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Impact of Health Education Intervention on Some Clinical and Laboratory Parameters among a group of Overweight and Mild Obese Patients with Type 2 Diabetic Attending Zagazig University Hospitals

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A B S T R A C T

Background: Prevention and control of obesity especially in type 2 diabetic patients depends mainly on patient education and motivation which are facilitated by sufficient patient's knowledge, attitude, and practice. **Objective:** To assess the impact of a health education intervention on the weight, random blood sugar, knowledge, and attitude of overweight and mild obese type 2 diabetic patients. **Method:** An interventional study was carried out on 142 overweight and mild obese type 2 diabetic patients attending diabetic outpatient clinic of Zagazig university hospitals divided equally into two groups (intervention and control). The study divided into three phases I pre intervention: - included questionnaire to assess socio demographic data, knowledge and attitude, clinical assessment, and laboratory investigation. II intervention: - covered health education program. III post intervention: - done after 3 months from intervention included the same questionnaire to assess knowledge and attitude after intervention, clinical assessment, laboratory investigation. **Results:** there were statistically significant reduction in means of weight and random blood sugar from 92.3and 202.5 to 86.4 and 193.6 before and after intervention respectively in intervention group. Also, statistically significant improvement in total adequate knowledge and attitude changes about obesity and diabetes from 14.1% and 9.9% in pretest to 45.1% and 47.9% in posttest respectively in the interventional group. **Conclusion:** health education intervention was effective on weight, random blood sugar, knowledge, and attitude among overweight and mild obese type 2 diabetic patients.

INTRODUCTION

The increasing prevalence of overweight and obesity is a major concern for public health. Over 40 years ago,[1] first used the term 'diabesity', to explain the inextricable link between type 2 diabetes mellitus and obesity.

Diabetes in Egypt is estimated to be 16.2%.[2] Overweight and obesity are defined as abnormal or excess fat deposition in adipose tissues that represents an adverse effect on human's health.[2]

There are various anthropometric measurements to measure overweight and obesity such as: Body Mass Index (BMI), skin folds thicknesses, waist circumference, waist to hip ratio and underwater weighing.[3]

Overweight and obesity are clearly leading to epidemic of associated chronic diseases affecting all age-groups, including type 2 diabetes mellitus, hypertension, atherosclerosis, and obstructive sleep apnea. About 80–90% of patients with type 2 diabetes are overweight or obese.[4]

So, the long duration visceral obesity is considered the cornerstone in type 2 diabetes pathogenesis, inducing both insulin resistance and pancreatic beta-cell dysfunction.[5] Current standard strategies for weight

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Table 1: Socio-demographic characters among studied groups

	Control group (N=71)	Intervention group (N=71)	χ2	P-value
Age (years)				
<30 years (n=19)	11 (57.9%)	8 (42.1%)	0.536	0.463
≥30 years (n=52)	25 (48.1%)	27 (51.9%)		
Sex				
Female (n= 25)	12 (48%)	13 (52%)	0.112	0.736
Male (n= 46)	24 (52.2%)	22 (47.8%)		
Education				
Illiterate (n=21)	10 (47.6%)	11 (52.4%)		
Intermediate (n= 32)	15 (46.9%)	17 (53.1%)	0.392	0.941
High intermediate (n=7)	4 (57.1%)	3 (42.9%)		
High (n=11)	6 (54.5%)	5 (45.5%)		
Job				
No/housewife (n=5)	3 (60%)	2 (40%)		
Farmer or worker (n=16)	9 (56.3%)	7 (43.7%)		
Skilled Worker (n=10)	4 (40%)	6 (60%)	0.941	0.918
Employee (n=38)	18 (47.4%)	20 (52.6%)		
Professional (n=2)	1 (50%)	1 (50%)		
Residence				
Rural (n=11)	5 (45.5%)	6 (54.5%)		
Slum (n=14)	6 (42.9%)	8 (57.1%)	0.449	0.798
Urban (n=46)	24 (52.2%)	22 (47.8%)		
Socioeconomic status				
Low (n=8)	5 (62.5%)	3 (37.5%)		
Moderate (n=37)	18 (48.6%)	19 (51.4%)	0.555	0.757
High (n=26)	14 (53.8%)	12 (46.2%)		
Income				
Enough (n=68)	35 (51.5%)	33 (48.5%)	0.265	0.606
Enough &more (n=3)	2 (66.7%)	1 (33.3%)		

