

## COMPARISON OF SOME ANTHROPOMETRIC AND NUTRITIONAL CHARACTERISTICS IN TWO GROUPS OF SARDINIAN BOYS

<sup>1</sup>Carbini, L., <sup>2</sup>Cosseddu, G.G., <sup>2</sup>Floris, G. and <sup>2</sup>Sanna, E.

<sup>1</sup>Istituto di Fisiologia Umana, Università degli Studi di Cagliari, Cagliari, Italy

<sup>2</sup>Dipartimento di Biologia Sperimentale, Sez. Scienze Antropologiche, Università degli Studi di Cagliari, Cagliari, Italy

**Abstract:** *The present cross-sectional study was conducted on 74 Sardinian schoolboys, aged 11-13 years, 48 from the urban municipality of Portoscuso and 26 from the semi-urban municipality of Sestu. In this work the following anthropometric measurements were analyzed: weight, stature, upper arm circumference, biepicondylar breadth of humerus. The following derived anthropometric variables were also calculated: relative sitting height, waist/hip circumference ratio, sum of biceps, triceps and medial calf skinfolds, estimated upper arm muscle plus bone area.*

*Food intake data were gathered during the period of anthropometric surveying. To standardize energy intakes (kcal/die) for age, these were expressed as a percentage difference of that recommended for Italian male children of the ages considered. By univariate analysis of variance a statistically significant difference in energy intake percentages was noted. The boys of Portoscuso showed a higher average of estimated energy intake than those of Sestu. Diets were grouped in three categories: hypercaloric, normocaloric, hypocaloric. G-test demonstrates a statistical significant intergroup variation. The boys of Portoscuso with respect to those of Sestu have lower percentages of normo- and hypocaloric diets. Standardized values of the anthropometric variables were compared between the two groups, by one-way analysis of variance. Comparison of the biometric variables revealed a statistically significant difference for estimated upper arm muscle area; the urban boys of Portoscuso were on the average higher than the semi-urban boys of Sestu. On the basis of the significant difference in dietary status, in estimated energy intake between the two groups compared, and the heteroscedasticity noted for the estimated upper arm muscle area, a substantial difference in nutritional habits between the two groups of Sardinian boys is hypothesized.*

**Keywords:** *Anthropometry; Nutrition; Sardinian boys.*

### Introduction

Studies in different part of the world indicate that children born and raised in better environmental circumstances have shown a better growth than coevals in disadvantaged conditions (Tanner 1962, Goldstein 1971, Meredith 1979, Greco et al. 1982, Singh et al. 1987, Eveleth and Tanner 1990, Johnston 1994).

Differences in growth are ascribed to the continuous action of direct (e.g. nutritional habits and health conditions) or indirect factors (e.g. social, economic, and demographic conditions) on human genetic potential for growth.

The aim of this work is to verify whether or not statistical significant differences between two groups of Sardinian boys (aged 11-13 years), from two municipalities of

southern Sardinia, exist for some anthropometric characteristics, energy intake, and dietary status.

One of these municipalities is classified from the Italian National Statistics Bureau (ISTAT 1986) as urban (Portoscuso) and the other one as semi-urban (Sestu).

### Subjects and Methods

The present cross-sectional study was conducted during March and April of 1993. The sample considered for this work was composed of 74 male Sardinian schoolboys, aged 11-13 years, 48 from the urban centre of Portoscuso and 26 from the semi-urban centre of Sestu.

All children measured were unrelated, apparently healthy, and presented no apparent physical defects or malformations. In this work the following anthropometric measurements were analyzed: weight (WG) and stature (ST) for body size, upper arm circumference (UA) - right side - and biepicondylar breadth of humerus (BH) - right side - for robustness. The following derived anthropometric variables were also calculated: relative sitting height (RSH) - sitting height/stature - for body shape, waist/hip circumference ratio (W/H) as an indicator of central fat distribution, sum of biceps, triceps and medial calf skinfolds (SS) as an indicator of peripheral fat distribution, estimated upper arm muscle plus bone area (UMA) as an indicator of body muscle and hence of body protein.

UMA was computed using the following formula (Forbes 1978, Clegg 1982), based on measurements of mid-arm circumference (C) and biceps (B) and triceps skinfolds (T) of the right side:

$$UMA = \{[C - \pi/2 (\Sigma B+T)]^2/4\pi\}.$$

Children's dietary data were collected by questionnaires where foods consumed were recorded daily, for a whole week. Nutrient intake per capita/die was calculated using a computerized data base and the foods composition table by Fidanza and Versigioni (1987). To evaluate energy intake (kcal/die) for age, this was expressed as a percentage difference of that recommended for Italian male children of the age considered from the Italian National Institute of Nutrition (INN, 1989), that is 2250 kcal/die for children aged 10-12 years and 2550 kcal/die for those aged 13-15 years. Besides, we have grouped the diets in three categories: hypercaloric, normocaloric, and hypocaloric. Considering normocaloric diets between  $\pm 10\%$  standard recommended values, and as hyper- or hypocaloric diets respectively higher or lower of 10% standard values.

