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THE ASSOCIATIONS AND RISK FACTORS RELATED WITH DIABETES HYPERTENSION AND PROTEINURIA AMONG ADULTS

Dr Ejaz ullah[1], Dr Hasham Hussain Farooqi[2], Dr Gohar Rahman[3]

[1] Hamdard Collage of Medicine and Dentistry, Karachi
[2] Kohat Institute of Medical Science, Khyber Medical University
[3] Bannu Medical College, Bannu

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Abstract:

Aim: *The purpose of this study was to investigate the relationship between hypertension, diabetes, and proteinuria and their risk factors in adults.*

Place and Duration: *In the Medicine department of Lady Reading Hospital (LRH) Peshawar for one-year duration from February 2019 to January 2020.*

Methods: *Data were collected from 2,890 people who agreed to participate in the study. The data included basic information about demographic and health research. Multivariate logistic regression models were used with three outcome variables (proteinuria, diabetes, and hypertension) and four independent and control variables (age, sex, pulse rate, and body mass index).*

Results: *Of the participants who had both hypertension and diabetes, 77% had proteinuria. Of those with diabetes, 55% had proteinuria and 45% had hypertension. Logistic regression models adjusted for age and sex showed that diabetes mellitus was significantly associated with proteinuria (odds ratio OR = 3.0, p = 0.005), while the relationship between hypertension and proteinuria was borderline significant (p <0.057). Hypertension was significantly associated with diabetes after adjusting for age and sex (OR = 1.5, P less than 0.001). Participants over the age of 40 had a greater chance of having diabetes or high blood pressure compared to participants aged 15 to 39.*

Conclusions: *Prevention of complications in non-communicable diseases (NCD) should focus on subpopulations over 40 years of age and people with hypertension, diabetes and / or proteinuria. Healthcare services are important for screening large numbers of unaware and undiagnosed patients with diabetes, hypertension and proteinuria.*

Key words: *diabetes, hypertension, proteinuria, risk factors.*

Corresponding author:
Dr. Ejaz ullah,
Hamdard Collage of Medicine and Dentistry, Karachi

QR code

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INTRODUCTION:

Hypertension, diabetes and proteinuria are of great importance for public health in both developed and developing countries, as these conditions are associated with a risk of complications such as cardiovascular disease (CVD) and chronic kidney disease. In Pakistan, these non-communicable diseases (CT) account for almost 60% of all deaths[1-2]. According to a new report by the World Health Organization (WHO), Pakistan has a high burden of hypertension among adult villagers, with an estimated incidence of 24%[3-4]. A meta-study of diabetic studies in Pakistan estimates that the incidence of diabetes among adults was more than double the 4% in 1995-2000, more than 9% between 2006 and 2010, and it is estimated that by 2030 it will be 13%. In such cases, it is known that both diabetes and hypertension are risk factors for proteinuria, which is an early marker of kidney damage and a manifestation of chronic kidney disease[5-6]. In addition, proteinuria is known as a common complication of hypertension and diabetes. Although Pakistan must prevent hypertension, diabetes and proteinuria, several studies have investigated the combination of these diseases and risk factors, particularly in the lower parts of rural areas. The aim of this study is to investigate the links between hypertension, diabetes and proteinuria in rural adults who participated in the study

METHODS:

