Nat. Volatiles & Essent. Oils, 2021; 8(3): 92-103

NVEO
Natural Volatiles &
Essential Oils

Evaluation Of Microalbuminuria As A Risk Marker Of Diabetic Nephropathy

MS. SHARONPRICILLA[1] , DR. M. SUDHEESH[2]

[1]RESEARCH SCHOLAR, LNCT UNIVERSITY, BHOPAL.

[2]RESEARCH SUPERVISOR, DEPARTMENT OF MEDICAL BIOCHEMISTRY, LNCT UNIVERSITY, BHOPAL.

Abstract

The objective of this study was to evaluate the status of renal function in diabetic nephropathy patients by analyzing the level of microalbuminuria. This study was done with 50 diabetic nephropathy patients admitted in the hospital from April 2020 to June 2020 at Govt. Super Specialty Hospital, Trichy. Among the 50 cases selected for this study, males were 23 and female were 27. The questionnaire was administered by interview method and data or information were gathered from the participants/patients and recorded like demography, family, history, information of disease, information about social, characteristics of clinical manner and laboratory examination. The data of demography includes the participant's age, gender, marital status, education levels such as Illiterates, primary, secondary, and tertiary. Nine risk factors include age, BMI, WHR, SBP, DBP, consumption of alcohol, cigarette smoking and habitual intake of analgesics/herbs were determined significantly in multiple logistic regression. The determination of increased level of UACR/CKD by systolic blood pressure (SBP) respectively.

Keywords: Diabetic nephropathy, End stage kidney disease, Microalbuminuria

Introduction

Diabetic nephropathy is a range of continuous renal injury due to diabetes ranged from hyper filtration of renal to final stage renal disease (Khosravi et al., 2005). The initial clinical proof of nephropathy is the microalbuminuria appearance. It formed in 30% of type 1 diabetic from 5 to 15 years after identification but have diagnosis in diabetic type 2. The appearance of microalbuminuria is obvious in proteinuria above next 7 to 10 years(Aaron and vinik, 2001).

The diabetic nephropathy is preventable one and it has advanced from disease subclinical via the early clinical diagnosed stage by microalbuminuria like albumin in urine is 30 to 300mg per day to unconcealed nephropathy with macroalbuminuria (Van der et al., 2009). The combined control of glycemic and different biochemical parameters in the appearance of microalbuminuria, glycated hemoglobin with reduced nephropathic occurrence.

The renal disorder is firmly related with heart disease and the microalbuminuria presence is a determinant or poor outcomes for renal and cardiac subjects (Navita Lakshmi et al., 2015). Microalbuminuria is formed by the injury of glomerular capillary and it is a marker for diffused dysfunction of endothelium. On the report of hypothesis by Steno, the albuminuria may consider a dysfunction of vascular and albumin leakage and some macromolecules in plasma like low density lipoproteins in to the vessels wall caused the inflammatory responses and process of atherosclerosis. Currently suggestion that microalbuminuria is the risk factor for the cardiovascular disease development in non-diabetic patients and take part in screening process. The initial diagnosis of nephropathy between diabetic patients screening allows new intervention and good control in the process of nephropathy and cardiovascular events and mortality (Olutayo et al., 2006).

Materials and Methods

Study Population

This study was conducted at Govt. Super Specialty Hospital, Trichy, in the Biochemistry department. Totally 50 cases were selected for this study among that male were 23 and female were 27. The study was conducted over three months of period from April 2020 to June 2020 and the cases with diabetes history was enrolled for this study.

Study Design

This research was a hospital dependent cross-sectional illustrative work. Data of baseline was collected from the patients according to their biography, characteristics of disease like symptoms and signs, measurements of anthropometric parameters such as weight, height, BMI, waist and hip circumference, WHR and spotting of urine at early morning. Nephropathy was identified by the microalbumin dipstick used and then established by ratio of albumin/creatinine in spot urine collection on early morning.

Selection Criteria

Inclusion criteria

All accepted patients had diabetes who visited in outpatient unit of Biochemistry department of the hospital. All the patients participated were in the age of 25-75 years included both male and female.

Exclusion criteria

All patients examined with infection in urinary tract, haematuria, illnesses of acute febrile, prostatitis, urethritis, vaginal discharge, menstruation and strong exercise were prohibited because they result false positive microalbuminuria. The patients had kidney disease or cardiac failure was prohibited.

