The Socio-economic Determinants of Obesity in Adults in the Bahamas

N Brathwaite[1], A Brathwaite[2], M Taylor[3]

ABSTRACT

Objective: *To determine the socio-economic determinants of obesity in adults in The Bahamas.*
Design and Methods: *A subpopulation of adults 21 to 60 years was analysed for socio-economic differences in obesity levels. Data from the 2001 Bahamas Living Conditions Survey, a nationwide comprehensive household survey which included anthropometric measurements, were used. Bivariate and binary logistic regression methods for complex samples were employed.*
Findings: *Overall obesity prevalence was 32% (38% female, 25% male, p = < 0.0001). An inverse relationship by education appeared to be the strongest predictor for all persons (OR = 0.78, CI 0.67, 0.90; p < 0.0001). This relationship was also evident for females (OR = 0.71, CI 0.59, 0.85; p < 0.0001) while a positive relationship existed by economic level for males (OR = 1.23, CI 1.07, 1.41; p = 0 .005).*
There was a difference in food group expenditure for starchy vegetables only (p = 0.049). Other food group household expenditure, urban residence and female headed households showed no significant differences by obesity.
Conclusions: *In line with international trends, obesity rates are high in The Bahamas, and especially affect females of lower socio-economic status. Public policy that targets this group is necessary to address this health concern.*

Keywords: Food expenditure, obesity, SES, urban

Las Determinantes Socioeconómicas de la Obesidad en los Adultos de Bahamas

N Brathwaite[1], A Brathwaite[2], M Taylor[3]

RESUMEN

Objetivo: *Establecer cuáles son las determinantes socio-económicas de la obesidad en los adultos en Bahamas.*
Diseño y Métodos: *Se analizó una subpoblación de adultos de 21 a 60 años en busca de las diferencias socio-económicas según los niveles de obesidad. Se usaron los datos de la Encuesta 2001 sobre las condiciones de vida en Bahamas – una encuesta general doméstica nacional que incluyó mediciones antropométricas. Se emplearon métodos de regresión logística bivariados y binarios para las muestras complejas.*
Resultados: *La prevalencia de obesidad global fue de 32% (38% hembras, 25% varones, p = < 0.0001). Una relación inversa para la educación pareció ser el predictor más fuerte para todas las personas (OR = 0.78, CI 0.67[N1], 0.90; p < 0.0001). Esta relación también se hizo evidente en las hembras (OR = 0.71, CI 0.59, 0.85; p < 0.0001) mientras que una relación positiva existió en el nivel económico para los varones (OR = 1.23, CI 1.07, 1.41; p = 0 .005).*
Hubo una diferencia en el gasto del grupo de alimentos en cuanto a verduras ricas en fécula solamente (p = 0.049). Otro gasto doméstico de grupo de alimentos, residencia urbana, y casas encabezadas por mujeres, no mostraron diferencias significativas en obesidad.
Conclusiones: *En concordancia con las tendencias internacionales, las tasas de obesidad son altas en Bahamas, y afectan sobre todo a las mujeres de más bajo estatus socio-económico. Se necesitan políticas públicas dirigidas a este grupo, a fin de abordar este problema de salud.*

From: [1]Ministry of Health, Nassau, The Bahamas, [2]Rand Memorial Hospital, Freeport, The Bahamas (Ret), and [3]Ministry of Education, Nassau, The Bahamas.

Correspondence: NV Brathwaite, PO Box N-921, Nassau, Bahamas, Fax: (242) 502-4802; e-mail: nanikab@hotmail.com.

Palabras claves: Gasto en alimentos, obesidad, estatus socio-económico (ESE), urbano

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INTRODUCTION

The relationship between socio-economic status (SES) and health has been well established in the literature. Looking at differences in longevity, Davey Smith (1) studied graveyard tombstones of those who died between 1800 and 1920 in Scotland, finding that those whose age at death was significantly older had fancier and taller grave markers, indicating family wealth (1). While specific diseases may be more prevalent among different social classes (2), the present prevailing view is that there exists a positive relationship between health and social class; poor health as defined by a number of ailments seems to be more likely to occur among the disadvantaged, while the rich seem to have the benefit of better health (1, 2).

