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Original Research Article

Body composition assessment among adults in Thika, Kiambu county, Kenya

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ABSTRACT

Background: Research has shown that body composition is directly related to health. Altered body composition, can greatly increase the risks of conditions such as cardiovascular disease and diabetes. Bioelectrical Impedance Analysis fosters early detection of an improper balance in the body composition, which allows for earlier intervention and prevention.
Methods: This was a cross sectional analysis of body composition for adults who volunteered to be screened during a Nutrition week in Kiambu County, Kenya. A total of 301 adults were included in the assessment. Body Mass Index (BMI) and Body composition (body fat %, bone mass, muscle mass, visceral fat and water %) were measured using bioelectrical impedance analysis.
Results: The age of the participants ranged from 18-99 years (mean 42.19±16.57 years). Most of the participants were males (53.5%). More than half (53.2%) of the participants had a poor BMI, 37.2% had high total body fat percentage, 12.6% had excess levels of visceral fat and 26.6% had poor water hydration status. Age (OR=0.095; p value <0.001; CI 0.033-0272) and visceral fat (r=0.74; p value <0.001) were significantly associated with the BMI. Females had a significantly higher BMI (P <0.001). Visceral fat was also positively correlated with age: r=0.74; P value <0.001.
Conclusions: Sex, age and BMI were important determinants of body composition. Increased physical activity, appropriate dietary practices are crucial in maintaining a healthy BMI and body composition. For timely intervention regular nutrition screening should be promoted among different populations.

Keywords: Bioelectrical impedance analysis, Body composition, Body fat percentage, Body mass index

INTRODUCTION

Research has shown that body composition is directly related to health. A normal balance of body fat is associated with good health and longevity. Altered body composition such as excess fat in relation to lean body mass can greatly increase the risks of cardiovascular disease, diabetes, and more.[1] Body composition describes the components that make up the body, of which body fat is predominant. Other components include bones, lean muscle mass, and water. Body composition is an important aspect as it helps understand the health status of an individual. A study carried out in Ghent Belgium

showed that less favourable body composition (with higher fat and lower muscle mass and accompanying higher leptin concentrations) and insulin resistance (IR) are associated with higher thyroid hormone levels in healthy young men with well characterized euthyroidism.[2] As presented in a review by Snijder et al, studies show that body fat distribution is relevant for the risk of cardiovascular disease and mortality, with time trend studies showing a consistent increase over time in the prevalence of obesity and particularly, abdominal obesity, which is likely to contribute to a higher incidence of type 2 diabetes, cardiovascular disease, and mortality.[3] Bioelectrical Impedance Analysis (BIA) fosters early detection of an improper balance in the body composition, which allows for earlier intervention and prevention.[1] These measurements are critical for assessing an individual's current state of health. This paper provides a report of a screening survey undertaken in Thika during a nutrition screening week in 2018 Kiambu county Chapter.

METHODS

Research design and target population

This was a cross sectional analysis of body composition for adults who volunteered to be screened during a Nutrition week in Kiambu County, Kenya. The study targeted adults within Kiambu county.

Sampling and sample size

A comprehensive sample of adults who voluntarily presented themselves for free nutrition screening during the nutrition screening week 2018 Kiambu County Chapter were included in the assessment. The study included 301 adults aged 18 to 99 years old.

Inclusion criteria

The study included all adults (≥18 years) who voluntarily presented themselves for the screening.

Exclusion criteria

The study excluded all the pregnant women.

Data collection procedures

Age of the participants was recorded in completed years. Standing height was taken without shoes using stadiometer. Body weight was measured after removal of shoes and any heavy outer clothing using a Tanita body composition analyser (BC 601 segmental body composition monitor). BMI was calculated by dividing the weight (in kilograms) by the squared height (in meters) and classified as; underweight (<18.50 kg/m^2), normal weight (18.50-24.99 kg/m^2), over- weight (25.00-29.99 kg/m^2), and obese (≥30.00 kg/m^2). Body composition (body fat %, bone mass, muscle mass, visceral fat and water %) was measured using Tanita body composition analyser (BC 601 segmental body composition monitor). The information was anonymous and had no specific client identifiers.

Data analysis

Data was entered and analysed using statistical package for social sciences (SPSS) Version 20. In the statistical analysis, the subjects were grouped into males and females. The results are expressed as mean±SD, frequency and percentages. Tests of statistical significance were done using Chi-square, correlations, t-test and regression analysis. A P<0.05 was used as the criterion for statistical significance

RESULTS

Demographic characteristics of the participants

Overall more males than females took part in the assessment. The mean age for the participants was 42.19 (SD±16.57) years. Majority of the participants were in the 36 to 59 years age category (48.8%) as shown in Table 1.

Table 1: Demographic characteristics of the participants.

