UNIVERSITI PUTRA MALAYSIA

FOOD TOLERANCE, NUTRITIONAL STATUS AND HEALTH-RELATED QUALITY OF LIFE OF PATIENTS WITH MORBID OBESITY AFTER BARIATRIC SURGERY IN A PUBLIC HOSPITAL IN MALAYSIA

ELINA TSEN POH YUE

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By

ELINA TSEN POH YUE

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FOOD TOLERANCE, NUTRITIONAL STATUS AND HEALTH-RELATED QUALITY OF LIFE OF PATIENTS WITH MORBID OBESITY AFTER BARIATRIC SURGERY IN A PUBLIC HOSPITAL IN MALAYSIA

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Chair : Associate Professor Barakatun Nisak Mohd Yusof, PhD
Faculty : Medicine and Health Sciences

Bariatric surgery has been proven to be the most effective weight loss treatment for patients with morbid obesity. However, the alteration in the anatomy of the gastrointestinal structure, food aversion, and non-compliance to recommended dietary advice after bariatric surgery may cause food intolerance, which may affect the nutritional status and health-related quality of life (HRQOL). This study aims to determine the effects of bariatric surgery on food tolerance, nutritional status, and HRQOL among patients with morbid obesity in Malaysia.

This prospective observational study screened a total of 97 patients with morbid obesity. Data on socio-demographic characteristics, food tolerance, nutritional status and HRQOL were collected and assessed at baseline, one month and three months after bariatric surgery. Food tolerance was evaluated using a validated quality of alimentation questionnaire. The anthropometry measurements, including the body mass index (BMI) and percent excess weight loss (EWL), were evaluated, and the dietary intake was collected using a three-day 24-hour food record. The HRQOL was assessed using the World Health Organization Quality of Life-BREF (WHOQOL-BREF) questionnaire. Data was collected in the Surgical Outpatient Department (SOPD) clinic, Hospital Kuala Lumpur, Malaysia.

The final recruited patients with morbid obesity were 90 patients, with a response rate of 100%. There were 62 females (68.9%) and 28 male (31.1%) patients, with 50% of the patients' age less than 40. The EWL one month and three months after surgery was 14.1% and 31.6%, respectively. There was a significant decrease in the total food tolerance score from 26.4 (SD = 0.8) at baseline to 17.7 (SD = 4.7) one month after bariatric surgery, but a gradual rise in the score to 21.7 (SD = 4.3) was observed three months after surgery. A

similar pattern is seen in the dietary intake assessment where a significant reduction in the total energy from 1842 kcal (SD = 445) at baseline to 570 kcal (SD = 180) one month and an increase to 731 kcal (SD = 185) three months after bariatric surgery. The HRQOL of the study patients showed a statistically significantly increase in the domain of physical health ($t = -7.253$, $p = < 0.001$), psychological ($t = -7.692$, $p < 0.001$), social relationship ($t = -5.767$, $p < 0.001$) and environment ($t = -4.208$, $p < 0.013$) three months after bariatric surgery.

In conclusion, the present study showed that bariatric surgery has effectively reduced weight and improved overall HRQOL domains among patients with morbid obesity despite reduced food tolerance and energy intake after bariatric surgery. Future longitudinal studies or randomized controlled trial are recommended to determine the cause-and-effect mechanisms with larger sample size about food tolerance, weight loss, dietary intake, HRQOL, and bariatric surgery in Malaysia.