Obesity is a health condition that appears to affect mainly those with lower socio-economic status. The World Health Organization definition of obesity is having a Body Mass Index (BMI), a ratio of weight and height, specifically the weight in kilograms divided by the square of the height in metres [kg/m^2], equal to or greater than 30 (3). This condition is becoming even more apparent in the face of an "obesity epidemic" that is affecting many nations, especially indus-trialized countries. Many have discussed the obesity para-dox, which lies in the fact that in industrialized countries, it is the relatively poor who show higher obesity rates. There is an opposite effect in developing countries, as obesity is more prevalent among the middle and higher classes; for the most part, obesity is a sign of health and wealth in these societies (4, 5). Recent findings, however, have found this striking difference between developed and developing countries narrowing, due to globalization trends and increasing GNP per capita (6, 7).

The Caribbean appears to be in the grips of this obesity crisis (8). While the English-speaking Caribbean has not yet reached industrial nation status, some studies have shown that obesity may be a condition of the poor here as well, mirroring trends of its neighbour, the United States of America (9–13). Most of these authors especially stress the disproportionate toll obesity has on women of lower SES.

Obesity is affecting The Bahamas as well. The Bahamas Living Conditions Survey, 2001 (14) has determined that two thirds (65%) of its adult population 21 to 60 years are overweight or obese. The report went on to say that "The Bahamas, like many other high-income countries, is experiencing an obesity epidemic" (14). The National Health and Nutrition Survey of 1989 showed that the overweight and obese prevalence of adults 15–64 years was 49% (14).

Being obese is a health problem as it increases the risk for comorbid conditions such as hypertension, other heart diseases, diabetes and stroke (8, 15). These all lead to an increased possibility for premature mortality (15, 16). International research has been linking obesity to other illnesses, such as certain types of cancer, specifically endometrial, post-menopausal breast and colon cancers (15). Treatment for these mostly preventable diseases places an unnecessary burden on the health system, not to mention their social, psychological and economic toll. These conditions, in line with obesity, have risen in prevalence in many parts of the world, including the Caribbean and The Bahamas.

The purpose of this paper is to determine the socio-economic aspects of adult obesity in The Bahamas, particularly economic status and education. Other aspects, all linked with SES, are also examined, namely urban living, female headed households and food expenditure.

HYPOTHESIS AND METHODS

This study is to test whether an inverse relationship exists in The Bahamas between specified aspects of socio-economic status and obesity among adults age 21 to 60 years. The measures of socio-economic status applied are economic level as measured by household expenditure, education and parents' education. Differences by urban *versus* rural residence, whether residents lived in a female-headed household and food group household annual expenditure were also studied. Rural areas were characterized in the Bahamas living conditions survey (BLCS) as having a higher proportion of poor households when compared to urban areas. Female-headed households carry an increased vulnerability to economic hardship (14). As for food expenditure, certain food groups, primarily starches, are cheaper and usually comprise a greater share of food expenditure in poorer households. This may contribute to increased obesity (8, 14, 17).

Data Source

Data from The Bahamas Living Conditions Survey, 2001 (14) were used (n = 6947). This comprehensive household survey was the first living conditions survey for The Bahamas, with the primary purpose to measure poverty using several topics, including household expenditure on food and non-food items, use of social programmes, a health component and general characteristics of the population. Data were collected using a representative sample of approximately 2000 randomly selected households in The Bahamas, including New Providence Island, on which the capital Nassau is located, and the outlying islands. This represented around 2% of all households.

A multi-staged complex sampling design of both clustering and stratification was employed. There were 4 strata, which consisted of island groupings in descending order of population and development: 1, Grand Bahama, New Providence; 2, Abaco, Andros, and Eleuthera; 3, Exuma and Long Island, and 4, Other Family Islands. The clusters, 100, were enumeration districts within each island (a more detailed report of the sampling methods and survey design is in the technical appendix to the BLCS report).

