

# Pharmacy Student's Knowledge of Diabetes and Obesity: A Cross-Sectional Study in Dharashiv, India

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## ABSTRACT

**Introduction:** The prevalence of diabetes and obesity is rising globally, necessitating effective management strategies. Adequate understanding of these conditions among healthcare professionals, including pharmacy students, is crucial for effective prevention and management. This study explores the association between course (B.Pharm/Pharm.D) curriculum and student's knowledge about diabetes and obesity, emphasizing the understanding of pathogenesis, risk factors and management. **Materials and Methods:** A cross-sectional observational study at ASPM's K. T. Patil College of Pharmacy included 346 participants. Ethical considerations were addressed and a self-administered questionnaire assessed pharmacy student's knowledge of diabetes and obesity. Twenty-two closed-ended questions with response options of "true," "false," and "don't know" were used. **Results:** A total of 346 students participated, with significant differences in correct responses between B.Pharm and Pharm.D students for diabetes and obesity-related questions. These findings highlight the impact of educational level on understanding these conditions. **Conclusion:** Our investigation highlights patterns and disparities in knowledge gaps among pharmacy students regarding diabetes and obesity. Integrating targeted modules and practical training into pharmacy curricula can enhance understanding and management of these conditions, ultimately improving healthcare outcomes.

**Keywords:** Diabetes, Obesity, Pharmacy education, Knowledge disparities, Cardiovascular health.

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## INTRODUCTION

The escalating prevalence of diabetes and obesity globally has sparked significant research interest, with both conditions now recognized as epidemics by the World Health Organization (WHO). Approximately two-thirds of the adult population is considered overweight or obese, underscoring the urgent need for effective management strategies.<sup>1</sup>

Diabetes is a chronic illness characterized by either inadequate insulin production or the body's inability to utilize insulin effectively, leading to elevated blood glucose levels.<sup>2</sup> The alarming rise in diabetes incidence is attributed partly to changes in lifestyle and an insufficient pace of healthcare advancements.<sup>3</sup> Type 1 Diabetes Mellitus (T1DM) results from insulin secretion issues, while Type 2 Diabetes Mellitus (T2DM) is caused by insulin resistance. T2DM primarily affects middle-aged and older individuals with persistent hyperglycemia due to poor dietary and

lifestyle choices, whereas T1DM affects children and adolescents. The pathophysiology, etiologies, symptoms and therapeutic approaches differ significantly between T1DM and T2DM.<sup>4</sup> Insulin resistance, a hallmark of T2DM, leads to inadequate insulin production, eventually resulting in T2DM development, which is increasingly diagnosed in younger populations due to rising obesity rates, sedentary lifestyles and energy-dense diets.<sup>5</sup>

Obese individuals often exhibit early signs of insulin resistance and impaired insulin secretion, which worsen with the development of diabetes. Insulin resistance is particularly associated with increased total body fat, especially in visceral and ectopic fat depots.<sup>6</sup> Obesity is intimately linked to T2DM<sup>7</sup> and is a primary risk factor for numerous non-communicable diseases, including Cardiovascular Disease (CVD), Hypertension (HTN) and certain cancers.<sup>8</sup> Obesity, defined by a Body Mass Index (BMI) of over 30, significantly increases the risk of developing diabetes and its complications, such as blindness, limb amputations and the need for dialysis.<sup>9</sup>

The association between obesity and T2DM is well-established, with obesity-related insulin resistance playing a crucial role in the development of both T1DM and T2DM.<sup>7</sup> Elevated levels of non-esterified fatty acids, glycerol, enzymes, cytokines,



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pro-inflammatory substances and other compounds implicated in insulin resistance are found in higher concentrations in obese individuals. These factors contribute to reduced beta-cell function, ultimately leading to the development of diabetes.<sup>2</sup>

Recent research has focused on the role of the gut microbiota in the onset of diabetes and obesity. Ongoing studies aim to elucidate the gut microbiota's impact on obesity, T1DM and T2DM development, as well as its interactions with the entire body. These findings could provide new insights and potentially reshape our understanding of the diabetes-obesity relationship.<sup>10</sup>

Given the close connection between diabetes and obesity, it is crucial to develop treatment strategies that address both conditions simultaneously. Combining various treatment modalities, such as bariatric surgery, may be an effective approach to managing and preventing diabetes in obese individuals.

