Could obesity mediate psychopathology and suicidal ideation in adolescents? An Egyptian study

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Introduction
Adolescence is a critical developmental phase characterized by intense physical and psychological changes. Physical changes and increased body weight are important preoccupations of adolescents and may predispose them to mental health consequences. Moreover, suicide is the third leading cause of death among adolescents. In Egypt, increasing rates of overweight and obesity in children and adolescents have become a public health concern. Numerous studies have investigated the causes of adolescent suicidal ideation. However, the relationship between obesity and suicidal ideation and behaviour is not well-understood, and conventional suicide risk factors do not adequately explain the associations observed.

Aim of work
The current study aimed to examine the relationship between obesity and suicidal ideation in a sample of Egyptian adolescents as well as potential psychopathological mechanisms of this relationship.

Patients and methods
Fifty adolescents with obesity (BMI≥95th percentile) and 50 healthy normal-weight adolescents were evaluated for body weight (kg), height (m) and BMI. Psychological assessment included Symptom Checklist 90 Revised, Beck Depression Inventory, Beck Anxiety Inventory, Beck Suicide Ideation Inventory, Body Shape Questionnaire and Rosenberg Self Esteem Scale.

Results
There was a statistically significant difference between the two groups as regards depression and anxiety as measured by the Symptom Checklist 90 Revised, Beck Depression Inventory II and Beck Anxiety Inventory ($P < 0.05$). There was a statistically significant difference between the two groups as regards the body image satisfaction, self-esteem and suicidal risk as measured by Body Shape Questionnaire-14, Rosenberg Self Esteem Scale and Beck Suicide Ideation Inventory, respectively ($P < 0.05$). There was a statistically significant positive correlation between BMI and depression severity, anxiety and body image dissatisfaction ($P < 0.05$) and a statistically significant negative correlation between BMI and self-esteem in adolescents with obesity ($P < 0.05$).

Conclusion
This study concludes that obese adolescents have more anxiety and depressive symptoms, less body image satisfaction and lower self-esteem when compared with normal-weight adolescents. Obese adolescents are also more prone to suicidal ideation and behaviour. Possible factors that may explain the risk for suicide in the population of study are disturbed body image and the low self-esteem.

Keywords:
adolescents, obese, suicide

Introduction
Obesity is a major public health problem in the world, and its prevalence is increasing in both developed and developing countries [1], with the highest rate of increase during adolescence [2]. The International Association for the Study of Obesity and International Obesity Task Force reported that 40–50 million school-aged children and adolescents globally are classified as obese, and that adolescent obesity has been linked to various physical health problems and many psychological and social difficulties, such as low self-esteem and depression [3]. In Egypt, increasing rates of overweight and obesity in children and adolescents are alarming. Estimated prevalence of obesity in Egyptian school

children and adolescents is ranging from 8 to 9.3%, whereas that of overweight from 11 to 31.4%. Obesity is currently rising as a public health concern in Egypt [4,5].

Adolescence is a critical developmental phase characterized by intense physical and psychological changes. These physical changes and increased body weight are important preoccupations of the adolescents and may predispose them to mental health consequences [1]. It is also well known that adolescent obesity has been associated with the development of disturbed body image [6]. Adolescents, who deviate from the widely accepted ideal body image of being thin for females and being muscular for males, are likely to be vulnerable to body image dissatisfaction [7].

The relationship between self-esteem and disturbed body image among adolescents overall is fairly strong. Both low self-esteem and disturbed body image early in life have been found to predict a range of adverse health and psychological outcomes later in life [8]. In addition, adolescence is a period known for increased risk for nonfatal suicidal behaviours, with noteworthy lifetime prevalence of suicidal ideation and attempts in this age group [9]. Moreover, suicide is the third leading cause of death among adolescents. Many studies have investigated the causes of adolescent suicidal ideation (e.g. depression, inadequate social support, low academic performance, peer victimization and family dysfunction), which are important predictors of attempted and completed suicide in adolescence [7]. However, most of the existing studies tend to disregard other factors that are highly relevant to this age group, such as body image dissatisfaction and low self-esteem [10].

