

## Knowledge and acceptance towards metabolic surgery as part of diabetes management among patients with type-2 diabetes with body mass index $\geq 30$ Kg/m<sup>2</sup> in ministry of health primary health care centers, Jeddah, 2017

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### Abstract

**Introduction:** Metabolic surgery is a treatment option for the Type-2 Diabetes (T2D) patients with high BMI. Are T2D patients aware or willing to undergo metabolic surgery needs to be answered.

**Objectives:** The objectives of the study were assessment of the level of knowledge of effectiveness of metabolic surgery in T2D treatment, remission and its acceptance as part of diabetes management; AND finding the determinants of the knowledge and acceptance of this procedure among T2D patients with BMI  $\geq 30$  kg/m<sup>2</sup> in Primary health care centers (PHCCs) of Jeddah, Saudi Arabia.

**Materials and Methods:** A cross-sectional study, with a total of 455 interviews, was conducted using standard Likert-type questionnaire, among T2D patients with BMI  $\geq 30$  kg/m<sup>2</sup>, who attended five randomly selected PHCC's in Jeddah. Binary logistic regression analysis was done to identify the determinants of knowledge and acceptance of metabolic surgery.

**Results:** The majority were Saudi citizens (83.7%) and females (55.6%). The mean age was  $47.6 \pm 9.6$  years (23-65 years) and the mean BMI was  $34.3 \pm 3.3$  kg/m<sup>2</sup> (30-45.8 kg/m<sup>2</sup>). About 41.1% had no clear opinion for the question on effectiveness of metabolic surgery. Among the remaining (268), 63.1% felt it is effective in T2D treatment and 60.6% in T2D Remission. Out of 348 patients, 49.1% were willing for metabolic surgery and 40.3% not willing. The adjusted determinants of willing to undergo metabolic surgery were age, (54 years plus vs 36 years or less: OR=0.230; 95% CI=0.069-0.769); education (bachelor degree vs illiterates: OR=0.025; 95%CI=0.001-0.890); 5000-15000 SR/month vs less than 5000 SR/month: OR=6.910; 95% CI=2.890-16.519); marital status (widower vs singles: OR=0.027;95%CI= 0.003-0.219); and A1c level (A1c level 10 or more vs A1c level  $\geq 5 - <10$ : OR=3.274; 95%CI=1.736-6.174). Only 7.7% of T2D patients were offered metabolic surgery as a treatment option by the treating physician at PHCCs.

**Conclusion:** The good knowledge of metabolic surgery among participants did not enhance to willingness to accept it as T2D management. Age, marital status, education level, income and A1c level determine the willingness for metabolic surgery among T2D patients with BMI  $\geq 30$  or more.

**Keywords:** Type2 Diabetes, Metabolic surgery, Perception, Effectiveness, Willingness.

### Introduction

Diabetic Mellitus (DM) is one of the most common chronic diseases that causes multiple life threatening complications such as end-stage renal disease, diabetic neuropathy, and heart disease. Worldwide, the estimated number of patients with Type 2 Diabetes (T2D) in 2017 was 425 million among adults aged 20 to 79 years old.<sup>1</sup> In Kingdom of Saudi Arabia (KSA), according to the national epidemiological health survey conducted in 2015, the prevalence of T2D among Saudi population aged between 30 to 70 years old was 23.7%.<sup>2</sup> The management of T2D includes lifestyle changes in diet and exercise and different regimens of oral and injectable medications. With simultaneous emergence of T2D and obesity, it has been challenging to achieve desired glycemic control and quality of life. Metabolic surgery is one such treatment option that is increasingly focused among T2D patients with high BMI like  $>30$ kg/m<sup>2</sup>. A number of studies ranging from original articles to systematic reviews have identified metabolic surgery to be more effective than medical treatments in achieving diabetes remission, tightening glycemic control and improving Cardio-vascular disease (CVD) risk factors.<sup>3-4</sup>

