

# Maternal overweight/obesity characteristics and child anthropometric status in Jos, Nigeria

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## ABSTRACT

**Background:** This study is to determine the pattern of overweight and obesity and its relationship with childhood anthropometric status in Nigeria. **Materials and Methods:** This cross-sectional study was conducted in Jos, Nigeria. Interviewer administered questionnaire was used in data collection. Maternal and child anthropometric measurements were obtained using standard WHO methods. Child anthropometric Z scores were obtained from WHO Anthroplus while BMI of mothers were also determined. Totally, 262 mother-child pairs were recruited. **Results:** Mean maternal age and mean child age were  $30.8 \pm 6.3$  yrs (15-47 yrs) and  $22.3 \pm 18.7$  months (3-72 months). Prevalence of maternal underweight, overweight and obesity was 4.2% (11/262), 29.4% (77/262) and 25.9% (68/262), respectively. Child overweight/obesity was 5.4% (14/262), severe under-nutrition 5.7% (15/262). Mean maternal BMI was higher in the older, more educated and higher socioeconomic status (SES). Child mean birth-weight, weight-for-age Z-score and BMI-for-age Z-score (BAZ) were higher among mothers with BMI  $\geq 25$  kg/m<sup>2</sup>. All large-for-age babies were in mothers with maternal BMI  $\geq 25$  kg/m<sup>2</sup>. Childhood over-nutrition was more common in maternal BMI of  $\geq 25$  kg/m<sup>2</sup>. Overall, BAZ was directly related with maternal BMI, maternal age and birth-weight, although it was inversely related with maternal BMI  $\geq 25$  kg/m<sup>2</sup>. **Conclusion:** Higher BMI is seen in educated and higher SES mothers and this impact on childhood anthropometry.

**Key words:** Maternal overweight, child anthropometry relationship

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## INTRODUCTION

Many studies have reported the impact of maternal body mass index (BMI) on the BMI of children, indicating that children born to obese parents are more likely to become obese than those not to.<sup>1-4</sup> It is also reported that maternal pre-pregnancy and intra-pregnancy BMI have significant impact on the birth outcome and birth weight of the offspring and in turn effect on development of obesity beyond childhood.<sup>2,4-7</sup> In developing countries, nutritional problems had hitherto been those of under-nutrition but emerging trends show a nutritional transition with double burden of malnutrition, the occurrence of both under- and over-nutrition in same population and even

within the same household.<sup>8-10</sup> There has also been documentation, although with varying results of the pattern of nutritional states between overweight/obese mothers and their children.<sup>11-13</sup> In Nigeria, the prevalence of maternal overweight and obesity is on the increase,<sup>14</sup> childhood nutritional states has been predominantly those of under-nutrition<sup>14</sup> with prevalence of overweight and obesity in adolescents on the increase. This study was therefore designed to determine the pattern of overweight and obesity in mothers and relationship between maternal overweight/obesity and the anthropometric status of children in our environment.

## MATERIALS AND METHODS

This was a cross-sectional descriptive study among mother-child pairs attending immunisation clinics and two pre-primary schools, conducted in Jos Nigeria. In all 262 consenting mother-child pairs were recruited over a 2-months period from the study sites. A semi-structured questionnaire was used to obtain information on socioeconomic status (SES) and child-feeding habits. Maternal and child anthropometric measurements were

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conducted according to standard procedures.<sup>15</sup> Maternal weight was measured using a digital weighing scale, calibrating to 0.1 kg, and height was measured with a stadiometer to the nearest 0.1 cm. Weight of children was measured using a Bassinet weighing scale for those less than 2 years, with minimal clothing, to the nearest 0.1 kg. Length of children at the age of 0-23 months were measured using an infantometer while older children with the stadiometer, to the nearest 0.1 cm. Body mass index (BMI kg/m<sup>2</sup>) of mothers was calculated using EPI info 7 statistical software. The nutritional status of the children was calculated using the World Health Organisation Anthro software 3. 2. 2.<sup>16</sup>

### Data analysis

Data collected were entered into and analysed with both EPI Info 7 and Stata 12 SE software. *P* - value was set at <0.05 for statistical significance, means of variables were compared using Student 't' test while other data were represented in frequency and 2 × 2 tables.

### Ethical approval

Approval for the study was obtained both from the institutional review boards of the Nagasaki University Japan and Jos University Teaching hospital Jos, Nigeria.

