



## EVALUATION OF THE LEVEL OF KNOWLEDGE OF TYP1 DIABETIC PATIENTS ABOUT THE COMPLICATIONS OF OBESITY ATTENDING IN PRIMARY HEALTH CARE CENTER AT MINISTRY OF HEALTH, SAUDI ARABIA 2022

Talal Mohammed Kumayyikh Alotaibi<sup>1\*</sup>, Abdullah Sulaiman Theyab Alotaibi<sup>2</sup>, Faisal Hamad Eid Alotaibi<sup>3</sup>, Mohammed Abdullah Abissan Alotibi<sup>4</sup>, Mohammed Safar Bin Hamdan Alotaibi<sup>5</sup>, Abdulrahman Mohammed Kumayyikh Alotaibi<sup>6</sup>, Maisah Siddiq Saeed Mahdi<sup>7</sup>, Nuzha Mohammed Saleh Alhamzi<sup>8</sup>, Neareen Abdualwahed Abdullah Almakki<sup>9</sup>, Amani Hamdan Mohammed Rashed Alhazmi<sup>10</sup>, Najwa Ayed Mohammed Alhaerbi<sup>11</sup>, Ghadah Mohammed Hassan Bagasi<sup>12</sup>, Tahani Ali Salem Alharbi<sup>13</sup>, Bashaer Abdulaziz Mohamad Yamani<sup>14</sup>, Fahad Salman Almajnoni<sup>15</sup>, Alaa Adnan Alattas<sup>16</sup>

### Abstract

#### Background

Obesity affects large numbers of patients with type 1 diabetes (T1D) across their lifetime, with rates ranging between 2.8% and 37.1%. Patients with T1D and obesity are characterized by the presence of insulin resistance, of high insulin requirements, have a greater cardio metabolic risk and an enhanced risk of developing chronic complications when compared to normal-weight persons with T1D, obesity in patients with type 1 diabetes (T1D) is now prevalent and accounts for significant health consequences, including obesity complications and dual diagnosis of type 1 diabetes. Physical activity and lifestyle are modifiable and play an important role in the prevention and management of obesity, but it is unclear how these factors relate to obese in patients with T1D. Prevalence of obesity ranged from 12.5% to 33.3%. Obesity in patients with T1D was associated with infrequent napping, increased screen time, and skipping breakfast and dinner.

**The study aimed:** To evaluation of the level of knowledge of typ1 diabetic patients about the complications of obesity attending in primary health care center at Ministry of health in Riyadh, makkah, Jeddah, Taif Saudi Arabia 2022.

**Method:** cross sectional study conducted about evaluation of the level of knowledge of typ1 diabetic patients about the complications of obesity attending in primary health care center at Ministry of health at Saudi Arabia Riyadh, makkah, Jeddah, Taif. Our total participants were (500) patients with Type 1 Diabetes about complications of obesity (aged from <25 to >45years), questionnaire sheet was used to evaluation of the level of knowledge of typ1 diabetic at Saudi Arabia 2022.

**Result:** shows that most of the participants (41.0%) were in the age group >45 years the majority of them were males (69.0%) the education most of participants Primary were(42.0%), the Social states most of participants married were(67.0%), regarding occupation the majority of participant are working were(78.0%) the Occupation most of participant answer Yes were (81.0%)

**Conclusion:** The coexistence of obesity as complications of T1D is a growing problem and poses a challenge for effective glycemic and weight management. All patients should be offered a lifestyle intervention by a multidisciplinary team including a balanced hypo caloric diet, physical activity and cognitive behavioral therapy. In the “roadmap” of the treatment of obesity in T1D, with a high obesity prevalence in patients attending in primary health care center.

**Keywords:** Evaluation, level, knowledge, typ1 diabetic, patients, complications, obesity primary health care, Saudi Arabia.

<sup>1\*,2,3</sup>Specialist Nursing, East Dawadmi Health Center, Saudi Arabia.

<sup>4</sup>Technician Pharmacy, East Dawadmi Health Center, Saudi Arabia.

<sup>5</sup>Technician Nursing, East Dawadmi Health Center, Saudi Arabia.

<sup>6</sup>Specialist-Public Health, Albjadyh general hospitals, Saudi Arabia.

<sup>7,8,9,10,11,13</sup>Social worker, King Faisal Hospital Makkah, Saudi Arabia.

<sup>12,14</sup>Clinical Dietitian, King Faisal Hospital Makkah, Saudi Arabia.

<sup>15</sup>Nursing Specialist, Directorate of health affairs, Makkah AlMukarramah, Saudi Arabia

<sup>16</sup>Nursing technician, Alnoor Hospital, Makkah AlMukarramah, Saudi Arabia

**\*Corresponding Author:** Talal Mohammed Kumayyikh Alotaibi  
\*Specialist Nursing, East Dawadmi Health Center, Saudi Arabia.

