Review Article

A Review of Literature on the experiences of people with Type 2 Diabetes Mellitus after Bariatric Surgery in Kuwait

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ABSTRACT

Bariatric surgery (BS) has become a popular intervention for weight loss amongst the obese and morbidly obese population with type 2 diabetes mellitus (T2DM) in Kuwait. Studies conducted in Kuwait have found that BS has positive effects on blood glucose levels of people with T2DM. An integrative review was conducted in five major research databases, where the final 14 articles were analysed thematically. In the western world, patients are provided with professional support to overcome both physiological and psychological concerns. Conversely, Kuwaiti individuals might avoid or neglect psychological supports due to insufficient service support and cultural stigmatisation. Although quantitative research may provide critical information about the result of BS physically, they neglect the psychological aspects behind undergoing the surgery, and how the lives of patients who have had BS are affected by this intervention. As a trending intervention for the management of T2DM, exploring the psychological effects after BS may provide a better understanding of the daily lives of individuals with T2DM and enable improvements in health care education for the bariatric population. This review provides evidence that there is a need for more qualitative research in Kuwait to address barriers that bariatric patients' might have faced and the importance of providing health care support to maintain long-term physical and psychological well-being.

KEYWORDS: bariatric surgery, culture, obesity, psychological effects, type 2 diabetes mellitus

INTRODUCTION

Kuwait provided a comfortable life for its citizens when the transition from a hard-working lifestyle into a sedentary one occurred after the discovery of oil in 1938[1]. High-fat low-fibre diets, sedentary lifestyle and high income have contributed to the rise of obesity and comorbidities, such as cardiovascular diseases and type 2 diabetes mellitus (T2DM) in the Kuwaiti population[2,3]. Additionally, poor eating habits in most Kuwaiti households has aided in the rise of this phenomenon[4]. Consequently, Kuwait became the eighth highest in the incidence of obesity and the ninth-ranked country for diabetes globally[5], and the incidence is predicted to double by 2030[6,7].

Bariatric surgery (BS) has recently gained popularity in managing T2DM and treating obesity in Kuwait[8,9]. Furthermore, Kuwait has one of the highest prevalence of people undergoing BS in the world[10]. Positive outcomes in managing blood glucose levels within normal ranges and achieving target weight loss results for the overweight, obese and morbidly obese population by undergoing BS in Kuwait have been reported[8,9,11,12]. For example, roux-en-y gastric bypass (RYGB) was found to be the most effective surgical intervention in providing long-term results for weight loss and the management of T2DM[12]. However, although the effects of BS on the psychological aspects in some obese men were positive, there were also negative consequences of excessive weight loss such as body image disturbance due to multiple skin folds that interfered with their social life, and dietary adjustments to their new digestive systems[13]. The bariatric population have reported benefits from receiving psychological support in maintaining good health[14], and that treating this population group psychologically to address underlying issues leading to obesity was essential in maintaining a physically healthy life[15].

For Kuwaiti individuals however, healthcare support has been limited after BS. This is due to the patient's initial satisfaction from the positive outcomes of the surgery and not requiring support, and

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from stigma associated with seeking psychological support, particularly due to cultural factors such as family reputation and gossip[16]. The lack of support, potentially, acts as a barrier between the healthcare team and the bariatric population. However, the lack of support might not be an issue in cultures known to have extended families who value their relationships with close friends and families, thus replacing the need for experts[17,18].

In order to establish the effectiveness of the role of family support for bariatric patients in Kuwait and for understanding the importance of the effects of BS on the psychological aspects of this population group, this integrative review has been conducted. The purpose of this review is to provide an understanding of the role of healthcare support for people with T2DM after BS in Kuwait and to answer the research question. To our knowledge, no other reviews have been conducted on this topic, hence, this review aims to (1) synthesise existing quantitative and qualitative research to determine the outcomes of BS in people with T2DM, (2) contribute information for developing bariatric programs in Kuwait, and (3) improve health care policy and procedures for the bariatric population.

METHODS

The methodology in this review followed Whittemore and Knafl's definition of integrative reviews[19], which was guided by the primary research question: 'What are the experiences of people with T2DM after BS in Kuwait?'

Search strategy

A comprehensive electronic database search of the literature used the following key concepts: bariatric surgery, weight loss surgery, metabolic surgery, diabetes surgery, laparoscopic adjustable gastric band, sleeve gastrectomy, RYGB, biliopancreatic diversion with duodenal switch, type 2 diabetes, patients experience and behaviour (Table 1). These keywords were used as sub-topics and MeSH terms in the following major research databases: Cumulative Index to Nursing and Applied Health Literature (CINAHL), Medical Literature Analysis and Retrieval System Online (MEDLINE), SCOPUS and Google Scholar. A hand-search on the reference lists of relevant articles was also conducted. The limits included identified human subjects only and peer-reviewed articles from 2013 to 31st July 2017. The chosen timeline was to include most recent surgical intervention in people with T2DM in Kuwait after a 3-month suspension period of performing bariatric surgery in 2013 by the Kuwaiti Minister of Health Dr Mohammed Al-Haifi to update policy, medical protocols and procedure[6].

