ORIGINAL ARTICLE

ANTHROPOMETRICS EVALUATION OF CHILDREN BETWEEN GENDERS

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ABSTRACT

In developing ergonomically sound furniture, there is a need in evaluating anthropometrics from various aspect such as gender differences. The objectives of this study was to evaluate anthropometrics differences between genders of children in Malaysia in order to determine the need in having specified chairs for each gender. Represented by four states in Malaysia, a total of 2400 children were involved in the study. A custom made measurer and an anthropometer were used to measure the subjects. Six body measurements, which are, sitting shoulder height, sitting subscapular height, shoulder breadth, buttock popliteal length, popliteal height and hip width were documented for evaluation. From this study, there were some significant differences on some body parts while other body parts were similar to male and female. Therefore, chairs are needed to be made according to the suitability of both gender.

Keywords: anthropometrics, ergonomics, children, gender

INTRODUCTION

The development of anthropometrics in ergonomics is undeniably an important part to be included. Ergonomics, which means the scientific discipline concerned with understanding of the interactions among humans and other elements of a system, (Dul & Weerdmeester, 2008) comprises many aspects to consider when developing standardized ergonomic products.

Anthropometrics which means body measurements are the based when designing ergonomic products. However, there are many issues in getting anthropometrics data to be applied in designs. These include lack of anthropometrics data, lack of specific measurements for singled sizes products (Bhattacharya & McGlothlin, 2012), not up-to-date data (Castellucci, Arezes, Molenbroek, & Viviani, 2015) and also differential issues as in ethnicity, provinces and gender (Panagiotopoulou, Christoulas, Papanckolaou, & Mandroukas, 2004).

Children growth rates differ from male and female due to the hormonal changes which females are being known to have faster growth rate than that of male during childhood. Since children's body parts are not fully developed, therefore it is harder to propose dimensions for product design. Furthermore, according to Jeong and Park (1990), there was a significant results on an observation regarding sexual differences which showed boys needed higher desk and chairs, however girls seems to need larger chair depths and widths (Oyewole, Haight, & Freivalds, 2010). These studies proves that the evaluation of gender needs to be done in order to propose dimensions for ergonomic product design.

Therefore, in this study, the objective was to evaluate the gender differences between the male and female children. In performing this study, the ability to propose accurate anthropometrics data for product design may be achieved.

METHODS

In order to obtain anthropometrics data for Peninsular Malaysia, a multi-stage sampling was performed. Three steps were taken in this sampling method in order to obtain the final sampling amount. The steps were shown in figure 1 where 3 stages of multi-stage sampling was made. Furthermore, samples were calculated based on a rule of thumb by Roscoe (1975), stated that a minimum number of 30 for each classification is sufficient (Sekaran & Bougie, 2009).
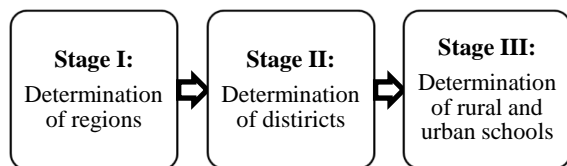
Figure 1: Flow Chart of Determining Samples

Stage I

The determination of regions were to divide Peninsular Malaysia to four regions, afterwards each region will present 1 state to represent its region, which in this study, the four states were Perak, Pahang, Johor and Selangor.

Stage II and III

Schools were chosen based on the highest number of schools in a district. Afterwards, schools from two provinces of rural and urban areas were chosen to be sampled, which were based on the highest number of students. Rural and urban areas were particularly included due to report where there were differences between the two areas (Yuhaniz, Seraila, Muhammed, & Saleh, 2014). Also because of poor nutritional status of children from low-income rural communities were reported on the 1980's and 1990's (Khor et al., 2009).

An involvement of a total of 2400 school children where an equal amount of male and females were conducted in this study. Representatives from grade 1 to grade 5 were included, as can be seen in figure 2. The anthropometrics measurements involved were sitting shoulder height, sitting subscapular height, shoulder breadth, buttock popliteal length, popliteal height and hip width.
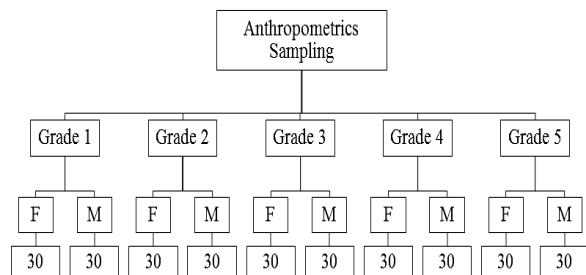

Figure 2: Anthropometrics sampling for each school

For the instruments in this study, a custom made measurer was made, as it will help in delivering accurate and efficient anthropometrics data to the researcher. The main criteria for the measurer was that it needed to be capable in measuring children without them moving, hence the measurer was made adjustable. Furthermore, a water level was used to ensure flatness of the instrument. The use of this instrument, as can be seen in plate 1, consumes less time as it can take measurements simultaneously (Yuhaniz, Muhammed, & Saleh, 2013).

