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SERUM ANTIOXIDANT MINERALS AND LIPID PROFILE STATUS AMONG GERIATRIC SUBJECTS

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ABSTRACT
Aging has been inevitable processes which occur overtime even in the absence of injury and thought to be characterized by oxidative stress and dyslipidaemia. A total of fifty (50) apparently healthy geriatric subjects were recruited in the study and serum malondialdehyde (MDA), copper, manganese, and zinc and lipid profile (total cholesterol, triacylglycerol, low density lipoprotein, high density lipoprotein, very low density lipoprotein and atherogenic index) were determined and the results compared to thirty (30) apparently young adults of socio and economic status using standard chemical method and atomic absorption spectrometry. The results indicated significant increase ($P<0.05$) in MDA, TC, TG, LDL-C, VLDL-C, AIX and decrease in copper, manganese and zinc in geriatrics when compared to those of young adults (control). The results further revealed that gender had no effect on antioxidant minerals and lipid profile but antioxidant minerals and lipid profile are age dependent.The results suggest that oxidative stress and dyslipidaemia could be attributing factors for aging.

KEYNOTE: Oxidative stress, antioxidant minerals, lipid profile.

INTRODUCTION
Geriatrics refer to medical care for the elderly, an age group that is not easily defined precisely (Richard, 2010). It is an inevitable, irreversible decline in organ function that occurs overtime even in the absence of injury, illness, environmental risks, and poor lifestyle choices (Chandrasekaran *et al*., 2017). The cardiovascular, renal, and central nervous systems are usually the most vulnerable. Although different hypotheses have been put forward to explain the cellular and molecular mechanism of aging. Previous studies reported that aging is due to accumulation of molecular damage, giving rise to a unified theory of aging (Hughes and Reynolds, 2005; Martins, 2012). The multiple pathology in aging might be connected to increase oxidative stress and consequently expose various organs to be prone to free radicals leading to decline in their functions (Crook, 2012).

Among reactions contributing to this damage, reactive oxygen species (ROS) and reactive nitrogen species (RNS) are the main ones produced by several endogenous and exogenous processes, and their deleterious effects are neutralized by antioxidant defences which comprises of antioxidant enzymes and their cofactors/co-enzymes such as Cu, Mn, Zn, vitamins A, C,and E (Lobo, 2010; Bishop, 2013).

Aging is among the largest known risk factors for human diseases (Dillin, 2014). Globally 100,000 people die each year of age-related diseases (De-Gray, 2007). The cause of aging is not clearly understood, but it is hypothesized to be related to oxidative damage to macromolecules by either ROS, RNS or both as stated by oxidative stress theory of aging (Hughes and Reynolds, 2005).

Body fat increases with age and is preferentially stored in the abdominal compartment resulting to increase risks for cardiovascular disease and diabetes in the elderly (Despre *et al*., 1994; Poehlman *et al*., 1995). Brock *et a*l. (2015) projected that elderly population (>65 years) will double by the year 2040.

Considering the global rapid rate of aging and its associated diseases among elderly people and in view of the fact that serum antioxidant minerals play a critical role in reducing the progression of aging and its attendant complications, determination of serum antioxidant minerals and lipid profile in aging could, therefore provide the basis for recommending their role vis-à-vis attendant complications among geriatrics.

MATERIALS AND METHODS
Chemical and reagents: All chemicals and reagents used were of analytical grade

Study area: The study was conducted in Sokoto metropolis, northen part of Nigeria, Africa.
Participants: A total of fifty (50) apparently healthy geriatric subjects of both sexes age 60 years and above and thirty (30) apparently healthy young adults of age 20-50 years were recruited in this study.
Experimental design: The participants were grouped as follows:
Group 1: Apparently healthy geriatric subjects (60 years and above) of both sexes (n=50)
Group 2: Apparently healthy young adults (20-50 years) of both sexes (n=30)

Ethical clearance and informed consent form: The ethical clearance of the study was obtained from the Ethics and Research Committee of Sokoto State Ministry of Health, Nigeria and informed consent of the participants were sought prior to collection of their bood.

Sample collection: Five (5) mL of blood was collected from cubical fossa using venipuncture transferred into sterile plain test tube allowed to clot, then centrifuge using top bench centrifuge at 1500 rpm for 5 minutes. Serum was separated using pasteur pipette and transfer to another sterile test tubes and stored at -4^0C until required.

Determination of biochemical parameters
Malondialdehyde (MDA) was determined using method of Chandra *et al*. (1994). Copper, manganese and zinc were determined using AAS 6300 Shimadzu Atomic Absorption Spectrometer (Keneko, 1990). Total cholesterol was determined using method of Allain *et al*. (1994). Triglyceride was determined using method of Trinder (1969). High density lipoprotein cholesterol was determined using method of Trinder (1969). Low density lipoprotein cholesterol was calculated using formular of Friedwald *et al.* (1974a). Very low density lipoprotein cholesterol calculated using Friedwald *et al.* (1974b) formular and atherogenic index (AIX) was calculated using method of Ranjna (1999).