χ2: - Chi square test

reduction in these patients include lifestyle interventions; pharmacotherapy and bariatric surgery have become available.[6] The health education through lifestyle interventions aims to improve dietary habits, increase physical activity and support behavioral modifications. Weight loss with diet and physical activity has been shown to effectively improve glycemic control, lipid profile (decrease triglycerides and LDL levels) and blood pressure.[7] This study aims to study effects of health education intervention on weight, knowledge, attitude, and diabetic control of overweight and mild obese type 2 diabetic patients.

METHODS

An interventional study was carried out on overweight and mild obese type 2 diabetic patients at Diabetic Outpatient Clinic of Zagazig university hospitals.

Sample size was calculated using the open Epi Info 7 program According to power 80%, 95%CI and the expected prevalence of weight reduction after health education 15%. [8] It was 121 patients and after adding 15% non-response rate the total calculated sample size was 142, (71 in each group).

Simple random sample, after doing sampling frame (adult overweight and mild obese type 2 diabetic patients registered in Diabetic Outpatient Clinic of Zagazig university hospitals), selection depend on random tables generated by computer.

Inclusion criteria: Adult type 2 diabetic patients Age > 25 years- <50 years, BMI 25- <35 kg/m², didn't have other chronic diseases. Study population was divided into two groups: - Group I: included 71 patients, who did not receive health education interventions.

Table 2: Comparison among the studied groups regarding weight, BMI, waist circumference, waist/hip ratio and random blood glucose

Variables	Control group (N=71)		Intervention group (N=71)		t	P-value
	Mean ±SD	Range	Mean ±SD	Range		
Weight (kg)						
Pre	91.9±9.1	80-110	92.3±7.3	80-107	0.23	0.81
Post	91.3±8.21	80-110	86.4±8.2	77-107	3.01	0.03*
†P-value	0.987		0.001*			
BMI (kg /m²)						
Pre	33.5±1.1	31.4-34.9	33.3±1.27	30.3-34.9	1.266	0.11
Post	33.9±2.1	30.3-34.5	29.9±2.1	28.3-34.9	2.98	0.045*
†P-value	0.986		0.046*			
Waist circumference (cm)						
Pre	100.6±6.39	90-110	100.1±6.38	90-110	0.48	0.55
Post	98.9±8.58	88-108	94.9±8.05	82-110	3.8	<0.001*
†P-value	0.487		<0.001*			
Waist Hip Ratio (WHR)						
Pre	0.979±0.04	0.92-1.04	0.979±0.05	0.91-1.01	0.243	0.21
Post	0.971±0.12	0.91-1.03	0.75±0.04	0.86-1.05	3.41	0.001*
†P-value	0.89		<0.001*			
Random blood glucose (mg/dl)						
Pre	202.9±9.69	188-223	202.5±10.3	185-223	0.098	0.892
Post	203.3±11.25	180-221	193.6±15.33	160-220	4.52	<0.001*
†P-value	0.84		<0.001*			

t= student t test P-value of student t test   to compare means of different parameters in pre or post intervention between control &interventional groups.   † = p value of paired t test to compare mean difference between pre and post intervention for the same control &interventional groups
*Significant   ** Highly Significant

Group II: included 71 patients, who received health education interventions.

