

# Relation between 25-hydroxyvitamin D<sub>3</sub> Level and Blood Pressure in Healthy Young Saudi Women: Effect of Adiposity

AI KADI H.A.<sup>1,2</sup>

<sup>1</sup>Centre of Excellence for Osteoporosis Research, <sup>2</sup>Department of Physiology, Faculty of Medicine, King Abdulaziz University, Jeddah, Saudi Arabia



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## Introduction

Vitamin D deficiency is a common health problem among the Saudi population. Data from cross-sectional and large observational studies; mainly on Western European and North American populations; report that low 25-hydroxyvitamin D<sub>3</sub> [25(OH)D<sub>3</sub>] is associated with higher blood pressure (BP) levels and a higher incidence of hypertension. However, randomized clinical trials are conflicting. Few data exist on the implications of poor vitamin D status on overall health and in particular on BP in young Saudi women. Therefore, the aim of this study was to determine the relationship between 25(OH)D<sub>3</sub> level and BP in Saudi women and to assess the effect of body mass index (BMI), as a measure of adiposity, on this relationship.

## Subjects and Methods

This cross-sectional study was conducted in the Center of Excellence for Osteoporosis Research (CEOR), Jeddah, Saudi Arabia. A total of 303 apparently healthy premenopausal Saudi women (20-40 years) were randomly recruited from a group of women visiting the CEOR for assessment of bone health. All women signed an informed consent and the study was approved by the Ethical Committee at CEOR. Fasting blood samples were collected for the measurement of 25(OH)D<sub>3</sub> and parathyroid hormone (PTH). Both were measured by direct competitive chemiluminescence immunoassay (CLIA) using LIASON autoanalyzer [DiaSorin Inc, Stillwater, MN, USA]. Blood pressure was measured by a standardized method using an automated blood pressure monitor (BPTru) that has been validated by the British Hypertension Society (BHS). The subjects were asked to rest in the seated position for five minutes in a quiet room and the procedure was explained before the first reading was taken. All women were given instructions not to talk or move during the measurement. Appropriate sized cuff was applied to the right upper arm and three readings were taken one minute apart. The average of the last two readings was used in the final analysis. SPSS version 16 was used for data analysis. Linear regression models were used to study the relationship between 25(OH)D<sub>3</sub> level and BP.