Data analysis: Data was analyzed using statistical package for social sciences (SPSS) version 20 In start 3.0. Subjects age 60 years and above values compared to those of controls using the two tailed student's t-test. Serum antioxidant minerals and lipid profile from the aged subjects were compared using ANOVA. Significant difference was considered when $P<0.05$.

RESULTS

There was significant increase in MDA and decrease in antioxidant minerals in geriatric subjects (Table 1). Gender and age had no effect on antioxidant minerals except copper (Table 2) and (Table 3) respectively.

There was significant increase (P<0.05) in lipid profile among geriatrics when compared to young adults (Table 4). Gender had no effect on lipid profile (Table 5). Lipid profile are age defendant (Table 6).

Table 1: Serum Malondialdehyde and Antioxidant Minerals Concentrations Among Geriatric Subjects.

Parameter	Geriatrics (n=50)	Young Adults (n=30)
Malondialdehyde (nmol/L)	109±4.93[a]	74.00±1.74[b]
Copper (mg/L)	2.06±0.14[a]	2.67±0.15[b]
Manganese (mg/L)	1.61±0.10[a]	2.72±0.36[b]
Zinc (mg/L)	0.81±0.14[a]	1.23±0.18[b]

Data is expressed as mean±SEM. Different superscripts on the row indicated significant difference (P<0.05).

Table 2: Sex Distribution of Serum Malondialdehyde and Antioxidant Minerals Among Geriatric Subjects.

Parameter	Geriatrics			Young Adults		
	Male (n=45)	Female (n=5)	Pool (n=50)	Male (n=24)	Female (n=6)	Pool (n=30)
MDA(nml/l)	110.77±5.45[a]	102.24±3.57[a]	109±4.93[a]	87.88±2.16[a]	87.20±1.51[b]	74.00±1.74b
Cu (mg/L)	2.07±0.15[a]	1.97±0.35[a]	2.06±0.13[a]	2.52±0.13[b]	3.28±0.54[b]	2.67±0.15[b]
Mn (mg/L)	1.56±0.11[a]	2.02±0.29[a]	1.61±0.10[a]	2.85±0.44[b]	2.19±0.30[b]	2.72±0.36[b]
Zn (mg/L)	0.80±0.10[a]	0.88±0.24[a]	0.81±0.14[a]	1.08±0.75[b]	1.83±0.55[b]	1.23±0.18[b]

Data is expressed as mean±SEM. Values bearing different superscripts on the row differ significantly (P<0.05) using ANOVA.

Table 3: Effect of Age Distribution on Serum MDA and Antioxidant Minerals Among Geriatric Subjects.

Parameter	60 65 year (n=38)	66-70 year (n=7)	71-75 year (n=3)	76-80 year (n=2)
MDA(nmol/L)	111.21±6.32[a]	111.71±6.10[a]	104.36±9.09[a]	87.44±3.53[a]
Cu (mg/L)	1.96±0.12[a]	2.04±0.33[a]	1.53±0.30[a]	4.77±1.80[b]
Mn (mg/L)	1.58±0.13[a]	1.81±0.19[a]	2.05±0.32[a]	0.85±0.08[a]
Zn (mg/L)	0.81±0.08[a]	0.74±0.26[a]	1.01±0.22[a]	0.89±0.03[a]

Data is expressed as mean±SEM. Values bearing different superscripts on the row differ significantly (P<0.05) using ANOVA.

Table 4: Serum Lipid Profile Concentrations Among Geriatric Subjects.

Parameter	Geriatrics (n=50)	Young adults (n=30)
TC(mmol/L)	3.87±0.12[a]	3.25±0.05[b]
TG(mmol/L)	0.62±0.02[a]	0.40±0.02[b]
HDL-C(mmol/L)	1.23±0.05[a]	1.28±0.04[b]
LDL-C(mmol/L)	3.42±0.12[a]	2.71±0.05[b]
VLDL-C(mmol/L)	0.28±0.01[a]	0.18±0.01[b]
AIX	2.78±0.07[a]	2.12±0.13[b]

Data is expressed as mean±SEM. Values with different superscripts on the row indicate significant difference (P<0.05). TC: total cholesterol; TG: triglycerol; HDL: high density lipoprotein; LDL: low density lipoprotein; VLDL: very low density lipoprotein; AIX: atherogenic index; n: number of participants.

Table 5: Sex Distribution of Serum Lipid Profile Concentrations Among Geriatric Subjects.

