

# A Study on the Prevalence of Diabetes Mellitus Among Students of Hail University

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**Abstract:** Glucose is the main type of sugar found in blood and main source of energy. Glucose comes from the food and is also made in liver and muscles. Blood carries glucose to all of body's cells to use for energy. Pancreas releases a hormone insulin, into blood. Insulin helps blood carry glucose to all body's cells. Glucose stays in blood and doesn't reach cells when body doesn't make enough insulin or the insulin doesn't work the way it should. Blood glucose levels increased and can cause diabetes or prediabetes. Prediabetes means that the amount of glucose in blood is above normal level but not high enough to be called diabetes. Chances of getting type 2 diabetes are higher with prediabetes. With some weight loss and moderate physical activity, the person can prevent type 2 diabetes. The person can even return to normal glucose levels, possibly without taking any medicines. [13] Diabetes is a group of metabolic diseases characterized by hyperglycemia resulting from defects in insulin secretion, insulin action, or both. Several pathogenic processes are involved in the development of diabetes. [3] The prevalence of type 2 diabetes has risen steadily in recent decades, and type 2 diabetes is now a global health problem. Diabetes causes greater morbidity and mortality. There is increased concern about prevalence of type 2 diabetes in Arabic countries especially Saudi Arabia. [7] Therefore, the current study designed to determine the prevalence of diabetes mellitus among female students in University of Hail; study the association of diabetes mellitus in relation to obesity and using of BMI as a diagnostic tool in the current classification system for obesity.

**Keywords:** Diabetes Mellitus, Type 1 Diabetes, Type 2 Diabetes, Gestational Diabetes, Symptoms of Diabetes, Control of Diabetes

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## 1. Introduction

Diabetes mellitus is a disorder resulting from a defect in insulin secretion, insulin action, or both. Complications of diabetes mellitus include retinopathy, nephropathy, neuropathy and cardiovascular. [1, 2].

There are three main types of diabetes are type 1, type 2, and gestational diabetes.

### 1.1. Type 1 Diabetes

Called juvenile diabetes, the body cannot produce insulin or enough insulin because immunesystem has attacked and the cells that make insulin destroyed. This disease develops

in young people; however, type 1 diabetes can also develop in adults. Treatment for type 1 diabetes includes: insulin injections, Sometimes oral medicines. [4, 13]

### 1.2. Type 2 Diabetes

Called adult-onset diabetes, can affect people at any age, even children. However, it develops most often in middle-aged and older people. It begins with insulin resistance that target tissues are unable to respond to normal circulating concentrations of insulin. As a result the output of insulin from the pancreatic beta-cells is increased (hyperinsulinemia)

to maintain normal blood glucose levels. Over time, the pancreas cannot produce enough insulin. This leads to impaired glucose tolerance, impaired fasting glycaemia (glucose values above the normal range but below those defined as diagnostic of diabetes). The patient will need to treat type 2 diabetes. [2, 4] Treatment for type 2 diabetes includes: Using diabetes medicines.

### 1.3. Gestational Diabetes (GD)

If the pancreas doesn't make enough insulin during pregnancy, a woman develops gestational diabetes. All women have insulin resistance late in their pregnancy due to production of hormones that can lead to insulin resistance. This condition disappeared after the baby is born but a woman who has had gestational diabetes is more likely to develop type 2 diabetes later in life. Overweight or obesity increase risk of gestational diabetes development.

### 1.4. Symptoms of Diabetes

Thirsty, urinating often feeling very hungry, tired, losing weight, feelings of pins in feet. These symptoms don't occur in all patients. [13]

### 1.5. Control of Diabetes

Insulin is required for treatment of type 1 diabetes while type 2 diabetes treated with oral medication, Foot care and Other saving interventions include: treatment for retinopathy; Blood lipid control; Screening for early signs of diabetes-related kidney disease and treatment. These measures should be supported by avoiding tobacco use, regular physical activity (at least 30 minutes of regular on most days to maintain healthy body weight), and a healthy diet. [4] The prevalence of obesity is increasing dramatically worldwide and contributes to the development of non-insulin-dependent (NIDDM) or type 2 diabetes so that weight control efforts are an important component of the clinical management of diabetes. Although epidemiological studies reported that the relationship between obesity and risk of diabetes is causal. [2, 3, 8, 9].