## RESULTS

Of the 262 mother-child pair, prevalence of overweight, obesity and under-nutrition were 29.4% (77/262), 25.9% (68/252) and 4.2% (11/262), respectively. Child overweight/obesity was 5.4% (14/262), severe under-nutrition 5.7% (15/262).

Among mothers with BMI ≥ 18.5 kg/m<sup>2</sup> (251/262) mean maternal age was 31.1 ± 6.2 years. Mothers with BMI ≥ 25 kg/m<sup>2</sup> were older, *P* < 0.0001. Similarly, those with BMI ≥ 25 kg/m<sup>2</sup> were more educated, *P* = 0.0002 and were in higher socioeconomic class *P* = 0.0035 [Table 1].

Mean child age was 22.3 ± 18.7 months, with children of mothers with BMI ≥ 25 kg/m<sup>2</sup> being older (26.5 ± 20.4 months vs. 16.7 ± 14.4 months, *P* = < 0.0001).

Child anthropometric characteristics and differences between maternal BMI groups are presented in the Table 2 below.

Mean child height for age Z score (HAZ) was not significantly different between normal BMI mothers and in overweight/obese mothers, *P* = 0.6 but other anthropometric indices differed significantly as shown in Table 2.

Utilising BMI-for-age Z-score (BAZ) >1 as over-nutrition and BAZ < -1 as under-nutrition, Table 3 shows that childhood over-nutrition was more common in maternal BMI ≥ 25 kg/m<sup>2</sup> while under-nutrition was commoner in maternal BMI < 25 kg/m<sup>2</sup>.

**Table 1: General maternal characteristics between BMI groups**

Variable	BMI <25	≥25	P - value
Mean maternal age	29.2 kg±6.2	32.4 kg±5.8	<0.0001
Mean maternal MUAC	26.1 cm±2.4	31.8 cm±3.9	<0.0001
Mean family size	5.1±2.2	5.7±2.0	0.044
Education	<i>n</i> (%)	<i>n</i> (%)	0.0002 (Fisher)
None	4 (3.8)	1 (0.7)	
Primary/Junior secondary	18 (17.0)	8 (5.6)	
Senior secondary/Diploma	51 (48.1)	66 (45.8)	
Graduate	33 (31.1)	69 (47.9)	
Socioeconomic status	<i>n</i> (%)	<i>n</i> (%)	0.0035
Lower	52 (49.0)	42 (29.0)	
Middle	36 (34.0)	61 (42.0)	
Upper	18 (17.0)	42 (29.0)	

**Table 2: Child anthropometric characteristics**

Variable	BMI <25	≥25	P-value
Mean birth weight	3.19kg±0.4	3.30 + 0.5	0.15
HAZ	-0.08±1.6	0.04±1.6	0.6
WAZ	-0.69±1.3	-0.02±1.2	<0.0001
BAZ	-0.87±1.6	-0.03±1.5	<0.0001
MUACZ	-0.001±1.1	0.45±1.06	0.0021
WHZ	-0.89±1.55	-0.02±1.58	<0.0001

**Table 3: Child Nutritional and Birth characteristics by maternal BMI group**

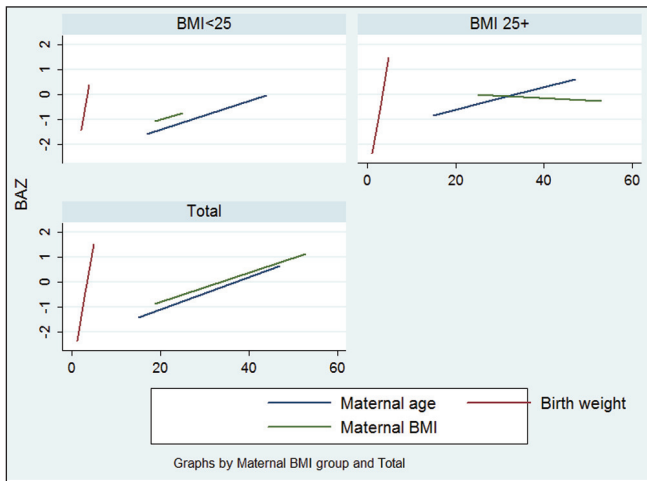
Variable	BMI <25	≥25	P-value
Child nutritional state			0.002
Normal	47 (44.3)	71 (49.0)	
Over-nutrition	13 (12.3)	38 (26.2)	
Under-nutrition	46 (43.4)	36 (24.8)	
Birth weight categories			Fisher's 0.01
Normal	63 (95.4)	102 (85.0)	
Large for gestational age	0 (0.0)	13 (10.8)	
Low birth weight	3 (4.6)	4 (4.2)	

Mean birth weight [Table 2] was similar in both maternal BMI groups but large for gestational age (LGA) babies were predominantly more from mothers with BMI ≥ 25 kg/m<sup>2</sup>. Low birth weight (LBW) babies were similar in all the groups [Table 3].