Pre-testing of instruments for data collection

The collection of data using questionnaire method with the cases in hospital is done, previous to study for avoiding the errors.

Method of Data Collection

The questionnaire was administered by interview method and data or information were gathered from the participants/patients and recorded like demography, family, history, information of disease, social information, characteristics of clinical manner and laboratory examination. The data of demography includes the participant's age, gender and marital status, education levels such as Illiterates, primary, secondary, and tertiary.

Anthropometry measurements were Weight (kg), Height (m), Waist circumference (cm), Hip circumference (cm), Waist/Hip ratio: Normal, Abdominal Obesity, Body Mass Index (BMI) (Kg/m^2): Underweight, Normal weight, Overweight, and Obesity.

Examination results in dipstick urinalysis using strips give results of appearance of yellow color showed the protein-negative while green color showed positive results on the strip, glucose, nitrite and microalbumin showed light blue color as negative results and dark blue color showed the positive results on the strip. Quantitative analysis of urinary albumin creatinine ratio (UACR) by Bayer machine on the positive result of urine samples in the dipstick (American Diabetes Association, 2006).

Measurement of Weight: By using the weighing scale ranged from 0 to 120kg, the weight was measured to the 0.10 kg without shoes or slippers and the participants were asked to wear light weight clothes. Before measurement of weight the wrist watches and handsets were required to remove. The correctness of the scale was prolonged by weighing scale checking using the standard 10kg weight later each ten measurements.

Measurement of Height: For measuring height, the Stadiometer were used in 0.10 meter. The patients allowed without shoes or slippers and caps or scarf and asked to stand straight with evenly on two feet, heels, head positioned and the vision line was perpendicular to body. The arms dangle in sides and head, neck, back, heels and buttocks in vertical rod. The calibrated rod was adjusted to top point of head.

The Body Mass Index (BMI): It was examined by measured weight of the patient in kilogram and divided into square of the height in meters (WHO, 2012).

WHO determination of WHR: The measuring tape made with non-elastic was used in this study for measurement of circumference of waist and hip.

Waist circumference: It was measured in last margin of the rib and top of the iliac crest.

Hip circumference: It measured by broad part of the hip with tape aligned to the floor. WHO recommended that obesity of abdominal can be explained as WHR that is divided the circumference of the waist by circumference of the hip and the values ranged for male is 0.9cm and for female is 0.85 cm.

Measurement of Blood Pressure:

The participants were measured their blood pressure by using the sphygmomanometer. Before the measurement of blood pressure, the patients were engaged for 5 minutes and asked to sit in chair comfort with their arms. After raising their arms, the pulse was felled by middle and index fingers some centimeters above the elbow in the arm. The suitable cuff for the patients was let down and radial pulse was recorded. The initial sound denotes the systolic blood pressure and the sound disappeared showed the diastolic blood pressure. The same procedure was repeated again in another arm and records the systolic and the diastolic blood pressures to the patients

Dipstick urinalysis and urinary albumin creatinine ratio (UACR) (Medscape, 2004**)**
The urin alysis was conducted by the researcher at the same time of quantitative estimation of UACR was analyzed in the laboratory. Spotting of midstream urine was collected at early morning in two individual sterile containers for detection of microalbuminuria/ albuminuria using the reagent of dipstick strip named as Dirui H11 MA (microalbumin).

The positive results obtained in this test were confirmed by a standard method called Urinary Albumin-Creatinine Ratio (UACR) it acts as a gold standard test for the analysis of microalbuminuria. The microalbuminuria was explained as Albumin: Creatinine Ratio (UACR) for males in 2.5-30 mg/ mmol and females for 3.5-30 mg/ mmol due to decreased concentration of excretion of creatinine or 30-300 mg/g. Dirui H11 MA (microalbumin) reagent strips are used for the estimation of proteins microalbumin, glucose, ketones, nitrites etc.

The reactive ingredients infused with Dirui H11 MA strips are 2.2% w/w of “sulfone phthalein, 96.0% w/w of buffer and 1.8% w/w of non-reactive ingredients. After acquiring the initial sample of urine, a Dirui H11 MA reagent strips was immersed into sample and read within 60 seconds of dipping. The strip was placed horizontally and read the strip with color chart. Within 2 minutes the color was changed. If the light blue color showed the absence of microalbuminuria but it showed dark blue it was noted as positive microalbuminuria. The result of strip was 15 mg/dl denotes the microalbuminuria.

