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Clinical Exposure improves Medical Students' Understanding of Bariatric Surgery: A Cross-Sectional Study at Mansoura University

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Abstract

Introduction:

The "100 Million Health" project in Egypt estimates that 29.5% of adult males and 49.5% of adult females suffer from obesity. Metabolic/Bariatric surgery (MBS) is considered one of the effective interventions. Despite this, awareness remains low among certain communities. This study aimed to assess the impact of the medical curriculum at Mansoura University on improving students' knowledge and attitudes toward MBS.

Methods

This cross-sectional analytical study was conducted among first-year students and interns at Mansoura University. A 30-question self-reported survey was distributed via social media platforms and on campus from the 4th of November 2024 to the 4th of January 2025.

Results

A total of 683 students (355 (52%) interns and 328 (48%) students in their first year of medical school) accepted to participate in the survey with a response rate of 97.57%. A significantly higher proportion of interns (81%) believe that surgical intervention is the best way to treat obesity compared to first-year medical students (63%) ($p < 0.001$). There was a major lack of knowledge on the eligible criteria for MBS (interns, 9.5%, and first-year students, 8.5%) with no significant difference ($p > 0.9$). Overall, Interns demonstrated a significantly higher median knowledge score (9.50) compared to first-year medical students (9.00) (p **< 0.001**). Univariate analysis revealed significant associations between attitude scores and years in medical school ($p < 0.001$), gender ($p = 0.005$), and nationality group ($p = 0.043$). Correlation revealed a weak positive relation between knowledge and attitude scores (Pearson's $r = 0.13$).

Conclusion

While undergraduate education markedly improved knowledge and attitudes, persistent gaps in understanding eligibility and a slightly negative perception of MBS underscore the need for enhanced teaching strategies, such as curriculum revisions and interactive learning, to address low awareness and optimize future physicians’ preparedness.

Introduction

Obesity is currently seen as a major public health concern and a major worldwide health issue. A body mass index (BMI) of more than 30 kg/m² is usually used to define it [1]. According to current estimates,

obesity will afflict more than one billion people globally by 2030 [2]. The "100 Million Health" project in Egypt found that 29.5% of adult males and 49.5% of adult females suffer from obesity [3].

Obesity is considered a significant contributory factor for many serious complications, such as insulin resistance, metabolic syndrome, type 2 diabetes mellitus, and cardiovascular diseases [4]. Additionally, non-alcoholic fatty liver disease, hypertension, and obstructive sleep apnea are other complications frequently linked to obesity [3]. Current clinical guidelines highlight lifestyle changes such as dietary adjustments, physical activity, and behavioral therapies as first-line management [5]. Pharmacological therapy, endoscopic procedures, or metabolic/bariatric surgery (MBS) may be considered when these measures are ineffective [6].

Patients with a BMI ≥ 35 kg/m², or patients with a BMI of 30–34.9 kg/m² with obesity related complications are considered eligible for MBS [7]. Sleeve gastrectomy remains the most performed MBS procedure globally, followed by Roux-en-Y gastric bypass and one anastomosis gastric bypass. Other procedures include single anastomosis duodeno-ileal bypass with sleeve gastrectomy, biliopancreatic diversion, adjustable gastric banding, single anastomosis sleeve ileal bypass, transit bipartition, and endoscopic techniques [8]. According to available data, MBS patients report higher life expectancy, better mental health outcomes, and increased psychosocial well-being [9].

Despite the increasing worldwide prevalence of obesity and the availability of effective interventions like MBS, awareness remains low among certain communities. Research shows that college students have low acceptance rates for MBS and frequently lack sufficient knowledge about obesity [10]. On the other hand, medical students who receive specialized education in MBS show a better comprehension and acceptance of these procedures [11]. This study aims to assess the impact of the medical curriculum at Mansoura University on improving students' knowledge and attitudes toward MBS.

Methods

This is a cross-sectional descriptive study that was designed to evaluate knowledge and attitude toward MBS among first-year students and intern doctors at the Faculty of Medicine, Mansoura University, Egypt. There is no dedicated curriculum for MBS at Mansoura University. Students' exposure is limited to a single lecture on obesity management in the third year. All interns included in the study studied at Mansoura University.

When conducting this study, the total number of interns was 3997, and the total number of first-year medical students was 1876. Assuming a minimum response rate of 65%, the calculated sample size was 670 (a minimum of 351 interns and 319 first-year students). From the 4th of November 2024 to the 4th of January 2025, the authors sent the questionnaire (available in the supplementary file 1) through university networks by local social media platforms like Facebook, Telegram, and WhatsApp groups, as well as distributing it in printed form randomly on random study days of the week. All participants gave informed consent and submitted the questionnaires on the principle of voluntariness, without providing economic and other material incentives.

The questionnaire was developed based on a comprehensive literature review on MBS awareness and educational interventions. It was designed to assess demographics (gender, religion, residency, nationality, and BMI), knowledge (15 items), and attitudes (15 items) toward bariatric MBS, with scores assigned for correct answers (1 point), incorrect answers (0 point), or "maybe" (0.5 point).

To ensure content validity, the initial draft of the questionnaire was reviewed by a panel of three experts in MBS and medical education. A pilot version was tested on 30 medical students (excluded from final analysis) to evaluate clarity, item interpretation, and completion time. Minor adjustments were made based on feedback.