BMI used as a diagnostic tool in the current classification system for obesity. It was found that there is an extremely strong association between BMI and risk of non-insulin-dependent (NIDDM) or type 2 diabetes. Women with a BMI of 23–25 have a 4-fold higher risk of type 2 diabetes than those with a BMI < 20; Those with a BMI 24–25 have a 5-fold increased risk, and a BMI > 35 increases the risk of developing type 2 diabetes 93-fold. [6]

## 2. Methodology

Study was planned and conducted to evaluate the prevalence of Diabetes mellitus among students of Hail University. Blood glucose level was estimated in blood samples which collected from random sample of 300 students from (Applied Medical Science College, Business Administration College and Education College). Subjects were asked to record their self-reported height and weight. Body mass index (BMI), was measured as a diagnostic tool for obesity to study the association of diabetes mellitus in relation to obesity. According to the WHO's classification for BMI, weight status was classified into four categories: underweight (BMI  $\leq$  18.5), normal weight (BMI= 18.5-24.9), overweight (BMI= 25-29.9), and obese (BMI  $\geq$  30) [16].

### 2.1. Sample Collection

Blood glucose level was estimated in blood samples which collected from students during the first semester (2016-2017).

### 2.2. Diabetes Mellitus Determination

Blood glucose level used as a range to determine Diabetes mellitus in the proposed study. The Glucometer used for analysis and gives immediate, digitally displayed results.

### 2.3. Statistical Analysis

Statistical analyses were performed using the Statistical Package for Social Sciences (SPSS) software, Arab Processor in Social Statistics and Mstat-c Program. Descriptive statistics such as means, standard deviations (SD) and ANOVA (one way analysis) according to Snedcor and Cochran (1980) were calculated for the parametric variables, Least significant differences (LSD) were used compare between means according to Waller and Duncan (1969) at probability 0.05 and 0.01. Non-parametric variables were tested by Chi-square tests. Differences were considered statistically significant at  $P < 0.05$  or  $P < 0.01$ . [11, 12]

## 3. Results and Discussion

Of 300 students participated in the study, 100 students from Applied Medical Science College, 100 students from Business Administration College and 100 students from Education College) in age group 18-25 year. Detail of characteristics of participants shown in Table 1.

Table 1. Characteristics of the participants.

Variables	Minimum	Maximum	Mean	Standard deviation
Age(year)	18	25	21.15	1.97
Weight(kg)	45	97	57.39	11.03
Height(cm)	145	166	155.67	5.12

Table 1 represent that a total of 300 female students participated in the current study. Total mean age  $\pm$  SD was  $21.15 \pm 1.97$  years (range 18-25). The mean weight and height were respectively  $57.39 \pm 11.03$  kg and  $155.67 \pm 5.12$  cm. Mean BMI (mean  $\pm$  SD=  $23.44 \pm 4.63$ ).

**Table 2.** Chi-square level of Blood glucose, social status and weight status.

Variables	Status	%	$\chi^2_{\text{t at } \alpha=0.01}$	$\chi^2_{\text{t at } \alpha=0.05}$	$\chi^2_{\text{c}}$
Social status	Single	93	3.84**	6.63*	76.45
	Married	6			
	Under wt.	6			
BMI (kg/m <sup>2</sup> )	Healthy Wt.	66	13.28**	9.49*	143.27
	Over Wt.	18			
	Obese	9			
	Severely Wt.	0			
	Hypoglycemia	12			
Glucose level(mg/dl)	Normal	57	11.34**	7.81*	62.84
	Prediabetes	24			
	Diabetes	6			

\* = Significant at  $\alpha = 0.05$  level and \*\* = Significant at  $\alpha = 0.01$  level (highly Significant).

