

## RELATIONSHIP BETWEEN BODY FATCONTENT AND SEXUAL MATURATION STATUS

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**Abstract:** *Purpose was to analyze body fat content in children belonging to the same age group, but different maturation stages and to the various of maturation indicators, but differing in age. Subjects: The subjects of the present subsample of a cross-sectional examination of urban children were such children that had already begun pubertal development. The chronological age of the girls (n = 2769) and boys (n = 2873) ranged between 10.0 and 16.0 years. The girls were subdivided by the maturation stages of the breast and pubic hair, while the boys by those of the genitals and pubic hair. Sexual maturation was assessed visually and rated by Tanner's suggestions (1962). Body composition was estimated by model of two components: percentage of body fat (Durnin-Rahaman 1967, Siri 1956) and model of four components: fat, bone, muscle and residual mass (Drinkwater and Ross 1991). The subgroups were compared by one-way ANOVA, between-group differences were tested by F-test at the 5% level of random error. Multiple comparisons of the means were tested by Scheffé's formula at the 5% level. In the girls early maturers were heavier and contained more fat than less matured girls. This increase relative and absolute fat mass was proportionate to weight gain. In the males increasing fat mass lagged behind the gain in lean body mass both with advancing age and maturity status. Body fatness and maturity status are closely interrelated in both genders while gender-specific tendencies increase dimorphism and the several factors making up the differences between maturation types. Fat content was greater in both sexes in the early maturers. Also the developmental rate of prepubertal fat accumulation was faster in the early maturers when compared to those maturing later.*

**Keywords:** *Body fatness; Skinfolds; BMI; Body components; Secondary sex characteristics; Menarche; Spermarche.*

### Introduction

Puberty embraces all the processes leading to sexual and physical maturation that involve not only the development of sex organs and secondary sexual characteristics, but the modification of body composition and body shape too. These processes have a relatively independent trend line each but they are simultaneously mutually interrelated. The endocrine changes in puberty have a strong impact on both the direction and rate of metabolism and on the proliferation of bone, muscle and fat. Because of the accelerated rate of growth more nutrients are needed. The specific requirements in nutrients are almost twice greater than in childhood. So the timing, rate and duration of the pubertal changes in the measurements and the sexual maturation depend on the nutrition status.

Our study dealt with the interrelations of sexual maturation and nutritional status. The goals of this study were to analyze body composition in children belonging to the same age group, but to different stages of maturation as well as displaying the same level of maturation characteristics, but varying in age.

## Subjects and Methods

Cross-sectional data were collected in Middle-Hungary in 2003. The subjects of the present subsample of the main study were such children that had already begun pubertal development (Table 1).

Table 1. Cross-sectional data were collected in Middle-Hungary in 2003.

Age (yrs)	Girls n	Boys n
10.0	188	171
10.5	147	162
11.0	231	224
11.5	255	264
12.0	215	276
12.5	205	241
13.0	237	239
13.5	251	228
14.0	287	309
14.5	269	226
15.0	191	193
15.5	109	172
16.0	184	168
Together	2673	2869

Nutritional status was estimated by different way: trunk skinfolds (sum of pectoral, subscapular, midaxillary, abdominal, suprailiac skinfolds), extremity skinfolds (sum of triceps, biceps, forearm, medial thigh, medial calf skinfolds), BMI, model of two components: percentage of body fat (Durnin-Rahaman 1967, Siri 1956), model of four components: fat, bone, muscle and residual mass (Drinkwater and Ross 1991).

The sexual characteristics (girls: breast developmental stages,; boys: genitals developmental stages) were rated according to Tanner's suggestions (1962). Data for determining menarche and spermarche were collected by the "status-quo" method.

The girls were subdivided by using menarcheal status and stages of breast development, while the factors for grouping the boys were spermarche, and stages of genital development.

After computing descriptive statistics the subgroups were compared by one-way ANOVA following which between-group differences were tested by F-tests at the 5% level of random error. Multiple comparisons of the means were tested for significance by Scheffé's formula used at the 10% level of F. Statistical evaluation was made by using the SPSS for Windows software (v. 120, 2004).

## Results and Discussion

When we contrasted pre- and post-menarcheal girls of the same age, significant differences in body composition emerged:

Post-menarcheal girls had significantly greater trunk and extremity skinfolds (Figures 1–2) as well as greater value of BMI than pre-menarcheal age-peers (Figure 3).

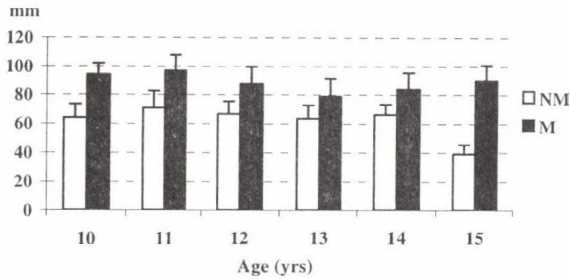


Figure 1: Sum of trunk skinfolds of pre- (NM) and post-menarcheal (M) girls.

