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Die Auswirkungen von Urbanisierung und Geschlecht auf die Häufigkeit des metabolischen Syndroms bei Ureinwohnern von Abuja in Nigeria

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ABSTRACT

Hintergrund: Das Metabolische Syndrom (MetS) ist eine bedeutende Ursache für Morbidität und Sterblichkeit. Die epidemische Situation in Nigeria entwickelt sich momentan schnell. Die Absicht war zu untersuchen, ob die Urbanisierung mit der zunehmenden Verbreitung von MetS zwischen Ureinwohnern aus ländlichen Gebieten in Abuja und genetisch verwandten Stadtbewohnern zusammenhängt. Material und Verfahren: Es war eine cross-sectionale Untersuchung. Für die Studie wurden 352 Ureinwohner aus Abuja in Städten und 325 Einwohner aus Feldern verwendet. Die Blutfettwerte, Glucose, Taillenumfang, Blutdruck und Körpermasseindex wurden während des Fastens ermittelt. Drei gängige Standards wurden verwendet, um die Definition des MetS zu bestimmen. Die statistische Analyse wurde mit SPSS 16.0 durchgeführt. Es wurde eine statistisch signifikante P-Wert von 0.05 verwendet. Resultate: Menschen in Städten hatten häufiger Obesity, Hypertriglyceridemia und Hypertension als Menschen in Landgemeinden. Die MetS wurde stärker mit der Geschlecht der Frau. Durch die drei gängigen Definitionen steigt die Frequenz von MetS erheblich an. According to the International Diabetes Federation, the World Health Organization, and the National Cholesterol Education Program Adult Treatment Panel III, the prevalence of MetS among people living in rural areas compared to people living in urban areas was 7.7% against 14.9%, with a p-value of 0.05. 0,0% im Vergleich zu 0,9%; P>0,05; und 3.7% gegenüber 13.7%, beide mit einem P-Wert von 0.05. Ergebnisse: This study shows that MetS is a major health problem among rural and urban Nigerians, and that urbanization increases its prevalence. This could be explained by the higher prevalence of dyslipidemia, obesity, and hypertension in urban areas, possibly as a result of stress, diet, and a lower level of physical activity. Daher ist eine wirksame Vorbeugungsstrategie erforderlich, um den erhöhten Risiko mit

Key words: Dyslipidemia, metabolic syndrome, Nigeria, obesity, urbanization

INTRODUCTION

Das metabolische Syndrom (MetS) ist eine Gruppe von Risikofaktoren für das Herz-Kreislauf-System (CV), darunter hypertension, dyslipidemia, impaired glucose tolerance/diabetes mellitus (T2DM), obesity und andere prokoagulative Erkrankungen.Auch wenn es verschiedene Kriterien für den

definition of MetS as recommended by the various working groups, the core components of the syndrome,which include increased waist circumference, impaired glucose tolerance, dyslipidemia, and hypertension, are commonly required by the various groups for diagnosis.[1-5] The prevalence of MetS varies in different populations and is influenced by race, gender, differing socio-economic status, work-related activities, and cultural views on body fat.[1] Reported prevalence ratesin different countries varies between 2% and 66.9%.
[1] Reports also showed that the prevalence of MetS is increasing to epidemic proportions not only in theUSA and other developed countries but also in the developing nations.[1]

As one of the largest growing economies in the world, Nigeria is currently experiencing its fair share of urbanization.[6] Rapid epidemiologic transition is occurring even in Nigeria. Urbanization is usually associated with increased prevalence of CV risk factorssuch as hypertension, obesity and dyslipidemia.[7] MetSis associated with increased cardiovascular risk much more than the summation of the constituent CV riskfactors.[8,9] MetS is now recognized as a major CV risk factor by major bodies such as the Joint National Committee JNC VII.[10] Population-based studies on MetS and impact of urbanization on MetS in Sub- Saharan Africa are very rare. MetS has been reported to be highly prevalent among hypertensive and diabeticsubjects in Nigeria.[11,12] It has also been shown to place hypertensive and diabetic subjects at significantly higher CV risk than those without MetS.[13,14] This study aimed at describing the epidemiology of MetSamong native Abuja settlers who still reside in the urban area and those that live in rural area of Federal Capital Territory (FCT) of Nigeria with a view to ascertaining the impact of urbanization on the prevalence of MetSamong the study participants.

