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CONTENTS

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EDITORIAL

Can Clinical Skill Laboratories (CSLs) be Online?

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Clinical skill laboratories (CSLs) are integrated community, objective, and outcome-based learning processes that integrate basic knowledge with clinical skills. CSLs are hospital or medical school-based teaching which includes self-directed, student-centred and problem-based learning. CSLs can be taught in the procedural room, out-patient department, primary healthcare centre, casualty department, and simulation settings (Al-Elq, 2007). Experienced clinician, a small group of self-motivated students, cooperative patients, adequate and reliable instruments, enough time to practice, and a comfortable room with adequate ventilation are factors for effective CSLs (Ramani & Leinster, 2008). The teaching activities and learning can be face-to-face or blended learning, e-learning and online learning. Nowadays, blended and online learning is gaining more popularity. Blended learning combines face-to-face and online learning that supports creative, critical thinking skills (Garrison & Kanuka, 2004). Synchronous and asynchronous learning is the part of online learning where teachers use video and audio technologies (Gormley et al., 2009).

The world has changed a lot due to the pandemic of COVID-19. The education sector, especially skill-based education, faced difficulties during the pandemic. Universities had to run the programme, and all teaching modalities were converted online during that pandemic time. Faculty of Medicine and Health Sciences, Universiti Malaysia Sabah

was no exception, and CSLs for undergraduate students had to be conducted online. It was a great challenge for the lecturers and the students to adjust to these new strategies. Prior to the session, lecturers posted videos and PowerPoints to the online platform. During the day of the session, lecturers demonstrated the procedure online by synchronous learning methods. Students observed the skills and practised at home. The advantages of online CSL sessions during a pandemic were that the students could attend a session from any part of the country; the programme ran without interruption, engaged students throughout a session, and COVID-19 spread could be prevented among students, teachers, and simulated subjects. However, interruption of internet connections, inadequate internet coverage, failure to observe the steps of the procedure, unavailability of proper instruments, and absence of hands-on training were the main disadvantages of many more during the pandemic. Therefore, the Faculty arranged hands-on revision sessions to overcome these pitfalls and re-inforced the students' skills.

CSLs combine different theories and mixed teaching and learning methods and activities that can be implemented to achieve the teaching and learning goals. Early exposure to clinical skills for preclinical students gains attention to fulfil the aim. Therefore, the students can correlate their basic science knowledge with clinical skills (Sahu et al., 2019). In addition, CSLs motivate the students and increase their self-esteem and self-confidence. For the CSL session, teachers need to know the level of students (undergraduate/graduate), time allocation, and venue. They should prepare the lesson plan and learning objectives before the session. Gormley et al. (2009) researched blended clinical skill learning where students practised on simulation, virtual patients, actual patients, accessing the online videos, patient cases, and checklist for OSCE.

Harrmann-Werner et al. (2013) stated that for clinical skills teaching, the "Best practice" model (BPSL) is better for students' outcomes than a traditional "see one, do one" teaching approach (TRAD). Without practising in CSLs, the students will forget the procedure during OSCEs or practice on other patients. In addition, from the preclinical year, exposing the students to clinical skills through simulation or simulated patients will build their confidence, motivation, and less fear of touching the patients. Therefore, for CSLs, hands-on sessions are mandatory to link cognitive and applied knowledge where students correlate their concepts with clinical science and know-how to apply their knowledge to clinical practices.

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ORIGINAL ARTICLE

Prevalence and Risk Factors of Sonographically Detected Uterine Fibroid among Iraqi Women in Medical Baghdad City, Baghdad, Iraq

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Keywords: *uterine fibroid, sonography, Iraqi women, risk factors*

ABSTRACT

Uterine fibroid (uterine myoma or leiomyoma) is the most common benign tumour of the women's pelvic. This study aimed to determine the prevalence and risk factors associated with uterine fibroid among Iraqi women in Baghdad, Iraq. A cross-sectional study was prospectively carried out in this survey. Women aged 13 years old and above were randomly recruited based on a systematic sampling method. The participants' personal and history information were collected using a structured self-administered questionnaire (SSAQ). In addition, a trans-abdominal ultrasound with both B-mode and Doppler was used to detect uterine fibroid. Transabdominal ultrasound was performed on 127 women with a mean age of 36.3 ± 11.5 years old. Among those, 43 (33.9%) women were reported to have a uterine fibroid. However, uterine fibroid was statistically associated with age (X^2 = 35.3, P < 0.001), BMI (X^2 = 11.2, P = 0.011), family history of uterine fibroid (X^2 = 8.1, P = 0.005), and age at first menstruation (X^2 = 12.9, P = 0.005). The prevalence of uterine fibroid detected by ultrasound was alarming among Iraqi women aged 49 to 60 years old. Being overweight, obese, having a positive family history of uterine fibroid, and early menarche increases the risk of developing uterine fibroid.

INTRODUCTION

Uterine fibroid, also referred to as uterine myoma or leiomyoma, is the most common benign tumour of the women's pelvic (Serden & Brooks, 1991; Baird et al., 2003; Pavone et al., 2018). Histologically, it is a benign tumour of the myometrium due to hormonal disruption

during early development growth (Cramer & Patel, 1990; Flake et al., 2003). It was reported that about 40 to 60% of all hysterectomies result from fibroid, and 30% of them are from young women between 18 and 44 years old (Merrill, 2008). Therefore, uterine fibroid considers a major indication for hysterectomy (Farquhar & Steiner, 2002; Merrill, 2008). Clinically, it is characterized by irregular menstrual bleeding associated with pelvic pains leading to chronic anaemia (Pérez-López et al., 2014). Although this condition rarely can cause death, it is considered the leading cause of morbidity (Baird et al., 2015).

The risk factors that induce tumorigenesis are still not apparent. However, oestrogen and progesterone have a critical role in growth (Bulun, 2013). Although the healthcare and morbidity costs are correlated with uterine fibroid, few studies determined its risk factors and possible strategy prevention. In this context, age, ethnicity, age of menarche, and parity are the most risk factors replicated (Laughlin et al., 2010).

However, the initiating factors of the uterine fibroid are still poorly understood, although previous studies demonstrated that age advances, obesity, smoking, earlier menstrual period, uterine infections, hypertension and diabetes mellitus, hormonal imbalance, and nulliparous are important risk factors for developing uterine fibroid (Laughlin et al., 2010; Pavone et al., 2018). The actual time of the commencement of fibroid growth is not usually known since no clinical manifestation is revealed at the early growth stage (Pavone et al., 2018). Ultrasound is widely used in detecting uterine fibroids since it is safe (non-ionizing radiation and readily available at a meagre cost compared to other diagnostic radiological modalities such as computed tomography (CT) and magnetic resonance imaging (MRI). Although this condition is considered a public health burden, no previous study in Iraq has been conducted to periodically screen uterine fibroid with ultrasound to detect its prevalence and risk factors (Baird et al., 2015). Thus, this study aimed to determine the prevalence and risk factors associated with uterine fibroid detected using ultrasound among Iraqi women.

MATERIALS AND METHODS

Study Design and Population

A prospective cross-sectional study was used in this study. The participants consisted of Iraqi women who attended the radiology department in Medical Baghdad City and were enrolled for 6 months from July 2019 to December 2019. Participants aged 13 years old and above at enrollment with an intact uterus were randomly selected using systematic sampling techniques. Women aged 18 years old and above signed the informed consent form before enrollment into this study. However, for those below18 years old, the consent form was signed by their parents. Variables such as demographic information, medical history, family history of the disease, and menstrual period schedules were obtained using a structured self-administered questionnaire (SSAQ) and interview. However, participants diagnosed with uterine fibroid, uterine cancer, or under chemotherapy/ radiotherapy or premenstrual period were excluded from the study. Ethical approval was obtained from the College of Health and Medical Technology with reference number 3/11/1654.

Sample Size Calculation

The sample size calculation was carried out using KC Lun and Peter Chiam software based on hypothesis tests for two population proportions (two-sided test). The differences between the two proportions having uterine fibroids (P1 and P2) were calculated. P1 was the larger population and P2 was the smaller. An α error of 0.05 and a power of 0.90 was used for sample size calculation. Thus, the sample size for the uterine fibroid group was calculated to be 53 patients and for the

group without uterine fibroid was 53 subjects. Therefore, a minimum total sample size for the present study was estimated to be 106 subjects. However, the sample size recruited and analyzed in this study was 127 subjects.

Anthropometric Data Acquisition

A weighing scale (COPY, max 180 kg/ 396 lbs) was used to measure body weight, whereas an elastic tape measure was used to measure body height, and then a body mass index (BMI) (kg/m^2) was calculated. BMI was classified based on a global database on BMI in adults as follows: BMI < 18.5 kg/m^2 was described as underweight, 18.5 – 24.9 kg/m^2 was described as normal, 25.0 – 29.9 0 kg/ m^2 was defined as overweight, BMI ≥ 30.0 0 kg/m^2 was described as obese (World Health Organization [WHO], 2000). Blood pressure was measured by using a standardized sphygmomanometer. The participants were considered to have hypertension if they had systolic blood pressure ≥ 140 mmHg or diastolic blood pressure ≥ 90 mmHg, had taken antihypertensive medication(s), and had a self-reported history of hypertension (National Cholesterol Education Program [NCEP], 2002). Similarly, the women were considered to have diabetes mellitus (DM) if they had fasting blood glucose (FBG) ≥126 mg/dL and glycosylated haemoglobin (HbA1c) ≥ 6.5 %, had taken antidiabetic medication (s), or had a self-reported history of DM (NCEP, 2002).

Sonography of Uterine Fibroid

This study used a GE LOGIQ 6 ultrasound machine equipped with a convex probe (3.5 MHz) for pelvic scanning. Radiologists carried out ultrasound examinations with more than 10-year work experience. Transabdominal ultrasound was performed to detect and evaluate uterine fibroids. Each participant was informed to drink water even if her bladder became full to make a good window for pelvic organs such as the uterus. The participant was informed to lie supine; then, both longitudinal and transverse scans were applied. A B-mode grayscale and Doppler study were performed in each scan. Since uterine fibroid is an overgrowth of the smooth muscle in the uterine wall, its echogenicity always appears similar to myometrium but sometimes echoic with acoustic shadowing. In addition, fibroid causes the uterus to be bulky and may be irregular in shape.

When the colour Doppler study was applied, there was no internal vascularity within the fibroid, but peripheral vascularity was shown. However, lack of vascularity was monitored if the necrotic or torsion was diagnosed within the fibroid. Colour Doppler of the uterine blood flow is mainly dependent on the quality of the ultrasound machine, parity and age of the women. For instance, in postmenopausal women, myometrium and endometrium of the uterus have shown hypovascularity in colour Doppler study.

Statistical Analysis

Statistical Package for the Social Sciences (SPSS) software version 22.0 was used to analyze the data. The descriptive statistics were used to find the percentages and frequencies for categorical variables and mean ±SD for the continuous variables. A Chi-square was used to determine an association between factors and uterine fibroid, where a P-value of less than 0.05 was considered statistically significant.

RESULTS

The characteristics of the study population are illustrated in Table 1. However, 127 consecutive women enrolled were scanned and included in the statistical analysis. The mean age of our study population was 36.3 ± 11.5 years old. Out of 127 participants, 43 (33.9%) women were reported to have fibroids, with 50.4 % of the women being overweight and 88.2% married. Non-smoking was overwhelming (96.9%) among our study population. In terms of the medical history of diseases, most of our study

population had normotensive and normal blood sugar (78.8% and 93.7%, respectively). Our results also reported that only 4 (3.1%) women were found to have a family history of fibroid. The premenopausal women (those who are still menstruating) had a higher percentage (81.1%) than postmenopausal women (18.9%). The women who had taken oral and hormonal contraceptives were less common than those without contraceptives (26.4% vs 73.6%). The number of women who had an abortion was lower than those who never had an abortion (32.7% vs 67.3). The majority of the women (38.6%) had their first menstrual cycle at 12 years old. Furthermore, the highest percentage of women was found among those who had delivered 3 children and above (46.4%), followed by 2 children (19.6%). In contrast, those who had delivered 1 child or never had parity were the lowest and equally in per cent (17.0%). The majority of the women had (53.8%) their first delivery between 14 and 20 years of age, whereas a high percentage of women (55.9%) had a final delivery between 24 and 31 years of age.

Table 1 Distribution of the study population (n = 127 subjects)

Variables	Mean ±SD	n (%)
Age	36.3 ± 11.5	
Marital status		
Single		15 (11.8)
Married		112 (88.2)
Smoking		
No		123 (96.9)
Yes		4 (3.1)
BMI categories		
Underweight		0 (0.0)
Normal		22 (17.3)
Overweight		64 (50.4)
Obese		41 (32.3)
Hypertension		
No		100 (78.8)
Yes		27 (21.3)
DM		
No		119 (93.7)
Yes		8 (6.3)
Family history of fibroid		
No		123 (96.9)
Yes		4 (3.1)
Menstruation status		
Premenopausal state		103 (81.1)
Postmenopausal state		24 (18.9)
Contraceptives use		
No		81 (73.6)
Yes		29 (26.4)
Abortion		
No		74 (67.3)
Yes		36 (32.7)
Presence of fibroid		
No		84 (66.1)
Yes		43 (33.9)
Age of 1st menstruation (Age of menarche)		
≥ 11 years		18 (14.2)
12 years		49 (38.6)
13 years		33 (26.0)
≥ 14 years		27 (21.3)
Parity		
None		19 (17.0)
1		19 (17.0)
2		22 (19.6)
≥ 3		52 (46.4)
Age of the 1st delivery		
14 – 20 years		50 (53.8)
21 – 27 years		38 (40.9)
28 – 34 years		4 (4.3)
≥ 35 years		1 (1.1)
Age of the last delivery		
16 – 23 years		21 (22.6)
24 – 31 years		52 (55.9)
32 – 39 years		15 (16.1)
≥ 40 years		5 (5.4)

Distribution of Fibroids and Association With Their Locations

Of those with uterine fibroid, 29 women (67.4%) had multiple fibroids, while 14 women (32.6%) had solitary fibroid (Figure 1). Our results also revealed that most of the women, 29 (67.4%), were noted to have fibroid in the fundus followed by corpus with 6 (13.9%), cervix with 4 (9.3%), fundus and cervix with 3 (7.0%), and fundus and corpus with 1 (2.3%) (Figure 2). The overall number of fibroids was counted to be 95 and was distributed as follows: 59 (62.1%) in the fundus, 15 (15.8%) in the fundus and cervix, 13 (13.7%), 5 (5.3%) in the cervix and 3 (3.1%) in fundus and corpus (Figure 3).