Further research is needed to better understand the complex interactions and mechanisms underlying diabetes and obesity. This study aims to evaluate the diabetes and obesity knowledge among pharmacy students in Dharashiv, India. The hypothesis suggests no association between the course (B.Pharm/Pharm.D) and the correctness of student responses, while the alternative hypothesis proposes an association. By exploring nuanced aspects of diabetes and obesity knowledge, this study seeks to enhance understanding of these conditions among pharmacy students and inform future educational interventions.

## MATERIALS AND METHODS

### Study design, participants and study settings

A cross-sectional observational study was conducted at ASPM's K. T. Patil College of Pharmacy, Dharashiv, over two months from November to December 2023. Approval was obtained from the college's principal and the study's purpose was explained to students, highlighting that participation was voluntary. Pharm.D first-year students and B.Pharm first and second-year students were excluded, while B.Pharm third and fourth-year and Pharm.D second to sixth-year students were encouraged to participate. Only students who agreed to participate were included in the study.

### Sample size and sampling method

To ensure statistical robustness, a sample size of 246 was aimed for, considering varying class sizes. This included 125 students per year for B.Pharm (totaling 500 students across four years) and 30 students per year for Pharm.D (totaling 180 students across six years). Calculated with a 5% margin of error, a 95% confidence level and an anticipated response distribution of approximately 50%, this sample size guarantees reliable and representative survey results. It aligns with the desired level of accuracy and confidence for the given population and response distribution.

### Data collection tool

A total of 400 eligible pharmacy students, including B.Pharm students in their third and fourth years and Pharm.D students in their second to sixth years, received a self-administered questionnaire. This questionnaire consisted of three sections: one for participant details (including gender, age, course and year) and two sections for assessing knowledge related to diabetes and obesity.

### Diabetes and obesity assessments

Participants were presented with a total of twenty-two closed-ended questions, with thirteen questions focusing on diabetes and nine on obesity. Each question had response options of "true," "false," and "don't know," requiring participants to select a single, correct response for each question.

### Ethical considerations

Ethical committee approval for data collection was not required, as participants were college students and their involvement was voluntary. Moreover, no interventions aimed at influencing the study participants were implemented. Additionally, permission was obtained from the college principal.

## RESULTS AND DISCUSSION

### Demographic details of participants

The study included 346 participants, with 222 in the B.Pharm group and 124 in the Pharm.D group. Gender distribution was balanced in the B.Pharm group, with 111 female and 111 male students, while the Pharm.D group had slightly more male students (63) than female students (61). Participants from the 1<sup>st</sup> and 2<sup>nd</sup> years of B.Pharm and 1<sup>st</sup> year of Pharm.D were excluded. The majority of participants were in their 3<sup>rd</sup> year (121, B.Pharm and 19, Pharm.D) and 4<sup>th</sup> year (101, B.Pharm and 26, Pharm.D). Additionally, 29 Pharm.D students were in their 2<sup>nd</sup> year, 27 in their 5<sup>th</sup> year and 23 in their 6<sup>th</sup> year. The demographic distribution is summarized in Table 1, which distinguishes between B.Pharm and Pharm.D students.

### Assessment of pharmacy student's knowledge of diabetes

In our investigation into diabetes-related knowledge among pharmacy students, we explored thirteen distinct questions to grasp nuanced aspects of their understanding. Table 2 displays participant's responses to the diabetes questionnaire items, while Table 3 presents the percentage of correct responses for diabetes with statistical interpretation. Figure 1 provides a graphical representation of participant's correct responses to the diabetes questionnaire items. The analysis revealed significant differences in correct responses between B.Pharm and Pharm.D students for several questions, indicating a clear association between educational level and response correctness.

**Table 1: Demographic distribution of participants.**

	B. Pharm students		Pharm.D students	
	n	%	n	%
<b>Gender</b>				
Female	111	50	61	49.19
Male	111	50	63	50.81
Total	222	100	124	100
<b>Students</b>				
2 <sup>nd</sup> year	0	0	29	23.39
3 <sup>rd</sup> year	121	54.50	19	15.32
4 <sup>th</sup> year	101	45.50	26	20.97
5 <sup>th</sup> year	-	-	27	21.77
6 <sup>th</sup> year	-	-	23	18.55