In summary, few studies in the literature have examined the association between BMI and suicidal ideation. Most of them found that increased body weight was associated with increased suicidal ideation. Thus, further examination of the relationship between obesity and suicidal behaviour and identification of the factors that account for potential associations between weight status and suicide have been cited as research priorities [9].

Aim of the work

The aim of the present study was (a) to explore the psychopathological aspects of adolescent patients with obesity, and (b) to demonstrate the relation between obesity, self-esteem, body image and suicidal ideation in adolescent patients with obesity seeking weight reduction.

Patients and methods

The study case-controlled, comparative, cross-sectional study was conducted on a convenient sample of Egyptian adolescent patients with obesity seeking weight reduction. The study was approved by the local scientific and ethical committee. A written informed consent was given by the care provider. Patients of both sexes, their ages ranging from 13 to 19 years, were included in the study.

Patients with past or current history of psychiatric or substance use disorders were excluded. In addition, those with any secondary causes of obesity or serious medical disorders or receiving medications influencing body weight 3 months before recruitment were excluded. Patients with suspected underlying medical condition that may contribute to weight gain were assessed by endocrinology staff members attending in the clinic and the necessary laboratory and/or radiological investigations were carried out to exclude secondary causes of obesity. The study sample consisted of two groups: group 1 (cases), which comprised 50 adolescent patients with obesity (BMI ≥ 95th percentile) according to Centre of Disease Classification growth charts categorization [11]; they were recruited consecutively from the Endocrinology Outpatient Clinic of Kasr Al-Ainy Hospital, Faculty of Medicine, Cairo University; and group 2 (controls), which comprised 50 healthy normal-weight adolescents (control sample) who volunteered to participate in the study, their BMIs ranging from 5th to 84th percentile.

All participants were subjected to the following:

(1) A semistructured clinical interview at the Psychiatry Department of Kasr Al-Ainy Hospital, which was used to cover the demographic and clinical characteristics of participants, including age, sex, educational level, occupation, residence, past medical, psychiatric history and family history.
(2) Anthropometric assessment.
   All participants were evaluated for body weight (kg) and height (m). Height and weight were used to calculate the BMI (kg/m^2). BMI was plotted against standard percentile Egyptian curves for each sex. On the basis of BMI, the participants were categorized as follows: healthy weight (5th–84th percentile) and obese (> 95th percentile). The standard Egyptian growth charts were constructed by the Faculty of Medicine, Cairo University, in collaboration with the National Research Centre [12].
(3) Psychometric assessment.
   (a) Symptom Check List-90-Revised [13] is a self-reported psychometric questionnaire designed to evaluate a broad range of psychological problems and symptoms of psychopathology. In the present study, an Arabic version of this questionnaire was applied [14].
   (b) The Beck Depression Inventory (BDI-II) [15].
      It is a 21-question multiple-choice, self-report inventory.
      The questionnaire is designed for individuals aged 13 and over, and comprises items related to symptoms of depression. An Arabic version of this questionnaire was used in the present study [16].
   (c) The Beck Anxiety Inventory (BAI) [17].
      It is a 21-item multiple-choice, self-reported inventory. An Arabic version of this inventory was used in the study [18].
   (d) Beck's Suicidal Ideation Scale (BSI) [19].
      It is a clinician-rating scale and is presented in a semistructured interview format. It is designed to

quantify and assess suicidal intention. It consists of 19 items that evaluate three dimensions of suicidal ideation: active suicidal desire, specific plans for suicide, and passive suicidal desire. Each item is rated on a three-point scale from 0 to 2. The higher the total score, the greater the severity of suicidal ideation. Total scores of 0–3 indicate low intent, 4–10 indicate medium intent, and 11 or more indicate a high suicidal intent. Its Arabic version was used in the study [20].