Metabolic surgery is the new term for bariatric surgery, because it is not only for weight loss purposes; additionally, it can improve other metabolic abnormalities such as T2D,

dyslipidemia and hypertension.<sup>3-4</sup> It is recommended by the American Diabetic Association (ADA) guideline in 2017 to treat patients with T2D and BMI  $\geq 40$  kg/m<sup>2</sup> as appropriate surgical candidates, regardless of the level of glycemic control, and in adults with hyperglycemia and BMI 35.0 – 39.9 kg/m<sup>2</sup> when blood sugar inadequately controlled despite lifestyle and optimal medical therapy. It is also considered for T2D patients with Body Mass Index (BMI) 30.0 – 34.9 kg/m<sup>2</sup> if hyperglycemia is inadequately controlled despite optimal oral or injectable medications.<sup>5</sup> The improvement in glucose hemostasis after metabolic surgery typically begins within days after the operation, even before significant weight loss occurs. Insulin sensitivity and  $\beta$ -cell function will improve in the absence of acutely elevated nutrient-stimulated GLP-1 levels that presents in remission of T2D after eight weeks of procedure.<sup>6</sup>

Internationally, there are few previous studies conducted within the same frame. A qualitative study conducted in United Kingdom on acceptance of weight loss surgery among non-morbidly obese showed that despite the belief that it was for morbidly obese T2D patients, there was a small fraction among non-morbidly obese who said they would consider weight loss surgery positively. Patients who had experienced adverse effects of T2D or overweight were more likely to consider weight loss surgery.<sup>7</sup> Another cross-sectional study

among T2D patients with BMI 30-40kg/m<sup>2</sup> in the USA, around one-third perceived bariatric surgery to be very effective for obesity treatment and 28.5% T2D patients thought that bariatric surgery was effective in T2D treatment. Around 8% said its ineffective T2D management. 63% remained neutral or no response. About 16.1% were willing to participate in a clinical trial study involving to undergo bariatric surgery for T2D management.<sup>8</sup> Higher educational levels, use of insulin and shorter duration of T2D are noted to be the main predicted factors interest in bariatric surgery. Want of remission, prevention of complications and reduction of medications were the reasons T2D patients considered bariatric surgery.<sup>9</sup>

According to the statistics mentioned in the Saudi Health Information Survey Handbook in 2013, there are about 1,851,080 patients with T2D over the age of 15 years, and it is estimated to increase to more than 4,300,000 in 2030. Most of the patients with T2D do not know about this new management method as per research in other parts of the world, and they are less willing to go for this procedure since surgical intervention is required. Kingdom of Saudi Arabia is burdened with large number of T2D patients with high BMI. There is no study conducted among T2D patients to see the if they are aware of this treatment option or they are routinely offered this treatment option in healthcare settings or even to see how willing they are to undergo metabolic surgery to achieve glycemic control and other benefits need to be answered. Hence, the researcher aims to assess the perception of effectiveness and acceptance of this new line of management among T2D patients attending Primary Health Care Centers (PHCCs) of Ministry of Health (MOH) in Jeddah. The objectives of the study were firstly, to assess the knowledge of effectiveness of metabolic surgery in T2D treatment and remission among patients with T2D patients with BMI  $\geq 30$  Kg/m<sup>2</sup> attending PHCCs Jeddah; Secondly, to assess acceptance to undergo metabolic surgery; Lastly, to identify factors influencing acceptance or rejection of metabolic surgery as part of T2D management among T2D patients with BMI  $\geq 30$  Kg/m<sup>2</sup> attending MOH PHCCs in Jeddah.

## Materials and Methods

This Cross-sectional study was carried out among consenting T2D patients with BMI  $> 30$ kg/m<sup>2</sup> attending five randomly selected PHCCs of ministry of health in Jeddah in last quarter of 2017. PHCCs cater to all Saudi citizens and expats in low paying jobs. The total sample size was divided equally between PHCCs. A total of 455 face to face interviews were conducted using a pre-tested, standardized

Likert-type item. It included questions on socio-demographic variables, medical history, anti-diabetic medication history, perception of effectiveness of metabolic surgery in treating diabetes and remission, and willingness to undergo metabolic surgery for better glycemic control and quality of life.