Abstrak tesis yang dikemukakan kepada Senat Universiti Putra Malaysia sebagai memenuhi keperluan untuk ijazah Master Sains

TOLERANSI MAKANAN, STATUS PEMAKANAN DAN KESIHATAN-BERKAITAN KUALITI KEHIDUPAN PESAKIT DENGAN MORBID OBESITI SELEPAS PEMBEDAHAN BARIATRIK DI HOSPITAL KERAJAAN, MALAYSIA

Oleh

ELINA TSEN POH YUE

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Pengerusi : Profesor Madya Barakatun Nisak Mohd Yusof, PhD
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Pembedahan bariatrik merupakan kaedah penurunan berat badan yang paling berkesan untuk pesakit yang mempunyai masalah obesiti morbid. Namun begitu, perubahan kepada anatomi gastrointestinal, pengadaan makanan dan ketidakpatuhan terhadap saranan diet yang disyorkan selepas pembedahan bariatrik boleh menyebabkan intoleransi makanan yang berpotensi mempengaruhi status pemakanan, dan kesihatan-berkaitan kualiti kehidupan (HRQOL). Kajian ini bertujuan untuk mengetahui kesan pembedahan bariatrik terhadap toleransi makanan, status pemakanan, dan HRQOL dalam kalangan pesakit yang mengalami obesiti morbid.

Kajian pemerhatian prospektif ini menyaring seramai 97 pesakit dengan obesiti morbid. Data mengenai ciri sosio-demografi, toleransi makanan, status pemakanan dan HRQOL dikumpulkan dan dinilai sebelum pembedahan, satu bulan dan tiga bulan selepas pembedahan bariatrik. Toleransi makanan dinilai menggunakan soal selidik alimentasi yang disahkan. Pengukuran antropometri merangkumi indeks jisim tubuh (IJT) dan peratus penurunan berat badan berlebihan (EWL), dan penilaian diet dikumpulkan dengan menggunakan ingatan diet 24-jam untuk tiga hari. HRQOL dinilai menggunakan soal selidik World Health Organization Quality of Life-BREF (WHOQOL-BREF). Data dikumpulkan di klinik pembedahan pesakit luar (SOPD), Hospital Kuala Lumpur, Malaysia.

Kajian ini melibatkan seramai 90 pesakit obesiti morbid yang menjalani pembedahan bariatrik pada akhirnya dengan kadar respons sebanyak 100%. Terdapat 62 pesakit perempuan (68.9%) dan 28 lelaki (31.1%) dengan 50%

pesakit berumur kurang dari 40 tahun. EWL satu bulan dan tiga bulan selepas pembedahan adalah 14.1% dan 31.6%. Terdapat penurunan yang signifikan dalam jumlah skor toleransi makanan dari 26.4 (SD = 0.8) sebelum pembedahan ke 17.7 (SD = 4.7) pada satu bulan selepas pembedahan bariatrik tetapi peningkatan skor ke 21.7 (SD = 4.3) pada tiga bulan selepas pembedahan. Pengambilan makanan menunjukkan pengurangan jumlah tenaga dari 1842 kal (SD = 445) sebelum pembedahan ke 570 kal (SD = 180) satu bulan dan peningkatan jumlah tenaga ke 731 kal (SD = 185) tiga bulan selepas pembedahan bariatrik. Pesakit kajian ini menunjukkan peningkatan skor HRQOL secara signifikan dalam aspek kesihatan fizikal ($t = -7.253$, $p = <0.001$), psikologi ($t = -7.692$, $p <0.001$), hubungan sosial ($t = -5.767$, $p <0.001$) dan persekitaran ($t = -4.208$, $p <0.013$) tiga bulan selepas pembedahan bariatrik.

Sebagai kesimpulan, kajian ini menunjukkan bahawa pembedahan bariatrik berkesan dalam pengurangan berat badan dan peningkatan skor domain HRQOL secara keseluruhan dalam kalangan pesakit dengan obesiti morbid walaupun dengan penurunan toleransi makanan dan pengambilan makanan selepas pembedahan bariatrik. Kajian jangka panjang atau percubaan terkawal secara rawak dengan ukuran sampel yang lebih besar adalah dicadangkan untuk menentukan mekanisme sebab dan akibat antara toleransi makanan, pengurangan berat badan, status pemakanan, HRQOL dan pembedahan bariatrik di Malaysia.

