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PREVALENCE AND DETERMINANTS OF UNDER-AND OVER-NUTRITION AMONG ADULT KENYAN WOMEN; EVIDENCE FROM THE KENYA DEMOGRAPHIC AND HEALTH SURVEY 2008-09

Masibo P.K[1], Buluku E[1], Menya D[1] and Malit V.C.[1]

Abstract

Objective: To analyze the prevalence and determinants of over- and under-nutrition among Kenyan adult women with data from the Kenya Demographic and Health Survey (KDHS) (2008-09)

Methods: A nationally representative sample of 5,916 women aged 20 to 49 years in 2008-2009 DHS data was analyzed. The dependant variable was women's nutritional status determined as Body Mass Index (BMI). A BMI <18.5 was considered underweight, above 24.9 was considered overweight and a BMI above 29.9 was considered obese.

Results: The mean age was 31.9 ± (8.4 SD) years while the mean BMI was 23.4 ± (4.6 SD) kg/m^2. Three quarters of the women lived in rural areas and Rift valley province contributed a majority of the participants (26.9%). More than half of the women (54.7%) had achieved primary level of education, 68.5% were married at the time of the survey while 27% were working in agricultural sector. Thirty percent of Kenyan women had over-nutrition as measured by overweight and obesity while 11% were underweight. Regional differentials existed in the distribution of women's nutritional status. Those living in Eastern province were 2 times significantly more likely to be undernourished compared to those living in Nairobi (OR: 2.0, CI; 1.0 – 4.2; p=0.045). Women living in households of lower, lowest and middle wealth quintiles were 80%, 70% and 50% respectively less likely to have over-nutrition compared to those from the highest wealth index households (p<0.001). Women who are married were 1.9 times (CI 1.2 to 3.2) more likely to have over-nutrition compared to those who were not married (p=0.007).

Conclusion: The burden of over-nutrition was higher than under-nutrition among Kenyan women in the 2008-09 DHS survey. The key determinants of under-nutrition include; household wealth, province of residence and education achievement. The key determinants of over-nutrition were; women's age, marital status, smoking status and partner's educational status.

Introduction

Women's health and nutritional status are important matters of Public Health and developmental concern as an integral part of the Millennium Development Goals (MDG) 1,3,4 and 5. Both under- and over-nutrition are important elements of maternal health especially so in the face of rapid nutrition transition and the emerging challenge of the double burden of malnutrition. Both forms of malnutrition have an impact on health and productivity of individuals and societies. On one end, under-nutrition among women is a major predisposing factor for morbidity and mortality among African women, with between 5% and 20% of African women having low BMI (1).

Factors associated with maternal under-nutrition include low socioeconomic status, chronic hunger (2), inadequate food intake, diets low in diversity and with insufficient nutrient density, morbidity, and short inter-pregnancy intervals (1).

Correspondence to: Correspondence: Peninah Masibo. Email; peninahmasibo@gmail.com. Moi University, School of Public Health, Department of Epidemiology and Nutrition, P.O Box 4606,- 30100, Eldoret Kenya.

Others are; inadequate education, unemployment, age, parity, marital status and unfavorable healthy environment (3). Nutritional vulnerability of women results from the increased demands of pregnancy and lactation that are often not met in resource constrained environments. Rising food insecurity and prevalence of HIV places most women at a high risk of malnutrition in Kenya (4). Good maternal nutrition is critical in breaking the intergenerational cycle of malnutrition and poverty. The cycle of under-nutrition also perpetuates the cycle of poverty, because an undernourished child has limited potential for learning and skills development at school, and thus does not achieve his or her full growth and development potential (5). Underweight mothers have a higher risk of low weight babies (6) which is further associated with stunting and underweight in school age children (7).

On the other hand, the prevalence of over-nutrition has continued to rise globally resulting in the nutrition transition (8) in the less developed world coupled with the double burden of malnutrition. This is characterized by the existence of under-

nourishment in children and overweight and obesity among the mothers in the same households (9). This phenomenon was described by Mburu and Okello (2008) (10), in Central Province of Kenya, in a black rural South African community of the Cape Peninsula (11) and in a rural Brazilian population (12). Overweight and obesity is associated with several demographic factors such as, living in urban areas, being married and having attained higher levels of education (13). Over-nutrition has also been described in rural populations and is associated with increasing wealth as well as education (10). It has also been explained that the increasing levels of overweight and obesity in developing countries is attributable to an increased fat intake resulting from adoption of western diets both in rural and urban populations (11). Overweight and obesity is associated with diet related non-communicable diseases such diabetes and hypertension (11,14).

