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Microalbuminuria and Macroalbuminuria in Type 2 Diabetes

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ABSTRACT

Background: Type 2 diabetes is the leading cause of end stage renal disease worldwide. Prevalence of diabetic nephropathy (DN) varies in the different ethnic groups. Nepal is country with great ethnic diversity. This study has been done to find the prevalence of microalbuminuria and macroalbuminuria in the two ethnic groups Jyapu and Brahmin.

Methods: In our study we have included two ethnics groups Jyapu and Brahmin type 2 diabetic patients. Inclusion criteria: Age ≥ 30 years, clinically diagnosed type 2 diabetic patients. Exclusion criteria: Patients with a history of urinary tract infection, hematuria, renal failure, intercaste marriage and women with menstruation at the time of sample collection.

Results: The overall prevalence of albuminuria was 49.05%. The prevalence of microalbuminuria was 35.89% in Jyapu and 37.73% in Brahmin which was comparable. There was significantly higher prevalence of macroalbuminuria in Jyapu 20.75% and Brahmin 3.77%. Association of dietary habit was seen with microalbuminuria and macroalbuminuria in both ethnic groups.

Conclusions: The overall prevalence of albuminuria in type 2 diabetes of our study was high and there was significantly higher macroalbuminuria in Jyapu compared with Brahmin. It, therefore, predicts a higher risk of having kidney disease in Jyapu population.

Key words: ethnicity, Nepal, macroalbuminuria, microalbuminuria, type 2 diabetes.

INTRODUCTION

Diabetes mellitus is a common disease worldwide. According to the World Health Organization, estimated cases of type 2 diabetes for 2000 was 171 million and is projected to increase to 366 million by the year 2030.[1] In Nepal, the prevalence diabetes was 436000 in the year 2000 and the projected figure for year 2030 is 1328000.[2]

Chronic renal insufficiency is reported twice as frequently in persons with diabetes.[3] A study done in Nepal found that about 18% of the patients admitted for hemodialysis were diabetic.[4] It has been shown that the risk of developing DN in type 2 diabetes is 30-40%.[5] Albuminuria in type 2 diabetic patients is the predominant renal risk marker for nephropathy[6] and cardiovascular complications.[7] Reduction in albuminuria is associated with a proportional effect on renal protection.[6] Therefore, early detection of microalbuminuria in type 2 diabetes is important.

It has been suggested that there is clustering of DN in families[8-10] and certain ethnic group.[11] Nepal is a

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country with multiple ethnic groups. We therefore, intended to find the prevalence of microalbuminuria and macroalbuminuria in two ethnic groups (Jyapu and Brahmin) in Nepal.

METHODS

A case-control study was conducted in Jyapu population of Patan and Brahmin population of Kathmandu and Kavre in 2008-2009. The hospital permission was taken. We have included indigenous Jyapu (case) and Brahmin (control) patients with type 2 DM. The sample size was calculated using EPI INFO version 3.3.2 which used 5% level of significance (α) and 80% power (1-β). The study was approved form the institutional research committee. A client's written consent was obtained prior to the study.

The patients aged ≥30 years with clinically diagnosed type2 DM were included. Only indigenous Jyapu population of Kathmandu Valley and Brahmins were included. Jyapu is one of the ethnic groups of the Newar community. Their main occupation is farming, but because of rapid urbanization of Kathmandu valley, their occupation has been gradually shifted to business and services. They live in a close community preserving their own rich culture and traditions. Unlike the Jyapu, Brahmin's are distributed throughout Nepal. Their main occupation is service, farming and some are priests. In order to maintain genetic homogeneity, patients with past history of inter caste marriage were excluded. Also patients with a history of urinary tract infection, hematuria, renal failure, and women with menstruation at the time of sample collection were excluded.