This study was held in the Medicine department of Lady Reading Hospital (LRH) Peshawar for one-year duration from February 2019 to January 2020**.** Basic participant demographic information such as age, gender and location were collected using a standard enrollment sheet. During the GP visit, trained medical entrepreneurs measured or tested the following anthropometric and clinical data: 1) height, 2) weight, 3) hip circumference, 4) waist circumference, 5) body temperature, 6) systolic blood pressure, 7) diastolic blood pressure blood, 8) blood glucose, 9) hemoglobin in the blood, 10) glucose in urine, 11) urine protein, 12) urobilinogen in urine, 13) urine pH, 14) heart rate, 15) cholesterol in the blood. The result of each follow-up was divided into one of four different risk levels, color coded as follows: green (healthy), yellow (caution), orange (affected), and red (emerging). Detailed methodologies, including the privacy and security of collecting patient health data, are described elsewhere. The main outcome variables were hypertension, diabetes, and proteinuria. Hypertension was defined as systolic blood pressure over 140 mmHg or diastolic blood pressure over 90 mmHg. Based on the definition, the variable for hypertension was dichotomously coded as "yes" or "no". Blood pressure was measured with A&D UA772PBT. This device can measure not only blood pressure, but also heart rate and arrhythmia. Diabetes was defined as blood glucose levels greater than 200 mg / dL at the time of primary health control. This definition was based on WHO criteria and diabetes was dichotomously classified as "yes" or "no". Random blood glucose levels were measured because the time since the participant's last meal was not asked. Diabetes was measured using Medisafe Fit (Terumo, Tokyo, Japan). A drop of blood was drawn from each participant's middle finger. Proteinuria was defined as urine protein levels greater than or equal to 30 mg / dL. It was measured by the strip method with Urine Test Stripes Uric 3V which provides a color scale that indicates five protein levels as follows: None (100 mg / dL) and 3+ (> 500 mg / dL). Proteinuria has been classified as "yes" or "no" binary per definition. The independent variables were overweight or obesity and abnormal pulse rate. WHO criteria were used to define all the variables. Overweight and obesity were defined as body mass index (BMI) values greater than 25 and 30 kg / m2. Abnormal pulse rate was defined as a pulse rate greater than 100 beats per minute or less than 50 beats per minute. All independent variables were coded dichotomously as "yes" or "no". Age and gender were selected as the main control variables

Data analysis

A two-dimensional analysis was performed to describe the interrelationships between hypertension, diabetes and proteinuria. Pearson's chi-square test (two-dimensional analysis) was performed to describe the uncorrected relationship between the dependent and independent / control categorical variables. Multiple logistic regression analysis was performed to describe the adjusted association of independent variables with the likelihood of hypertension, diabetes and proteinuria after adjusting for age and gender. Each independent variable was included in the logistic regression models separately because the independent variables were strongly correlated (collinearity). For example, there were significant correlations between hypertension and overweight / obesity ($p < 0.001$), abnormal pulse rate and overweight / obesity ($p = 0.009$), and between hypertension and proteinuria ($p = 0.03$) (Supplementary Table 1). Therefore, the following four different models were used for each dependent variable:

Model 1: Logit Y1 (X) - 0 + 1 (age) + 2 (sex) + 3 (hypertension or diabetes) + ε

Model 2: Logit Y1 (X) - 0 + 1 (age) + 2 (gender) + 3 (invalid pulse) + ε

Model 3: Logit Y1 (X) - 0 + 1 (age) + 2 (gender) + 3 (overweight or obese) + ε

Model 4: Logit Y1 (X) - 0 + 1 (age) + 2 (sex) + 3 (hypertension or proteinuria) +

All statistical analyses were conducted using SPSS version 21 (IBM Corp., Armonk, NY). The P value is considered <0.05 valid.

RESULTS:

A total of 2,890 people was participated in this study. Among these subjects, children under 15 years of age (19 cases) and children with incomplete or inconsistent data were excluded from the analysis (4 cases). Therefore, the total sample size for analysis was 2867. The most common part of health check chosen by participants was a study of blood sugar for diabetes (n-2539), hypertension (n-2411) and heart rate (n-2400). Only 18.8% (n-539) and 15.3% (n-440) were measured in height/body weight and urinary protein, respectively.

Table 1 Socio-demographic characteristics and health status among individuals who participated in the study

Items	Total	
	N	%
Age (years)	2867	Mean = 44.1
		Range = 15-95
Age groups	2867	-
15-29 years	424	14.8
30-39 years	739	25.8
40-49 years	671	23.4
50-59 years	591	20.6
≥60 years	442	15.4
Sex	2867	-
Male	1758	61.3
Female	1109	38.7
Pulse rate category	2400	-
Normal (50-100 beats/min)	2110	87.9
Abnormal (≤49 or ≥101 beats/min)	290	12.1
BMI category	539	-
Underweight (<18.5 kg/m^2)	60	11.1
Normal (18.5-25 kg/m^2)	292	54.2
Overweight or Obese (≥25 kg/m^2)	187	34.7
Hypertension	2411	-
No	1510	62.6
Yes	901	37.4
Diabetes	2539	-
No	2091	82.4
Yes	448	17.6
Urinary Protein test	440	
Negative (−) <14 mg/dL	200	45.5
Trace (−/+) 15-29 mg/dL	101	23
Positive (+1) 30-99 mg/dL	121	27.5
Positive (+2 or +3) ≥100 gm/dL	18	4.1