Phases of the study: The study divided into three phases I pre intervention, II intervention, and III post intervention

First phase (pre intervention):

I-Questionnaire: All subjects were interviewed personally regarding Socio demographic data as: name, age, sex, residence, education, occupation, income to calculate the socioeconomic status.[9] Also, pretest Questionnaire to assess knowledge about diabetes mellitus such as (definition, source of knowledge, prevalence, risk factors, symptoms, duration, investigations, drugs ...etc.) and knowledge about obesity such as (definition, source of knowledge, prevalence, risk factors, symptoms, duration, investigations, drugs ...etc.) and to assess attitude of the studied patients to reduce their weight through healthy eating &physical activity.
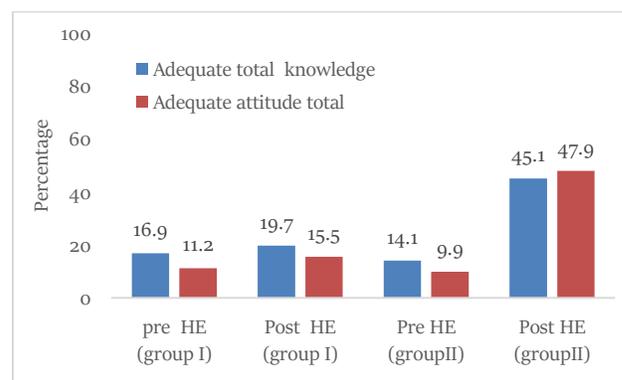

Figure 1: The changes among knowledge and attitude scores about obesity and DM among the studied groups in pre – post health education interventions **HE=(health education)*

II-Clinical Assessment: 1-Height and weight: They were generally measured with a standing platform scale and a height attachment the platform scales should be calibrated to zero before the patient is weighed.[10]

Table 3: Relation between percentage of change in obesity knowledge and socio-demographic characters in the interventional group post health education interventions

Socio-demographic characters	Changes in obesity knowledge N (%)		χ2	P-value
	Not adequate (n= 22)	Adequate (n=49)		
Age (years)				
<30 years (n=19)	7 (36.8%)	12 (63.2%)	0.073	0.786
≥30 years (n=52)	21 (40.4%)	31 (59.6%)		
Sex				
Female (n= 25)	11 (44%)	14 (56%)	0.02	0.894
Male (n= 46)	21 (45.6%)	25 (54.4%)		
Education				
Illiterate (n=21)	15 (71.4%)	6 (28.6%)		
Intermediate (n= 32)	19 (59.4%)	13 (40.6%)	7.93	0.048*
High intermediate (n=7)	2 (28.6%)	5 (71.4%)		
High (n=11)	3 (27.3%)	8 (72.7%)		
Job				
No/ housewife (n=5)	3 (60%)	2 (40%)		
Farmer or worker (n=16)	14 (87.5%)	2 (12.5%)		
Skilled Worker (n=10)	7 (70%)	3 (30%)	13.86	0.008*
Employee (n=38)	15 (39.5%)	23 (60.5%)		
Professional (n=2)	0 (0.0)	2 (100%)		
Residence				
Rural (n=11)	8 (72.7%)	3 (27.3%)		
Slum (n=14)	12 (85.7)	2 (14.3%)	8.26	0.016*
Urban (n=46)	21 (45.6%)	25 (54.4%)		
Socioeconomic status				
Low (n=8)	5 (62.5%)	3 (37.5%)		
Moderate (n=37)	20 (54.1%)	17 (45.9%)	0.77	0.679
High (n=26)	12 (46.2%)	14(53.8%)		
Income				
Enough (n=68)	42 (61.8%)	26 (38.2%)	4.54	0.033*
Enough &more (n=3)	0 (0.0)	3 (100%)		

*χ2: - Chi square test   *Significant*

2-Body mass index: -The calculation is as follows according to [11]; Body mass index (BMI) = weight in kilograms'/height square in meters and it is classified as follow: -Underweight (Less than 18.5), Normal (from 18.5 to 24.99), Overweight (from 25 to 29.99, Mild obese (from 30 to 34.99), Moderate obese (from 35 to 39.99) and severe obese (40 or over). Waist Hip Ratio (WHR): both waist and hip circumferences were measured in centimeters. Waist hip ratio was calculated by dividing these two values with each other.[12] The normal level of waist– hip ratio is below 0.90 for males and below 0.85 for females.[13]