**DOI:** 10.53555/ecb/2022.11.02.038

## Introduction

Obesity affects large numbers of patients with type 1 diabetes (T1D) across their lifetime, with rates ranging between 2.8% and 37.1%. Patients with T1D and obesity are characterized by the presence of insulin resistance, of high insulin requirements, have a greater cardio metabolic risk and an enhanced risk of developing chronic complications when compared to normal-weight persons with T1D. (1,2) Dual treatment of obesity and T1D is challenging and no specific guidelines for improving outcomes of both glycemic control and weight management have been established for this population. (3) There has been an alarming increase in the prevalence of obesity in people with type 1 diabetes in recent years. Although obesity has long been recognized as a major risk factor for the development of type 1 diabetes and a catalyst for complications, much less is known about the role of obesity in the initiation and pathogenesis of type 1 diabetes. (4) Emerging evidence suggests that obesity contributes to insulin resistance, dyslipidemia, and cardio metabolic complications in type 1 diabetes. Unique therapeutic strategies may be required to address these comorbidities within the context of intensive insulin therapy, which promotes weight gain. There is an urgent need for clinical guidelines for the prevention and management of obesity in type 1 diabetes. (5) The prevalence of Obesity is common in KSA, so there is a need to explore' knowledge of Obesity as complications of type 1 diabetic in the primary care physicians in Saudi Arabia toward management of Obesity and type 1 diabetic. So that policymakers can devise policies to educate the typ1 diabetic patients. (6)

The development of these recommendations will require a trans disciplinary research strategy addressing metabolism, molecular mechanisms, lifestyle, neuropsychology, and novel therapeutics. (7) Nevertheless, although level of knowledge of typ1 diabetic patients is scarce, a comprehensive approach based on a balanced hypo caloric diet, physical activity and cognitive behavioral therapy by a multidisciplinary team, expert in both obesity and diabetes, remains as the best clinical practice. (8) However, weight loss responses with lifestyle changes alone are limited, so in the "roadmap" of the treatment of obesity in T1D, it will be helpful to include anti-obesity pharmacotherapy despite at present there is a lack of evidence since T1D patients have been excluded from anti-obesity drug clinical trials. In case of severe obesity, bariatric surgery has proven to be of benefit in obtaining a substantial and long-term weight loss and reduction

in cardiovascular risk. (9) The near future looks promising with the development of new and more effective anti-obesity treatments and strategies to improve insulin resistance and oxidative stress. Advances in precision medicine may help individualize and optimize the medical management and care of these patients about level of knowledge of typ1 diabetic patients about the complications of obesity attending in primary health care center in all facets of the treatment of patients with obesity and T1D. (10)

The prevalence of Obesity in various regions has attracted significant attention of the medical experts. also thereby increasing disease the prevalence of diabetes and Obesity is expected to increase in the future due to changes in lifestyle and unhealthy diets of individuals in KSA.(11) More than two-thirds (70%) of patients with diabetes mellitus (DM)and Obesity reside in lower middle-income countries (12) In the medical services space, the most multiplied illness perceived over the world is diabetes. This is obvious from the expanded revealing of diabetes illness which is relied upon to arrive at a figure of 366 million (13) and expected to turn into the seventh driving reason for death by 2030 (14)

Diabetes is a major disease burden in KSA, and we are home to the second largest number of diabetes cases in the world (15). In 2017, With changing lifestyles the prevalence of diabetes mellitus (DM) has been rising worldwide over the past few decades. According to a recent estimate by the International Diabetes Federation, the age-adjusted prevalence of diabetes in Saudi Arabia is 17.7%.(16). Obesity can be defined simply as the disease in which excess body fat has accumulated to such an extent that health may be adversely affected. World Health Organization (WHO) reported that obesity is one of the most common and also the most neglected, public health problems in both developed and developing countries.(17) Obesity is strongly associated with other metabolic disorders, including diabetes, hypertension, dyslipidemia, cardiovascular disease even some cancers.(18) Overweight and obesity also increases the likelihoods of suboptimal glycaemic control making it difficult to achieve glycaemic targets.(19)

## Literature Review

Shah reported that significant correlation of Obesity with TG, HDL-C and Non-HDL-C in the T1D group. This correlation was interestingly found stronger than an independent from the effect of HbA1c as evidenced by the beta coefficient values in the multiple linear regression model. Further,

HbA1c did not correlate with any of the lipid profile elements in the T2D group while Obesity was found to correlate with TG and HDL-C. This suggests that obesity, as a risk factor for dyslipidemia in patient with diabetes 1, is as important as glycemic control. This finding has also been shown in SEARCH for Diabetes in Youth study where both adiposity and poor glycemia control were associated with the progression of Non-HDL-C, this study however did not look at the association between adiposity and glycemia control with other lipid profile elements (20). Previous studies of the association between childhood BMI and incident type 1 diabetes reported a wide range of odds ratios. For children at ages 7–13 years, the reported ORs ranged between insignificance to 1.2 and 1.8 per unit z score (21) The results of one study in the US showed that physicians' knowledge in the treatment of diabetes was not enough and knowledge level of different medical groups such as general practitioners, specialists, internal medicine residents and medical students had significant differences with each other. (22) In Yemen, estimated the prevalence of obesity in patients 25 years old/above with type 2 diabetes mellitus. The prevalence of obesity among male patients (BMI  $\geq$  30 kg/m<sup>2</sup>) was 11% whereas it was 32% among female patients (23) Published a review regarding the association between obesity and type 2 diabetes in the Arab world and concluded that the Arab world have an epidemic of obesity and type 2 diabetes mellitus. They reported that replication studies have identified several genetic variants in Arab people with obesity linked diabetes (24). El-Kebbi et al (2021) reported in their comprehensive review that over the last two decades, obesity was risk factors for increasing incidence of type 2 diabetes mellitus among Arabs. They explained that to the fact that obesity is strongly associated with insulin resistance, which, if associated with insulin deficiency, leads to overt type 2 diabetes mellitus (25). A meta-analysis of nine studies reported ORs for type 1 diabetes within a range of 1.7–3.8 for children with obesity (pooled OR 2.0) . A wide range of point estimates was also apparent in cohorts of young adult women with obesity (age range approximately 20–50 years), with reported HRs of 2.7 and 4.7(26). Methodological factors that contribute to this discrepancy may include population selection, age of childhood BMI assessment, methods used to define type 1 diabetes (self-reported vs established diagnosis by various criteria), and measured vs recalled anthropometric data. Factors related to statistical methodology may also play a part, including controlling for health status at baseline