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This thesis was submitted to the Senate of Universiti Putra Malaysia and has been accepted as fulfilment of the requirement for the degree of Master of Science. The members of the Supervisory Committee were as follows:

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVIATIONS

AGB	Adjustable Gastric Banding
AACE	American Association of Clinical Endocrinologists
APMBSS	Asia-Pacific Metabolic and Bariatric Surgery Society
ASMBS	The American Society for Metabolic and Bariatric Surgery
BMI	Body Mass Index
BPD	Billiopancreatic Diversion
EWL	Excess weight loss
IBW	Ideal Body Weight
IDF	International Diabetes Federation
MGB	Mini Gastric Bypass
NCD	Non-Communicable Diseases
NHMS	National Health and Morbidity Survey
NIH	National Institutes of Health
NMRR	National Medical Research Register
HRQOL	Health-Related Quality of Life
RYGB	Roux-en-Y Gastric Bypass
SD	Standard Deviations
SE	Standard Error
SOPD	Surgical Outpatient Department
SF-36	36-Item Short-Form Health Survey
SPSS	Statistical Package for Social Sciences
T2DM	Type 2 Diabetes Mellitus
WHO	World Health Organization
WHOQOL-100	World Health Organization Quality of Life

WHOQOL-BREF	Short Version of World Health Organization Quality of Life
VBG	Vertical Banded Gastroplasty

CHAPTER 1

INTRODUCTION

1.1 Background

Obesity is a metabolic disorder that has gradually become a prevalent public health concern in developed and developing countries, including Malaysia. It is usually classified by body mass index (BMI) where obesity and morbid obesity for Asian population is defined as BMI ≥ 27.5 kg/m^2 and BMI ≥ 37.5 kg/m^2, respectively (WHO expert consultation, 2004). In the year 2016, more than 1.9 billion (39%) adults age 18 years and older, were overweight and of these over 650 million (13%) were obese (WHO, 2020a). In Malaysia, the country is declared the most obese nation in South East Asia and possibly Asia by the Global Burden of Disease Study with 48.3% men and 48.6% women identified as either overweight or obese (Ng et al., 2014). The 2019 National Health and Morbidity Survey (NHMS) has also shown a significant rise in the prevalence of obesity from 4.4% to 19.7% in just a short span of two decades (Institute for Public Health, 2020).

Obesity is associated with life-threatening comorbidities, including type 2 diabetes mellitus (T2DM), cardiovascular disease, and cancer, decrease health-related quality of life (HRQOL) and life expectancy (Kritchevsky et al., 2015; Warkentin et al., 2014; WHO, 2020a). Obesity-related non-communicable diseases (NCD) such as T2DM, cardiovascular disease, cancers, respiratory problems, and gallbladder diseases, is found to be the major determinant of approximately 73% of total death in Malaysia (Institute for Public Health, 2015). The various treatments for obesity include lifestyle intervention programs with diet therapy, behaviour modification, exercise programs, and pharmacotherapy (Kritchevsky et al., 2015; Malaysian Dietitian's Association, 2013; Mechanick et al., 2019).

Losing 5-10% excess weight through conventional lifestyle intervention of diet, physical activity and behavioural modification leads to an improvement in obesity-related conditions and decreased mortality rates (Kritchevsky et al., 2015; Malaysian Dietitian's Association, 2013; Ryan & Yockey, 2017). A meta-analysis of the randomized controlled trial looked into the effect of intentional weight loss, and mortality found an approximately 15% reduction in all-cause mortality with obese adults who intentionally lose weight (Kritchevsky et al., 2015). Unfortunately, the conventional lifestyle intervention method that includes dietary changes and increased physical activity often result in insufficient weight loss, minor clinical improvement in HRQOL, and weight loss maintenance is usually inadequate for individuals with morbid obesity (Warkentin et al., 2014).

