Albuminuria in Rural Thai People: A Community-Based Screening with Combur Test and Micral Test Strips

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Objectives: *To identify albuminuria prevalence and examine the association of albuminuria with plasma glucose, blood pressure and body mass index in rural Thai people aged 35 and older.*
Material and Method: *All volunteer adults aged 35 and older at Ban Nayao, Chachoengsao Province were recruited in this cross-sectional study. Macroalbuminuria and microalbuminuria were tested in first morning urine using Combur and Micral Test strips. Fasting plasma glucose, blood pressure, weight and height were determined. Chi-square and multiple logistic regression analysis were used for analysis.*
Results: *Of the 357 participants, 26.61% had microalbuminuria, 3.08% had macroalbuminuria, and 9.2%, 19%, 7.3% had diabetes, hypertension, and obese, respectively. The prevalence of microalbuminuria and macroalbuminuria in people with diabetes were 30.30% and 15.15%, respectively. In the obese, the prevalence was 50% and 3.8% and was 30.88% and 7.35% in the hypertensive group, respectively. Strong significant associations between plasma glucose ($p = 0.013$), and body mass index ($p = 0.008$) with the progression of albuminuria were observed. According to multiple logistic regression analysis, diabetes and obesity were independent risk factors for albuminuria statistically significant ($p = 0.036$ and $p = 0.005$, respectively, 95% CI).*
Conclusion: *The present study showed increased risk of albuminuria in diabetes and in obese people in a rural area of Thailand. Thus, community-controlled diabetes and weight program should be introduced to the rural community.*

Keywords: *Albuminuria, Plasma glucose, Hypertension, Body mass index*

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Albumin, the main protein in the blood, can escape through glomeruli and be detected in urine in small amounts (less than 30 mg/day) in normal healthy people[1]. Processes that damage glomeruli including diabetes, hypertension and renal diseases can cause proteinuria[2]. It is now known that leakage of protein especially albumin in the

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urine is a sensitive marker for increased glomerular permeability, declining kidney function, and hence chronic kidney disease due to diabetes, hypertension and glomerular disease[1,2]. Albuminuria, therefore, has been known for decades to be a strong and independent risk factor for diabetic, cardiovascular and renal morbidity and mortality.

Microalbuminuria defined as urinary albumin excretion rate of 20-200 μg/min or 30-300 mg/day[1] or equal to or greater than 20 mg/L[3] is found to be positively related to an increased morbidity and mortality in diabetic and non-insulin-dependent diabetic patients mainly from cardiovascular disease[4]. For patients with hypertension, the presence of microalbuminuria is correlated to the presence of left ventricular hypertrophy[1]. Reports also show that micro albuminuria is associated with hypertension[5], renal function abnormalities[6], obesity[7] and older age[8] in non-diabetic subjects. Interestingly, micro albuminuria is also a predictor of morbidity and mortality in patients with no evidence of renal disease[1].

Therefore, the need of testing for albuminuria and microalbuminuria as a way to detect early renal damage is necessary. The information will be used for preventing further deterioration of the renal function in these patients. Thus, the screening will be able to reduce the number of patients suffering from diabetic nephropathy, heart failure, and renal failure.

Ban Nayao, Chachoengsao Province, situated in the central part of Thailand, is one of several areas where people from the northeast relocated and formed a new community. People in the community usually do not move out from this place except for working to earn their living for a short period of time. Thus, this community has been chosen for conducting a health survey since 2002. Preliminary data has shown a high prevalence of diabetes (3.8%) and hypertension (7.4%) in adults aged equal to or older than 35 years. Moreover, renal failure is the leading cause of death in this community. To our knowledge the prevalence in Thai population has not been reported. Taken together, the present study aimed to screen for macroalbuminuria and microalbuminuria in people aged equal to or older than 35 years in this remote community and to analyze the association of albuminuria with plasma glucose, blood pressure and body mass index (BMI). The information received would enable a health-care team to improve care, provide health education and treatment more effectively

Material and Method

Participants

This cross-sectional study approved by the ethic committee of Royal Thai Army Medical Department was carried out on participants aged 35 years or older living in Ban Nayao community, Chachoengsao Province, Thailand. Of the 642 people, written informed consents were obtained from 450 people and 357 people were eligible to enroll in the study. They were entirely voluntary. On the screening day, they were asked to bring first morning urine samples collected in a clean plastic bottle for albuminuria testing. Blood samples were taken, after overnight fast, for plasma glucose assessment. Weight and height were recorded using standardized equipment. Blood pressure was also measured according to the seventh report of the Joint National Committee (JNC7) guidelines using sphygmomanometer.