Reliability testing was done using Jamovi software, and internal consistency was assessed using Cronbach's alpha, which yielded a value of 0.66 with corrections. Data were analyzed using R 4.4.2, employing chi-square tests, Wilcoxon rank-sum tests, and quantile regression ($p < 0.05$ deemed significant). Categorical variables were described using frequency distributions, and continuous variables were described using median and range for non-parametric data and mean and standard deviation for parametric data. Ethical approval was granted by the local ethical committee of the Faculty of Medicine, Mansoura University. (code number: R.24.10.2831) and was conducted in accordance with the ethical principles of the Declaration of Helsinki. All the data collected was anonymous and confidential.

Results

A total of 700 students were asked to participate in the survey. Six hundred and eighty-three students (355 (52%) interns and 328 (48%) students in the first year of medical school) completed the survey, with a response rate of 97.57%. Demographically, the cohort was 60.8% female, 98.8% Muslim, and 80.4% Egyptian, with 67.8% from urban areas and 80.5% having an average BMI (18.5–25 kg/m²). Table 1 summarizes the demographics of participants. A diagram depicting the nationalities of the included participants is in Fig. 1.

Table 1
Demographic Data

Characteristic	Overall, N = 683[1]	Year 1 (Sem 1 and Sem 2), N = 328[1]	Intern (Year 1 and Year 2), N = 355[1]	p-value[2]
Gender				0.3
Female	415 (61%)	192 (59%)	223 (63%)	
Male	268 (39%)	136 (41%)	132 (37%)	
Religion				0.3
Christianity	7 (1.0%)	5 (1.5%)	2 (0.6%)	
Islam	675 (99%)	323 (98%)	352 (99%)	
Not religious	1 (0.1%)	0 (0%)	1 (0.3%)	
Residency				0.3
Rural	220 (32%)	112 (34%)	108 (30%)	
Urban	463 (68%)	216 (66%)	247 (70%)	
Nationality group				**< 0.001**
Arabic Egyptian	548 (80%)	228 (70%)	320 (90%)	
Arabic non-Egyptian	108 (16%)	78 (24%)	30 (8.5%)	
Non-Arabic	27 (4.0%)	22 (6.7%)	5 (1.4%)	
BMI Group				**< 0.001**
Average (BMI 18.5–25)	550 (81%)	268 (82%)	282 (79%)	
Overweight (BMI Over 25)	97 (14%)	34 (10%)	63 (18%)	
Underweight (BMI Under 18.5)	36 (5.3%)	26 (7.9%)	10 (2.8%)	

[1]n (%)

[2]Pearson's Chi-squared test; Fisher's exact test

A univariate analysis (Table 2) compared the responses to the knowledge questions collected from first-year medical students and interns. Knowledge scores revealed significant differences between groups. Interns outperformed first-year students (median score 9.50 vs. 9.00, $p < 0.001$), reflecting the impact of clinical exposure. For instance, 90% of interns vs. 70% of first-years recognized BMI as a key obesity indicator ($p < 0.001$), and 81% of interns vs. 63% of first-years viewed MBS as the best treatment for

obesity ($p < 0.001$). Interns also demonstrated greater awareness of long-term consequences (76% vs. 57%, $p < 0.001$), pregnancy as a contraindication (70% vs. 53%, $p < 0.001$), and procedural types (40% vs. 24%, $p < 0.001$). However, both groups showed poor knowledge of eligibility criteria (9.5% interns, 8.5% first-years, $p > 0.9$), where they falsely believe that there is an upper age limit for MBS, and they believed that patients below 18 years old are not eligible for MBS, with non-significant difference between the groups ($p = 0.6$ and $p = 0.3$ respectively).

Table 2
Influence of Year in Medical School on Knowledge Questions

Characteristic	**Overall, N = 683[1]**	**Year 1 (Sem 1 and Sem 2), N = 328[1]**	**Intern (Year 1 and Year 2), N = 355[1]**	**p-value[2]**
1. BMI is an important indicator of obesity				**< 0.001**
Maybe	106 (16%)	75 (23%)	31 (8.7%)	
No	28 (4.1%)	22 (6.7%)	6 (1.7%)	
Yes	549 (80%)	231 (70%)	318 (90%)	
2. Diet & exercise are effective means for sustained weight loss in morbid obese patients				**0.002**
Maybe	112 (16%)	46 (14%)	66 (19%)	
No	45 (6.6%)	12 (3.7%)	33 (9.3%)	
Yes	526 (77%)	270 (82%)	256 (72%)	
3. Is there an upper age limit for bariatric surgery?				0.6
Maybe	274 (40%)	135 (41%)	139 (39%)	
No	73 (11%)	31 (9.5%)	42 (12%)	
Yes	336 (49%)	162 (49%)	174 (49%)	
4. Patients below 18 years old are eligible for bariatric surgery				0.3
Maybe	235 (34%)	112 (34%)	123 (35%)	
No	348 (51%)	161 (49%)	187 (53%)	
Yes	100 (15%)	55 (17%)	45 (13%)	
5. Surgical intervention is the best way to treat obesity				**< 0.001**