On the other hand, bariatric surgeries are presently the most effective treatment for patients suffering from morbid obesity (Gloy et al., 2013; Lee & Wang, 2005; Mechanick et al., 2019). Morbid obesity indication for bariatric surgery according to the 2005 Asia-Pacific Bariatric Surgeons Group consensus statement is BMI ≥ 37 kg/m^2 or BMI 32.5 kg/m^2 with T2DM or two other obesity-related comorbidities (Godoy et al., 2012; Kasama et al., 2012). The surgical intervention is classified into three primary forms: the restrictive, malabsorptive and combination of both restrictive and malabsorptive procedures (Mechanick et al., 2019). The restrictive surgery includes the sleeve gastrectomy (SG), adjustable gastric banding (AGB), and vertical banded gastroplasty (VBG); the malabsorptive surgery includes the biliopancreatic diversion (BPD) and BPD with a duodenal switch; and finally, the Roux-en-Y Gastric Bypass (RYGB) as the restrictive-malabsorptive procedures (Chang et al., 2014).

Patients with morbid obesity who underwent bariatric surgery are expected to have an improved result as early as one month after surgery and stabilized three months after surgery (Buzgova et al., 2014; Chang et al., 2010b; Julia et al., 2013; Subramaniam et al., 2018). The prospective study by Subramaniam et al. (2018) among 57 Malaysian patients with obesity that underwent bariatric surgery noted a total EWL percentage of 40.5% three months and 63.3% six months after surgery. It was also expected to have a 29% to 87% of excess weight loss in one to two years following surgery depending on the surgical procedure and an 89% reduction of all-cause mortality (Gloy et al., 2013; Kang & Le, 2017; Mechanick et al., 2020). Bariatric surgery not only could prolong weight loss and reduces obesity-associated comorbidities and mortality; it also contributes to the improvement of HRQOL among the patients with morbid obesity (Buzgova et al., 2014; Julia et al., 2013; Kim & Kim, 2016; Lee et al., 2011). However, despite the benefits, bariatric surgery is not without challenge.

The change in anatomy and physiology of the gastrointestinal structure after bariatric surgery may cause food intolerance (Godoy et al., 2012; Overs et al., 2012). Food intolerance is characterized as inadequate digestive ability with digestive symptoms such as nausea, regurgitation, vomiting and abdominal distention (Aills et al., 2008; Moreira et al., 2015; Overs et al., 2012). It can be assessed with the validated “Quality of Alimentation” questionnaire by Suter et al. (2007). Good food tolerance is defined as the ability to eat a variety of foods with minimal regurgitation/vomiting. However, persisting food intolerance causes nutritional deficiencies in long-term, extreme dietary changes, and abdominal pain and weakness caused by vomiting (Bloomberg et al., 2005; Moizé et al., 2011; Overs et al., 2012).

There is much evidence of the safety and effects of bariatric surgery. However, it is still unclear on the diet, food intolerance, and HRQOL at one and three months after surgery. The recent Asia-Pacific Metabolic and Bariatric Surgery Society (APMBSS) congress has also highlighted the concern over the lack of awareness and comprehension among the physicians and public on bariatric surgery in Asia-Pacific regions despite the rapid rise of bariatric surgery (Ohta et al., 2019). Therefore, it is especially crucial to have local studies looking at the

effects of bariatric surgery on food tolerance, nutritional status, and HRQOL among patients with morbid obesity.

1.2 Problem Statement

Bariatric surgery has been proven beneficial for patients with morbid obesity and obesity-related comorbidities (Gloy et al., 2013; Kang & Le, 2017; Rajan et al., 2020). Although there is an exponential increase in bariatric procedures performed over the years, research in bariatric surgery is still at its infancy stage, especially in Malaysia (Lee et al., 2001). There are a total of nine research studies done in Malaysia with a majority of the study being a single-centered, observational study looking at the effects of bariatric surgery on weight changes, complications, and obese-related comorbidities such as T2DM and obstructive sleep apnea (Loo et al., 2020; Nor Hanipah et al., 2019; Mohd Nasir et al., 2020; Pok et al., 2016; Rajan et al., 2020; Tan et al., 2019). Other than that, some studies evaluate the predicting factors of weight loss and a cross-sectional study on the relationship between nutrition intake and weight loss after bariatric surgery (Mazri et al., 2019; Subramaniam et al., 2018; Vanoh et al., 2015). However, few of these studies determined the effects of bariatric surgery on food tolerance, nutritional intake and HRQOL.