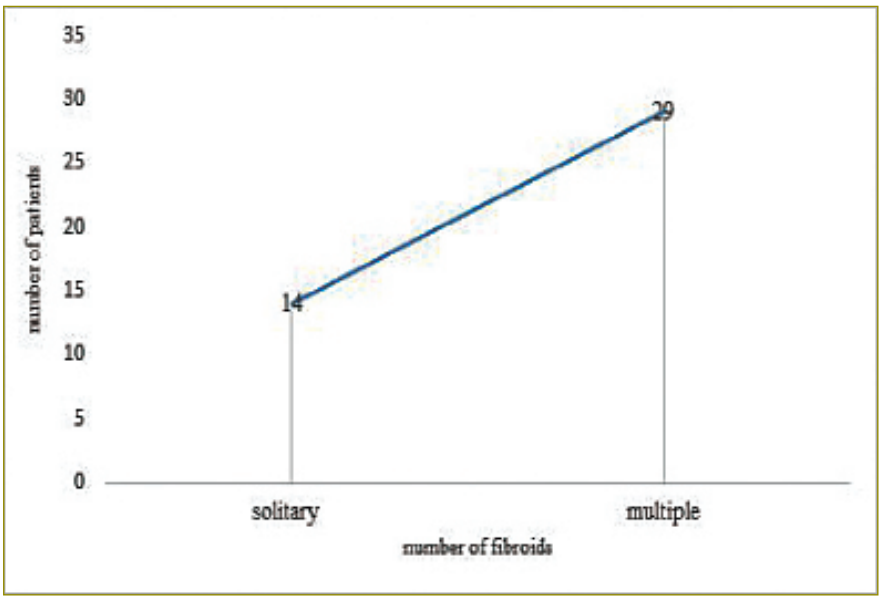

Figure 1 Distribution of the number of fibroids among women with uterine fibroid

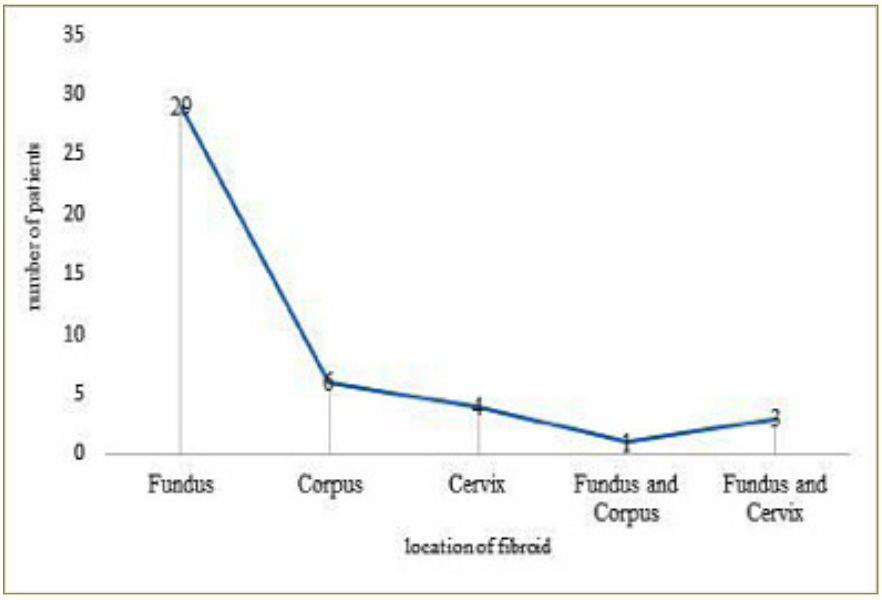

Figure 2 Distribution of uterine fibroids according to their locations within the uterus

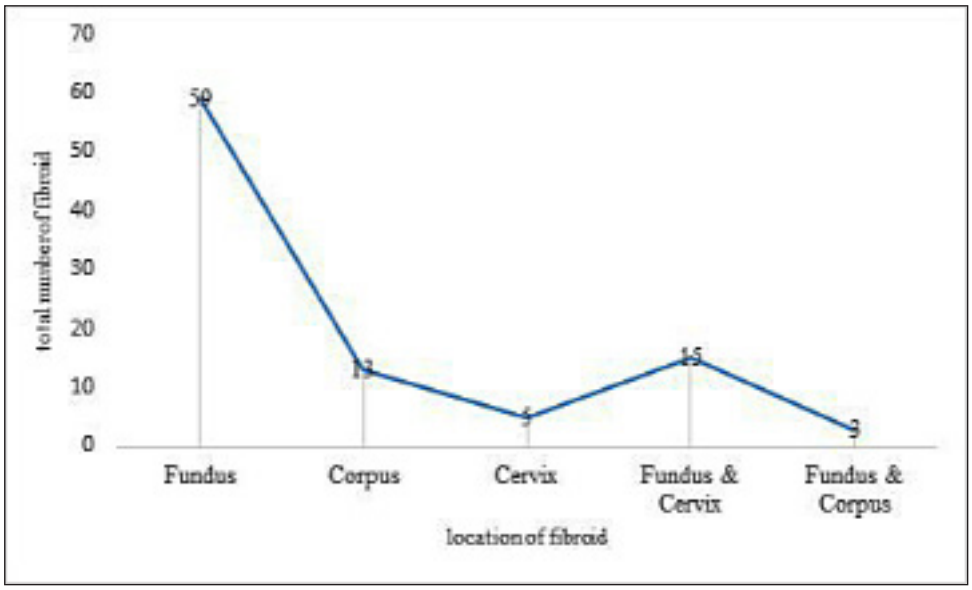

Figure 3 Distribution of the total number of uterine fibroids according to their locations within the uterus

Factors Associated with Uterine Fibroid

As shown in Table 2, the results of this study revealed that the 49 – 60 years old age group had the highest fibroid prevalence, whereas the 13 – 24 years old age group had the lowest prevalence. Age was significantly associated with the uterine fibroid ($X^2 = 35.3$, $P < 0.001$). Similarly, the women who were overweight and obese had more frequent uterine fibroid than those with normal BMI. This indicated a significant association between BMI and uterine fibroid ($X^2 = 11.2$, $P = 0.011$). In addition, the highest prevalence of uterine fibroid (56.3%) was noted in women who had their first menstruation at 11 years old and below. So, a significant association between the age at first menstruation and uterine fibroid was reported ($X^2 = 12.9$, $P = 0.005$). The findings reported that women with a family history of uterine fibroid were more likely to have the disease than those without. Thus, an association between a family history of uterine fibroid and the disease itself was significant ($X^2 = 8.1$, $P = 0.005$). On the contrary, our results revealed no significant associations between marital status, smoking, hypertension, DM, menstruation status, parity, contraception, abortion, and first and last delivery with the uterine fibroid ($P < 0.05$).

Table 2 Association between the fibroid and some factors

Variables	Presence of fibroid		X^2	*P*-value
	Yes	No		
Age group (years)			35.3	< 0.001
13 – 24	1 (6.7)	14 (93.3)		
25 – 36	9 (16.1)	47 (83.9)		
37 – 48	22 (59.5)	15 (40.5)		
49 – 60	10 (76.9)	3 (23.1)		
≥ 61	1 (16.7)	5 (83.3)		
Marital status			3.2	0.074
Single	9 (52.9)	8 (47.1)		
Married	34 (30.9)	76 (69.1)		
Smoking			0.48	0.488

No	41 (33.3)	82 (66.7)		
Yes	2 (50.0)	2 (50.0)		
BMI categories			11.2	0.011
Underweight	0 (0.0)	0 (0.0)		
Normal	2 (9.1)	20 (90.9)		
Overweight	25 (39.1)	39 (60.9)		
Obese	16 (39.0)	25 (61.0)		
Family history of fibroid			8.1	0.005
No	39 (31.7)	84 (68.3)		
Yes	4 (100.0)	0 (0.0)		
Hypertension			1.7	0.190
No	12 (44.4)	69 (69.0)		
Yes	31 (31.0)	15 (55.6)		
DM			0.9	0.319
No	39 (32.8)	80 (67.2)		
Yes	4 (50.0)	4 (50.0)		
Menstruation status			1.0	0.309
Premenopausal state	37 (35.9)	66 (64.1)		
Postmenopausal state	6 (25.0)	18 (75.0)		
Age of 1st menstruation (Age of menarche)			12.9	0.005
≤ 11 years	10 (55.6)	8 (44.4)		
12 years	22 (44.9)	27 (55.1)		
13 years	6 (18.2)	27 (81.8)		
≥ 14 years	5 (18.5)	22 (81.5)		
Parity			5.9	0.113
0	2 (11.8)	15 (88.2)		
1	4 (21.1)	15 (78.9)		
2	7 (31.8)	15 (68.2)		
≥ 3	21 (40.4)	31 (59.6)		
Contraceptives use			0.2	0.652
No	26 (32.1)	55 (67.9)		
Yes	8 (27.6)	21 (72.4)		
Abortion			2.9	0.089
No	19 (25.7)	55 (74.3)		
Yes	15 (41.7)	21 (58.3)		
Age group of the 1st delivery			2.1	0.559
14 – 20 years	17 (34.0)	33 (66.0)		
21 – 27 years	13 (34.2)	25 (65.8)		
28 – 34 years	1 (25.0)	3 (75.0)		
≥ 35 years	1 (100.0)	0 (0.0)		
Age group of the last delivery			3.1	0.381
16 – 23 years	6 (28.6)	15 (71.4)		
24 – 31 years	16 (30.8)	36 (69.2)		
32 – 39 years	7 (46.7)	8 (53.3)		
≥ 40 years	3 (60.0)	2 (40.0)		

DISCUSSION

Uterine fibroid is the most gynaecological benign tumour in women. A total of 127 women underwent transabdominal ultrasounds and were included in the analysis. The main limitation of some studies is based on the clinical diagnosis of fibroid by uterine palpation. However, when sonography was performed in these studies, most cases were confirmed to have fibroid (Parazzini, 2006). A recent study from Italy showed that the prevalence of uterine fibroid among women aged 30 – 60 years old was 21.4% (Marino et al., 2004). Moreover, a study from Ghana showed that the prevalence of uterine fibroid among Ghanaian women was 36.9% (Sarkodie et al., 2016). Our study found that the overall prevalence of uterine fibroid among our study population was 33.9%.

A previous study stated that age increases the risk of fibroid. The incidence of fibroid pathologically increases with age advances; even it reaches its peak at 50 years of age. The same study also showed that fibroids did not occur before maturity (Marshall et al., 1997). Likewise, a previous review from the United Kingdom showed that women over 40 years old were more likely to have uterine fibroid four times than those under 40 years old (Selo-Ojeme et al., 2008). Our study revealed that an increase in age was significantly associated with the incidence of uterine fibroid. Our subjects in the age group of 49 to 60 years old had the highest prevalence of uterine fibroid others. According to marital status, Chen et al. (2001) from the United States found no significant association between marital status and uterine fibroid. However, although the present study revealed that single women had a higher incidence of having uterine fibroid than married women, an association between marital status and uterine fibroid was not significant.

The relationship between smoking and the uterine fibroid is still controversial (Chiaffarino et al., 2016). Early results showed that smoking was a protective factor for uterine fibroid (Parazzini et al., 1996; Templeman et al., 2009). Nevertheless, the subsequent study suggested an increased risk of uterine fibroid (Dragomir et al., 2010), whereas others did not find an association (Wise et al., 2004). Smoking leads to decreased levels of oestrogen bioavailability where it inhibits the enzyme aromatase, which plays a vital role in transforming androgens to estrone and shifting estradiol (E2) metabolism toward 2-hydroxylation pathways as the result of reducing circulating estrogen (Biegon et al., 2012). Moreover, smoking may also exert oestrogen-related effects on the uterus, inducing cell growth (Ohtake et al., 2003; Marom-Haham & Shulman, 2016; Helle et al., 2017). The present study documented no significant association between smoking and uterine fibroid even though the incidence of uterine fibroid was higher among smoking women than non-smoking women.

In terms of anthropometrics, a recent study conducted in 2016 by Wise and Laughlin-Tommaso was consistent with our study. Both confirmed that high BMI was closely associated with uterine fibroid. In the present study, the prevalence of uterine fibroid was higher among overweight and obese women than those with a normal BMI. A case-control study from Japan showed that hypertension could increase the risk of uterine fibroid by five folds (Takeda et al., 2008). Furthermore, a systematic review demonstrated that DM was considered a potential risk factor for inducing uterine fibroid (Stewart et al., 2017). A significant association between hypertension and DM with uterine fibroid was not observed in this study.

Genetically, uterine fibroid risk was high in women with a positive family history of fibroid (Lumbiganon et al., 1996). This result was in line with our results. We identified a high significant prevalence of uterine fibroid (100%) in women with a family history of uterine fibroid compared to those without fibroid (31.7%).

Several epidemiological studies showed that the premenopausal state was significantly associated with uterine fibroid risk (Flake et al., 2003; Samadi et al., 1996; Templeman et al., 2009). Unexpectedly, our study revealed no significant association between menstruation status and risk of uterine fibroid despite the role of female gonadal steroid hormones in inducing uterine fibroid growth (Flake et al., 2003). In their prospective study, Marshall et al. (1998) observed an inverse association between early age of menstruation and uterine fibroid. Incompatible with this finding, the present study found a higher prevalence of uterine fibroid in women with earlier age of menarche (55.6% at ≤ 11 years and 44.9% at 12 years) than in women with late age of menarche (18.2% at 13 years and 18.5% at ≥ 14 years). Thus, the risk of developing uterine fibroid was significantly increased with the early age of menarche in this study.

Several previous studies confirmed that an increase in parity was considered a protective factor against progressing uterine fibroid (Chen et al., 2001; Sato et al., 2002). This could cause infertility or subfertility, subsequently decreasing parity itself. However, we did not identify an association between parity and uterine fibroid development. Numerous studies documented a protective effect of oral contraceptive use on uterine fibroid development (Chiaffarino et al., 1999; Lumbiganon et al., 1996; Marshall et al., 1998). Nonetheless, our study was not compatible with these studies since we did not find a significant association between contraceptives and uterine fibroid, even though the incidence of the uterine fibroid was lower in women who used contraceptives than in those who did not use them. Previous studies also discussed the association between abortion and uterine fibroid. For instance, a study done by Parrizzini et al. (1996) revealed that abortion promoted the risk of uterine fibroid development. However, our study was in line with a study done by Bizjak et al. (2016), which both reported that abortion was not significantly associated with uterine fibroid.

In 2016, Sarkodie et al. found that the last age of delivery was significantly associated with uterine fibroid. The authors observed that the late age of last delivery increases the risk of uterine fibroid. In the light of that, Sarkodie and colleagues agreed with our findings in which a significant association between the first age of delivery and uterine fibroid was not reported.

According to fibroid location within the uterus parts, a study from the US by Baird et al. (2015) reported that the majority of uterine fibroids were located in the corpus (72%), whereas 46% of them were located in the fundus and only 8% located at the lower uterine segment.

The limitations of this study are that our data were obtained from single centres where they were not representative of the general population. Some of our data were dependent on the history of the self-report, which could be affected by recall bias. Besides, the trans-pelvic ultrasound frequently results in overestimation of incidence as it is not a specific or sensitive test.