MATERIALS AND METHODS

Die Untersuchung war eine querschnittliche Untersuchung. Die Studie fand in Abuja (FCT) statt.

Before it became Nigeria's capital about 18 years ago, Abuja was mostly inhabited by the "Gbagi" tribe. Einige der "Gbagis" sind von der Stadtentwicklung betroffen, während andere, entfernt von Kilometern, noch eine Dorflebensweise führen. In order to determine the effects of the environment on their metabolic indices, the study recruited 342 people (165 men, 177 women) from the "Gbagi" tribe living in the city area of Abuja and 325 (171 men, 154 women) from the "Gbagi" tribe living in the rural area.

Blood pressure was obtained using mercury sphygmomanometer according to standardized criteria.[15] An average of three consecutive measurements was taken as the mean systolic and diastolic blood pressure. The height was taken with a stadiometer to the nearest 1 cm while the weight was taken while the participant was in light clothing to the nearest 0.5 kg. Body mass index was determined using the weight and the height. Waist circumference (in centimeters) was measured at the

mid-point between the lowest rib and the iliac crestin expiration. The hip circumference (in centimeters) was taken over the greater trochanters. The waist- to-hip ratio was determined by dividing the waist circumference by the hip circumference. The fasting plasma glucose was measured by the glucose oxidase method. Other investigations done include fasting plasma lipid profile, which includes total cholesterol (TC), low-density lipoprotein cholesterol (LDL-C), high-density lipoprotein cholesterol (HDL-C), and total triglycerides (TG). Subjects with chronic kidney disease, diabetes mellitus and pregnancy were excluded from the study.

The International Diabetes Federation (IDF) was also used for the diagnosis of MetS.[1,5] It include the presenceof increased waist circumference (population specific)plus any 2 of the following

a. Triglycerides ^{3}150 mg/dL (1.7 mmol/L) or on triglyceride treatment
b. HDL-C <40 mg/dL (1.03 mmol/L) in men or
   <50 mg/ dL (1.30 mmol/L) in women or on HDL-C treatment.
c. Systolic blood pressure ^{3}130 mmHg or diastolic blood pressure ^{3}85 mmHg (or both).
d. Fasting blood sugar ^{3}100 mg/dL (5.6 mmol/L) (includes diabetes).

The National Cholesterol Education Program Adult Treatment Panel (NCEP ATP) III relies on the presenceof at least three of five CV risk factors, which include hypertension, impaired glucose tolerance, low HDL, hypertriglyceridemia, and visceral obesity.[2] The World Health Organization (WHO) relies on the presence of impaired glucose tolerance plus the presence of two of four other CV risk factors, which include obesity, hypertension, low HDL, and hypertriglyceridemia.[4]

Data collection forms were used to collect data such as age, gender, cigarette smoking, and family history of hypertension, and diabetes mellitus. Research approvals were obtained from Benue State University, Abuja Municipal, and Kuje Area Councils ethical committees. Individual informed consent was also obtained from each subject. Continuous and categorical variables were displayed as means ± standard deviation (S.D.) and percentages respectively. The student's t-test was used to assess the differences between means. Differences between categorical variables were analyzed by chi square test. *P* value <0.05 was taken as statistically significant.

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RESULTS

Both the urban and rural participants were well matched in terms of age and gender. Table 1 shows the clinical and laboratory parameters of the patients and controls. Die durchschnittlichen Lebensjahre der beiden Geschlechter der Teilnehmer unterschieden sich nicht erheblich. Rural participants had lower systolic blood pressure, diastolic blood pressure, waist circumference, and mean body mass index than urban participants. In addition, urban participants had higher fasting blood sugar and total cholesterol than rural participants. Aber die durchschnittliche HDL der Stadtbewohner war erheblich niedriger als die der Landbewohner.