Table 1: Search strategy

S.No	Key terms	Results
1	Diabetes type 2	28,207
2	T2DM	1,512
3	Diabetes II	28,207
4	1 or 2 or 3	28,573
5	Obese*	37,022
6	Morbid obese*	37,001
7	Overweight	35,036
8	5 or 6 or 7	37,022
9	BS	3046
10	Weight loss	3046
11	Roux-en-Y gastric bypass	3040
12	Metabolic surgery	300
13	BPDDS	3046
14	Sleeve gastrectomy	154
15	Gastric band	54
16	9 or 10 or 11 or 12 or 13 or 14 or 15	3151
17	Experience	102,431
18	Attitude	100,021
19	Behavior*	25,600
20	Perception	18,698
21	Lifestyle	100,024
22	Culture	157,856
23	17 or 18 or 19 or 20 or 21	117,879
24	4 and 8 and 16 and 22 and 23	162
25	Limit 23 to English language and yr= "2013-current"	70

T2DM: type 2 diabetes mellitus; BS: bariatric surgery; BPDDS: biliopancreatic diversion with a duodenal switch

The inclusion and exclusion criteria were established, which applied the Population, Intervention, Comparison, Outcome, Time (PICO/T) method[20]. The inclusion criteria were: adults (18 years old and above) who had one of the following BS - laparoscopic adjustable gastric band (LAGB), sleeve gastrectomy (SG), RYGB or biliopancreatic diversion with duodenal switch (BPD-DS) surgery; who had a diagnosis of T2DM with outcomes reporting changes in glycosylated haemoglobin (HbA1c) or blood glucose levels (BGLs); and reported patients' experiences six months after BS. Excluded articles were on adolescence; weight-loss interventions for T2DM other than BS such as medical T2DM therapy, weight loss pills and diets; and comorbidities other than T2DM.

Using the PRISMA flow diagram (Figure 1), the generated publications were screened, and irrelevant articles were excluded after applying inclusion and exclusion criteria. Both quantitative and qualitative articles were included.

Synthesis and analysis of the results

Details from each article were extracted, which included documenting the author(s) names, year of publication, the name of the journal in which the articles were published, the title of the article, the country, research aim, method used, sample