Patient's blood pressure, height, weight, waist circumference and hip circumference were measured. For biochemical analysis, blood was collected after overnight (8 hrs) fast and a morning urine sample was taken. Urine microalbumin was measured from morning urine sample with immunoturbidimetric method. The reagents were available form Spinreact Spain. Glycated hemoglobin (HbA1c) test was done by ion exchange chromatography. The reagents used were from BioSystem, Spain. Creatinine was also measured by Jaffes method; Urea was also measured by the Berthelot method; total cholesterol and triglyceride were measured by enzymatic method and HDL-cholesterol was measured by the precipitation method. The reagents used were from Accurex, India. LDL-Cholesterol and VLDL-Cholesterol was calculated by Friedwald Formula. These parameters were obtained form semiatoanalyzer Erba Chem 15 analyzer, India. Microalbuminuria was diagnosed if the albumin excretion was 30-299 µg/mg of creatinine12 and macroalbuminuria was diagnosed if the albumin excretion was ≥300 µg/mg of creatinine.

Statistical analysis was done using SPSS software version 16.0. Histogram and Shapiro-Wilk test of normality was used to assess the normality of continuous variables. Descriptive statistics was used to find the prevalence of microalbuminuria and macroalbuminuria. Chi-square test was used to draw inferences from nominal variables. T-test was used for statistical inferences in case of normally distributed quantitative variables and Mann-Whitney test was used to compare the non-normal continuous variables with binary outcomes.

RESULTS

The overall prevalence of albuminuria was 49.05% in our study. The prevalence of microalbuminuria was 35.89% in Jyapu and 37.73% in Brahmin which was comparable. The prevalence of macroalbuminuria in Jyapu was 20.75% and Brahmin 3.77% (Table 1). The chi-square test showed significantly higher prevalence of macroalbuminuria, higher alcohol and non-vegetarian diet consumption in Jyapu (Table 2). Therefore, we further analyzed these significant parameters controlling for the microalbuminuria and macroalbuminuria. It showed that microalbuminuric Jyapu are significantly higher alcohol consumers and non-vegetarian compared to microalbuminuric Brahmin and macroalbuminuric Jyapu were significantly higher non-vegetarian compared to macroalbuminuric Brahmin (Table 3).

Table 1. Prevalence of albuminuria

Ethnicity (n)	Microal buminuria (n)%	Macroal buminuria (n)%	Total Albu minuria (n)%
Jyapu (53)	(19) 35.89	(11) 20.75	(30) 56.64
Brahamin (53)	(20) 37.73	(2) 3.77	(22) 41.50
Total (106)	(39) 36.79	(13) 12.26	(52) 49.05

Table 2. Chisquare test performed for various parameters between Jyapu and Brahmin

Description	Class	Jyapu(53)	Brahmin(53)	p-value
Diet	Veg	1	21	<0.001
	Non-veg	52	32	
Alcohol	Yes	34	4	<0.001
	No	19	49	
Smoking	Yes	9	6	NS
	No	44	47	
Antidiabetic Drug	Yes	40	44	NS
	No	13	9	
Antihypertensive Drug	Yes	15	16	NS
	No	38	37	
Lipid Lowering Drug	Yes	1	4	NS
	No	52	49	
Microalbuminuria	Normoalbuminuria	23	31	NS
	Microalbuminuria	19	20	
Macroalbuminuria	Normoalbuminuria	23	31	<0.01
	Macroalbuminuria	11	2	

Note: NS- Not Significant

Table 3. Comparison of nominal variables in microalbuminuria and macroalbuminuria between Jyapu and Brahmin

	Microalbuminuria		Macroalbuminuria	
	Chi-square*	Odds Ratio	Chi-square*	Odds Ratio
Diet	7.26b	NA	6.45c	NA
Alcohol	14.38a	41.16	0.79NS	NA

Note:

* Corrected Chi-square (Continuity Correction) NA - At least one of the 2 x 2 cell value is empty.
p<0.05=a, p<0.01=b, p<0.001=c and NS- Not Significant

Comparison of different parameters between Jyapu and Brahmin showed significantly higher levels of cholesterol, triglyceride, VLDL-C, LDL-C and urea in Jyapu compared to Brahmin (Table 4). However when controlled for the microalbuminuria and macroalbuminuria , only microalbuminuric Jyapu showed significantly higher cholesterol and LDL-C compared to microalbuminuric Brahmin (Table 5).

