Asian Journal of Surgery 44 (2021) 303–306

Contents lists available at ScienceDirect

Asian Journal of Surgery

journal homepage: www.e-asianjournalsurgery.com

Original Article

Bariatric Surgery in Vegetarians: Asia-Pacific Metabolic and Bariatric Surgery Society (APMBSS) survey of Asian surgeon experience

Daniel Leonard Chan [a, b, c], Prudence Tai-Huen Tam [a], Ingrid YM. Kan [a], Simon Kin-Hung Wong [a], Enders Kwok-Wai Ng [a, *]

[a] Division of Upper Gastrointestinal & Metabolic Surgery, Department of Surgery, Faculty of Medicine, The Chinese University of Hong Kong, Hong Kong, China
[b] School of Medicine, Western Sydney University, Sydney, New South Wales, Australia
[c] Faculty of Medicine, The University of New South Wales, Sydney, New South Wales, Australia

ARTICLE INFO

Article history:
Received 18 May 2020
Received in revised form
23 June 2020
Accepted 12 July 2020
Available online 14 August 2020

Keywords:
Bariatric surgery
Dietary supplements
Micronutrients
Vegetarian
Surveys and questionnaires

ABSTRACT

Purpose: Bariatric and metabolic surgery is increasing in Asia to address the growing obesity epidemic. Literature is scarce regarding this surgery in vegetarian patients. We aim to survey surgeons regarding their practices and experiences with the vegetarian population.

Materials and methods: The regional bariatric and metabolic surgery society distributed a multi-national electronic questionnaire to surgeon members. The questionnaire was in the English and Chinese languages.

Results: Fifty-six bariatric and metabolic surgeons responded to the questionnaire (response rate 40.6%). Twenty-two respondents (48.9%) have vegetarian patients in their case volume. Patients mostly consume a vegetarian diet for religious (66.7%) and health (66.7%) reasons. More than 60% of surgeons are unsure of micronutrient deficiency status amongst these patients. Over half of the respondents (58.8%) reported that their vegetarian patients do not take multivitamins or vitamin supplements. Significant proportions of respondents (44.4–61.1%) were unsure of the iron, vitamin B12, vitamin D, zinc, and folic acid deficiency status of these patients. Only 38.9% of respondents routinely prescribe multivitamin supplementation.

Conclusions: Vegetarian bariatric patients in East and South-East Asia are an under-recognized patient cohort at risk of micronutrient deficiencies. There is a knowledge gap among regional surgeons in long-term nutritional assessment and management.

1. Introduction

The prevalence of obesity continues to increase internationally, with nearly a third of the world's population now classified as overweight or obese.[1] Increasing urbanization over the past two decades has promoted a sedentary lifestyle and overnutrition, which has fueled the prevalence of obesity in Asia. Previously considered a problem of Western countries, Asia now has a non-alcoholic fatty liver disease (NAFLD) prevalence of around 25%.[2] Associated conditions such as type 2-diabetes mellitus, cardiovascular disease, and obstructive sleep apnea contribute to a significant burden of obesity-related morbidity and mortality.

Bariatric and metabolic surgery results in long-term weight loss, improvements in diabetes mellitus and other obesity-associated co-morbidities, and decreased overall mortality.[3,4] Taiwan performed the first bariatric surgery in Asia in 1981, with many countries in the region soon following.[5] It has been reassuring the see the significant results in studies with mainly Caucasian populations broadly reflected in the regional literature with Asian patients.[5,6] However, differences remain, including Asians being more prone to develop diabetes mellitus with the same body mass index (BMI) values as Caucasian patients. Regional consensus for a lower BMI threshold by 3 kg/m^2 for the indication of bariatric surgery has existed since 2005.[5] Regional access to bariatric surgery has also shown steady progress through governmental and social support.[7,8]

* Corresponding author. Department of Surgery, Prince of Wales Hospital, The Chinese University of Hong Kong, 30-32, Ngan Shing Street, Shatin, New Territories, Hong Kong.
E-mail address: endersng@surgery.cuhk.edu.hk (E.K.-W. Ng).