Food intolerance is identified as one of the complications commonly observed after bariatric surgery, but limited studies evaluate early phase (one to three months) food intolerance after surgery (Godoy et al., 2012; Overs et al., 2012; Stumpf et al., 2015). This may be due to the conventional dietary protocol that suggests a liquid diet for at least one to three months after surgery. Only solid foods are introduced depending on hospital protocols and patients' tolerance (Aills et al., 2008; Leahy & Luning, 2015). The introduction to solid food at any time point after surgery with the lack of compliance to follow new recommended eating behaviour will trigger regurgitation and vomiting, causing food intolerance (Cano-Valderrama et al., 2017; Godoy et al., 2012; Stumpf et al., 2015). In Hospital Kuala Lumpur, the dietary protocol allows solid food as early as two weeks after bariatric surgery. This early introduction to solid food has been the standard of practice for all bariatric surgery patients since 2012. There was no indication of any adverse event, according to the surgeon, until now.

A systematic review evaluated 14 studies that used the validated "Quality of Alimentation" questionnaire by Suter et al. (2007) to assess food tolerance after bariatric surgery (Stumpf et al., 2015). This review found that food tolerance was observed three months after surgery, with the lowest food tolerance score identified at three to six months after bariatric surgery (Stumpf et al., 2015). However, a retrospective study among 936 patients found that early progression to solid food at 12 hours after surgery was feasibility, but food tolerance in this study was not assessed using the quality of alimentation questionnaire (Theunissen et al., 2016). Despite food tolerance after bariatric surgery has been evaluated in other countries like Switzerland, Israel, Belgium, Spain, Australia, Brazil, Greece, Venezuela, and the Netherlands, no study has been done in

Malaysia (Stumpf et al., 2015; Theunissen et al., 2016). Hence, this study desires to determine the effect of bariatric surgery on food tolerance as early as one month after surgery in Malaysia.

Nutrition deficiency caused by the decrease in food consumption, intestinal malabsorption, and food intolerance after a bariatric procedure is another common concern after surgery (Bloomberg et al., 2005; Moizé et al., 2011; Shankar et al., 2010; Stumpf et al., 2015). The daily energy intake three months after bariatric surgery is approximately 700 kcal and increased to 918 kcal 12 months after surgery (Gjessing et al., 2013). However, a single centred cross-sectional study done among 43 Malaysian patients found that the mean energy and protein intake was only 562 ± 310 kcal and 29.6 ± 16.1 g per day three months after bariatric surgery (Vanoh et al., 2015). The value difference in both research studies triggers the interest in finding out the total energy and macronutrient intake patients can tolerate daily with an early introduction to solid food one month after bariatric surgery. Hence the desire to include nutritional status (anthropometry measurement and dietary intake) as part of the parameter of this study.

Bariatric surgery is also known to show significant improvement to the HRQOL of morbidly obese patients as early as three months after surgery (Brunault et al., 2011; Buzgova et al., 2014; Chang et al., 2010b; Julia et al., 2013; Kim & Kim, 2016; Lee et al., 2011). The 36-Item Short-Form Health Survey (SF-36), and impact of weight on QoL (IWQoL)-Lite measure are questionnaires commonly used to assess HRQOL after bariatric surgery, but little study uses the Short Version of World Health Organization Quality of Life (WHOQOL-BREF) questionnaire (Raaijmakers et al., 2017). To date, there are only two studies from Taiwan and one study from the Czech Republic that uses the WHOQOL-BREF questionnaire to assess HRQOL after bariatric surgery (Buzgova et al., 2014; Chang et al., 2010a; Chang et al., 2010b). Therefore, this study hopes to use the WHOQOL-BREF questionnaire, which covers more domains than other HRQOL questionnaires, to assess the HRQOL among patients before and after bariatric surgery.