III-Laboratory Investigation: A random sample of venous blood was collected. Normal random glucose range was from 200 mg/dl or more.[14]

Second phase (intervention among group II (HE):
Health education sessions have taken about one and half hours every two weeks for two months. Health education message were included about healthy diet its recommended amount, contents, how to build a healthy meal for breakfast, lunch, dinner as a guide for creating healthy, balanced meals. It explained instructions about practicing physical activity, and some positive and negative tips, in addition to how to calculate BMI. Posters about tips to build healthy meals, tips to enjoy your food but eat less, and tips to practice exercise), simple brochures, lectures and power point presentation sessions about healthy eating were also done. Counseling, group discussion was used as needed. Any feedback was documented to be clearer & simpler.

Table 4: Relation between percentage of change in total attitude and socio-demographic characters in the group II post health education interventions

	Not adequate (n= 26)	Adequate (n=45)	χ2	P-value
Age (years)				
<30 years (n=19)	8 (42.1%)	11 (57.9%)	0.199	0.655
≥30 years (n=52)	25 (48.1%)	27 (51.9%)		
Sex				
Female (n= 25)	12 (48.0%)	13 (52%)	0.04	0.837
Male (n= 46)	21 (45.7%)	25 (54.3%)		
Education				
Illiterate (n=21)	14 (47.6%)	7 (52.4%)		
Intermediate (n= 32)	14 (43.8%)	18 (56.2%)	8.07	0.044*
High intermediate (n=7)	1 (14.3%)	6 (85.7%)		
High (n=11)	3 (27.3%)	8 (72.7%)		
Job				
No/ housewife (n=5)	4 (80%)	1 (20%)		
Farmer or worker (n=16)	7 (43.8%)	9 (56.3%)		
Skilled Worker (n=10)	6 (60%)	4 (40%)	10.881	0.027*
Employee (n=38)	8 (21.1%)	30 (78.9%)		
Professional (n=2)	1 (50.0%)	1 (50.0%)		
Residence				
Rural (n=11)	5 (45.5%)	6 (54.5%)		
Slum (n=14)	12 (85.7%)	2 (14.3%)	15.91	<0.001**
Urban (n=46)	12 (26.1%)	12 (26.1%)		
Socioeconomic status				
Low (n=8)	6 (75%)	2 (25%)		
Moderate (n=37)	15 (40.5%)	22 (59.5%)	7.21	0.027*
High (n=26)	6 (23.1%)	20 (76.9%)		
Income				
Enough (n=68)	40 (58.8%)	28 (41.2%)	4.04	0.044*
Enough &more (n=3)	0 (0.0%)	3 (100.0%)		

χ2: - Chi square test, *Significant, ** Highly Significant

Physical activity for at least 30 minutes for 5 days/week was encouraged.

Third phase (post intervention): It was done after 3 months. The same clinical assessment and laboratory investigations Post-test were repeated to evaluate effectiveness of health education interventions among both groups.

Scoring of knowledge and attitude: Knowledge questions with yes or no answer were scored (Yes = 1 and No = zero), Questions with open answers were scored (Don't know = zero, know incomplete answer = 1 and complete answer = 2), Attitude questions responses were scored in 4-point Likert scale (from strongly disagree = 0 to strongly agree =4), Questions with multi true answers were scored as follows: if they answered at least half of the decided right answers of the question it took 1, otherwise it took 0. Total score of all items of knowledge about obesity was ranged from (0- 21 degrees), total score of all items of knowledge about diabetes mellitus was ranged from (0- 20 degrees) and total score of all items of attitude was ranged from (0- 36 degrees). Adequacy of knowledge and attitude was considered as follows: Score equal to 60% or more of total score was considered satisfactory (Adequate) score. Score less than 60% of total score was considered unsatisfactory (Not adequate) score. Change of knowledge after the interventional program was calculated as follows: Total knowledge after intervention minus total knowledge before intervention divided by total knowledge before intervention (×100). If the result was equal to 60% or more this was considered

satisfactory (Adequate) change. If the result was less than 60% this was considered unsatisfactory (Not adequate) change. And the same was done for change of attitude.

