Collection of Anthropometric Data From Primary Schoolchildren

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Abstract

This paper concerns the conclusions of a collection of anthropometrical data from primary schoolchildren and focused on the selection of methodologies for anthropometric data gathering, its implementation, as well as the subsequent data acquisition and statistical treatment.

The sample was composed of 1472 children, 738 female and 734 male, aiming at a statistically representative sample of a population of 2850 students from six primary schools from the Odivelas municipality in Portugal. The students' age was between 5 and 14 years (average age of 8 years, with a standard deviation of 1 year). The distribution per grades was as follows, 20,2% for the 1st grade, 25,2% for the 2nd grade, 26,1% on the 3rd grade and 28,5% on the 4th grade.

The anthropometric profile evaluation was accomplished with the use of the DIGITA program system, developed at the FMH-UTL Ergonomics Laboratory. The DIGITA system is based on photometric techniques, being a fast and effective method for the anthropometric characterization of a particular population. The system involves three steps: (1) data acquisition with digital photography, (2) Cartesian coordinates digitalization and (3) statistical data treatment and results. In this study we measured twenty six linear anthropometric variables and the body weight.

The first conclusions indicate that our sample, for the majority of the evaluated variables, have higher values than the ones concerning the British population,

(Pheasant, S., 1988), with the exception of the buttock-popliteal length, the popliteal height, the upper limb length and the hand length, all of which present lower average values. However our sample has, for these same variables, a higher standard deviation.

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1. Introduction

School work requires children to sit for "extended" periods of time – Knight et al., 1999; David, 1994; Paulsen et al., 1994; Freudenthal et. al. 1991; Mandal, 1984; Lamarche et. al., 1993; Bendix et al., 1986; Marchall et. al. (1995), Froufe et al. (2002). It is at this stage of physical development (the first four years at school) that changes to the spinal column can come about as a result of incorrect posture frequently caused by inappropriate school furniture.

It is this fact which constitutes the reason for wishing to carry out a study to help develop appropriate design strategies for primary school furniture.
This document sets out the conclusions drawn from the first stage of the study which focused on the selection of an appropriate methodology for data collection, on its implementation and on the statistical processing of the resulting data.

To this end, photometric methods were used to take 28 anthropometric measurements including 26 linear measurements as well as body weight and abdominal circumference.

The sample for the study comprised 1472 children (738 girls and 734 boys), care being taken to ensure a representative sample of the total school population of 2850 pupils in six schools in Odivelas Municipality. The age range was from 5 to 14 years (with the average age being 8 years with a standard deviation of 1 year) The breakdown of the sample by school year is 20.2% in 1st year, 25.2% in 2nd; 26.1% in 3rd and 28.5% in fourth year.

2. Experimental Methodology for Assessing the Anthropometric Profile
The anthropometric profile assessment of the pupils was carried out in three stages:
- Digital imaging;

- Digitalisation of coordinates (using the DIGITA system);
- Processing of data.

2.1. Digital imaging

The schoolchildren were asked to wear a bathing suit and markers were placed at the anthropometric points: greater trochanter, acromia, external malleoli and the central points of the knee, elbow and wrist joints. The children were then asked to go to the "photographic stage" where an elastic band (fig. 1) was placed on their heads so as to compress their hair and thus minimise the margin of error in the subsequent digitalisation of the images.

2.1. Digitalisation of Coordinates (using the DIGITA system)

All the work to quantify the data obtained from the photographic images was carried out practically at the same time as the previous stage. To this end, the DIGITA computer programme, developed by the Ergonomics Laboratory of the Technical University of Lisbon (Rebelo, F. et al. 2000). This programme allows the user to select anatomical points on any image on screen by means of a cursor (fig. 3). Once the points in each image have been identified, the programme archives the data in corresponding files.

Figure 3- *Screen dump showing the* **DIGITA system**

Twenty-six anthropometric measurements were taken: head width, chest width; abdominal width; hip width; thigh width; leg width; shoulder (biacromial) width ; upper limb length; height; shoulder height; arm length; forearm length; hand length; hip height; popliteal height, external malleolus height; head depth; chest depth; abdominal depth; thigh depth; leg depth; arm depth; forearm width; hand width; buttock-knee length; buttock-popliteal length.

2.3. Processing of data

The data collected were processed statistically using Excel 2000 in order to calculate the mean values, standard deviation and other percentiles.

3. Results

Table 1 provides a statistical description of all the variables for the 26 measurements taken for the entire sample.

Table 1- Statistical description of the measurements of 1472 pupils in Odivelas Municipality. (in mm)

Anthropometric measurement	Mean	Standard deviation	5 Percentile	95 Percentile
Head width	143.91	7.99	131.92	158.01
Chest width	230.33	25.25	194.82	276.53
Abdominal width	216.55	30.86	175.84	274.70
Hip width	243.87	30.76	201.98	298.91
Thigh width	118.98	17.83	94.05	151.24
Leg width	83.46	11.24	66.46	103.21
Biacromial width	208.53	20.41	178.35	244.37
Upper limb length	539.41	51.40	461.26	631.14
Height	1294.19	97.54	1142.94	1458.78
Shoulder height	1059.34	93.17	914.71	1214.22
Arm length	214.70	27.41	171.95	260.83
Forearm length	179.41	21.89	145.30	217.32
Hand length	137.25	15.20	114.15	162.72
Hip height	682.64	63.67	584.22	789.04
Popliteal height	307.49	35.59	248.73	366.09
External malleolus height	63.52	9.02	49.28	78.81
Head depth	185.17	10.03	168.87	201.45
Chest depth	167.83	22.03	138.90	208.99
Abdominal depth	182.98	28.89	145.95	236.65
Thigh depth	140.59	20.14	111.94	177.24
Leg depth	96.34	12.63	77.80	117.32
Arm depth	76.73	11.81	60.44	98.10
Forearm width	65.46	9.26	51.37	81.85
Hand width	80.85	9.63	66.10	97.02
Buttock-knee length	441.12	40.49	377.37	507.77
Buttock-popliteal length	333.10	31.93	282.06	384.14
Weight	30.18	8.03	20.00	45.00
Abdominal circumference	63.22	8.75	52.00	79.00

3.1. Comparison of Results Obtained from Other Authors

Initial conclusions reveal that our sample exhibited higher values, for most variables, than the British population (Pheasant, S., 1988), with the exception of the buttock-popliteal length, popliteal height, upper limb length and hand length, which were smaller. However, our sample also had a greater standard deviation for these variables.

In the Odivelas sample, girls exhibited higher mean values for height than boys at the ages of 6, 8, 10 and 11. Jeonji, B. et. al. (1990), showed that in the Korean population, girls exhibited higher mean heights than boys at 10 years of age. The mean height of girls is smaller than that of boys in all other age groups.

The data obtained by Pheasant (1988), indicated that the mean height of boys was greater than that of girls at 6 and 7 years of age. The difference in the mean values subsequently levelled out gradually till the age of 10 with the mean value among 11 and 12 year olds being greater for girls.

The Korean population also exhibited higher mean values for popliteal height and buttock-popliteal length than our sample.

4. Conclusion

The anthropomorphic profile was evaluated using the DIGITA system based on photometric methods. The photometric approach offered the advantage of being both fast and not very intrusive.

The methodology used proved to be suitable for the objectives set, notably as regards the speed with which it allowed anthorpometric data to be collected and registered using a reasonable sample size (1472).

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