The health component followed the main survey, with the intention to measure health aspects of all participating households of the original survey (n = 4450, a coverage rate of 64%). Registered nurses were used as interviewers and measurers for this process. Certain individuals in the selected households were asked questions from a separate questionnaire designed to measure more specific health aspects. Anthropometric measures of individuals 2 to 60 years old were recorded using measuring tape and scales for height and weight respectively. This was then used to calculate BMI.

Variables

Outcome (dependent) variable

The dependent variable is obesity, using BMI as a measure. This binary variable was created by assigning 1 to BMI $\geq$ 30.00 and 0 to BMI < 30.00.

Predictor (independent) variables

Socio-economic status variables

Economic status was used as is in the dataset. This was estimated using annual per-capita consumption expenditure, as opposed to income (14). Expenditure patterns were measured at both the household and individual level, and assigned to each individual in that household. These were then grouped into 5 quintiles, in ascending order of annual expenditure: persons, in the lowest and poorest quintile 1, had expenditure ranges of B$ (comparable to US$) $0.00 to $3967.99; next to lowest quintile 2, $3968.00 to $5947.99; quintile 3, the middle, $5948.00 to $8523.99; quintile 4, next to highest, $8524.00 to $13 446.99; quintile 5, the wealthiest, $13 447.00 to infinity.

Education was also used as is in the data with slight changes in grouping and order. Education, measured as the highest education level achieved for each individual, was recoded in ascending order from 1, no education through primary school; 2, high school education 3, technical/ vocation school; 4, college/university. Those who did not know their highest educational attainment (n = 31) were assigned as missing. Father's and mother's education were also recoded as described.

Other predictor variables

Female-headed households was used as already defined in the dataset, with a female-headed household assigned as 1 for each individual in this household, and 0 for a non-female-headed household.

An urban/non-urban variable was created using the island groups/strata as already defined. Stratum 1, New Providence and Grand Bahama, the two most populous islands comprising 85% of the population, was considered urban and coded 1. All other strata (all other islands), were coded 0, non-urban. This way of defining urban and rural islands is widely used and accepted in The Bahamas.

Food expenditure was the annual expenditure for food categories as described in the BLCS. These food categories, conveyed to respondents as grocery items, were food consumed inside the home, specifically cereals, starchy vegetables, sugars, legumes, vegetables, fruits, animals, fats and oils, and other food. Food expenditure for outside home consumption rounded out total food expenditure. A variable was then created by computing for each food group as a percentage of the total food expenditure.

Sex, coded as 1 for males, and 2 for females, was used as is.

Sample weighting

A sample weight (Factor) was in the dataset. The sampling design was self-weighting, which means that the probability of a household being selected is the same for all households in the population. This resulted in a fixed sampling interval for all strata, with different fractions for each stratum. An adjustment factor was applied at the enumeration district level for non-responses to preserve the self-weighting nature. The sampling fraction (Factor variable) is therefore equal to the number of assigned dwellings divided by the number of dwellings accepted for analysis (14).

Statistical analyses

Variance estimation and statistical analysis methods for complex samples (different from those typically employed, which infers simple random samples) were applied in this study. This includes using weighted estimates (variable Factor already in the dataset) and showing design effects, a ratio to measure the effects of survey design variance compared to simple random survey variance.

Exploratory and descriptive analyses testing for differences in categories against the dependent variable were conducted with contingency tables. The Rao-Scott chi-square-like F-Test for surveys was performed for tests of significance. Binary logistic regression (backward elimination) was then performed for all, then for males and females separately, using only variables where significance was < 0.25 with the binary tests. Obesity (1, 0) was the outcome variable, and sex, household expenditure quintile, education, urban, female-headed household, and food expenditure share for each food group as the predictor variables. Parents' education was not used in the regression analyses due to the close relationship with respondent's education (multicollinearity). Beta-coefficients were estimated using "Pseudo" Maximum Likelihood method, and Wald Chi-Square F tests for statistical significance.