In 2011, the International Society of Nephrology defined microalbuminuria as concentration of albumin in urine is 30–300 mg/L. In 2004, Medscape defined microalbuminuria as urinary sample in 20–200 mg/dl. The strip Dirui H11 MA was able to estimate the lower level of 20 mg/ dl also. This strip could give false-positive results because of concentrated urine, haematuria, and contrast agents and false–negative results due to dilute urine.

Data Analysis
Analysis of data was run with EPI info version 3.5.1, 2010 with computation of software. Age, sex and occupation information obtained were showed in frequencies and percentages. The data were indicated by tables, figures and charts. Standard deviation and mean were estimated for ratio of age, height, weight, waist hip. Pearson Chi square was used to analyze the correlation among the qualitative measures like BMI and microalbuminuria, Waist Hip Ratio and microalbuminuria, presence of microalbuminuria using dipstick and UACR status. The Logistic regression was used to analyze the risk factors related with

microalbuminuria. The 95% confident result was studied and p-value of less than 0.05 considered significant.

Results and Discussion

This investigation was carried out for a period of three months from April 2020 to June 2020.The work of this research turns on quality of collection of data, gathered, arranged, extended, examined and dispersed. The data collected was used for diagnosis, prediction, investigation and analysis treatment.

The diabetic nephropathy pathogenesis is not clearly known so there is still constant challenge to analyze the actual crux process, there are several evidences from the researchers suggested that resistance of insulin has a main role in the diabetic nephropathy growth. The major reason for diabetic nephropathy is the higher level of free fatty acid that delivered fat cells of insulin resistance (Kawar et al., 2009).

Microalbuminuria was usual between diabetic patients with rate of prevalence at 59.2% using dipstick (M11 Dirui) urinalysis single spot was 53.3% were again established by gold standard Urinary Albumin Creatinine Ratio (UACR). This disclosed higher prevalence of nephropathy between the targeted groups because microalbuminuria is a nephropathy predictor (Go et al., 2004).

Socio demographic characteristics of the participants

Totally 50 diabetic nephropathy patients were selected for this research study. The participants' rate was 100%. Most of them were female participants at 27 of 54% while the male was 23 of 46%.

The range of age of the patients were among 25 to 75 years had the increased frequency at 45 of 40%. Most of the patients were females with higher frequency at 27 of 54% and males were 23 of 46%. Major of the participants 45 of 90% got married. Most of the participants had primary education level at 18 of 36%, illiterates at 12 of 24%, 15 of 30% of participants had level of secondary education and 5 of 10% of patients had tertiary educational level. Majority of the participants were unemployed at 27 of 54% and 11 of 22% were unskilled. While skilled participants were noted as 12 of 24% (Table-1).

Table-1: Socio demographic characteristics of the participants

Characteristics	Frequency	Percentage (%)
Age in years		
25-35	13	26%
36-45	20	40%
46-55	11	22%
56-65	4	8%
66-75	2	4%
Total	50	100%
Gender		
Female	27	54%
Male	23	46%.

Total	50	100%
Marital status		
Married	45	90%
Single	5	10%
Total	50	100%
Level of Education		
Illiterate	12	24%
Primary-Level	18	36%,
Secondary-Level	15	30%
Tertiary-Level	5	10%
Total	50	100%
Occupation of respondents		
Unemployed	27	54%
Unskilled	11	22%
Skilled	12	24%
Total	50	100%

This result was similar to study of family practice clinic in Southern Nigeria (Ishani) at the mean age of the patients was 50.52 ± 13.03 years (Coresh et al., 2004). And also in this study, the age group among 25 to 75 years had the higher rate of frequency at 27 of 54% for female and 23 of 46% for male. This report results were close to the previous study by Ishani in the age of ≥ 45 years with frequency of 70.4%. Our study has found no significant correlation among the age and microalbuminuria (nephropathy) in logistic regression.

Social information of the participants

Most of the participants did not smoke cigarette at 43 of 86% and did not drinking alcohol at 31 of 62%. Majority of the participants at 44 of 88% did not exploit drugs or herbs ingestion. The 24 of 48% participants did not do exercise and most of the participants at 26 of 52% had exercise less than three time weekly (Table-2).