(e) Body Shape Questionnaire-14 (BSQ-14) [21].
It consists of 14 items to measure concerns about body image dissatisfaction and the experience of 'feeling fat' among adolescents. It is based on a on a six-point scale ranging from never (1 point) to always (6 points) and an overall score ranging from 14 to 84 points. Higher scores indicate higher levels of body image dissatisfaction. It was translated into Arabic language for use in this study after the researchers were given permission from the author, and then was back translated into the English language.

(f) F-Rosenberg self-esteem scale [22].
It is a 10-item scale with items ranging range from 1 to 4, with a total range from 10 to 40 (from strongly agree to strongly disagree). Items represent a continuum of self-worth statements ranging from statements that are endorsed even by individuals with low self-esteem to statements that are endorsed only by persons with high self-esteem. It is available in an Arabic version (D. Abd El-Gabar, Z. Sarha, M. Askar, unpublished thesis).

Statistical analysis
Data were coded and entered using the statistical package for the social science, version 21 (SPSS Inc., Chicago, Illinois, USA). Quantitative data were summarized using mean ± SD, , median, minimum and maximum, and categorical data using frequency (count) and relative frequency (%). Comparisons between quantitative variables were carried out using the nonparametric Mann–Whitney test. For comparing categorical data, the χ^2-test was carried out. The exact test was used instead when the expected frequency was less than 5. Correlation was determined to test for linear relations between quantitative variables by using the Spearman correlation coefficient. P-values less than 0.05 were considered statistically significant.

Results
Description of the sample
Ages of the participants ranged from 13 to 19 years. The mean age for the cases group was 15.96 ± 2.04 years and the mean age of the control group was 16.12 ± 1.77 years. There was no statistically significant difference between the two groups ($P > 0.05$). The cases group included 16 (32%) males and 34 (68%) females, whereas the control group included 15 (30%) males and 35 (70%) females.

There was no statistically significant difference between the two groups as regards sex ($P > 0.05$). As regards marital status, in cases group, 45 (90%) patients were single and five (10%) patients were married, whereas, in the control group, 48 (96%) individuals were single and two (4%) patients were married. Therefore, there was no statistically significant difference between the two groups ($P < 0.05$). As regards educational level, in the cases group, 23 (46%) patients were in the preparatory stage, nine (18%) patients were in secondary stage, four (8%) patients were in diploma and 14 (28%) patients were in college. In the control group, 20 (40%) patients were in preparatory stage, 16 (32%) patients were in secondary stage, five (10%) patients were in diploma and nine (18%) patients were in college. There was no statistically significant difference between the two groups as regards educational level ($P > 0.05$). As regards residence, 39 (78%) of the cases group patients were living in urban areas and 11 (22%) were living in rural areas, whereas in control group, 30 (60%) patients were living in urban areas and 20 (40%) patients living in rural areas. Therefore, there was no statistically significant difference between the two groups as regards residence ($P > 0.05$). As regards the family history of psychiatric disorders, five (10%) patients of cases group had a positive family history of psychiatric disorders, whereas four (8%) of the control group participants had a positive family history of psychiatric disorders. Thus, there was no statistically significant difference between the two groups as regards family history of psychiatric disorders ($P > 0.05$). In total, 25 (50%) patients had a positive family history of obesity in the cases group, whereas 18 (36%) individuals in the control group had a positive family history of obesity. Thus, there was no statistically significant difference between the two groups as regards family history of obesity ($P > 0.05$). Table 1 summarizes the demographic and clinical characteristics of the participants.
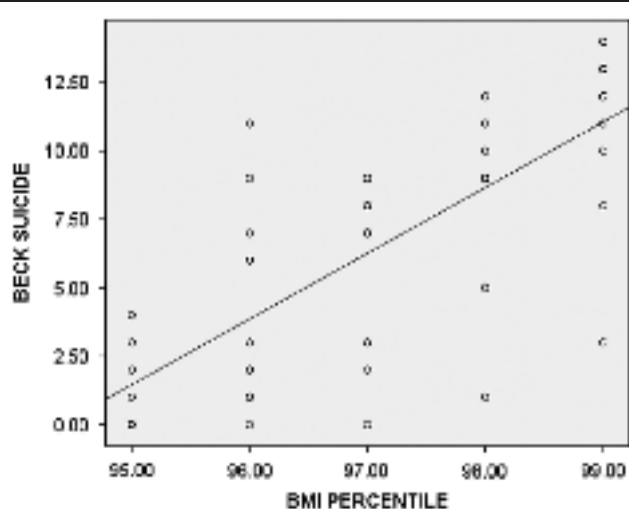
Classification of obese adolescents according to BMI
As regards BMI, there were differences in the grades of obesity among participants. A total of 37 (74%) patients were suffering from obesity with BMI ranging from 95th to 98th percentile, and 13 (26%) patients were suffering from extreme obesity with BMI greater than or equal to 99th percentile. Figure 1 shows the severity of obesity in the cases group (Table 2).