Assessment of urine albumin

Aliquot of urine of each participant was tested for albuminuria using Combur-10 dipstick (Roche diagnostic manufacturer, Ltd) according to the manufacturer's instruction. The dipsticks included a reagent strip treated with 3',3",5', 5"-tetrachlorphenol-3,4,5,6-tetrabromsulfophthalein

dye. Color on the strip will change when albumin binds to antibody on the strip. This test detects albumin at concentration of negative, 1+ (≥ 300 mg/L), 2++ (≥ 1000 mg/L), and 3+++ (≥ 5000 mg/L)[9]. The urine, negative for albumin by Combur-10, was processed further with Micral test (Roche diagnostic manufacturer, Ltd). This test is also based on the color shift of a monoclonal antibody to human albumin after binding of urinary albumin to antibody. It is a semi-quantitative screening tool and the results of this test were read as 0 mg/L, 20 mg/L, 50 mg/L and 100 mg/L. A reading of 20 mg/L or more was considered positive, according to manufacturer's recommendation.

Definition

Albuminuria refers specifically to increased urinary excretion of albumin[10].

Microalbuminuria refers to urinary albumin excretion that exceeds the normal range (20-200 μg/min or > 20 mg/L) but is below the minimum level for detection by standard dipstick (300 mg/L)[3,10].

Macroalbuminuria is defined as urinary albumin concentration above 200 μg/min[11].

Diabetes is defined as fasting plasma glucose equal to or greater than 126 mg/dl according to The American Diabetes Association criteria[12].

Hypertension is defined as systolic blood pressure equal to or greater than 140 mmHg or diastolic blood pressure equal to or greater than 90 mmHg according to JNC7[13]. Value is calculated from the mean of the three measurements.

Overweight and obesity were defined on the basis of BMI measurement calculated as the ratio between weight (kg) and the square of height (m^2). Both were classified according to the 1999 World Health Organization criteria. Cut-off points for BMI were : Overweight (BMI equal to or greater than 25 kg/m^2), and obesity (BMI equal to or greater than 30 kg/ m^2).

Statistical analysis

Results are shown as mean ± standard error of mean (SEM). Data were analyzed using the statistic package for the social science (SPSS) version 11.5 software (SPSS Inc., Chicago). Chi-square test was performed to compare categorical variables. The association between independent variables and albuminuria was assessed using multiple logistic regression analysis. A p-value less than 0.05 was considered statistically significant.

Results

Three hundred and fifty-seven adults (aged 35 years and older) living in Moo 15, Ban Nayao, Thakradan Subdistrict, Sanamchaikhet District, Chachoengsao Province were screened in many measurements. Those screened were 156 males (43.70%; mean age = 52.88 years) and 201 females (56.30%; mean age = 49.40 years).

Overview of screening results

The overall means (± SEM) of participant's characteristics are shown in Table 1. Weight was higher in male than in female participants significantly ($p<0.05$). In contrast, the body mass index was significantly lower in males than in females ($p<0.05$). Diastolic and systolic blood pressure were higher in males than in females and plasma glucose level was lower in males than in females. However, these levels did not reach levels of statistical significance.

Table 2 summarizes the overall prevalence of albuminuria, diabetes, hypertension and obese. In brief, approximately one-fourths of all participants screened (26.61%) had microalbuminuria, whereas the prevalence of macroalbuminuria was 3.08%. It was found that 67.5% had a normal plasma glucose level, 23.2% had a risk to diabetes mellitus

Table 1. Summary of measurements conducted during screening of participants*

Items	All Adult (n=357)	Male (n=156)	Female (n=201)
Age (years)	50.92 ± 0.60	52.88 ± 1.00	49.40 ± 0.71
Blood pressure (mmHg)			
Systolic	122.28 ± 1.27	122.63 ± 2.44	122.01 ± 1.22
Diastolic	78.43 ± 0.46	78.72 ± 0.71	78.20 ± 0.61
Weight (kg)	58.98 ± 0.53	60.61 ± 0.84[a]	57.72 ± 0.67[b]
BMI (kg/m^2)	23.99 ± 0.21	22.83 ± 0.28[b]	24.90 ± 0.28[a]
Plasma glucose (mg%)	102.84 ± 1.90	100.55 ± 3.19	104.62 ± 2.29