In summary, bariatric surgery not only affects food tolerance, but the discomfort, extreme dietary modification and social isolation due to dietary restriction also affect the nutritional status and HRQOL (Overs et al., 2012; Schweiger et al., 2010). To date, no study evaluates all three of the parameters together (Chang et al., 2010a; Gjessing et al., 2013; Theunissen et al., 2016; Stumpf et al., 2015; Vanoh et al., 2015). Therefore, with the constant rise of bariatric procedures in Malaysia, this study was aimed to evaluate the food tolerance, nutritional status, and HRQOL among patients with morbid obesity after bariatric surgery who underwent bariatric surgery in Hospital Kuala Lumpur, Malaysia.

1.3 Study Significance

All first letters of principal words are capitalised and the subheading is left justified. Research concerning the effectiveness of bariatric surgery in the South East Asian country is sparse. As bariatric surgery is becoming widely accepted as an obesity treatment in this multi-ethnic country, it is crucial to further the body research in this region to better understand how bariatric surgery affects patients' lives after this elective procedure to treat morbid obesity.

This investigation provides insight to the practicing healthcare professionals specializing in bariatric care to improve the postoperative management after bariatric surgery in Malaysia. Research has shown the importance of active attendance to clinic follow-up sessions after bariatric surgery to ensure better weight loss progress, food tolerance, and HRQOL hence the need for this research (Hachem & Brennan, 2016). This knowledge could also provide additional insight into recommended dietary habits and identify structured or prescribed methods of supporting long-term weight loss success and HRQOL of patients with morbid obesity after bariatric surgery.

This study aims to examine the effects of bariatric surgery on food tolerance, nutritional status (anthropometry measurement and dietary intake) and HRQOL in patients with morbid obesity who underwent bariatric surgery in Hospital Kuala Lumpur, Malaysia. Hospital Kuala Lumpur is one of the largest public hospitals in Malaysia, and since 2012, bariatric surgery has been a treatment option for patients with morbid obesity ("Hospital Kuala Lumpur," n.d.). However, to our knowledge, this is the first study to examine such parameters in the South East Asian region. Hence, we believe a study conducted in this hospital will provide further insight for future research on bariatric surgery trends in the area.

1.4 Research Questions

This study addressed the following research questions:

1. What is the before and after effect of bariatric surgery on food tolerance among patients with morbid obesity in Hospital Kuala Lumpur?
2. What is the changes in weight loss among patients with morbid obesity before and after bariatric surgery in Hospital Kuala Lumpur?
3. What is the changes on dietary intake among patients with morbid obesity before and after bariatric surgery in Hospital Kuala Lumpur?
4. What is the before and after effect of bariatric surgery on health-related quality of life among patients with morbid obesity in Hospital Kuala Lumpur?

1.5 Objectives

The general objective of this study is to determine the food tolerance, nutritional status, and health-related quality of life of patients with morbid obesity after bariatric surgery in Hospital Kuala Lumpur, Malaysia.

1.5.1 Specific Objectives

1. To determine the socio-demographic characteristic (age, gender, ethnicity, marital status, employment, education level, family history, smoking status and alcohol consumption, comorbidities), food tolerance, nutritional status, and health-related quality of life among patients with morbid obesity at baseline.
2. To determine the food tolerance at baseline, one month and three months among patients with morbid obesity after bariatric surgery.
3. To determine the nutritional status (anthropometry measurement, dietary intake) at baseline, one month and three months among patients with morbid obesity after bariatric surgery.
4. To determine the health-related quality of life at baseline and three months among patients with morbid obesity after bariatric surgery.