**Table 2: Participant's responses to diabetes questionnaire items.**

Sl. No.	Questions <sup>11</sup>	Correct response	B. Pharm students, n=222			Pharm.D students, n=124		
			Correct response (n)	Incorrect response (n)	Don't know (n)	Correct response (n)	Incorrect response (n)	Don't know (n)
1	There are several different types of diabetes.	True	135	63	24	114	10	00
2	Hereditary factors play a major role in the development of diabetes.	True	129	66	27	106	16	02
3	Hereditary factors only play a minor role in the development of diabetes.	False	87	109	26	76	48	00
4	Eye disorders can be a consequence of diabetes.	True	114	74	34	72	47	05
5	For some individuals with diabetes, it is not advisable to take insulin.	True	137	63	22	87	31	06
6	Individuals with diabetes may only eat special types of sweets.	False	83	114	25	60	60	04
7	In diabetes, sugar cannot enter the cells sufficiently.	True	108	86	28	70	48	06
8	Poor appetite is a frequent symptom of diabetes.	False	68	125	29	51	71	02
9	In diabetes, too much sugar enters the cells.	False	82	113	27	43	74	07
10	Frequent urination is a classic symptom of diabetes.	True	137	58	27	102	21	01
11	Individuals with diabetes must receive insulin shots.	False	103	96	23	29	94	01
12	Arteriosclerosis is one of the sequelae of diabetes.	True	122	64	36	50	63	11
13	In diabetes, sugar cannot move in the blood.	False	77	107	38	82	35	07

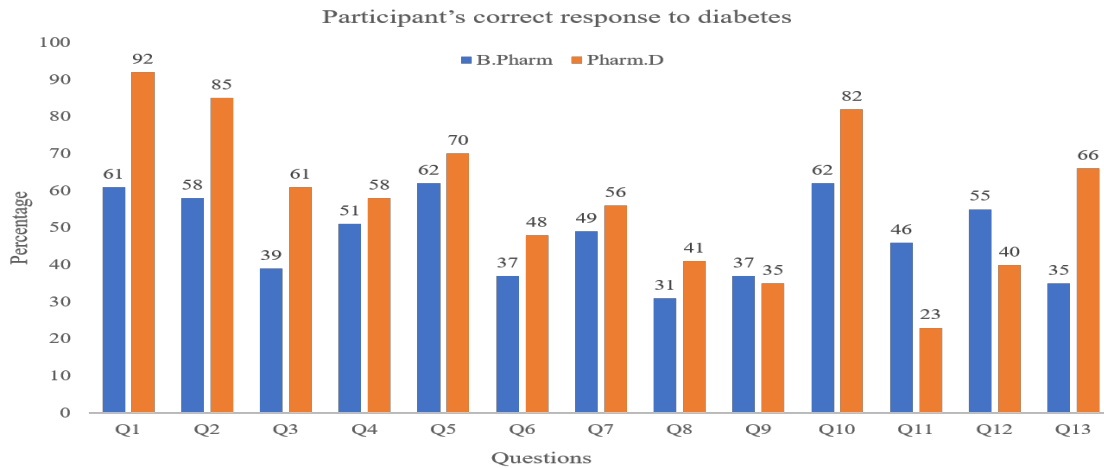
For instance, questions addressing the hereditary factors contributing to diabetes (Question 1) and the advisability of insulin for some individuals with diabetes (Question 5) showed substantial discrepancies in correct responses between B.Pharm and Pharm.D students, with 61% and 62% correct responses from B.Pharm students compared to 92% and 70% from Pharm.D students, respectively. These disparities underscore the impact of educational level on the understanding of these diabetes-related concepts.

Furthermore, questions pertaining to the consequences of diabetes on eye disorders (Question 4) and arteriosclerosis (Question 12) also revealed notable differences in correct responses between

the two student groups, highlighting the influence of educational background on diabetes-related knowledge.

As we explored various aspects of diabetes, including its relationship with appetite (Question 8), sugar metabolism (Question 9) and insulin therapy (Question 11), the observed differences in correct responses further emphasize the role of education in shaping diabetes-related knowledge among pharmacy students.

These findings emphasize the importance of tailored educational strategies to address specific knowledge gaps within pharmacy curricula, ensuring that future pharmacists are equipped with a comprehensive understanding of diabetes and its management.