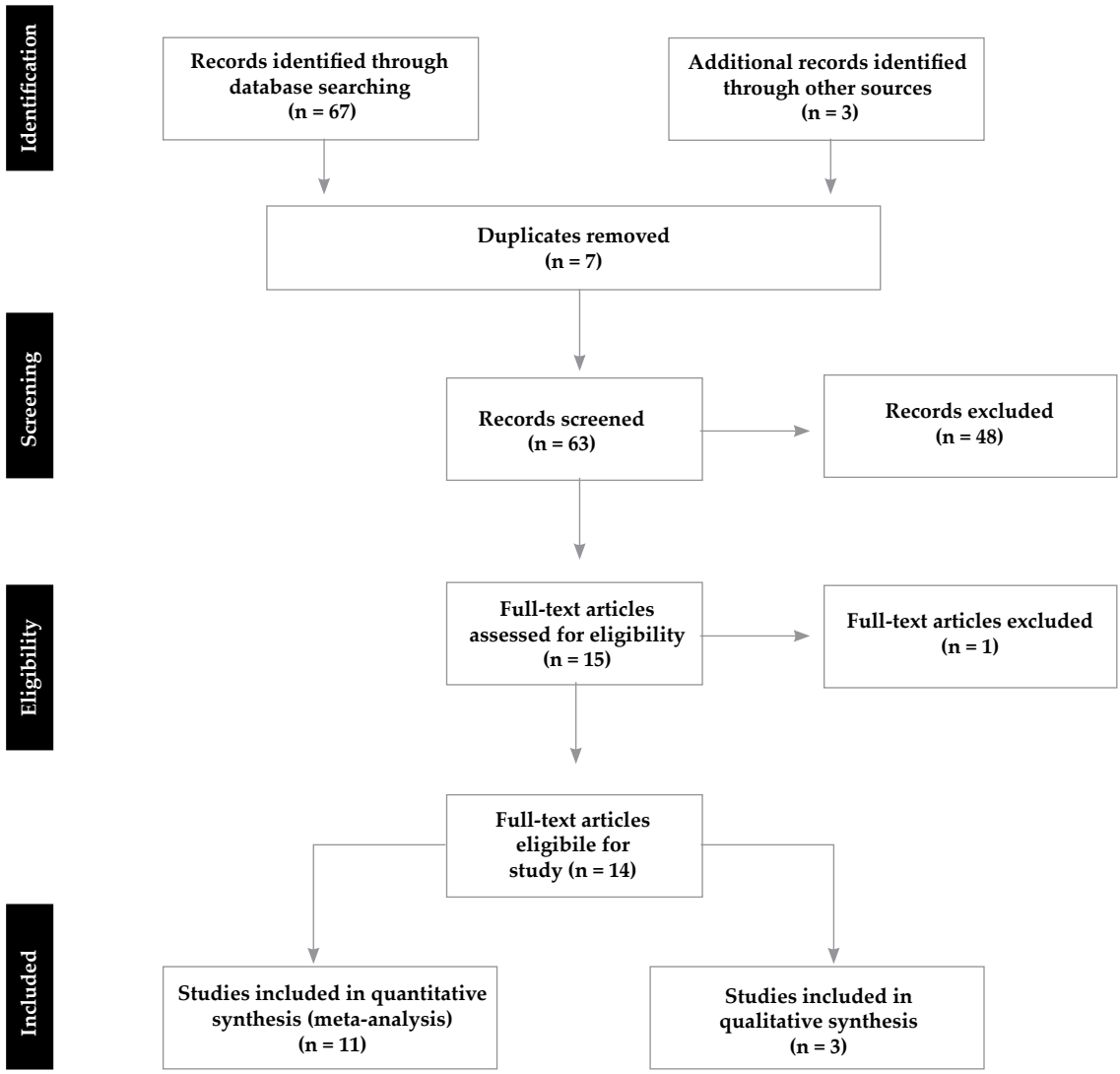

Fig 1: Flow chart of study selection process

population and findings. The primary researcher (AA) extracted the data from the articles and documented the findings. Another researcher (AH) extracted the data independently, and then the two reseachers compared their findings with the original articles. The final step involved a review by the other two researchers (WA, PH) for completeness and precision.

To check the quality of the articles, the Critical Appraisal Skill Program (CASP) tool was utilised to critique the articles that included randomised control trials (RCTs), qualitative and cohort studies. The Joanna Briggs Institute (JBI) appraisal tool was utilised for articles on cross-sectional studies and literature reviews[21]. Both tools were helpful in understanding the weaknesses and strengths of the articles. A table was constructed to present the year of publication and location of the included articles (Table 2), details of each of the articles (Table 3), and limitations and significance of the articles to the research question (Table 4). A narrative review was also conducted to report the findings of the articles.

The databases generated 70 articles; seven were duplicates, 63 screened and then 49 excluded after reviewing the title and abstract, resulting in 15 articles. After conducting a full-text analysis to examine the relevance of the articles, one was excluded. A total number of 14 articles were included in this review; two publications were RCTs that investigated the physiological effects of patients undergoing different types of weight loss surgeries[22,23], four articles were cohorts studies, two were retrospective[24,25] and two were prospective studies[26,27]. There were two

Table 2: Included articles

Authors	Date of Publication	Journal / Title	Country
Almarri *et al*	2017	Obesity Surgery/ A call for more research from the Arabian Gulf	Arabian Gulf
Courcoulas *et al*	2014	JAMA Surgery/ Surgical vs. medical treatment for type 2 diabetes mellitus: A randomised clinical trial	USA
Edward *et al*	2016	American Journal of Men's Health/ Personal descriptions of life before and after BS from overweight or obese men	Australia
Gautier *et al*	2012	Obesity Surgery/ Indications and mid-term results of conversion from sleeve gastrectomy to Roux-en-Y gastric bypass	France
Himpens *et al*	2012	Obesity Surgery/ Long-term results of laparoscopic Roux-en-Y gastric bypass: Evolution after 9 years	Unclear
Ikramuddin *et al*	2013	JCOM Journal/ Should we bypass meds in favour of surgery? BS for the moderately obese diabetic patient	USA and Taiwan
Jamal and Aminian	2015	Kuwait Medical Journal/ Bariatric surgery: is it a safe treatment modality?	Unclear
Julia *et al*	2013	Diabetes & Metabolism/ Quality of life after Roux-en-Y gastric bypass and changes in body mass index and obesity-related comorbidities	France
Jumbe, Hamlet and Meyrick	2017	Current Obesity Report/ Psychological aspects of BS as a treatment for obesity	Unclear
Lier *et al*	2015	Journal of Clinical Nursing/ Patients' daily experiences five years after gastric bypass surgery - A qualitative study	Norway
Mayer and Dwyer	2016	Nutrition Today/ BS or conventional medical therapy? which is best for severely obese adults with type 2 diabetes?	Unclear
Neff *et al*	2013	Obesity Surgery/ Beyond weight loss: Evaluating the multiple benefits of BS after Roux -en-Y gastric bypass and adjustable gastric band	UK
Ritter, Vetter and Sarwer	2012	Postgraduate Medicine/ Lifestyle modifications and surgical options in the treatment of patients with obesity and type 2 diabetes	USA
Yan, Cohen and Aminian	2017	Surgery for Obesity and Related Diseases/ Re-operative bariatric surgery for treatment of T2DM	Unclear

qualitative research studies: one was a descriptive-exploratory study that examined the psychological effect of BS on six male patients[13], and the other a phenomenological study that conducted in-depth interviews to understand how excessive weight loss had changed participants' lives[28]. The included studies were conducted in the United States of America (USA), Taiwan, France, Norway, Australia, and the Arabian Gulf. There were six literature reviews included: five focused on the effect of BS on BGLs in people with diabetes[8,12,29-31] in which two reviews included the Kuwaiti population[8,12], and one was a qualitative review that presented the importance of addressing factors that lead to obesity[15].

