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CHANGES OF BODY COMPOSITION AS A FUNCTION OF AGE ANALYZED BY NON-PARAMETRIC STATISTICAL METHODS

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Abstract: *With usual methods of anthropology 3529 school aged children (6–18 years) were investigated in town Pécs. The data obtained were analyzed sorting them into separate age groups. The growth curves were created by the traditional statistical methods with help of different smoothing techniques (polynomial smoothing) determining their goodness of fit and statistical significance. By development of statistical methods it became possible to eliminate the errors originated from the computation of averages and from the applied statistical corrections. The authors present growth curves obtained by the non-parametric regression analysis in which each points represents the real, uncorrected value for each persons examined, like body weight, lean body mass, and weight of body fat. The regression curves of each registered parameters of body composition represent the exact value of these parameters as the function of age treated as a continuous variable. The clinical importance of this method is that it provides more precise judgement concerning the measured data of a given person.*

Key words: *Growth study; Percentile curves; "Non-parametric regression".*

Introduction

More than one quarter of life time of human being is used for growth and development. The biological changes during this period of life increase in the number of cells, increased size of the cells and function differentiation, lead to the attainment of the adult status. This process is often called maturation. However, even during adult status there are similar biological transformations. Such age related changes may be regarded as a "continuing maturation" representing the descending part of the life cycle. The period of the growth and development which goes from conception to adulthood, represents the ascending part of the life cycle.

Growth refers to change in the physical dimension of the body or parts of it, as a function of time. Such changes are measurable in quantitative terms and can be evaluated by the statistical analysis appropriate to variables.

The aim of the present study is to demonstrate the use of "non-parametric regression" in growth studies, demonstrated in boys' data.

Sample and Methods

To demonstrate to usefulness of the "non-parametric regression" it was used during evaluation on the results of the "Pécs Growth Study" (Dóber 1991). Within this study 3529 school-aged children (from 6 to 18 years) were investigated in the 1983–84 school-year. Nineteen different body measurements were determined according to Martin – Saller (1957) and the International Biological Program (Tanner et al. 1969) like body weight, height, sitting height, bi-acromial width, bi-iliac width, humerus- and femur bi-epicondylus, head,- chest,- and arm-circumference was measured both in relaxed and in flexed position of the knee and calf circumference, skinfolds above biceps-, triceps – buscle and in the subscapular and supra-iliacal regions, etc. On the basis of these measurements indexes for body-shape, obesity were calculated. Few parameters of body composition were computed as well, like lean body mass, fat body mass, and body fat