Psychometric assessment of the participants
Table 3 shows that there were statistically significant differences between the two groups with patients in the cases group having higher scores in the Symptom Check List-90-Revised subscales measuring depressive symptoms, somatization, anxiety symptoms, hostility, Global Severity Index (GSI) and Positive Symptoms Distress Index (PSDI). The mean of the total scores of the BDI-II in the cases group was 34.68 ± 7.02, and in the control group it was 17.76 ± 5.46. There was a highly statistically significant difference between the two groups ($P < 0.001$). Table 3 also shows that, the mean of the total scores of the BAI in the cases group was 17.48 ± 3.74 and in the control group it was 13.50 ± 7.75. There was a statistically significant difference

Table 1 Demographic and clinical characteristics of the participants

	Obese group ($N=50$) [n (%)]	Control group ($N=50$) [n (%)]	χ^2	P value
Age (mean ±SD) (years)	15.96±2.04	16.12±1.77		0.726
Sex				
Male	16 (32)	15 (30)		0.829
Female	34 (68)	35 (70)		
Marital status				
Married	5 (10)	2 (4)	1.382	0.436
Single	45 (90)	48 (96)		
Educational level				
Preparatory	23 (46)	20 (40)	3.367	0.331
Secondary	9 (18)	16 (32)		
College	14 (28)	9 (18)		
Diploma	4 (8)	5 (10)		
Residence				
Urban	39 (78)	30 (60)	3.787	0.055
Rural	11 (22)	20 (40)		
Family history of mental disorders				
Positive	5 (10)	4 (8)		0.9
Negative	45 (90)	46 (92)		
Family history of obesity				
Positive	25 (50)	18 (36)		0.157
Negative	25 (50)	32 (64)		

Figure 1

Scatter diagram showing statistically significant positive correlation between the Beck Suicide Ideation Scale and BMI percentile ($r=0.75$, $P=0.001$).

Table 2 Classification of the adolescents with obesity according to BMI

BMI classification	Obese group ($N=50$) [n (%)]
Obese (95th–98th percentile)	37 (74)
Extremely obese ($\geq$ 99th percentile)	13 (26)

between the two groups ($P<0.05$). The mean of the total scores of the BSI in the cases group was 6.74 ± 4.56 and in the control group it was 4.86 ± 3.22. There was a statistically significant difference between the two groups ($P<0.05$). The mean of the total scores of the BSQ-14 in the cases group was 60.00 ± 11.82 and in the control group was 27.28 ± 8.60. Thus, there was a highly statistically significant difference between the two groups ($P<0.001$). The mean of the total scores of the Rosenberg Self Esteem Scale in the cases group was 20.52 ± 3.55 and in the control

group it was 22.52 ± 3.57. The higher the RSES score, the greater the self-esteem. There was a statistically significant difference between the two groups ($P<0.05$).