Studies on the dual burden of malnutrition have mainly focused on the occurrence of stunting in children coupled with maternal overweight in the same household (9,10). Little is known about this double burden in adults. The factors associated with both under and over nutrition among women are also less reported. Our main objective was to analyze the prevalence and determinants of over and under nutrition among Kenyan adult women using KDHS data (2008-09).

Nutrition and Public Health interventions such as increased food availability at the household level have mainly focused on underweight women. There has however, been little focus on interventions that target women with overweight and obesity. Appropriate interventions for women with both over- and under-nutrition requires an identification of the extent of the two forms of under-nutrition at a country level as well as identify the determinants.

Methods

Data was analyzed from the KDHS 2008-09 data. A national representative sample of 5,916 women aged 20 to 49 years was included in this analysis. This sample was selected from a total of 8,444 women who were included in the DHS survey. The current analysis excluded adolescent girls less than 20 years, pregnant women and women within two months postpartum.

Nutritional status

Measurement of body mass index (BMI) was used as a measure of nutritional status of the women in this study. Height and weight measurements were taken for interviewed women using standard procedures. BMI defined as weight in kilograms divided by height in meters squared (kg/m2) was used to measure thinness, overweight and obesity as per the WHO cut-offs (15). A BMI below 18.5 was used as cut off for chronic energy under-nutrition, a BMI of above 24.9 was used as cut-off for overweight while BMI above 30 was used to indicate obesity. Overweight and obesity were combined in this analysis and used to define over-nutrition.

The covariates included in this study were household background characteristics, women's characteristics and partner's characteristics.

Household characteristics

These included rural or urban residence, province, wealth index and the sex of household head. The household wealth index was used as a proxy indicator for socio-economic status constructed on the basis of the level of wealth based on data about household ownership of assets and consumer goods, dwelling characteristics and other household socio-economic status characteristics(16). A factor score generated through principal components analysis is assigned to each asset, and the resulting asset scores are standardized in relation to a normal distribution(17). In the present analysis, the wealth index was grouped into lowest, lower, middle, high and highest categories.

Women's characteristics

Women's characteristics included in this analyses were; education level classified as no education, primary, secondary and higher levels; marital status, occupation, work status, use of tobacco substances, access to health insurance, contraceptive use, religion, occupation as well as the number of children ever born.

Partner's characteristics included were the occupation and education level of the partner

Results

The total number of women included in this analysis was 5,916 aged 20 to 49 years. The distribution of the sample in different covariates is shown in Table 1. A higher percentage of the women (74.6%) were from the rural areas compared to 25.4% living in urban areas. Rift valley province contributed the largest sample (26.9%) and North Eastern province contributed the least (1.9%). The highest proportion of women lived in in the highest wealth index quintile (28.6%) and over half (62.6%) were in male headed households. Almost half of the women were above 30 years (48.9%), slightly above half (54.7%) had achieved primary level of education and a further

68.5% were married at the time of the survey. Only 8.3% of adult Kenyan women interviewed had health insurance. The mean age w31.9 ± 8.4 and the mean was BMI of 23.4 ± 4.6 kg/m^2 (Table 2). The prevalence of under-nutrition defined as BMI less than 18.5 was 10.5% while the prevalence of overweight and obesity (BMI >25) was 29.6% (Table 3).

Factors associated with under and overweight/obese

At the bivariate level, the household characteristics significantly associated with women's nutritional status were the area of residence (χ^2 = 259.688, 2df; p<0.001), Province of residence (χ^2 =230.423, df 14; p<0.0001) and household wealth index (χ^2 =577.99, df 8; p<0.001). The prevalence of underweight was higher among rural (12.4%) compared to urban women (5.2) while close to half (44.5%) of the women in the urban areas were overweight or obese compared to 24% among rural women (Table 3). The prevalence of underweight was lowest in Nairobi (3%) and highest in Eastern province (14.1%). On the other hand the prevalence of overweight and obesity was highest in Nairobi and Central provinces (45% and 40%). Women's characteristics significantly associated with nutritional status were age (χ^2=190.453, df 4; p<0.001), education (χ^2= 328.894, 6df; p<0.001), smoking status (χ^2= 77.461, 2df; p<0.001), contraceptive (χ^2= 104.530, 4df; p<0.001), and number of children ever born (χ^2= 95.397, 8df; p<0.001). The prevalence of overweight/obese nutrition increased with age and education levels. The prevalence of underweight was higher (11.9%) among formerly married women compared to never married (9.0%) and currently married (10.5%) women. The prevalence of underweight was higher among those with five or more births (13.6%) while those with two births had the highest level of overweight and obesity (36.5%).