1.6 Hypothesis

1.6.1 Null Hypothesis

1. There was no significant change of bariatric surgery on food tolerance among patients with morbid obesity at baseline, one month and three months after surgery in Hospital Kuala Lumpur.
2. There was no significant change of bariatric surgery on nutritional status among patients with morbid obesity at baseline, one month and three months after surgery in Hospital Kuala Lumpur.
3. There was no significant change of bariatric surgery on health-related quality of life among patients with morbid obesity at baseline and three months after surgery in Hospital Kuala Lumpur.

1.7 Conceptual Framework

Figure 1.1 shows a comprehensive overview of the conceptual framework of the present study. This study assessed, measured, and recorded socio-demographic, food tolerance, nutritional status (anthropometry measurement and dietary intake) and HRQOL. The research aimed to determine the relationship between the independent and dependent variables among patients

with morbid obesity that underwent bariatric surgery in Hospital Kuala Lumpur, Malaysia.

The dependent variable includes food tolerance, nutritional status, and HRQOL. The effect of bariatric surgery on food tolerance was assessed with the quality of alimentation questionnaire. The BMI, percent EWL and 24-hour food record were used to measure the nutritional status variable, which comprises anthropometry measurements and dietary intake assessment. For the HRQOL variable, WHOQOL-BREF score with parameters on physical health, psychological, social relationship and the environment was used. The food tolerance and nutritional status were censored at baseline, one month and three months after bariatric surgery, whereas the HRQOL was censored at baseline and three months after surgery. At baseline, the socio-demographic characteristics included age, gender, ethnicity, marital status, employment, education level, family history, smoking status, alcohol consumption and comorbidities were assessed. Finally, bariatric surgery is the independent variable of this study.

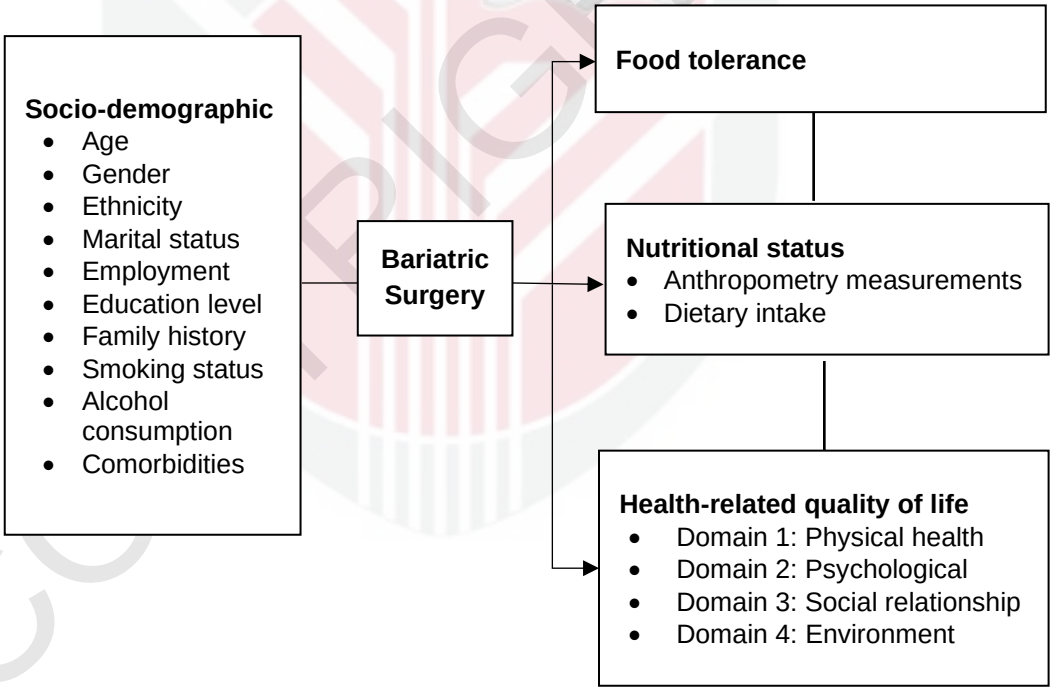

Figure 1.1 : Conceptual framework of study variables

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