[2]Pearson's Chi-squared test

Characteristic	Overall, N = 683[1]	Year 1 (Sem 1 and Sem 2), N = 328[1]	Intern (Year 1 and Year 2), N = 355[1]	p-value[2]
Maybe	139 (20%)	89 (27%)	50 (14%)	
No	495 (72%)	206 (63%)	289 (81%)	
Yes	49 (7.2%)	33 (10%)	16 (4.5%)	
6. I know the eligible criteria for Bariatric Surgery				> 0.9
Maybe	177 (26%)	87 (27%)	90 (25%)	
No	383 (56%)	183 (56%)	200 (56%)	
Yes	123 (18%)	58 (18%)	65 (18%)	
7. The benefits of bariatric surgery are worth the risks of the operation				0.5
Maybe	331 (48%)	167 (51%)	164 (46%)	
No	154 (23%)	71 (22%)	83 (23%)	
Yes	198 (29%)	90 (27%)	108 (30%)	
8. Bariatric surgery has long term consequences (eg, malnutrition & gallstones) post-operatively?				**< 0.001**
Maybe	197 (29%)	120 (37%)	77 (22%)	
No	27 (4.0%)	20 (6.1%)	7 (2.0%)	
Yes	459 (67%)	188 (57%)	271 (76%)	
9. Pregnancy is an absolute contraindication to perform bariatric surgery				**< 0.001**
Maybe	177 (26%)	92 (28%)	85 (24%)	

[2]Pearson's Chi-squared test

Characteristic	Overall, N = 683[1]	Year 1 (Sem 1 and Sem 2), N = 328[1]	Intern (Year 1 and Year 2), N = 355[1]	p-value[2]
No	83 (12%)	61 (19%)	22 (6.2%)	
Yes	423 (62%)	175 (53%)	248 (70%)	
10. I believe that comorbidities (such as diabetes and hypertension) of obesity can be treated with bariatric surgery				**0.006**
Maybe	260 (38%)	127 (39%)	133 (37%)	
No	246 (36%)	133 (41%)	113 (32%)	
Yes	177 (26%)	68 (21%)	109 (31%)	
11. I know the basic types of surgical procedures in the field of bariatric surgery				**< 0.001**
Maybe	130 (19%)	70 (21%)	60 (17%)	
No	331 (48%)	179 (55%)	152 (43%)	
Yes	222 (33%)	79 (24%)	143 (40%)	
12. The cost of bariatric surgery can be an issue				**< 0.001**
Maybe	164 (24%)	98 (30%)	66 (19%)	
No	30 (4.4%)	18 (5.5%)	12 (3.4%)	
Yes	489 (72%)	212 (65%)	277 (78%)	
13. I know what matters to patients when deciding to do bariatric surgery				0.4
Maybe	186 (27%)	95 (29%)	91 (26%)	
No	159 (23%)	70 (21%)	89 (25%)	

[2]Pearson's Chi-squared test

Characteristic	Overall, N = 683[1]	Year 1 (Sem 1 and Sem 2), N = 328[1]	Intern (Year 1 and Year 2), N = 355[1]	p-value[2]
Yes	338 (49%)	163 (50%)	175 (49%)	
14. There is a postoperative psychiatric side effect				0.7
Maybe	202 (30%)	93 (28%)	109 (31%)	
No	49 (7.2%)	26 (7.9%)	23 (6.5%)	
Yes	432 (63%)	209 (64%)	223 (63%)	
15. Malabsorption & hypovitaminosis are a short-term postoperative side effect.				**< 0.001**
Maybe	236 (35%)	170 (52%)	66 (19%)	
No	129 (19%)	45 (14%)	84 (24%)	
Yes	318 (47%)	113 (34%)	205 (58%)	
[1]n (%)				
[2]Pearson's Chi-squared test				

Influence of year in medical school on attitudes toward MBS using univariate analysis showed an overall positive attitude (Table 3). Interns had higher median scores (7.50 vs. 7.00, $p < 0.001$) and were less likely to view MBS as "cheating" (6.2% vs. 16%, $p < 0.001$), while first year students believe it is an easy way to lose weight. Interns significantly perceived higher mortality rates with pediatric MBS (34% vs 31%, $p = 0.01$), but lesser mortality rates in MBS in adults (21% vs. 26%, $p < 0.001$). They were also more willing to refer relatives for MBS (46% vs. 34%, $p = 0.002$) and discuss weight management with patients (74% vs. 57%, $p < 0.001$). 84% of interns vs. 64% of first-years worried about complications ($p < 0.001$), and 63% of both groups opposed repeat surgeries after suboptimal clinical response ($p = 0.3$).