Parameter	Geriatrics (n=50)			Young Adults (n=30)		
	Male	Female	Pool	Male	Female	Pool
TC(mmol/L)	3.87±0.11[a]	3.94±0.01[a]	3.87±0.12[a]	3.61±0.05[b]	3.20±0.11[b]	3.25±0.05[b]
TG(mmol/L)	0.62±0.30[a]	0.60±0.30[a]	0.62±0.02[a]	0.50±0.01[b]	0.34±0.01[b]	0.40±0.02[b]
HDL(mmol/L)	1.24±0.05[a]	1.10±0.01[a]	1.23±0.05[a]	1.29±0.04[b]	1.13±0.07[b]	1.28±0.04[b]
LDL(mmol/L)	3.41±0.12[a]	3.55±0.01[a]	3.42±0.11[a]	2.70±0.05[b]	2.79±0.12[b]	2.70±0.05[b]
VLDL(mmol/L)	0.28±0.01[a]	0.28±0.04[a]	0.28±0.01[a]	0.23±0.01[b]	0.15±0.06[b]	0.18±0.01[b]
AIX	2.17±0.07[a]	2.53±0.28[a]	2.78±0.07[a]	2.87±0.13[b]	2.98±0.01[b]	2.12±0.13[b]

Data is expressed as mean±SEM. Values with different superscripts on the row indicate significant difference (P<0.05). TC: total cholesterol; TG: triglycerol; HDL: high density lipoprotein; LDL: low density lipoprotein; VLDL: very low density lipoprotein; AIX: atherogenic index; n: number of participants.

Table 6: Effects of Age Distribution on Serum Lipid Profile Among Geriatric Subjects.

Parameter	20-29 years	30-39 years	60-69 years
TC (mmol/L)	3.25±0.05[a]	3.85±0.31[a]	3.88±0.09[b]
TG (mmol/L)	0.49±0.02[a]	0.52±0.34[a]	0.62±0.02[b]
HDL-C (mmol/L)	1.28±0.04[a]	1.23±0.05[a]	1.24±0.01[b]
LDL-C (mmol/L)	2.71±0.05[a]	3.35±0.31[a]	3.45±0.08[b]
VLDL-C (mmol/L)	0.22±0.01[a]	0.24±0.02[a]	0.28±0.01[b]
AIX	2.20±0.13[a]	2.80±0.32[a]	2.78±0.13[a]

Data is expressed as mean±SEM. Values with different superscripts on the row indicate significant difference (P<0.05). TC: total cholesterol; TG: triglycerol; HDL: high density lipoprotein; LDL: low density lipoprotein; VLDL: very low density lipoprotein; AIX: atherogenic index.

DISCUSSION

Aging is associated with many undesirable changes in the body composition such as antioxidant minerals and lipid profile. In the current study, it aimed to evaluate serum antioxidant minerals and lipid profile among geriatric subjects.

Frijhoff *et al*. (2015) reported that in aging several reactive aldehydes including malondialdehyde are produced during the course of lipid peroxidation. Our result is in line to this. There was significant increase in MDA in geriatrics when compared to young adults (controls). This confirmed the evidence that oxidative stress contributes to aging. The increased levels of MDA might be probably as a result of increase lipid peroxidation as explained by the oxidative stress theory of aging which is based on the structural damage-based hypothesis that age-associated functional lose is due to the accumulation of oxidative damage to macromolecules by reactive oxygen species (ROS) or reactive nitrogen species (RNS).

The significant (P<0.05) decrease in concentrations of antioxidant minerals (copper, manganese, and zinc) among geriatric subjects compared to young adults. This finding is in line with Kunwar *et al*. (2011) who reported decreased antioxidant minerals in aging. The decrease levels could be probably due to their exhaustion during the challenge of free radical stress in aging and consequently altered oxidant/antioxidant defence equilibrium (Sunde, 2012; Wali *et al*., 2016). The findings also confirmed evidence that antioxidant minerals are the co-factors of antioxidant enzymes and their decrease leads to decrease in the activities of their enzymes vis-à-vis.

The serum MDA and antioxidant minerals levels were shown to be gender independent but age defendant in our study. This is in agreement with the report of Wali *et al*. (2016) who reported that gender has no effect on serum antioxidant status. The age defendant could be reflection by drastic increment in their levels as age increases. The significant increase in copper levels among geriatrics might be conveniently explained by the fact that high

concentration of copper may lead to pro-oxidant formation (Tereda *et al*., 1999).

Previous studies reported that oxidative stress is positively linked with LDL-C and negatively linked with HDL-C. (Preveen *et al*., 2005; Wali *et al*., 2016). The geriatric values of LDL-C and HDL-C are in agreement with this. The increased TC, TG, LDL-C, VLDL-C and AIX and decreased HDL-C in geriatric subjects is partly explained by clustering of risk factors and by direct consequences of hyperglycaemia and glycation, which favours the oxidation and modification of LDL-particles, accelerating the development of atherosclerosis (Michael *et al*., 2005; Eljaodi *et al*., 2017). Polidori (2005) also reported that alteration of micronutrients (amount and ratio) may lead to oxidation of lipoproteins and ox-LDL may penetrate the microvasculature and cause pathology.

The results further revealed that gender had no effect on lipid profile but age had. This might be connected to the fact that similar pattern of lipid profile and antioxidant minerals were observed in both male and female.

CONCLUSION

In conclusion, there was significant increase in malondialdehyde and decrease in antioxidant minerals and dyslipidaemia in geriatric subjects. Gender had no effect on antioxidant minerals and lipid profile but Age had on lipid profile.

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