Data management: All data were entered and analyzed by SPSS v.25.0 for statistical analysis. Descriptive statistics, including means and standard deviations for quantitative data while, frequency and percent for qualitative data. Paired t-tests was used to compare pre and posttests results among participants'. Chi-square test also used to compare independent qualitative data. The level of statistical significance for all analyses was set at P value ≤ 0.05.

RESULTS

Table (1) shows that there was no statistically significant difference among the studied groups as regarding socio – demographic data of patients which includes (age, sex, education, job, residence, Socioeconomic status and income).

Table (2) shows that there were no statistically significant differences in the means of weight, BMI, waist circumference, waist/hip ratio and random blood glucose in group I & group II pre intervention, while there were statistically significant reduction in the means of weight, BMI, waist circumference, waist/hip ratio and random blood glucose in group II post intervention. By comparing pre and post intervention in the group II (HE) there were reduction in means of the weight, BMI, waist circumference, waist/hip ratio and random blood glucose from 92.3±7.3, 33.3±1.27, 100.1±6.38, 0.979±0.05and 202.5±10.3 respectively in pretest to 86.4±8.2, 29.9±2.1, 94.9±8.05, 0.75±0.04and 193.6±15.33 respectively in posttest.

Figure (1) shows the changes among knowledge and attitude scores about obesity and DM among the studied groups in pre – post interventions. This bar chart illustrates that there is marked statistically significant improvement in adequate total obesity knowledge from 10 (14.1%) and total attitude from 7(9.9%) in pretest to 32 (45.1%) and 34 (47.9%) respectively in posttest of the studied overweight and obese type 2 diabetic patients at the post health education.

Table (3) shows that there was statistically significant difference associated with adequate percentage of change in obesity knowledge in the high intermediate

and high level of education in the group II post (HE) 5(71.4%) & 8 (72.7%) respectively. Also, a statistically significant difference associated with adequate percentage of change in obesity knowledge was seen in employee and professional jobs in the group II post (HE) (23(60.5%) & 2(100.0%) respectively). Also, the table shows that a statistically significant difference associated with adequate percentage of change in obesity knowledge in the group II post (HE) is revealed in the urban residence & enough and more income 25 (54.4%) & 3 (100.0%) respectively.

Table (4) shows that high intermediate, high level of education, employee, and professional reveal statistically significant differences regarding percentage of change to adequate attitude in the group II post (HE) 6 (85.7%), 8 (72.7%), 30 (78.9%) & 2 (100.0%) respectively). also shows that urban residence, high Socio-economic status & enough and more income in the group II post (HE) reveals statistically significant differences regarding percentage of change for adequate attitude 34 (73.9%), 20 (76.9%) & 3 (100.0 %) respectively.

DISCUSSION

As regard the anthropometric measurements of obesity and DM among the groups, our study showed that there was no statistically significant difference in means of the weight, BMI, waist circumference, waist/hip ratio and random blood glucose in group I & group II pre intervention, while there was statistically significant reduction in the means of weight, BMI, waist circumference, waist/hip ratio and random blood glucose in group II post intervention as demonstrated in table (2).By comparing pre and post intervention in the group II (HE) there was statistically significant reduction in the means of weight from 92.3 ±7.3 to 86.4±8.2, BMI from 33.3 ±1.27to 29.9 ±2.1, waist circumference from 100.1 ± 6.38 to 94.9, waist/hip ratio from 0.979 ± 0.05to 0.75 ± 0.04and random blood glucose from 202.5 ± 10.30 to 193.6 ± 15.33 as demonstrated in table (2). These findings were in agreement with the study of [15] which proved that the health education interventions beneficially influenced anthropometrics by reducing weight, BMI, waist and waist-to-hip ratio, and prevented weight gain. Also, our study was in agreement with [16] which revealed reduction of weight after health education intervention on studied group in which weight was