Plate 1: Custom made measurer

Plate 2: Anthropometric data collection

Results and Discussions

Table 1: Anthropometric measures of Primary School Children in Malaysia

Anthropometric measures	p-value	Female		Male	
		Mean (mm)	SD	Mean (mm)	SD
Shoulder Breadth	0.300	293.10	40.87	294.72	35.77
Hip Width	0.000*	257.23	46.87	242.67	45.68
Sitting Shoulder	0.665	417.86	49.01	417.04	43.92
Sitting Subscapular Height	0.000*	324.13	36.31	318.91	30.83
Buttock Popliteal Length	0.000*	364.80	39.51	357.32	36.26
Popliteal Height	0.644	346.24	36.63	345.57	33.74

*The mean difference is significant at $p<0.05$
N=2400

The six sitting anthropometrics data involved in this study were collected as in plate 2, and evaluated using a statistical package of SPSS version 16. Independent samples T-test was undergone to evaluate gender differences.

As can be seen in table 1, among the six dimensions evaluated, three showed significant differences between male and female. Hip width, sitting subscapular height and buttock popliteal height, all showed p-values of 0.000, which the female children showed higher values in those anthropometric measures. A study of children in Bangladesh, had met with results like this was by Rahman (2015), where he also founded significant differences in some body parts while most body parts had similar values.
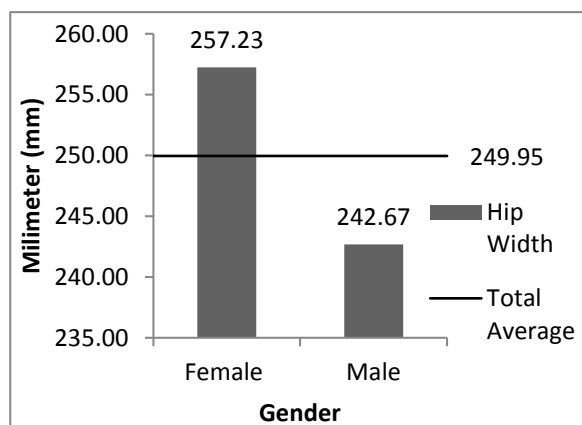

Figure 3: Hip width of male and female

Figure 3 showed the dimensions of the female and male differences where female had value of 14.56mm higher than male. Other body parts such as sitting subscapular height and buttock-popliteal length as in figures 4 and 5, also showed female as the larger gender.

Figure 4 shows the sitting subscapular height of male and female where the female had higher values. This is similar with the study of Haroon and Rosman (2013) where female had higher value dimensions at sitting shoulder height. In figure 5 also exhibits the dissimilarity between male and female, where female was reported to have longer length of buttock to the popliteal.
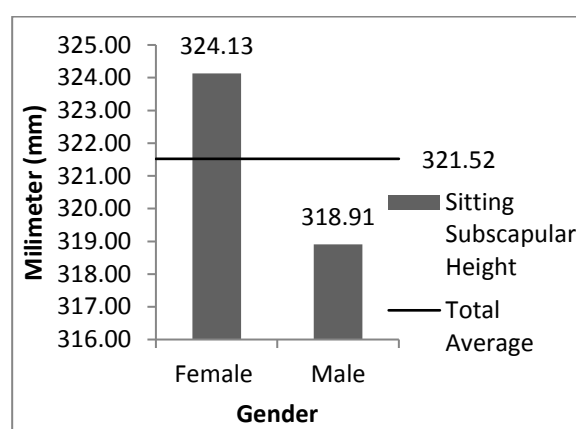

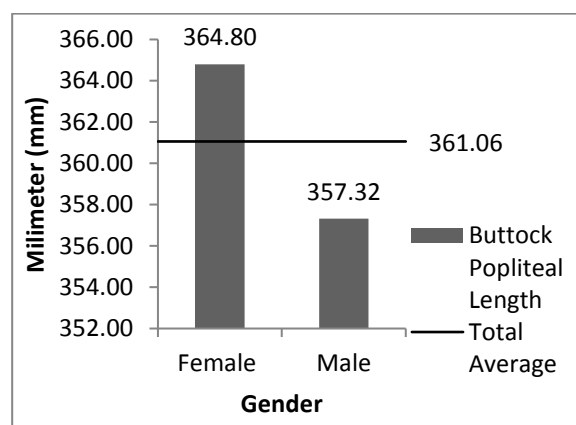Figure 4: Sitting subscapular height of male and female

Figure 5: Buttock-popliteal Length of male and female

CONCLUSION

From this study, it can be concluded that male and female do have different anthropometrics. However, only a few of the body were dissimilar, while others are not significantly different. Therefore, products designs such as chairs, has to be produced acquiring both genders differential. Future studies should consider evaluating gender according to their ages as this will lead to a more precise product dimensions.

COMPETING INTERESTS

There is no conflict of interest.

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