Table-2: Social information of the participants

Characteristics	Frequency	Percentage (%)
Cigarette smoking		
Yes	07	14%
No	43	86%
Total	50	100%
Consumption of alcohol		

Yes	19	38%
No	31	62%.
Total	50	100%
Intake of Analgesics/Herbs		
Yes	06	12%
No	44	88%
Total	50	100%
Doing exercise		
Yes	26	52%
No	24	48%
Total	50	100%

This was hold up by many studies like 119 (86.9%) of participants does not smoke cigarette in study of Ishani observe no smoking at 480 (89.4 ±1.3%). The correlation among the tobacco smoking and microalbuminuria/CKD was not statistically significant due to the limited smokers only involved in this study. This study was opposed by Study of Swedish case control that gave support evident for history of current or former smoking as a risk factor for CKD in the population (Appel, 2003).

Different means of some parameters

The participant's systolic blood pressure (SPB) levels among 90-280 mmHg had a mean of 130±25 mmHg. Then the range of diastolic blood pressure (DBP) among 60-170 mmHg had a mean of 85±15 mmHg. Both of them were bring down at stage I at 130-155/85-95 mmHg of the nephropathy patients. The recommendations from the European Society of Hypertension (ESH), European Society of Cardiology (ESC) and WHO that reduced the risk of physicians' reduction that for the blood pressure lesser than 130/80 mmHg with presence of albuminuria and hypertension (Williams et al., 2004).

The body weight of the patients were 35-126 kg had a mean of 73.25± 19.22 kg that nearly result with average weight of the patient 70 kg and their height ranged among 1.43-1.86 meters had a mean of 1.65± 0.9 meters. The range of the body mass index (BMI) was evaluated as 13.6-43.5 kg/m2 had a mean of 26.05± 7.03 kg/m2 and it indicated that the BMI average of the participants bring down within overweight of 26-29.4 kg/m2. The circumference of Hip mean was 100.02± 13.90 cm and the circumference of Waist was 85.78± 12.65 cm. The ratio of waist hip mean was (WHR) of the patient was 0.95± 0.51, that signified to the stomach obesity disregarding of sex (>0.8 in males and > 0.83 in females) (Table-3).

Table-3: Different means of some parameters

S.No.	Parameter	Mean	Deviation

1	Age	50.18	± 12.77
2	Rate of pulse	76.25	± 7.45
3	Waist Hip ratio	0.95	± 0.51
4	Systolic blood pressure (mmHg)	130	± 25
5	Diastolic blood pressure (mmHg)	85	± 15
6	Weight (kg)	73.25	± 19.22
7	Height (m)	1.65	± 0.9
8	Hip circumference (cm)	100.02	± 13.90
9	Waist circumference (cm)	85.78	± 12.65
10	Body Mass Index (kg/m2)	26.05	± 7.03

The study of previous report suggested that BMI and calcium channel blockers (CCB) were the independent factors of increased excretion of urinary albumin but the ethnic variation among the Thai study explained the hypertension has the complications severe between the blacks and African-American compared to Whites (Warmoth et al., 2005).

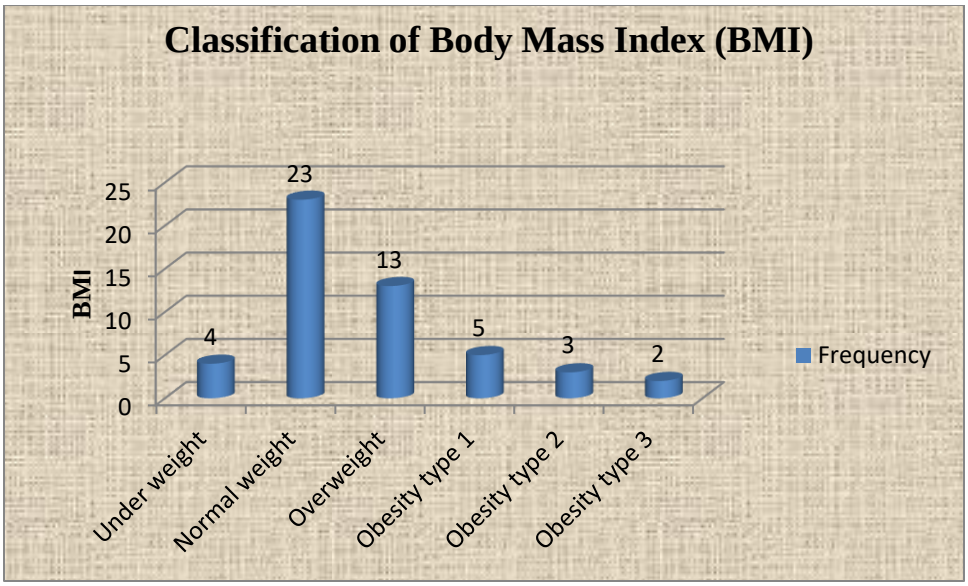
Clinical investigation of participants

In the classification of Body mass index (BMI) showed that most of the participants had 23 (46%) had normal weight. The proteinuria i.e. urine protein ubiquity between the diabetic nephropathy patients was 30% had a frequency of 15 and absent in the participants were 35 in the mean of 70% (Table-4).