BMI was positively and statistically significantly correlated with BDI-II, BAI and BSI in the cases group with correlation coefficient (r) and P value (0.88, <0.001), (0.39, 0.005), and (0.75, 0.001), respectively. BMI was positively statistically significantly correlated with BSQ-14 scores and negatively statistically significantly correlated with RSES scores, with correlation coefficient (r) and P value (0.82, 0.001) and (−0.81, 0.001), respectively. BSI was positively and highly statistically significantly correlated with BSQ-14 scores and negatively and highly statistically significantly correlated with RSES scores, with correlation coefficient (r) and P value (0.94, < 0.001) and (− 0.90, <0.001), respectively. Tables 4 and 5 and (Figs 1–3) outline the previously mentioned correlations.

Discussion

To our knowledge, this was the first Egyptian study conducted on adolescents with obesity aiming at the exploration of the relation between obesity, body image, self-esteem and suicidal risk.

Key findings

(1) Adolescents with obesity had higher levels of depression, anxiety, somatization and hostility symptoms when compared with healthy-weight adolescents.
(2) Adolescents with obesity seeking body weight reduction may constitute a vulnerable group with increased suicidal ideation, intent or even attempt.
(3) Low self-esteem and body image dissatisfaction in adolescents with obesity may be associated with suicidal ideation.

The present study showed that adolescents with obesity report more depressive and anxiety symptoms when compared with normal-weight adolescents. These

Table 3 Psychometric tests scores (mean and SD) in the two groups

Symptom Check List-90-Revised	Obese group (N=50)		Control group (N=50)		
	Mean	SD	Mean	SD	P value
Somatization	24.12	4.26	9.04	2.79	<0.001**
Obsessive–compulsive symptoms	8.62	1.12	8.84	1.33	0.324
Interpersonal sensitivity	8.64	1.06	9.00	1.54	0.059
Depression	31.34	5.84	13.02	4.04	<0.001**
Anxiety	15.32	2.86	13.52	3.9	0.026*
Hostility	11.70	2.53	9.24	4.15	0.047*
Phobia	7.48	1.98	8	1.65	0.122
Paranoid ideation	7.32	1.90	6.6	1.85	0.068
Psychosis	4.7	0.84	4.2	1.36	0.05
Global Severity Index	1.3	0.15	1.15	0.28	0.042*
Positive Symptom Total	78.9	0.15	76.06	9.2	0.17
Positive Symptom Distress	1.47	2.94	1.34	0.21	0.005*
Beck Depression Inventory II	34.68	7.02	17.76	5.46	<0.001**
Beck Anxiety Inventory	17.48	3.74	13.50	7.25	0.001*
Beck Suicidal Ideation Inventory	6.74	4.56	4.86	3.22	0.012*
Body Shape Questionnaire-14	60	11.82	27.28	8.6	<0.001**
Rosenberg Self Esteem Scale	20.52	3.55	22.52	3.57	0.004*

*$P<0.05$, statistically significant.
**$P<0.01$, highly statistically significant.

Table 4 Correlation between BMI and psychometric tests in adolescents with obesity

Variable	Obese group (N=50) (BMI)	
	Correlation coefficient (r)	P value
Beck Depression Inventory II	0.88	<0.001**
Beck Anxiety Inventory	0.39	0.005*
Beck Suicide Ideation Scale	0.75	0.001*
Body Shape Questionnaire-14	0.82	0.001*
Rosenberg Self Esteem Scale	− 0.81	0.001*

