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***Research Article** (Open Access)*

STUDIES ON ANTHROPOMETRIC AND PHENOTYPIC PARAMETERS OF OBESE AND NON OBESE PARTICIPANTS IN ALAJUE AND OKINNI COMMUNITIES IN OSOGBO, OSUN STATE, NIGERIA

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ABSTRACT
Obesity is a major public health problem throughout the world. Obesity results from complex interactions between genetic and environmental factors. Several genes are known to drive obesity, including TNF-α and Leptin genes. Genetic factors that regulate appetite and energy homeostasis are important factors in controlling weight gain and obesity. In this study, the genes of TNFA-G308A and LEP-G2548A in obese and non-obese participants were evaluated in order to determine their association with obesity in Alajue and Okinni communities of Osogbo, South West Nigeria. The two polymorphisms were examined in 100 participants consisting of fifty (50) obese, and fifty (50) non-obese people from these two communities in Osogbo. Polymerase Chain Reaction-Restriction Fragment Length Polymorphism (PCR-RFLP) was employed for genotyping. Chi-square and t-test were used for bivariate analysis of data collected. Level of significance was set at $p<0.05$. Allelic distribution of leptin gene based on A 28.0% among obese participants is lower compared to A 72.0% among the non-obese subjects P=0.0001 while allelic distribution of G 62.0% among obese participants showed a higher frequency compared to allelic distribution of G 38.0% among non-obese participants P=0.0012.

***Keywords**: Anthropometric, phenotypic, obese, non obese, Alajue and Okinni Communities*

INTRODUCTION
Obesity-free world remains a much distant vision as ever, despite more than a century's effort and early optimism. Obesity has become the leading cause of morbidity and mortality, among non-communicable diseases in Nigeria (Chukwuonye *et al.,* 2013). Obesity is a chronic condition characterized by accumulation of body fat (Ogunbode *et al.,* 2011). It is also referred to as one of the most important preventable diseases in developed countries (Chukwuonye *et al.,* 2013). Obesity (BMI 30.0-34.9) and overweight (BMI 25.0-29.9) are associated with several diseases, including cardiovascular diseases, type 2 diabetes, high blood pressure, high cholesterol, obstructive sleep apnea, and certain types of cancer, stroke, osteoarthritis and depression (Ogden *et al.,* 2006). These conditions can cause or contribute to premature death and substantial disability. The balance between calorie intake and energy expenditure determines a person's weight. If a person eats more calories than he or she burns (metabolizes), the person gains weight. If a person eats fewer calories than he or she metabolizes, he or she will lose weight. Total Daily Energy Expenditure (TDEE) is an estimation of how many calories is burn per day when exercise is taken into account. It is calculated by first figuring out your Basal Metabolic Rate (BMR), then multiplying that value by an activity multiplier (Ogden *et al.,* 2006). Since BMR represents how many calories body burns when at rest, it is necessary to adjust the numbers upwards to account for the calories burn during the day. This is true even for those with a sedentary lifestyle. TDEE calculator uses the best formulas and displays score in a way that's easy to read and meaningful energy homeostasis is critical for the survival of species. Therefore, multiple and complex mechanisms have evolved to regulate energy

intake and expenditure to maintain body weight. For weight maintenance, not only does energy intake have to match energy expenditure, but also macronutrient intake must balance macronutrient oxidation. However, this equilibrium seems to be particularly difficult to achieve in individuals with low fat oxidation, as case may be in case of TNF-α inhibiting the expression of mRNA of Peroxisome Proliferator Activated Receptor protein, that is involve ion the metabolism of fats (Ogden *et al.* , 2006). Low energy expenditure, low sympathetic activity or low levels of spontaneous physical activity, as in addition to excess energy intake, all of these factors explain the tendency of some people to gain weight. Therefore the most common causes of obesity are; over eating (a diet high in calorie), genetics, physical inactivity, medications, physiological factors (for example when body chemistry is off as a result of unbalanced nutrition, dehydration etc.) and diseases such as hypothyroidism, insulin resistance, polycystic ovarian syndrome and Cushing's syndrome (Lim *et al.,* 2013). In addition to the aforementioned factors, there is also the risk of developing obesity from culture, community, government and world food policies. Genetics also affects hormones involved in fat regulation. Although genetic factors are clearly important determinants of obesity susceptibility, a significant hereditary contribution to the etiology of obesity had been suggested by several studies (Chouchane *et al.*, 2001). Literature has also established the relationship between some candidate genes and obesity, among which are tumor necrosis factor-alpha and Leptin genes (Andrew *et al.*, 2006). In Nigeria, obesity has kept on increasing among the populace and has become problem of both adults and children. Various studies have been carried out on prevalence, effect of diets and some other factors associated with the development of obesity (WHO, 2004).