https://doi.org/10.1016/j.asjsur.2020.07.016

The Academy of Nutrition and Dietetics position states a vegetarian diet will have a reduced risk of cardiovascular disease and obesity due to a low intake of saturated fat and a high intake of vegetables, fruits, and soy products.[9] However, recent South Asian evidence suggests vegetarian dietary patterns are associated with an increased incidence of morbid obesity due to refined and processed food consumption.[10] Deficiencies in vitamin B12 and other micronutrients resulting in anemia are well recognized and reported in up to 80% of Vegans in Hong Kong (China) and India.[11,12] This population is also unlikely to consume supplements or fortified foods.

Literature is scarce among vegetarian bariatric surgery patients in the Asian region. We aim to survey surgeons regarding their practices and experiences with the vegetarian population.

2. Methods

The Asia Pacific Metabolic and Bariatric Surgery Society (APMBSS) initiated a multi-national electronic questionnaire to investigate the prevalence of vegetarianism in bariatric and metabolic surgery patients. The society distributed the online questionnaire in January 2019 to the Asian region bariatric and metabolic surgeons. The 20-question survey (Appendix 1) comprised of two parts: A - General information of the respondent's practice, and B – Demographics of the vegetarian population of respondent's practice. Questions had a range of possible answers, with the option to provide additional comments and answers.

Patients with a vegetarian diet were in four categories. Type 1 - vegan, abstains from eating any animal products. Type 2 - lacto-vegetarian, abstains from any animal products except dairy products. Type 3 – ovo-vegetarian, abstains from animal products except for eggs. Type 4 – lacto-ovo-vegetarian, socially referred to as vegetarian, those that do not eat animal flesh/meat but still consume dairy and eggs.

The inclusion criteria were full-members, surgeons of APMBSS. Exclusion criteria were declining the invitation to participate in the survey and surveys with incomplete data. To improve the response rate, the questionnaire was in the English and Chinese languages. All respondents and facilities were de-identified. Apart from distribution and explaining the purpose of the questionnaire, APMBSS made no comment or expression of any opinion that might influence respondents. Responses were tabulated and presented in the form of the number of respondents (percentage of responses for that question). The response rate was calculated as the number of respondents/number of eligible respondents.

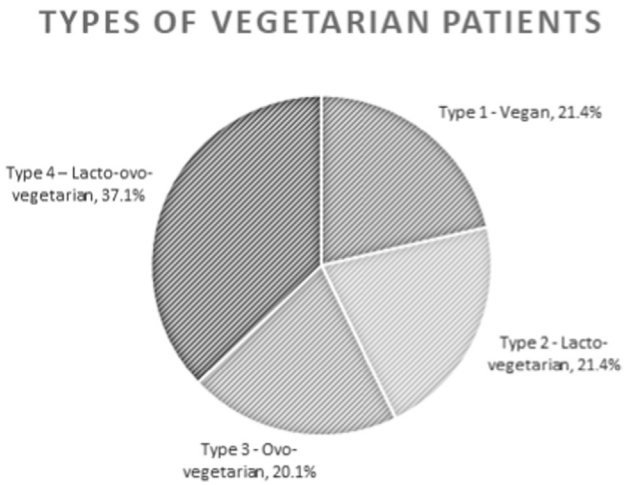

Fig. 1. Types of vegetarian patients.

3. Results

Fifty-six surgeons participated in the questionnaire. At the time of distribution, APMBSS had 138 eligible surgeon members. This provided a response rate of 40.6%. Ten incomplete surveys with insufficient data were excluded.

3.1. Characteristics of respondents

The majority of respondents (36, 80%) worked at a public hospital facility and nine (20%) from a private hospital facility. The distribution of respondents was 21 (46.7%) from China, 15 (33.3%) from Hong Kong (China), three (6.6%) from Japan, two (4.4%) from Taiwan, and one (2.2%) each from Korea, Malaysia, Singapore and Brunei. There were no respondents from Indonesia, Iran, India, Philippines, or Thailand.