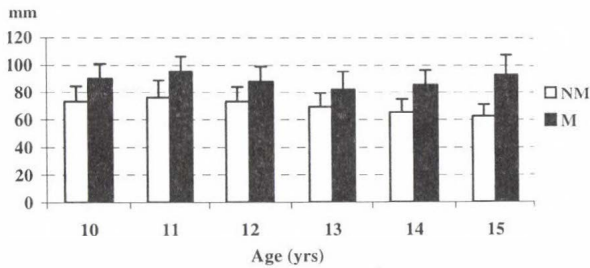


Figure 2: Sum of extremity skinfolds of pre- (NM) and post-menarcheal (M) girls.

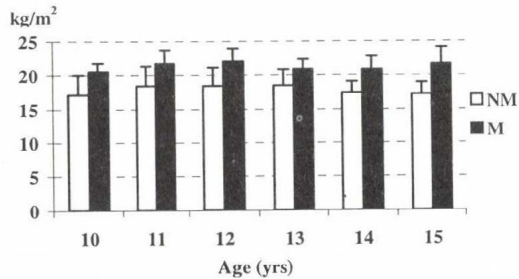


Figure 3: BMI-values of pre- (NM) and post-menarcheal (M) girls.

The pattern of differences in percentage of body fat shows the same (Figure 4). The percentage of body fat was practically the same in all post-menarcheal girls while the girls maturing late for their age displayed a decreasing series of relative fat content as their belatedness grew. All these observations prepare the way for the inference that the smaller the extent of fat accumulation, the later menarche would occur.

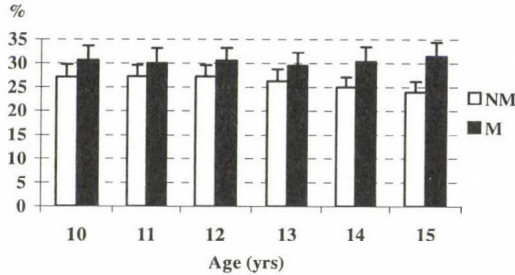


Figure 4: Body fat percentage of pre- (NM) and post-menarcheal (M) girls (Siri-method).

Post-menarcheal girls had not only a significantly greater amount of body fat than pre-menarcheal ones, but greater bone and muscle fractions of body mass too (Figure 5). It means that the smaller fat content the lower growth-rate of bone and muscle.

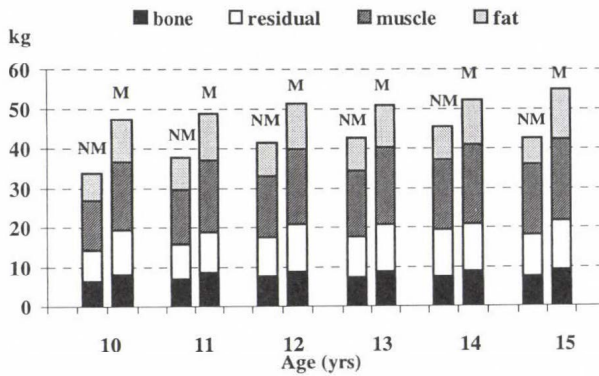


Figure 5: Body components of pre- (NM) and post-menarcheal (M) girls (Drinkwater and Ross-method).

When pre- and post-spermarcheal boys were compared, the latter were found to have significantly greater BMI, but their trunk and extremity skinfolds (except in age-group of 11 years) were smaller (Figures 6–8).

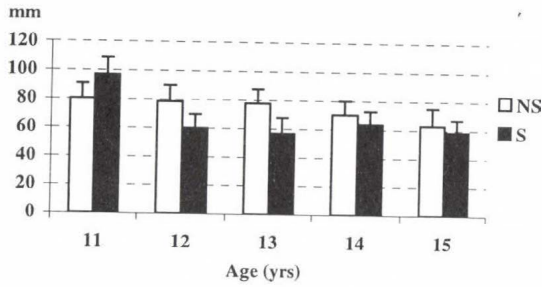


Figure 6: Sum of trunk skinfolds of pre- (NS) and post-spermarcheal (S) boys.

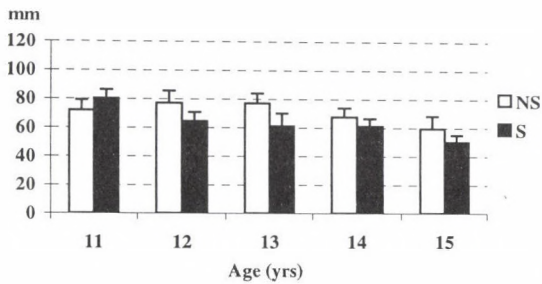


Figure 7: Sum of extremity skinfolds of pre- (NS) and post-spermarcheal (S) boys.