CONCLUSION

The high prevalence of uterine fibroid among Iraqi women in Baghdad is alarming. The 49 – 60 years old age group, overweight and obese, positive family history of fibroid, and early age of having a first menstrual period (≤ 11 years old) were strongly associated with increased risk of uterine fibroid. However, marital status, smoking, hypertension, DM, menstruation status, parity, contraceptive use, abortion, and age at the first and last delivery were not associated with uterine fibroid development. A large based-population study is recommended for future studies. In addition, a broad spectrum of factors with a case-control design should be taken into account in determining the risk factors of uterine fibroids.

CONFLICT OF INTEREST

The authors declare that they have no competing interests in publishing this article.

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ORIGINAL ARTICLE

Descriptive Profile of Urolithiasis Cases in a Tertiary Hospital in Sabah

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ABSTRACT

Urolithiasis is a common urological problem in Malaysia. Stones can be formed by precipitation or crystallization of minerals and urinary constituents. It is a multifactorial, recurrent disease distributed worldwide with a trend of increasing incidence. This study aims to describe the characteristics of patients with urolithiasis in a tertiary centre in Sabah. Patients seen in the urology clinic or inpatient ward in the Department of Urology, Hospital Queen Elizabeth, Sabah, who had urolithiasis confirmed on plain CT KUB were reviewed. Demographic data regarding age, gender, race, address, and BMI were recorded. Details regarding fluid intake and family history of urolithiasis associated with medical conditions like diabetes, hypertension, and gout were collected during the interview with the patient. Routine urine and blood investigations for urolithiasis were performed, and results with CT scan findings were recorded in a data collection sheet. A total of 300 patients with urolithiasis were reviewed. The median age was 54 years, with similar gender distribution. BMI above normal was found in 69% of participants, and 55% had underlying hypertension. The highest incidence was seen in the Kadazan-Dusun population. Those who consume < 2 L/day of fluid also had a higher frequency of urolithiasis. 60.6% of stones were unilateral, whereas 43.7% were found to be renal. There were 39.7% of patients who had CKD stage 2. The mean Hounsfield unit of stones was 1,091. In conclusion, urolithiasis is a common problem worldwide, and it is apparent that its burden on the healthcare system is increasing. These findings will help better understand local clinical characteristics to prevent and reduce morbidity and mortality by urolithiasis.

INTRODUCTION

Urolithiasis is a common urological problem increasing in prevalence in many high-incidence nations and worldwide (Trinchieri et al., 2000). The prevalence of urolithiasis appears to have increased over the last 30 years in the USA (Stamatelou et al., 2003). This leads to a substantial economic burden on the healthcare systems in various countries. Data from Hospital Episode Statistics in the UK shows a 63% increase in the incidence of urolithiasis between the year 2000 to 2010 (Turney et al., 2012). In Asia, an increasing trend of urolithiasis is seen in Japan, China, and Korea. The prevalence of urolithiasis in China was 6.5% in 2015 (Yang et al., 2016). In Korea, the incidence rate was 457 per 100,000 Koreans in 2002, higher than in most of Asia (Bae et al., 2014).

Malaysia is situated in the Asian 'stone belt' region with a high incidence of urolithiasis. However, there is still a paucity of data on demographics, clinical characteristics, and stone profiles. The prevalence of kidney stone disease among patients admitted to Hospital Universiti Sains Malaysia (HUSM) from 2012 to 2016 was 1.8% (Nouri & Hassali, 2018). A study on the incidence and management of urinary stones in Malaysia between 1980 – 1989 showed no difference in urinary stone disease occurrence among the Malay, Chinese and Indian races (Sreenevasan & Moynihan, 1990). Those working in conditions that cause dehydration, such as construction workers, firefighters, farmers, or those who delay urination when needed, such as nurses, pilots, and truck drivers, are at increased risk for urolithiasis (Goldfarb & Arowojolu, 2013).

Individuals with a family history of the stone disease have a 2.5 × higher risk of developing urolithiasis (Curhan et al., 2004). Diabetes mellitus, hypertension, and obesity have been correlated with urolithiasis. Insulin resistance causes impaired ammonia formation by the kidney, which lowers urinary pH, leading to uric acid stone formation (Daudon et al., 2006). The renal stone disease has been associated with renal impairment due to the renal stone per se (obstruction, infection), parenchymal damage induced by the primary condition leading to stone formation (e.g., nephrocalcinosis), frequent urological interventions with large stone burden, and co-existing medical disease. An increasing number of studies have been done over the past few years concerning the relationship between urolithiasis and the development of chronic kidney disease. A registry study on residents of Olmsted County, Minnesota, confirmed that stone formers were at higher risk for ESRD after adjusting for diabetes, hypertension, dyslipidaemia, gout and CKD (El-Zoghby et al., 2012). The marked variations in the occurrence of urolithiasis can identify causes and help in planning prevention. This study aimed to give insights into the epidemiological aspects of urolithiasis in Sabah by determining the sociodemographic characteristics of patients treated at Hospital Queen Elizabeth.

MATERIALS AND METHODS

This is a prospective descriptive analysis study of patients with urolithiasis in Hospital Queen Elizabeth, Sabah, a public hospital serving a multi-ethnic population, with ethical permission by the Ethics Committee of Kementerian Kesihatan Malaysia (NMRR-21-513-59200). A random sample of 300 patients diagnosed with urolithiasis and presented to the urology clinic or ward for one year (1 January 2019 to 31 December 2019) was included in this study. Diagnosis of urolithiasis was confirmed using non-contrasted CT KUB in all patients. Patients reviewed in outpatient clinics or inpatients with urolithiasis were either newly diagnosed or under follow-up and treatment, and those above the age of 12 years were included in this study. Those below 12 years of age and non-citizens were excluded from this study. This is because the paediatric age group (below 12 years) was seen and managed at a different hospital/

centre, whereas non-citizen patients tended to be lost during treatment and follow-up. A data collection sheet was used where demographic information such as gender, address, BMI, family history, and medical history was collected during the interview with the patient. In addition, routine investigations such as urine FEME, culture and sensitivity, blood urea, and electrolytes were sent, and results were later put in the datasheet. Estimated GFR was calculated using the MDRD formula. CT scans were reviewed to determine the side and site of stones, and Hounsfield unit calculation was done using the Radiant DICOM software. Data collected was analyzed by descriptive statistical analysis using IBM SPSS software version 26.

RESULTS

Figure 1 shows the age and sex distribution of urolithiasis across different age groups in males and females. The participants in this study were predominantly middle-aged, of which 61 – 70 years were the most frequently seen in both males and females.

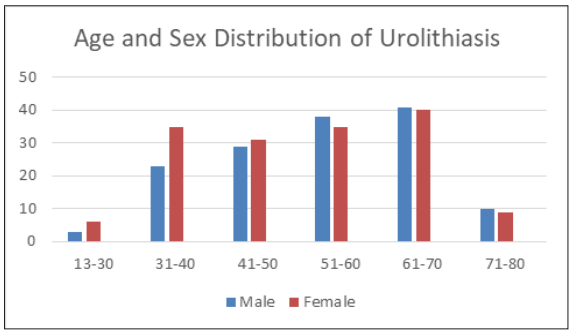

Figure 1 Age and sex distribution of urolithiasis across different age groups in males and females

The demographics and clinical characteristics of participants are summarized in Table 1. The median age of patients with urolithiasis was 54 years. Almost equal incidence of stone disease was found among males (48%) and females (52%). In addition, 40% of patients with urolithiasis were overweight, and 19.3% were obese. The Kadazandusun people had the highest incidence of urolithiasis (37%), the largest ethnic group in Sabah, followed by the Bajau. Others who form 24% of patients with urolithiasis consist of people in the less common ethnic groups such as Bugis, Suluk, Kedayan, Lundayeh, etc. Most participants consumed less than 2 L of fluids per day (63.3%) and had unilateral stone disease (60.6%). More than half of patients with urolithiasis had hypertension (55%), and almost a quarter had diabetes mellitus. Only 17.3% of patients with stone disease had a positive urine culture.

Table 1 Demographics and clinical characteristics of participants

Characteristics	n (%)
Age, median (years)	54
Gender	
Male	144 (48)
Female	156 (52)
BMI	
Underweight	10 (3.3)
Normal	112 (37.3)
Overweight	120 (40)
Obese	58 (19.3)
Race	
Kadazandusun	111 (37)
Bajau	43 (14.3)
Murut	14 (4.7)
Malay	21 (7)
Chinese	39 (13)
Others	72 (24)
Fluid Intake	
< 2 L/day	190 (63.3)
> 2 L/day	110 (36.7)
Diabetes Mellitus	
Yes	74 (24.7)
No	226 (75.3)
Hypertension	
Yes	165 (55)
No	135 (45)

Ischaemic Heart Disease	
Yes	14 (4.7)
No	286 (95.3)
Gout	
Yes	44 (14.7)
No	256 (85.3)
Urine Culture	
Positive	52 (17.3)
Negative	248 (82.7)
Stone Side	
Unilateral	172 (60.6)
Bilateral	37.3 (39.4)

The distribution number of patients with urolithiasis seen from various regions in Sabah who were treated in Hospital Queen Elizabeth is shown in Figure 2. Kota Kinabalu had the highest number of patients as it is the capital city and the most densely populated in Sabah. The map chart also shows higher incidences of urolithiasis among those living in coastal regions than in the interiors.

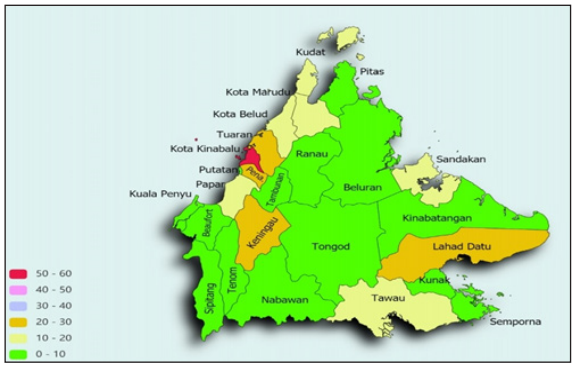

Figure 2 Map chart showing distribution number of patients with urolithiasis who were treated at Hospital Queen Elizabeth

The anatomical location of urinary tract calculi and frequency of occurrence is shown in Table 2. The analysis showed that the highest incidence of uroliths was seen in the kidney, followed by multiple sites and ureter.

Table 2 Anatomical location of urinary tract calculi and frequency

Anatomical site	Number	Percentage (%)
Renal	131	43.7
PUJ	19	6.3
Ureter	54	18.0
VUJ	10	3.3
Bladder	14	4.7
Urethra	2	0.7
Multiple sites	70	23.3
Total	**300**	**100.0**

Figure 3 shows the chronic kidney disease stage based on the estimated glomerular filtration rate (eGFR) calculation. The analysis shows that only 23.7% of the study population had an eGFR of 90 or higher, with the most significant number of patients with urolithiasis having stage 2 CKD.

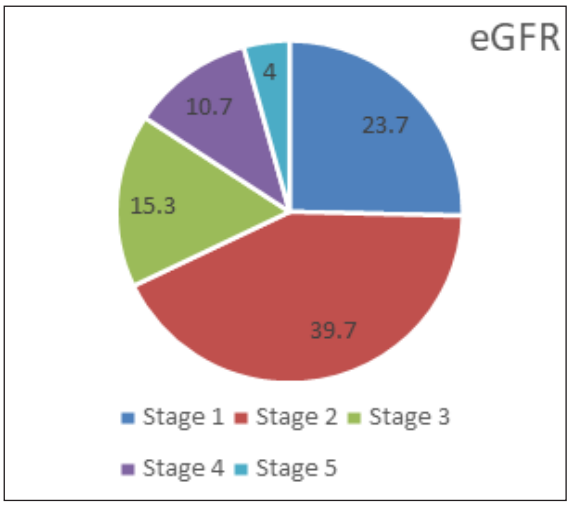

Figure 3 Stage of chronic kidney disease based on estimated glomerular filtration rate (eGFR)

Figure 4 shows the incidence of proteinuria being 56% among the study population, which is associated with renal disease and is a predictor of end-organ damage in patients with hypertension. Data for stone density from CT scans were available for 170 of the study population. The mean stone density measured in the Hounsfield unit (HU) was 1091.

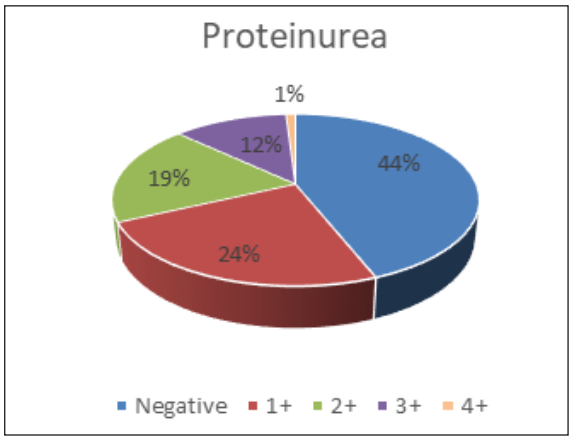

Figure 4 Incidence of proteinuria among patients with urolithiasis

DISCUSSION

The lifetime prevalence of kidney stones is approximately 10% in developed countries, with the most affected in the middle-aged group (Romero et al., 2010). Historically urinary stone disease was found to be more frequent in men. Scales et al. (2007) found a change in the prevalence by gender from a 1.7:1 to 1.3:1 male-to-female ratio in the United States. In Sabah, most patients with urolithiasis were between 51 – 70 years, with an almost equal incidence among males and females. The race has been proposed as a significant factor, where higher incidences of urolithiasis were observed in Caucasians compared to African-Americans and Asians (López & Hoppe, 2010). This study observed that 59.3% of patients had BMI above normal. A higher BMI affects urinary homeostasis by lowering urinary pH and increasing urine calcium and uric acid secretion, promoting stone formation (Schwalfenberg, 2012).

We found a higher incidence of urolithiasis among patients from coastal regions of Sabah. The coastal city stretches on land near a coast, less than 10 km from the coastline. A similar finding was also reported by Yang et al. (2016), who found a higher risk of urolithiasis in coastal provinces of China. Underdeveloped road networks from the interior to Kota Kinabalu and financial constraints to travel are the main factors for a reduced number of patients with urolithiasis seen in these regions. Supersaturation of urine with stone-forming salts leads to the formation of urinary stones. Increased fluid intake leads to higher urine output and flow and dilution of stone-forming salts (Siener & Hesse, 2003). Those who consume fluid less than 2 L/day were more frequent to have a stone disease.

Cappuccio et al. (1999) reported that the incidence and risk of developing kidney stone disease were higher in hypertensive than in normotensive men. Hypertension is a significant predictor of kidney stone disease rather than a consequence of renal damage caused by stones. Similar findings were seen in this study, where 55% of the study population with urolithiasis had hypertension. A higher urinary H+ ion concentration in primary gout was associated with urolithiasis (Alvarez-Nemegyei et al., 2005). The role of diet in urolithiasis pathogenesis and relapse proves to be very significant. Higher intake of animal-derived protein, salt, and supplemental calcium increases the risk of urinary stone formation, whereas dietary calcium, citrate, and total fluid per day reduce the risk (Curhan et al., 2004). A total of 14.7% of patients had gout, which is a risk factor for uric acid stone formation in this study.