Table-4: Estimation of some parameters among the diabetic nephropathy patients

Proteinuria		
Urine protein	**Frequency**	**Percentage**
Absent	35	70%
Present	15	30%
Total	50	100%
Microalbuminuria		
Absent	19	38%
Present	31	62%
Total	50	100%
UACR		
Normal	29	58%
Microalbuminuria	21	42%
Total	50	100%
Gender		
Male	18	36%
Female	15	30%
Normal	17	34%
Total	50	100%

Fig-1: Classification of Body Mass Index (BMI)



Estimation of microalbuminuria, proteinuria, UACR based on gender

By using the dipstick method, the microalbuminuria prevalence between the patients was 62% with a frequency of 31. Microalbuminuria screening using dipstick was accomplished to investigate the more participants 31 (62%) with nephropathy compared to proteinuria was 15 (30%).The urinary albumin creatinine ratio (UACR) was estimated quantitatively by the confirmation of microalbuminuria at 21 in the mean of 42% participants that who are all positive for microalbuminuria by using the dipstick. So, the microalbuminuria prevalence among the 50 participants was 42%.The microalbuminuria found that was related to gender showed male patients had increased level was 18 (36%)and the female was 15 (30%). This result observed that the microalbuminuria prevalence was increased among the male gender compared to female (Table-4).

The report in 2011 by, the International Society of Nephrology (ISN) stated that microalbuminuria is elucidated as albumin in urine at the concentration of 30–300 mg/l of spot collection of urine at early morning (MacKinnon et al., 2006). The urinary albumin excretion at 24 hours rate is 30-300mg or ratio of albumin: creatinine in urine is 5-30mg/mmol for men, 3.5-30 mg/mmol for women on 2-3instance and proteinuria is called as ratio of albumin: creatinine at > 30mg / mmol or concentration of albumin > 200 mg/L.

Association between BMI and proteinuria

The results showed that the statistically significant higher level in the proteinuria with high BMI between the participants and reduced proteinuria with lesser BMI ($p = 0.0228$). The evaluation study of UK showed that the microalbuminuria prevalence in the participants had BMI < 25 kg/m^2 was 3.1% compared to 12.1% with BMI among 25-30 kg/m2 and 27.2% in obese patients with BMI > 30 ($p< 0.001$). The microalbuminuria prevalence suggested the increased category of BMI (Ishani et al., 2006).

Association between BMI and microalbuminuria

The association among the BMI and microalbuminuria results observed that the increased in the statistically significant range in microalbuminuria (UACR) among participants with higher level of BMI ($p = 0.0008$).

Most of the participants were not aware about overweight or obesity as a risk factor that leads to the CKD progression. The proteinuria was statistically significant increase in proteinuria had high BMI among the participants and also had a UACR (microalbuminuria) with increased level of BMI. These results were illustrated in Thailand that obesity was considered as independent determinant of increased albumin secretion in urine in a model of multiple logistic regression (Mbanya and Sobngwi, 2003).

Association between WHR and microalbuminuria (dipstick) according to gender

The relationship among the microalbuminuria and abdominal obesity was statistically significant to the male at $p = 0.034$. There was no association among the statistically significant microalbuminuria and abdominal obesity between female at $p = 0.099$. The WHR was significantly correlated with CKD/ UACR in the study of Ilesa dissimilar to BMI. The assumption of diets of Western has been found to be responsible for the obesity in developing countries includes Nigeria (Marije et al., 2009).

Association between WHR and microalbuminuria (UACR) according to gender

There was nostatistically significant association among the microalbuminuria (UACR) and abdominal obesity between male participants ($p = 0.172$) and no relation among the female participants ($p = 0.095$).These results were similar to the report of Thai study had an increased UAE using antibody depend dipstick of 559 total population from that screened population were 183. So, 110 participants showed positive result by antibody-depend dipstick were confirmed by elevated ratio of albumin-creatinine gives the 19.6% of 95% CI: 14.4%–18.8%. After excluding 17 participants had macroalbuminuria and 93 cases were found to have microalbuminuria (Kadiri, 2005).