Table 3
Influence of Year in Medical School on Attitude Questions

Characteristic	Overall, N = 683[1]	Year 1 (Sem 1 and Sem 2), N = 328[1]	Intern (Year 1 and Year 2), N = 355[1]	p-value[2]
1. Having a bariatric surgery is considered cheating				**< 0.001**
Maybe	117 (17%)	72 (22%)	45 (13%)	
No	490 (72%)	202 (62%)	288 (81%)	
Yes	76 (11%)	54 (16%)	22 (6.2%)	
2. If a specialist recommended this surgery for me, I will be willing to do it				0.13
Maybe	262 (38%)	113 (34%)	149 (42%)	
No	214 (31%)	109 (33%)	105 (30%)	
Yes	207 (30%)	106 (32%)	101 (28%)	
3. I would refer a first-degree relative to bariatric surgery when indicated				**0.002**
Maybe	214 (31%)	109 (33%)	105 (30%)	
No	193 (28%)	108 (33%)	85 (24%)	
Yes	276 (40%)	111 (34%)	165 (46%)	
4. The media coverage negatively affects bariatric surgery's image?				**0.015**
Maybe	250 (37%)	138 (42%)	112 (32%)	
No	214 (31%)	91 (28%)	123 (35%)	
Yes	219 (32%)	99 (30%)	120 (34%)	
5. The future treatment of morbid obesity must be based primarily on lifestyle and				**< 0.001**

[2]Pearson's Chi-squared test

Characteristic	Overall, N = 683[1]	Year 1 (Sem 1 and Sem 2), N = 328[1]	Intern (Year 1 and Year 2), N = 355[1]	p-value[2]
pharmacotherapy				
Maybe	183 (27%)	103 (31%)	80 (23%)	
No	75 (11%)	20 (6.1%)	55 (15%)	
Yes	425 (62%)	205 (63%)	220 (62%)	
6. Will you choose bariatric surgery if you are morbidly obese?				**< 0.001**
Maybe	254 (37%)	126 (38%)	128 (36%)	
No	212 (31%)	124 (38%)	88 (25%)	
Yes	217 (32%)	78 (24%)	139 (39%)	
7. I discuss weight loss management with overweight or obese patients?				**< 0.001**
Maybe	107 (16%)	64 (20%)	43 (12%)	
No	127 (19%)	76 (23%)	51 (14%)	
Yes	449 (66%)	188 (57%)	261 (74%)	
8. I am concerned with complications after bariatric surgery				**< 0.001**
Maybe	114 (17%)	76 (23%)	38 (11%)	
No	59 (8.6%)	41 (13%)	18 (5.1%)	
Yes	510 (75%)	211 (64%)	299 (84%)	
9. Would you recommend a second bariatric surgery to a morbid obese patient after a failed one				0.3
Maybe	162 (24%)	70 (21%)	92 (26%)	

[2]Pearson's Chi-squared test

Characteristic	Overall, N = 683[1]	Year 1 (Sem 1 and Sem 2), N = 328[1]	Intern (Year 1 and Year 2), N = 355[1]	p-value[2]
No	433 (63%)	212 (65%)	221 (62%)	
Yes	88 (13%)	46 (14%)	42 (12%)	
10. If you are eligible for surgery, would you refuse surgery to avoid complications post-operatively				0.4
Maybe	244 (36%)	109 (33%)	135 (38%)	
No	121 (18%)	58 (18%)	63 (18%)	
Yes	318 (47%)	161 (49%)	157 (44%)	
11. I think the mortality rate is high in pediatric bariatric surgery?				**0.010**
Maybe	310 (45%)	167 (51%)	143 (40%)	
No	150 (22%)	59 (18%)	91 (26%)	
Yes	223 (33%)	102 (31%)	121 (34%)	
12. I think the mortality rate is high in bariatric surgery in general?				**< 0.001**
Maybe	246 (36%)	144 (44%)	102 (29%)	
No	276 (40%)	99 (30%)	177 (50%)	
Yes	161 (24%)	85 (26%)	76 (21%)	
13. My religion prohibits bariatric surgery				**< 0.001**
Maybe	193 (28%)	129 (39%)	64 (18%)	
No	424 (62%)	149 (45%)	275 (77%)	

[2]Pearson's Chi-squared test

Characteristic	Overall, N = 683[1]	Year 1 (Sem 1 and Sem 2), N = 328[1]	Intern (Year 1 and Year 2), N = 355[1]	p-value[2]
Yes	66 (9.7%)	50 (15%)	16 (4.5%)	
14. I am interested in becoming a bariatric surgeon				**< 0.001**
Maybe	116 (17%)	76 (23%)	40 (11%)	
No	470 (69%)	191 (58%)	279 (79%)	
Yes	97 (14%)	61 (19%)	36 (10%)	
15. I am interested in educational programs and webinars to increase awareness on weight management options				**0.039**
Maybe	109 (16%)	59 (18%)	50 (14%)	
No	91 (13%)	52 (16%)	39 (11%)	
Yes	483 (71%)	217 (66%)	266 (75%)	
[1]n (%)				
[2]Pearson's Chi-squared test				

A univariate and multivariate analysis was performed to explore additional influencers on knowledge and/or attitude. One significant association was found between knowledge scores and the year of medical school (p **< 0.001**). Specifically, interns demonstrated a significantly higher median knowledge score (9.50) compared to first-year medical students (9.00). Other variables, including gender, religion, residency, nationality group, and BMI group, did not show statistically significant associations with knowledge scores ($p > 0.05$) (Table 4). Males (Beta = 0.50, $p = 0.003$) and interns (Beta = 0.50, $p = 0.005$) exhibited more positive attitudes, as did Arabic non-Egyptians vs. Egyptians (Beta = 0.50, $p = 0.013$) (Table 5).