Various urinary stones are based on their chemical composition, such as calcium oxalate, calcium phosphate, uric acid, ammonium urate, struvite, cysteine, etc. A retrospective study conducted in Taiwan analysed the impact of different urinary stone compositions on renal function. They found that the patients with uric acid and struvite stones had significantly lower estimated glomerular filtration rates than those with other stone components. Struvite stones may impair renal function due to recurrent urinary tract infections or obstruction (Chou et al., 2011). We found that 17.3% of patients in our study had a positive urine culture and were at risk of developing struvite stones.

Furthermore, stone constituents influence the treatment chosen, e.g., brushite and cystine stones are harder and, therefore, more resistant to shock wave lithotripsy. Similarly, pharmacotherapy such as potassium citrate can alkalinize urine as part of medical management in patients with uric acid stones (Preminger et al., 2007). The Hounsfield unit calculated from non-contracted CT KUB estimates stone density. This helps plan the most appropriate treatment for the patient, e.g., stones with HU more than 900 were more resistant to shockwave lithotripsy (Nakasato et al., 2015).

An increasing number of studies have been done over the past few years concerning the relationship between urolithiasis and the development of chronic kidney disease. The possible causes and risk factors for renal function impairment in patients with urolithiasis include anatomical abnormality (e.g., obstructive uropathy), infection and inflammation with parenchymal scar formation, underlying metabolic disorders (e.g., chronic urate nephropathy), environmental factors, repeated interventions, dietary factors, and molecular or genetic factors (Worcester et al., 2003). This study found that only 23.7% of the total study population had a normal eGFR. Proteinuria was observed in 57.3% of patients, where the urine FEME showed at least a protein 1+ result. The presence of proteinuria is a sign of kidney damage. Therefore, it is essential to identify proteinuria early to reduce and prevent further loss of renal function.

This study provided information on sociodemographic factors associated with urolithiasis formation and comorbid conditions that may contribute to the onset or progression of chronic kidney disease among patients in this region. One drawback of this study is excluding patients aged 12 years and below, as children are at increased risk of recurrent stone formation and require detailed metabolic evaluation. Another limitation of this study is that data for stone density was not available for all patients. In addition, not all radiologists report on stone density, and softcopy for CT scans was unavailable for all patients.

CONCLUSION

Urolithiasis is a common problem, and the burden on the healthcare system is increasing worldwide. To our knowledge, the demographics of urolithiasis in Sabah have not been previously described. These findings will help better understand local clinical characteristics to prevent and reduce morbidity and mortality by urolithiasis. More research is warranted, such as identifying the incidence, prevalence, and chemical composition of urinary stones commonly encountered in this region. There has been no published literature on the chemical composition of uroliths in Malaysia.

CONFLICT OF INTEREST

The authors declare that they have no competing interests in publishing this article.

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ORIGINAL ARTICLE

The Diabetes Knowledge Assessment in Type 2 Diabetic Patients: A Survey in West Coast Division of Sabah

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ABSTRACT

The main concern in Type 2 Diabetes Mellitus (T2DM) management is to control the glycaemic level and thus prevent complications by behavioural modifications as a part of the government's national strategic plan. The patient should know about the disease for behavioural modification to be implemented. Thus, this study evaluated the level of knowledge among T2DM patients in primary healthcare in the West Coast Division of Sabah. This is a cross-sectional study conducted in 2015 involving 15 primary healthcare clinics. A validated Malaysian version of the Michigan Diabetes Knowledge Test (MDKT) questionnaire was used to assess patients' diabetes knowledge. The mean age of 369 patients is 54.9 years old (SD = 11.04). The means of knowledge scores were significantly different among the age group, education level, and employment status. No significant differences in knowledge were found in the group regarding the duration of diabetes and glycaemic control. Of 369 diabetic patients, 26.3% had poor knowledge, 65.0% had adequate knowledge, and only 8.7% had good knowledge. Overall, patients with T2DM in primary healthcare clinics have adequate knowledge regarding diabetes. Our study's findings indicate that patients' knowledge is associated with age group, level of education, and employment status. Healthcare providers should plan a good strategy to educate their patients based on these differences.

INTRODUCTION

Type 2 diabetes mellitus (T2DM) is a disease that causes a high glucose level in the blood. T2DM prevalence is increasing worldwide and

continues to pose as a global burden disease. According to the fourth Malaysia National Health and Morbidity Survey (NHMS), the national prevalence of diabetes increased from 15.2% to 17.5% in adults (>18 years) in 5 years (Institute for Public Health, 2020).

There has been a remarkable increase in overall diabetes prevalence in Sabah from 9.0% in 2011 to 14.2% in 2015 (Institute for Public Health, 2020). T2DM is primarily due to insulin resistance as well as deficiency. No known cure is available for the disease, but it can be controlled to improve the individual's quality of life. Despite the availability of pharmacological anti-diabetic agents in controlling the disease, lifestyle interventions by increasing physical activity, a healthy diet, and weight loss play a crucial role in improving patient outcomes. Thus, it is essential to educate the patients about diabetes to make healthy choices.

A previous study showed that being knowledgeable about their disease is associated with good glycaemic control (Al-Qazaz et al., 2011). Good control of blood glucose can eventually decrease the risk of diabetes complications. In addition, behavioural modifications through information and education have been part of the government's national strategic plan for managing non-communicable diseases. The latest national guideline is available to be utilized by healthcare professionals in T2DM management (Ministry of Health Malaysia, 2020). Hence, evaluating the patient knowledge can give a glimpse into the effectiveness of our healthcare practice in educating the patient about the disease.

To date, there are many studies conducted on the assessment of diabetes knowledge among diabetic patients in Malaysia (Al-Qazaz et al., 2011; Badariah et al., 2013; Mohd Nadzri et al., 2014). Therefore, to plan for diabetic patient education, they need to assess their knowledge about the disease. This triggered the research question; what are the knowledge levels on diabetes among patients in our setting and the factor associated with their understanding? Hence, in this study, we want to evaluate diabetes knowledge among the type 2 diabetic patients in primary healthcare in Sabah and the factors associated with the patients' knowledge.

MATERIALS AND METHODS

Setting and Population

This is a cross-sectional study conducted from March 2015 until August 2015. The target population was patients with type 2 diabetes mellitus attending government primary healthcare clinics in the West Coast Division of Sabah, which covers the districts of Ranau, Kota Belud, Tuaran, Penampang, Papar, and the state capital Kota Kinabalu. The region of interest had 22 government clinics at the point of study commencement, and cluster sampling was applied to select 15 clinics where study participants were recruited randomly. At the respondent level, convenience sampling was used during the study recruitment.

The list of clinics (Klinik Kesihatan [KK]) selected for our study include: KK Inanam, KK Luyang, KK Menggatal, KK Telipok, KK Likas, KK Penampang, KK Putatan, KK Kiulu, KK Tamparuli, KK Tenghilan, KK Jawi-jawi, KK Kinarut, KK Kundasang, KK Paginatan and KK Timbua. We conveniently collect at least 25 respondents from each clinic; if the clinic has less than the targeted number of samples, the other clinic respondent data is used to fulfil the sample size.

The sample size calculation was based on estimating the prevalence of a good level of knowledge in diabetes using the measurement tool (described below) in this study. An educated guess of 20% was made based on a previous local (Al-Qazaz et al., 2010). With 5% precision, the minimum sample size required was 246 participants (Naing et al., 2006). Considering the implementation of

cluster sampling in this study, the sample size was multiplied by the design effect of 1.5 to obtain the final sample size requirement of 369 participants.

Measurement Tool and Procedure

Evaluation of diabetes knowledge among subjects in this study was performed using Michigan Diabetes Knowledge Test (MDKT), the Malay version, validated in Diabetes Clinic, Hospital Pulau Pinang (Al-Qazaz et al., 2010). This is the first study using this tool in Sabah. Permission to use this questionnaire was obtained. The questionnaire contained 14 questions on general knowledge of diabetes mellitus. Each question had multiple choices of possible answers but only one correct answer.

Patients' level of knowledge was graded based on the total score from the 14 questions answered adapted from the original study (Al-Qazaz et al., 2010). The total score was also categorized into the following categories: Poor (<7 correct answers), Acceptable (7 – 10 correct answers), and Good (>10 correct answers). In addition, for glycaemic control, patients' last HbA1c levels were considered: good glycaemic control was defined as ≤6.5%, according to the Malaysian Clinical Practice Guidelines on Type 2 Diabetes Mellitus (Ministry of Health Malaysia, 2015)toxic chemical products formed as secondary metabolites by a few fungal species that readily colonise crops and contaminate them with toxins in the field or after harvest. Ochratoxins and Aflatoxins are mycotoxins of major significance and hence there has been significant research on broad range of analytical and detection techniques that could be useful and practical. Due to the variety of structures of these toxins, it is impossible to use one standard technique for analysis and/or detection. Practical requirements for high-sensitivity analysis and the need for a specialist laboratory setting create challenges for routine analysis. Several existing analytical techniques, which offer flexible and broad-based methods of analysis and in some cases detection, have been discussed in this manuscript. There are a number of methods used, of which many are lab-based, but to our knowledge there seems to be no single technique that stands out above the rest, although analytical liquid chromatography, commonly linked with mass spectroscopy is likely to be popular. This review manuscript discusses (a.

In each participating health clinic, to be recruited into the study, patients had to be diagnosed with type 2 diabetes mellitus for at least 1 year, be over 18 years of age, and understand the Malay language to answer the questions in the questionnaire. Type 1 diabetes mellitus patients and gestational diabetes mellitus patients (GDM) were excluded from this study. Only type 2 diabetes mellitus patients were selected after considering the knowledge gained when diagnosed with diabetes would be the same. The knowledge gained about the disease could be different if we included Type 1 diabetes mellitus, which can be diagnosed early. As for GDM patients, the knowledge about the disease can be temporary as they may have the condition only when they are pregnant. After identifying potential subjects using the criteria above, written informed consent was elicited from each participating subject before the questionnaire was self-administered. At the same visit, demographic data including gender, age, ethnicity, level of education, and employment status were collected, and patients' weight and height measurements were recorded. Investigators also retrieved information on patients' disease duration and last HbA1c levels from their medical records. No personal information or patient identifiers were collected or maintained during any part of this study.

Statistical Analysis

Patients' demographic data, clinical information, and their diabetes knowledge score were described using appropriate descriptive statistics: percentages and

frequencies for categorical variables and mean (standard deviation) or median (interquartile range) for continuous variables. The data distribution was checked to compare patient demographics and clinical variables with knowledge scores. An independent t-test or one-way analysis of variance (ANOVA) test was used. Scheffe's post-hoc procedure was applied if significant differences were found in the one-way ANOVA test. In addition, a chi-square test was employed to compare the level of knowledge categories with the glycaemic control level. The level of significance was set at a *p*-value <0.05. All analyses were done using IBM SPSS version 20.0 (IBM Corporation, Armonk, NY, USA).

Ethical and Site Approval

This study received ethical approval from the Medical Research and Ethics Committee (MREC), Ministry of Health Malaysia (NMRR-16-1328-23061). In addition, permission to conduct the study in local government health clinics was granted from the Sabah Public Health Department.

RESULTS

The final analysis included 369 patients from the 15 participating health clinics. About 400 patients were approached during the study, making a 92.3% response rate. Most patients were female, comprising 60.2% of the entire cohort. Our study patients' mean age was 54.9 years old (SD 11.04), with almost two-thirds the above 50 years of age. The remaining demographic data were summarized in Table 1.

Table 1 Demographic and disease characteristics of patients with diabetes (n = 369), total and according to levels of knowledge

Characteristics	Total sample	Level of knowledge		
	n = 369 (%)	Low (<7) n = 97 (%)	Acceptable (7 – 10) n = 240 (%)	Good (>10) n = 32 (%)
Age group				
≤ 50 years	126 (34.1)	27 (27.8)	81 (33.8)	18 (56.3)
> 50 years	243 (65.9)	70 (72.2)	159 (66.3)	14 (43.8)
Gender				
Male	147 (39.8)	41 (42.3)	96 (40.0)	10 (31.3)
Female	222 (60.2)	56 (57.7)	144 (60.0)	22 (68.8)
Ethnicity				
Dusun/Kadazan	229 (62.1)	55 (56.7)	155 (64.6)	19 (59.4)
Bajau	55 (14.9)	20 (20.6)	31 (12.9)	4 (12.5)
Malay	20 (5.4)	7 (7.2)	11 (4.6)	2 (6.3)
Chinese	12 (3.3)	1 (1.0)	9 (3.8)	2 (6.3)
Others	53 (14.4)	14 (14.4)	34 (14.2)	5 (15.6)
Education level				
No formal education	73 (19.8)	27 (27.8)	43 (17.9)	3 (9.4)
Primary education	74 (20.1)	22 (22.7)	48 (20.0)	4 (12.5)

Secondary education	193 (52.3)	45 (46.4)	131 (54.6)	17 (53.1)
Tertiary education	29 (7.9)	3 (3.1)	18 (7.5)	8 (25.0)
Employment status				
Not employed	177 (48.0)	58 (59.8)	113 (47.1)	6 (18.8)
Private sector	71 (19.2)	13 (13.4)	49 (20.4)	9 (28.1)
Government sector	74 (20.1)	10 (10.3)	50 (20.8)	14 (43.8)
Retired	47 (12.7)	16 (16.5)	28 (11.7)	3 (9.4)
BMI of patients*, mean (SD)	28.1 (5.41)	27.9 (5.24)	28.1 (5.52)	28.2 (5.16)
DM duration in years, median (IQR)	3.0 (5.00)	3.0 (5.00)	3.0 (5.00)	3 (5.10)
HbA1c (%), mean (SD)	7.5 (1.72)	7.3 (1.44)	7.5 (1.81)	7.5 (1.86)
14-item MDKT score, mean (SD)	7.7 (2.11)	5.0 (1.14)	8.3 (1.06)	11.4 (0.67)

* BMI refers to body mass index, derived from body mass of patient (kg) divided by the square of body height (m), expressed in units of kg/m^2

Our study cohort's mean diabetes knowledge score was 7.7 (SD 2.11). When graded into categories of knowledge, only 32 patients, 8.8%, had a good level of knowledge (scoring above 10 for total knowledge score). The majority of the patients only achieved an acceptable level of knowledge (total score between 7 to 10, comprising 65.0% of the entire cohort). In comparison, the remaining 26.3% of the patients had poor knowledge levels, scoring below 7 (out of 14).

The mean age for each category of knowledge was 57.4 years old (SD 10.67) for a low level of knowledge, 54.6 years old (SD 10.75) for an acceptable level of knowledge, and 49.8 years old (SD 12.45) for a good level of knowledge group respectively.

The diabetes knowledge scores did not differ between patients of different gender but were significantly different across other age groups, education levels, and employment statuses (Table 2 and Table 3). Patients who were 50 years old or below, had at least secondary education, and who were in active employment (private or government sector) had higher MDKT knowledge scor

es (p <0.05).