* Values represent mean ± SEM

[a, b] Mean in the same row with different superscripts differed significantly ($p<0.05$; compared between male and female groups). BMI, body mass index

and 9.2% had diabetes mellitus. For blood pressure study, greater than 30% of participants had normal blood pressure, 45.7% were pre-hypertension, 14% had hypertension stage 1 and 5% had hypertension stage 2. At the end of the survey, it revealed that more than 50% of the participants had normal BMI, 6.4% was thin. One-third of the population screened were overweight, and 7.3% of the participants were obese.

Table 3 demonstrates that of the diabetic participants, microalbuminuria was detected in 30.3% (the mean level of plasma glucose = 199.64 ± 34.09) and macroalbuminuria was 15.2% (the mean level of plasma glucose = 234.36 ± 26.92). Of those with hypertension-stage 1, 26% had microalbuminuria and 4% had macroalbuminuria. For hypertension-stage 2 participants, 44% had microalbuminuria. In addition, 50% of the obese were found to have microalbuminuria and that 3.8% had macroalbuminuria. The data also demonstrates albuminuria in participants without diabetes, hypertension and obesity. The Chi-square test established the association of plasma glucose levels, and body mass index with the progression of albuminuria (p=0.013 and 0.008, respectively). There was also a trend of association between hypertension and albuminuria, but this did not reach levels of statistical significance.

The analysis using the multiple logistic regression, in which other variables were controlled, revealed a significant association between diabetes and albuminuria (p=0.036) as well as obesity and albuminuria (p = 0.005). The Odd Ratio increased with the increased level of plasma glucose, stage of hypertension and increased BMI. In other words, participants with diabetes mellitus and obesity were more likely to have albuminuria than those without either of these conditions (Odd Ratio 2.21 (OR), 95% Confidence Interval (CI) 1.05-4.64, p=0.036 and OR 7.78, 95% CI 1.85-32.71, p=0.005, respectively) as shown in Table 4.

Discussion

As albuminuria is a predictor of nephropathy[14,15], a risk of cardiovascular death and a key feature in metabolic syndrome[15,16], it has attracted much attention from clinicians in recent years. The implementation of albuminuria screening has also been asked from the International Society of Nephrology because the costs of kidney failure, heart failure and diabetic nephropathy account for the majority of the health care budget

Table 2. Prevalence of albuminuria, hypertension, and overweight and obese in participants

Items		All Adult (n=357)	Male (n=156)	Female (n=201)
Albuminuria*	**n (%)**			
Normal		251 (70.31%)	110 (70.50%)	141 (70.10%)
Microalbuminuria		95 (26.61%)	41 (26.30%)	54 (26.90%)
Macroalbuminuria		11 (3.08%)	5 (3.20%)	6 (3.00%)
Plasma glucose**	**n (%)**			
Normal		241 (67.50%)	110 (70.50%)	131 (65.20%)
Impaired fasting glucose		83 (23.20%)	34 (21.80%)	49 (24.40%)
Diabetes mellitus		33 (9.20%)	12 (7.70%)	21 (10.40%)
Blood pressure level***	**n (%)**			
Normal		126 (35.30%)	51 (32.70%)	75 (37.30%)
Pre-hypertension		163 (45.70%)	74 (47.40%)	89 (44.30%)
Hypertension - stage 1		50 (14.00%)	27 (17.30%)	23 (11.4.0%)
Hypertension - stage 2		18 (5.00%)	4 (2.60%)	14 (7.00%)
Body mass index****	**n (%)**			
Normal		199 (55.7%)	105 (67.3%)	94 (46.80%)
Thin		23 (6.4%)	13 (8.8%)	10 (5.00%)
Overweight		109 (30.5%)	33 (21.2%)	76 (37.80%)
Obesity		26 (7.3%)	5 (3.2%)	21 (10.40%)

* Albuminuria were divided into two groups: microalbuminuria (urine protein 20-200 mg/L) and macroalbuminuria (urine protein > 300 mg/L)