Characteristic	N=301	
	Number (n)	Percentage (%)
Age category (years)		
18-35	105	34.9
36-59	147	48.8
≥60	49	16.3
Mean±SD: 42.19±16.57		
Sex		
Male	161	53.5
Female	140	46.5

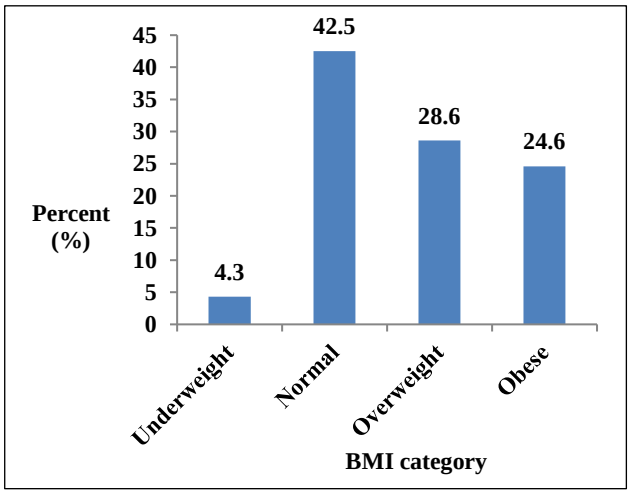

Figure 1: BMI category among the participants.

Body mass index of the participants

The mean Body Mass Index was 26.08±5.66 and ranging from 13.40 to 46.70 kg/m^2. Of the total population, 28.6% were overweight while 24.6% were obese Figure 1.

Table 2 below presents a cross tabulation of the BMI category and sex of the participants. Further analysis revealed that the mean BMI between males and females was significantly different with females having a higher BMI (27.70) as compared to males (24.66) (t-test, P value <0.001).

Body composition profile of the participants

Table 3 shows the body composition profile of the participants. The mean total body fat percentage was 24.98 (SD±10.80) with women having significantly higher body fat % compared to the males (P<0.001). Most (87.4%) of the participants had healthy levels of visceral fat with no significant difference between males and females.

Table 2: Cross tabulation between BMI category and sex.

N=301		Male n (%)	Female n (%)	Total n (%)
BMI category	Underweight	7 (2.3)	6 (2.0)	13 (4.3)
	Normal weight	84 (27.9)	44 (14.6)	128 (42.5)
	Overweight	46 (15.3)	40 (13.3)	86 (28.6)
	Obese	24 (8.0)	50 (16.6)	74 (24.6)

Table 3: Body composition profile of the participants.

Characteristic	Number (n)	N-301 Percentage (%)	Mean by sex		P value
			Male	Female	
Body fat percentage					
Low	105	34.9			
Normal	84	27.9			
High	112	37.2			
Mean±SD: 24.98±10.80			18.75	32.13	<0.001
Visceral fat					
Healthy levels of visceral fat	263	87.4			
Excess levels of visceral fat	38	12.6			
Mean±SD: 7.10±4.66			7.23	6.96	0.614
Bone mass					
Low bone mass	237	78.7			
Healthy bone mass	64	21.3			
Mean±SD: 2.61±0.42			2.83	2.36	<0.001
Muscle mass					
Mean±SD: 49.02±8.46			53.49	43.87	<0.001
Body water percentage					
Dehydrated	40	13.3			
Normal hydration	221	73.4			
Over hydration	40	13.3			
Mean±SD: 55.29±7.22			59.30	50.67	<0.001

Males were found to have significantly higher bone mass compared to their female counterparts (P<0.001). Body muscle was also significantly (P<0.001) higher in males than females. At the time of the assessment, 73.4% of the participants had normal hydration status. However, compared to females the males had a significantly (P<0.001) higher body water percentage.

Associations between variables

Relationship between participants age and their BMI

The study observed a significant positive correlation between the participants' age and their BMI. As the age increased the BMI also increased (P value<0.001, r=0.314) (Table 4). Table 5 presents a cross tabulation

between the participants age category and BMI category. Most of the overweight and obese participants were in the age category of 35-59 years. Further, logistic regression revealed that those participants aged less than 35 years were 0.095 times less likely to be obese than those aged 60 and above [(OR=0.095; P value<0.001; CI (0.033-0.272)]. Those participants aged less than 35 years were 0.319 times less likely to be overweight than those aged 60 and above [(OR=0.319; p value =0.09; C.I (0.135-0.755)]. This was done with normal BMI being the reference category and at 95% confidence interval.

Table 4: Correlation between participants age and BMI.

Variable		Age	BMI
Age	Pearson Correlation	1	.314**
	Sig. (2-tailed)		.000
	N	301	301
BMI	Pearson Correlation	.314**	1
	Sig. (2-tailed)	.000	
	N	301	301

**Correlation is significant at the 0.01 level (2-tailed).

Table 5: Cross tabulation between participants age and BMI.

Variable		18-35 years (young adults), n (%)	35-59 years (middle aged), n (%)	≥ 60 years (elderly) n (%)	Total n (%)
BMI category	Underweight	7 (2.3)	3 (1.0)	3 (1.0)	13 (4.3)
	Normal weight	69 (22.9)	44 (14.6)	15 (5.0)	128 (42.5)
	Overweight	22 (7.3)	49 (16.3)	15 (5.0)	86 (28.6)
	Obese	7 (2.3)	51 (16.9)	16 (5.3)	74 (24.6)
Total		105 (34.9)	147 (48.8)	49 (16.3)	301 (100)

Table 6: Correlation between participants age and total body fat percentage.