DM, diabetes mellitus.*$P<0.05$, statistically significant.
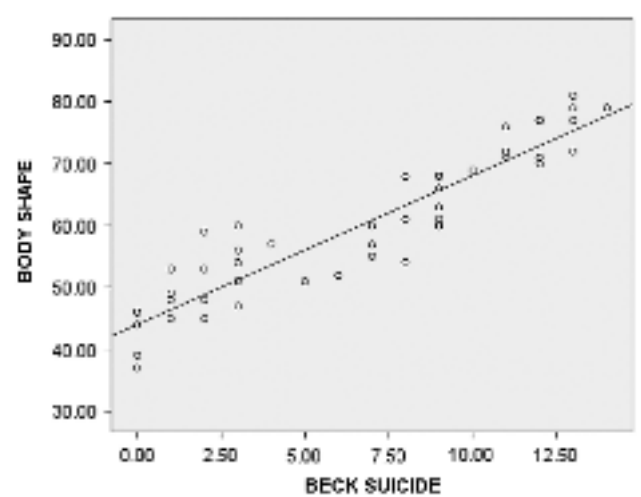**$P<0.01$, highly statistically significant.

Table 5 Correlation between the Beck Suicidal Ideation Scale and other psychometric tests in adolescents with obesity

Variable	Obese group (N=50) (Beck Suicidal Ideation Scale)	
	Correlation coefficient (r)	P value
Body Shape Questionnaire-14	0.94	<0.001**
Rosenberg Self Esteem Scale	− 0.90	<0.001**

**$P<0.01$, highly statistically significant.

Figure 2

Scatter diagram showing statistically significant positive correlation between the Beck Suicide Ideation Scale and the Body Shape Questionaire-14 ($r=0.94$, $P<0.001$).

findings are consistent with those of previous studies that found depression to be more prominent in the obese population compared with the normal-weight individuals [23]. Several studies have examined this issue, with some reporting obesity as a consequence of depression, and others regarding depression to be a result of obesity [24]. However, Wardle *et al*. [25] found that in community samples of adolescents, regardless of the sex, socioeconomic status or ethnicity, reports of depressive symptoms are not significantly higher in obese than normal-weight group. The difference between the findings of the present study and the above-mentioned study may be explained by the fact that adolescents with obesity seeking weight reduction are more likely to have more body image dissatisfaction, and therefore are likely to have more depressive and anxiety symptoms. Previous research found a higher prevalence of anxiety symptoms in obese patients [26,27]. Anxiety and stress may promote obesity via physiological pathways, including

activation of the sympathetic nervous system and hypothalamic–pituitary–adrenocortical axis. Higher levels of cortisol as a result of chronic activation of these pathways are associated with changes in appetite hormones and weight gain [28]. In addition, behavioural changes that occur as a result of anxiety, which include avoidance of certain physical activities that may elicit panic-like symptoms (e.g. walking or aerobic activity), increased eating as a way to cope with anxiety and stress and decreased sleep due to worry, may result in weight gain and obesity [27]. Coping strategies used to deal with stress, depression and anxiety, such as comfort eating, in turn will lead to obesity. It is likely that these strategies are used to regulate mood status among obese individuals. Part of this complex biological process includes activation of the reward pathway; stimulation in this area of the brain positively reinforces the behaviour and makes comfort eating as addicting as drug abuse [29]. It was

Figure 3
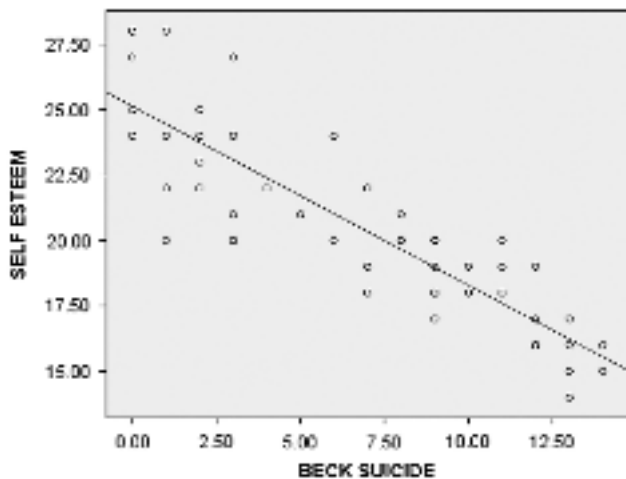
Scatter diagram showing statistically significant negative correlation between the Beck Suicide Ideation Scale and the Rosenberg Self-Esteem Scale ($r = -0.90$, $P < 0.001$).