Results from table 2 showed that there is a highly significant difference among levels of blood glucose (hypoglycemia 12%; Normal 57%; prediabetes 24% and Diabetes 6%). Also, there is a highly significant difference in social status and BMI (9 % obese, 18% over weight, 66%healthy weight and 6% underweight) at  $P < 0.05$  or  $P < 0.01$ .

**Table 3.** Effect of type of College on Social status.

College	Social status		$\chi^2_{\text{c}}$	$\chi^2_{\text{t at } \alpha=0.05}$	$\chi^2_{\text{t at } \alpha=0.01}$
	Single	Married			
Applied Medical Science	30	3	9.21	5.99	3.19
Business Administration	33	0			
Education	30	3			

Results from Table 3 showed that there is a nonsignificant difference in social status between three Colleges. Type of College has not any effect on social status.

**Table 4.** Effect of type of College on weight status.

Weight status (kg/m <sup>2</sup> )	College			$\chi^2_{\text{c}}$	$\chi^2_{\text{t at } \alpha=0.05}$	$\chi^2_{\text{t at } \alpha=0.01}$
	Applied	Business	Education			
Under wt.	6	0	0	20.9**	15.51*	84.27
Healthy Wt.	27	33	6			
Over Wt.	0	0	18			
Obese	0	0	9			
Severely Wt.	0	0	0			

Table 4 represent that there is a highly significant difference in weight status among colleges. It was found that(27%,from Applied college, 33% from Business college and 6% from Education college) have Healthy weight and 6% from Applied college was under weight, but only 9% from Education college was Obese at  $P < 0.05$  or  $P < 0.01$ . Type of College has a significant effect on weight status.

**Table 5.** Effect of type of College on Blood glucose level.

Glucose level (mg/dL)	College			$\chi^2_{\text{c}}$	$\chi^2_{\text{t at } \alpha=0.05}$	$\chi^2_{\text{t at } \alpha=0.01}$
	Applied	Business	Education			
Hypoglycemia	12	0	0	16.81**	12.59*	108
Normal	21	33	3			
Prediabetes	0	0	24			
Diabetes	0	0	6			

$\chi^2_{\text{t}}$ = Chi square tabulated and  $\chi^2_{\text{c}}$ = Chi square calculated.

Table 5 represent that there is a highly significant difference in blood glucose level among colleges. It was found that (21%, from Applied college, 33% from Business college and 3% from Education college) have normal blood glucose level and 12% from Applied college was hypoglycemia, but only 24% from Education college was prediabetes at  $P < 0.05$  or  $P < 0.01$ . Type of College has a significant effect on blood glucose level. This result is supported by study conducted by Ibrahim Abdelmajeed

Ginawiet al who found that the prevalence rates of DM in Hail, Baqaa, Ash Shinan and Ghazala were 27%, 35%, 18.6% and 35%, respectively. Another study showed that the prevalence of diabetes in general Saudi population was 30% (Khalid, et al. 2011). While Mansour, et al (2004) reported an overall prevalence of DM of 23.7% in KSA, with the highest prevalence rates were among the Northern Saudi population of 27.9% followed by the Eastern region of 26.4%, then Saudis from the Western region of 24.7%, and from the

Central region of 23.7%, whereas the lowest prevalence was from the Southern region of 18.2%.

**Table 6.** Comparison among studied traits in different colleges 'Applied Medical Science, Business Administration and Education.'

College	Weight (Kg)	Height (cm)	BMI (kg/m <sup>2</sup> )	Blood glucose (mg/dl)
-Applied Medical Science	49.82±3.63b	159.27±4.22	19.62±0.88c	75.09±9.17c
-Business Administration	53.64±3.91b	156.09±5.13	22.00±0.79b	93.45±4.01b
-Education	68.73±11.87a	154.64±5.24	28.70±4.30a	111.09±10.03a
LSD at $\alpha$ 0.05 level	6.541	N.s	2.241	7.125
Applied Medical Science	49.82±3.63b	159.27±4.22	19.62±0.88B	75.09±9.17c
Business Administration	53.64±3.91b	156.09±5.13	22.00±0.79b	93.45±4.01b
Education	68.73±11.87a	154.64±5.24	28.70±4.30a	111.09±10.03a
LSD at $\alpha$ 0.01 level	8.807	N.s	3.018	9.595

N.s = Non-significant The means followed by the same alphabetical letters were not significantly different at the probability level of 0.05 and 0.01.