Determinants of underweight

At the multivariate level of analysis, household characteristics that were identified as determinants of underweight included province of residence and wealth index (Table 4). Women living in Eastern Province were 2 times significantly more likely to be undernourished compared to those living in Nairobi (p=0.045). Those living in households classified in the lowest and lower wealth index quintiles were 2 times and 2.4 times significantly more likely to be underweight compared to those in the highest wealth quintiles (p values =0.041 and 0.009).

Women's educational achievement, smoking status and contraceptive use were significant determinants of underweight. Women with no education, primary and secondary levels were 6.2, 3.5 and 4.4 times respectively more likely to have underweight compared to those who had achieved higher levels of education (p<0.0001, 0.007 and 0.002 respectively). Those using hormonal methods of contraception were 30% less likely to be under nourished compared those not using contraceptives (p=0.029). Women who did not smoke were 50% less likely to be undernourished compared with those who smoked. Those who's partners did not work in the previous year were 2 times significantly more likely to be under nourished compared to those whose partners were in professional occupation in the previous year (p=0.03;Table 4).

Determinants of overweight and obesity

Women living in lower, lowest and middle wealth index households were 80%, 70% and 50% respectively less likely to be overweight/obese compared to higher wealth index(p<0.001). Older women (30-49years) were more likely to be overweight/obese compared to the younger ones (p<0.001). Women who are currently married were 1.9 times more likely to be overweight/obese compared to those who were not married (p=0.007).

Table 1: Distribution of Kenyan adult women by background characteristics (Kenya Demographic and Health Survey 2008-09)

Covariates	Category	Frequency	Percent
	Household characteristics		
Residence	Rural	4303	72.7
	Urban	1613	27.3
Province	North Eastern	112	1.9
	Central	676	11.4
	Coast	472	8.0
	Eastern	964	16.3
	Nyanza	939	15.9
	Rift valley	1593	26.9
	Western	600	10.1
	Nairobi	560	9.5
Wealth index	Lowest	899	15.2
	Lower	984	16.6
	Middle	1100	18.6
	Higher	1240	21
	Highest	1694	28.6
Sex of household head	Male	3703	62.6
	Female	2213	37.4
	Women's characteristics		
Women's age	20 to 24	1446	24.4
	25 to 30 years	1577	26.7
	Above 30	2893	48.9
Education	No education	580	9.8
	Primary	3238	54.7
	Secondary	1548	26.2
	Higher	550	9.3
Marital status	Never married	1038	17.5
	Currently married	4052	68.5
	Formerly married	827	14
Religion	Roman catholic	1251	21.1
	Protestant	4109	69.5
	Muslim and others	557	9.4
Work status	Not working	1779	30.1
	Working	4137	69.9
Occupation	Not worked in the last year	1796	30.4
	Skilled manual	238	4
	Agriculture	1588	26.8
	Unskilled manual	463	7.8
	Professional	1832	31
Smoking status	Does not smoke	5805	98.1
	Smokes something	111	1.9
Contraception	Barrier methods	882	14.9
	Hormonal methods	1684	28.5
	Not using	3350	56.6
Number of children ever born	One birth	836	14.1
	Two births	1038	17.5
	Three to four births	1644	27.8
	Above 5	1680	28.4
	None	719	12.2
Health insurance	No insurance	5425	91.7
	Insured	491	8.3
	Partner characteristics		
Partners education	No education	420	7.1
	Primary	2288	38.7
	Secondary	1643	27.8
	Higher	528	8.9
	No partner	1038	17.5
Partner occupation	Not worked in the last year	147	2.5
	Agriculture	1410	23.8
	Unskilled manual	945	16
	Skilled manual	494	8.3
	Professional	1883	31.8
	No partner	1038	17.5
Total		5916	100

2: Distribution of nutritional status indicators for Kenyan women (KDHS 2008-09)

Variable	Mean (sd)	Standard Error	95% Confidence Interval
Age (years)	31.9(8.4)	0.2	31.6 , 32.2
Weight (kg)	59.3(12.0)	0.3	58.6 , 60.0
Height (cm)	159.3(7.1)	0.2	159.0 , 159.7
Body mass index (kg/m^2)	23.4(4.6)	0.1	23.1 , 23.6

Women who did not smoke tobacco were 3.9 times more likely to be overweight/obese ($p<0.001$) compared to those who were smoking tobacco. Partner's education and occupation were significant determinants of nutrition outcomes. Women whose partners had no education and who did not work in the previous one year were 60% and 50% less likely to be overweight/obese compared to those whose partners had higher levels of education and whose partner's had professional occupation respectively ($p<0.05$; Table 5).

