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An Investigation into the Influence of Socioeconomic Variables on Gestational Body Mass Index in Pregnant Women Living in a Peri-Urban Settlement, South Africa

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Abstract

Maternal and child mortality rates are still unacceptably high in South Africa. The health status of women in peri-urban areas has been influenced by political and socio-economic factors. Examining socio-economic variables (SEV) in a population aids in the explanation of the impact of social structures on an individual. Risk factors can then be established and pregnant women in these higher risk groups can be identified and given additional support during pregnancy. The aim of this study was to investigate the association between SEV and gestational Body Mass Index (GBMI) in a peri-urban settlement, South Africa. This was a sub-study of the Philani Mentor Mothers' Study (2009–2010). Maternal anthropometry and SEV were obtained from 1,145 participants. Multinomial regression was used to analyse the data. Household income was the only SEV that was significantly associated with GBMI. The odds of being underweight rather than normal weight during pregnancy increase by a factor of 2.145 ($P < 0.05$) for those who had a household income lower than R2000 per month. All other SEV were not significant. Logistic regression was therefore not carried out. Women who had a lower income were at risk of having a

lower GBMI during pregnancy. This can lead to adverse birth outcomes such as premature birth, low birth weight, height and head circumference. Public health policy needs to be developed to include optimal nutrition health promotion strategies targeting women with a low income ante and post-natally. Once implemented, they need to be evaluated to assess the impact on maternal and child mortality.

Keywords

Socioeconomic variables; Peri-urban settlement; Gestational body mass index; Pregnancy

Introduction

Maternal and child health has been one of the top health priorities in South Africa since the Millenium Development Goals were implemented by the United Nations in 1990 and the African National Congress came into power in 1994 [1]. Despite some progress, maternal and child mortality rates are still unacceptably high in South Africa [1]. The health status of women in peri-urban areas has been influenced by the South African political transition, increased urbanisation and the awareness of the importance of healthcare for maternal and child health [2]. In the Western Cape, Khayelitsha is one of the fastest expanding peri-urban areas [2–5]. Urbanisation is a determinant of health and can be positive if it increases the access to health care facilities, however it also gives rise to poverty, especially in South Africa [2, 6, 7]. The negative effects of urbanisation are highest among pregnant women [2, 7]. Examining the influence of socioeconomic variables (SEV) assists in explaining the impact of social structures on an individual [8]. Politics and race have also been South Africa's social determinants of health and the government still needs to reduce health inequalities in order to improve maternal and child health for the benefit of all in South Africa [1]. Maternal mortality is still too high in South Africa, especially in the black population and it is therefore important to look at SEV and the influence these have on pregnancies [9]. Risk factors can then be established and pregnant women in these higher risk groups can be identified and given additional antenatal clinic appointments [8, 9]. Priority can also be given to these high risk pregnant women during labour [9].

A mother's nutritional status is one of the most important determinants of maternal and birth outcomes [1, 2]. A logarithmic equation was developed by the Argentinian Ministry of Health to adjust maternal BMI for gestational age (GBMI) using an adaptation of the epinut programme (Epi-infoTM) [10]. The method has been used previously in South America to aid in predicting high risk pregnancies [10]. Previous studies have looked at the influence of SEV and pre-pregnancy BMI, but no studies have looked at this influence on GBMI.

The knowledge and the establishment of the influence of SEV can assist in the prevention of adverse birth outcomes and the development of maternal morbidities [7, 8]. Social inequalities dominate the peri-urban population. The influence of SEV on GBMI needs to be determined in order to understand the influence of specific SEV to aid in the development and evaluation of public health policy [8].

The aim of this study (2009–2010) was to investigate the association between SEV and GBMI in a peri-urban setting.

Methods

Participants

The current sub-study used baseline data from participants ($n = 1,145$) in a community-based, cluster-randomized controlled trial, the Philani Mentor Mothers' Study (PMMS) [11]. The PMMS took place in Khayelitsha, Western Cape, South Africa between 2009 and 2010. Twenty-four neighbourhoods were identified in the peri-urban settlement. Recruiters knocked on the door of every house in each neighbourhood and invited all pregnant women in the household to participate in the PMMS. If no one was present at the house, the recruiter would return until someone was at home to make certain that no pregnant women were missed. All participants were given a personal participant identity number.