and differential adjustment for potential confounders. In this regard, our study has several strengths, including a homogeneous and narrow age range at assessment, measured anthropometric data, and an established diagnosis of type 1 diabetes. (27) In Jeddah (2013), Bakhotmah identified the risk factors for developing obesity among 723 Saudi diabetic patients attending PHC centers. The prevalence of obesity was 38.3% [ among them, 15.9% had severe obesity. (28).

### **Rationale:**

Overweight and obese patient with type 1 or type 2 diabetes share similar elevation in triglycerides. Non-traditional therapies for patients with T1D and obesity as complications of T1D need to be evaluated in the near future. Similarly, level of knowledge of typ1 diabetic patients about the complications of obesity attending in primary health care center, it still needs to be established whether may find a place in the prevention of progression to overt T1D and improve clinical outcomes in established diabetes in patients with obesity, with the changes in major lifestyles, the prevalence of obesity is increasing; therefore, this issue implicated to complicate the diabetes outcome, well -being and productivity. Improved quality of life has been regarded as a key goal of all healthcare interventions including a special interest in obesity and its related complication, particularly in type I diabetic patient's obesity and affected to diabetes mellitus management. Up to the researcher's knowledge the prevalence of obesity is increasing; therefore, this issue implicated to complicate the diabetes 1 outcome. Up to the researcher's knowledge, no published studies were conducted in Saudi Arabia defined the level of knowledge of typ1 diabetic patients about the complications of obesity attending in primary health care center.

### **The study aimed**

To evaluation of the level of knowledge of typ1 diabetic patients about the complications of obesity attending in primary health care center at Ministry of health in Riyadh, makkah, Jeddah, Taif Saudi Arabia 2022.

### **Methodology**

#### **Study design:**

Cross-sectional design in the present study

#### **Study area and population:**

Patients type 1 Diabetic patient who registered in primary health care center at Ministry of health in Riyadh, makkah, Jeddah, Taif Saudi Arabia.

### Inclusion criteria

- Patients type 1 diabetic.
- Both males and females.

### Sample size:

Sample size was calculator by Raosoft Online sample size calculator. It was 500 patients, based on assumption that during the last 2 month, the total number of diabetic patients who visited the primary health care center in at Ministry of health in Riyadh, makkah, Jeddah, Taif Saudi Arabia 2022, was 500 patients, prevalence was considered as 50%, confidence level was 95%, margin of error was 5%. By adding 10% for defaulter and non-respondent, 500 patients were invited to participate in the study.

### Sampling technique

Systematic sampling technique was used. Approximately 25 patients visit the PHC center daily. Ten patients were selected daily by choosing every other patient. Thus, nearly 20 working days were needed to collect the sample

### Data collection tool

Self-administrated questionnaire was used for data collection. It was adopted from a previous Saudi study.(29) Some modifications were done and the new format was validated by three consultants (family medicine, Endocrinology and community medicine). The final draft of the questionnaire consists of two sections:

- First section: Includes socio-demographic and personal characteristics of the participants.
- Second section: Includes associated factors with obesity in type I diabetic patients (physical exercise, diet habit. Additionally, the body mass index (BMI) was calculated by an expert nurse.

### Data Collection technique

- During the study period (1/ January to 28/ February 2022), the researcher was available at

the involved primary healthcare centers 5 days in the week to clarify any issue.

- The researcher distributed the questionnaire in the waiting area by themself to the selected patients.
- The questionnaires were collected at the same time.

### Data entry and analysis

Data were entered and analyzed using the Statistical Package for Social Sciences (SPSS version 24). Categorical variables were presented as frequency and percentage whereas continuous variables were presented as mean and standard deviation ( $\pm$ SD). Statistical significance was determined at  $p < 0.05$  for all comparisons.

### Pilot study/pretesting

A pilot study was conducted on 50 patients, representing approximately 10% of the sample size. It was done in another PHCC rather than those involved in the study to test the clarity of the questions and feasibility of the methodology. No modifications were made according to the pilot results.

### Ethical considerations

Research committee approval, Written permission from the joint program of family medicine in Ministry of health in Riyadh, Makkah, Jeddah, Taif Saudi Arabia, written permission from concerned authority in Ministry of Health (MOH) PHC at Riyadh, Makkah, Jeddah, Taif Saudi Arabi, Individual verbal consent from all participants before data collection, Acknowledgments of all supervisors, advisors, helpers, facilitators and participants. All collected data were kept confidential.