Table 3: Percent distribution of underweight and overweight and obesity based on BMI among adult Kenyan women

	N(%)	Standard Error	95% Confidence Interval
Underweight (BMI <18.5)	618 (10.5)	0.6	9.3, 11.8
Normal (BMI 18.5 – 24.9)	3,547 (60.0)	1.2	57.5, 62.4
Overweight and obesity (≥25.0 BMI)	1,751 (29.6)	1.3	27.0, 32.3

Discussion

The study found the coexistence of under-nutrition and over-nutrition among adult Kenyan women. The mean BMI was within normal range as per the WHO classification(18). However, the prevalence of overweight and obesity was higher than the prevalence of underweight. This phenomenon has been described by (Mendez 2005) (19) using DHS data from 36 countries based on a rural-urban and socio-economic stratification. In their analysis Mendez and colleagues found the median ratio of overweight to underweight as 5.8 in urban and 2.1 in rural areas. Our results describes the pattern of distribution of these two types of malnutrition in Kenya as well as supporting the evidence of rising dual burden reported in sub-Saharan Africa (9,10,20). Although our study did not investigate the existence of the dual burden in the same households, this has been demonstrated previously in Kenya (21,22). The dual burden described in our current study is the co-existence of over-and under-nutrition in the same population of Kenyan adult women age 20 – 49 living in both rural and urban areas. It is important to consider both forms of malnutrition since both have considerable consequences and impact on societal development in different ways. Identifying the scope of both under- and over- nutrition among Kenyan women is critical as it highlights the need to focus on addressing each of the problems separately. Addressing the two extremes of the nutrition spectrum presents unique public health challenges as both levels results to different health risks. Public health resources need to be appropriately channeled in-order to address the two types of malnutrition.

Table 4: Percentage of women with underweight and overweight/obese by household, women and partner characteristics, (Kenya Demographic and Health Survey 2008-09)

Covariates	Category	Thin	Overweight and obese	Person Chi-Square	Df	P-value
		Household Characteristics				
Residence	Rural	12.4	24	259.688	2	0.000***
	Urban	5.2	44.5			
Province	North Eastern	25.7	12.5			
	Central	8	40	230.423	14	0.000***
	Coast	13.2	35.1			
	Eastern	14.1	25			
	Nyanza	8.2	25.3			
	Rift valley	11.8	27.9			
	Western	9.4	21.2			
	Nairobi	3	45			
Wealth Index	Lowest	19.1	11.1	577.986	8	0.000***
	Lower	15.2	15.1			
	Middle	11	24.5			
	Higher	8	36.5			
	Highest	4.5	46.1			
Sex of Household Head	Male	10.3	29	1.954	2	0.376
	Female	10.7	30.5			
		Women Characteristics				
Women's Age	20 to 24	11.3	16.4	190.453	4	0.000***
	25 to 30 years	9.8	29.3			
	Above 30	10.4	36.4			
Education	No education	25.8	16.5	328.894	6	0.000***
	Primary	9.9	25.6			
	Secondary	8.9	37.1			
	Higher	1.9	45.6			
Marital Status	Never married	9	23.6	33.490	4	0.000***
	Currently married	10.5	31.4			
	Formerly married	11.9	28.1			
Religion	Roman catholic	12.9	26.5	64.491	4	0.000***
	Protestant	8.6	30.8			
	Muslim and others	18.4	27.9			
Work Status	Not working	12.9	22.7	62.693	2	0.000***
	Working	9.4	32.5			
Occupation	Not worked in the last year	12.8	22.8	200.465	8	0.000***
	Skilled manual	15	25			
	Agriculture	12.5	24			
	Unskilled manual	7	34.4			
	Professional	6.6	40.5			
Smoking Status	Does not smoke	10	30	77.461	2	0.000***
	Smokes something	33.4	6.4			
Contraception Use	Barrier methods	8.7	37	104.530	4	0.000***
	Hormonal methods	7.2	35.3			
	Not using	12.5	24.8			
Number of Children Ever Born	One birth	6.6	30	95.397	8	0.000***
	Two births	10.6	36.5			
	Three to four births	9.9	32.4			
	Above 5	13.6	25.1			
	None	8.6	23.1			
Health Insurance	No insurance	10.8	27.8	99.900	2	0.000***
	Insured	6.9	49.3			
		Partner Characteristics				
Partners Education	No education	26.7	10.9	405.333	8	0.000***
	No partner	9	23.6			
	Primary	11.4	25.3			
	Secondary	7.7	35.9			
	Higher	4.8	55.2			
Partner Occupation	Not worked in the last year	25.5	15.3	263.893	10	0.000***
	No partner	9	23.6			
	Agriculture	15	20			
	Unskilled manual	8.1	29			
	Skilled manual	11.3	34.2			
	Professional	7.6	40.2			