Table 4. Comparison of various parameters between Jyapu and Brahmin by t-independent test and Mann-Whitney test

Parameters	Ethnicity	Number	Mean	SD	p value
Waist	Jyapu	53	89.83	9.09	NS
	Brahmin	53	88.79	8.52	
W/H	Jyapu	53	0.96	0.07	NS
	Brahmin	53	0.96	0.06	
BMI	Jyapu	53	24.12	3.19	NS
	Brahmin	53	23.95	3.90	
MAP	Jyapu	53	105.17	14.05	NS
	Brahmin	53	102.38	9.86	
Parameters	Ethnicity	Number	Median	IQR	p value
Age	Jyapu	53	54	21	NS
	Brahmin	53	55	15	
Duration of disease	Jyapu	53	5	7	NS
	Brahmin	53	5	7.8	
Cholesterol	Jyapu	53	199	96	<0.001
	Brahmin	53	130	86	
Triglyceride	Jyapu	53	130	64	<0.05
	Brahmin	53	106	66	
HDL-C	Jyapu	53	28	13	NS

	Brahmin	53	31	10	
VLDL-C	Jyapu	51	26	11	<0.05
	Brahmin	52	21	13	
LDL-C	Jyapu	51	120	88	<0.001
	Brahmin	52	78	64	
HbA1c	Jyapu	53	6.6	2	NS
	Brahmin	53	6.5	2.4	
FBS	Jyapu	53	144	95	NS
	Brahmin	53	125	82	
Urea	Jyapu	53	27	14	<0.001
	Brahmin	53	21	9	
Creatinine	Jyapu	53	1.1	0.3	NS
	Brahmin	53	1.0	0.3	
Microalbumin	Jyapu	53	69	236	NS
	Brahmin	53	27.5	69	

NS = Not Significant

Table 5. Comparison of various parameters between microalbuminuric / macroalbuminuric Jyapu and Brahmin by Mann-Whitney test

Parameters	Ethnicity	Microalbuminuria			Macroalbuminuria		
		Number	Median	IQR	Number	Median	IQR
Cholesterol	Jyapu	17	172a	96	11	217	113
	Brahmin	19	131	84	2	218	-
Triglyceride	Jyapu	17	129	30	11	134	50
	Brahmin	19	120	97	2	126	-
VLDL-C	Jyapu	17	26	6	11	27	10
	Brahmin	19	24	19	2	41	-
LDL-C	Jyapu	17	120a	88	11	155	94
	Brahmin	19	83	84	2	155	84
Urea	Jyapu	17	27	9	11	34	12
	Brahmin	19	25	11	2	19	11

Note: p<0.05=a, p<0.01=b and p<0.001=c

Table 6. Comparison of various parameters between normoalbuminuria and Microalbuminuria / Macroalbuminuria by t-independent test and Mann-Whitnney test

Parameters	Normoal buminuria (54)	Microal buminuria (39)	Macroa buminuria (13)
	Mean(SD)	Mean(SD)	Mean(SD)
Waist	89.85(9.14)	88.18(9.27)	90.46(5.22)
W/H	0.95(0.06)	0.97(0.08)	0.99(0.05)c
BMI	24.31(3.59)	23.82(3.76)	23.52(2.80)
MAP	101.74 (10.35)	105 (14.61)	108 (9.96) c
	Median(IQR)	Median(IQR)	Median(IQR)
Age	55(13)	55.50(20)	50(26)
Duration of disease	4(5.8)	7(6.8)	5(8)
Cholesterol	150(86)	156(104)	217(90) b
Triglyceride	112(58)	125(46)	153(65)
HDL-C	30(12)	31(12)	28(16)
VLDL-C	23(12)	25(10)	31(13)
LDL-C	78(70)	95(72)	155(80) b
HbA1c	6.6(2.1)	6.3(2.7)	7.2(2.8)
FBS	120(78)	128(96)	164(114)
Urea	20(9)	27(10)	30(19) c
Creatinine	1.0(0.3)	1.1(0.2)	1.1(0.4)

Note: p<0.05=a, p<0.01=b and p<0.001=c

Comparison of different parameters between normoalbuminuria and microalbuminuria in the total subjects of our study did not show any significant result. But comparison between normoalbuminuria and macroalbuminuria showed Waist Hip ratio (W/H), Mean Arterial Pressure (MAP), cholesterol, LDL-C and urea significantly higher in the group with macroalbuminuria (Table 6).