Table 2 Comparison of 14-item MDKT scores among patient characteristics

Variable	n	MDKT score Mean (SD)	Mean difference (95% CI)	*p*-value[a]
Age group				
≤ 50 years	126	8.1 (2.15)	0.6 (0.1, 1.0)	**0.012**
> 50 years	243	7.5 (2.07)		
Gender				
Male	147	7.7 (2.01)	-0.1 (-0.5, 0.3)	0.529
Female	222	7.8 (2.18)		
Glycaemic control (HbA1c)				
HbA1c ≤ 6.5%	128	7.8 (2.03)	0.2 (-0.2, 0.7)	0.331
HbA1c > 6.5%	241	7.6 (2.15)		

[an] Independent t-test

For educational level, post-hoc analysis using Scheffe's procedure showed that patients having at least a secondary level of education scored significantly higher than those with primary education ($p = 0.010$) and no formal education ($p = 0.002$). Similarly, for employment status, patients who were actively employed (private or government) scored significantly higher than those who were retired ($p = 0.042$) and those who were not employed ($p < 0.001$).

Table 3 Comparison of 14-item MDKT scores among patient characteristics

Variable	n	MDKT score Mean (SD)	*p*-value[a]
Education level			
Secondary or higher	222	8.1 (2.03)	**<0.001**
Primary education	74	7.2 (2.00)	
No formal education	73	7.1 (2.26)	
Employment status			
Employed (private or government)	145	8.4 (1.93)	**<0.001**
Retired	47	7.5 (2.38)	
Not employed	177	7.2 (2.04)	

[a] One-way ANOVA test

The glycaemic control of our study cohort, assessed by using their latest HbA1c levels, showed that over one-third ($n = 128$, 34.7%) of the patients had good control, defined as having HbA1c ≤ 6.5%. Mean knowledge scores did not differ between patients with good and poor glycaemic control (Table 2). Table 4 shows the distribution of patients in different levels of knowledge scores in both good and poor glycaemic control groups, which did not show significant differences.

Table 4 Relationship between levels of knowledge (14-item MDKT) and glycaemic control groups (n = 369)

Glycaemic control group	n (%)	Level of knowledge			*p*-value[a]
		Low (< 7) n = 97	Acceptable (7 – 10) n = 240	Good (> 10) n = 32	
Good glycaemic control (HbA1c ≤ 6.5%)	128 (34.7)	28 (28.9)	89 (37.1)	11 (34.4)	0.357
Poor glycaemic control (HbA1c > 6.5%)	241 (65.3)	69 (71.1)	151 (62.9)	21 (65.6)	

[a] Chi-square test

DISCUSSION

Most of the patients had an acceptable level of knowledge; this is consistent with other Malaysian study findings (Al-Qazaz et al., 2011; Qamar et al., 2017)the prevalence of diabetes is enormously increasing and 50% of the Malaysian adults with diabetes are still unaware of their disease status. Therefore, this study aimed to assess the awareness of diabetes mellitus (DM. In contrast, Badariah et al. (2013) reported a poor level of diabetes knowledge amongst the indigenous population in Peninsular Malaysia. The difference in demographic in terms of cultural differences might explain this contradictory finding (Sachdeva et al., 2015). Indigenous people tend to try home remedies for their condition. Thus, this may lead to a low level of knowledge as they are not seeking diabetic care from the healthcare. This study recruited respondents who attended the clinic for diabetic care, thus explaining the adequate diabetes knowledge acquired by most patients. Our findings also revealed that knowledge level is associated with age, education level, and employment status; this is similarly reported by Mohd Nadzri et al. (2014) and Al-Qazaz et al. (2011). Those in the less than 50 years old group with higher education levels and were employed have higher scores, as these groups are more accessible and exposed to disease information. Nowadays, most information is available online; thus, these groups are more likely to utilize the internet to obtain knowledge. However, the study above also reported that higher knowledge of diabetes predicts good glycaemic control (Al-Qazaz et al., 2011); it is found nonsignificant in our research. This result suggests that even though most patients have acceptable knowledge about their disease, they need to assess patients' dietary patterns and medication adherence that may influence their glycaemic control.

Because of the increasing number of non-communicable diseases (NCD) in Malaysia, the existing NCD care needs to be efficient and effective at a lower cost. Thus, there is an urgent need to empower the patient to understand their disease and promote self-care to prevent further complications related to NCD. The healthcare provider can work with diabetes educators to create and provide the self-care diabetes programme and standard treatment. One systematic review on group diabetes self-management education revealed a significant reduction of HbA1c and fasting blood glucose after the intervention (Steinsbekk et al., 2015). In addition, the study showed significant improvement in patient self-efficacy. Based on our findings, it is suggested that the module for the programme should cater to these demographic differences. For those in the older age group, a detailed explanation with an infographic can be introduced during face-to-face consultation to understand the disease better.

The study is limited in evaluating the general knowledge of diabetes, and no specific domain is emphasized. Thus, we cannot assess the specific gap in patient knowledge. In future research, it is recommended to assess a multidisciplinary approach for assessing

the patient knowledge gap in diabetes, either within the self-care, lifestyle behaviour, dietary pattern, or medication adherence. Assessment of these knowledge gaps can help develop appropriate modules for diabetes programmes to cater to the needs and characteristics of the patient (Alhaik et al., 2019).

CONCLUSION

Patients with a low level of knowledge should be targeted to receive intervention and diabetes education programmes. Healthcare providers and diabetes educators should plan a well-structured educational programme to educate their patients based on these differences to deliver diabetes education effectively.

CONFLICT OF INTEREST

The authors declare that they have no competing interests in publishing this article.

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ORIGINAL ARTICLE

Lactobacillus acidophilus NCFM, Inulin, and Oat Bran Reduce TC and LDL-C in Adults with Hypercholesterolaemia

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ABSTRACT

The present study was carried out to examine the effect of daily intake of 20 × 10^9 CFU *Lactobacillus acidophilus* NCFM or 10 g inulin or 10 g beta-glucan (β-glucan) or synbiotic on fasting blood lipid levels in healthy adult men and women with moderately raised total plasma cholesterol (TC). This study was a randomized-controlled intervention in which 30 participants received either 10 g inulin or 10 g β-glucan or 20 × 10^9 CFU *L. acidophilus* NCFM or synbiotic for a period of 8 weeks. Fasting blood samples were collected before the supplementation period (baseline) and at week 8, with a follow-up at week 12. There was a trend for TC values, compared with baseline, to be lower in the probiotic group by 9.31%, (–0.55 mmol/l; P > 0.05), inulin group by 9.58%, (–0.53 mmol/l; P > 0.05), and β-glucan group by 8.55%, (–0.47 mmol/l; P > 0.05) at week 8. There was a trend for LDL-C values, compared with baseline, to be lower in the probiotic group by 9.34% (–0.34 mmol/l; P > 0.05), inulin group by 7.98% (–0.29 mmol/l; P > 0.05), and β-glucan group by 16.08% (–0.41 mmol/l; P > 0.05) at week 8. The changes were statistically insignificant but clinically significant in all groups except synbiotic, as all levels fell into the desirable biochemistry range. There were no statistical and clinical changes in the TC and LDL-C levels in synbiotic groups. There were no statistical and clinical changes in the HDL-C and TG levels in all groups. These data suggest that the intervention supplementation except synbiotics may improve blood lipid profiles, mainly TC and LDL-C.

INTRODUCTION

Cardiovascular disease (CVD) is one of the leading causes of death worldwide. The World Health Organization (WHO) has predicted that CVD will remain the leading cause of global death by 2030. High levels of serum cholesterol and low-density lipoprotein (LDL) cholesterol are major determining factors for CVD. Clinical and epidemiological studies have proved that an increased risk of CVD is highly correlated with hypercholesterolaemia. The risk of heart attack is threefold in people with elevated cholesterol levels compared to those with normal cholesterol levels.

Current recommendations for lowering serum cholesterol levels include dietary management, lifestyle modification, and medications (Stone et al., 2014). The AHA Prevention Guideline also reported that these measures are not always effective in lowering serum cholesterol levels. Some actions, such as cholesterol medication, may have adverse side effects on the patients. Many hypercholesteraemic people seek nonpharmacological approaches and natural products to improve their serum lipid profile. Probiotics, prebiotics, and dietary fibre are some of the most popular choices.

Probiotics, defined as living microorganisms, when administered orally in adequate amounts, may exert health benefits to the host beyond the inherent essential nutrition (Guarner & Schaafsma, 1998). Probiotics are safe for human consumption, and many probiotic products are available in the marketplace. Many studies have been conducted to investigate the role of probiotics as a hypercholesterolaemia lowering agent (Cho & Kim, 2015). In vitro and animal studies have supported the probiotic effect in reducing hypercholesterolaemia (Kim et al., 2017, Das et al., 2016). Probiotics are well recognized for their general health improvements, such as lactose intolerance alleviation, improvement of inflammatory and allergic reactions (Ouwehand, 2007)and the incidence is still rising with no sign of an end to this trend. Reduced exposure to microbial allergens as a result of our hygienic lifestyle has been suggested as one of the possible causes. It has also been suggested that probiotics may provide safe alternative microbial stimulation needed for the developing immune system in infants. This idea is supported by the fact that allergic infants have been observed to have an aberrant intestinal microbiota. They were shown to have more clostridia and fewer bifidobacteria and, in addition, to have an adult-like Bifidobacterium microbiota. Clinical trials have shown that the standard treatment of infants with atopic eczema, extensively hydrolyzed infant formula, can be significantly improved through the addition of Lactobacillus rhamnosus GG or Bifidobacterium lactis Bb-12. It has also been shown possible to halve the incidence of allergy in at-risk infants through administration of L. rhamnosus GG to expecting mothers and subsequently to their infants during the first half-year of life. Many mechanisms have been proposed for these beneficial effects, ranging from improved mucosal barrier function to direct influences on the immune system. However, the exact mode(s, anti-colon cancer effect (Hirayama & Rafter, 2000) and antihypertensive effects (Ayyash et al., 2018). More recently, probiotics have been studied for their cholesterol-lowering effect in human and animal studies (Michael et al., 2017; Ruscica et al., 2019). However, the studies on humans yielded inconsistent results with some showed positive effects, while others had no effect. With conflicting results, human randomized controlled trials may benefit in evaluating the cholesterol-lowering effect of probiotics.

Lactobacillus acidophilus NCFM is a human isolate bacteria used commercially for over 25 years as a probiotic culture (Sanders & Klaenhammer, 2001). The strain can survive in the gastrointestinal tract (Sanders & Klaenhammer, 2001; Sui et al., 2002), adhere to human epithelial cells (Greene & Klaenhammer,

1994), utilizes fructooligosaccharides (Barrangou et al., 2003), modulates the host immune response, and prevent microbial gastroenteritis (Varcoe et al., 2003). Analysis of the NCFM strain genome sequence revealed the presence of two putative bile-salt hydrolases (BSH) genes (Altermann et al., 2005).

The reduction of TC and LDL-C found in blood serum is thought to lower the risk of CHD. Probiotic cultures have been proposed to play a part in reducing cholesterol, although research to date is still equivocal. An in vitro study on *L. acidophilus* NCFM (Gilliland et al., 1985; Gilliland & Walker, 1990) proposed the ability of the strain to remove cholesterol from a laboratory growth medium. NCFM was reported to take up cholesterol in the presence of bile and the absence of oxygen, both conditions present in the colon. The significance of these in vitro studies has been proved in human studies to evaluate cholesterol levels in NCFM consumers.

Prebiotics are the alternative of cofactors to probiotics. Prebiotics are indigestible food ingredients that beneficially affect the host by selectively stimulating the growth and activity of one or a limited number of indigenous bacteria, thus promoting the host's health. Prebiotics can reduce cholesterol in many studies. A randomized controlled trial in hamsters treated with inulin resulted in a total reduction of 29% decrease in cholesterol (Delzenne et al., 2019). In a randomized controlled human study, inulin administered to 120 hypercholtoteraemic men had a mean significant reduction in cholesterol by 6.6% (Kietsiriroje et al., 2015).

Dietary fibres, which are neither absorbed nor digested, are subjected to bacterial fermentation in the gastrointestinal tract, thus impacting the composition of indigenous bacteria and their metabolic activities. In the meta-analysis of randomized controlled trials by (Ho et al., 2016), dietary fibres have been shown to exert cholesterol-lowering effects when consumed at recommended levels. In a randomized, double-blind study by study by Wolever et al. (2016), consuming 3 g of β-glucan for four weeks is effective in reducing human LDL-C levels.

Studies combining probiotics and prebiotics have been studied to a limited extent. Synbiotics may improve the survival of the upper GI bacteria, thereby enhancing their beneficial effect on the colon. According to the research conducted by Wang et al. (1999), the combination of resistant starch with probiotics has increased the survival of the probiotics. Remarkably, synbiotics can selectively stimulate growth and activate the limited number of health-promoting bacteria in the GI tract, thus improving the GI tract's microbial balance (Roberfroid, 2000). Prebiotics, probiotics, and synbiotics treatments are still in their infancy but are becoming the mainstream options to reduce hypercholesterolaemia.

MATERIALS AND METHODS

This study was a randomized controlled trial in adults with mild hypercholesterolaemia with fasting serum cholesterol levels ranging from 5.2 to 6.0 mmol/l. This study was a randomized-controlled intervention in which 30 adult participants between 23 to 66 years old (Table 1) received either 10 g inulin as prebiotic or 10 g β-glucan as dietary fibre, or 20×10^9 CFU *L. acidophilus* NCFM as probiotic or a combination of prebiotic and probiotic for the synbiotic effect of statin as a positive control group or diet counselling as a negative control group for a period of 8 weeks. Before supplementation intervention, the groups were comparable in weight, height, BMI, fasting blood glucose (Table 2), and nutritional status (Table 3). Fasting blood samples were collected before the supplementation period (baseline) and at week 8, with a follow-up at week 12. Volunteers were recruited from housing areas in the vicinity of Universiti Malaysia Sabah (UMS) through leaflets and

advertisements in Polyclinic UMS. Participants expressing interest in the study who met the initial screening criteria were invited for a blood screen after fasting 10 to 12 hours before the test. Exclusion criteria included immune-compromised disease, pre-existing medical conditions, recent use of lipid-altering medications such as statins, and pregnancy for female volunteers. The conditions and procedures of the study were reviewed, and written informed consent was obtained from each subject. The Medical Research Ethics Committee of the Faculty of Medicine and Health Sciences, Universiti Malaysia Sabah, approved the protocol. The ethics approval code is JEtika 3/14(2). Blood samples were collected from each participant's forearm for serum cholesterol levels on the day of each time frame (baseline, week-8 and week-12). Before the study, each participant was asked to fill out detailed diet records for 3 days (2 weekdays and 1 weekend). Nutrient calculations were performed using The Nutritionist Pro software (First Data Bank) to convert all reported foods and beverages into energy and nutrient intakes. If an analytical value is not available for a nutrient in a food, the values were calculated based on the nutrient content of other nutrients in the same food or on a product ingredient list or estimated the value based on the nutrient content of similar foods. Participants were advised not to change their eating habits throughout the intervention. Participants were instructed to maintain their usual level of activity during the study. They were instructed to note as specific as they could what they eat (the brand and, if possible, the preparation method of the food). The amount of food consumed was measured based on household measurements or grams. Participants were given symptom evaluation surveys to complete once during each intervention. All data were analysed using IBM SPSS Statistics 24 (SPSS Incorporated, USA). The mean differences between 3 or more groups of continuous variables were examined using one-way ANOVA with Tukey's-b post hoc test and Kruskal-Wallis test. The probability value of $P < 0.05$ was considered to be significant. The statistical test used to analyze the effect size was eta-squared (η^2). Size of effect: $0.01 \leq \eta^2 \leq 0.06$ (small), $0.06 \leq \eta^2 \leq 0.14$ (medium), $\eta^2 \geq 0.14$ (large).