*** Significant at P value <0.0001

Notably in our study, there was far more prevalence of overweight and obesity than

underweight among women residing in both rural and urban areas of the country. This points to the increasing burden of over-nutrition among rural populations in the presence of a considerable level of under-nutrition. When data was considered at a multivariate level of analysis rural or urban residences was not a significant determinant of any of the two types of malnutrition. This is contrary to findings by Mendez 2005 (19) who reported that urbanization was a predictor of overweight among women especially with low education in both rural and urban areas of countries with low gross national income. We hypothesis that the population of women in Kenya residing in rural areas may be having access to infrastructure and services that may facilitate a changed lifestyle such as access to energy dense foods and motorized transportation thus causing the observed lack of significant influence of residence at the multivariate level of analysis.

Strong regional disparities were observed in the distribution of both types of malnutrition. The prevalence of over-nutrition was highest in Central and Nairobi Provinces with over one in every ten women being overweight or obese in Central and slightly more than that in Nairobi Province. On the other hand, one-quarter of adult women in North Eastern Province were underweight compared to only 3 percent underweight in Nairobi Province. The North Eastern Province of Kenya is largely semi-arid marked with persistent food insecurity that is accelerated by deterioration of pastoral livelihoods in the region as a result of frequent droughts (23). The rates of childhood wasting are reported as persistently high in this region (DHS 2008-09) (21).

This study found household wealth as a significant determinant of the dual burden of malnutrition. The women from lowest to middle wealth index quintile households were significantly more likely to be underweight while those in the same wealth index quintiles were less likely to be overweight or obese. Similarly with this relationship, women with no education or those with primary and secondary levels were more likely to be underweight. Higher education of women is associated with women's employment and a higher income.(22) The higher income may result to an increased access to more energy-dense foods with higher sugar and fat content that contributes to the high likelihood of overweight or obese among more educated women(24). Similar trends were reported among black South African women by Bourne (2002)(11) who reported that women without education had higher levels of underweight. Women without education or with primary level of education tend to be engaged in more manual labour than their educated counterparts.

Over-nutrition appeared to increase with age from 16% among women 20-24 years old to 36% among the older women above 30 years of age. This trend was maintained at the multivariate level of analysis where older women were significantly more likely to be overweight or obese. This trend demonstrates that over-nutrition starts earlier in age among Kenyan women as further shown by the DHS report that 8.7% of adolescent girls aged 15-19 years are overweight or obesity in the country(16).

Further, married women were found to be significantly more likely to be overweight or obese compared to those never married. Similar to our findings, married men and women in Poland were more likely to be overweight or obese compared to their never married, separated, divorced or widowed counterparts(25). After controlling for household wealth, women's age, number of children ever born, education, and partner's education and work status, the relationship between marital status and overweight/obesity was still significant. It has been reported that married individuals tend to eat a greater number of meals and have higher energy intakes (25-27) which may explain the higher prevalence of overweight and obesity observed in this group compared to those who are not married. In addition, women who didn't smoke any form of tobacco had higher odds of being overweight or obese. This is contrary to expectation since smoking is a known risk factor for overweight and obesity. These results should be interpreted with caution as the number of women who did not smoke any form of tobacco was 98% of the population. The association between smoking and body weight is complex with controversies over whether or not smoking decreases weight or if smoking is a risk factor for overweight or obesity(28). Numerous studies report that smokers have lower mean body weight and lower mean BMI(29). On the other hand, smokers tend to cumulate other risk behaviors potentially favoring weight gain such as poor diet or low physical activity (28,30). This effect of smoking occurs more among heavy smokers than other smokers(28).