All standard error estimates were calculated using the Taylor Series Linearization method. Analyses were performed using *Stata* (Version 10.1) using svy: prop, svy: tab, svy: mean and svy: logistic commands. Significance testing was set at < 0.05. The subpopulation under study was adults age 21 to 60 years whose anthropometric measures were taken (n = 2469).

RESULTS

Bivariate analyses

In the subpopulation of adults 21 to 60 years, the mean BMI was 28.0. About a third (32%) was characterized as obese (25% males, 38% of females, $p < 0.0001$). There were significant inverse associations for obesity by education levels of the respondent ($p = 0.0001$) and mothers education ($p = 0.022$). Significance was not evident by expenditure quintile ($p = 0.485$), urban ($p = 0.661$), female-headed household ($p = 0.285$), or father's education ($p = 0.120$) [Table 1]. Design effects ranged from 0.83 (non-urban) to 3.3 (mother's education = high school). Closer examination of education reveals that those whose highest education was high school had the highest level of obesity at 36%, when compared to the other groups, even those with less than high school education (25% obese).

Among males 21 to 60 years old (Table 2), there was a difference for education only ($p = 0.017$). Among females (Table 3), differences existed for expenditure quintile ($p = 0.006$), education ($p = 0.0001$), mother's education ($p = 0.002$) and father's education ($p = 0.021$). Design effects for males ranged from 0.9 (non-urban) to 3.3 (non-female-headed household, mother's education = high school). For

Table 1: Rao-Scott Chi-square results of per cent obese by predictor categories, adults 21 to 60 years (n = 2469)

Independent Variables	**Categories**	**Sub-Sample Size (n)**	**Subpopulation Total Weighted Proportion %**	***(95% CI)***	***Per cent Obese***	***95% CI Per cent Obese***	**Chi-Square F Test *p*-value**	**Design Effect**
Sex (n = 2469)	Male	1254	48.6	(46.1, 51.1)	***25.2***	*21.3, 29.5*	**< 0.00001**	2.7
	Female	1215	51.4	(48.9, 53.9)	***37.8***	*33.7, 42.2*		2.4
Expenditure Quintile (n = 2469)	1 (poorest)	415	14.8	(10.8, 18.9)	***31.1***	*24.7, 38.3*	0.485	2.0
	2	459	16.6	(13.4, 19.9)	***35.1***	*28.2, 42.8*		2.5
	3	504	20.4	(17.5, 23.4)	***34.3***	*27.9, 41.4*		2.6
	4	522	22.4	(19.1, 25.6)	***27.8***	*22.7, 33.4*		2.0
	5 (wealthiest)	569	25.7	(20.8, 30.6)	***31.1***	*25.1, 37.9*		3.1
Education (n = 2438)	Primary school or less	259	7.7	(5.6, 9.9)	***24.9***	*16.5, 33.3*	**0.0001**	1.8
	High school	1637	66.5	(62.8, 70.2)	***36.3***	*32.4, 40.4*		2.9
	Technical/Vocational	101	4.5	(3.3, 5.6)	***22.2***	*13.8, 33.6*		1.6
	College/University	441	21.3	(17.4, 25.3)	***23.0***	*18.3, 28.5*		2.0
Urban (n = 2469)	Non-urban	1086	13.7	(12.0, 15.3)	***32.8***	*28.5, 37.3*	0.661	0.8
	Urban	1383	86.3	(84.7, 88.0)	***31.5***	*28.0, 35.2*		3.2
Female Headed Household (n = 2469)	Non-female-headed	1679	64.3	(60.3, 68.2)	***30.4***	*26.5, 34.6*	0.285	3.1
	Female-headed	790	35.7	(31.8, 39.7)	***34.0***	*29.1, 39.2*		2.6
Mother's Education (n = 2036)	Primary school or less	992	40.4	(35.5, 45.3)	***34.5***	*29.5, 39.9*	**0.022**	2.5
	High school	923	52.2	(47.6, 56.7)	***29.0***	*24.2, 34.3*		3.3
	Technical/Vocational	32	2.0	(0.7, 3.3)	***29.3***	*11.7, 56.7*		2.8
	College/University	89	5.4	(4.1, 6.8)	***12.9***	*7.1, 22.4*		1.4
Father's Education (n = 1777)	Primary school or less	873	40.2	(34.9, 45.6)	***33.1***	*28.0, 38.7*	0.120	2.3
	High school	779	51.4	(46.5, 56.4)	***30.3***	*26.2, 34.7*		2.0
	Technical/Vocational	24	1.6	(0.8, 2.4)	***12.2***	*3.4, 35.9*		1.5
	College/University	101	6.8	(4.9, 8.6)	***22.6***	*14.0, 34.3*		1.8