Table 1 shows the age and gender of the participants, as well as their health status. The majority of participants (85%) were men aged 30 years and over, with an average age of 44 and 60% of men. In 12% of participants, an abnormal pulse was detected. More than a third (35%) respondents were obese and 11% were weak. The proportion of participants with hypertension, diabetes and proteinuria was 37%, 18% and 32%, respectively.

Table 2 Unadjusted association of independent variables with hypertension, diabetes, and proteinuria

Items	Hypertension (N = 2,411)			Diabetes (N = 2,539)			Proteinuria (N = 440)		
	n/N	%	P for Diff.	n/N	%	P for Diff.	n/N	%	P for Diff.
Sex	N = 2411	-	-	N = 2539	-	-	N = 440	-	-
Male	541/1462	37	0.34	257/1574	16.3	0.015	73/254	28.7	0.081
Female	360/949	37.9		191/965	19.8		66/186	35.5	
Age groups	N = 2411	-	-	N = 2539	-	-	N = 440	-	-
15–39 years	264/993	26.6	<0.001	103/1013	10.2	<0.001	61/190	32.1	0.86
40–49 years	231/568	40.7		116/602	19.3		30/106	28.3	
50–59 years	241/505	47.7		130/531	24.5		24/72	33.3	
≥60 years	165/345	47.8		99/393	25.2		24/72	33.3	
Pulse rate	N = 2388	-	-	N = 2139		-	N = 408	-	-
Normal	756/2099	36	<0.001	322/1892	17	0.12	101/351	28.8	0.033
Abnormal	140/289	48.4		50/247	20.2		24/57	42.1	
Overweight/ obesity	N = 536	-	-	N = 490		-	N = 385	-	-
No	83/350	23.7	<0.001	34/320	10.6	0.48	78/264	29.5	0.5
Yes	87/186	46.8		19/170	11.2		35/121	28.9	
Hypertension	-	-	-	N = 2154	-	-	N = 412	-	-
No	-	-	-	191/1344	14.2	<0.001	81/298	27.2	0.026
Yes	-	-	-	182/810	22.5		43/114	37.7	
Diabetes	N = 2154	-	-	-	-	-	N = 407	-	-
No	628/1781	35.3	<0.001	-	-	-	108/378	28.6	0.004
Yes	182/373	48.8		-	-	-	16/29	55.2	
Proteinuria	N = 412	-	-	N = 407	-	-	-	-	-
No	71/288	24.7	0.026	13/283	4.6	0.004	-	-	-
Yes	43/124	34.7		16/124	12.9		-	-	-

Table 2 shows associations with hypertension, diabetes and proteinuria. Both hypertension and diabetes were significantly associated with the age group (P.026). The proportion of participants with hypertension was significantly higher among overweight or obese people (47%). (P<0.026). people with diabetes (49%) among people not related to diabetes (35%) (P.026) and among those with proteinuria (35%) proteinuria, this is between 190 (25%) (P-0.026). The proportion of participants with diabetes was significantly higher among those with hypertension (23%). 190 per proteinuria (5%) (p. 026). The proportion of participants with proteinuria was significantly higher among patients with diabetes mellitus (55%) among people without diabetes (29%) (P.026%) and 10 (P.026%) hypertension among people with hypertension (38%). 77% of participants with hypertension and diabetes have proteinuria. In addition, 63% of people with diabetes and proteinuria had hypertension. Finally, among people with hypertension and proteinuria, 26% had diabetes.

