



Undergraduate

Introduction

Childhood is a critical period for bone growth [1]. During childhood, bone development is modulated by mechanical forces on bone which can be affected by body composition. The muscle-bone unit (MBU) is a measure of bone strength development [2]. However, limited data is available to examine the association between body composition and MBU in Malaysian preadolescent children.

This study aims to compare the sex differences in total body (TB), and regional (arm, leg, trunk, android, and gynoid) body composition, and MBU of preadolescent children aged between 9-11 years old.

Methodology

- **Design:** Secondary analysis (Baseline data from PREBONE-Kids study)
- **Setting:** 3 primary school in Bangsar and Brickfields
- **Participants:** 243 children aged 9 to 11 years old (127 boys and 116 girls)

Inclusion Exclusion

- | | |
|--|---|
| <ul style="list-style-type: none"> ➤ Healthy ➤ Tanner stage 1 or 2 ➤ Able to provide assent | <ul style="list-style-type: none"> ➤ Have history of serious medical condition ➤ Receive medication that interfering with bone metabolism |
|--|---|

- Baseline body composition, bone mineral content (BMC) and bone mineral density (BMD) were derived from the Dual energy X-ray absorptiometry scan reports (DXA).



- Total and regional MBU were calculated by dividing BMC with lean body mass (LBM).

$$\text{Total/Regional MBU} = \frac{\text{MBU}}{\text{LBM}}$$

- Ethical approval was obtained from IMU Research & Ethics Committee (R235/2021)
- Data was analysed using SPSS version 28.0 with a significance level of $p < 0.05$

Results & Discussion

Sociodemographic data

- Median age: 10.17 (1.65) years old
- Ethnicity: Malay (90.5%) & Indian (9.5%)
- Tanner stage: Tanner stage 1 (94.7%) Tanner stage 2 (5.3%)

BMI for age

Half of the participants (58.0%, $n=141$) were of normal weight, while another 40% (16.0% and 17.3%) were overweight and obese, respectively.

Bone parameter

BMD [boys: 0.772(0.100) g/cm^2 vs girls: 0.748(0.089) g/cm^2 ; $p=0.004$], and BMC were higher in boys [boys: 1153.3(336.8) g vs girls: 1079.1(313.7) g ; $p=0.037$].

Body composition

Table 1: Total and regional body composition of study participants by sex ($n=243$)

Body composition	All ($n=243$)	Boys ($n=127$)	Girls ($n=116$)	p-value
LBM				
TB (g)	21221.0 (7012.0)	21313.0 (6566.0)	20397.0 (7390.0)	0.043*
Arm (g)	1929.0 (766.0)	2011.0 (780.0)	1821.0 (835.0)	0.003*
Leg (g)	7173.0 (3093.0)	7266.0 (2988.0)	6789.5 (3479.0)	0.053
Trunk (g)	9295.0 (2904.0)	9425.0 (2736.0)	9149.5(3151.0)	0.048*
Android(g)	1241.0 (458.0)	1262.0 (412.0)	1194.0 (473.0)	0.010*
Gynoid (g)	2770.0 (1183.0)	2827.0 (1053.0)	2726.5 (1199.0)	0.093
FM				
TB (g)	7893.0 (8669.0)	7561.0 (9167.0)	8422.0 (7969.0)	0.195
Percentage of fat (%)	27.9 (13.6)	25.3 (15.3)	29.1 (12.2)	0.004*
Arm (g)	976.0 (910.0)	934.0 (1010.0)	988.0 (858.0)	0.328
Leg (g)	3313.0 (2986.0)	3180.0 (3036.0)	3510.5 (2873.0)	0.155
Trunk (g)	2899.0 (4554.0)	2716.0 (4808.0)	3145.0 (4261.0)	0.118
Android(g)	325.0 (724.0)	306.0 (775.0)	338.5 (673.0)	0.322
Gynoid (g)	1275.0 (1418.0)	1168.0 (1491.0)	1426.0 (1259.0)	0.054

All data presented as median (interquartile range). Significance difference between groups at * $p < 0.05$ by Mann-Whitney U test.

Table 2: MBU of study participants by sex

MBU	All ($n=243$)	Boys ($n=127$)	Girls ($n=116$)	p-value
TB	0.052(0.006)	0.052(0.006)	0.052(0.006)	0.330
Arm	0.062(0.011)	0.059(0.008)	0.065(0.012)	<0.001*
Leg	0.054(0.007)	0.053(0.007)	0.055(0.007)	0.011*
Trunk	0.030(0.005)	0.029(0.005)	0.030(0.004)	0.202
Android	0.012(0.002)	0.012(0.002)	0.013(0.003)	<0.001*
Gynoid	0.031(0.004)	0.030(0.005)	0.031(0.004)	0.122

All data presented as median (interquartile range). Significance difference between groups at * $p < 0.05$ by Mann-Whitney U test.

Table 1

Boys had higher total body LBM than girls ($p=0.043$)

- Caused by increased growth hormone and androgen concentration during adolescence facilitating the acquisition of more lean tissue in boys [3].

- Boys tend to be more active than girls which correspond to the rise in metabolic rate, as well as increases in physical strength and energy expenditure [4].

Girls had higher %BF ($p = 0.004$)

Due to rapid growth of breast tissue and substantial development of the feminine body frame with fat accumulation at the thighs and hips [5].

Table 2

Girls had significantly higher MBU than boys in the arms ($p < 0.001$) legs ($p=0.011$), and android ($p < 0.001$)

Sex differences in the MBU could be due to the effect of oestrogen as girls attain puberty earlier [6]. Further investigation is encouraged in studying the sex-related differences in total and regional MBU among children.

Conclusion

Body composition and MBU sexual dimorphism were present in children aged 9-11 years. Hence, this study provides reference data for Malaysian children and is important to further understand the bone health status of growing children.

References

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