Source: Bahamas Living Conditions Survey, 2001

Table 2: Rao-Scott Chi-square results of per cent obese by predictor categories, male adults 21 to 60 years (n = 1254)

Independent Variables	**Categories**	**Sub-Sample Size (n)**	**Subpopulation Total Weighted Proportion %**	**(95% CI)**	***Per cent Obese***	***95% CI Obese***	**Chi-square F Test *p*-value**	**Design Effect**
Expenditure Quintile (n = 1254)	1 (poorest)	198	13.2	(9.3, 17.1)	***19.3***	*12.4, 28.9*	0.143	1.8
	2	234	17.2	(13.3, 21.0)	***20.8***	*13.9, 29.9*		2.1
	3	255	20.2	(16.9, 23.6)	***25.6***	*17.9, 35.2*		2.5
	4	259	22.2	(18.8, 25.7)	***22.9***	*16.1, 31.5*		2.4
	5 (wealthiest)	308	27.2	(22.0, 32.5)	***32.3***	*24.7, 42.0*		2.7
Education (n = 1238)	Primary school or less	142	8.3	(5.4, 11.2)	***12.1***	*6.5, 21.5*	**0.017**	1.3
	High school	859	69.8	(65.1, 74.6)	***29.0***	*24.3, 34.3*		2.7
	Technical/Vocational	64	6.1	(4.2, 8.0)	***19.9***	*10.1, 35.5*		1.9
	College/University	173	15.7	(11.3, 20.2)	***20.1***	*12.8, 30.1*		2.3
Urban (n = 1254)	Non-urban	595	15.4	(13.5, 17.3)	***23.7***	*18.5, 29.8*	0.631	.9
	Urban	659	84.6	(82.7, 86.5)	***25.5***	*21.1, 30.4*		3.1
Female Headed Household (n = 1254)	Non-female-headed	1033	80.5	(76.7, 84.3)	***26.2***	*21.5, 31.4*	0.253	3.3
	Female-headed	221	19.5	(15.7, 23.4	***21.1***	*15.3, 28.3*		1.6
Mother's Education (n = 1028)	Primary school or less	501	39.4	(33.9, 45.0)	***23.2***	*18.0, 29.3*	0.101	1.8
	High school	461	52.5	(47.0, 58.0)	***28.6***	*22.1, 36.0*		3.3
	Technical/Vocational	21	2.4	(0.5, 4.3)	***19.5***	*4.2, 56.8*		2.8
	College/University	45	5.7	(3.6, 7.8)	***5.9***	*1.1, 26.5*		2.5
Father's Education (n = 913)	Primary school or less	451	39.0	(32.8, 45.2)	***24.2***	*18.5, 30.9*	0.355	1.9
	High school	402	52.9	(46.6, 59.2)	***28.9***	*22.5, 36.2*		2.8
	Technical/Vocational	10	1.1	(0.3, 2.0)	***0***	*n.a.*		n.a.
	College/University	50	7.0	(4.4, 9.5)	***23.4***	*11.7, 41.4*		2.0

Source: Bahamas Living Conditions Survey, 2001

females, the effects of the survey design were the lowest for non-urban (0.5) and the highest for urban (2.6).

As for mean differences in food group expenditure, there was a difference for starchy vegetables (p = 0.049). Obese persons resided in households where the mean per cent spent on starch vegetables was 5.2%, compared to non-obese persons at 4.7%. This pattern existed for males as well (p = 0.038; 5.7% obese, 4.4% non-obese). No significant differences in food expenditure were revealed for females.