DISCUSSION:

For our knowledge, this is the first study to examine the relationships and factors associated with hypertension, diabetes and proteinuria together in the western rural region of Pakistan. In this community study, the main finding is that about 80% of participants with hypertension and diabetes have proteinuria[9-10]. In addition, more than half of the participants had proteinuria, and about half had hypertension, proteinuria in 38% of participants with hypertension and diabetes mellitus in 23%. The results also showed that diabetes is significantly associated with proteinuria after age and gender adjustment, and the

relationship between hypertension and proteinuria is limiting[11-12]. Although these results are largely linked to proteinuria, diabetes and hypertension, proteinuria suggests that rural western Pakistan may have a stronger relationship with diabetes than hypertension. One possible reason is a higher percentage of unconscious residents with diabetes than unconscious residents with hypertension in Pakistan. According to a recent population study on diabetes and hypertension in Pakistan, about 60% of people with diabetes were unaware of their diabetes status, while about 50% of people with hypertension were unaware of their hypertension status. In addition, only 14.2% of patients with diabetes received treatment that was consistent with blood sugar levels compared with 27% of patients with hypertension[13]. The highest proportion of unconscious and uncontrolled patients with diabetes may be due to a lack of diabetes diagnosis and treatment centers in rural Pakistan. These results support our claim that diabetic patients who have not received diabetes treatment for a long time are more likely to develop proteinuria than conscious and controlled patients with diabetes. In rural Pakistan, the number of uninformed and untreated patients with hypertension is also high, particularly in rural Pakistan, due to lack of access and inadequate equipment and medicines for the prevention and treatment of TT. Given these conditions, a simple urine level test, combined with blood glucose testing and blood pressure measurement used in PHC health care services, may be an effective approach in detecting a large number of patients with diabetes and hypertension who have not been diagnosed at an early stage of the disease before complications develop. This joint screening can identify and identify people at high risk of mortality from all causes, echography and discomfort, because proteinuria, diabetes and hypertension are known risk factors for KVK and mortality for all causes. More work is needed to examine the profitability of PHC services to prevent KKT. Other important results in our study are that diabetes is significantly associated with hypertension after age and gender management and vice versa, and participants over the age of 40 are more likely to have diabetes or hypertension than the proportion of participants aged 15-39[14]. It should be noted that overweight/obesity is not associated with diabetes, but it has been associated with hypertension. These findings are inconsistent with the results of the previous meta-investigation and systematic study in developed countries. However, in Pakistan, several studies have also found a significant link between diabetes and overweight/obesity using an international standard BMI of 25 kg/m2. Previous studies in Pakistan have been proposed as the optimal cutting point for BMI for detecting diabetes at 23 kg/m2. In our example, when overweight/obesity was defined as 23 kg/m2 BMI, the link with diabetes was not yet statistically significant (Annex 2). However, when the BMI was equal to or less than 22 kg/m2, the relationship with diabetes became statistically significant. Finally, a cross-sectional study that does not allow us to investigate the relationship between hypertension and proteinuria, demonstrating that proteinuria can be the cause or consequence of hypertension[15]. However, the dynamics of diabetes associated with hypertension and proteinuria are already established worldwide, with hypertension and the relationship between diabetes and proteinuria and diabetes. Therefore, it is impossible to deceive the causal pathways between these three diseases, but more focus on the compounds and risk factors of these three diseases.

CONCLUSION:

Despite these limitations, this study provided insight into diabetic complications with proteinuria, as well as factors associated with proteinuria, diabetes, and hypertension. These three diseases were highly co-existed and associated with each other as risk factors. It was found to be effective to screen a large number of unaware and undiagnosed diabetic, hypertensive, and proteinuria patients at the early disease stage before the development of complications. The study also found other key risk factors for hypertension, such as older age (≥40 years), overweight/obesity, and abnormal pulse rate. Moreover, the study findings shed light on the need to identify an appropriate BMI cut-off point for the risk of developing diabetes or proteinuria. For the prevention of complications in NCD, a combined set of health check-up services should be promoted, particularly for those older than 40 years of age and those having hypertension, diabetes, or proteinuria. Future studies on the risk factors of proteinuria, diabetes, and hypertension should consider other potential factors including socio-economic factors, health-related behavioral factors, and environmental factors.

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