Table 1 Socio-demographic characteristics of all volunteers

Characteristics	All (n = 30) N(%)
Sex	
Female	20 (66.7)
Male	10 (33.3)
Ethnic groups	
Kadazandusun	14 (6.7)
Malay	11 (36.7)
Chinese	2 (6.7)
Others	3 (10.0)
Education level	
Primary education	5 (16.7)
Secondary school	11 (36.7)
A-Level/ STPM	4 (13.3)
Bachelor's degree	8 (26.7)
Master's degree	1 (3.3)
PhD	1(3.3)
Income (RM/month)	
< 2,000	18 (60.0)
2,000 – 3,000	2 (6.7)
3,001 – 4,000	3 (10.0)
4,001 – 5,000	2 (6.7)
> 5,000	5 (16.7)
Marital status	
Single	7 (23.3)
Married	22 (73.3)
Widow/ Widower	1 (3.3)

Table 2 Baseline data of anthropometric and fasting blood glucose (FBG) measurements by treatment groups

Treatment group	Prebiotic	Probiotic	Dietary fibre	Synbiotic	Statin (Control)	Diet counselling (Control)
All, n = 30						
N (%)	6	5	5	5	4	5
Weight (kg)	66.7±7.64	69.70±10.72	58.12±13.97	68.66±13.88	71.67±13.43	57.76±11.60
Height (m)	1.56±0.07	1.53±0.02	1.57±0.10	1.56±0.01	1.60±0.56	1.52±0.08
BMI (kg/m2)	27.34±1.23	29.83±4.60	23.03±3.82	28.11±5.21	27.79±3.90	24.64±3.61
FBG	4.83±0.45	4.54±0.36	5.14±0.39	5.07±0.89	5.00±0.85	5.14±0.30

Data presented as Mean±SD.

Table 3 Baseline data of energy and macronutrients on all treatment groups

Treatment group/ Energy/ macronutrients	Prebiotic, N = 6	Probiotic, N = 5	Dietary Fibre, N = 5	Synbiotic, N = 4	Statin, N = 4	Diet Counselling, N = 5	Total mean, N = 29
Energy (kcal/day)	1,359±140	1,834±763	1,281±262	1,910±891	1,027±327	1,372±315	1,445±553
Carb (g/day)	172.2±37.6	220.1±76.9	183.4±27.7	276.7±141.7	151.0±52.3	195.2±36.2	196.7±73.5
Protein (g/day)	63.5±19.7	86.2±50.9	51.2±13.5	67.4±25.4	47.6±10.4	55.7±8.4	61.5±26.9
Fat (g/day)	44.7±10.2	57.5±38.5	39.2±16.5	61.4±37.0	22.6±9.2	43.7±24.6	44.1±25.7
Dietary fibre (g/day)	5.0±1.8	7.8±5.8	7.6±4.9	3.1±2.7	4.1±2.1	3.0±1.5	5.3±3.9
Cholesterol (mg/day)	180.6±103.7	370.3±291.8	210.3±105.8	207.7±189.1	111.8±66.7	182.6±68.4	211.6±165.0
Mono fat (g/day)	8.2±4.2	11.7±7.8	8.1±2.2	13.1±11.5	4.2±1.8	7.9±3.6	8.7±6.0
Poly fat (g/day)	8.2±1.1	9.4±5.4	8.0±3.9	13.2±14.6	4.6±1.6	8.3±4.7	8.4±6.2
Trans fat (g/day)	0.3±0.5	0.4±0.9	1.2±1.9	0.7±1.2	0.0±0.1	0.7±1.3	0.6±1.2
Saturated fat (g/ day)	7.2±4.8	13.8±14.0	10.0±5.7	13.5±11.7	2.8±1.3	7.4±3.3	9.1±8.3

Data presented as Mean±SD.

Table 4 Mean cholesterol level throughout the intervention

Treatment group	Cholesterol, mmol/L			% Difference (Wk 0 – Wk 8)	CI value (95%)	P-value	Eta-squared
	Wk 0	Wk 8	Wk 12				
Pre	n = 6	n = 6	n = 6				
	5.53±0.18	5.00±0.56	4.95±0.53	–9.58	5.33 – 5.72	0.08	0.28
Pro	n = 5	n = 4	n = 4				
	5.69±0.47	5.16±1.16	5.55±0.77	–9.31	5.11 – 6.28	0.63	0.09
DF	n = 5	n = 5	n = 5				
	5.50±0.22	5.03±0.83	4.90±0.70	–8.55	5.24 – 5.77	0.33	0.17
Syn	n = 5	n = 3	n = 4				
	6.45±0.56	6.93±0.33	6.51±0.45	+7.44	5.75 – 7.14	0.40	0.18
Statin	n = 4	n = 4	n = 4				
	5.62±0.28*	4.01±0.49*	5.31±0.90*	–28.65	5.18 – 6.06	**0.01***	0.63
DC	n = 5	n = 5	n = 5				
	5.63±0.21	5.27±0.40	5.12±0.35	–6.40	5.36 – 5.89	0.08	0.34

Data presented as Mean±SD.

Values with the mark (*) in a row for each analysis are significantly ($P < 0.05$) different. Eta-squared was analyzed by comparing means for eta-squared score. Size of effect: $0.01 \leq \eta^2 \leq 0.06$ (small), $0.06 \leq \eta^2 \leq 0.14$ (medium), $\eta^2 \geq 0.14$ (large). $\eta^2 = 0.28$

Table 5 Mean LDL-C level throughout the intervention

Treatment Group	LDL-C, mmol/L			% Difference (Wk0-Wk 8)	CI value (95%)	p-value	Eta-squared
	W0	Wk 8	Wk 12				
Pre	n = 6	n = 6	n = 6				
	3.63±0.22	3.34±0.54	3.29±0.51	–7.98	3.40 – 3.86	0.39	0.12
Pro	n = 5	n = 4	n = 4				
	3.64±0.19	3.30±0.90	3.59±0.55	–9.34	3.41 – 3.88	0.67	0.07
DF	n = 5	n = 5	n = 5				
	2.55±1.39	2.14±1.37	2.16±1.21	–16.08	0.83 – 4.27	0.86	0.02
Syn	n = 5	n = 3	n = 4				
	4.28±0.70	4.53±0.91[a]	4.40±0.72	+5.84	3.41 – 5.15	0.90	0.02
Statin	n = 4	n = 4	n = 4				
	3.93±0.29*	2.31±0.47*	3.25±0.79*	–41.22	3.48 – 4.39	**0.008***	0.66
DC	n = 5	n = 5	n = 5				
	3.07±0.92	3.55±0.27	3.28±0.33	+15.63	1.93 – 4.22	0.46	0.12

Data presented as Mean±SD.

Values with the mark (*) in a row for each analysis are significantly ($p<0.05$) different. Eta-squared was analyzed by comparing means for eta-squared score. Size of effect: $0.01 \leq \eta^2 \leq 0.06$ (small), $0.06 \leq \eta^2 \leq 0.14$ (medium), $\eta^2 \geq 0.14$ (large). $\eta^2 = 0.28$

Table 6 Mean HDL-C level throughout the intervention

Treatment Group	HDL-C, mmol/L			% Difference (W0- Wk 8)	CI Value (95%)	p-value	Eta-squared
	W0	Wk 8	Wk 12				
Pre	n = 6	n = 6	n = 6				
	1.29±0.32	1.14±0.26	1.08±0.32	Negligible	0.96, 1.63	0.45	0.10
Pro	n = 5	n = 4	n = 4				
	1.07±0.28	1.21±0.40	1.18±0.42	+13.10	0.72, 1.42	0.85	0.03
DF	n = 5	n = 5	n = 5				
	1.32±0.29	1.06±0.31	1.03±0.31	−19.70	0.97, 1.68	0.28	0.19
Syn	n = 5	n = 3	n = 4				
	1.01±0.24	1.17±0.47	1.06±0.32	+15.84	0.71, 1.30	0.81	0.05
Statin	n = 4	n = 4	n = 4				
	1.11±0.43	1.08±0.26	1.30±0.50	Negligible	0.42, 1.80	0.73	0.07
DC	n = 5	n = 5	n = 5				
	1.78±1.16	1.27±0.17	1.24±0.14	+28.65	0.34, 3.22	0.40	0.14

Data presented as Mean±SD.

Eta-squared was analyzed by comparing means for eta-squared score. Size of effect: $0.01 \leq \eta^2 \leq 0.06$ (small), $0.06 \leq \eta^2 \leq 0.14$ (medium), $\eta^2 \geq 0.14$ (large). $\eta^2 = 0.28$

Table 7 Mean triglyceride level throughout the intervention

Treatment group	Triglyceride, mmol/L			% Difference (W 0 – Wk 8)	CI value (95%)	p-value	Eta-squared
	Wk0	Wk 8	Wk 12				
Pre	n = 6	n = 6	n = 6				
	1.14±0.56	1.14±0.68	1.40±1.03	Negligible	0.55, 1.73	0.80	0.02
Pro	n = 5	n = 4	n = 4				
	1.81±0.61	1.50±0.42	1.83±0.54	−17.12	1.05, 2.58	0.62	0.08
DF	n = 5	n = 5	n = 5				
	2.27±1.54	2.54±1.25	2.52±1.37	+11.89	0.36, 4.18	0.94	0.01
Syn	n = 5	n = 3	n = 4				
	2.06±1.17	3.28±3.05	2.51±1.78	+21.84	0.61, 3.52	0.70	0.08
Statin	n = 4	n = 4	n = 4				
	1.19±0.42	0.90±0.30	1.03±0.46	−24.37	0.52, 1.85	0.61	0.10
DC	n = 5	n = 5	n = 5				
	1.22±0.38	0.98±0.44	1.02±0.53	−19.67	0.74, 1.70	0.68	0.06

Data presented as Mean±SD.

Eta-squared was analyzed by comparing means for eta-squared score. Size of effect: $0.01 \leq \eta^2 \leq 0.06$ (small), $0.06 \leq \eta^2 \leq 0.14$ (medium), $\eta^2 \geq 0.14$ (large). $\eta^2 = 0.28$

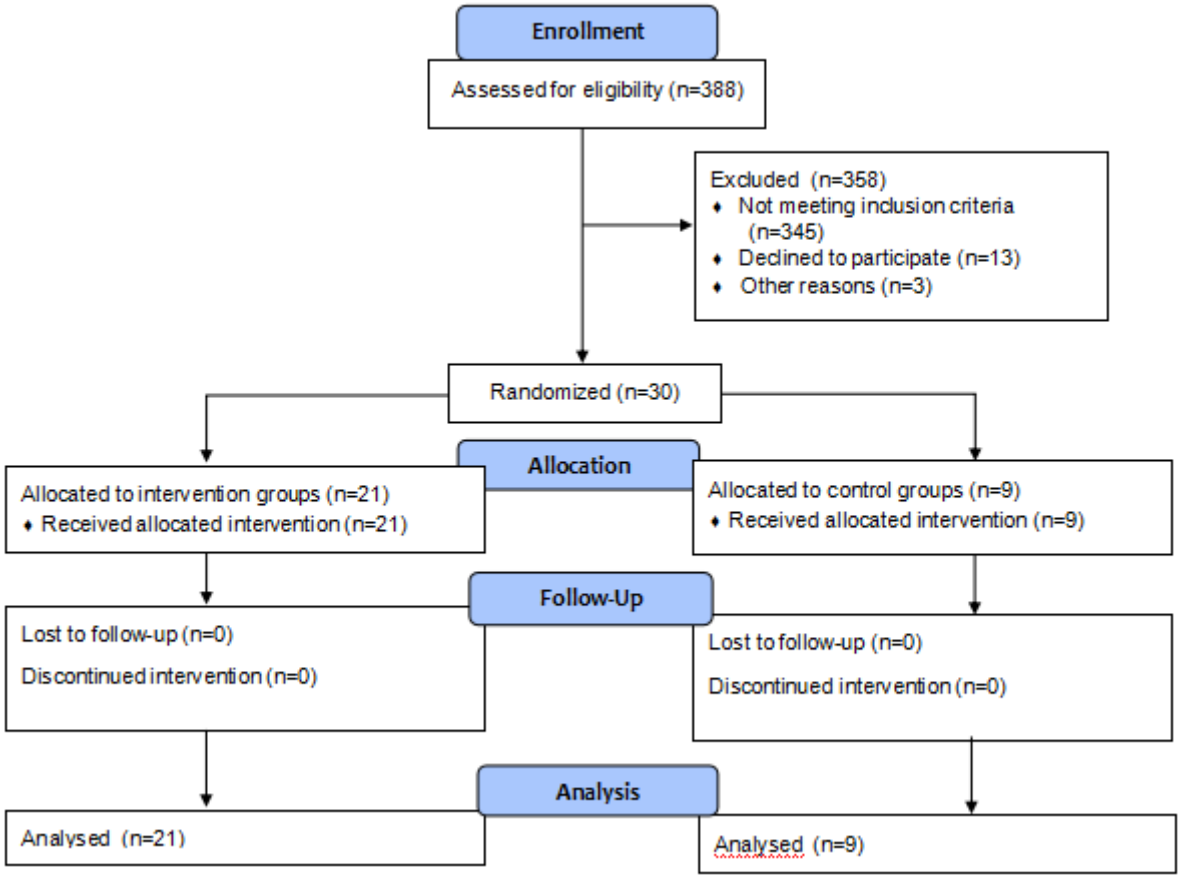

Figure 1 Participants' recruitment flow

RESULTS

Analysis of Participants' Baseline Habitual Diets

The participants' baseline habitual diets (Table 3) revealed a mean caloric intake of 1445 ± 553 kcal/day. The macronutrient breakdown is as follows: Protein: 61.5 ± 26.9 g/day (17% TEI). Fat: 44.1 ± 25.7 g/day (27.47% TEI). Carbohydrate: 196.7 ± 73.5 g/day (54.5% TEI). Dietary fibre (total): 5.3 ± 3.9 g/day. Saturated fat: 9.1 ± 8.3 g/day (5.67% TEI). Monounsaturated fat: 8.7 ± 6.0 g/day (5.42% TEI). Polyunsaturated fat: 8.4 ± 6.2 g/day (5.23% TEI). Trans fat: 0.6 ± 1.2 g/day (0.3% TEI). Dietary cholesterol: 211.6 ± 165.0 mg/day. After the 8-week intervention period, there were no significant differences in dietary intake among the 4 groups.