LITERATURE REVIEW

The articles revealed two main categories namely, physiological effects and psychological effects of BS. Each category generated sub-categories that represented the outcomes for people with T2DM who had BS.

Physiological effects

Surgical alteration to various parts of the digestive system affected the body in several ways. These changes caused individuals to lose excess weight and reduced levels of comorbidities (*e.g.* glycaemic levels, low-density lipoprotein (LDL) levels, systolic blood pressure (SBP) and nutrients). This review focuses on two identified physiological effects: weight loss and BGLs.

Weight loss

The main goal of BS was for obese and morbidly obese people to reduce weight to a level that made it easier for them to achieve good health and reduce complications. Patients who had undergone RYGB after unsuccessful weight loss from LAGB achieved the same outcomes after conversion to RYGB as patients who had primary RYGB surgery[24,31]. RYGB is considered the most successful method for weight loss with minimal side-effects reporting that participants lost significant weight one year after surgery[23,24]. The highest percentage of weight loss was in the three months after BS[26]. However, studies reported that patients regained weight between five to nine years after LAGB, RYGB and SG[15,25].

Blood glucose levels (BGLs)

Three RCTs reported a change in BGLs of people with T2DM as a primary outcome of BS and found that 25% of their sample had T2DM remission at the end of 12 months post-BS[22,23,27]. However, studies by Courcoulas *et al* and Gautier *et al* found that participants with T2DM had relapsed and needed oral hypoglycaemic medication to manage their hyperglycaemia[22,24].

Table 3: Characteristics of included articles

S.No.	Authors	Study Design	Research Aim / Statement	Method	Sample	Outcomes / Findings
1	Almarri F, Alsabah S, Alhaddad E, Vaz, J.D.	Literature review	To examine all studies published on BS in the Arabian Gulf and evaluate quality, quantity and impact	unclear	Original papers, systematic reviews and case report was done in: Kuwait, KSA, Qatar, UAE vs. USA and Australia	• No publications before 2000, sharp increase of publication 2012 onwards • Majority of publication in clinical outcomes of weight loss procedures (47%), studies on anaesthesia during bariatric procedure (14%) • Retrospective (54.4%, majority @ Alamiri hospital by Dr Salman Alsabah), 31% on sleeve gastrectomy (popular at that time), 75% in Obesity Surgery Journal • Articles from Kuwait (44), Bahrain and Qatar (6), UAE and KSA (19). • Studies on pre-op surgery, effects of surgery on obesity-related comorbidities, long-term survival benefits of surgical weight loss • Only 3% from Arabian Gulf vs. 30% worldwide are RCT • Kuwaiti adolescent population has the highest prevalence of obesity (male 34.8%, female 20.6%)
2	Courcoulas A, Goodpaster B, Eagleton J, Belle S, Kalarchian M, Lang W, Toledo F, Jakicic J.	Quantitative, RCT	Feasibility of RCT and compare outcomes of BS (RYGB and LAGB) and structured weight loss program	12 months, three arm RCT at a single centre	69 (adults 25-55 years) with BMI 30-40 kg/m^2	• RYGB showed most significant weight loss and HbA1c at the end of 12 months, then LAGB. No significance in LWLI group. • T2DM remission observed in 27-50% in RYGB, 23-25% in LAGB. • Reduction in antidiabetic meds in all groups, especially in RYGB and LAGB. • Anti-hypertensive meds were reduced in all groups • Only three severe side effects reported (RYGB - 1 Ulcer, LAGB - 2 dehydration.)
3	Edward KL, Hii MW, Giandinoto JA, Hennessy J, Thompson L.	Qualitative, descriptive exploratory	• Explore descriptions from male bariatric patients before and after surgery - adaptation to a new lifestyle, boundaries post-surgery • Illuminate potential barriers to seeking consultation for BS	• In-depth semi-structured interviews • Data collected and analysed between May and October 2016 • Recruited via advertisement flyer	• Morbidly obese or obese male who had undergone BS • Ages 27-69 years	• Telephone interviews may contribute to willingness of participants and the authentic of their experiences fully • Improved medium and long-term outcomes for men who require BS • Need more information targeted for men who are deciding to undergo BS • Readily accessible information of life experiences of other men who had BS may be preferred by men • Internet-based healthcare information may offer a private first step for males considering weight loss surgery
4	Gautier T, Sarcher T, Contival N, Roux Y, Alves A.	Quantitative, cohort, retrospective data	-	• Conversion from SG to RYGB (October 2006 to July 2011) • measured reflux, sleep apnoea, BMI, SBP and diabetes	• 18 patients (BMI > 50 kg/m^2) with one or more comorbidities • Participants aged 24-55 years old	• Improvements significant after conversion to RYGB and had similar outcomes as primary RYGB patients
5	Himpens J, Verburgghe A, Cadiere GB, Everaerts W, Greve JW.	Quantitative, cohort, retrospective data	To evaluate long-term results of LRYGB	Retrospective data from (2001 - 2002) and analysed in 2011	• 77 patients (including 18 with the previous BS) • No post-op mortality	• BMI lost (52±29%) • 27% developed new onset diabetes • 4 hospitalised due to hypoglycaemia • 2 underwent reversal of BS due to metabolism problems • QoL was fair in all