Twenty-six respondents (57.8%) had a high case volume practice of >100 cases annually. Of those, 15 (33.3%) had 101-200 cases annually. Four surgeons (8.9%) reported a case volume of >501 annually. Nineteen respondents (42.2%) had a case volume of ≤100 cases annually.

3.2. Characteristics of vegetarian patients

Almost half of the respondents (22, 48.9%) noticed vegetarian patients (all types) in their case volume. The majority of respondents (38, 84%) noted a vegetarian prevalence of 0.1–5%. Only three respondents (6.7%) from China[2] and Hong Kong SAR[1] reported a vegetarian prevalence of 5.1–10% in their case volume. Twenty-three respondents (51.1%) reported there to be no vegetarian patients within their cases.

More respondents (30, 66.7%) identified vegetarian patients were more likely female. Twenty (44.4%) respondents estimated the female proportion to be 76–100%. Respondents estimated the makeup of vegetarian patients to be mainly Type 4 – Lacto-Ovo-Vegetarian (13, 37.1%), followed by both Type 1 – Vegan and Type 2 – Lacto-Vegetarian (8, 22.8% each) and Type 3 – Ovo-Vegetarian (7, 20.1%) (Fig. 1).

Patients mainly consumed a vegetarian (any type) for religious and or health (20, 66.7%) reasons. Other reasons included ethical (3, 10%) and environmental (2, 6.7%) concerns. Respondents reported a range of average duration that patients had consumed a vegetarian diet, from 0-1 year (3, 17.6%), 1–5 years (6, 35.3%), 5–10 years (3, 17.6%) to >10 years (1, 5.8%). Some respondents (4, 23.5%) were unsure of the average duration. The majority (13, 76.5%) reported patients would continue their vegetarian diet post-operatively.

3.3. Vitamin and mineral deficiencies and supplementation

Almost 60% (n = 10) of respondents were unsure of the micronutrient deficiency status among their vegetarian population. The majority of respondents (8, 53.3%) reported their vegetarian patients either did not consume multivitamins/vitamin supplements or that they were unsure of the supplement status. Of those respondents (7, 41.2%) that reported dietary supplementation, it was at 50–80% of patients. Of the 17.6% (n = 3) of respondents that noted mineral deficiency, a range of Iron (10–50%) and Folic acid (5–60%) deficiency was noted. Respondents were unsure of Iron (8, 47.1%), Vitamin B12 (10, 58.8%), Vitamin D (10, 58.8%), Zinc (11, 64.7%) and Folic acid (10, 58.8%) deficiency status of these patients (Fig. 2). Only 38.9% of respondents routinely prescribe multivitamin supplementation.

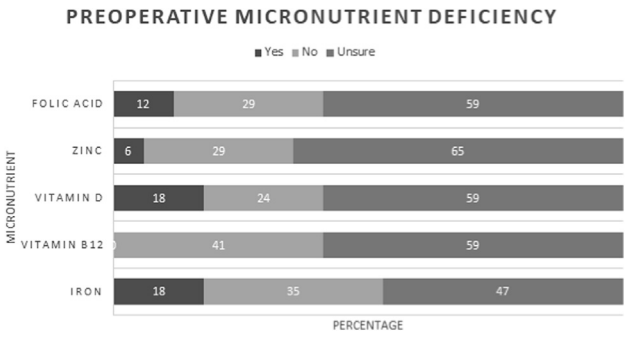

Fig. 2. Preoperative micronutrient deficiency.

4. Discussion

The worldwide prevalence of obesity nearly tripled between 1975 and 2016, fueled by trends of sedentary lifestyle and overnutrition in urban society.[1] With the economic and social development in Asia in the past decades, the prevalence of obesity in Asia has risen to a high level. It is estimated about 1 billion people in Asia and the Pacific are overweight or obese, with corresponding increases in obesity-associated co-morbidities.[2] Vegetarian diets are prevalent among Asian countries due to various religious and cultural reasons. Conventionally considered healthy diets, a cohort study of 235 Asian Indian patients has discredited this myth, with findings of increased refined and processed food consumption.[10] All types of vegetarian diets are associated with micronutrient deficiencies. The compounding risk of a vegetarian diet in bariatric surgery candidates, the East and South-East Asian surgeon experience, and specific micronutrients are discussed.