## Results

**Table 1** Distribution of demographic data (age, gender, social, Occupation, job years, economic level, Duration of diabetes mellitus, Sources of information) in our study(n=500)

	N	%
<b>Age</b>		
<25	125	25
25-45	170	34
>45	205	41
<b>Gender</b>		
Male	345	69
Female	155	31
<b>Patient education:</b>		
Illiterate	115	23
Primary	210	42
Secondary	75	15

University	100	20
<b>Social</b>		
Married	335	67
Single	165	33
<b>Occupation</b>		
No	95	19
Yes	405	81
<b>Economic level</b>		
Low	120	24
Medium	245	49
High	135	27
<b>Duration of diabetes mellitus</b>		
<5	95	19
5-10.	185	37
>10	220	44
<b>Sources of information</b>		
Booklets and brochures	155	31
Mass media	330	66
Own personal experience	120	24
Educational films	30	6

Table 1 shows that most of the participants (41.0%) were in the age group >45 years follow by the (34.0%) were in the age 25-45 years and regarding the majority of them were males (69.0%) while female (31.0%), also regarding the Patient education most of participants Primary were (42.0%) while Illiterate were (23.0%), but University were (20.0%), also regarding the Social states most of participants married were (67.0%) while single were (33.0%), regarding occupation the majority of participant are working were (78.0%)

while not work were (22.0%), regarding the Occupation most of participant answer Yes were (81.0%) while No were (19.0%). Regarding the economic level the majority of participant medium economic level were (49.0%), but high were (27.0%), regarding the duration of diabetes mellitus the majority of participant >10 years were (44.0%) but 5-10 were (37.0%) while sources of information most of participants from Mass media were (66.0%) while Booklets and brochures were (31.0%)

**Table 2** Distribution of the habitual factors associated of the studied participated

	N	%
<b>Duration of diabetes complication (obesity)</b>		
Less than 6 months	95	19
6-12 months	110	22
More than 1 year	295	59
<b>Discovery mode:</b>		
By symptom	185	37
By chance	315	63
<b>Do you have any complications from obesity?</b>		
Yes	115	23
No	385	77
<b>Body mass index:</b>		
Normal	145	29
Over weight	185	37
Obese	170	34
<b>you have any complication, please select it?</b>		
Complication on foot	110	22
Complication on eye	95	19
Complication on kidney	170	34
Cardiovascular complication	105	21
Neuropathy	20	4

Table 2 show regarding the Duration of diabetes complication (obesity) the most of participant more than 1 year were (59.0%), regarding Discovery mode the most of participants By chance were (63.0%), follow By symptom were(36.0%) , regarding Do you have any complications from obesity the most of participant answer No were(77.0

%) follow by answer Yes were (23.0%), regarding BMI the majority of the participants Over weight were (37.0%) followed by Obese were (34.0%), regarding you have any complication, please select it the most of participant Complication on kidney were(34.0 %) follow by Complication on foot were (22.0%).

**Table 3** Distribution of the habitual factors (Physical activities) associated of the studied participated.

	N	%
<b>Physical activities or exercises</b>		
No	350	70
Yes	150	30
<b>If yes What is type of physical activities or exercises</b>		
Walking	335	67
Running	75	15
Both	90	18
<b>Do you stop aerobic exercise for two consecutive days or more per week?</b>		
Always	335	67
Sometimes	125	25
No	40	8
<b>Risk factor</b>		
Asthma	115	23
High blood pressure	185	37
High fat and cholesterol	110	22
Emphysema or COPD	50	10
Other lung diseases Type of lung disease	80	16
Heart diseases	95	19
Arthritis or other rheumatic diseases	110	22

Table 3 show regarding Physical activities or exercises more than half of the participants answer No were (70.0%), regarding If yes what is type of physical activities or exercises the majority of the participants walking were (67.0%), followed by both were(18,0%), regarding you stop aerobic exercise for two consecutive days or more per week

the majority of the participants always were (67.0%) but Sometimes were(25.0%). Regarding Risk factor the majority of the participants High blood pressure were (37.0%) while Asthma were(23.0%) but High fat and cholesterol, Arthritis or other rheumatic diseases were( 22.0%).

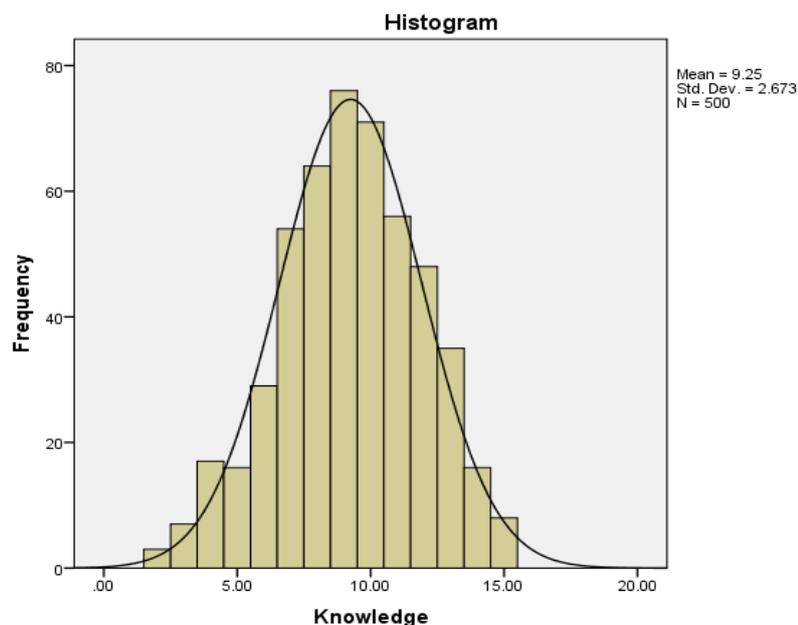
**Table (4)** Distribution the level of knowledge of typ1 diabetic patients about the complications of obesity

	Knowledge		Score	
	N	%	Range	Mean±SD
<b>Weak</b>	118	23.6	2-13.	9.25±2.673
<b>Average</b>	266	53.2		
<b>High</b>	116	23.2		
<b>Total</b>	500	100		
<b>X<sup>2</sup></b>	88.816			
<b>P-value</b>	<0.001*			

Table 4 Regarding level of knowledge of typ1 diabetic patients about the complications of obesity results show the majority of participant had average

knowledge were(53.2%) while Weak knowledge were(23.6%) but the High were (23.2%) the data ranged from(2-13) by mean ±SD(9.25±2.673).