Five selected PHCCs included were Al-Marwah, Al-Nahda, Al-Sulaymaniyah, Prince Abdul-Mgeed and Al-Bald. All eligible patients were interviewed in a consecutive manner after obtaining their consent. Descriptive analysis was performed for all the independent variables and presented in the form of appropriate percentages, mean and standard deviation. BMI was calculated using formula weight in kilogram divided by the square of the height in meters. BMI classification of World Health Organization was used.

Bivariate analysis was done using Fisher's exact test and Chi-square test to study the associations between independent and dependent variables. For all analysis, a p value of less than 0.05 was determined as a significant association. Binary logistic regression analysis using backward approach was done to know the adjusted effects of various characteristics with willingness to undergo metabolic surgery for treatment of T2D.

Likert-type item was used. Responses were levelled 1-5; 1 being very in-effective, 2 in-effective, 3 neutral 4 effective, and 5 very-effective. For analysis, Likert item values were combined into three main categories of responses. One with negative knowledge included Very In-effective and In-effective responses. Those who could not give a conclusive opinion included neutral or no response. Whereas, those who said very effective and effective were combined in one category named as Positive Knowledge.

The same categorization was applied for the bivariate assessment of willingness for metabolic surgery. No response and neutral response were excluded from the binary logistic regression analysis. The data was analysed using statistical software SPSS version 21. This self-funded study obtained ethical clearance from the ethical review committee of Joint Program of Family and Community Medicine in Jeddah.

## Results

Table 1 presents the descriptive characteristics of the sample. The mean age was 47.6  $\pm$  9.6 years (range 23 – 65 years). Majority of them were in the age-group 36 to 54 years (67%), followed by age-group 55 to 65 years (20.9%). Saudi patients represented 83.7% of the study group. Females outnumbered males in the study sample (55.6% vs 44.4%). About half (49.5%) of the participants belonged to an average class earning between 5,000 and 15,000 SR per month.

**Table 1: Descriptive characteristics of study sample (N-455)**

Characteristic/Category	n (%)	Characteristic/Category	n (%)
<b>Age:</b> (mean $\pm$ SD) Years	47.6 $\pm$ 9.6	<b>Monthly income (SAR):</b> < 5,000	194 (42.6%)
18 – 35 years	55 (12.1%)	$\geq 5,000 - 15,000$	225 (49.5%)
36 – 54 years	305 (67.0%)	> 15,000 – 30,000	31 (6.8%)
55 – 65 years	95 (20.9%)	> 30,000	5 (1.1%)
<b>Nationality:</b> Saudi	381 (83.7%)	<b>Weight</b> (mean $\pm$ SD) Kg	90.0 $\pm$ 12.2
Non-Saudi	74 (16.3%)	<b>Hight</b> (mean $\pm$ SD) Meter	161.8 $\pm$ 9.0

<b>Gender: Male</b>	202 (44.4%)	<b>BMI* (mean ± SD) (Kg/M<sup>2</sup>)</b>	34.3 ± 3.3
Female	253 (55.6%)	≥ 30 - < 35	290 (63.7%)
<b>Educational status: Illiterates</b>	8 (1.8%)	≥ 35 - < 40	132 (29.0%)
Read & Write	114 (25.0%)	≥ 40	33 (7.3%)
High School	110 (24.2%)	<b>Duration since T2D (mean ± SD) years</b>	6.5 ± 4.7
Diploma	33 (7.2%)	<b>A1c (mean ± SD)</b>	8.5 ± 1.8
Bachelor Degree	159 (35.0%)	<b>Developed one or more complication</b>	38 (8.4%)
Post Graduate	31 (6.8%)	<b>Using Insulin</b>	145 (31.9%)
<b>Occupational status: Housewives</b>	128 (28.1%)	<b>Using Hypoglycemic Medication</b>	440 (96.7%)
Educational Services	91 (20.0%)	Once/ day	143 (32.5%)
Private Sectors	72 (15.8%)	Twice / day	236 (53.6%)
Government Sectors	43 (9.5%)	Three / day	59 (13.4%)
Military Services	32 (7.0%)	≥ Four/ day	2 (0.5%)
Medical Services	21 (4.6%)		
Other	68 (15.0%)		

Table 2 summarizes the responses of the study participants to metabolic surgery. 41% percent of the participants did not

respond (No Opinion) when asked about the effectiveness of metabolic surgery in treating T2D.