** Plasma glucose level were divided into three groups: normal (<100 mg%); Impaired fasting glucose (100-125 mg%) and diabetes mellitus (>125 mg%)

*** Blood pressure were divided into four groups: normal (<120/<80 mmHg); pre-hypertension (120-139/80-89 mmHg); hypertension-stage 1 (140-159/90-99 mmHg) and hypertension-stage 2 (≥160/≥100 mmHg)

**** Body mass index were divided into four groups: thin (BMI<18.5 kg/m^2); normal (BMI=18.5-24.9 kg/m^2), overweight (BMI=25-29.9 kg/m^2) and obesity (BMI≥30 kg/m^2)

today. The importance of albuminuria screening is to provide sufficient early evidence of risk for those diseases and prompt preventive action.

Screening for albuminuria in a community setting needs simple and cheap tests and yields quick results. In the present study, Combur-10 dipstick and Micral test were used to detect macroalbuminuria and microalbuminuria, respectively. The Combur-10 is usually a standard dipstick that detects urinary albumin at high concentrations (>300 mg/L)[9,17] and the Micral test has a good sensitivity and specificity at a cut-off point of urinary albumin concentration of 20 mg/L[18, 19]. They were designated as screening tools in a primary care setting and clinical setting as they offer simple, reliable, rapid and convenient method[18,19].

Of the 450 people, 93 people were excluded because of fever, menstruation, refrained from heavy working, pregnancy and missing data. The present study shows a high prevalence of overall microalbuminuria and macroalbuminuria

Table 3. The association between interesting risk factors and albuminuria category*

Items	Normal n, % (value)	Microalbuminuria n, % (value)	Macroalbuminuria n, % (value)	p-value**
Plasma glucose level (mg%)				
Normal (n= 241)	175, 72.6% (89.61 ± 0.62)	64, 26.6% (91.21 ± 1.03)	2, 0.8% (91.08 ± 1.08)	0.013
Risk (n = 83)	58, 69.9% (105.79 ± 0.58)	21, 25.3% (107.06 ± 1.29)	4, 4.8% (111.69 ± 3.46)	
DM (n = 33)	18, 54.5% (167.39 ± 8.99)	10, 30.3% (199.64 ± 34.09)	5, 15.2% (234.36 ± 26.92)	
Blood pressure (mmHg)* **				
Normal (n = 126)	93, 73.8% (107 ± 1 / 70 ± 0)	32, 25.4% (111 ± 1 / 71 ± 1)	1, 0.8% (110 ± 0 / 69 ± 0)	0.305
Pre-hypertension (n = 163)	116, 71.2% (123 ± 1 / 80 ± 0)	42, 25.8% (121 ± 1 / 81 ± 1)	5, 3.1% (120 ± 5 / 83 ± 2)	
Hypertension-stage 1 (n = 50)	32, 64.0% (140 ± 2 / 85 ± 2)	13, 26.0% (138 ± 3 / 89± 1)	5, 4.0% (137 ± 3 / 88 ± 2)	
Hypertension-stage 2 (n = 18)	10, 55.6% (161 ± 3 / 94 ± 2)	8, 44.4% (157 ± 7 / 101 ± 3)	- (0%)	
Body mass index (kg/m^2)				
Normal (n = 199)	146, 73.4% (22.10 ± 0.10)	52, 26.1% (22.20 ± 0.20)	1, 0.5% (22.70 ± 0.00)	0.008
Thin (n = 23)	20, 87.0% (17.20 ± 0.20)	2, 8.7% (17.40 ± 0.90)	1, 4.3% (17.20 ± 0.00)	
Overweight (n = 109)	73, 67.0% (26.80 ± 0.10)	28, 25.7% (26.90 ± 0.30)	8, 7.3% (26.70 ± 0.60)	
Obesity (n = 26)	12, 46.2% (33.20 ± 0.70)	13, 50.0% (32.30 ± 0.70)	1, 3.8% (30.70 ± 0.00)	

* Values represent mean ± SEM
** Chi-square test
*** Blood pressure represents both systolic and diastolic