Participants were included in the PMMS if the following inclusion criteria were met; over 18 years of age, pregnant, living in the study neighbourhood within Khayelitsha for the duration of the study and able to give informed consent.

Procedure

Participants willing to participate in the PMMS were collected from their homes, and taken to the data assessment centre in Khayelitsha, Cape Town. Once they had signed an informed consent form, assessment interviewers carried out interviews using population specific questionnaires (baseline questionnaires developed by the research team and translated into Xhosa (the predominant language spoken in Khayelitsha)). Information was recorded using mobile phone technology [12]. Once the interview was uploaded to a central database, it was automatically deleted from the mobile phone. Participants were then given a food voucher and taken home.

Measures

Socio-Economic Variables—In the current sub-study, the following SEV were used from the baseline questionnaire; age (years), possession of identity document, home language, marital status, smoking, education level, employment status, monthly household income (South African rands (SAR)), number of people living in household, housing description, water source, household toilet, electricity and parity. Human immunodeficiency virus (HIV) status and tuberculosis (TB) status were also obtained as HIV prevalence (33%) and TB incidence (1,600 per 100,000) are considerably high in Khayelitsha [14].

Anthropometry and Gestational BMI—Maternal weight was measured to the nearest 0.1 kg using a calibrated Precision Health Scale (model UC321) [15]. Maternal height was measured to the nearest 0.01 m using a calibrated stationary stadiometer (model-MM5). Duplicates of these measures were completed by three data collectors during the baseline questionnaire, using standardised methods [15].

GBMI was calculated using the equation for adjusted BMI for gestational age and categorised into underweight (>10 to <19.8 kg/m²), normal weight (>19.8 to <26.1 kg/m²), overweight (>26.1 to <29 kg/m²), and obese (>29 to <50 kg/m²) [10].

Data Analysis—Microsoft Excel was used to capture the data and SPSS (version 15) was used to analyse the data. Summary statistics described the variables. Medians or means were used as the measures of central location for ordinal and continuous responses and standard deviations and quartiles as indicators of spread. Participants were categorised into the four GBMI categories. All other continuous variables were categorised into quartiles.

Associations between two categorical variables were analysed with multinomial regression. Multinomial comparisons were performed using Wald chi-square analysis for categorical variables.

Unadjusted odds ratios, 95% and *P* values were calculated for SEV, with an alpha level of 0.05. 95% confidence intervals were used to describe the estimation of unknown parameters.

Ethics—Ethics approval was obtained for the PMMS from both the University of California (No G07-02-033) and Stellenbosch University (No8/08/218) ethics committees. Each participant signed an informed consent form. Each participant was given a personal identity number to maintain participant confidentiality.

Results

Characteristics of Participants

Baseline characteristics, anthropometry and SEV of 1,145 pregnant women participating in the PMMS are shown in Table 1.

Participants had an average age ($\pm$ standard deviation) of 26 (± 5.45 years), height 1.59 (± 0.06 m) and GBMI 27.3 (± 5.8 kg/m²), with the majority of the group (43.41%, *n* = 997) in the normal GBMI category. Most of the participants were either in the second (46.3%, *n* = 531) or third (48.1%, *n* = 551) trimester and the majority were primiparous (41.2%, *n* = 472).

Xhosa (93.01%, *n* = 1,065) was the predominant language spoken by participants. A low percentage (3.5%, *n* = 40) reported to be smokers. Approximately ninety percent (89.2%, *n* = 1,021) of the participants had identity documents (ID). IDs are essential for booking into the antenatal clinics of which 76.9% (*n* = 881) of the participants had done. Over fifty percent (56.8%, *n* = 650) of the participants were either married or cohabiting.