Multivariate analyses

Sex (OR = 1.85) and education (OR = 0.78) were the final predictors in the logistic regression model for all adults (Table 4), with both variables significant. Females had an 85% increased odds of being obese over males, and each educational increment showed a 22% decreased odds. The design effect for both predictors was 2.3. For males (Table 5), the final predictors were expenditure quintile (OR = 1.23) and starchy vegetables (OR = 1.07). Males had increased odds of being obese the higher the expenditure quintile and house-hold expenditure share of starchy vegetables. Design effects were 1.9 and 2.5 respectively. Education remained the final and only independent variable for females (OR = 0.71) [Table 6] revealing an inverse relationship. The design effect was 2.1.

DISCUSSION

The strongest predictors for obesity in The Bahamas for adults appear to be female with less than tertiary level education. Upon closer examination of the bivariate analyses, those with high school education had the highest rates of obesity, even when compared to their counterparts with less than a high school education (this was also true for both sexes). Those with the lowest rates of obesity among all groups were individuals whose mother's education was college/university (13%). It was surprising, however, that food expenditure did not have more of an effect on obesity. This may be due to household measures of expenditure and not individual consumption. More in-depth analysis of each food group as defined by the Department of Statistics is needed.

For males, the outcome was stronger for economic level (expenditure quintile) and higher household expenditure for starchy vegetables, though the effect for the latter

Table 3: Rao-Scott Chi-square results of per cent obese by predictor categories, female adults 21 to 60 years (n = 1215)

Independent Variables	**Categories**	**Sub-Sample Size (n)**	**Subpopulation Total Weighted Proportion %**	***(95% CI)***	***Per cent Obese***	***95% CI Per cent Obese***	**Chi-square F Test *p-v*alue**	**Design Effect**
Expenditure Quintile (n = 1215)	1 (poorest)	217	16.3	(11.4, 21.3)	***40.1***	*31.2, 49.7*	**0.006**	1.8
	2	225	16.2	(12.8, 19.6)	***49.5***	*39.6, 59.5*		2.0
	3	249	20.7	(17.2, 24.2)	***42.4***	*34.3, 51.0*		1.9
	4	263	22.5	(18.4, 26.6)	***32.3***	*25.8, 39.5*		1.5
	5 (wealthiest)	261	24.3	(19.2, 29.4)	***29.9***	*23.5, 37.1*		1.7
Education (n = 1200)	Primary school or less	117	7.2	(5.1, 9.4)	***36.7***	*25.9, 49.0*	**0.0001**	1.3
	High school	778	63.3	(59.4, 67.3)	***43.9***	*38.6, 49.4*		2.3
	Technical/Vocational	37	2.9	(1.8, 4.0)	***26.6***	*13.3, 46.2*		1.3
	College/University	268	26.6	(22.3, 30.8)	***24.6***	*18.6, 31.9*		1.9
Urban (n = 1215)	Non-urban	491	12.1	(10.2, 13.9)	***43.8***	*38.0, 49.8*	0.080	0.5
	Urban	724	87.9	(86.1, 89.8)	***37.0***	*32.4, 41.9*		2.6
Female Headed Household (n = 1215)	Non-female-headed	646	48.9	(44.4, 53.5)	***37.0***	*32.1, 42.3*	0.678	1.7
	Female-headed	569	51.1	(46.5, 55.6)	***38.6***	*32.7, 44.9*		2.5
Mother's Education (n = 1008)	Primary school or less	491	41.3	(35.8, 46.9)	***44.6***	*37.9, 51.5*	**0.002**	2.0
	High school	462	51.9	(46.6, 57.2)	***29.3***	*23.7, 35.7*		2.3
	Technical/Vocational	11	1.6	(.20, 3.0)	***43.0***	*14.1, 77.6*		2.4
	College/University	44	5.2	(3.6, 6.7)	***20.1***	*10.8, 34.5*		1.2
Father's Education (n = 864)	Primary school or less	422	41.5	(35.3, 47.6)	***41.4***	*34.4, 48.7*	**0.021**	1.9
	High school	377	50.0	(44.4, 55.5)	***31.7***	*26.3, 37.6*		1.6
	Technical/Vocational	14	2.1	(.71, 3.4)	***18.7***	*4.9, 50.5*		1.5
	College/University	51	6.5	(4.5, 8.5)	***21.7***	*12.3, 35.5*		1.1