Hypertriglyceridemia was significantly commoner among urban dwellers, especially males, than their rural counterparts. Likewise, elevated systolic blood pressure, elevated diastolic blood pressure, and visceral obesity were commoner among urban dwellers than rural dwellers. (31.0 vs. 13.5%; 23.1 vs. 11.7%, and 59.4 vs. 25.8%, respectively. Low HDL was, however, commoner among rural dwellers than urban dwellers (25.8% vs. 3.8% respectively). MetS as defined by the IDF was commoner among urban dwellers than rural dwellers (14.9% vs. 7.7% respectively, $P<0.05$) as shown in Table 2.

Figure 1 shows the prevalence of MetS using the three different standard criteria for definition. Urbanization significantly affects the pattern of MetS among study participants. The NCEP ATP III revealed that thefrequency of MetS among rural participants was 3.7% and this increased to 13.7% among urban dwellers, $P<0.005$. However, the WHO criteria failed to show any significant increase in the prevalence of MetS among study participants despite a minimal increase infrequency of prevalence among urban dwellers.

DISCUSSION

Diese Studie betonte, dass MetS möglicherweise eine bedeutende Herausforderung sogar in traditionellen Gesellschaften wie der untersuchten Bevölkerung darstellen könnte. In addition, it was discovered that urbanization has a significant impact on a number of metabolic risk factors, which has a direct impact on the frequency of MetS. Die Urbanisierung hat einen erheblichen Einfluss auf den Lebensstil durch die Auswirkungen von Ernährung und Umwelt, was sich auf CV-Risikofaktoren und MetS auswirkt..

These evidences are compatible with other reports among other population. Sarkar *et al.* showed that

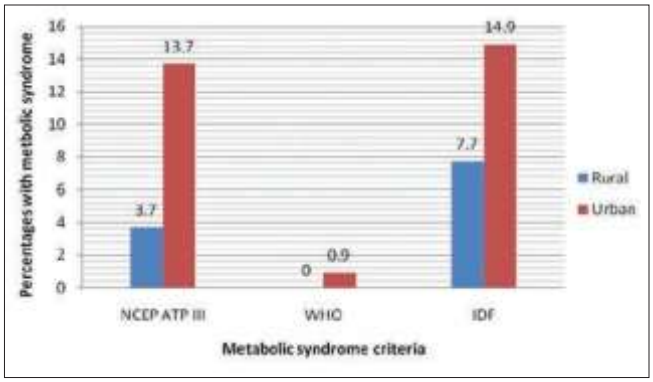

Figure 1: Prevalence of metabolic syndrome using three different standard criteria. NCEP ATP III- National Cholesterol Education Program Adult Treatment Panel III, who- World Health Organization,
IDF-International Diabetes Federation

urbanization had an adverse impact on metabolic risk factor profile and MetS among native rural versus urban dwellers in India and Pakistan.[16-18] They showed that the prevalence of MetS was between 30 and 50% among urban dwellers while it was 4–9% among rural dwellers. In addition to this, the rural population in their studyhad an alarmingly high level of dyslipidemia as 37–67% had low HDL or high triglyceride level. A similar report was documented in this study as 39.2% of men and 54.5% of females had low HDL. Also, at least a quarter of the rural populace had elevated triglyceride levels. Genetics has a significant contribution to development of MetS. However, obesity, especially visceral obesity, seems to be the major determinant factor in the prevalence

of MetS in Sub-Saharan Africa as shown in this study and other studies.[19]

Living in the urban centers is almost always associated with definite lifestyle changes. Urbanization resulted in significant impact on almost all CV risk factors among this study population including the prevalence of MetS. Urban settlers had a higher mean body massindex, waist circumference, systolic blood pressure, diastolic blood pressure, total cholesterol, and fasting blood glucose than their age-matched rural settlers with similar genetic constituent. All the urban cohorts in this study works as unskilled workforce in the city center as construction workers, laborers, among other things. They have their attachment to the village but their diet and general living standard has completely changed due to urbanization. Although it is likely that occupations may significantly influence CV parameters, the homogeneity of the occupation among the study group precludes any significant difference in the changes in the frequency of MetS due mainly to occupation. The impact of urbanization is similar to what has