**Figure 1:** Participant's correct response to diabetes questionnaire items.

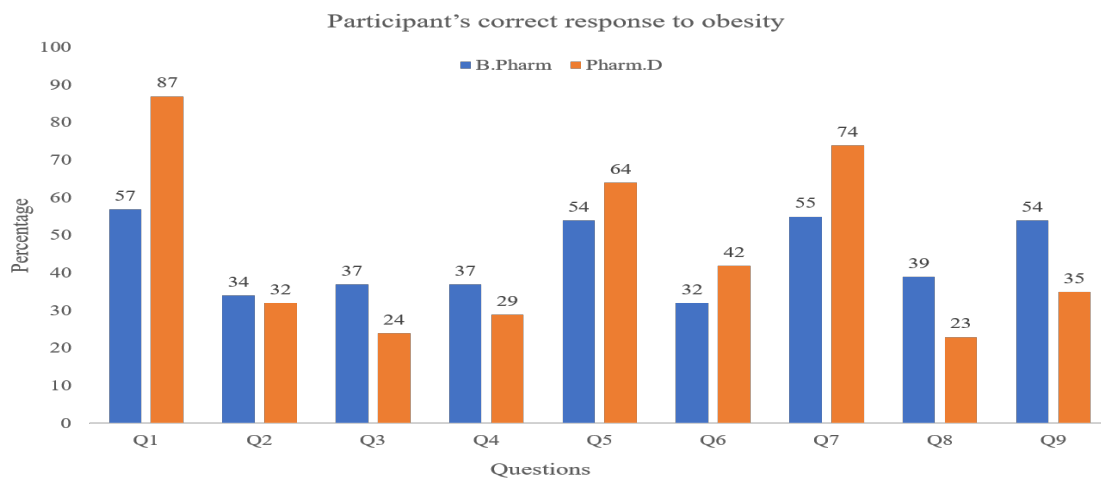
**Table 3:** Percentage of correct response for diabetes with statistical interpretation.

Question No.	Percentage of B.Pharm student's correct response	Percentage of Pharm.D student's correct response	Chi-squared Statistic	Degrees of Freedom	p-value	Result
1	61	92	2.333E-134	2	0.05	Significant
2	58	85	3.4819E-85	2	0.05	Significant
3	39	61	2.5292E-61	2	0.05	Significant
4	51	58	2.4104E-54	2	0.05	Significant
5	62	70	8.9541E-58	2	0.05	Significant
6	37	48	4.2138E-61	2	0.05	Significant
7	49	56	1.7469E-89	2	0.05	Significant
8	31	41	6.143E-101	2	0.05	Significant
9	37	35	6.205E-123	2	0.05	Significant
10	62	82	7.809E-111	2	0.05	Significant
11	46	23	3.8605E-94	2	0.05	Significant
12	55	40	2.2799E-53	2	0.05	Significant
13	35	66	4.4408E-31	2	0.05	Significant

Note: The "E" stands for "exponent", indicating that the value following it should be interpreted as a number raised to a power. For example, "2.333E-134" should be read as "2.333 x 10<sup>-134</sup>", which is a very small number close to zero.

**Table 4: Participant's responses to obesity questionnaire items.**

Sl. No.	Questions <sup>12</sup>	Correct response	B.Pharm students, n=222			Pharm.D students, n=124		
			Correct response (n)	Incorrect response (n)	Don't know (n)	Correct response (n)	Incorrect response (n)	Don't know (n)
1	Obese individuals have an elevated risk of suffering a myocardial infarction.	True	126	68	28	108	15	01
2	Adiposity is not only caused by nutrition, but other factors contribute as well.	False	76	110	36	40	76	08
3	An excessively fatty, high-caloric diet is the only factor that determines adiposity.	False	82	113	27	30	90	04
4	The terms 'overweight' and 'adiposity' are synonyms.	False	83	110	29	36	80	08
5	Cessation of breathing while sleeping is a possible consequence of adiposity.	True	119	69	34	79	40	05
6	Obese individuals have the same risk as non-adipose individuals of suffering a stroke.	False	72	116	34	52	64	08
7	Obese individuals are more likely to suffer from arteriosclerosis.	True	123	77	22	92	29	03
8	Liposuction is the best possible treatment for increased adiposity.	False	86	103	33	28	83	13
9	Adiposity can be treated surgically.	True	119	66	37	80	33	12

**Figure 2:** Participant's correct response to obesity questionnaire items.

### Assessment of pharmacy student's knowledge of obesity

In our investigation into obesity-related knowledge among pharmacy students, we explored nine distinct questions to grasp nuanced aspects of their understanding. Table 4 displays participant's responses to the obesity questionnaire items, while

Table 5 presents the percentage of correct responses for obesity with statistical interpretation. Figure 2 provides a graphical representation of participant's correct responses to the obesity questionnaire items. The analysis revealed significant differences in correct responses between B.Pharm and Pharm.D students for several questions, indicating a clear association between educational level and response correctness.