Variable		Age	Body fat (%)
Age	Pearson correlation	1	0.170**
	Sig. (2-tailed)		0.003
	N	301	301
Body fat (%)	Pearson correlation	0.170**	1
	Sig. (2-tailed)	0.003	
	N	301	301

**Correlation is significant at the 0.01 level (2-tailed).

Relationship between participants age and total body fat composition

In this study, significant positive correlation between the participants' age and their body fat composition was revealed. As the age of the participants increased, the body fat percentage also increased (P value=0.003, r=0.170) (Table 6).

Relationship between participants sex and their BMI

More females were overweight and obese than males (Table 7). Logistic regression showed that males were 0.251 times less likely to be obese as compared to females [(OR=0.251; P value<0.001; C.I (0.137-0.462)]. In this analysis, normal BMI was the reference category and with a confidence interval of 95%.

Relationship between participants sex and body fat percentage

Table 8 shows the cross tabulation between the participants sex and their body fat percentage. More females had higher total body fat percentage compared to their male counterparts. Logistic regression showed that males were 38. 520 times more likely to have normal fat levels as compared to females [(OR=38.520; P value <0.001; CI (14.147-104.885)]. This was conducted when high fat was the reference category and at 95% confidence interval.

Table 7: Cross tabulation between participants sex and BMI.

Variable	Characteristic	Male n (%)	Female n (%)	Total n (%)
BMI Category	Underweight	7 (2.3)	6 (2.0)	13 (4.3)
	Normal weight	84 (27.9)	44 (14.6)	128 (42.5)
	Overweight	46 (15.3)	40 (13.3)	86 (28.6)
	Obese	24 (8.0)	50 (16.6)	74 (24.6)
Total		161 (53.5)	140 (46.5)	301 (100)

Table 8: Cross tabulation between participants sex and body fat percentage.

Variable		Male n (%)	Female n (%)	Total n (%)
Body fat percentage	Low	102(33.9)	3(1.0)	105(34.9)
	Normal	54(17.9)	30(10.0)	84(27.9)
	High	5(1.7)	107(35.5)	112(37.2)
Total		161(53.5)	140(46.5)	301(100)

Relationship between participants BMI and body fat composition

Results revealed a significant positive correlation between the participants' BMI and their total body fat composition. This denoted that as the BMI increased the total body fat percentage also increased (p value<0.001, r=0.741) as shown in Table 9. Logistic regression showed that those who had normal BMI were 2.47 times more likely to have normal body fat percentage than those who were obese (p=0.019).

Table 9: Cross tabulation between participants BMI and body fat percentage.

Variable		BMI	Body fat (%)
BMI	Pearson Correlation	1	.741**
	Sig. (2-tailed)		.000
	N	301	301
Body fat (%)	Pearson Correlation	.741**	1
	Sig. (2-tailed)	.000	
	N	301	301

**correlation is significant at the 0.01 level (2-tailed).

DISCUSSION

The aim of the present work was to assess the body composition of adults in Kiambu County using the Bioelectrical Impedance Analysis (BIA). Bioelectrical Impedance Analysis is used for determining the total body water percentage, fat mass and the fat free mass, a method that measures the impedance by passing a small electric current through the body's water pool.[4] Bioelectrical impendences is a non-invasive and inexpensive method that can applied even in low resource settings.[5] The screening could help to identify nutrition related health risks and facilitate timely interventions.

The results of the assessment showed a significant number of the participants had a high BMI. Females had a significantly higher BMI than the males. A study conducted in 63 countries also found that females had a higher prevalence of overweight and obesity.[6] Further, analysis showed a significant positive correlation between age and BMI. In this assessment the older age category was more likely to be overweight and obese than the younger age category. Similar observations were made in a study conducted in Malaysia. In the study, the youngest age cluster had the lowest prevalence of overweight or obesity. [7] This can be attributed to higher levels of activity among the young adults compared to the older adults. BMI is an important indicator for obesity and a marker for risk of diseases.[8] Results of a systematic review revealed that a high BMI (overweight and obesity) is associated with increased risk of heart failure.[9]

Findings of the assessment showed that a relatively high number of the participants had a high total body fat. The results further showed that women had significantly higher body fat percentage compared to males. In addition, a significant correlation between the participants BMI and total body fat was observed. Similar findings are also documented by Sedek et al.[7] High body fat composition has been linked to a wide range of diseases such as cardiovascular diseases, type 2 diabetes and cancer among others. A study among college students revealed a significant positive correlation between body fat and coronary heart disease.[10] Another study conducted by Kim J et al, showed that high body fat percentage was associated with cardio-metabolic risk factors such as high blood pressure, hyperlipidemia and hyperglycemia.[11]

CONCLUSION

Sex, age and BMI were important determinants of body composition. Increased physical activity, appropriate dietary practices are crucial in maintaining a healthy BMI and body composition. For timely intervention regular nutrition screening should be promoted among different populations.

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