Table 4
Impact of Variables on Knowledge Scores

Characteristic	N	Knowledge Scores[1]	p-value[2]
Overall	683	9.50 (3.00, 13.50)	
Year in Medical School			**< 0.001**
Year 1 (Sem 1 and Sem 2)	328	9.00 (3.50, 13.00)	
Intern (Year 1 and Year 2)	355	9.50 (3.00, 13.50)	
Gender			0.6
Female	415	9.50 (3.50, 13.50)	
Male	268	9.50 (3.00, 13.50)	
Religion			> 0.9
Christianity	7	9.50 (7.50, 12.50)	
Islam	675	9.50 (3.00, 13.50)	
Not religious	1	9.00 (9.00, 9.00)	
Residency			0.2
Rural	220	9.50 (5.50, 13.50)	
Urban	463	9.50 (3.00, 13.50)	
Nationality group			0.7
Arabic Egyptian	548	9.50 (3.50, 13.50)	
Arabic non-Egyptian	108	9.50 (3.00, 13.50)	
Non-Arabic	27	9.50 (5.00, 12.00)	
BMI Group			0.2
Average (BMI 18.5–25)	550	9.50 (3.00, 13.50)	
Overweight (BMI Over 25)	97	9.50 (5.50, 12.50)	
Underweight (BMI Under 18.5)	36	9.00 (6.50, 12.50)	

[1]Median (Min, Max)

[2]Wilcoxon rank sum test, Kruskal-Wallis rank sum test

Table 5

Impact of Variables on Attitude Scores

Characteristic		Univariate analysis			Multivariate analysis (Quantile regression)			
	N	**Attitude Scores[1]**	**p-value[2,3]**		**Beta[4]**	**SE**	**95% CI**	**p-value[3]**
Overall	683	7.50 (2.00, 13.00)		**(Intercept)**	6.5	0.211	6.1, 6.9	**< 0.001**
Year in Medical School			**< 0.001**					
Year 1 (Sem 1 and Sem 2)	328	7.00 (2.00, 12.00)			—	—	—	
Intern (Year 1 and Year 2)	355	7.50 (2.50, 13.00)			0.50	0.176	0.15, 0.85	**0.005**
Gender			**0.005**					
Female	415	7.00 (2.00, 12.00)			—	—	—	
Male	268	7.50 (3.00, 13.00)			0.50	0.166	0.17, 0.83	**0.003**
Religion			0.14					
Christianity	7	6.50 (5.00, 8.00)						
Islam	675	7.50 (2.00, 13.00)						
Not religious	1	4.50 (4.50, 4.50)						
Residency			0.5					
Rural	220	7.50 (2.00, 13.00)						
Urban	463	7.50 (2.50, 12.00)						

Characteristic		Univariate analysis		Multivariate analysis (Quantile regression)			
	N	**Attitude Scores[1]**	**p-value[2,3]**	**Beta[4]**	**SE**	**95% CI**	**p-value[3]**
Nationality group			**0.043**				
Arabic Egyptian	548	7.50 (2.50, 13.00)		—	—	—	
Arabic non-Egyptian	108	7.00 (3.50, 12.00)		0.50	0.200	0.11, 0.89	**0.013**
Non-Arabic	27	8.50 (2.00, 11.50)		1.5	0.824	-0.12, 3.1	0.069
BMI Group			0.7				
Average (BMI 18.5–25)	550	7.50 (2.00, 12.00)					
Overweight (BMI Over 25)	97	7.50 (3.50, 13.00)					
Underweight (BMI Under 18.5)	36	7.00 (3.50, 11.00)					
[1]Median (Min, Max)							
[2]Wilcoxon rank sum test, Kruskal-Wallis rank sum test							
[3]Bold values indicate statistical significance ($p < 0.05$)							
[4]Unstandardized regression coefficients (Beta)							
Abbreviations: CI = Confidence Interval, SE = Standard Error							

Correlation between knowledge and attitude scores revealed a weak positive correlation (Pearson's r = 0.13) between the two variables. This suggests that improved understanding does not strongly predict favorable attitudes (Fig. 2).

Discussion

This study aimed to evaluate the knowledge and attitude of medical students about MBS and was conducted with 683 medical students in Mansoura University, Egypt. This study highlights significant gaps in medical students' knowledge and attitudes toward MBS, despite clinical exposure improving overall understanding. Interns demonstrated superior awareness compared to first-year students, particularly regarding surgical indications, long-term consequences, and procedural types. However, misconceptions about eligibility criteria, perceived risks, and low interest in pursuing MBS as a career persist. These findings underscore the need for targeted educational interventions to enhance preparedness and reduce bias in future physicians.

A systematic review done by Vitolins et al on 5 studies demonstrated that there are gaps within undergraduate medical education on MBS, including specific training that addresses obesity. Also, only two studies addressed medical student attitude towards obesity and patients with obesity, in which the students were negatively biased [12]. In jay et al, after adjusting results for confounders, the residents who took a curriculum on obesity counseling appeared to provide significantly higher quality counseling than those in the control group ($P < 0.05$) [13]. Another study by Stanford et al demonstrated that the physicians who were young (aged < 40), had obesity, or received obesity-related education in medical school or in postgraduate training were more prepared to answer MBS-related knowledge questions and were more likely to answer them correctly [14]. Therefore, it is important to evaluate the impact of undergraduate education on the level of knowledge of medical students on MBS, as well as evaluate their attitude towards it.