**Table 2: Responses to study questions regarding effectiveness and willingness to undergo metabolic surgery for T2D in PHCC's Jeddah, 2017.**

Question	N*	Likert Scale Values %				
		Very In-effective	In-effective	Neutral	Effective	Very effective
<b>Effectiveness</b>						
Do you think Metabolic Surgery effective in treating type 2 Diabetes	268	0.7%	10.1%	20.9%	63.1%	5.2%
Do you think Metabolic Surgery effective in type 2 Diabetes Remission	264	0.8%	9.8%	23.1%	60.6%	5.7%
<b>Acceptance</b>		Very unwilling	unwilling	Neutral	Willing	Very willing
Are you willing to choose Metabolic Surgery as method for type 2 Diabetic treatment	348	9.5%	30.8%	10.6%	42.8%	6.3%

\*Excludes No response.

The bivariate results of various socio-demographic factors and medical factors related to T2D with knowledge towards effectiveness of metabolic surgery for T2D treatment are shown in Table 3. Age, nationality, marital status, education level, occupational status, monthly income, duration since T2D diagnosis, and presence of complications, turned to be statistically significant factors (P value <0.05) for knowledge towards effectiveness of metabolic surgery in

T2D treatment. Similar findings were identified for perception towards effectiveness of metabolic surgery in T2D remission. Age, nationality, marital status, education level, occupational status, monthly income, BMI and A1c were statistically significant factors (P value <0.05) for willingness to undergo metabolic surgery for management of T2D (not shown in the table).

**Table 3: Association of socio-demographic factors and medical parameters with knowledge of effectiveness of MS in T2D treatment, in PHCC's, Jeddah, 2017. (N=455)**

Factor	Likert Scale* Values n (%)			F or X <sup>2</sup> Value	P-value	
	In-effective and Very in-effective	Neutral and No opinion	Effective and very effective			
<b>Age</b> mean ± SD years	49.1 ± 9.5	49.4 ± 10.4	44.9 ± 7.6	12.6	0.0000	
<b>Nationality</b>				9.3	0.0096	
	Saudi	23 (6.0%)	193 (50.7%)	165 (43.3%)		
	Non-Saudi	6 (8.1%)	50 (67.6%)	18 (24.3%)		
<b>Gender</b>				0.678	0.7	
	Male	15 (7.4%)	193 (53.0%)	165 (39.6%)		
	Female	14 (5.5%)	136 (53.8%)	103 (40.7%)	1	
<b>Educational Level</b>	Illiterate	0 (0.0%)	8 (100%)	0 (0.0%)	69.7	0.0000

	Read & Write	5 (4.4%)	88 (77.2%)	21 (18.4%)		
	High School	10 (9.1%)	66 (60.0%)	34 (30.9%)		
	Diploma Degree	1 (3.0%)	15 (45.5%)	17 (51.5%)		
	Bachelor Degree	12 (7.6%)	57 (35.9%)	90 (56.6%)		
	Post Graduate	1 (3.2%)	9 (29.0%)	21 (67.7%)		
<b>Monthly Income (SAR)</b>	< 5,000	10 (5.2%)	130 (67.0%)	54 (27.8%)	32.2	0.0000
	≥ 5,000 – 15,000	17 (7.6%)	102 (45.3%)	106 (47.1%)		
	> 15,000 – 30,000	2 (6.5%)	11 (35.5%)	18 (58.1%)		
	> 30,000	0 (0.0%)	0 (0.0%)	5 (100%)		
<b>BMI mean ± SD Kg/M<sup>2</sup></b>		34.0 ± 3.2	34.1 ± 3.3	34.6 ± 3.2	1.4	0.2
<b>Duration since T2D diagnosis mean ± SD years</b>		6.2 ± 4.6	7.5 ± 5.0	5.2 ± 4.0	12.5	0.0000
<b>A1c mean ± SD</b>		8.3 ± 1.5	8.5 ± 1.8	8.6 ± 1.8	0.17	0.8
<b>Using Insulin</b>	Yes	8 (5.5%)	84 (57.9%)	53 (36.6%)	1.8	0.4
	No	21 (6.8%)	159 (51.3%)	130 (41.9%)		
<b>Developed Complication</b>	Yes	2 (5.3%)	28 (73.7%)	8 (21.1%)	7.1	0.03
	No	27 (6.5%)	215 (51.6%)	175 (42.0%)		