Table 1: Clinical and laboratory parameters of study participants stratified based on gender and place of domicile

Parameters	Rural		Urban		*P*
	Male	Female	Male	Female	(Rural vs. Urban.)
Mean age(yrs)	42.3 (14.4)	41.9 (15.6)	44.1 (13.2)	42.3 (12.4)	0.318
BMI (kg/m^2)	23.2 (2.94)	22.8 (2.9)	25.7 (3.2)[a,c]	27.9 (5.9)[b]	<0.001*
WC (cm)	81.5 (7.2)	80.6 (7.5)	87.6 (11.6)[a,c]	92.5 (12.4)[b]	<0.001*
SBP (mmHg)	115.8 (11.8)[a]	111.0 (15.2)	123.0 (19.0)[c]	122.0 (21.8)[b]	<0.001*
DBP (mmHg)	74.6 (8.4) a	71.5 (10.7)	79.0 (13.3)[a,c]	75.0 (14.7)[b]	<0.001*
TChol (mmol/L)	3.2 (0.9)[a]	3.02 (0.82)	3.2 (0.8)[a]	3.4 (1.1)[b]	0.009*
Triglycerides (mmol/L)	1.4 (0.4)[a]	1.5 (0.43)	1.72 (0.54)[a,c]	1.49 (0.39)	<0.001*
HDL-C (mmol/L)	1.25 (0.37)	1.23 (0.4)	1.5 (0.46)[c]	1.5 (0.43)[b]	<0.001*
LDL-C(mmol/L)	1.36 (0.8)[a]	1.2 (0.8)	0.95 (0.70)[a,c]	1.3 (1.0)	0.038*
FBS(mmol/L)	3.6 (0.83)	3.6 (1.2)	3.8 (1.1)	3.9 (2.4)	0.014*

*Values are mean (± standard deviation) [a]P<0.05 between males and females [b]P<0.05 between females in urban areas compared to those living in rural areas. [c]P<0.05 between males in urban areas compared to those living in rural areas. *Statistically significant. BMI = Body mass index; TG = Triglycerides; IFG = Impaired fasting glucose; TChol = Total cholesterol; WC = Waist circumference; SBP = Systolic blood pressure; DBP = Diastolic blood pressure; HDL-C = High density lipoprotein cholesterol; LDL-C = Low density lipoprotein cholesterol; FBS = Fasting blood glucose.*

Table 2: MetS criteria and other CV risk factors among study participants

Parameters	Rural		Urban		*P*
	Male (171%)	Female (154%)	Male (165%)	Female (177%)	
TG ³1.7 mmol/Lâ	45 (26.3)	48 (31.2)	85 (51.5)[a,c]	46 (26.0)	0.008*
IFG ³5.6 mmol/L	5 (2.9)	6 (3.9)	10 (6.1)	9 (5.1)	0.176
SBP >130 mmHg	23 (13.5)	21 (13.6)	55 (33.3)[c]	51 (28.8)[b]	<0.001*
DBP >85 mmHg	23 (13.5)	15 (9.7)	42 (25.5)[c]	37 (20.9)[b]	<0.001*
HDL <1.04 mmol/L (M), <1.29 mmol/L (F)	67 (39.2)[a]	84 (54.5)	20 (12.1)[a,c]	63 (35.6%)[b]	<0.001*
WC >94 cm (M), >80 cm (F)	7 (4.1)[a]	77 (50.0)	51 (30.9)[a,c]	152 (85.9)[b]	<0.001*
BMI ≥28.8 kg/m^2	5 (2.9)	6 (3.9)	22 (13.3)[a,c]	64 (36.2)[b]	<0.001*
Smoking (n)	48 (28.1)[a]	21 (13.6)	14 (8.5)[a,c]	1 (0.6) [b]	<0.001*
IDF MetS Present	1 (0.6)[a]	24 (15.6)	15 (9.1)[a,c]	36 (20.3)	0.003*
Total IDF MetS present	25 (7.7)		51 (14.9)	<0.001*	
Total WHO MetS present	0 (0)		(0.9)	<0.001*	
Total NCEP ATP III MetS present	13 (3.7)		47 (13.7)	<0.005*	