Conaty et al created a survey for primary care physicians' (PCPs) clinical perceptions regarding MBS, and it found that between 83 and 88% of PCPs were supporting MBS as an effective option to treat obesity and its related complications [15]. In our study, a significantly higher proportion of interns (81%) believe that surgical intervention is the best way to treat obesity compared to first-year medical students (63%) ($p < 0.001$). The study also reported that 21.5% of PCPs demonstrated concern regarding surgical complications and/or long-term side effects as a barrier for referral to MBS [15].

In our study, 48% of responders opted to "maybe" when asked about whether the benefits of MBS outweigh its risks, and a significantly higher proportion of interns (76%) acknowledged the long-term consequences of MBS compared to first-year students (57%) ($p < 0.001$). This perception may stem from limited clinical exposure and misconceptions about surgical safety. Data from the ASMBS/IFSO guidelines indicates that the major complication rate for MBS is approximately 4%, and the mortality rate is around 0.1% [7], making it as safe or safer than other common procedures such as gallbladder surgery, appendectomy, and joint replacement. These outcomes underscore the importance of integrating accurate risk–benefit information into medical education to improve students' confidence in recommending MBS when clinically appropriate.

About half of the PCPs (46.6%) affirm any familiarity with the NIH eligibility criteria for MBS [15]. Similarly, our results show only 9.5% and 8.5% of first-year medical students and interns, respectively, claiming awareness of the eligibility criteria for MBS.

In Lopez et al, 24.4% of provider-identified barriers to discussing MBS included the patient's insurance ability to cover the MBS [16]. In our study, a significantly higher proportion of interns (78%) recognized the cost of MBS as an issue compared to first-year students (65%) ($p < 0.001$). In the same study by Lopez, 40.0% of PCPs didn't feel competent to prescribe weight loss programs for patients with obesity [16]. In our results, 66% and 75% of first-year medical students and interns, respectively, are interested in educational programs and webinars to increase awareness of weight management options. About 44.4% of PCPs in Lopez et al study, incorrectly believed the mortality rate following MBS was approximately 3 to 4% [16]. In our study, 50% interns and 30% first-year medical students believe that mortality rates are high in MBS with a lack of knowledge of the mortality rate in the pediatric age group (45%).

Zawadzka et al studied the knowledge of diabetologists and internists on MBS. They found that most responders (68.8%) claimed to know the eligibility criteria of patients under 18 years old for MBS; however, 0% of responders knew the absolute contraindications of MBS, and only 31.3% needed to broaden their knowledge on types of MBS [18]. In our study, 51% of responders believe that patients under 18 years old aren't eligible for MBS, 70% of interns to 53% medical students ($p < 0.001$) acknowledge that pregnancy is an absolute contraindication to MBS, and a significantly higher proportion of interns (40%) know the basic types of surgical procedures in MBS compared to first-year students (24%) ($p < 0.001$).

A Swedish survey study including 157 PCPs found a significant positive correlation between high knowledge and positive attitudes towards MBS ($r = 0.235$, $p < 0.001$) [19]. In our study, there was a weak positive correlation between high knowledge and positive attitude ($r = 0.13$). In a German study evaluating barriers to seeking MBS and their relation to weight groups, the least relevant factor was considering MBS as cheating ($p = 0.345$). However, there were differences across different weight groups of participants in two areas: being afraid of MBS itself ($p = 0.005$) and potential negative consequences after MBS ($p = 0.018$) [20]. In our study, there was no effect of the BMI of responders on overall knowledge ($p = 0.2$) or attitude ($p = 0.7$) towards MBS. About considering MBS as cheating, semi-structured interviews conducted with thirty Brazilian women who underwent MBS revealed that many patients agree to statements like "I should have tried more myself" or "I cheated" [21]. In our study, most responders (72%) do not consider MBS as cheating.

In our study, 62% of participants believed that the future treatment of severe obesity must be based primarily on lifestyle and pharmacotherapy, despite recent ASMBS/IFSO joint guidelines advocating for broader eligibility for MBS [22]. Only 14% of participants are interested in becoming bariatric surgeons. These findings highlight critical gaps in awareness and engagement that have direct implications for medical education.

In addition to clinical efficacy, economic considerations are pivotal in promoting the uptake of MBS, particularly in Egypt, where obesity imposes a substantial burden on the publicly funded healthcare system amid limited resources [3]. Recent evidence underscores the favorable cost-effectiveness profile of MBS in this context. A patient-level simulation model evaluating MBS from the perspective of Egypt's

Universal Health Insurance Authority demonstrated that procedures such as laparoscopic sleeve gastrectomy and Roux-en-Y gastric bypass dominate no intervention, yielding both cost savings and improved outcomes over a lifetime horizon, including gains in life expectancy of 3.4–3.9 years and reduced incidence of obesity-related comorbidities like diabetes and cardiovascular events [23].

Furthermore, when compared to emerging pharmacological therapies, MBS offers a compelling economic advantage. Docimo et al. (2024) analyzed national retail prices and found that the cumulative costs of GLP-1 receptor agonists (e.g., semaglutide and liraglutide) exceed those of common MBS procedures—such as Roux-en-Y gastric bypass (break-even at approximately 1 year) and sleeve gastrectomy (break-even at 9 months)—due to the ongoing medication expenses, highlighting a critical break-even point that favors surgery for sustained weight management [24].