6	Ikramuddin S, Korner J, Lee W, Block J, Jay M, Hwang U, Vijayaraghavan M, Lewis K, Hung W	Quantitative, RCT	To determine if RYGB is better than medical management to improve diabetes, dyslipidaemia and hypertension in patients with BMI 30-39.9 kg/m^2	• RCT - 2008-2011 - 3 centres in USA and one centre in Taiwan • RYGB vs. medical therapy • RYGB-discontinue meds after surgery • Medical therapy group - meds titrated to have HbA1c < 7%, LDL < 100mg/dL, SBP <130 mmHg • Both groups received intensive lifestyle modification intervention (counselling and meetings included) • At least 325 minutes of physical activity per week.	• 120 participants randomised (block randomisation) • 60 RYGB and 60 medical therapy • T2DM with HbA1c > 8.0% (at least 6 months) • BMI 30-39.9 kg/m^2 • Free from psych disease, cardiovascular disease, malignant disease and no prior gastrointestinal surgeries.	• Dropouts (3 in each group lost in follow-up), 1 had RYGB, 2 refused surgical intervention, no deaths • No significant changes between groups in LDL and SBP • RYGB achieved better HbA1c and BMI results (diabetes remission) • RYGB have nutritional deficiencies (iron and vit B) • 22 RYGB advert reactions, 15 in medical therapy • Cost to have RYGB is high
7	Jamal M, Aminian A.	Literature review	Discuss the types of bariatric surgeries and their safety and complications	Review of the current literature concerning BS and its complications and safety	Papers on bariatric surgeries in Kuwait	• LAGB is the safest and least invasive bariatric procedure, non-threatening complications • LSG relatively simple and safe with reasonably low complication rates in very high-risk patients • LGP is after LSG with even lesser complications due to no gastric resection involved, post 24 months average of 3.7% reoperate. Absence of durability of weight loss from LGP • RYGP most common, beneficial effects on weight and co-morbidities especially T2DM and GERD • BPD high incidence of marginal ulcers at gastro-ileal anastomosis and gallstone • BPD-DS is the modified version of BPD at the gastric portion of operation that shows excellent and durable weight loss but technically difficult, higher perioperative and late complications and nutritional deficits • In BPD-DS, lifetime follow up and supplements are essential to maintaining good health.
8	Julia C, Ciangura C, Capuron L, Boiullot J, Basdevant A, Poitou C, Oppert J	Quantitative, cohort, prospective data	To investigate early and midterm changes in QoL after RYGB and their relationship to BMI, DM, HTN and increased LDL	• QoL questionnaires (French version) with two dimensions: physical and mental QoL, taken at 3, 6, and 12-month post-op.	• Hospital admissions for RYGB (March 2007- October 2009) • excluded patients with previous BS • 80% women with mean age 42.1 ± 11.2 • 124 (53 excluded - incomplete data), (57 of 71 included are female)	• Most significant data were measured at three months post-surgery. • Remission of DM in 41%, dyslipidaemia in 85%, hypertension in 52% and sleep apnoea in 78% • PSC significantly higher in female over time?! • PSC independent of change in BMI • MSC not significant