MATERIALS AND METHODS

Study Area

This is a community based, cross sectional, case control study that was carried out in two rural communities in Osun State, South western Nigeria. The two rural communities are Alajue which is located on km 8 Ede-Osu-Ilesa road, in Osogbo South-Eastern part and Okinni which also located on km5 Osogbo-Ilobu road, North-Eastern part of Osogbo the state capital. The two communities have a total population of about 35,000 and 65,500 people respectively. The majority of the dwellers are farmers and traders. Factors predisposing to a western lifestyle appeared minimal in these two communities, although there are roads and electricity which make them to be accessible to towns and cities; and also to be connected to the world through information gathered on radio and television. Members of the communities aged 18-65 years were selected and constituted the study sample.

Entry into the communities

Entry commenced with holdings of series of meetings with Baales, traditional chiefs, politicians, heads of households, and other stakeholders in the communities such as heads and executive officers of different artisans. The rationale for the screening exercise was communicated to community members at these meetings. Community town hall meetings were organized for each of the communities to further mobilize and sensitize community members. At these meetings, community members eligible for screening were encouraged to come out in their large numbers, with the assurance that those who came out and consented to the exercise would be screened. The two communities were mobilized and sensitized regarding the importance of screening for non-communicable diseases, in particular obesity. All consenting adults who participated in the screening exercise had their BP recorded, in addition to anthropometric measurements. The selected study populations were administered semi-structured questionnaires forms. The variables of the questionnaire include bio data, educational status, family history and risk factors for obesity among the respondents.

Operational Definition /Estimations

Obesity was defined as a BMI of $\geq$ 30kg/m^2 according to the WHO definition (World Health Organization, 2011). A standardized calibrated mercury column type sphygmomanometer, stethoscope, common weighing machine, glucometer, and measuring tape were used for physical examinations.

Measurements

Blood pressure was measured after obtaining verbal informed consent. The participants were kept at rest for about 30 minutes, before BP was measured on two occasions, at one minute interval to the nearest 2mmHg on the two occasions. Occasion when the two readings differed by 10mmHg or more, a third reading was obtained and the average of the 3 measurements was recorded. Body weight was measured using a calibrated weighing scale participants firmly stood, look strait, each leg apart (10cm) and weight evenly distributed on each leg. Participants were not allowed to wear footwear and were instructed to wear light clothes as their weight was being measured. Fasting blood sugar of the participants were measured, using standardized glucometer. Height was measured using a calibrated tape and with the subjects standing in an erect position against a vertical surface. Also measured with the calibrated tape were waist and hip circumferences.

Calculations

BMI was calculated as weight in kilograms divided by height in square meter. Based on their BMI, individuals were classified into two groups; non-obese (BMI 18.5-24.9) and obese (BMI $\geq$ 30.0).

Waist-hip ratio was calculated as waist circumference in centimeter divided by hip circumference in centimeter. The normal values of waist hip ratio for Men and women are (80-85) Cm and (90-95)Cm respectively.Values greater than these in both men and women are considered to be obese (Alaska, 2019)

Questionnaire Form

Standardized questionnaire form was developed based on key clinical manifestation of the disease among which include; high blood pressure, diabetes, stroke, sleep apnea etc.

Inclusion Criteria

100 participants (50 obese and 50 non -obese) who met the following criteria were considered fit and completed the consent forms before their samples were collected.

I. Individuals who were resident of the two communities.
II. Individuals aged between 18 and 65 years.
III. Individuals who did not have any complication (such as stroke).

Exclusion Criteria

These include:

I. Individuals who were hypertensive, diabetic, and who were on drug (s).
II. Those who were pregnant and those who were on any other medication.

Sample Collection, Processing and Storage

Mini field laboratory facilities were set up in each field trip. The participants that fulfilled inclusion criteria were selected for study. Five (5) ml of venous Fasting blood sample was obtained from each participants and control aseptically into tubes containing sodium ethylene tetra acetic acid (Sodium EDTA). The tubes were then stored in container tightly packed with iced cubes/packs before analysis. Samples in sodium EDTA bottles and plain bottles were kept at -20^0C.

Ethical consideration

The study protocol was approved by the Osun State University (Ethical Committee). The heads of the villages were given written information while individual consent was sought before blood sampling was done.