Food intake data were gathered during the period of the anthropometric surveying.

Since anthropometric data of male children of different ages were pooled, anthropometric measurements were transformed into z-scores, using as reference data those of 267 boys aged 11-13 years attending the lower secondary schools in the municipalities of Portoscuso and Sestu. These data were collected from 1992 to 1993, and represent the 51.74% of the whole male lower secondary school population of the two centres.

The male children of the reference sample were grouped into 1/2 year age cohorts, e.g. 11.00-11.49, 11.50-11.99, ..., 13.50-13.99, based on the date of birth of each child. The z-score of a measurement is obtained as  $z_i = (x_i - m)/s$ ,  $x_i$  being the observed value for that measurement of a subject of a given decimal age, and  $m$  and  $s$ , respectively, the mean and standard deviation of that measurement in the coeval reference sample.



## Results and Discussion

One-way analysis of variance showed heteroscedasticity for estimated energy intake (EEI) in the comparison between the Portoscuso and the Sestu samples. The average of EEI was higher in the sample of male children from the urban municipality of Portoscuso than in those of the semi-urban municipality of Sestu (Table 1). However, both groups presented lower energy intake with respect to that recommended for Italian coevals (INN 1989).

Table 1: One-way analysis of variance of energy intake percentages in comparing the sample of urban boys from Portoscuso and the semi-urban sample from Sestu

	Portoscuso		Sestu		F (df=1; 72)	P <
	n	$\bar{X}$	n	$\bar{X}$		
$\Delta$ % kcal/die	48	-10.7102 >	26	-23.8348	7.148	0.01

In Table 2 the result of the statistic G (log-likelihood ratio test) for testing for differences of the distribution in dietary status between Portoscuso (urban) and Sestu (semi-urban) boys is showed. The G value indicates a statistically significant difference. The boys of Portoscuso compared with those of Sestu have lower percentages of normo- and hypocaloric diets.

Table 3 presents the mean of the anthropometric variables expressed in standardized values, and the results of the one-way analysis of variance applied for each variable in the two samples of the Sardinian boys examined.

Table 2: Percentage of boys in 3 caloric category of dietary status and G-test for difference in distribution of dietary status in two groups of Sardinian boys aged 11-13 years

Groups	Hypercaloric	Normocaloric	Hypocaloric	TOT
Portoscuso	22.92	14.58	62.50	48
Sestu	0.00	23.08	76.92	26

G = 8.637\* d.f. = 2 p = 0.0133

Table 3: Means of the anthropometric variables expressed in standardized values, and univariate F-statistics

Anthropometric variables	Portoscuso $\bar{X}$ (n = 48)	Sestu $\bar{X}$ (n = 26)	F (df = 1; 72)
Weight	0.0606 >	-0.1178	0.524
Stature	0.1702 >	-0.0508	0.812
Upper arm circumference	0.0680 >	-0.2212	1.713
Biép. breadth humeri	-0.0269 >	-0.0288	0.001
Relative sitting height	0.0811 >	-0.1408	1.137
Waist/hip ratio	-0.1379 <	0.2200	3.385
$\Sigma(B+T+MC)$ skinfolds	-0.1137 <	0.1265	1.219
UMA	0.2737 >	-0.4197	7.757**

\*\* p < 0.01

One-way analysis of variance showed heteroscedasticity for the estimated upper arm muscle plus bone area, with the values of the urban boys of Portoscuso being on the average higher than those of the semi-urban of Sestu. They were on the average lower for the other anthropometric variables considered, whereas the waist/hip ratio (W/H) and the sum of biceps, triceps and medial calf skinfolds (SS) are exceptions (Figure 1), though no significant departures from homoscedasticity were observed (Table 3).