The relative body fat content of the early maturing boys was also smaller than the later maturing age-peers, only boys maturing very early (e.g. at age 11) had a significantly larger amount of relative fat.

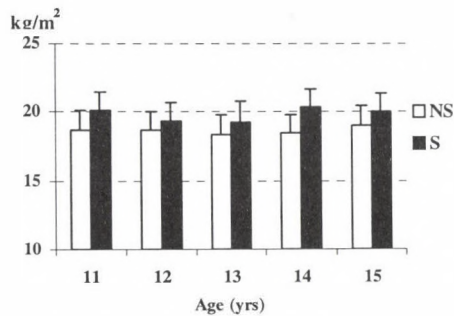


Figure 8: Body fat percentage of pre- (NS) and post-spermarcheal (S) boys (Siri-method).

It could be stated that pre- and post-spermarcheal boys differed in all body components Figure 9. The post-spermarcheal boys had greater bone and muscle mass than the pre-spermarcheal boys of the same chronological age.



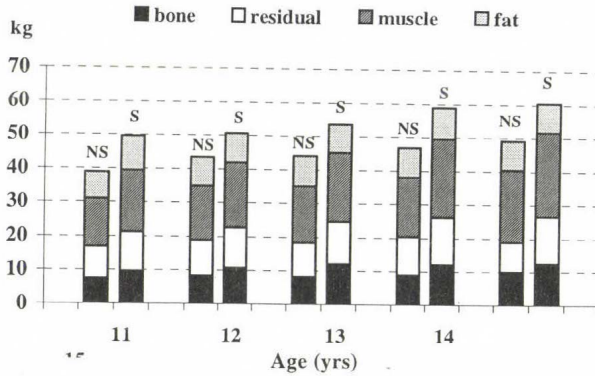


Figure 9: Body components of pre- (NS) and post-spermarcheal(S) girls (Drinkwater and Ross-method).

In comparing the corresponding groups of sexual maturity in the two genders one obviously should be aware of the time difference when menarche, respectively spermarche occur, namely, that they take place in a different phase of adolescent growth.

Menarche occurs when pubertal growth-rate decreases, while boys' growth-rate increases after occurrence of spermarche. The relative fat content of the body is smaller around the age of peak height velocity because of the fat loss. Pre-spermarcheal boys that have not yet entered the phase of peak height velocity tend to accumulate fat and very lean ones usually mature later.

Successive stages of female breast development displayed significant differences in bone and muscle mass while there was no marked difference of relative body fat content (Figures 10–11). The only exception was between breast stage 4 and 5.

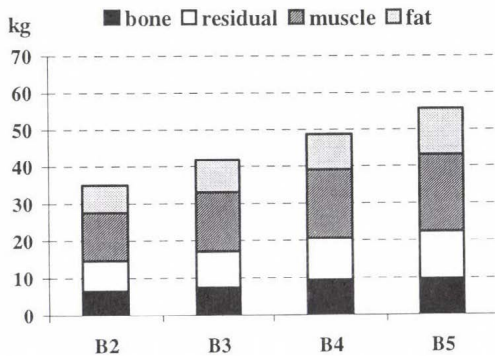


Figure 10: Body components in girls of different maturation status (Drinkwater and Ross-method).

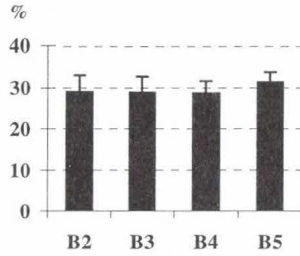


Figure 11: Body fat percentage in girls of different maturation status (Siri-method).

The pattern of changes in body component shows the similar tendency during successive stages of genitals (12–13). The development of genitals is associated with relative fat lots.

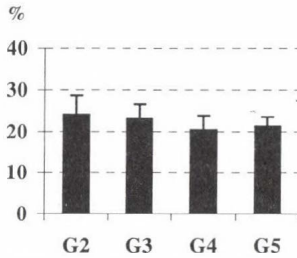


Figure 12: Body fat percentage in boys of different maturation status (Siri-method).

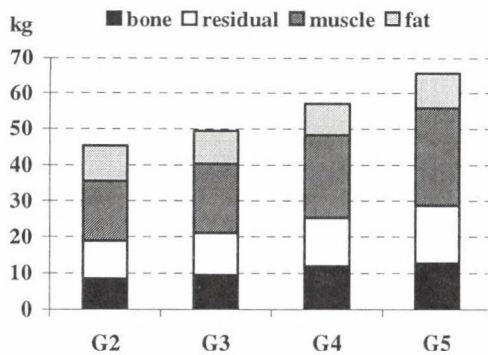


Figure 13: Body components in boys of different maturation status (Drinkwater and Ross-method).

In summary, these observations strongly confirm the inference that maturation status is reflected by body composition and also the age change of body fat depends on it. Fat content was greater in both sexes in the early maturers. Also prepubertal fat accumulation increases its developmental rate in the early maturers when compared to those maturing later.

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