Table 5: Relationship between underweight and household, women and partner characteristics, (Kenya Demographic and Health Survey 2008-09)

Covariates	Category	Odds Ratio	95% CI	P-value
		Household Characteristics		
Residence	Rural	1.0	0.6, 1.7	0.817
	Urban(rc)	1.0		
Province	North Eastern	1.5	0.7, 3.4	0.245
	Central	1.4	0.6, 3.4	0.361
	Coast	1.7	0.8, 3.4	0.132
	Eastern	2.0	1, 4.2	0.045*
	Nyanza	1.0	0.4, 2.2	0.952
	Rift valley	1.4	0.6, 2.8	0.335
	Western	1.2	0.5, 2.5	0.622
	Nairobi(rc)	1.0		
Wealth Index	Lowest	2.0	1, 3.9	0.041*
	Lower	2.4	1.2, 4.8	0.009**
	Middle	1.6	0.8, 3.1	0.103
	Higher	1.2	0.6, 2.2	0.476
	Highest(rc)	1.0		
Sex of Household	Male	1.0	0.7, 1.3	0.804
Head	Female(rc)	1.0		
		Women Characteristics		
Women's Age	20 to 24	1.5	0.9, 2.4	0.069
	25 to 30 years	1.2	0.8, 1.6	0.233
	Above 30(rc)	1.0		
Education	No education	6.2	2.3, 16.3	0.000***
	Primary	3.5	1.4, 9	0.007**
	Secondary	4.4	1.7, 11.5	0.002**
	Higher(rc)	1.0		
Marital Status	Currently married	0.7	0.4, 1.3	0.288
	Formerly married	0.9	0.5, 1.7	0.693
	Never married(rc)	1.0		
Religion	Roman catholic	1.2	0.7, 2	0.325
	Protestant	0.8	0.5, 1.4	0.596
	Muslim and others(rc)	1.0		
Work Status	Not working	3.5	0.8, 16	0.094
	Working(rc)	1.0		
Occupation	Not worked in the last year	0.3	0, 1.7	0.209
	Skilled manual	1.7	0.9, 3.3	0.086
	Agriculture	1.3	0.7, 2.1	0.289
	Unskilled manual	0.8	0.4, 1.4	0.557
	Professional(rc)	1.0		
Smoking Status	Does not smoke	0.5	0.3, 0.8	0.013*
	Smokes something(rc)	1.0		
Contraceptive Use	Barrier methods	0.9	0.6, 1.2	0.63
	Hormonal methods	0.7	0.5, 0.9	0.029*
	Not using(rc)	1.0		
Number of Children	One birth	0.7	0.4, 1.4	0.456
Ever Born	Two births	1.3	0.6, 2.9	0.378
	Three to four births	1.1	0.6, 2.1	0.604
	Above 5	1.3	0.6, 2.6	0.456
	None(rc)	1.0		
Health Insurance	No insurance	0.5	0.2, 1.3	0.202
	Insured(rc)	1.0		
		Partner Characteristics		
Partners Education	No education	1.4	0.6, 3.2	0.407
	No partner(rc)	1.0		
	Primary	1.0	0.4, 2.2	0.995
	Secondary	0.9	0.4, 1.9	0.793
	Higher(rc)	1.0		
Partner Occupation	Not worked in the last year	2.1	1, 4.3	0.03*
	Agriculture	1.4	0.9, 1.9	0.053
	Unskilled manual	0.9	0.6, 1.3	0.615
	Skilled manual	1.4	0.9, 2.1	0.125
	Professional(rc)	1.0		

rc=reference category; *** significant at P value <0.0001; ** significant at P value <0.005 and *significant at P value <0.05

Table 6: Relationship between Overweight/obese and household, women and partner characteristics, (Kenya Demographic and Health Survey 2008-09)