Table 6. represent the Comparison among studied traits in different Colleges Applied Medical Science, Business Administration and Education; the results show that there is a highly significant difference in blood glucose level among Colleges. It was found that students from Education college have the highest blood glucose level which was 111.09mg/dl (within the range of prediabetes; they have a risk to be diabetic. Applied Medical Science and Business Administration have blood glucose level within normal.

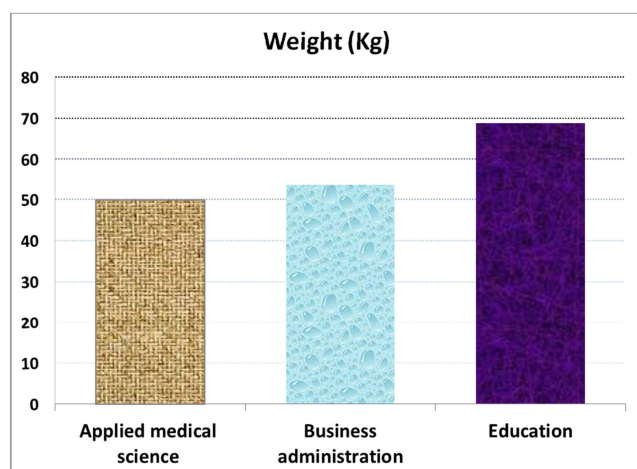
The results show that there is a highly significant difference in BMI and Weight among Colleges. It was found that students from Education College have the highest weight and BMI which was 28.7 (within the range of overweight; they have a risk to be obese) while Applied Medical Science and Business Administration have BMI (19.62 and 22) respectively which was within normal weight. In respect to height, there is no significant difference between Colleges at  $P < 0.05$  or  $P < 0.01$ . Type of College has a significant effect on blood glucose level.

**Table 7.** Simple Correlation ( $r$ ) between Studiedtraits.

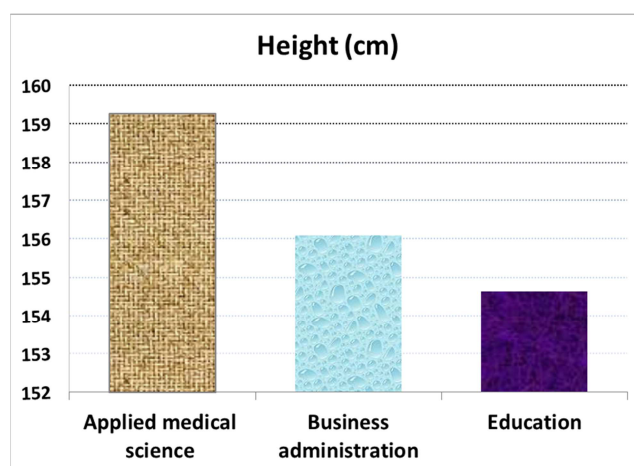
Variables	Weight (Kg)	Height (cm)	BMI (kg/m <sup>2</sup> )
Blood glucose (mg/dl)	0.828**	-0.278	0.891**
BMI (kg/m <sup>2</sup> )	0.939**	-0.277	
Height (cm)	0.064		

\* = Significant at  $\alpha$  0.05 level \*\* = Significant at  $\alpha$  0.01 level (Highly Significant)

Table 7 represent the correlation between studied traits (Blood glucose level, BMI and weight); the results show that the correlation between blood glucose level and weight was highly significant. Also the correlation between blood glucose level and BMI was highly significant. Students with high BMI within range of overweight or obese will be in risk of diabetes.