9	Jumbe S, Hamlet C, Meyrick J.	Literature review	• Discuss the literature behind the psychological impact of BS • Explore whether the procedure addresses the underlying condition that can lead to morbid obesity • Effect on eating behaviour post-op.	unclear	unclear	• Psychological problems linked to disordered relationship with food • Need to identify risk group among BS patient who might need additional support • Lack of post-BS psychological follow-up despite the undisputed leading intervention in weight loss • Psychological problems linked to physiological changes (body image, mood, concerns, stress, substance use and weight regain)
10	Lier HØ, Aastrom S, Rørtveit K.	Qualitative	Explore and describe patients' daily life experiences five years after gastric bypass surgery	• Qualitative method using content analysis • Guided semi-structured in-depth interview audio-taped (60-90 minutes) • Asked via telephone to participate	• 11 patients, 10 accepted to participant (3 men, four women) • Ages 39-57 years old • Participants had LGBP (gastric bypass) in 2008 and 2009	• Body image has an impact on patients' emotional well-being after excessive weight loss that can be challenging in close relationships • Hanging skin is problematic, effects everything from sexual attractiveness to everyday wardrobe dilemmas, clothing becomes a focal that protects dignity, hides embarrassing bodily issue • Long-lasting difficulties in eating habits (dumping - food doesn't stay in body) • Improved self-esteem, weight closer to societal norm convinces other that one has self-control • Fear of regaining weight • Feeling attractive changes from look good dressed to looking bad naked • Patients are mainly satisfied with their lives • Study can serve as basis or knowledge for patients (patient education) and awareness for people wanting to have BS (both helps in increasing quality of treatment and care)
11	Mayer J, Dwyer J.	Literature review	Explores the risks and benefits of conventional therapies and Roux-en-y gastric bypass in morbidly obese adults.	Comparison between diabetes-related outcomes of roux-en-y gastric bypass and conventional medical therapy	unclear	• Morbid obese T2DM treated conventionally (diet, meds and lifestyle) vs. BS (Sleeve Gastrectomy vs. gastric bypass) • RYGB most effective for T2DM and maintaining weight loss and least malabsorption and side effect. • RYGB effective in T2DM remission due to alteration in anatomy • SG causes oesophageal reflux and weight regain • RYGB vs. SG = RYGB 80% recovery from DM and if DM gain only single drug or diet needed, weight is maintained, lipoprotein levels and systolic blood pressure and albuminuria reached normal within one year vs. conventional • RYGB unclear on diabetic neuropathy (mild vs. severe) • Long life supplement needed for RYGB vs. conventional treatment (costly) • Dumping syndrome reduced at 15-18 months post op in RYGB • QoL in RYGB is better than in conventional treatment • BS expensive as treatment pre-and post op, body contouring costs in the future

12	Neff K, Chuah L, Aashiem E, Jackson S, Dubb S, Radhakrishnan S, Sood A, Olbers T, Godsland I, Miras A, Roux C.	Quantitative, cohort, prospective data	• To evaluate the outcomes after RYGB and LAGB using modified King's Obesity Staging System before and 12 months after surgery. • To assess the impact of treatment on multiple patient outcomes after RYGB and LAGB • To evaluate the effects on respiratory functions after RYGB and LAGB • To emphasise a modified King's obesity staging system with high clinical utility	• Assessing obesity-related comorbidities via modified King's Obesity Staging system including BMI and glycaemic markers assessed by clinicians pre-op. and 12 months postop. • Chi-square test • McNemar-Bowker test • Statistics via PASW and STATA 8.0	• 217 consecutive patients (RYGB 148, LAGB 69) - non-randomised • Majority is female • LAGB younger and healthier than RYGB	• RYGB is more effective than LAGB in DM remission and BMI • RYGB and LAGB are equally effective in most domains • LAGB was not significant in gonadal, economic and image domains • Recommendations for further studies to include more domains like hypertension, neurological disease, kidney disease, medication and gastro-oesophageal reflux. • Need for further research with a bigger sample was implied.
13	Ritter S, Vetter M, Sarwer D.	Literature review	Review on current practices in the treatment of obesity as it specifically pertains to the management of T2DM	unclear	unclear	• BS is an option for obese people with uncontrolled T2DM • DM remission also relies on lifestyle modification after surgery.
14	Yan J, Cohen R, Aminian A.	Literature review	To summarise the evidence and determine whether revisional surgery can have a positive impact on metabolic diseases that were not reversed by initial BS	unclear	30 studies	• Revisions induced 20–80% additional excess weight loss, or further decrease of body mass index by 10–30% • Conversion to Roux-en-Y gastric bypass (RYGB) yielded improvement of diabetes in 79%, 72%, and 62% of patients who previously had VBG, AGB or SG, respectively • Converting AGB to SG improved diabetes in 65% of patients, and SG to duodenal switch improved diabetes in 79% of patients • Revision of the gastric pouch or stoma in RYGB yielded improvement of diabetes in 79% of patients

BS: bariatric surgery; RCT: randomised control trials; RYGB: roux-en-y gastric bypass; LAGB: laparoscopic adjustable gastric band; BMI: body mass index; HbA1C: glycosylated haemoglobin; T2DM: type 2 diabetes mellitus; SG: sleeve gastrectomy; SBP: systolic blood pressure; HTN: hypertension; LDL: low-density lipoprotein; LSG: laparoscopic gastric pilation; GERD: gastroesophageal reflux; BPD: biliopancreatic diversion; LGBP: laparoscopic gastric bypass; VBG: vertical banded gastroplasty; AGB: adjustable gastric banding