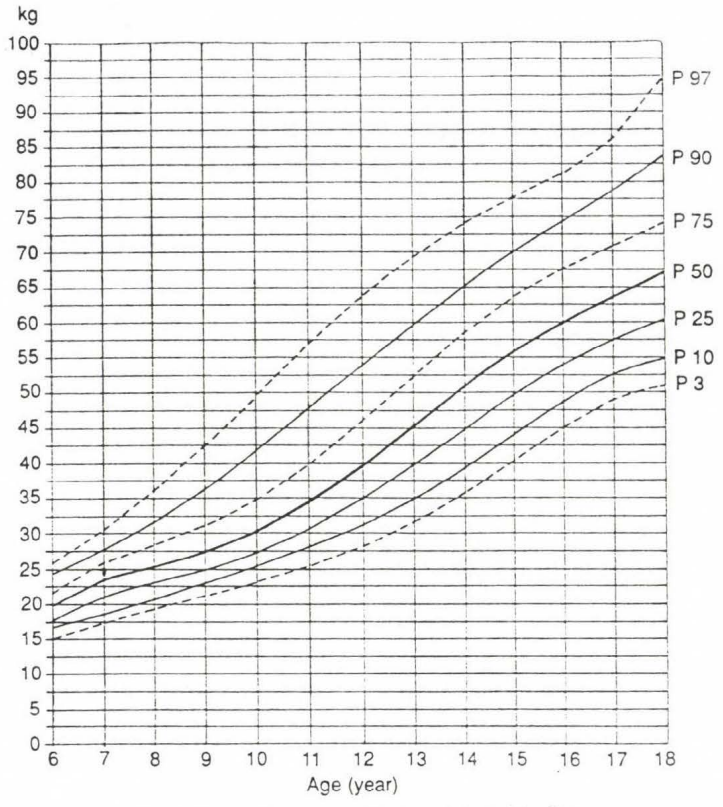

Fig. 1: Percentile curves of body weight in Pécs Boys

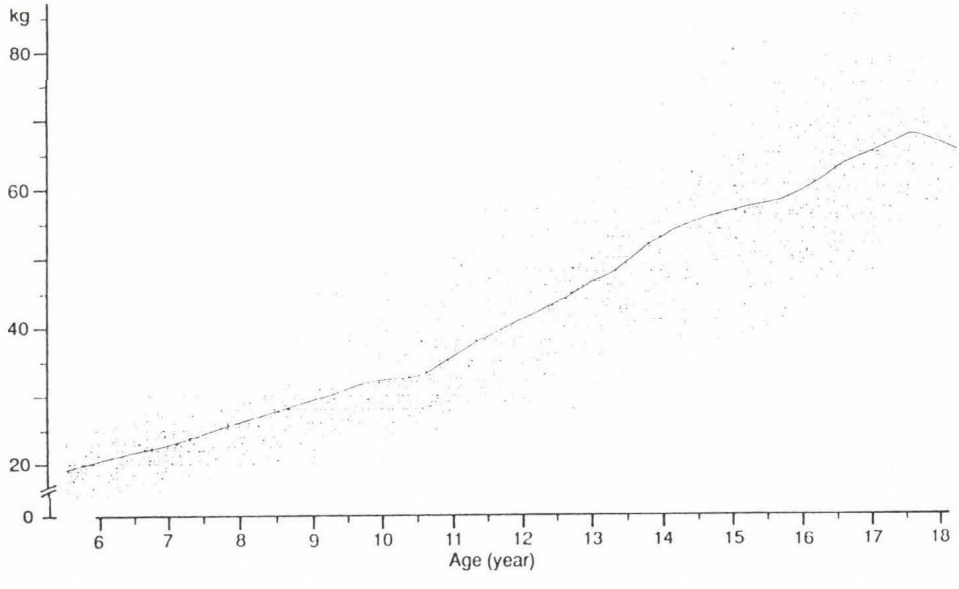

Fig. 2: Body weight growth curces in Pécs boys (N=1732) made by non-parametric regression method