DISCUSSION

Our study showed overall prevalence of 36.79% microalbuminuria. The prevalence of microalbuminuria in two ethnic groups of our study was 35.89% (Jyapu) and 37.73% (Brahmin) which was comparable. The overall prevalence of microalbuminuria is similar to the study done in South India by Varghese et al[13] but was lower than the study done in Pokhara, Nepal by Shigdel et al[14] which was 45.5% and higher than the study done in the North India by Gupta et al[15] which was 26.6%. The overall prevalence of macroalbuminuria in our study was 12.26%. The prevalence of macroalbuminuria in two ethnic groups of our study showed a significantly higher prevalence in Jyapu (20.75%) compared to Brahmin (3.77%). The overall prevalence of macroalbuminuria in our study is comparable with study done in Pokhara 11.2%.[14]

The result of microalbuminuria prevalence between Jyapu and Brahmin is comparable. However, a significantly higher prevalence of macroalbuminuria in Jyapu predicts the higher prevalence of kidney disease in Jyapu compared to Brahmin. The variation in the prevalence could be because of difference in population, glycemic control, durartion of disease, lipid level and dietary habits.

Keane et al have shown the role of lipid in excretion of albumin through the kidney.[16] In our study, we have observed significantly high cholesterol, triglyceride, VLDL-C and LDL-C in Jyapu compared to Brahmin. The result is similar to the study done in two Chinese ethnic groups where they concluded that the differences in the lipid levels may be because of the differences in dietary habits and alcohol consumption.[17] In our study also, there was the significant association of diet and alcohol with microalbuminuria and diet with the macroalbuminuria between Jyapu and Brahmin. Culturally, in Jyapu community, they have higher frequency of festivals where they celebrate with varied food (including meat) and drinks (alcohol) compared to Brahmin. Studies have suggested that meat eaters have higher lipid levels.[18] In alcohol drinkers, the influence on lipids depends on the amount of alcohol consumption.[19] Therefore, the higher prevalence of the macroalbuminuria in the Jyapu population could be associated with the difference in dietary habits. And also it could be due to a true difference in ethnic susceptibility for nephropathy. However, there might be other causes associated with it.

Unnikrishnan et al have found significantly higher age of the patient, duration of disease, BMI, Waist circumference, blood pressure, FBS, HbA1c in case of microalbuminuria and macroalbuminuria when compared with normoalbuminuria.[20] Similarly, Bessie et al have found significantly high level of age, duration of disease, total cholesterol, triglyceride, LDL-C, HbA1c and FBS.[21] But, comparison of these parameters between normoalbuminuria and microalbuminuria did not show significantly different result in our study. However, comparison between normoalbuminuria and macroalbuminuria has shown significant difference in waist hip ratio, MAP, total cholesterol, LDL-C and urea. Therefore, this difference in our result could be because of ethnic difference. And it also could be because of the limited sample size in our study. Hence, further study with a larger sample is necessary in order to obtain the valid result in the population of our study.

Limitation of our study is that we hypothesized the ratio of diabetic nephropathy in the two ethnic groups to be 4:1.the ratio as it is unknown in our population. Therefore, if the ratio turns out to be different, the required sample size may be different and the result may be biased. Thus, our study would act as pilot study and give many baseline data required for further research in this area. Due to the logistic reason, single morning urine sample was used for the screening of the microalbuminuria and macroalbuminuria.

CONCLUSIONS

The prevalence of microalbuminuria is comparable in two ethnic groups Jyapu and Brahmin of Nepal. However, there is significantly higher prevalence of macroalbuminuria in Jyapu compared to Brahmin, predicting higher prevalence of kidney disease in Jyapu population. This study could be taken as baseline study for larger scale research on predictors/risk factors of diabetic nephropathy in Nepalese population.

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