**Table 5: Percentage of correct response for obesity with statistical interpretation.**

Question No.	Percentage of B.Pharm student's correct response	Percentage of Pharm.D student's correct response	Chi-squared Statistic	Degrees of Freedom	p-value	Result
1	57	87	1.31311E-95	2	0.05	Significant
2	34	32	2.67268E-65	2	0.05	Significant
3	37	24	1.99915E-74	2	0.05	Significant
4	37	29	1.11831E-80	2	0.05	Significant
5	54	64	3.14293E-76	2	0.05	Significant
6	32	42	2.55798E-67	2	0.05	Significant
7	55	74	1.50917E-56	2	0.05	Significant
8	39	23	3.32819E-37	2	0.05	Significant
9	54	65	1.37118E-10	2	0.05	Significant

Note: The "E" stands for "exponent" and is used in scientific notation to represent very large or very small numbers. For example, "1.31311E-95" means  $1.31311 \times 10^{-95}$ , which is an extremely small number close to zero.

For instance, questions addressing the risk of myocardial infarction in obese individuals (Question 1) and the causes of adiposity (Question 2) showed substantial discrepancies in correct responses between B.Pharm and Pharm.D students, with 57% and 87% correct responses from B.Pharm students compared to 87% and 64% from Pharm.D students, respectively. These disparities underscore the impact of educational level on the understanding of these obesity-related concepts.

Furthermore, questions pertaining to the misconceptions about diet and adiposity (Questions 3 and 8) also revealed notable differences in correct responses between the two student groups, highlighting the influence of educational background on obesity-related knowledge.

As we explored various aspects of obesity, including its consequences on breathing (Question 5), stroke risk (Question 6) and arteriosclerosis (Question 7), the observed differences in correct responses further emphasize the role of education in shaping obesity-related knowledge among pharmacy students.

These findings emphasize the importance of tailored educational strategies to address specific knowledge gaps within pharmacy curricula, ensuring that future pharmacists are equipped with a comprehensive understanding of obesity and its management.

## CONCLUSION

In conclusion, our study sheds light on the knowledge levels of pharmacy students regarding diabetes and obesity, highlighting the need for tailored educational strategies to address knowledge gaps. Our findings reveal significant disparities in understanding between B.Pharm and Pharm.D students, emphasizing the impact of educational level on diabetes and obesity-related knowledge.

The study underscores the importance of comprehensive education on these conditions, considering their global

prevalence and impact on public health. By addressing specific misconceptions and nuances related to diabetes and obesity, educational interventions can better equip future pharmacists to contribute effectively to prevention and management strategies.

Moving forward, it is imperative to integrate targeted modules, workshops and practical training into pharmacy curricula to ensure that future professionals possess a thorough understanding of these critical health issues. Such initiatives will not only enhance the quality of healthcare but also contribute to mitigating the burden of diabetes and obesity on society.

Our study not only adds to the existing body of knowledge on diabetes and obesity but also advocates for a proactive approach to shaping the educational landscape for healthcare professionals. By empowering pharmacy students with the necessary knowledge and skills, we pave the way for a future generation of healthcare providers who are better equipped to address the challenges posed by these prevalent and impactful medical conditions.

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## CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

## ABBREVIATIONS

**BMI:** Body mass index; **B.Pharm:** Bachelor of Pharmacy; **CVD:** Cardiovascular disease; **HTN:** Hypertension; **Pharm.D:** Doctor of Pharmacy; **T1DM:** Type 1 diabetes mellitus; **T2DM:** Type 2 diabetes mellitus; **WHO:** World Health Organization.

## SUMMARY

This study assessed the knowledge of diabetes and obesity among pharmacy students in Dharashiv, India. A cross-sectional observational study was conducted, involving 346 pharmacy students. Significant differences in correct responses were found between B.Pharm and Pharm.D students, highlighting the impact of educational level on understanding these conditions. The study underscores the importance of tailored educational strategies to address knowledge gaps, recommending the integration of targeted modules and practical training into pharmacy curricula. These interventions can enhance understanding and management of diabetes and obesity among future pharmacists, ultimately improving healthcare outcomes.

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