**Figure 1** Distribution the level of knowledge of typ1 diabetic patients about the complications of obesity.



**Table (5)** Distribution the level of knowledge of typ1 diabetic patients about the complications of obesity and the demographic data (age, gender, education , marital status, Occupation, economic level, Duration of diabetes mellitus)

		N	Knowledge		F or T	ANOVA or T-test	
			Mean	± SD		test value	P-value
Age	<25	125	11.472	± 1.299	F	264.327	<0.001*
	25-45	170	10.312	± 1.910			
	>45	205	7.010	± 2.103			
Gender	Male	345	9.684	± 2.738	T	5.606	<0.001*
	Female	155	8.277	± 2.243			
Patient education	Illiterate	115	6.913	± 2.242	F	265.257	<0.001*
	Primary	210	8.229	± 1.597			
	Secondary	75	11.613	± 1.532			
	University	100	12.300	± 0.948			
Social	Married	165	9.515	± 2.729	T	1.571	0.117
	Single	335	9.116	± 2.639			
Occupation	No	95	6.179	± 1.429	T	-14.953	<0.001*
	Yes	405	9.968	± 2.370			
Economic level	Low	120	8.125	± 0.975	F	15.847	<0.001*
	Medium	245	9.457	± 2.938			
	High	135	9.867	± 2.906			
Duration of diabetes mellitus	<5	94	6.766	± 3.743	F	168.751	<0.001*
	5-10	186	8.366	± 1.551			
	>10	220	11.055	± 1.309			

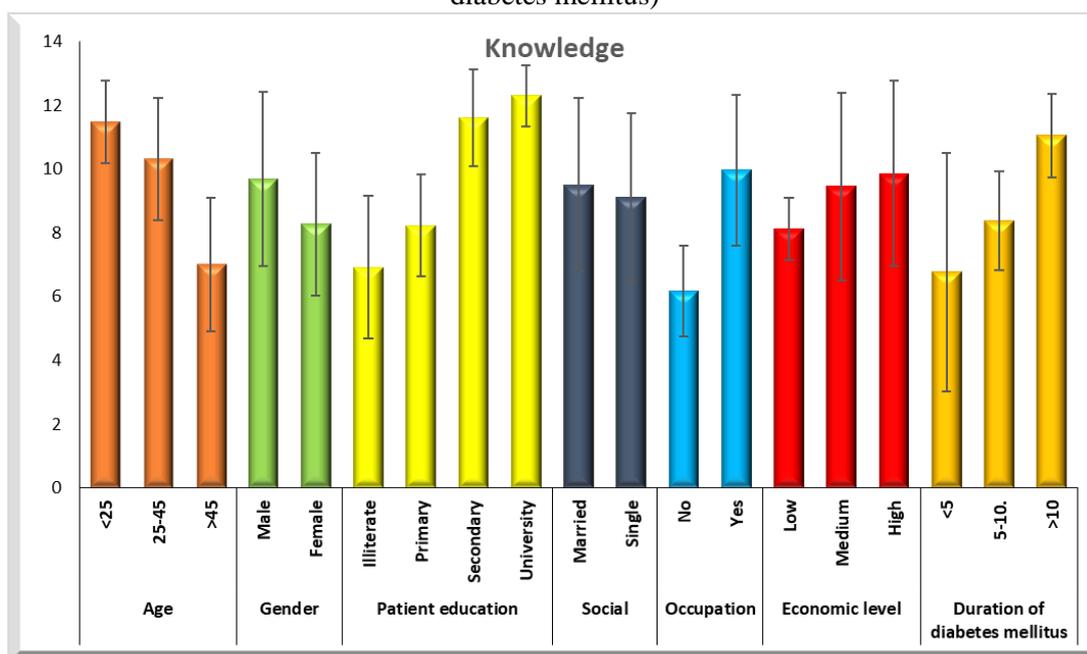
Table (5) show that is a significant relation between knowledge and demographic data regarding age (increase in <25 follow by age 25-40) where F=264.327 and P-value=0.001 by mean+ SD respectively (11.472 ± 1.299, 10.312 ± 1.299). Regarding gender in our study the majority of our participants were noticed in male more than female with respectively Mean± SD (9.684 ± 2.738, 8.277±2.243) with a significant relation between

knowledge and gender were T=5.606 and P-value=0.001. Regarding Patient education show that is a significant relation between knowledge and Patient education (increase in University followed by Secondary)were F=-265.257 and P-value=0.001 by mean+ SD respectively (12.300±0.948, 11.613±1.532), regarding marital status show that is no significant relation between knowledge and marital status (increase in Married) were F=-1.571

and P-value=0.117 by mean+ SD (9.515±2.729), regarding to the Occupation show that is a significant relation between knowledge and occupation (increase in answer Yes) were T=-14.953 and P-value=0.001 by mean+ SD (9.968±2.370). Also regarding the economic level show that is a significant relation between knowledge and economic level (increase in the high income participants followed by medium) were

F=15.847 and P-value=0.001 by mean+ SD respectively (9.867±2.906, 9.457±2.938 ). Regarding the duration of diabetes mellitus show that is a significant relation between knowledge and duration of diabetes mellitus (increase in participant >10 followed by 5-10) were F=168.751 and P-value=0.001 by mean+ SD respectively (11.055±1.309, 8.366±1.551) .