Generally, maternal age, BMI and birth weight show positive linear relationship with BAZ (Graph Total), in mothers with BMI ≥ 25 kg/m<sup>2</sup> maternal BMI has an inverse linear relationship (graph 25 +) as was shown in Figure 1.

## DISCUSSION

This study highlights the relationship between and impact of maternal overweight and obesity on the anthropometric status of children in Jos, in north central Nigeria. The prevalence of maternal overweight and obesity in the study population was higher than those of the republic of Benin<sup>17</sup> as well as the Nigerian national average for overweight and



**Figure 1:** Graph of BAZ with birth weight, maternal age and maternal BMI

obesity as reported in the 2013 demographic health survey report<sup>14</sup> but overall rates were lower than those among urban women in Ghana.<sup>18</sup>

The high prevalence of maternal BMI > 25 kg/m<sup>2</sup> was observed in women with higher level of education (high school and above), older women and especially mothers in the middle SES strata. This is similar to the study conducted by Neuman *et al.*, which showed that overweight and obesity increased with socioeconomic status in low and lower middle-income countries.<sup>19</sup> However, the finding in our study is not the same as in developed countries as demonstrated by Bonaccio *et al.*, where obesity was found more in those of lower socio-economic strata.<sup>20</sup> This departure from common trend could be that the obesity epidemic begins from the higher social strata and later in the lower class in developing economies. The finding, however, is also contrary to the higher prevalence of overweight and obesity in mothers of lower educational attainment as reported by Johnson *et al.*<sup>21</sup> On the other hand, regarding the age of mother, our study is consistent with the report of increased prevalence of obesity in older women.<sup>22</sup> The older the mothers are, the more weight they have with higher BMI.

Mean child BMI for age (BAZ), weight for age Z score (WAZ) and mid upper arm for age Z score (MUACZ) differed significantly between those born to mothers with BMI < 25 kg/m<sup>2</sup> and BMI > 25 kg/m<sup>2</sup>. Thus higher maternal BMI is associated with higher child anthropometric characteristics such as Mean child BMI for age (BAZ), weight for age Z score (WAZ) and mid upper arm for age Z score (MUACZ). This finding is consistent with studies that demonstrate that parental overweight is predictive of high anthropometric findings in children especially as it relates to childhood overweight and obesity.<sup>1,4,23</sup>

In order to accommodate the various classes of childhood over-nutrition, the term over-nutrition was adopted in

this study as BAZ > 1.<sup>24</sup> Childhood over-nutrition was seen commonly in mothers with BMI > 25 while childhood under-nutrition occurred much more in children of mothers with normal BMI, being consistent with reports showing higher childhood anthropometry in maternal overweight and obesity,<sup>1,4,23</sup> our study also revealed that higher maternal BMI is responsible for childhood overweight and obesity.

Furthermore, we found higher maternal BMI was also associated with higher birth weight, though this was not statistically significant but prevalence of large-for-age babies was much more in maternal BMI > 25 kg/m<sup>2</sup> than in mothers with normal BMI. This finding is consistent with those of Kim and Sharma<sup>25</sup> that higher maternal BMI was associated with increased frequency of LGA births. Prevalence of low birth weight was similar in the two maternal BMI group (Normal BMI, and BMI > 25).

Maternal BMI, maternal age and child weight at birth were positively correlated with childhood BAZ in linear regression model. However, higher maternal BMI > 25 kg/m<sup>2</sup> had an inverse linear relationship with childhood BAZ. This deviation is more pronounced in maternal BMI > 30 kg/m<sup>2</sup>. Why this is so in obese mothers maybe due to some distancing of mother-child relationship and also that as mothers engage in sedentary jobs with more income, they experience a positive energy balance from less physical activity.<sup>26</sup> It is also possible that the inverse relation between obese mothers and childhood BAZ may be from growth restriction (rather than macrosomia) in utero, with babies of such mothers showing reversed patterns of maternal-child BMI relationship while growing.<sup>27</sup>

From the foregoing, we demonstrate higher BMI in older, middle SES and higher educated mothers as well as higher anthropometric characteristics such as BAZ, WAZ and MUACZ in children of such mothers. In the prevention of childhood overweight and obesity, maternal regulation of overweight and obesity is required.

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