Source: Bahamas Living Conditions Survey, 2001

Table 4: Survey logistic results for final models – all

	***p*-value**	**Final Model (All Adults) Odds Ratio *(95% Wald Confidence Limits)***	**Design Effect**
Wald Test (nullβ = 0)	< 0.00001		
Gender			
1 = Male (*Referent*) 2 = Female	< 0.00001	**1.85** *(1.41, 2.43)*	**2.3**
Education			
1 = Primary or less 2 = High school 3 = Technical/Vocational 4 = College/University	0.001	**0.780** *(0.672, .904)*	**2.3**

Source: Bahamas Living Conditions Survey, 2001

Table 5: Survey logistic results for final model – males

	***p*-value**	**Final Model (Males) Odds Ratio *(95% Wald Confidence Limits)***	**Design Effect**
Wald Test (nullβ = 0)	0.0013		
Expenditure Quintile			
1 = Poorest 2 = Next to poorest 3 = Middle 4 = Next to wealthiest 5 = Wealthiest	0.005	**1.23** *(1.07, 1.41)*	**1.9**
% Expenditure starchy vegetables	0.002	**1.07** *(1.03, 1.12)*	**2.5**

Source: Bahamas Living Conditions Survey, 2001

Table 6: Survey logistic results for final model – females

	p-value	Final Model (Females) Odds Ratio (*95% Wald Confidence Limits)*	Design Effect
Wald Test (nullβ = 0)	0.0003		
Education 1 = Primary or less 2 = High school 3 = Technical/Vocational 4 = College/University	< 0.00001	**0.706** *(0.586, 0.850)*	**2.1**

Source: Bahamas Living Conditions Survey, 2001

was not very strong. The positive relationship for males by expenditure quintile is in line with previous surveys that suggested similar patterns (18) for urban males, suggesting higher economic status of this group compared to their rural counterparts. This may be due to decreased physicality, and it is suggested that many males in higher socio-economic levels have more sedentary occupations. It was therefore unexpected for this study that being an urban male was no more a predictor than living in a rural area.

For females, education appeared to be a stronger predictor. It should be noted though that economic level was also a predictor in the univariate female logistic model. In other words, just as education was the only predictor for females, it could very well have been quintile, but the two could not be in the model together, more than likely due to multicollinearity. Education was chosen as the *p*-values were lower for this model. These findings are in line with previous research as well and the literature suggests several possible mediators: societal attitudes toward fatness in developed societies for women, which is felt more strongly by women of high SES than those of low SES, social mobility, and SES and obesity status of parents [inheritance] (4). Olsen (19) found that food deprivation in childhood influenced attitudes toward food in adulthood for women. Increased parity may also play a role in women of lower SES (12).

The main limitation was that the dataset used was from a survey conducted in 2001, and more recent data were not available. The authors feel secure in the findings from the BLCS, however, as robust data collection methods were used, it was representative of all The Bahamas, it contained numerous variables that were in line with the hypothesis testing, and it stood up to international scrutiny. The authors are also confident that there was very little real change in the variables used from 2001 to now.

Another potential variable could be occupation but, unfortunately, this was not coded in the dataset. Also open for further grouping and coding is enumeration district, which can give rise to obesity testing by neighbourhood, popular among schools of social epidemiology (20).

There were also some high design effects due to clustering, especially for the urban variable. Obesity has been argued to be "contagious" (21) and clustering effects of the design may have had an effect on variance estimation for obesity.

In summary, females of lower economic status and less than a tertiary level education appear to be especially vulnerable to being obese. Health education and promotion programmes which target this group, together with policies that stipulate structural changes in their immediate environment, are necessary to reduce their high rates of obesity.

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