**Figure (2)** Distribution the level of knowledge of typ1 diabetic patients about the complications of obesity and the demographic data(age, gender, education , marital status, Occupation, economic level, Duration of diabetes mellitus)



## Discussion

In this large diabetic typ1 patients on -based descriptive study, we found that increased BMI in diabetic typ1 was associated with incident type 1 diabetes in childhood. The HR for type 1 diabetes and BMI score increment and the risk for (type 1) diabetes were nearly doubled among obese childhood. These point estimates withstood rigorous sensitivity analysis, and remained stable following adjustment for socio demographic variables, also for adolescents who were overweight or obese, respectively.

The magnitude of the problem of obesity and its influence on patients with type 1 with diabetes has not attracted enough attention, and relatively few obese diabetic patients are offered the option of weight management as an integral part of their management (30) The present study aimed to evaluation of the level of knowledge of typ1 diabetic patients about the complications of obesity attending in primary health care center at Ministry of health Riyadh, makkah al-mokarramah, Jeddah,

Taif Saudi Arabia 2022 . In the current study shows that most of the participants (41.0%) were in the age group >45 years, regarding the majority of them were males (69.0%) , also regarding the Patient education most of participants Primary were(42.0%), regarding the Social states most of participants married were(67.0%), regarding occupation the majority of participant are working were(78.0%), Occupation most of participant answer Yes were (81.0%) while No were(19.0). Regarding the economic level the majority of participant medium economic level were (49.0%), regarding the duration of diabetes mellitus the majority of participant >10 years were(44.0%), while sources of information most of participants from Mass media were (66.0%)(table 1)

Previous studies of the association between childhood BMI and incident type 1 diabetes . For children at ages 7–13 years(31) . A meta-analysis of nine studies reported ORs for type 1 diabetes within a range of 1.7–3.8 for children with obesity (pooled OR 2.0) A wide range of point estimates was also

apparent in cohorts of young adult women with obesity (age range approximately 20–50 years) (32)

Although the data on the role of physical activity in patients with T1D are limited, two recently published reviews have examined this topic in detail (33). The authors observed that physical activity improves fitness in patients with T1D, but patients still have a low level of cardiorespiratory fitness, suggesting that aerobic power, strength, balance, and flexibility might be compromised in patients with T1D (26). Regular participation in physical activities also improves lipid levels, endothelial function, and insulin resistance, but not blood pressure in youth with T1D (30). Interestingly, these authors observed that although physical activity improves insulin dosage regimens in youth with T1D, the effect of physical activity on glycemic control is limited. Others have promoted the use of family-based intervention strategies to engage patients in moderate to vigorous physical activity in order to enhance fitness levels and minimize future cardiovascular risk in patients with T1D (28)

Obesity are complex and multifactorial conditions that are associated with many risk factors. Thus, in addition to physical activity, other lifestyle behavioral factors are important to consider for patients with T1D, including sedentary behavior, sleep, and diet. (See Table 2,3) In the current study, almost average of knowledge of typ1 diabetic patients about the complications of obesity . This figure is higher than those reported in other similar studies carried out either locally or internationally. In Aseer region, in Al-Khobar region , in Jeddah , in Yemen, in Tanzania, in the United Kingdom (34) . The high prevalence of obesity among type 1 diabetic patients is explained by the fact that obesity is strongly associated with insulin resistance, which, if associated with insulin deficiency, leads to overt type 2 diabetes mellitus (28). This higher prevalence of obesity among type 1 diabetic patients in the present study over most of other similar studies necessitates greater efforts from responsible authorities to investigate the problem and find possible solutions. The high prevalence of obesity and low of knowledge of type 1 diabetic patients is explained by the fact that obesity is strongly associated with insulin resistance, which, if associated with insulin deficiency, leads to overt type 1 diabetes mellitus (30) (See table 4) The current study revealed that type 1 diabetic patients who treated with insulin were at higher significant risk for obesity compared to those treated with tables. Insulin therapy is usually given

to type 1 diabetic patient with poor glycemic control. In a study carried out in Aseer region, poor diabetic control significantly association with obesity (34).

### Conclusion

The data indicate that both overweight and obesity are rising in the population of children and youth with T1D and that the rates now mirror that of the general population. Indeed, the more recent studies included in this review demonstrated a high prevalence of overweight/obesity among children and youth with T1D, the prevalence of obesity in KSA is greater than the global prevalence of obesity, and risk factors are multifactorial. Three intervention approaches are commonly used to treat obesity; Obesity is highly prevalent among type 1 diabetic patients. Divorced, , patients who stopped aerobic exercise for two consecutive days or more per week as well as those treated with insulin were more likely to be obese. Policymakers, public health professionals, and practitioners engaged in public health and clinical management of obesity are encouraged to use findings to expedite nationwide reductions in the prevalence of obesity in KSA, the evaluation of the level of knowledge of typ1 diabetic patients about the complications be less variable than this range suggests because all but one study had a mean obesity rate to more, although an epidemiologic review is needed to confirm this observation. Nevertheless, the high prevalence of overweight is concerning in that overweight/obesity in combination with T1D might contribute to development of double diabetes, in addition to other obesity-related complications.

