with women.

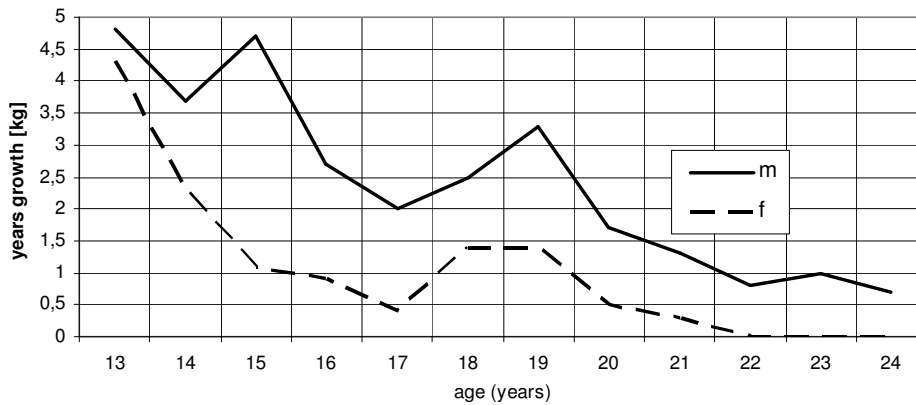
**Fig. 5. The variability of increase values of pelvis width with both sexes**



**Fig. 6. The variability of increase values of thorax width with both sexes**



**Fig. 7. The variability of increase values of body mass with both sexes**



## DISCUSSION

The analysis conducted in this study confirmed the conclusions reached from the earlier publications on diverse growth rate of particular somatic features [1, 2]. The diversity results in certain sequence of features of the growth phase.

With men the sequence of the traits of growth phase are as follows: for 16-year-olds the phase starts with body height, thorax length and length of lower limbs. Shoulder and pelvis width enters the phase a year later. The end of the adolescence phase with this sex varies a lot. Trunk length follows (a year later), and next (with 22-year-olds) - the length of lower limbs and body mass. At the age of 23 body height and thorax width finish the growing process. Shoulder width finishes the growing process last (with 24-year-olds). With males the growth phase for pelvis width lasts the shortest (4 years), and the longest (7 years) for body height.

With women the growth phase starts on the average about 2 years earlier than with men. The phase starts for thorax width already at the age of 13. At the age of 14 - for trunk length, shoulder length and body mass (the other start at the age of 16). The end of the growing process generally takes place at the age of 20; only the pelvis width and body mass still grow with 22-year-old women. With females thorax width is characterized by the shortest and the earliest growing period (about 3 years). It is a year longer for the length of limbs. For the other features it varies from 5 to 6 years (only body mass is characterized by 7-year growing period).

## CONCLUSIONS

1. Varied sequence of entering the traits into the growth phase is observed with both sexes. With men longitudinal traits enter the phase about a year earlier compared with the diameters. With men the sequence is reverse.
2. Dimorphic variety in the length of growth phase is revealed by the fact that the phase lasts longer with men in cases of the majority of examined traits, and different sequence of traits that enter the growing process. Only the pelvis width and body mass grow longer with females.

## REFERENCES

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## SUMMARY

The aim of the study is an attempt to determine the age at which there is a transition from pubertal spurt phase to growth phase as well as to determine the age at which the growing processes end. The material for the research makes up children and students from Wrocław (1457 male and 1344 female) from 13 to 24 years live. The research was conducted in semi longitudinal way. The following somatometric traits were analyzed: body height, trunk length, lower limb length, shoulder width, pelvis width, thorax width and body mass. The length of growth phase was analyzed on the basis of growth rate of the analyzed traits. There was estimated the significance of differences between the growth during the following years of studies by means of t-Student test. The age at which statistically insignificant differences between the following stages of growth took place was adopted as the beginning of the phase. The lack of progress in the growing process determined the end of the phase. With men longitudinal traits enter the phase about a year earlier compared with the diameters. With men the sequence is reverse. Dimorphic variety in the length of growth phase is revealed by the fact that the phase lasts longer with men in cases of the majority of examined traits, and different sequence of traits that enter the growing process.

## STRESZCZENIE

Celem pracy jest próba określenia wieku, w którym następuje przejście z fazy skoku pokwitaniowego do fazy dorastania oraz wieku zakończenia fazy dorastania. Materiał do badań stanowiły dzieci i studenci z Wrocławiu (1457 płci męskiej i 1344 płci żeńskiej) w wieku od 13 do 24 roku życia. Badania przeprowadzone zostały w sposób semilongitudinalny. Analizowano następujące cechy somatometryczne: wysokość ciała, długość tułowia, długość kończyn dolnych, szerokość barkowa, szerokość miednicy, szerokość klatki piersiowej i masę ciała. Długość fazy dorastania analizowano na podstawie tempa wzrastania analizowanych cech. Ocenione zostały istotności różnic między przyrostami w kolejnych latach badań za pomocą testu t-Studenta. Za początek fazy przyjęto wiek, w którym wystąpiły nieistotne statystycznie różnice pomiędzy kolejnymi przyrostami. Zakończenie fazy dorastania określał brak przyrostów. U mężczyzn o około 1 rok wcześniej wchodziły w tę fazę cechy longitudinalne. Zróżnicowanie dymorficzne w długości fazy dorastania ujawnia się dłuższym czasem trwania tej fazy u płci męskiej w większości badanych cech, a także inną kolejnością cech wstępujących w dorastanie.