The majority of the women (68.8%, *n* = 788) lived in an informal dwelling (wood and iron structure, which does not meet basic building standards) [15]. Almost ninety percent (89.3%, *n* = 1,022) had access to electricity and over half of the women had access to water (53.4%, *n* = 612) and flush toilet (54.1%, 619) on the premises site. Over seventy percent (74.1%, *n* = 848) of the women had not finished school. Under twenty percent (19.1%, *n* = 219) of the women were employed and 55.5% (*n* = 635) earned less than 2000 SAR (290 USD) per month.

Over five percent (5.6%, $n = 64$) of the participants had terminated previous pregnancies, 27.8% ($n = 318$) had at least one previous stillbirth and 9.9% ($n = 112$) had given birth to a low birth weight (LBW) infant. During the current pregnancy, 20.2% ($n = 232$) and 91.4% ($n = 1,047$) had been tested for TB and HIV, respectively. Of those tested, 0.97%, ($n = 2$) had TB and 25.9% ($n = 272$) were HIV positive.

Multinomial comparisons are presented in Table 2. The only SEV that was significantly associated with being in the underweight GBMI category was household income. The odds of being underweight rather than normal weight during pregnancy increase by a factor of 2.145 ($P < 0.05$) for those who had a household income lower than 2000 SAR per month compared to those who had a household income of more than 2000 SAR. All other SEV were not significant, further logistic regression was therefore not conducted.

Discussion

The population in Khayelitsha is predominantly black, Xhosa speaking and young [1, 9, 13]. Although maternal and child mortality rates have decreased in the past ten years, they are still relatively higher than the urban parts of the Western Cape [1, 9, 13]. The most recent study investigating SEV in the African population was the South African Demographic and Health Survey (SADHS) in 2003 [9]. More recently, the relationship between SEV and health status in economically active subjects has been looked at by Stellenberg et al. [16], in the coloured population and Malhotra [4], in the black African population in the Western Cape. Unfortunately there are very few studies that look at the SEV as predictors of health, especially in pregnant women in the black South African population [2, 17]. One of the main studies that has looked at socioeconomic inequalities as a predictor of health is the YENZA (Xhosa word for 'do it') cross-sectional study [17]. It was established that the main determinants of health in a South African peri-urban setting included education, access to electricity and refuse disposal. It was proposed from the survey's results that education and basic services need to improve to help reduce health inequalities and improve the impact on health [17].

In high income countries, it has been found that women with a lower level of education and those unemployed, had a higher body mass index (BMI) and therefore were at a greater risk of developing co-morbidities such as pregnancy induced hypertension (PIH) and gestational diabetes mellitus (GDM) [3, 18]. The opposite has been found in poor to middle income countries [10, 19, 20]. This is in agreement with the study by Banda et al. [21]. in Zambia and Bourne et al. [22] and Malhotra et al. [4] who investigated the black population of South Africa. Bourne et al. [22] established that women who had a higher level of education, tended to have a higher BMI compared with those with little or no schooling, whereas Malhotra et al. [4] found that married women had a higher BMI. Banda et al. [21] also found that the women with the higher BMI were older, and had higher parity. In the South African setting, parity has decreased in the black population from 3.2 (2001) to 2.75 (2007) [23]. This decline is thought to be due to socio-economic factors such as increased economic growth, urbanisation, social mobility and education of women with regards to family planning [23].

The average age of the participants in this sub-study was comparable to other maternal studies [24–26] conducted in Khayelitsha, but lower than studies conducted in high-income countries [27, 28]. There was no association between age and GBMI. This is contradictory with other studies, where older women had higher GBMI [2, 17].

The average height of the participants is comparable with various other studies conducted in a peri-urban setting [9, 29]. Unlike other studies, no association was found between height and GBMI [30–32]. The evidence from the previous studies suggests that shorter women (height <1.51 m) are found to have lower socio-economic status and may have been subjected to foetal and/or childhood under-nutrition [30].