### References

1. Vilarrasa, N., San Jose, P., Rubio, M. Á., & Lecube, A. (2021). Obesity in patients with type 1 diabetes: links, risks and management challenges. *Diabetes, Metabolic Syndrome and Obesity: Targets and Therapy*, 2807-2827.
2. Elhabashy, S. A., Elbarbary, N. S., Hassan, A. A., & Thabet, R. A. (2022). Outcomes of Health Care Services Provided to Egyptian Patients with Type 1 Diabetes Mellitus: A Single Centre Experience from a Developing Country.
3. Zhang, R., Mamza, J. B., Morris, T., Godfrey, G., Asselbergs, F. W., Denaxas, S., ... & Banerjee, A. (2022). Lifetime risk of cardiovascular-renal disease in type 2 diabetes: a population-based study in 473,399 individuals. *BMC medicine*, 20(1), 1-11.
4. Abbasi, A., Juszczak, D., van Jaarsveld, C. H., & Gulliford, M. C. (2017). Body mass index and incident type 1 and type 2 diabetes in

- children and young adults: a retrospective cohort study. *Journal of the Endocrine Society*, 1(5), 524-537.
- Pinsker, J. E., Müller, L., Constantin, A., Leas, S., Manning, M., McElwee Malloy, M., ... & Habif, S. (2021). Real-world patient-reported outcomes and glycemic results with initiation of control-IQ technology. *Diabetes technology & therapeutics*, 23(2), 120-127.
  - Xu, Y., Grimsman, J. M., Karges, B., Hofer, S., Danne, T., Holl, R. W., ... & Dunn, T. C. (2021). Personal glycation factors and calculated hemoglobin A1c for diabetes management: real-world data from the Diabetes Prospective follow-up (DPV) Registry. *Diabetes Technology & Therapeutics*, 23(6), 452-459.
  - Rapattoni, W., Zante, D., Tomas, M., Myageri, V., Golden, S., Grover, P., ... & Rose, J. B. (2021). A retrospective observational population-based study to assess the prevalence and burden of illness of type 2 diabetes with an estimated glomerular filtration rate < 90 mL/min/1.73 m<sup>2</sup> in Ontario, Canada. *Diabetes, Obesity and Metabolism*, 23(4), 916-928.
  - Ryan, D., Barquera, S., Barata Cavalcanti, O., & Ralston, J. (2021). The global pandemic of overweight and obesity: Addressing a twenty-First century multifactorial disease. In *Handbook of global health* (pp. 739-773). Cham: Springer International Publishing.
  - Iceta, S., Panahi, S., García-García, I., & Michaud, A. (2021). The impact of restrictive and non-restrictive dietary weight loss interventions on neurobehavioral factors related to body weight control: The gaps and challenges. *Current Obesity Reports*, 10, 385-395.
  - Calcaterra, V., Verduci, E., Pascuzzi, M. C., Magenes, V. C., Fiore, G., Di Profio, E., ... & Zuccotti, G. (2021). Metabolic derangement in pediatric patient with obesity: The role of ketogenic diet as therapeutic tool. *Nutrients*, 13(8), 2805.
  - Ergun-Longmire, B., Clemente, E., Vining-Maravolo, P., Roberts, C., Buth, K., & Greydanus, D. E. (2021). Diabetes education in pediatrics: how to survive diabetes. *Disease-a-Month*, 67(8), 101153.
  - Grunvald, E., Shah, R., Hernaez, R., Chandar, A. K., Pickett-Blakely, O., Teigen, L. M., ... & AGA Clinical Guidelines Committee. (2022). AGA Clinical Practice Guideline on Pharmacological Interventions for Adults With Obesity. *Gastroenterology*, 163(5), 1198-1225.
  - Ritchie, R. H., & Abel, E. D. (2020). Basic mechanisms of diabetic heart disease. *Circulation Research*, 126(11), 1501-1525.
  - Alhndi, N. M., Almajnoni, M. M., Al Bariqi, A. A., Al-Zahrani, H. M., Alghamdi, M. A., Alzahrani, S. M., ... & Alha, R. M. (2021). Assessment the Awareness' of the Elderly Patient's Knowledge and Attitudes Among Diabetes Complication in Makkah Al-Mokarramah 2021. *Annals of the Romanian Society for Cell Biology*, 25(7), 2031-2046.
  - Ehrlich, K. B. (2020). How does the social world shape health across the lifespan? Insights and new directions. *American Psychologist*, 75(9), 1231.
  - Alotaibi, A., Perry, L., Gholizadeh, L., & Al-Ganmi, A. (2017). Incidence and prevalence rates of diabetes mellitus in Saudi Arabia: an overview. *Journal of epidemiology and global health*, 7(4), 211-218.
  - El-Batal, A. I., Abd Elkodous, M., El-Sayyad, G. S., Al-Hazmi, N. E., Gobara, M., & Baraka, A. (2020). Gum Arabic polymer-stabilized and Gamma rays-assisted synthesis of bimetallic silver-gold nanoparticles: Powerful antimicrobial and antibiofilm activities against pathogenic microbes isolated from diabetic foot patients. *International Journal of Biological Macromolecules*, 165, 169-186.
  - Alzheimer's Association. (2018). 2018 Alzheimer's disease facts and figures. *Alzheimer's & Dementia*, 14(3), 367-429.
  - Esawi, H. H., Al Hazmi, M. A., Alshareef, T. N. S., Al Muzaini, M. S., Bassuoni, A. M., Alhawsawi, H. M., ... & Moh, W. (2021). Assessment of Knowledge, Attitudes, and Practices of Primary Care Physicians in Makkah 2021 at Saudi Arabia toward Management of Type 2 DM in RAMADAN. *Annals of the Romanian Society for Cell Biology*, 25(7), 2259-2273.
  - Shah, A. S., Dolan, L. M., Dabelea, D., Stafford, J. M., D'Agostino Jr, R. B., Mayer-Davis, E. J., ... & SEARCH for Diabetes in Youth Study. (2015). Change in adiposity minimally affects the lipid profile in youth with recent onset type 1 diabetes. *Pediatric diabetes*, 16(4), 280-286.
  - Antvorskov, J. C., Aunsholt, L., Buschard, K., Gamborg, M., Kristensen, K., Johannesen, J., ... & Svensson, J. (2018). Childhood body mass index in relation to subsequent risk of type 1 diabetes—a Danish cohort study. *Pediatric Diabetes*, 19(2), 265-270.