Table 4 show the results of multivariate logistic regression analysis using backward approach on willingness to undergo metabolic surgery among T2D patients in the study. The category with neutral response or no opinion was excluded. Variables age-group, marital status, education, income and A1c level were significant predictors of willingness to undergo metabolic surgery for T2D management in the binary logistic regression analysis. T2D patients aged 56 years plus were at 4.3 times lesser odds of willing to undergo metabolic surgery compared to those T2D patients less than 36 years age (OR=0.230; 95% CI=0.069-

0.769; P value=0.017). The odds of willing to undergo metabolic surgery was 7 times higher in participants earning between 5,000-15,000 SR per month compared to those earning less than 5,000 SR income per month (OR=6.910; 95%CI=2.890-16.519; P value=0.0001). However, this finding was not sustained with further increases in income. T2D patients with A1c levels 10 or more had 3.2 higher odds of willing to undergo metabolic surgery compared to those with A1c levels of ≥ 5 - <10 (OR=3.274; 95%CI=1.736-6.174; P value=0.0001). Only 35 (7.7%) participants were offered by their treating physician to choose metabolic surgery as treatment option of T2D (not shown in table).

**Table 4: Multivariate logistic regression analysis on willingness to undergo metabolic surgery among T2D in MOH PHCC's, Jeddah, 2017. (N=290)**

Predictor variable	B	SE	Wald	df	P-value	Exp (B) OR	Lower 95% CI	Upper 95% CI
<b>Age &lt; 36 years</b>			16.480	2	0.000			
36 - 55 years	0.286	0.456	0.394	1	0.530	1.332	0.545	3.254
> 56 years	-1.470	0.616	5.689	1	0.017	0.230	0.069	0.769
<b>Marital status: Single</b>			14.151	3	0.003			
Married	-0.893	0.611	2.140	1	0.143	0.409	0.124	1.354
Divorced	-0.008	0.812	0.000	1	0.992	0.992	0.202	4.871
Widowed	-3.616	1.071	11.409	1	0.001	0.027	0.003	0.219
<b>Income per month: ≤ 5,000</b>			20.444	3	0.000			
≥ 5,000 – 15,000	1.933	0.445	18.896	1	0.000	6.910	2.890	16.519
> 15,000 – 30,000	0.972	0.622	2.447	1	0.118	2.644	0.782	8.941
> 30,000	2.289	1.202	3.625	1	0.057	9.861	0.935	104.005
<b>A1c level: ≥ 10</b>	1.186	0.324	13.429	1	0.000	3.274	1.736	6.174

Variables in the model at step1: Age-group, nationality, marital status, education, occupation, income, A1C level.

**Discussion**

This study showed that knowledge regarding effectiveness of metabolic surgery was as high as 68.3% for T2D treatment, and 66.3% for T2D remission. It is much higher than the study done by Sarwer et al. where only 28.5% of their participants perceived that bariatric (Metabolic) surgery was effective for treating T2D<sup>8,10</sup> and this is also

better than a study conducted in KSA where 45% said bariatric surgery was effective in T2D treatment.<sup>11</sup> It is interesting to note that even when very few were offered the option of metabolic surgery in PHCCs, nearly 70% had the perception that it was effective in T2D treatment and remission, probably due to the role of media and internet sources. Despite good positive knowledge of study

participants, their willingness to choose metabolic surgery as method for T2D treatment was lower (49.1%). However, this is much better than other studies where it was about 16.1%.<sup>8</sup> It may be so because T2D patients are choosing the conservative line of treatment to prevent any surgical complication.