The prevalence of smoking in this sub-study was comparable to the YENZA [17] study, but double the number that was found in a study conducted by Steyn et al. [33]. However, the Steyn et al. study had a sample size almost double that of the sub-study and examined four different South African urban cities as opposed to one peri-urban settlement [33]. Health promotion and awareness of the dangers of smoking is higher in urban areas [33]. Although the number of smokers in the present sub-study was small, the following related SEV were similar to the smokers in the YENZA study: lower education, increasing age and informal housing [33]. In this sub-study, no significant association was found between smoking and GBMI. This is contradictory to the findings by Dode and Santos who found that smoking had a negative association with the development of GDM [34]. This protective effect could however be due to the lower BMI associated with smoking [35–37]. However this protective effect has not been found in other studies [38, 39].

Marital statistics are difficult to compare as studies categorise marital status in different ways. In South Africa, the customary marriage act came into place in 1998 where traditional African marriages were recognised as valid [40]. This could explain why the current sub-study's marital status statistics are different from those of Hoffman et al. [2] but comparable to Malhotra [4]. The results also differ from SADHS, but as previously mentioned, the SADHS take into account the whole of South Africa [4, 9]. The present sub-study found no association between marital status and GBMI. This is not in agreement with other studies that found that married women were more likely to have a higher household income and therefore a higher GBMI [4, 41].

In this sub-study, an overall improvement was found in the education statistics compared to a study conducted by Hoffman in the same population 12 years before and in the SADHS [2, 9]. The majority of participants had started secondary school and 25.9% (n = 297) had completed their final year of school. The SADHS identified younger and more urbanised individuals to have a higher education level [9]. This sub-study had a relatively younger population and this could explain why the education level was higher. Another explanation for observed improvements could be due to government initiatives to rectify imbalances in schools across the country since apartheid and the introduction of fee-free schools [25]. The number of women who had obtained a post-graduate diploma (3.5%, n = 40) was comparable to the Khayalitsha population register, but lower than the SADHS figures (6.7%) [3]. The reason for this disparity could be due to the SADHS including all populations of the Western Cape. No significant association was found between education

levels and GBMI, unlike findings from previous studies [17, 22]. This could be explained by the fact that the population was more urbanised.

Unemployment statistics were higher in the present sub-study compared to earlier studies [2, 4, 9]. Discrepancies between these results could be due to the increased population size of Khayelitsha [3]. In addition the worldwide recession could have had an impact on employment statistics. There was no significant association between employment and GBMI. This is contradictory to findings of other studies conducted in poor to middle income countries [10, 17, 21, 22]. They all found that women who were employed had a higher GBMI and therefore had a higher risk of developing maternal morbidities. Bourne et al. [22] suggested that with an increase in employment, individuals have less time to cook and tend to buy more high-fat 'fast' food on their way home from work rather than spending time cooking healthy meals.

There was a significant positive association between household income and the underweight GBMI category. The odds of being underweight rather than normal weight during pregnancy increase by a factor of 2.145 ($P < 0.05$) for participants who had an income less than 2000 SAR per month. This is in agreement with other studies [17, 22] which established that an increase in income in a peri-urban setting resulted in a more 'western' diet which was lower in carbohydrate and higher in fat. This led to an increase in obesity, and therefore an increase in chronic diseases of lifestyle [22]. Women who are underweight during pregnancy have an increased risk of adverse birth outcomes such a premature birth and low birthweight, height and head circumference [20]. Public health policy and health promotion could target this group of women, before and during their pregnancy.

The percentage of people living in formal brick structures was 13.7% greater than in Hoffman's study [2]. A reason for this could be that in a peri-urban setting, the length of urbanisation improves housing status [7]. Unlike the results from the study by Cooper et al., this sub-study did not find a significant association between housing status and GBMI [7]. Reasons for this difference could be that informal housing is difficult to compare as data on serviced informal houses was not collected in a similar way across studies.

Electricity was provided to more of the participants than was reported in the SADHS in 2003 [9]. In the SADHS there was a large difference between rural and urban settlements with regards to access to electricity [9]. In this sub-study, no relationship was found between GBMI and electricity. This differed from the YENZA study, where high BMI and high blood pressure were associated with having access to electricity [17]. The difference in results could again be because the YENZA study was conducted in a relatively less urbanised population.