Table 4: Limitations of included articles

Authors	Limitations
Almarri *et al* (2017)	• High quality studies less cited than other due to a factor of time. • Failure to reveal contribution in development of BS and metabolic surgery over the past 60 years • Bahrain was not included in search strategy, although it is one of the GCC • Lack of quantitative studies included
Courcoulas *et al* (2014)	• Small sample size, single centre • Drop-outs due to randomizations? • Long-term effects need to be studied • Longer, and bigger sample size need to be studied to have generalised findings
Edward *et al* (2015)	• Culture of the men interviewed, all white, homogeneous sample • Types of BS and the severity (How long before going back to almost normal) • Keywords like 'Life' and 'information' were not included in the search strategy • Time of interview after surgery was not mentioned
Gautier *et al* (2012)	• No limitations mentioned. • Unclear in diabetes parameter and improvement measurements • Period of data collection after surgery was not clear • Type of analysis was not stated • No implications or recommendations made
Himpens *et al* (2012)	• Subjective data with telephone interviews regarding weight and diabetes [majority of patients] • Location of cohort, country not mentioned or sample population
Ikramuddin *et al*. (2013)	• BMI >40 was not included • LDL and SBP were close to normal at the beginning of intervention for both groups • Small sample can't be generalised • Results in physical activity was not found in the outcome.
Jamal and Aminian (2015)	• Safety of RTGB not mentioned • LGP durability in weight loss (not mentioned) • No research to compare data with from bariatric surgeries in Kuwait (lack of data -complications, mortality) • Sample size of 44 only in bariatric surgeries that the author yielded data from (unpublished study or not referenced) • Mortality has decreased significantly in comparison to BS 20 years ago • Databases reported 4% complication rate • Possible overestimation of medical approach benefit and surgical approach risk
Julia *et al* (2013)	• Authors reported significant (higher) change in female PSC (due to 80% women participants) - not accurate • Remission of T2DM - Study follow-up period might not be enough to diagnose remission. • Male population data was not mentioned (considered as insignificant)
Jumbe, Hamlet and Meyrick, J. (2017)	• Psychological research relies heavily on self-report quantitative data
Lier, Aastrom and Rørtveit (2016)	• Possible loss of meaning in translation (from Norwegian to English) • Sample had similar background/culture
Mayer and Dwyer (2016)	• The review did not include the timeframe of papers collected • The review did not clearly state the inclusion criteria of their papers
Neff *et al* (2013)	• Age group not specified • Inclusion criteria not clearly stated. • LAGB were healthier than RYGB pre-op. • Not equal number between genders in the groups • Location of the cohort was not mentioned • No reports of dropouts in the whole period. • No reports of complications post-op.
Ritter, Vetter and Sarwer (2012)	• Time frame was not mentioned • Number of articles included was not clear.
Yan, Cohen and Aminian (2017)	• Time frame was not clear • Inclusion criteria of articles was between 1 and 5 years after BS, which presented several variables.

Long term effects of BS included reoccurence of T2DM being diagnosed nine years after BS[25], and that T2DM remission relied on lifestyle changes after BS[30]. A qualitative study reported that patients still found challenges adjusting to their new diet five years after BS and suggested providing patient education before BS to help deal with the undesired outcomes that may arise after surgery[28]. Literature reviews from the Middle-Eastern and Western countries supported weight loss surgery as a new treatment for T2DM[8,12,15,29]. However, lifestyle modification and bariatric education were reported as being essential to maintaining positive outcomes[13,28,30]. Apart from diabetes, improvements in SBP, LDL, sleep apnoea, gastroesophageal reflux and dumping syndrome were reduced 15 - 18 months post surgery. Conversely, absorption was affected adversely, which lead to micronutrient deficiency (*e.g.* iron and vitamin B)[23,24,26,29].

Psychological effects

As a consequence of rapid weight loss, psychological aspects such as level of confidence and stigma on patients may have been affected. Studies found boosts in the confidence of bariatric individuals as well as the removal of stigamatisation linked with their obesity[13,15]. These impacts affected the bariatric population's daily routine and gave them new experiences, such as participating in outdoor activities and socializing[15,28]. This review focused on two psychological effects of BS on individuals with T2DM: quality of life (QoL) and psychological support.

Quality of Life (QoL)

Positive changes in the patients' quality of life were mentioned among people who had BS; this included increased physical activities, removal of stigmatisation and boosts in confidence levels[13,15,29]. In contrast, some individuals who had BS found it hard to adjust to their new eating habits and changes in their digestion[28].

Psychological Support

The importance of having support both professionally and personally was reported in two studies[15,28]. The significance of counselling and addressing the reasons behind bariatric people's obesity may be an essential factor in preventing obesity and maintaining weight loss for a longer period in people after BS[15].