Conclusion

The family medical practitioner required to recommend initial screening of patients at usual outpatient clinics who had higher risk of development of diabetic nephropathy and to assist them to slow down the process of end stage renal disease by diet modification. The need to analyze the microalbuminuria among glycated hemoglobin by family medical practitioner is suggested.

Reference

1. Khosravi A, Ansari RA, Shirani S. Blood pressure levels and trends of obesity in hypertensive patients versus healthy individuals: ISFAHAN 1991 – 2001. ARYA J 2005; 1(1): 19-24.
2. Aaron and vinik. Diabetes and macrovascular disease, Journal of diabetes and its complications. 2001.Vol no.16, pp.235- 245.

3. Van der VM, Halbesma N, de Charro FT, Bakker SJ, de Zeeuw D, de Jong PE, et al. J Am Soc Nephrol. 2009; 20(4):852-862.
4. Navita Lakshmi, Dr. B. Kiranmayi, Dr.R.R Tagore. Study of hyperglycemia in NIDDM individuals by HbA1c and Micro-albuminuria‖, International Journal of Pharmaceutical Research and Bioscience. 2015.Vol. 4, issue -1, pp. 81-88.
5. Olutayo CA, Olugbenga OA, Adigun A, Olutoyin AI. Chronic renal failure at the Olabisi Onabanjo University Teaching Hospital, Sagamu, Nigeria. Afr Health Sci. 2006; 6(3): 132-138.

6. American Diabetes Association: Standards of medical care in diabetes.2006. Diabetes Care, vol.29 pp.S4–42.

7. WHO. Obesity and overweight. Available from www.WHO/obesity/overweight.htm (Accessed 23/05/2012).
8. Medscape. Definition of microalbuminuria. J Clin Hypertens. 2004; 5: 15-17.
9. Kawar B, Bello AK, El Nahas AM. High prevalence of microalbuminuria in the overweight and obese population: data from a UK population screening programme. Nephron Clin Pract. 2009; 112 (3):205-212.
10. Go AS, Chertow GM, Fan D, McCulloch CE, Hsu CY. Chronic kidney disease and the risks of death, cardiovascular events, and hospitalization. N Engl J Med. 2004; 351: 1296-1305.
11. Coresh J, Astor B, Sarnak MJ. Evidence for increased cardiovascular disease risk in patients with chronic kidney disease. Curr Opin Nephrol Hypertens. 2004; 13:73-81.
12. Appel LJ. Lifestyle modification as a means to prevent and treat high blood pressure. J Am Soc Nephrol. 2003; 14(suppl 2):99-102.
13. Williams B, Poulter NR, Brown MJ, Davis M, McInnes GT, Potter JF, et al. Guidelines for management of hypertension: report of the fourth working party of the British Hypertension Society. BHS IV. J Hum Hypertens. 2004; 18(3):139-85.
14. Warmoth L, Regalado MM, Simoni J, Harrist RB, Wesson DE. Cigarette smoking enhances increased urine albumin excretion as a risk factor for glomerular filtration rate decline in primary hypertension. Am J Med Sci. 2005; 330(3):111-9.
15. MacKinnon M, Shurraw S, Akbari A, Knoll GA, Jaffey J, Clark HD. Combination therapy with an angiotensin receptor blocker and an ACE inhibitor in proteinuric renal disease: a systematic review of the efficacy and safety data. Am J Kidney Dis. 2006; 48(1):8-20.
16. Ishani A, Grandits GA, Grimm RH, Svendsen KH, Collins AJ, Prineas RJ, et al. Association of single measurements of dipstick proteinuria, estimated glomerular filtration rate, and hematocrit. J Am Soc Nephrol. 2006; 17(5):1444-52.
17. Mbanya C, Sobngwi E. Diabetes in Africa. Diabetes microvascular and macrovascular disease in Africa. J cardiovasc risk. 2003; 2: 97-102.
18. Marije VV, Nynke H, Frank TC, Stephan JB. Screening for albuminuria identifies individuals at increased renal risk. J Am Soc Nephrol. 2009; 20(4): 852-862.
19. Kadiri S. “Tackling cardiovascular disease in Africa.” British Medical Journal. 2005; 331-711.