*Values are number (%), [a]P<0.05 between males and females *- Statistically significant. [b]P<0.05 between females in urban areas compared to those living in rural areas. [c]P<0.05 between males in urban areas compared to those living in rural areas. BMI = Body mass index; TG = Triglycerides; IFG = Impaired fasting glucose; WC = Waist circumference; SBP = Systolic blood pressure; DBP = Diastolic blood pressure; HDL-C = High density lipoprotein cholesterol; LDL-C = Low density lipoprotein cholesterol; FBS = Fasting blood glucose; IDF MS = International Diabetes Federation Definition of metabolic syndrome present*

been reported by other authors in Africa.[19-21] MetS is therefore commoner in urban areas than rural areas irrespective of gender.

The frequency of MetS is lower than what has been reported among US adults, China, and India.[22-25] Among US adults, more than a third have been shown to have MetS.[22] The prevalence is, however, higher than what has been reported from Cameroun.[18] This pattern may reflect the increased prevalence of major CV risk factors and the impact of urbanization in dietary intake among Nigerians and reduced physical activity compared to

Cameroonians. It may also reflect the economic strength and the degree of western influence on both communities.

This study also revealed that MetS is more frequent among the female gender. This increased frequency is possibly driven by the high prevalence of visceral obesity among females, which is most likely related to urbanization in this study population. This is driven by a higher chance of sedentary lifestyle and unhealthy diets. Most of them are traders and housewives. There is also a cultural perception about obesity in women where obesity is regarded as a sign of affluence and satisfaction in many cultures. Majority of urban menin this study are construction workers with significantinfluence on dietary and social modifications whereas rural men are mostly hunters and farmers. The relationship between urbanization and MetS is linked to lower physical activity energy expenditure, dietary changes, obesity, increasing insulin resistance, and increasing frequency of dyslipidemia.[1,5,7]

Another aspect of this study revealed that MetS is common among native Abuja settlers and it is affected by urbanization. It also showed that different definitions of MetS revealed different prevalence based on the constituent criteria. The WHO criteria gave the lowest prevalence while the IDF criteria resulted in the highest prevalence. The NCEP ATP III is more closely related to the IDF in their use for the identification of MetS. However, the IDF criteria may be more relevant becauseof the race-specific definition for visceral obesity and the definition of impaired glucose tolerance, which hasbeen shown to be more specific for identifying impairedglucose homeostasis. Impaired glucose homeostasis is also an independent CV risk factor. Since obesity is common among Africans, a definition with specific emphasis on race-specific definitions will be more relevant to identify MetS. Therefore, we suggest thatthe IDF criteria are a good instrument in identifyingMetS among the (Nigerian/African) population sinceit relies on a specific definition of obesity. Otherstudies have shown that MetS is not affected by urbanization.[16] However, this study shows that the prevalence of MetS among urban settler is significantlyhigher than their genetically related rural dwellers.

Based on the result of this study, we recommend that special attention should be given to MetS by government, international health organizations working in developing countries, and health-oriented Non-Governmental Organizations (NGOs) in developing countries. This is because MetS is a major issue even among rural Nigerian communities and the impact of rapid urbanization leads to astronomical rise in prevalence of MetS among urban settlers.MetS is both a major CV risk factor and a CV diseaseequivalent, and it is a potential preventable disease if the scourge of obesity, reduced physical inactivity, dietary indiscretion, and diabetes/impaired glucose tolerance are well tackled. Equal attention such as is given to HIV/AIDS should be placed on CV disease prevention as developing countries may definitely not be able to adequately tackle the enormous burden of CV disease in the next few decades.

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