The articles in this review focused on BS carried out in countries that were reported to have a high prevalence of obesity, which included Kuwait. The significance and limitations in these articles were examined; for example, AlMarri *et al* failed to mention whether qualitative studies were included in their literature search[8]. Similarly, a review conducted by Jamal and Aminian on published BS articles in Kuwait also failed to mention the timeframe of the collected data and the lack of reporting the inclusion of qualitative studies or mixed methods[12]. Despite these limitations, a clear description of the safety and effectiveness between the different types of bariatric surgery and their findings would be considered as justification for the preferable BS in Kuwait[8,12]. The recommendations from two studies that included Kuwait suggest a regional guideline in BS to provide standard care in the Arabian gulf countries[8,32]. Conducting qualitative research is essential to gain deep understanding of the experiences that people with T2DM in Kuwait have gone through after BS.

A couple of RCT in the bariatric field was conducted, both significant despite the sample size due to the difficulty of accessing participants for this type of surgery[22,23]. A cohort study by Courcoulas *et al* reported findings from 69 participants, which is considered a small sample size for this type of study, but due to the absence of sample drop-outs, the generalisability and transferability of this study may be a limitation[22]. Another RCT by Ikramuddin *et al* recruited 120 participants from three different centres (two in USA and one in Taiwan) where the intervention group and control group had close to normal levels of blood glucose at the beginning of the study, so changes in them were not substantial, therefore, not reflective of the bariatric population in Arabian Gulf countries[23].

Two quantitative literature review articles were included in this paper[27,29]. A literature review on BS versus conventional medical therapy for T2DM showed significant findings including T2DM remission due to the surgical changes in anatomy and not weight loss[29]. Mayer and Dwyer found that people who had BS achieved healthy reductions in comorbidities within one year of surgery compared to the unachieved levels in the conventional therapy group[29]. People who choose RYGB instead of LAGB had favourable levels in weight loss, diabetes, hypertension, gonadal, economic and body image, but the inclusion criteria and settings were unclear, and no dropouts were mentioned in the study[27].

Three qualitative articles were examined in this review[13,15,28]. Edward *et al* conducted a qualitative study by collecting data via telephone, which provided participants with more freedom to express their feelings and describe their experiences[13]. Nevertheless, the sample was homogeneous (privileged male) and the timeframe was not mentioned, which could affect the experiences that the participants were going through at the time[13]. The study findings by Lier, Aastrom, and Rørtveit's corresponds with Jumbe, Hamlet and Meyrick findings that highlighted the importance

of conducting further research in the qualitative paradigm to understand the outcomes of BS on individuals physically and mentally[15,28]. However, a limitation was identified by Jumbe, Hamlet and Meyrick in obtaining data that relied on patients' self-reported quantitative data[15].

Significant outcomes were found in the included articles such as: patient education is needed for BS people, highlighting that T2DM remission can only be achieved if changes in daily living habits are made[30]. The only long-term study that was found in the selection process was a nine-year study that followed 77 patients, which revealed that reoccurring T2DM in 27% of the sample population, and two individuals reversed their BS due to metabolism complications[25]. However, it also stated a possible limitation was that participants could have provided incorrect weight and glycaemic levels[25]. A study by O'Brien *et al* supports these findings in their 15-year follow up study that showed maintained weight-loss until the time of follow up[33], which contradicts the findings of Himpens *et al* that reported weight gain within eight years of undergoing BS[25]. Approximately 25 - 50% of T2DM remission was reported after five years in other studies[24,25,29,30,33,34]. A review by Yan, Cohen and Aminian revealed that although RYGB was successful in improving glycaemic levels in people with T2DM, 20 - 30% of people with T2DM that have undergone BS surgery have reported poor glycaemic management[31].

Although bariatric surgery appears to have promising results on weight and comorbidities leading to increased quality of life, the literature suggests that living a long and healthy life after BS is possible through lifestyle change and patient education. To accomplish this would require clinicians to be aware of the physiological and psychological impact of BS on individuals, as well as involving policy-makers to improve the care needed by the bariatric population.

The evidence behind BS as an alternative intervention for the treatment of T2DM has been explored in this review. The strengths of this review lie in the synthesis of both qualitative and quantitative data. Notable gaps in knowledge have been highlighted, particularly in qualitative research in Kuwait. However, limitations were evident in each article, such as timeframe of data collected or small sample size. Although this review included several literature reviews on BS and T2DM, the literature combined identified a gap in knowledge when dealing with the bariatric population in the Arabian Gulf countries.

CONCLUSION

Bariatric surgery has been shown to have promising results on body mass index and co-morbidities especially in regard to type 2 diabetes mellitus, hence, leading to increased quality of life. Lifestyle modification and patient education are necessary to maintain a healthy life for people who have undergone BS. Furthermore, it is essential to address the psychological well-being of people who have had BS in Kuwait. However, professional psychological support has been avoided by Kuwaiti individuals due to the effect of cultural stigmatisation, thereby acting as a barrier between the healthcare team and the bariatric population. The lack of knowledge on the effects of BS on the psychological aspects of people in Kuwait needs to be explored further, particularly from a qualitative research perspective. Having a greater understanding of individual patient experiences could improve the overall quality of life for all patients who undergo bariatric surgery, as well as contribute to higher quality care provision.

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