Covariates	Category	Odds Ratio	95% CI	P-value
Household Characteristics				
Residence	Rural	0.8	0.6, 1.1	0.339
	Urban (rc)	1.0		
Province	North Eastern	0.6	0.3, 1.2	0.242
	Central	1.3	0.9, 1.9	0.15
	Coast	1.0	0.7, 1.5	0.649
	Eastern	0.8	0.5, 1.1	0.245
	Nyanza	0.9	0.6, 1.3	0.878
	Rift valley	1.0	0.7, 1.3	0.875
	Western	0.8	0.5, 1.2	0.309
	Nairobi(rc)	1.0		
Wealth Index	Lowest	0.2	0.1, 0.4	0.000***
	Lower	0.3	0.2, 0.4	0.000***
	Middle	0.5	0.3, 0.7	0.000***
	Higher	0.7	0.5, 1	0.15
	Highest(rc)	1.0		
Sex of Household Head	Male	0.8	0.6, 1	0.165
	Female(rc)	1.0		
Women Characteristics				
Women's Age	20 to 24	0.2	0.2, 0.3	0.000***
	25 to 30 years	0.5	0.4, 0.7	0.000***
	Above 30(rc)	1.0		
Education	No education	0.8	0.4, 1.6	0.674
	Primary	0.8	0.6, 1.2	0.524
	Secondary	0.9	0.7, 1.3	0.985
	Higher(rc)	1.0		
Marital Status	Currently married	1.9	1.2,3.2	0.007**
	Formerly married	1.3	0.8, 2.3	0.293
	Never married(rc)	1.0		
Religion	Roman catholic	0.6	0.3, 0.9	0.045*
	Protestant	0.7	0.5, 1.1	0.184
	Muslim and others(rc)	1.0		
Work Status	Not working	1.0	0.1, 6.4	0.924
	Working(rc)	1.0		
Occupation	Not worked in the last year	0.6	0.1, 4.1	0.665
	Skilled manual	0.7	0.3, 1.2	0.25
	Agriculture	0.7	0.5, 1	0.124
	Unskilled manual	1.0	0.7, 1.5	0.772
	Professional(rc)	1.0		
Smoking Status	Does not smoke	3.9	1.8, 8.4	0.000***
	Smokes tobacco (rc)	1.0		
Contraceptive Use	Barrier methods	1.1	0.9, 1.5	0.217
	Hormonal methods	1.1	0.9, 1.4	0.241
	Not using(rc)	1.0		
Number of Children	One birth	1.0	0.7, 1.5	0.645
Ever Born	Two births	1.3	0.9, 1.8	0.083
	Three to four births	1.0	0.6, 1.5	0.982
	Above 5	0.9	0.6, 1.3	0.653
	None(rc)	1.0		
Health Insurance	No insurance	0.9	0.7, 1.2	0.625
	Insured	1.0		
Partner Characteristics				
Partners Education	No education	0.4	0.2, 0.7	0.002**
	No partner	1.0		
	Primary	0.7	0.4, 1.1	0.206
	Secondary	0.7	0.4, 1.2	0.257
	Higher(rc)	1.0		
Partner Occupation	Not worked in the last year	0.5	0.2, 0.9	0.035*
	Agriculture	0.7	0.5, 0.9	0.013*
	Unskilled manual	0.8	0.6, 1	0.149
	Skilled manual	0.9	0.7, 1.3	0.927
	Professional(rc)	1.0		

rc=reference category; *** significant at P value <0.0001; ** *** significant at P value <0.005 and *significant at P value <0.05

Our study found an association between access to health insurance with the prevalence of under-and over-nutrition. The percent of underweight women was higher among women with no health insurance while almost half of those with access to medical insurance were overweight and obese. This

relationship was not sustained at the multivariate level of analysis that controlled for household wealth, education, occupation and work status. Partner's education and occupation was associated significantly with the nutrition outcome of adult Kenyan women. One-quarter of women whose partners had no education and were not working were underweight while slightly above half of the women whose husbands had secondary or higher levels of education were overweight or obese while 40% of the women whose partners where in professional employment were overweight or obese. These associations were sustained at the multivariate level after controlling for household wealth index and women's education amongst other demographic characteristics.

The study documents a higher burden of over-nutrition than under-nutrition in Kenyan adult women. This shift is a mark for the nutrition transition and the increasing dual burden of under- and over nutrition that is characteristic of many developing countries. Overweight and obesity is associated with a number of metabolic abnormalities such as hyperinsulinemia, insulin resistance type 2 diabetes, hypertension, dyslipidemia, coronary heart disease, gallbladder disease and certain malignancies(31). As the Kenya ministry of health and other stake holders continue to fight under-nutrition especially among children, there should also be efforts to address the increasing levels of over-nutrition in the country.

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