An increase in both water access and sanitation was found in the sub-study compared to other studies [2, 9, 17]. This is in agreement with the increased piped water that has been created in peri-urban settlements [9]. With regards to toilets, it is not possible to compare figures with other studies, as they did not separate private and public toilets. The number of bucket and pit latrines seems to have decreased, but the number of people who have no sanitation at all is greater than the SADHS statistics [9]. These figures show an increase of

sanitation services to the more formal structures which will hopefully have an impact on health. No association was found between water source or type of toilet and GBMI.

The average parity in this sub-study was lower than the mean African black population [23]. The discrepancy could be due to the fact that this sub-study is not measuring the parity of both urban and rural populations. The lower number could also be due to the increased urbanisation and family planning offered to women which has been seen in the rest of South Africa [23]. There was no significant association between parity and GBMI. It should follow from results of other studies that if parity is reduced, obesity should also be reduced, but it has been found that black African women retain more weight postpartum and this outweighs the effect of reduced parity [31].

There was a low percentage of participants who tested for TB and of those who tested positive, there was a similar incidence compared with health reports undertaken in Khayelitsha [13]. A high percentage of participants had tested for HIV/AIDS. This is comparable with health reports that have shown that being tested for HIV/AIDS in the antenatal clinics is becoming more culturally acceptable [13]. The prevalence of HIV/AIDS was 25.9%, this is in accordance with the decrease in prevalence of HIV/AIDS in pregnant women in Khayelitsha due to increased testing and prevention strategies [13]. Previously HIV/AIDS was associated with an increased risk for losing weight, however it was found in a meta-analysis that with the increased education, urbanisation and use of Anti-Retroviral Drugs (ARV), the proportion of HIV positive women with a low BMI has decreased [42]. The present sub-study had the lowest proportion of HIV positive women in the underweight GBMI category. This is lower than findings from previous studies [43–46]. No significant association was found between either TB or HIV status and GBMI.

Limitations

No participants under the age of 18 years were included in the study and therefore the sub-study. One in ten women aged between 15 and 19 years has had at least one child. Most of the information was from participant's memory recollection. Quality of the data is therefore variable.

Conclusion

To the best of our knowledge this sub-study is the first to examine the associations between SEV and GBMI in a peri-urban pregnant black population in South Africa. There was no evidence of an association with any SEV and GBMI except household income. Women who had a lower household income were at an increased risk of being in the underweight GBMI category during pregnancy. This could increase the risk of adverse birth outcomes such as premature birth and low birthweight, height and head circumference. Women with lower incomes need to be identified and priority given during antenatal clinic appointments and labour. Optimal nutrition health promotion policy targeting women before and during conception should be implemented. Once implemented, they need to be evaluated to assess the impact on maternal and child mortality

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Table 1

Characteristics, anthropometry and socioeconomic variables of participants (percentage and number or mean $\pm$ standard deviation)

Characteristics	Mean $\pm$ SD	Percentage (%)	Number (N)
Age	26.28 $\pm$ 5.45		1,145
Height	1.59 $\pm$ 0.06		1,145
GBMI	27.32 $\pm$ 5.8		1,145
% Underweight (GBMI)		4.98	57
% Normal (GBMI)		43.41	497
% Overweight (GBMI)		18.08	207
% Obese (GBMI)		33.53	384
<i>Smokers</i>			
No		96.4	1,105
Yes		3.5	40
<i>Identity document</i>			
No		10.8	124
Yes		89.2	1,021
<i>Language</i>			
Xhosa		93.1	1,065
Other		6.3	72
English		0.2	2
Zulu		0.4	4
<i>Marital status</i>			
Single		43.2	495
Married/Cohabiting		56.8	650
<i>Education</i>			
Primary		7.9	90
Secondary		88.6	1,015
Tertiary		3.5	40
<i>Employed</i>			
No		80.9	926
Yes		19.1	219
<i>Household monthly income</i>			
0–2000 SAR		55.5	635
> 2000 SAR		44.5	510
<i>Type of housing</i>			
Informal		35.9	412
Formal		64.1	733
<i>Electricity</i>			
No		10.7	123
Yes		89.3	1,022
<i>Parity</i>			