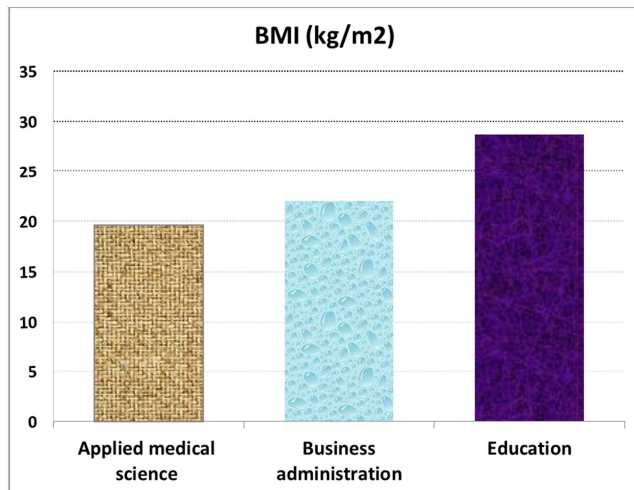


**Figure 1.** Weight (kg) average of Colleges students "Applied Medical Science, Business Administration and Education".

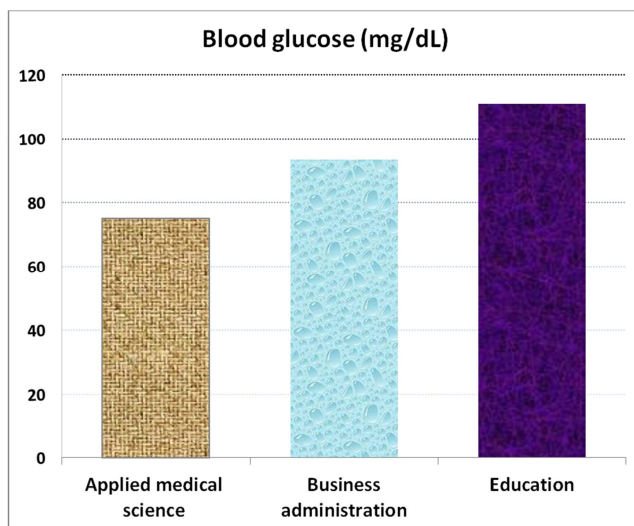


**Figure 2.** Height (cm) average of Colleges students "Applied Medical Science, Business Administration and Education".

The present results supported by a study conducted by Maria, et al. (2001) who established the relationship between obesity and diabetes. Another study from KSA conducted by ALShahrani and Al-Khaldi (2013) to assess the effect of overweight and obesity on diabetes and hypertension reported that the prevalence of obesity among diabetics and hypertensive patients was 46% and 54%, respectively.



**Figure 3.** BMI (Kg/cm<sup>2</sup>) average of Colleges students 'Applied Medical science, Business Administration and Education.'



**Figure 4.** Blood glucose (mg/dl) average of Colleges students 'Applied Medical Science, Business Administration and Literary and Education.'

## 4. Conclusion and Recommendation

Type 2 DM is due primarily to lifestyle factors and genetics. A number of lifestyle factors are known to be important to the development of type 2 DM. These are physical inactivity, sedentary lifestyle, cigarette smoking and generous consumption of alcohol. Obesity has been found to contribute to approximately 55% of cases of type 2 DM. [1, 20, 21].

In the current study, results of statistical analysis indicate that:

- All students have Healthy weight except 9% from Education College was Obese.

- All students have normal blood glucose level except 24% from Education College was prediabetes.

- Students from Education College have the highest blood glucose level which was 111.09 mg/dl (within the range of prediabetes) and they have a risk to be diabetic. Students of Applied Medical Science and Business Administration have blood glucose level within normal.

-Students from Education College have the highest weight and BMI which was 28.7 (within the range of overweight) and they have a risk to be obese while Applied Medical Science and Business Administration have BMI within normal weight. Results reflect that students of Education College have poor nutritional knowledge. The results showed that the correlation between blood glucose level and BMI was highly significant. Students with high BMI within range of overweight or obese will be in risk of diabetes.

Finally, we conclude that there is a strong correlation between Diabetes and Obesity. Health Education program regarding good food choice and physical exercise is required because type 2 DM is a metabolic disease that can be prevented through lifestyle modification, diet control, and control of overweight and obesity. Patients with type 2 DM should receive a medical nutrition evaluation and lifestyle recommendations according to physical and functional ability.

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