Table 4. The association between albuminuria and risk factors

Items	Normal	Albuminuria	Univariate Odds Ratio	p-value**	95% CI
Plasma glucose					
Normal	175	66	1.00	0.111	
Risk	58	25	1.14	0.633	0.66 - 1.98
DM	18	15	2.21	0.036	1.05 - 4.64
Blood pressure					
Normal	93	33	1.00	0.314	
Pre-hypertension	116	47	1.14	0.618	0.68 - 1.92
Hypertension-stage 1	32	18	1.58	0.198	0.79 - 3.20
Hypertension-stage 2	10	8	2.26	0.115	0.82 - 6.20
BMI					
Thin	20	3	1.00	0.012	
Normal	146	53	2.42	0.167	0.69 - 8.46
Overweight	73	36	3.29	0.068	0.92 - 11.78
Obesity	12	14	7.78	0.005	1.85 - 32.71

* Values represent mean ± SEM
** Multiple logistic regression analysis

in participants. Prevalence of diabetes in this community was similar to data reported for the estimated national diabetes prevalence in Thai adults (approximately 9%)[20]. Generally, prevalence of microalbuminuria in a person with diabetes is 30% to 40%[21]. The study in Asia-Pacific Rim

established that the prevalence of microalbuminuria was 39.8% and macroalbuminuria 18.8% in hypertensive diabetic adult patients[22]. The report from the present study showed that 30.3% of diabetic participants had microalbuminuria, thus, it was in the range reported in early evidence. Microalbuminuria is common in type 2 or non-insulin dependent diabetes mellitus. Once it is detected, overt nephropathy can occur within six to twelve years as its excretion rate increase at 4% to 9% per year (for review see 23). The present study showed that the mean plasma glucose level that microalbuminuria was found was 199.64 ± 34.09 mg% and this is consistent with the study reported by Col M *et al*[24] in which microalbuminuria prevalence was high in patients who had a plasma glucose level more than 180 mg%. Of the diabeties reported in the present study, 3.8% had macroalbuminuria. This may be possible if hyperglycemia and other modifiable factors such as blood pressure were not treated. Indeed, several studies have reported that overt nephropathy develops in 25-50% of diabetic patients, especially if increased plasma level of glucose are not controlled, and is aggravated by continued hyperglycemia and development of renal impairment-related hypertension[25,26].

The prevalence of microalbuminuria in hypertensive patients has been established to range widely from 6% to 40% depending on severity, duration of hypertension, age and ethnic group[27, 28]. The present study, microalbuminuria was detected in 30.88% of those with hypertension. Although there was no association between albuminuria and blood pressure in the present study, several lines of evidence showed that microalbuminuria predicts cardiovascular events and the development of renal insufficiency in non-diabetic hypertensive patients[29]. In addition, from a large cross-sectional study, hypertensive patients with microalbuminuria were found to have a high prevalence of coronary artery disease, left ventricular hypertrophy, and peripheral vascular disease[30].

Consistent with the study in Australia[31,32], the presented data demonstrated the association between albuminuria and BMI, and plasma glucose level. This association was significantly greater for participants with diabetes or with obesity. However, one study demonstrated no relationship between albuminuria and BMI levels[24]. Glomerular hyperfiltration, insulin resistance and elevated glucagon levels has been suggested to be the involved mechanisms[33]. Obesity has also been reported to be associated with the initiation and progression of glomerulonephritis[34] and the incidence of glomerulosclerosis is higher in obesity than in lean individuals[35]. Therefore, there is no doubt that albuminuria is detected in obesity. Obesity-associated proteinuria responds well to a weight-loss program and captopril treatment[36].

From the present study there were non-diabetic, non-hypertensive and non-obese participants with early renal functional abnormalities in relation to microalbuminuria. It has been concluded in some reviews that microalbuminuria was common even among patients without diabetes or hypertension[37]. The numbers increased starting at 40 years of age. Microalbuminuria is a strong independent risk factor for cardiovascular diseases both in persons with or without diabetes and hypertension[4,38]. Urinary albumin was also associated with renal impairment in a non-diabetic population[6]. It is not overstated that this group of population needs longitudinal follow-up.

Although urine strip has been suggested for albuminuria screening, it is a semi-quantitative estimation, therefore, the present findings may reflect an underestimation of the association mentioned in this report. Furthermore, information on confounding variables such as nutritional intake, a family history of diabetes and hypertension as well as duration and onset of such diseases that might affect the

association with albuminuria were not assessed. These limitations must be considered in the interpretation of the present findings. Despite the limitation, the authors hope that the present findings provide a background of albuminuria and the associated factors in a rural Thai population, stimulate other researchers to design a more focused albuminuria screening strategy in other communities and give insight in relation to the implication of population and targeted screening for albuminuria. Such a strategy will potentially reduce the number of people with renal and cardiovascular diseases. As the incidence of type 2 diabetes increases, the authors suggest that screening of a general population for albuminuria in a cost-effective manner should be advocated in the future.