Analysis of Participants' Blood Lipid Profiles in All Timeline

For the cholesterol category, the trend towards intervention-related reduction was observed in the volunteers in all groups except for the synbiotic ($P > 0.05$) when compared with the statin (positive control) group. Except for the statin control group, all reduction was not statistically significant. Still, it was observed that after the intervention, not only did the cholesterol levels show an improvement, but all subjects except in the synbiotic group and negative control group (diet counselling) had cholesterol levels within the normal range, i.e., < 5.2 mmol/L, thus could be considered as clinically significant. In the prebiotic group, there was a 9.58% (–0.53 mmol/L; $P > 0.05$) reduction in cholesterol at week-8, from 5.53 ± 0.18 mmol/L to 5.00 ± 0.56. After the wash-out period, the cholesterol level maintained its desirable level

at 4.95 ± 0.53, which showed another slight decrease of 1.0% (–0.05 mmol/L; P > 0.05). This observation agrees with results reported by Jackson et al. (1999) that suggested the 8-week daily supplementation of 10 g inulin does not significantly lower cholesterol. However, in this study, it was found that the level of cholesterol entered the healthy/ desirable range, and the effect size (η^2) was 0.28 (large), thus making it clinically significant. In the probiotic group, there was a 9.31% (–0.55 mmol/L; P > 0.05) reduction in cholesterol level after week-8, from 5.69 ± 0.47 to 5.16 ± 1.16, and an increase of 7% (+0.39 mmol/L; P > 0.05) after the wash-out period. The cholesterol level improvement was medium according to the sample size effect score. The concentration fell into the desirable range of below 5.20mmol/l, thus could be considered clinically significant despite not being statistically significant compared to the statin control group. In the dietary fibre group, there was an 8.55% (–0.47 mmol/L; P > 0.05) reduction in cholesterol level after week-8, from 5.50 ± 0.22 to 5.03 ± 0.83 mmol/L. Even after the wash-out period, the improvement could be seen with another slight 2.60% reduction. 10 g/day of oat bran was an efficient therapy for clinically improving cholesterol in this study because there was a significant effect size (0.17), and cholesterol level improved into a desirable range of below 5.2 mmol/l. In the synbiotic group, there was a 7.44% increase in cholesterol (+0.48 mmol/L; P > 0.05) from 6.45 ± 0.56 to 6.93 ± 0.33 mmol/ L. The level reduced to its original level at baseline after the wash-out period. The result is statistically insignificant, as the cholesterol level remained in the 'high' range compared to baseline. The blood sample in the statin group could not be adequately studied due to instrumentation error, thus giving the researcher a questionable result.

Except for synbiotic and negative control (diet counselling group), reduction of LDL-C levels to below 3.4 mmol/L could be seen in all intervention groups. Similar to cholesterol levels, the reduction was seen after the intervention was not statistically significant but could be considered clinically significant as the changes dropped to a more desirable biochemical range. In the prebiotic group, there was a 7.98% (–0.29 mmol/L; P > 0.05) reduction of LDL-C, from 3.63 ± 0.22 mmol/L to 3.34 ± 0.54, and a further 1.50% decrease to 3.29 ± 0.51 after the wash-out period. The result was found to be statistically insignificant. However, after the intervention period, the level of LDL-C improved from the 'borderline high' range in week-8 compared to baseline, and the reduction after wash-out, although small, improved the range to 'above normal.' The effect size score was also found to be medium (0.12). Thus, the improvement in LDL-C level could be suggested as clinically significant. For probiotic group, there was a 9.34% (–0.34 mmol/L; P > 0.05) reduction after week-8, from 3.64 mmol/L to 3.30 mmol/L. Similar to cholesterol, after the wash-out period, the level increased by 8.80% (+0.2 mmo/l; P > 0.05). This result was not statistically significant, but the effect size found was 0.07, suggesting a medium improvement of LDL-C despite the concentration still in the borderline high range after the intervention period. There was a 16.08% (–0.41 mmol/L; P > 0.05) reduction in LDL-C in the dietary fibre group, from 2.55 ± 1.39 to 2.14 ± 1.37 mmol/L after week-8, and the concentration was constant after the wash-out period. The result was not clinically significant because the effect size was small (0.02) and not statistically significant. However, LDL-C concentration was within the healthy range in week-8. There was a 5.84% increase from 4.28 ± 0.70 to 4.53 ± 0.91 mmol/L (+0.25 mmol/L, P > 0.05) for the synbiotic group and a small 2.87% reduction to 4.40 ± 0.72 mmol/L after the wash-out period. The result is statistically insignificant, as the cholesterol level remained in the 'high' range compared to baseline, and the effect size was small.

It was observed that all groups had clinically normal HDL-C levels at baseline, between 1.01 – 1.78 mmol/L and there were no statistically significant changes in HDL-C levels in any timeframe. HDL-C level did not show any significant changes in the prebiotics group in week-8 compared to baseline. The slight

change in HDL-C level (1.29 ± 0.32 to 1.14 ± 0.26 in week-8 and 1.08 ± 0.32 after the wash-out period) is negligible as the mean level of HDL-C remained to be above 1.00 mmol/L, which is the normal and healthy range for HDL-C in healthy humans (National Institutes of Health [NIH], 2002). There was a modest, statistically insignificant 13.10% increase in HDL-C (+0.14 mmol/L, P > 0.05) in the probiotic group after week-8, from 1.07 ± 0.28 to 1.21 ± 0.40 mmol/L, and the concentration was constant after the wash-out period. The concentration of HDL-C in all timelines was maintained in the 'normal' range. For the dietary fibre group, there was a 19.70% (–0.26 mmol/L; P > 0.05) reduction from 1.32 ± 0.29 to 1.06 ± 0.31 mmol/L in week-8 compared to the baseline. The concentration was constant after the wash-out period. However, despite the large effect size found, the reduction was not clinically significant, as HDL-C level remained in the healthy range (over 1.00 mmol/L) after the intervention. In the synbiotic group, there was a 15.84% increase from 1.01 ± 0.24 to 1.17 ± 0.47 mmol/L (+0.16 mmol/L; P > 0.05) after week-8 compared to baseline, and the level reduced to 1.06 ± 0.32 after the wash-out period by 9.40% (–0.11; P > 0.05). The changes are insignificant as the effect size was small. HDL-C levels remained in a healthy biochemical range.

The prebiotic intervention had a neutral effect on triglyceride levels which was in agreement with previous studies (Maki et al., 2012). Triglyceride levels do not show any changes at week-8 and after the wash-out period compared to the baseline level. The levels were identical at all time-frame. The present study could not demonstrate a positive effect from 10 g/day of inulin to decreasing triglyceride levels. Letexier et al. (2003) demonstrated triglyceride reduction efficacy of 10 g/day of inulin only when consumed with a low-fat, high-carbohydrate diet. Ten grams per day of inulin was found to be an efficient therapy to clinically improve cholesterol and LDL-C levels to desirable and healthy levels but had no effect on triglycerides and HDL-C levels in all time frames. The effect size for all the groups was either small or medium, with no significant effect, indicating all treatments did not clinically affect triglyceride levels. Triglyceride levels in the probiotic group had an insignificant decrease by 17.12% (–0.31 mmol/L; P > 0.05) from 1.81 ± 0.61 to 1.50 ± 0.42 in week-8. The level bounced back to its original level at 1.83 ± 0.54, which increased by 22%. Triglyceride level in week-8 was not clinically significant, as the reduction remained at an unhealthy level (NIH, 2002). Triglyceride in the dietary fibre group showed an 11.89% (+0.27 mmol/L; P > 0.05) increase from 2.27 ± 1.54 to 2.54 ± 1.25 mmol/L, and the level remained constant after the wash-out period. The result was clinically and statistically insignificant, as the triglyceride level remained in the 'high' range compared to baseline. Clinical trials have also confirmed that the consumption of β-glucans reduces total cholesterol levels, including LDL-C, without affecting HDL-C and triglyceride levels (Anderson et al., 2009). The increase in triglyceride concentration in the synbiotic group appeared to be big. Still, there were no significant differences statistically and clinically, as the level of triglycerides remained in the high biochemical range. It was seen that after the wash-out period, the concentration of triglyceride decreased to 2.51 ± 1.78 mmol/L, showing a smaller 21.84% change from baseline (–0.45 mmol; P > 0.005) compared with baseline to week-8.

The present study found mild to no abdominal symptoms from consuming the intervention products.

DISCUSSION

Ten grams per day of inulin was found to be an efficient therapy to clinically improve TC and LDL-C levels to desirable and healthy levels but had no effect on triglycerides and HDL-C levels in all time frames. HDL-C had statistically insignificant changes but remained in the healthy range above 1.00 mmol/l. This observation agrees with results reported by Jackson et al. (1999) that suggested the 8-week daily supplementation of 10 g inulin showed a positive effect on lowering cholesterol, although not significant

statistically. Another similar study (10 g/ day in a 12-week intervention) showed that a powdered inulin-based fibre supplement consumption did not significantly change the cholesterol level in volunteers diagnosed with hypercholesterolaemia (Bonsu & Johnson, 2012). However, in this study, it was found that the level of TC entered the healthy/ desirable range, thus making it clinically significant. In several studies, the effect of inulin consumption on HDL-C was either increased modestly or nonsignificant, so the evidence of inulin on HDL-C was found to remain inconclusive. The intervention had a neutral effect on triglyceride levels, which agrees with previous studies (Maki et al., 2012). Beneficial effects of inulin on lipid profile mainly mediated by short-chain fatty acid (SCFA). Butyrate inhibits liver cholesterol synthesis and provides a source of energy for human colon epithelial cells. Acetate may act as a precursor for cholesterol synthesis, while propionate could inhibit hepatic cholesterol synthesis by decreasing the use of acetate as a precursor of cholesterol. Also, inulin-type fructans may contribute to cholesterol reduction by increasing faecal bile acid excretion, reducing intestinal cholesterol absorption, and increasing the expression of 3-hydroxy-3 methylglutaryl-COA reductase (HMG-COA reductase) (Lye et al., 2010).

The present study examined the effects of an 8-week supplementation of *L. acidophilus* NCFM and *Bifidobacterium lactis* Bi-07 mixed powder on serum lipid levels in hypercholesteraemic participants. Based on a previous literature search, this study was the first to evaluate the effects of consumption of *L. acidophilus* NCFM strain on serum lipid concentrations *in vivo* (human trial). As the strain NCFM has never been studied in vivo before this research, no direct comparison could be made for this group. Comparison is made with other *L. acidophilus* subspecies, as in-vitro studies suggested that *L. acidophilus* may be more effective than different types of probiotics in reducing cholesterol (Klaver & Meer, 1993; Lye et al., 2010). Comparison is also made with in vitro and animal studies in place of in vivo studies; 20×10^9 CFUs *L. acidophilus* NCFM was efficient therapeutic to improve TC levels to desirable and healthy levels clinically but had modest effects on triglycerides and HDL-C levels in all time frames. LDL-C level is not clinically and statistically different because the concentration was still borderline high and above normal after the intervention period. In human clinical studies, there is no consensus on the effects of consumption of *Lactobacillus* strains on lipid profile. One of the earliest studies on the *Lactobacillus* strain has shown that 3 weeks of administration of 200 ml milk containing *L. acidophilus* L1 was associated with reducing cholesterol levels in hypercholesterolaemic individuals (Gilliland et al., 1985). However, a more recent study by Hove et al. reported that 12 weeks of intake of milk fermented with *L. helveticus* did not affect serum lipids. As the strain, NCFM has never been studied *in vivo*. This research proved that another subspecies of *L. acidophilus* could be associated with reducing cholesterol levels in hypercholesterolemic individuals. Comparison is made with other *L. acidophilus* subspecies, as studies suggested that *L. acidophilus* may be more effective than different types of probiotics in reducing cholesterol. *L. acidophilus* NCFM strain is often used in clinical trials in combination with *B. lactis* Bi-07 as formulated by the product's manufacturer. However, based on a genetic analysis study by many researchers, only the *L. acidophilus* NCFM strain posseses the bile-salt hydrolase gene, the enzyme needed to deconjugate bile acids via the bile metabolism process, thus aiding in cholesterol removal via fecal (McAuliffe et al., 2005). Increased excretion of bile acids should result in lower serum concentrations, which would decrease the amount of bile acids reaching the liver for secretion back into the intestine through enterohepatic circulation. To replace the excreted bile acids, more would have to be synthesized from cholesterol in the liver. Thus, it has been suggested that in a steady-state situation, deconjugation of bile acids could lead to the reduction of serum

cholesterol by increasing the formation of new bile acids or by reducing cholesterol absorption throughout the intestinal lumen (Pereira & Gibson, 2002). Cholesterol assimilation in vitro was shown by the appearance of cholesterol in the cells during growth which was associated with decreases in cholesterol concentration in the growth medium. This uptake of cholesterol occurred only when the culture was grown anaerobically in the presence of bile. The amount of bile required to enable the cultures to remove cholesterol from the growth medium was not in excess of the levels normally encountered in the human intestine (Gilliland et al., 1985). Thus, the conditions required in the in vitro system for cholesterol uptake by NCFM strain would also be expected to occur in the human intestinal tract. This should enable humans to assimilate at least part of the cholesterol ingested in the diet, thus making it unavailable for absorption into the blood. A similar action could be exerted on endogenous cholesterol in the intestines.

Clinical trials have confirmed that the consumption of β-glucans reduces total cholesterol levels, including LDL-C, without affecting HDL-C and triglyceride levels (Anderson et al., 2009). Despite the slight reduction in LDL-C, the result was not clinically and statistically significant, as the week-8 concentration is within the healthy range. Oat brans can bind with bile acids in the small intestine, therefore removing them from the body and decreasing the bile acid recycling activity. As a result, TC and LDL-C in the blood are reduced, while HDL-C and triglycerides are unaffected (Xie et al., 2015). In addition, oat brans are fermented in the colon into short-chain fatty acids (SCFAs) and gases. When SCFAs enter the circulatory system, they may regulate intestine hormones, inhibit the liver from producing cholesterol, and consequently have a direct cholesterol-lowering effect. Many researchers believe that short SCFAs, particularly propionate, might be involved in lowering cholesterol concentrations in serum and liver either by inhibiting hepatic cholesterogenesis and redistributing cholesterol from plasma to the liver (Pereira & Gibson, 2002; Colburn et al., 2012; Xie et al., 2015).

In the synbiotic group, all parameters showed an increase in concentration in week 8 compared with the baseline value. However, all deals dropped back to baseline concentration after week 12. The increase was statistically and clinically insignificant, as all concentrations remained in the same biochemical range. A study by Taghizadeh et al. (2014) found that no significant effects of the synbiotic food consumption on serum TC, LDL, HDL, and plasma TAC levels ($P > 0.05$) could be observed.