decreased from 93.1 ±7.3 to 88.4 ±8.2, BMI from 33.3 ±1.27to 30.1 ±2.1, waist circumference from 100.8 ± 6.38 To 95.9 ± 8.05, waist/hip ratio from 0.98 ± 0.05 to 0.77 ± 0.04and random blood glucose from 203.5± 94.2 to 193.6 ± 15.33.In the present study, there was a statistically higher significant difference regarding the adequate total obesity knowledge (45.1% versus 14.1%) and total attitude (47.9% versus 9.9%) in the group II post and pre health education interventions as shown in figure (1). this result was in agreement with [16] who revealed that adequate total obesity knowledge (46.5% versus 15.5%) and total attitude (46.5% versus 5.6%) in the group II post and pre health education interventions. These results were lower than that reported by other studies[17] in which over 90% of the respondents were aware about healthy eating. Another study showed that most of the adults lacked even basic knowledge of the United States Department of Agriculture current recommendations on daily nutrition. Only 49% of them were able to correctly identify the current Food Guide Pyramid.[18]

Regarding percentage of change in obesity knowledge and its relation to socio-demographic characters in the group II post health education interventions, Table (3) showed an increase in the adequate percentage of change in obesity knowledge of the group II post health education interventions especially in high intermediate and high level of education, employee and professional jobs, urban residence & enough and more income (71.4%, 72.7%, 60.5%, 100%, 54.4% & 100% respectively) seen in the post health education interventions to the overweight and obese type 2 diabetic patients. Similar results were found by [19], the results of their study provided evidence that there were significant association of levels of knowledge of adolescent students regarding obesity with selected variables such as education, area of residence and socio-economic status) .also, this result was in agreement with [14] who revealed that an increase in the adequate percentage of change in obesity knowledge of the group II post health education interventions especially in high intermediate and high level of education, employee and professional jobs, urban residence & enough and more income (60.0%, 100.0%, 58.5%, 100.0%, 57.4% & 75.0% respectively) seen in the post health education lifestyle

interventions to the overweight and obese type 2 diabetic patients.

Concerning percentage of change in total attitude and its relation to socio-demographic characters in the group II post health education interventions, Table (4) showed also an improvement in the adequate percentage of change in attitude of overweight and obese type 2 diabetic patients especially in high intermediate and high level of education, employee, professional, urban residence, high socio economic status & enough and more income (85.7%, 72.7%, 78.9%, 100.0%, 73.9%, 76.9% & 100.0% respectively) seen in the post health education interventions to the overweight and obese type 2 diabetic patients, so this improvement lead to achieve desired weight reduction. Similar results were found by [20], the results of their study provided evidence that higher social class, tertiary education, non-smokers, lower bodyweights and increased recreational activity were associated with a lower odds ratio for having a negative attitude towards their healthy eating behavior. Also it was in consistent with results of [15] who revealed an improvement in the adequate percentage of change in attitude of overweight and obese type 2 diabetic patients especially in high intermediate and high level of education, employee, professional, urban residence, moderate socio economic status & enough and more income (90.0%, 100.0%, 73.2%, 100.0%, 74.5%, 65.6% & 100.0% respectively) seen in the post health education lifestyle interventions to the overweight and obese type 2 diabetic patients.

CONCLUSIONS

There was statistically significant reduction in means of weight, BMI, waist circumference, waist/hip ratio and random blood sugar also, improvement in total adequate knowledge and attitude about obesity and diabetes in the intervention group after health education intervention.

Ethical Approval: Approval was obtained from the Institutional Review Board of Zagazig University No ZU-IRB#11117/11-9-2023. An official permission from Zagazig University, Faculty of Medicine was taken to the Diabetic Outpatient clinic of Zagazig University. Informed consent was obtained from all participants of

this study after explaining the objectives and the nature of the research to them.