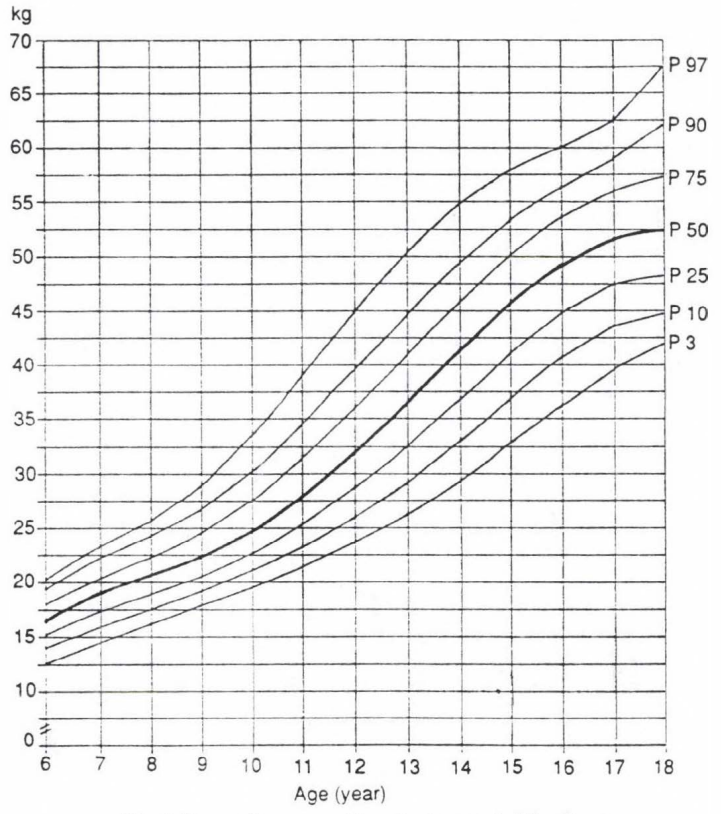

Fig. 3: Percentile curves of lean body mass in Pécs Boys

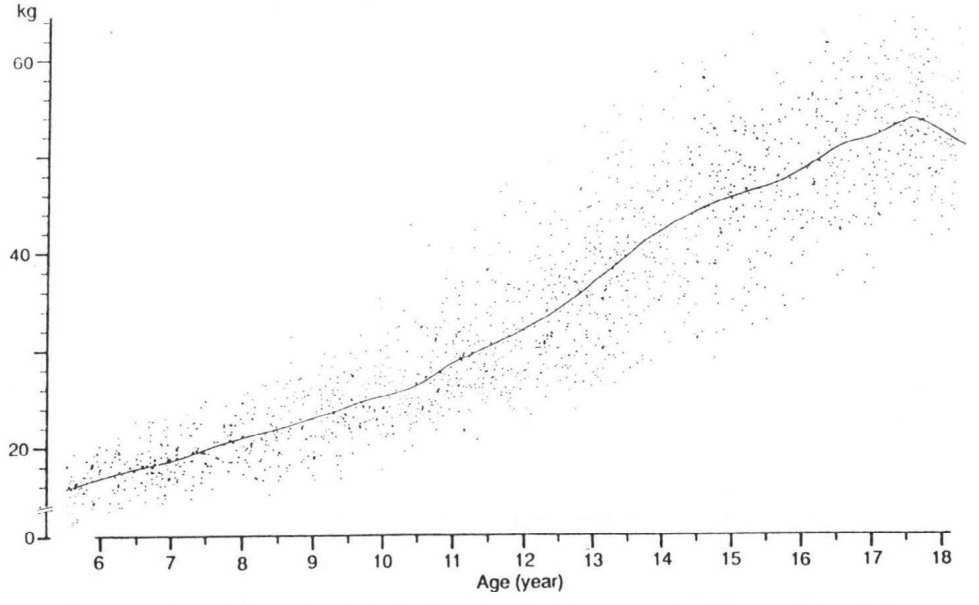

Fig. 4: Lean body mass growth curces in Pécs boys made by non-parametric regression method

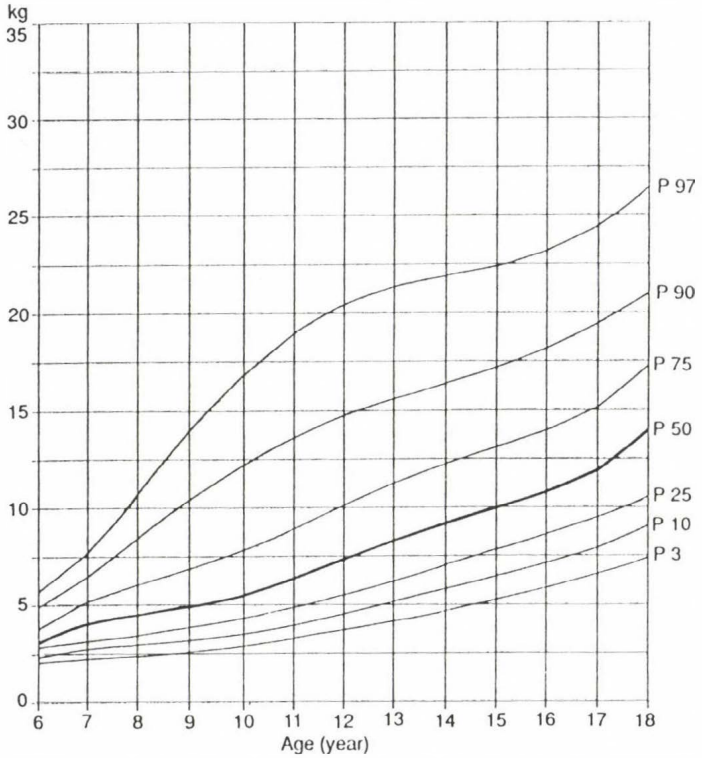

Fig. 5: Percentile curves of body fat in Pécs Boys (kg)