22. Wiklund, P. (2016). The role of physical activity and exercise in obesity and weight management: Time for critical appraisal. *Journal of Sport and Health Science*, 5(2), 151-154.
23. Alshareef, M. N. S., Alharbi, S. S., Alshanqity, H. M. A., Al-Shareef, H. M., Albeladi, B. H., Alwafi, A. M., ... & Al-Sharif, A. A. A. (2021). Assessment Prevalence of the Obesity and Effected in Type 2 Diabetes and Obesity-Related Risk Factors on Patients Attending in Primary Health Care Center in Makkah Al-Mokarramah 2021. *Annals of the Romanian Society for Cell Biology*, 25(6), 21343-21358.
24. Abuhendi, N., Qush, A., Naji, F., Abunada, H., Al Buainain, R., Shi, Z., & Zayed, H. (2019). Genetic polymorphisms associated with type 2 diabetes in the Arab world: a systematic review and meta-analysis. *Diabetes research and clinical practice*, 151, 198-208.
25. El-Kebbi, I. M., Bidikian, N. H., Hneiny, L., & Nasrallah, M. P. (2021). Epidemiology of type 2 diabetes in the Middle East and North Africa: Challenges and call for action. *World journal of diabetes*, 12(9), 1401.
26. Fiorentino, M., Bolignano, D., Tesar, V., Pisano, A., Biesen, W. V., Tripepi, G., ... & ERA-EDTA Immunonephrology Working Group. (2017). Renal biopsy in patients with diabetes: a pooled meta-analysis of 48 studies. *Nephrology Dialysis Transplantation*, 32(1), 97-110.
27. Zucker, I., Zloof, Y., Bardugo, A., Tsur, A. M., Lutski, M., Cohen, Y., ... & Twig, G. (2022). Obesity in late adolescence and incident type 1 diabetes in young adulthood. *Diabetologia*, 65(9), 1473-1482.
28. Bakhotmah, B. A. (2013). Prevalence of obesity among type 2 diabetic patients: non-smokers housewives are the most affected in Jeddah, Saudi Arabia.
29. Goweda, R., Shatla, M., Alzaidi, A., Alzaidi, A., Aldhawani, B., Alharbi, H., ... & Rawa, B. (2017). Assessment of knowledge and practices of diabetic patients regarding diabetic foot care, in Makkah, Saudi Arabia. *Journal of Family Medicine and Health Care*, 3(1), 17.
30. Rehackova, L. (2017). Efficacy, acceptability and experiences of very low energy diets in adults with type 2 diabetes (Doctoral dissertation, Newcastle University).
31. Norris, J. M., Johnson, R. K., & Stene, L. C. (2020). Type 1 diabetes—early life origins and changing epidemiology. *The lancet Diabetes & endocrinology*, 8(3), 226-238.
32. Alaqeel, A., Aljuraibah, F., Alsuhaibani, M., Huneif, M., Alsaheel, A., Dubayee, M. A., ... & Khalifah, R. A. (2021). The impact of COVID-19 pandemic lockdown on the incidence of new-onset type 1 diabetes and ketoacidosis among Saudi children. *Frontiers in endocrinology*, 12, 669302.
33. Brennan, M. C., Brown, J. A., Ntoumanis, N., & Leslie, G. D. (2021). Barriers and facilitators of physical activity participation in adults living with type 1 diabetes: a systematic scoping review. *Applied Physiology, Nutrition, and Metabolism*, 46(2), 95-107.
34. Amour, A. A., Chamba, N., Kayandabila, J., Lyaruu, I. A., Marieke, D., Shao, E. R., & Howlett, W. (2019). Prevalence, patterns, and factors associated with peripheral neuropathies among diabetic patients at tertiary Hospital in the Kilimanjaro Region: descriptive cross-sectional study from north-eastern Tanzania. *International journal of endocrinology*, 2019.