Characteristics	Mean $\pm$ SD	Percentage (%)	Number (N)
0		38.7	443
1–2		53.4	612
3		5.4	62
> 4		2.5	28
<i>Previous still births</i>			
No		72.2	827
Yes		27.8	318
<i>Termination of previous pregnancy</i>			
No		94.4	1,081
Yes		5.6	64
<i>Previous low birth weight (LBW) babies</i>			
No		90.1	1,033
Yes		9.9	112
<i>TB tested this pregnancy (20.2%)</i>			
Negative TB result		98.3	228
Positive TB result		1.7	4
<i>HIV test this pregnancy (91.4%)</i>			
Negative HIV result		74.1	272
Positive HIV result		25.9	775

Table 2

Multinomial comparisons for categorical data (N = 1,145)

Socioeconomic variable	Underweight category				Normal weight category				Overweight category				Obese category			
	GBMI (> 10 to < 19.8 kg/m ²)				GBMI (> 19.8 to < 26.1 kg/m ²)				GBMI (> 26.1 < 29 kg/m ²)				GBMI (> 29 to < 50 kg/m ²)			
	n	%	OR	95% CI	n	%	OR	95% CI	n	%	OR	95% CI	n	%	OR	95% CI
Smoking			2.226	0.292,16.946			1				0.989	0.426,2.296			1.232	0.591,2.571
No	56	98.2			478	96.2			199	96.1			372	96.9		
Yes	1	0.8			19	3.8			8	3.9			12	3.1		
Identity document			1.167	0.528,2.581			1				0.681	0.392,1.183			0.762	0.495,1.174
No	8	14			61	12.3			18	8.7			37	9.6		
Yes	49	86			436	87.7			189	91.3			347	90.4		
Booked antenatal clinic			1.422	0.768,2.634			1				1.254	0.859,1.831			1.084	0.787,1.492
No	16	28.1			107	21.5			53	25.6			88	22.9		
Yes	41	71.9			390	78.5			154	74.4			296	77.1		
Marital status			1.612	0.928,2.800							0.826	0.594,1.149			0.909	0.695,1.190
Single	32	56.1			220	44.3			82	39.6			161	41.9		
Married/cohabiting	25	43.9			227	55.7			125	60.4			223	58.1		
Employed			1.391	0.637,3.038			1				0.818	0.548,1.220			0.952	0.677,1.337
No	49	85.9			405	81.5			162	78.3			310	80.7		
Yes	8	14.1			92	18.5			45	21.7			74	19.3		
Income (SAR)			2.145	1.184,3.885*			1				1.096	0.791,1.517			1.249	0.955,1.634
0–2000 SAR	40	70.2			260	52.3			113	54.6			222	57.8		
> 2000 SAR	17	29.8			237	47.7			94	45.4			162	42.2		
Housing type			1.392	0.740,2.620			1				0.765	0.545,1.075			1.115	0.833,1.491
Informal	43	75.4			342	68.8			130	65			273	71.1		
Formal	14	25.6			155	31.2			70	35			111	28.9		
Electricity			1.252	0.539,2.909			1				1.172	0.700,1.965			1.098	0.712,1.694
No	7	12.3			50	10.1			24	11.6			42	10.9		
Yes	50	87.7			447	89.9			183	88.4			342	89.1		
Previous stillbirths			1.341	0.701,2.565			1				0.885	0.621,1.260			1.125	0.833,1.581
No	44	77.1			356	71.6			143	69.1			284	73.9		