Although the risk of micronutrient deficiencies following bariatric and metabolic surgery is well recognized, the prevalence of preoperative deficiencies are less so.[13,14] A cross-sectional study of nutritional deficiencies among candidates for bariatric and metabolic surgery with NAFLD, noted below dietary reference intake recommendations for iron, calcium, folic acid, vitamin B12, and vitamin B1 in (14–58%) of patients.[15] Serum vitamin D deficiency was found in 22% of this cohort. A Chilean cohort study of 103 preoperative bariatric patients had prevalent deficiencies in iron (12.6%), ferritin (8.7%), calcium (3.3%), and zinc (2.9%).[16] Another review noted, preoperative bariatric surgery candidates had serum deficiencies in vitamin B1 (15–29%), vitamin B12 (10–13%), and iron (9–16%).[17] It is reasonable to assume in a patient cohort with the combination of a vegetarian diet and morbid obesity indicating bariatric surgery would exacerbate poor dietary micronutrient intake and resulting serum deficiencies.

There is a paucity of literature concerning the vegetarian bariatric population in Asia. There is a risk of overlooking this at-risk population is real. Though rare, mortality from severe protein malnutrition and resulting in liver failure in a vegetarian patient has been reported.[18] Our survey reflects the current experience of bariatric surgeons in the East and South-East Asian regions. About half (48.9%) of surgeons reported being aware of vegetarian patients in their bariatric case volume. Furthermore, only a minority of surgeons (38.9%) reported the routine prescription of multivitamin supplements for this patient cohort. Our study shows suboptimal awareness of micronutrient and mineral deficiencies in vegetarian bariatric patients among Asian surgeons (Fig. 2). Consumption of a vegetarian diet should be elicited initial assessment for bariatric surgery in countries where this is prevalent. Preoperative and postoperative investigation for deficiencies and appropriate supplementation in imperative for this at-risk patient group.

Vitamin B12 is a water-soluble vitamin naturally found in animal products such as fish, poultry, meat, eggs, milk, and dairy products and is not present in plant food. Therefore, vegetarians are of high risk of having vitamin B12 deficiency. A systematic review of the prevalence of vitamin B12 deficiency among vegetarians using serum levels found that vitamin B12 deficiency was noted in up to 86.5% of vegan patients.[19] Of note, the one study reporting 0% deficiency rate was in vegan subjects consuming vitamin B12-fortified foods. The combined prevalence of vitamin B12 deficiency for lacto-vegetarians, ovo-vegetarians, lacto-ovo-vegetarians, and vegans was reported as up to 81% in this same review. These results show that vitamin B12 deficiency is common in vegetarians but improves with dietary supplementation.

Iron deficiency affects an estimated 2 billion people worldwide and is a leading risk factor of morbidity and mortality.[20] Vegetarians are also at risk of iron deficiency given their lower total dietary intake of iron and the lower bioavailability of iron from plant food. A retrospective review on iron status and dietary iron intake in vegetarians showed that female vegetarians, female vegans, and male vegans have lower serum ferritin levels and high transferrin levels, meaning lower iron storage than subjects taking normal diet.[21] Additionally, obese patients frequently have iron deficiency, which bariatric surgery exacerbates. A systematic review of iron deficiency anaemia following sleeve gastrectomy and gastric bypass found the prevalence was 15.2% preoperatively and 16.6% postoperatively.[22] Another cross-sectional study of vegetarian bariatric surgery patients in Israel found no significant differences in nutritional deficiencies. Preoperative use of vitamin B12 and iron supplementation was at much higher rates among vegetarian patients than omnivores (57.1 vs. 6.7%, $p < 0.001$ and 23.8 vs. 6.7%, $P = 0.015$, respectively).[23] In addition to prescribed supplementation, plants bio-fortified in iron and plant ferritin continues to develop as a non-animal iron sources.[24,25]