In conclusion, albuminuria, especially in a little amount known as microalbuminuria, if detected in the early stage, could be applied for the care of diseases. For example, the onset of kidney disease and cardiovascular disease can be slowed, halted, and reversed in some cases with effective treatment involving control of plasma glucose level as well as blood pressure. The present study demonstrates a high prevalence of albuminuria in the people of Ban Nayao community, Chachoengsao province, Thailand. Therefore, to reduce the development and burden of those chronic diseases, community awareness program and health education programs should be provided to the people in rural communities. Health services such as blood glucose and blood pressure control, weight-control programs, and albuminuria screening must be made available to people at risk in rural communities.

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อัลบูมินในปัสสาวะในประชากรไทยชนบท: การคัดกรองในชุมชนด้วยแถบจุ่มทดสอบชนิด Combur และ Micral

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วัตถุประสงค์: *เพื่อศึกษาความชุกของการมีอัลบูมินในปัสสาวะ และความสัมพันธ์ระหว่างอัลบูมินในปัสสาวะกับระดับน้ำตาลในเลือด ความดันโลหิต และดรรชนีมวลกายในประชากรไทยชนบทที่มีอายุตั้งแต่ 35 ปีขึ้นไป*

วัสดุและวิธีการ: *เป็นการศึกษาภาคตัดขวางเพื่อตรวจวัดอัลบูมินที่มีระดับสูงมาก (macroalbuminuria) และระดับสูงเล็กน้อย (microalbuminuria) ในปัสสาวะตอนเช้าด้วยแถบจุ่มชนิด Combur และ Micral ผู้เข้าร่วมโครงการจะได้รับการตรวจระดับน้ำตาลในเลือด ความดันโลหิต ชั่งน้ำหนัก และวัดส่วนสูง สถิติที่ใช้วิเคราะห์ผลการศึกษาได้แก่ chi-square และ multiple logistic regression analysis*

ผลการศึกษา: *จากผู้ที่ถูกคัดเลือกเข้าศึกษา 357 คน พบว่า 26.61 % มีอัลบูมินระดับสูงเล็กน้อย, 3.08 % มีอัลบูมินระดับสูงมากในปัสสาวะ, 9.2 % เป็นเบาหวาน, 19 % มีความดันโลหิตสูง และ 7.3 % มีภาวะอ้วน, 30.3 % ของผู้ที่เป็นเบาหวานตรวจพบอัลบูมินระดับสูงเล็กน้อย และ 15.15 % มีอัลบูมินระดับสูงมากในปัสสาวะ ในผู้ที่มีภาวะอ้วน พบว่า 50% มีอัลบูมินระดับสูงเล็กน้อย และ 3.8% มีอัลบูมินสูงมาก สำหรับในกลุ่มความดันโลหิตสูง 30.88% มีอัลบูมินระดับสูงเล็กน้อยในปัสสาวะ และ 7.35% พบอัลบูมินสูงมาก พบว่าระดับอัลบูมินที่เพิ่มขึ้นในปัสสาวะมีความสัมพันธ์กับระดับน้ำตาลในเลือด ($p=0.013$) และดรรชนีมวลกายอย่างมีนัยสำคัญ ($p=0.005$) เมื่อทำการวิเคราะห์ด้วย multiple logistic regression การเป็นเบาหวานและภาวะอ้วนเป็นปัจจัยสำคัญที่ทำให้มีอัลบูมินในปัสสาวะ ($p=0.036$ และ $p=0.005$ ตามลำดับ ที่ความเชื่อมั่น 95%)*

สรุป: *การศึกษานี้แสดงให้เห็นถึงความเสี่ยงของการมีอัลบูมินในปัสสาวะในผู้ที่เป็นเบาหวาน และผู้ที่มีภาวะอ้วน ดังนั้นควรมีการควบคุมระดับน้ำตาลในเลือดและการควบคุมน้ำหนักในประชากรในชุมชนชนบทที่มีภาวะดังกล่าว*