REFERENCES

1. Sims E, Danforth E, Horton E, Bray G, Glennon J, Salans I, et al. Endocrine and metabolic effects of experimental obesity in man. Recent Prog Horm Res. (2005); 29:457-96.

2. World Health Organization (WHO). WHO Facts Sheets available at http://www.who.int/mediacentre/factsheets/fs311/en. Accessed 23 January, 2021.

3. Hu F. Measurements of Adiposity and Body Composition. In: Hu F, ed. Obesity Epidemiology. 2018; 1 :53–83.

4. James W. The epidemiology of obesity: the size of the problem. J Intern Med. 2017; 263: 336– 352.

5. Smyth S, and Heron A. Diabetes and obesity: the twin epidemics. Nat Med J. 2019; 12: 75– 80.

6. National Institute for Clinical Excellence(NICE). Obesity: the prevention, identification, assessment and management of overweight and obesity in adults and children (Guideline CG43), NICE Clinical Guidelines. 2019; No. 43.

7. David M, Nathan D, John B, Buse J, Bernard R, Ziman T. Medical management of hyperglycaemia in type 2 diabetes mellitus: a consensus algorithm for the initiation and adjustment of therapy: a consensus statement from the American Diabetes Association and the European Association for the Study of Diabetes. Diabetologia J. 2020; 52:17–30.

8. Norris S, Zhang X, Avenell A, Gregg E, Bowman B, Serdula M et al. Long-term effectiveness of lifestyle and behavioral weight loss interventions in adults with type 2 diabetes. The American Journal of Medicine 2019; 117 : 762-774.

9. El-Gilany A, El-Wehady A, El-Wasify, et al. Updating and validation of the socioeconomic status scale for health research in Egypt. EMH J. 2012; 18 :29-34

10. Steven J, Katz E and Huxley R .Associations between gender, age and waist circumference. Eur J Clin Nutr. 2018; 64:6–15.

11. World Health Organization (WHO). The International Classification of adult underweight, overweight and obesity according to BMI. Available at http://www.assessmentpsychology.com/icbmi.htm . Accessed 15 May 2022.

12. Yalcin B, Sahin E and Yalcin E,.Prevalence and Epidemiological Risk Factors of Obesity in Turky Middle East J. Family Med. 2014; 6: 541-507.

13. World Health Organization (WHO). Waist Circumference and Waist-Hip Ratio, Report of a WHO Expert Consultation. Available at http://www.assessmentobesity.com/icwhr.htm . Accessed 26 November 2022.

14. International Diabetes Federation. Diabetes and Obesity: Time to Act. International Diabetes Federation (IDF) and International Association for the Study of Obesity (IASO).2019.

15. Margareta E, A .3-year lifestyle intervention in primary health care Effects on physical activity, cardiovascular risk factors, quality of life and cost-effectiveness, The Björknäs Study. Scand J Publ Health. 2020; 34:453-461.

16. Abd El-Maksoud A, Ali A, Orabi E. Effect of health education interventions on reduction of weight in overweight and obese type 2 diabetic patients. Master thesis In Family Medicine in Zagazig University. 2021

17. Health Survey for England. A survey carried out on behalf of the NHS Information Centre Edited by Rachel Craig and Nicola Shelton, Healthy lifestyles: knowledge, attitudes and behaviour Department of Epidemiology and Public Health, UCL Medical School. 2017 ;1: 113-119.

18. Truesdale K, and Stevens J. Do the obese know they are obese? Experimental Biology. North Carolina Medical Journal. 2018; 69:188-94.

19. Titi A, Avier N, Mangalathil T, Pushpendra K, Vikas C. Knowledge and attitude regarding obesity among adolescent students of Sikar, Rajasthan, India. IOSR Journal of Nursing and Health Science (IOSR-JNHS). 2021; 3: 44-48

20. Heartya A, McCarthya S, Kearneyb J. Relationship between attitudes towards healthy eating and dietary behavior, lifestyle and demographic factors in a representative sample of Irish adults. Appetite J. 2018; 48: 1–11.