These findings suggest that enhanced medical education on MBS could empower future physicians not only to improve patient outcomes but also to advocate for cost-effective interventions that alleviate the national economic strain of obesity, estimated to affect over 20 million adults [3, 24]. Addressing these economic aspects in undergraduate curricula may further bridge knowledge gaps and foster a more holistic approach to obesity care.

To address these gaps, we propose several curriculum enhancements; earlier integration of MBS topics during preclinical years to build foundational understanding, development of dedicated modules focused on obesity management and surgical interventions, incorporation of case-based learning and simulation-based training to foster clinical reasoning and procedural familiarity, structured clinical rotations in MBS units to provide hands-on experience and real-world exposure, promotion of interprofessional education involving surgeons, dietitians, psychologists, and primary care providers to reflect the multidisciplinary nature of obesity care, opportunities for direct interaction with MBS patients to humanize the treatment journey and reduce stigma, and establishment of mentorship programs to inspire interest in MBS as a career path. We believe these educational strategies can significantly improve medical students’ knowledge, attitudes, and career interest in MBS, ultimately enhancing the quality of obesity care in future clinical practice.

Limitations

Even though this study has included a large sample of students, we acknowledge several limitations in the present study. First, its cross-sectional design prevents us from establishing causality; we can only infer associations between clinical exposure and student knowledge and attitudes. A prospective cohort study with pre- and post- medical education surveys would be necessary to truly measure the change in knowledge and attitudes over time.

Second, as a questionnaire-based study, our findings are subject to recall bias and social desirability bias, where participants' self-reported data may not perfectly reflect their true knowledge or attitudes.

Third, a limitation in the internal consistency of our newly developed questionnaire. The calculated Cronbach's alpha of 0.66, though falling within the generally accepted range for a new scale in educational and social science research, indicates a need for further refinement and validation of the instrument in future studies, we acknowledge that values > 0.70 are preferable. This may be due to the multi-faceted nature of the constructs being measured (knowledge and attitudes toward MBS).

Finally, while we observed statistically significant differences by gender and nationality, these findings may be influenced by cultural or structural biases rather than purely by educational exposure. The study was conducted at a single university in Egypt and may not be fully representative of medical students and interns in other countries or diverse educational systems. The limited number of non-Egyptian and non-Muslim participants also affects the generalizability of these findings. Further research is needed to explore these demographic differences more deeply.

Conclusion

Medical education at Mansoura University significantly improves students' knowledge and attitudes toward MBS, with interns outperforming first-years in key areas. Yet, deficits in foundational knowledge and lingering apprehensions underscore the need for targeted enhancements. As Egypt grapples with rising obesity, equipping future physicians with comprehensive training—beyond rote learning to practical application—will be critical. We advocate curriculum updates incorporating eligibility criteria, risk-benefit analyses, and real-world scenarios to bridge these gaps, ensuring graduates are prepared to address obesity effectively through surgical and non-surgical means.

Declarations

Ethics Approval:

The Mansoura Faculty of Medicine Institutional Research Board (MFM-IRB) approved this research under proposal code R.24.10.2831. All participants gave informed consent and submitted the questionnaires on the principle of voluntariness, without providing economic and other material incentives. The participants were made aware of the purpose of the questionnaire and the importance of their participation.

Clinical trial number

not applicable.

Conflict of Interest:

The authors declare no conflict of interest.

Consent for Publication:

Not applicable.

Competing Interests:

The authors declare that they have no competing interests.

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Author Contribution

R.E.A and A.E.E created the draft for the questionnaire, along with the pilot study. M.A and H.H supervised the pilot study and gave expert advice for questionnaire validation. O.M.A, R.S.E, H.A.A, T.E, A.R.G, L.E.A, F.O.E, A.H, B.S, B.E.A.A, and S.D distributed and collected the paper and electronic questionnaires on medical students. They also entered the data on an excel sheet from paper forms after collection. R.E.A and M.A did the data analysis and wrote the results section. A.H wrote the methods section, H.A.A wrote the introduction. T.E, R.A.E, L.E.A, and F.O.E wrote the discussion section. R.E.A and A.E.E revised the written sections. M.A and H.H supervised every step of this manuscript and revised its draft.

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Not applicable.

Data Availability

The datasets used and/or analyzed during the current study are available from the corresponding author upon reasonable request.