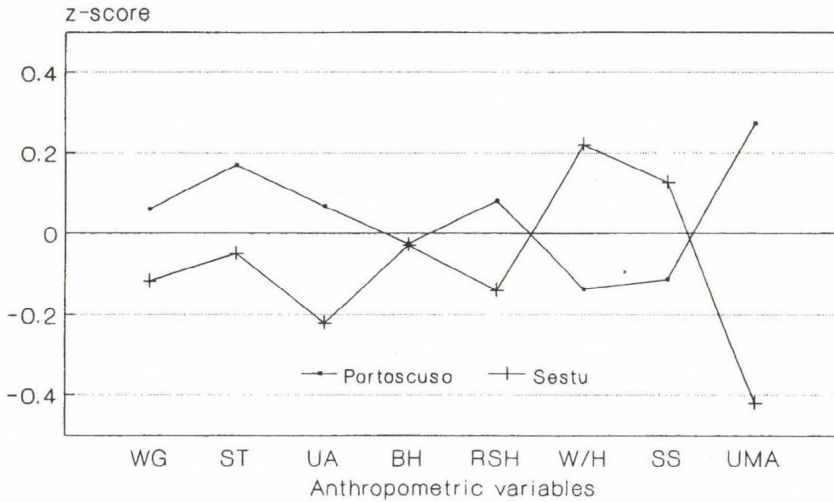


Fig. 1: Biometric profiles of the boys from Portoscuso and Sestu aged 11-13 years

However, the significant differences in EEI (Table 1), and in dietary status (Table 2) between the two samples compared, the heteroscedasticity noted for the estimated upper arm muscle plus bone area (Table 3), and the fact that UMA is considered a good indicator of body muscle and hence of body protein, allow us to formulate the hypothesis of a substantial difference in nutritional habits between the two groups of Sardinian boys examined (Sanna et al. 1994).

Besides, as suggested by Buffa et al. (1995), it may also be hypothesized that other different environmental conditions influence the growth performance of urban Sardinian boys from Portoscuso with respect to their semi-urban peers from Sestu.

\*

*Acknowledgements: The authors wish to thank the Headmasters of the lower secondary schools in which this investigation was conducted for their kind and generous assistance. They also wish to thank the parents who gave their consent to the collection of data.*

*Work supported by grants 40% and 60% from M.U.R.S.T.*

\*

Received: 16 October 1997

## References

- Buffa, R., Cosseddu, G.G., Floris, G., Porcedda, A., Sanna, E. (1995): Comparison of anthropometric and socio-demographic characteristics of two groups of Sardinian male children (11 to 13 years) living in different urban environments. *Acta Med. Auxol.*, 27; 17-25.
- Clegg, J. (1982): The influence of social, geographical and demo-graphic factors on the size of 11-13 year old children from the isle of Lewis, Scotland. *Hum. Biol.*, 54; 93-109.
- Eveleth, P.B., Tanner, J.M. (1990): *Worldwide variation in human growth*. Cambridge: Cambridge University Press.
- Fidanza, F., Versiglioni N. (1987): *Tabelle di composizione degli alimenti*. Napoli: Idelson.
- Forbes, G.B. (1978): Body composition in adolescence. In: Falkner, F., Tanner, J.M. (Eds) *Human growth. 3. Postnatal growth*. Plenum Press, New York. 239-272.
- Goldstein, H. (1971): Factors influencing the height of seven-year- old children. Results from the National Child Development Study. *Hum. Biol.*, 43; 92-111.
- Greco, L., Mayer, M., Grimaldi, M., Capasso, G. (1982): Factors affecting growth in Campania's schoolchildren. *Acta Med. Auxol.*, 14; 177-187.
- INN. LARN. (1989): *Livelli di assunzione giornalieri raccomandati di energia e nutrienti per la popolazione italiana*. Revisione 1986-87. Milano: Istituto Nazionale della Nutrizione-Litho Delta.
- ISTAT. (1986): *Classificazione dei comuni secondo le caratteristi che urbane e rurali*. Note e relazioni, n.2. Roma: Istituto Centrale di Statistica.
- Johnston, F.E. (1994): Growth, growing up, and the social and economic environments of children. *Humanbiol. Budapest.*, 25; 135-143.
- Meredith, H.V. (1979): Comparative findings on body size of children and youths living at urban centers and in rural areas. *Growth*, 43; 95-104.
- Sanna, E., Carbini, L., Floris, G., Porcedda, A., Cosseddu, G.G. (1994): Anthropometric and nutritional comparison between two groups of Sardinian boys (aged 11-13 years). Preliminary report. *Humanbiol. Budapest.*, 25; 373-376.
- Singh, S.P., Sidhu, L.S., Malhotra, P. (1987): Growth performance of Punjabi children aged 6-12 years. *Ann. Hum. Biol.*, 14; 169-179
- Tanner, J.M. (1962): *Growth at adolescence*. Blackwell Scientific Publications, Oxford.

*Mailing address:* Dr. Emanuele Sanna  
Dipartimento di Biologia Sperimentale  
Sez. Scienze Antropologiche  
Cittadella Universitaria  
SS.554 - Km 4.5  
09040 Monserrato (CA)  
Italy