Socioeconomic variable	Underweight category				Normal weight category				Overweight category				Obese category			
	GBMI (> 10 to < 19.8 kg/m ²)				GBMI (> 19.8 to < 26.1 kg/m ²)				GBMI (> 26.1 < 29 kg/m ²)				GBMI (> 29 to < 50 kg/m ²)			
	n	%	OR	95% CI	n	%	OR		n	%	OR	95% CI	n	%	OR	95% CI
Yes	13	22.9			141	28.4			64	30.9			100	26.1		
Termination previous pregnancy			0.851	0.289,2.510			1				1.044	0.524,2.081			1.306	0.717,2.380
No	53	92.9			467	93.9			195	94.2			366	95.3		
Yes	4	7.1			30	6.1			12	5.8			18	4.7		
Previous low birth weight baby			1.189	0.454,3.113			1				1.201	0.683,2.110			1.041	0.669,1.621
No	52	91.2			446	89.7			189	91.3			346	90.1		
Yes	5	8.8			51	10.3			18	8.7			38	9.9		
Tuberculosis status			287641.1	?			1				0.415	0.026,6.672			0.385	0.035,4.263
Negative	57	100			496	99.7			206	99.7			382	99.4		
Positive	0	0			1	0.3			1	0.3			2	0.6		
HIV status			1.131	0.590,2.170			1				1.050	0.719,1.532			1.147	0.837,1.571
Negative	44	77.2			368	74.9			157	75.8			295	77.4		
Positive	13	22.8			123	25.1			50	24.1			86	22.6		
Age Quartiles (years)																
< 22	17	29.8	1.262	0.569,2.796	147	29.6			64	30.9	1.136	0.725,1.780	101	26.3	0.982	0.673,1.431
22.1–26	11	19.3	1.121	0.467,2.691	107	21.5			41	19.8	1.000	0.609,1.640	95	24.7	1.268	0.857,1.878
26.1–30	18	31.6	1.596	0.724,3.522	123	24.7			56	27.1	1.188	0.747,1.889	104	27.1	1.208	0.824,1.770
> 30	11	19.3	1		120	24.1			46	22.2	1		84	21.9	1	
Height Quartiles (meters)																
< 1.54	13	22.8	1.027	0.452,2.334	134	27.0			47	22.7	0.636	0.409,0.990	111	28.9	1.182	0.817,1.711
1.541–1.59	11	19.3	1.200	0.508,2.836	97	19.5			35	16.9	0.655	0.403,1.062	82	21.4	1.206	0.809,1.799
1.591–1.63	21	36.8	1.599	0.756,3.381	139	28.0			55	26.6	0.718	0.468,1.101	102	26.6	1.047	0.722,1.520
> 1.631	12	21.1	1		127	25.6			70	33.8	1		89	23.2	1	
Parity																
0	22	38.6	0.645	0.174,2.390	182	36.6			90	43.5	1.978	0.643,6.089	149	38.8	2.620	0.938,7.318
1–2	28	49.1	0.545	0.150,1.986	274	55.1			102	49.3	1.489	0.486,4.559	208	54.2	2.429	0.876,6.738
3	4	7.0	0.853	0.168,4.326	25	5.0			11	5.3	1.760	0.477,6.491	22	5.7	2.816	0.886,8.948
> 4	3	5.3	1		16	3.2			4	1.9	1		5	1.3	1	
Education																

Socioeconomic variable	Underweight category				Normal weight category				Overweight category				Obese category			
	GBMI (> 10 to < 19.8 kg/m ²)				GBMI (> 19.8 to < 26.1 kg/m ²)				GBMI (> 26.1 < 29 kg/m ²)				GBMI (> 29 to < 50 kg/m ²)			
	n	%	OR	95% CI	n	%	OR	95% CI	n	%	OR	95% CI	n	%	OR	95% CI
Primary	3	5.3	1.500	0.146,15.461	36	7.2	1		14	6.8	0.778	0.283,2.137	37	9.6	1.542	0.651,3.653
Secondary	53	93.0	2.153	0.282,16.458	443	89.1	1		184	88.9	0.831	0.366,1.883	335	87.2	1.134	0.539,2.387
Tertiary	1	1.8	1		18	3.6	1		9	4.3	1		12	3.1	1	

GBMI gestational body mass index, *n* number, OR odds ratio, CI confidence interval, SAR South African Rands, HIV human immunodeficiency virus,

* $P < 0.05$