## Results

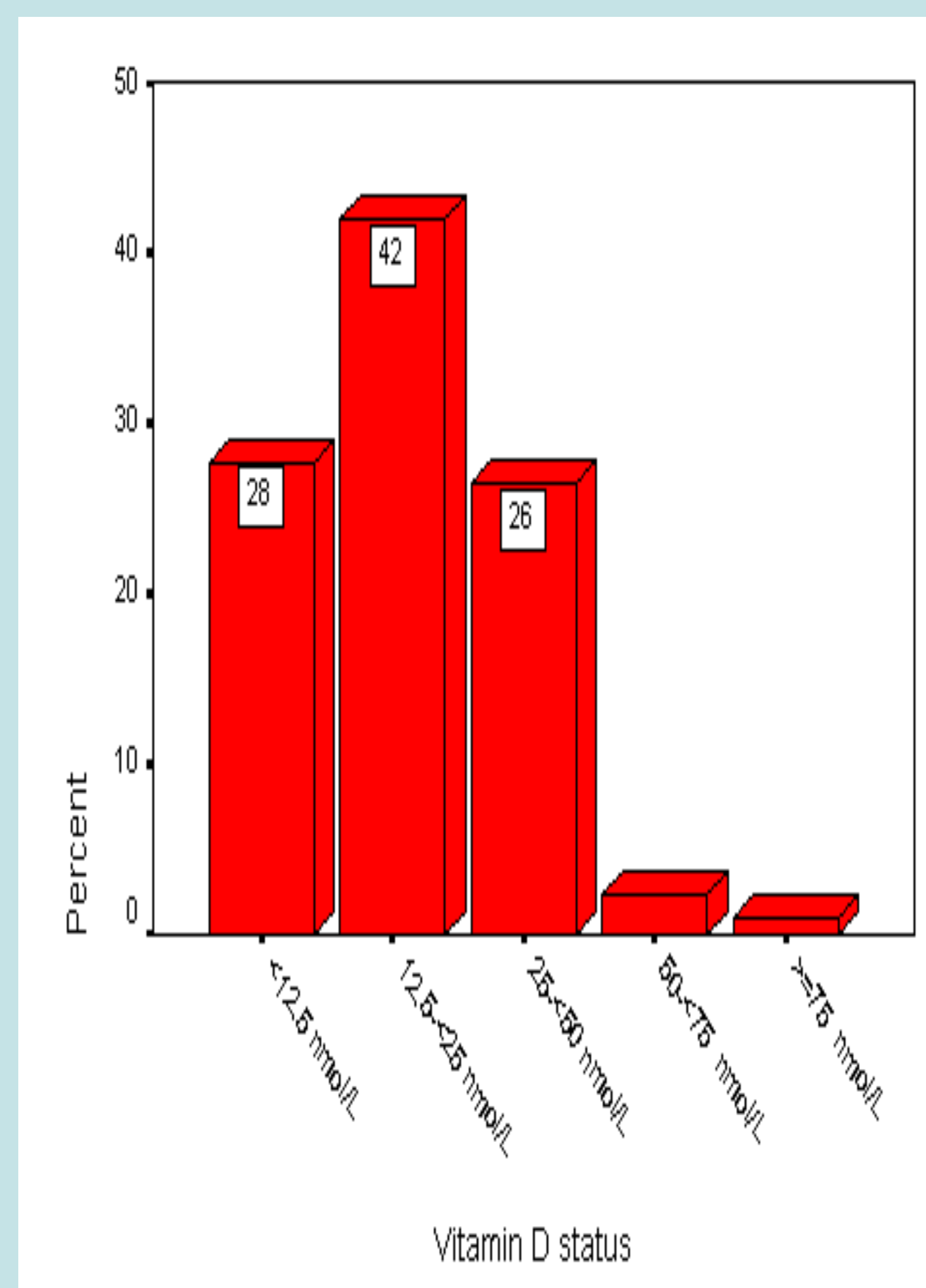
Characteristics of the study group are presented in Table 1. Vitamin D deficiency was highly prevalent among the study group with 96% having 25(OH)D<sub>3</sub> levels <50nmol/L and 70% having levels <25 nmol/L (Figure 1). Fifty% of the studied women were either overweight (26%) or obese (25%) (Figure 2). Multiple linear regression analysis showed that 25(OH)D<sub>3</sub> concentrations were negatively correlated to both systolic ( $\beta = -6.401$ ,  $P < 0.0001$ ) and diastolic BP ( $\beta = -3.915$ ,  $P = 0.014$ ) in models adjusted for age and PTH. When adding BMI to the model, the relationship between 25(OH)D<sub>3</sub> and BP was still negative and significant for the systolic BP ( $\beta = -5.288$ ,  $P = 0.002$ ), and for the diastolic BP ( $\beta = -4.335$ ,  $P = 0.003$ ) (Table 2).