Statistical Analysis

Data were analyzed using IBM Statistical Packages for Service Solution (SPSS) version 21. Frequency distributions, percentages, mean scores and standard deviations were computed and tabulated. Chi-square and T-test were employed for bivariate analysis of data collected. Level of significant was set at $p<0.05$.

RESULTS

Table 3.1: Shows the basics anthropometric and phenotypic indices between the obese and non-obese participants. There is no significant difference in the mean of age between obese and non-obese

participants but there is a significant increase in the mean of other indices in obese participants compared to non-obese participants. There is an increase in the weight, BMI, waist hip ratio of obese participants while there is decrease in the height of obese participants compared with non-obese participants ($p < 0.05$) in each case.

Table 1: Basic anthropometric and phenotypic indices between obese and non-obese participants

GROUP	Obese participants (n=50)	Non obese participants (n=50)	p Value
AGE (Year)	38.58±10.71	37.42±11.04	0.622
SEX	F(25), M(25)	F(25), M(25)	
BW (Kg)	80.40±0.91	58.18±5.77	0.000
Height(M)	1.58±0.01	1.64±0.07	0.001
BMI (Kg/m^2)	32.19±2.02	21.62±2.24	0.000
WC (Cm)	81.92±1.45	74.76±10.5	0.000
HC (Cm)	115.22±10.48	95.84±6.77	0.001
WHR	0.85±0.05	0.78±0.80	0.000
Systolic BP MmHg	118.54±10	115.6±12	0.385
Diastolic BP MmHg	97.7±18.24	78.90±8.0	0.159

BW= Body weight, WC= weight circumference, HC= hip circumference, WHR= waist hip ratio

Table 2: The genotype distribution of TNF-α among the study participants in the Table 3.2 based on GG shows that TNF-α among the obese participants have frequency distribution of GG 26.0% which is significantly lower compared to the 78% GGin non-obese (p=0.001), while frequency distribution of AA 22.0% and AG 52.0% among the obese participants is significantly higher compared to AA 6.0% and AG 16.0% among non-obese participants at (p=0.0407) and p=0.0003) respectively.

Table 2: Genotypic distribution of TNF-α gene among the study participants

Genotype		Non-obese	Obese participants	Total	P value.	Odds ratio	95% confidence Interval odds ratio
TNF α	AA	3	11	14	0.0407	11.10	1.150 - 16.970
	AG	8	26	34	0.0003	9.75	2.226 - 14.530
	GG	39	13	52	0.0001	0.010	0.040 - 0.249

Table 3 showed the genotypic distribution of leptin based on AA 28.0% and AG 20.0% among the obese participants is significantly lower compared to genotype distribution of AA 62.0% and 26% in non-obese

participants (p=0.0001) and (p=0.0353) respectively . Genotype distribution of GG 52.0% among the obese participants is significantly higher compared to the non-obese participants GG 12.0% (p=0.0001).

Table 3: Genotypic distribution of LEP among the study participants

Genotype		Non-obese	Obese participants	Total	P value	Odds ratio	95% confidence interval of odds ratio
LEP	AA	31	14	45	0.0001	1.769	0.103 - 0.5527
	AG	13	10	23	0.0353	1.965	0.279 – 1.818
	GG	6	26	32	0.0001	1.701	2.871 – 21.980

DISCUSSION

In this study, leptin and TNFA polymorphic allele distributions in obese, was compared with those obtained from normal participants. These two polymorphisms LEP-G2548A and TNFA-G308A were examined. These two polymorphisms -2548G>A and -308G> are characterized by a single nucleotide exchange replacing an adenine (A) by a guanine (G) in LEP and by a single nucleotide exchange replacing a guanine (G) by an adenine (A) in TNFA, at the promoter region of both the LEP and TNFA genes.

Leptin and TNFA genes are associated with body mass index (BMI) and body fat in non-obese and obese subjects. The body mass index (BMI) is used for defining anthropometric height/weight characteristics in adults and for classifying into groups. The BMI ranges are based on the effect that excessive body fat has on disease and death and are reasonably well related to adiposity. BMI was developed as a risk indicator of disease; as BMI increases, so does the risk for some diseases (World Health Organization, 2011). Leptin and TNFA genes are associated with body mass index (BMI) and body fat in non-obese and obese subjects. In this study, a significant increase in the mean body mass index was observed among the obese participants (32.19±2.02) (Table 3.1) compared to non-obese subjects (21.62±2.24) p=0.0001, this findings corroborate the report of Brand *et al.*(2001) who observed increase in body mass index among overweight and obese participants in Caucasian participants.

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