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Figures

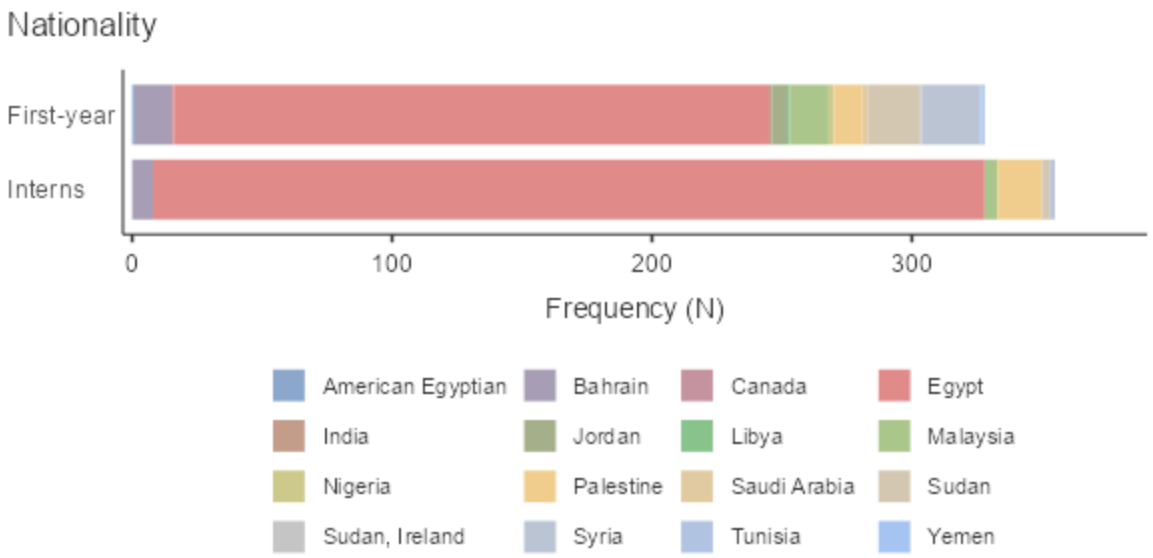


Figure 1

Diagram Depicting Nationalities of Included Participants

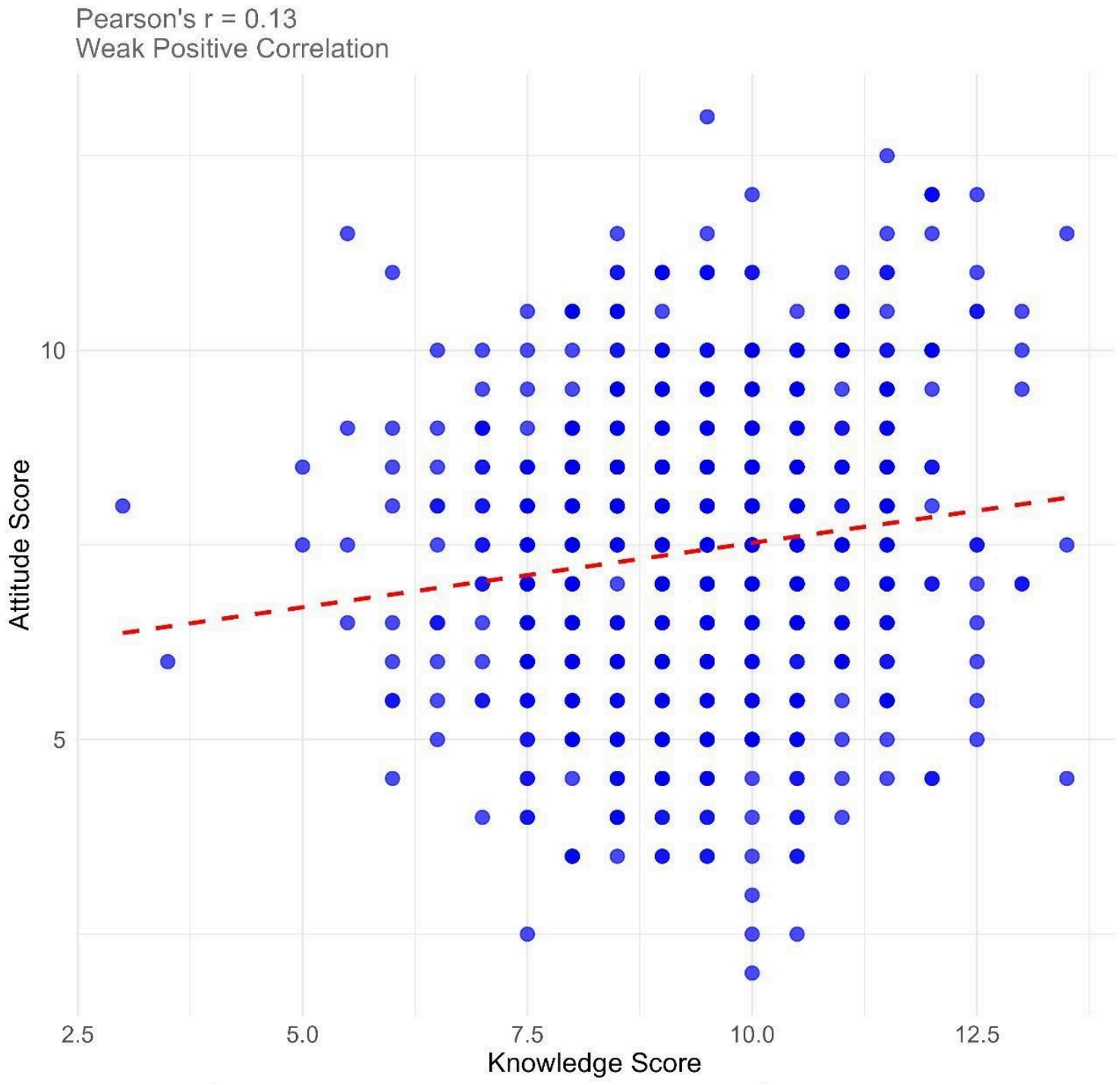


Figure 2

Correlation Between Knowledge and Attitude Scores