Zinc is present in a variety of plant and animal food including red meat, shellfish, legumes, seeds, and whole grains. However, the bioavailability of zinc from plant food is lower due to the presence of phytic acid in legumes, nuts, and seeds, which inhibits zinc absorption.[26] A review in Switzerland has shown that zinc deficiency is more prevalent in vegan and vegetarian subjects. In a study of vegetarian and vegan adults in Switzerland, zinc deficiency prevalence was noted in 18.9% of vegetarians and 47.2% of vegans.[27]

Unfortunately, from the result of this survey, the awareness of micronutrient deficiency in vegetarian patients is low amongst Asian surgeons. More than 60% of respondents unsure of their vegetarian patients had micronutrient deficiency before surgery and the majority of patients do not have supplements after the surgery. Although we do not have information on the type of procedures these vegetarian patients undertook, micronutrient supplements should be recommended in all bariatric patients. As the procedural trend amongst these patients should reflect the broader Asian experience, the majority of procedures performed are likely laparoscopic sleeve gastrectomy and gastric bypass.[28] The preferred operation for vegetarian patients was not specifically addressed in the questionnaire. Whether patient dietary preference changed the surgeons' choice of operation towards restrictive, rather than malabsorptive surgery is unknown. Additionally, the awareness of micronutrient deficiency in non-vegetarian patients was not addressed, which is a potential bias of the study.

The subjective nature of the questionnaire and responses based on surgeons' experience rather than direct patient data and serum micronutrient levels is a limitation. This study represents the perspectives of surgeons, rather than patient experience. Moreover, lack of respondent from India, Indonesia, Iran, and Malaysia where the vegetarian population is high, which make this study mainly represent East-Asian population, rather than the entire

Asia–Pacific region. However, APMBSS supported and distributed this questionnaire and with a high response rate (40.6%), this captures the regional surgeon experience. This supports the development of the literature on Asian vegetarian bariatric patients.

5. Conclusion

Despite the compounded risk of vegetarian bariatric surgery patients, current literature on micronutrient deficiency in this cohort is scarce, particularly in East and South-East Asian. There a knowledge gap among regional surgeons in long-term nutritional assessment and management.

Declaration of competing interest

The authors have no conflicts of interest to declare.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.asjsur.2020.07.016.