In our study, on bivariate analysis, significant determinants of willing to undergo metabolic surgery were age, nationality, marital status, education level, occupational, monthly income, BMI, and A1c level. Similar results were seen in a study conducted by Chua HW.<sup>12</sup> The differences noted in multivariate analysis findings may be due to the categorization of variables, setting of the study, and type of severity of cases seeking treatment at PHCCs. A Canadian research on the acceptance of bariatric surgery found that the acceptance was 23% among patients of T2D, and BMI was a significant determinant of acceptance of surgery. Participants who were interested in surgery believed that there would be a significant reduction in weight loss with surgery.<sup>13</sup> In another study all participants believed that metabolic surgery is for morbid obesity.<sup>7</sup> In our study too, the BMI as a continuous variable showed high significance on bivariate analysis. Perception of weight being high among class 3 obese patients determined their interest in metabolic surgery. However, a fear of risky surgical procedure made people to decline the surgical option.<sup>14</sup> This may explain why knowledge of effectiveness of metabolic surgery did not enhance adequately to willingness to try it.

In multivariate logistic regression analysis, those who were older than 56 years and widows were identified to be rejecting the idea of undergoing metabolic surgery for T2D management. Higher A1c levels was a significant determinant of positive attitude towards willingness to undergo metabolic surgery in T2D. This shows those who have uncontrolled DM are likely to accept metabolic surgery in T2D management. Patients who have past success with weight loss and have high financial concerns may not show interest in bariatric surgery. On the other hand, patients who have positive social support show more interest in surgical procedure.<sup>14</sup>

Metabolic surgery is considered a recent development in T2D treatment. Many physicians may have read about it or it was in their part of the training but still they were not fully convinced to recommended it to their patients. Many studies report such behavior. A study among the academic and community doctors in Philadelphia noted that 67.4% doctors felt that bariatric surgery was effective in obesity but only 20.8% of them actually agreed to refer their T2D patients for a clinical trial on bariatric surgery.<sup>10</sup> Another study in USA reported that among those with moderate to High BMI, 34% seriously considered bariatric surgery and about 20% of the patients had been referred for bariatric surgery by their doctors.<sup>15</sup>

Metabolic surgery began to gain attention in the recent years as an effective treatment option in diabetes after IDF and ADA started releasing statements about its effectiveness.<sup>16</sup> It may be that our physicians in PHCC's are not updated to the policy of this procedure in T2D

management. Hence, only a small percentage of T2D patients were given the choice of metabolic surgery based on their higher BMI and A1c levels. Gender was not a determinant in this study, whereas a study conducted in KSA noted that female gender and high BMI levels were significant determinants of favorable beliefs towards bariatric surgery.<sup>11</sup> The differences were related to the purpose of surgery. When the procedure is related to treatment methods, gender differences usually disappeared.

## Conclusion

Although study group showed good knowledge of metabolic surgery for treatment and remission of T2D, this knowledge was not from their treating physician. The proportion of T2D patients willing to undergo metabolic surgery was less than the proportion of T2D patients who thought that the metabolic surgery was effective in T2D treatment or remission. On multivariate analysis, variables age-group, marital status, income and A1c level were significant predictors of willingness to undergo metabolic surgery for T2D management in the binary logistic regression analysis. Primary care physicians should share all methods of management, especially, the newest one with their patients to be considered in the treatment plan. Primary care physicians should offer referral for metabolic surgery as part of management to patients with T2D if they meet the criteria required. Health education activities should be undertaken to further increase the awareness of metabolic surgery for T2D patients.

## Recommendations

The study identified that Primary care physicians should provide and share all methods of management especially the newest one with their patients to be considered in the treatment plan. Primary care physicians should offer referral for metabolic surgery as part of management to patients with T2D if they meet the criteria required. General Directorate of Non-Communicable disease in MOH, need to provide priority for operation (Metabolic surgery) to patients with T2D as part of their management. We also recommend that Family physicians should be a health advocate to their patients in providing the best and most recent methods in management plan.

**Conflict of Interest:** None.

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