## Results

**Table 1.** Age, anthropometric measures, blood pressure and biochemical characteristics of the study group.

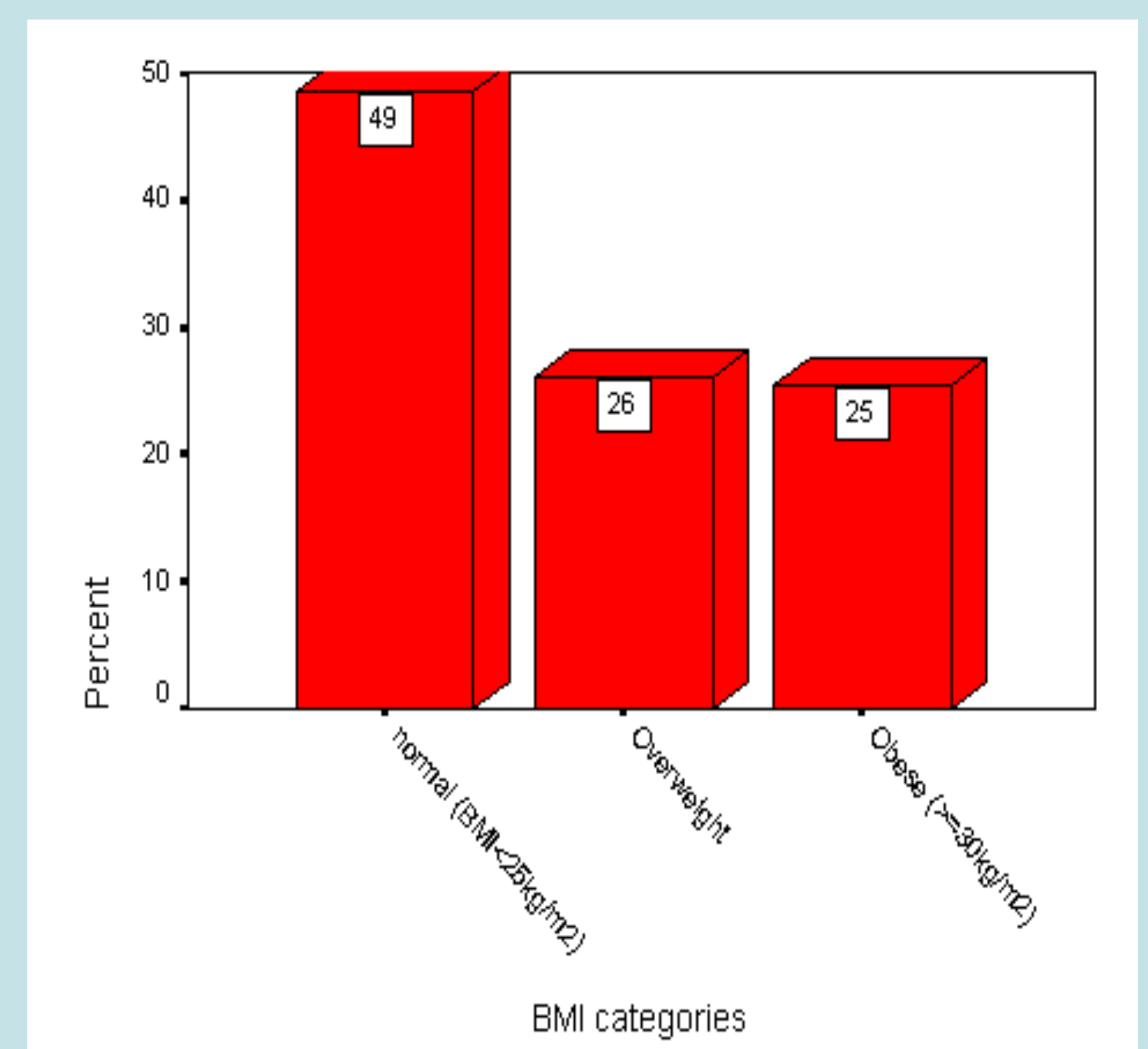
Variables	Mean $\pm$ SD
Age (years)	28.4 $\pm$ 6.1
Weight (kg)	65.2 $\pm$ 15.7
Height (cm)	157.5 $\pm$ 6.0
BMI (kg/m <sup>2</sup> )	26.3 $\pm$ 6.3
Waist circumference (cm)	76.4 $\pm$ 14.0
Hip circumference (cm)	97.8 $\pm$ 11.7
Waist:hip ratio	0.78 $\pm$ 0.08
Average Systolic BP (mmHg)	102.0 $\pm$ 8.4
Average Diastolic BP (mmHg)	65.9 $\pm$ 7.1
25(OH)D <sub>3</sub> nmol/L	20.8 $\pm$ 13.4
PTH pmol/L	10.6 $\pm$ 5.9

BMI: body mass index; BP: blood pressure; 25(OH)D<sub>3</sub>: 25-hydroxyvitamin D; PTH: parathyroid hormone; SD: standard deviation.



**Figure 1.** Vitamin D status in the study group.

## Results



**Figure 2.** Prevalence of overweight and obesity among the study subjects.

**Table 2.** Multiple regression analysis between 25(OH)D<sub>3</sub> and BP adjusting for BMI, age and PTH.

Dependant Variables	Predictors	$\beta$ estimate	P value
Systolic BP	BMI	0.475	<0.0001
	Log 25(OH)D <sub>3</sub>	-5.288	0.002
Diastolic BP	BMI	0.275	<0.0001
	Log 25(OH)D <sub>3</sub>	-4.335	0.003

25(OH)D<sub>3</sub>: 25-hydroxyvitamin D; BP: blood pressure; BMI: body mass index; PTH: parathyroid hormone.

## Conclusions

In young Saudi women, both 25(OH)D<sub>3</sub> and BMI are significant predictors for BP. Since both vitamin D deficiency and obesity are prevalent among Saudi women, proper measures for the management of these health problems have to be taken in order to prevent future hypertension and other cardiovascular events. Longitudinal studies to confirm these findings, and intervention studies to assess the BP lowering effects of 25(OH)D<sub>3</sub> on hypertensive and obese subjects are needed.

**Conflict of Interest:** None declared.