References

1. Chooi YC, Ding C, Magkos F. The epidemiology of obesity. *Metabolism*. 2019;92:6–10.
2. Fan JG, Kim SU, Wong VW. New trends on obesity and NAFLD in Asia. *J Hepatol*. 2017;67(4):862–873.
3. Sjostrom L, Peltonen M, Jacobson P, et al. Bariatric surgery and long-term cardiovascular events. *JAMA*. 2012;307(1):56–65.
4. Sjostrom L, Narbro K, Sjostrom CD, et al. Effects of bariatric surgery on mortality in Swedish obese subjects. *N Engl J Med*. 2007;357(8):741–752.
5. Lee WJ, Wang W. Bariatric surgery: Asia-Pacific perspective. *Obes Surg*. 2005;15(6):751–757.
6. Wong SK, Kong AP, Mui WL, et al. Laparoscopic bariatric surgery: a five-year review. *Hong Kong Med J*. 2009;15(2):100–109.
7. Lim J, Cho YH, Yamamoto H, Eng A, Markovic T, Kim KK. Governmental or social support of bariatric surgery in the Asia-Pacific region. *J Obes Metab Syndr*. 2017;26(1):10–14.
8. Lee PC, Ganguly S, Tan HC, et al. Attitudes and perceptions of the general public on obesity and its treatment options in Singapore. *Obes Res Clin Pract*. 2019;13(4):404–407.
9. Melina V, Craig W, Levin S. Position of the Academy of nutrition and Dietetics: vegetarian diets. *J Acad Nutr Diet*. 2016;116(12):1970–1980.
10. Borude S. Which is a good diet-veg or non-veg? Faith-based vegetarianism for protection from obesity-a myth or actuality? *Obes Surg*. 2019;29(4):1276–1280.
11. Woo J. Nutrition and health issues in the general Hong Kong population. *Hong Kong Med J*. 1998;4(4):383–388.
12. Woo KS, Kwok TC, Celermajer DS. Vegan diet, subnormal vitamin B-12 status and cardiovascular health. *Nutrients*. 2014;6(8):3259–3273.
13. Shah M, Simha V, Garg A. Review: long-term impact of bariatric surgery on body weight, comorbidities, and nutritional status. *J Clin Endocrinol Metab*. 2006;91(11):4223–4231.
14. Bloomberg RD, Fleishman A, Nalle JE, Herron DM, Kini S. Nutritional deficiencies following bariatric surgery: what have we learned? *Obes Surg*. 2005;15(2):145–154.
15. Sherf Dagan S, Zelber-Sagi S, Webb M, et al. Nutritional status prior to laparoscopic sleeve gastrectomy surgery. *Obes Surg*. 2016;26(9):2119–2126.
16. Sanchez A, Rojas P, Basfi-Fer K, et al. Micronutrient deficiencies in morbidly obese women prior to bariatric surgery. *Obes Surg*. 2016;26(2):361–368.
17. Frame-Peterson LA, Megill RD, Carobrese S, Schweitzer M. Nutrient deficiencies are common prior to bariatric surgery. *Nutr Clin Pract*. 2017;32(4):463–469.
18. Kermansaravi M, Abdolhosseini MR, Kabir A, Pazouki A. Severe hypoalbuminemia and steatohepatitis leading to death in a young vegetarian female, 8 months after mini gastric bypass: a case report. *Int J Surg Case Rep*. 2017;31:17–19.
19. Pawlak R, Lester SE, Babatunde T. The prevalence of cobalamin deficiency among vegetarians assessed by serum vitamin B12: a review of literature. *Eur J Clin Nutr*. 2014;68(5):541–548.
20. Zimmermann MB, Hurrell RF. Nutritional iron deficiency. *Lancet*. 2007;370(9586):511–520.
21. Haider LM, Schwingshackl L, Hoffmann G, Ekmekcioglu C. The effect of vegetarian diets on iron status in adults: a systematic review and meta-analysis. *Crit Rev Food Sci Nutr*. 2018;58(8):1359–1374.
22. Enani G, Bilgic E, Lebedeva E, Delisle M, Vergis A, Hardy K. The incidence of iron deficiency anemia post-Roux-en-Y gastric bypass and sleeve gastrectomy: a systematic review. *Surg Endosc*. 2020;34(7):3002–3010. https://doi.org/10.1007/s00464-019-07092-3.
23. Sherf-Dagan S, Hod K, Buch A, et al. Health and nutritional status of vegetarian candidates for bariatric surgery and practical recommendations. *Obes Surg*. 2018;28(1):152–160.
24. Zielinska-Dawidziak M. Plant ferritin–a source of iron to prevent its deficiency. *Nutrients*. 2015;7(2):1184–1201.
25. Lv C, Zhao G, Lonnerdal B. Bioavailability of iron from plant and animal ferritins. *J Nutr Biochem*. 2015;26(5):532–540.
26. Saunders AV, Craig WJ, Baines SK. Zinc and vegetarian diets. *Med J Aust*. 2013;199(S4):S17–S21.
27. Schupbach R, Wegmuller R, Berguerand C, Bui M, Herter-Aeberli I. Micronutrient status and intake in omnivores, vegetarians and vegans in Switzerland. *Eur J Nutr*. 2017;56(1):283–293.
28. Lomanto D, Lee WJ, Goel R, et al. Bariatric surgery in Asia in the last 5 years (2005-2009). *Obes Surg*. 2012;22(3):502–506.