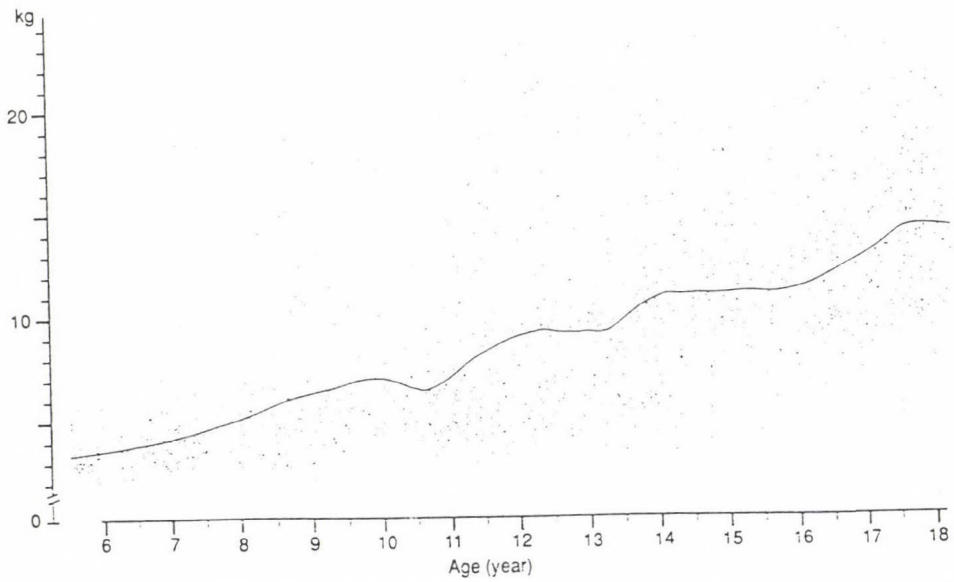

Fig. 6: Body fat of Pécs boys made by non-parametric regression method

content (Dóber 1991). Analyzing the data measured standard deviations and percentile values were determined creating age groups as described by Martin – Saller 1957, separately for boys and girls with the help of the BMDP statistical program (Dixon et al. 1983). For the clinical use growth curves were constructed, made by polynomial smoothing technique (Chambers et al. 1983). To demonstrate the usefulness of "non-parametric regression" in growth studies growth-curves were made by "non-parametric regression" method as well.

Results and Discussion

On the first figure (*Fig. 1*) the percentile curves of body weight for boys is demonstrated. The different lines represent the percentile values, like 3, 10, 25, 50, 75, 90, 97 percentiles. By increasing the age, the values of standard deviations were found increased, as well. The curves, representing the different percentile values tend to expand by the age from the puberty. Demonstrating the percentile values as curves, using smoothing technique is a classical method in growth studies. By the evolution of new computer programs available using "non-parametric regression" made it possible to reduce the errors deriving from the estimations of mean value, smoothing technic etc.

In the *Fig. 2* the body weight curve of boys made by "non-parametric regression" is shown. In this figure each points represent the measured value of boys. The regression curve demonstrates graphicall the measured parameters as function of age. The originally measured points and the "non-parametric regression" curves are displayed together. (Our growth study data set contains the ages with accuracy of five decimal digits.) Therefore the "non-parametric regression" supplies growth curves free from errors of percentile methods.

The *Fig. 3* demonstrates the lean' body mass of boys, and the *Fig. 4* shows the lean body mass curves made by "non-parametric regression".

The *Fig. 5* and *6* represents weight of the body fat. The Fig. 5 shows the percentile curves, and the Fig. 6 demonstrates the "non-parametric regression" curves.

The clinical importance of "non-parametric regression" in growth studies is that this method can provide local standards for different parameters of physical development. With help of this method it is possible to have more exact growth curves than with the traditional percentile technique.

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