found that consumption of food that is high in fats and carbohydrates reduces anxiety via feedback to the hypothalamic–pituitary–adrenocortical axis [26]. Unfortunately, these comfort foods are easily accessible to all, especially those living in poorer communities [30]. In contrast, in a study comparing obese and normal-weight individuals, no differences were found as regards anxiety [31]. The present study showed that there was a highly statistically significant difference between the two groups as regards body image satisfaction and self-esteem, which is consistent with the findings of a study that obese individuals have higher rates of body image dissatisfaction than normal-weight individuals [32]. Acceptance from friends and family is crucial to the development and maintenance of positive body image [33]. Negative comments may lead to further body image dissatisfaction for the obese individual [34].

Moreover, previous research revealed a link between body weight, body image and self-esteem that was significantly different in the obese when compared with healthy-weight participants [25]. In contrast to the findings of the present study, a study reported no significant difference as regards self-esteem between normal-weight and obese adolescents [35]. Several differences were observed between the two studies that may account for this difference: first, it was a longitudinal, prospective study, whereas our study was cross-sectional; and, second, it was a population-based study, whereas our study recruited the sample from a clinical setting; moreover, cultural differences may be an additional contributing factor. The present study found that adolescents with obesity are more likely to have suicidal ideations when compared with normal-weight adolescents. This is consistent with the studies published by Carpenter and colleagues [24,36], which found that obesity is usually linked to suicidal thoughts and behaviours. In contrast, some studies have not found statistically significant difference as regards suicidal ideation and behaviour between obese and normal-weight individuals [37]. The present study reported that the high body weight is associated with body image dissatisfaction and low self-esteem, which may be associated with suicidal ideation in adolescents suffering from obesity. This is consistent with a study that reported a strong relation between negative body image and suicidal ideation and attempts [7]. A recent study revealed that there was high negative correlation between self-esteem and suicidal ideation among adolescents [38]. In contrast to this, another study reported that body image dissatisfaction is not predictive of suicide [39].

Conclusion

The present study highlights the higher potential for suicidal ideation and behaviour in the population of study. The study showed that adolescents suffering from obesity tend to have more depressive and anxiety symptoms compared with normal-weight adolescents. It also showed that adolescents suffering from obesity tend to have body image dissatisfaction, which in turn lead to lower self-esteem. The study considers low self-esteem and disturbed body image as potential mediators for the risk for suicide in adolescents suffering from obesity.

Moreover, the study showed that adolescents suffering from obesity were likely to show higher levels of somatization, and hostility when compared with normal-weight adolescents.

Possible limitations of this study include the study design, which was cross-sectional, and the use of a convenience sample, which precluded the examination of causality. Furthermore, the small sample size, which was predominantly composed of low and middle social class adolescents, may have limited the generalization of these findings to the Egyptian population. The sample examined was made up of individuals who were seeking weight loss and therefore were not a representative sample of Egyptian adolescents suffering from obesity.

The study underlines the widely recognized need for careful psychiatric evaluation of adolescents suffering from obesity as a routine practice in nutrition clinics. It recommends the addition of psychological assessment and psychotherapy in the management of obesity, which would result in higher quality of life, psychological well-being and better prognosis for patients suffering from obesity in Egypt. It highlights the need for further studies with a large sample size aiming at the study of the prevalence rates of psychiatric disorders in adolescents suffering from obesity and longitudinal studies aiming at the exploration of the causal relationship between obesity and psychological well-being. Moreover, further studies are required for the assessment of the relation between suicide and obesity and mediating factors between them.

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