Clinical interpretation of treatment outcomes is essential because it influences clinical decision-making, including patient safety and efficacy. Clinical significance is the practical importance of the treatment effect, whether it has a natural, palpable, or noticeable impact on daily life. In this study, none of the results in any groups but statin therapy (positive control) showed a statistically significant improvement in lipid profiles. However, it does not automatically imply that the interventions given were not clinically effective, as the intervention effect offers more information for clinicians to assess the application of the research finding, including the magnitude and direction of the intervention outcome. According to Page (2014), clinically relevant changes in outcomes are identified (sometimes interchangeably) by several similar terms, including "minimal clinically important differences (MCID)," "clinically meaningful differences (CMD)," and "minimally important changes (MIC)." However, the researcher has a reason to believe that the samples in the synbiotic group had lower stability compared to other intervention groups, thus showing a higher concentration of all lipid profiles than the other groups, especially in week 8. This might be due to more extended storage of the samples at –40°C for baseline samples and week-8 samples. The models had to be rerun using a different chemistry analyser because

our faculty's chemistry analyser broke down in the middle of the intervention, creating another limitation, considering other analyser systems might have a diverse reference range for their lipid control values.

When the results in the statin control group were compared with the other intervention groups, it was found that the intervention groups (except synbiotic) maintained the cholesterol level changes even after the wash-out period ended, making the inclusion of intervention products to be a more viable recommendation for short-term treatment of Hypercholesterolaemia than a statin. It is also suggested that the inclusion of the products could continue improving the cholesterol level in the long run without having to consume cholesterol-lowering drugs (statins).

In the prebiotic group, only 1 volunteer reported mild flatulence during the inulin consumption period, while the others said no side effects. Other volunteers could tolerate inulin very well in their diets. Gastroenterology research by Azpiroz et al., 2017 also reported that inulin intake did not cause any increase in symptoms such as bloating and flatulence or other side effects. Plausibly, any positive response to inulin is related to the adaptation of microbiota activity, as inulin can promote the proliferation of more efficacious microbiota such as bifidobacteria, which can ferment residues using metabolic pathways with the lower gas release (Manichanh et al., 2014). Other pools of colonic microorganisms, particularly sulfate-reducing bacteria, acetogenic bacteria, and methanogenic archaea, consume largely the gases produced by fermentation.

In the dietary fibre group, 1 volunteer reported stomach discomfort from very mild bloating and slightly severe flatulence cases. The same volunteer also reported having mild diarrhoea. Quickly adding a large amount of oat bran has been found to cause digestive stress with symptoms such as diarrhoea, stomach discomfort, bloating, and flatulence (Mälkki et al., 2001). To prevent these side effects, it was recommended to slowly introduce foods like oat bran into your diet over a few weeks.

In probiotic and synbiotic groups, the volunteers experienced virtually no abdominal symptoms and reported a relatively high level of digestive comfort. Volunteers well tolerated the intervention products.

This study has some relevant limitations. The first one is the relatively low number of subjects investigated per treatment group, related to the low participation in the enrolment. Naing et al. (2006) suggested oversampling the calculated sample size required by 10 – 20% to consider the possibility of respondents withdrawing their participation during actual research. However, each arm had exactly 5 volunteers as calculated due to participation, time, and financial limitations. However, the study was sufficiently powered based on the sample size calculation. Secondly, the study was relatively short, so we do not know if the observed effect could be confirmed and improved in the long term. However, from the improvement of the cholesterol and LDL-C levels, we have no reason to doubt that this evidence could be translated to the intervention products. Due to limitations on instrumentation and blood sample availability, not all blood samples could be analysed. In the probiotic group, the limitation was due to the failure to draw blood from the volunteer's vein. Because it is an intrusive procedure, the blood drawing was stopped by the medical laboratory technologist to prevent further pain, which if continued, could lead to further problems such as withdrawal from the study. In the synbiotic group, the lack of blood samples was due to the condition of the blood and the instrumentation. The chemistry analyzer which was used to analyze the blood was found to be faulty, thus it did not print out the results needed. Because several attempts were made that used quite a large volume of blood serum, by the time the researcher sent

it to a private path lab, the volume needed for the analysis was insufficient, thus resulting in missing data. The data gathered in other intervention groups was good. A significant body of research aimed at understanding *L. acidophilus* NCFM at microbiological, genetic, and clinical levels has been conducted over the past 25 years. These studies have provided insight into the probiotic functionality of this strain. Furthermore, this strain has been used successfully in commercial applications, with a minimum of technological hurdles. Confirmation of the strain functionality in lowering cholesterol level will, however, require well-controlled clinical evaluations aimed at appropriate target populations and clinical end points.

CONCLUSION

In conclusion, the study findings suggested that a small lifestyle modification such as the introduction of 10 g oat bran, 20×10^9 CFUs *L. acidophilus* NCFM and *B. lactis* Bi-07, and 10g inulin could have a positive effect on the volunteers. The effect size analyzed in this study showed that the interventions had a medium to large effect on the volunteers' health, which suggested a clinically significant effect on the improvement of lipid profiles in hypercholesterolemic adults. The prebiotic group showed the highest improvement in total cholesterol and LDL-C levels, followed by the probiotic group and dietary fibre group respectively. The study was unable to observe beneficial results in lowering cholesterol levels in synbiotic intervention.

CONFLICT OF INTEREST

The authors declare that they have no competing interests in publishing this article.

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ORIGINAL ARTICLE

Overweight and Obesity Among Rural Community in Northern Borneo: Prevalence, Body Weight Perception and Its Associated Factors

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ABSTRACT

The World Health Organization (WHO) reported that Malaysia has the highest rate of obesity and overweight among Asian countries. There is an increasing trend in obesity from 11.9% (2015) to 14.8% (2019), according to the National Health and Morbidity Survey (NHMS). This study aimed to investigate the prevalence, bodyweight perception, and associated factors of overweight and obesity among rural communities in Northern Borneo. This cross-sectional study was conducted in one village in Northern Borneo. Adults from 18 to 69 years of age (n = 165) were included in the survey, and data were collected by interview or self-administered questionnaires. Measurements of weight and height were done for body-mass-index (BMI) calculation. The prevalence of overweight and obesity in the village was 71.5%. Kappa statistic indicated only a slight agreement between perceived and actual body weight status (k = 0.163, 95% CI = –0.156 to 0.482, p < 0.000). There were higher odds of being overweight and obese among the middle-aged group (35 – 55 years old) than the younger group (<35 years old) (OR = 3.575; 95% CI: 1.667, 7.667; p < 0.05) and among the married adults than the unmarried adults (OR = 2.196; 95% CI: 1.057, 4.565; p < 0.05). Although age and marital status are non-modifiable factors of overweight and obesity, this research indicated poor consistency between perceived and actual body weight with kappa statistics. The large magnitude of body weight misperception might contribute to overweight and obesity in the rural community.

INTRODUCTION

Overweight and obesity are excessive or abnormal fat accumulation that incurs health risks. WHO considered them a global burden as about 1.9 billion adults were overweight and 650 million were obese in 2016 (World Health Organization, 2020). The epidemic of overweight and obesity has led to a major challenge to chronic disease prevention and health worldwide (Gupta, 2014). NHMS 2019 showed that 50.1% of adults were overweight or obese in Malaysia. Besides, NHMS 2015 also showed an increasing trend of overweight or obesity from 44.5% in 2011 to 47.7% in 2015. In a health screening programme in the Inanam sub-district, Kota Kinabalu, Sabah, the prevalence of obesity based on BMI was 28% (Zarkasi et al., 2020). Another cross-sectional study in the rural community of Kudat also showed that 28.2% of respondents were found to be obese (Wong et al., 2017).

Obesity is strongly associated with chronic non-communicable diseases (NCDs), including diabetes and hypertension, leading to more severe complications. Nowadays, it is no longer being labelled as an urban-specific health issue about the high prevalence of overweight and obesity in rural areas compared to urban areas in a particular country (Shen et al., 2019).

Self-perceived body weight is an essential facilitator for people to maintain or lose weight (Park et al., 2016). It was suggested that body weight perception initiates one to attempt weight control. The attempt is less likely to be taken in overweight or obese people without accurate body perceptions (Rahman & Berenson, 2010). Thus, body weight perception was studied in this research to investigate the agreement between perceived and actual body weight status.

In this study, the associated factors of overweight and obesity were categorised into sociodemographic characteristics (age, gender, marital status, education level, and household income) and lifestyle factors (dietary habits and physical activity). This study aimed to investigate the prevalence, bodyweight perception, and associated factors of overweight and obesity among rural communities in Northern Borneo to target the ways to combat obesity and overweight effectively.

MATERIALS AND METHODS

Study Site Description

Kudat, a district located in the northern part of Borneo, Sabah, Malaysia, is about 190 kilometres from the state capital, Kota Kinabalu, with a total population of 101,683 (Department of Statistics Malaysia [DOSM], 2020). Rungus, a sub-ethnic group of the Kadazan-Dusun, makes up the majority of the people of Kudat.

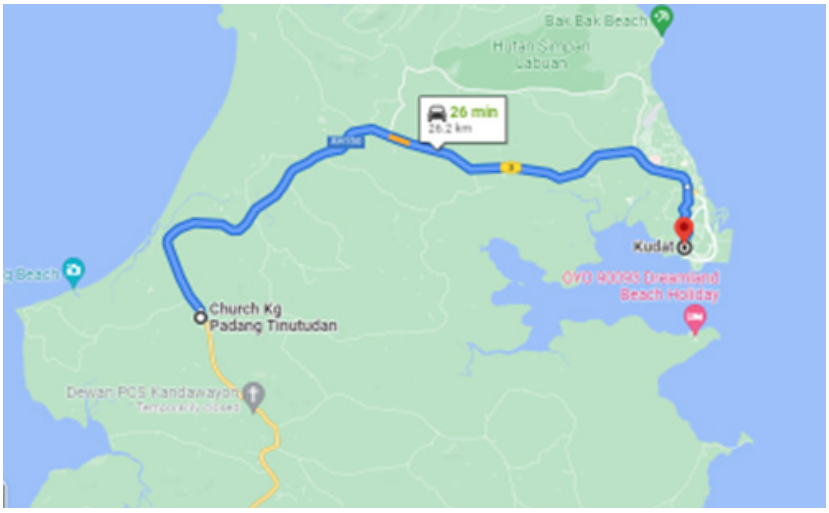

Figure 1 Kampung Tinutudan is 26.2 km away from Kudat, accessible via Jalan Kota Belud (Google, n.d.)

Data Collection

The study was conducted in Northern Borneo from November 2019 to December 2019. The inclusion criteria were male and female adults aged 18 to 69 years old for the International Physical Activity Questionnaire (IPAQ). Out of 297 people, 165 participants (56%) participated in our study by the universal sampling method. Pregnant ladies and those who were physically injured were excluded from our research. Data were collected through interviewing or self-administering questionnaires.

Research Tools

The questionnaire consisted of four components: (a) sociodemographic information, namely age, gender, date of birth, marital status, educational level, and household income; (b) body weight perception; (c) healthy eating assessment; and (d) IPAQ short form. Weight and height were measured with Seca weighing scale and measuring tape, respectively, for BMI calculation. BMI is defined as the ratio of a person's weight (kg) to the square of height (m^2). Based on the Malaysian Clinical Practice Guideline (CPG) Management of Obesity, a BMI greater than or equal to 23.0 kg/m^2 until 27.4 kg/m^2 is considered overweight, while a BMI over or equal to 27.5 kg/m^2 is considered obese.

Bodyweight perception is defined as how the participants describe their body images. It was classified into: (i) very underweight; (ii) underweight; (iii) normal; (iv) overweight; and (v) obese. Actual body weight status was categorised into underweight, normal, overweight, and obese. In contrast, body weight perception was then re-categorized into underweight (combination of very underweight and underweight), normal, overweight, and obese data analysis.

In Malaysia, marriage procedures consist of Islamic procedures for Muslim couples (Islamic Law) and civil systems for non-Muslims registered under the Marriage and Divorce Act 1976, Act 164 (National Registration Department of Malaysia, 2019). In this study, marital status was divided into two categories: (i) Married; and (ii) Unmarried (single, widow/ widower/ divorcee). Education status is the official confirmation in the form of a document certifying the successful completion of an educational programme or a stage of the programme (UNESCO Institute for Statistics, 2012). Education level was divided into four categories: (i) primary; (ii) secondary; (iii) tertiary; and (iv) others (no formal education). Household income is the monetary receipts, goods, and services received by the household members, excluding irregular, one-time receipts and windfall gains (Conference of European Statisticians, 2011). It was classified into: (i) less than RM800; (ii) RM801 – 2,000; (iii) more than RM2,000.

Dietary habit is defined as regarding individuals' or groups' food intake (Preedy & Watson, 2010). It was classified based on the Healthy Eating Assessment Score derived from the Northwest Territories government: (i) needs improvement: 10 – 19; (ii) fair: 20 – 29; (iii) good: 30 – 39; and (iv) excellent: 40 – 50. The scoring system was based on the questionnaire of Healthy Eating Assessment Score (Government of Northwest Territories, 2017)

Physical activity level was calculated with International Physical Activity Questionnaire (IPAQ) short form scoring protocol, namely: (i) high – a high-intensity activity for at least three days which achieves a minimum of 3,000 metabolic equivalents of task (MET) min/ week or around one hour of activity per day or more with at least a moderate intensity; (ii) moderate – five or more days of moderate-intensity activity or achieves 600 – 2,999 MET min/week; and (iii) low: MET of less than 600 min/week (IPAQ, 2008).

The interviewer assisted illiterate participants in further clarification of the in-depth questions: Healthy Eating Assessment and IPAQ short form. Weight was measured where the weighing scale was placed on a flat

surface and was calibrated before asking the participants to stand on it. The participants were also made sure not to carry extra belongings such as a wallet or handphone. Height was measured where the participants had to stand straight, leaning to a straight wall and facing forward. Three readings were taken, and their average was used for BMI calculation.

Statistical Data Analysis

IBM SPSS Statistics for Windows, Version 26.0 was used for data analysis. A p-value ≤ 0.05 was defined as statistically significant. The chi-square test of the association tested the presence of an association between the variables. If there was a significant association between the variables, the odds ratio and 95% confidence interval (CI) were estimated by multiple logistic regression analysis. Sociodemographic factors (age, gender, marital status, education level and household income) and lifestyle factors (dietary habit and physical activity) were the independent predictor variables, whereas BMI (overweight and obesity) were the dependent variable.

Ethical Clearance

This study was approved by the Ethics and Research Committee, Universiti Malaysia Sabah (UMS) (JKEtika 3/21(25)). The study protocol was explained to all participants before giving verbal and written informed consent. The participants had the right to withdraw from the study without penalty, and their data remained anonymous.

RESULTS

Sociodemographic Characteristics, Dietary Habit and Physical Activity of Adults Aged 18 – 69 Years

Out of 297 people, a total of 165 participants (56%), aged from 18 to 69 years, participated in the study, where most participants belonged to the age group of 35 to 55 years old (49%) (Figure 2). There were more female (54%) participants than male participants (46%) (Figure 3). More than two-thirds of the participants were married (73.3%). For educational status, most of the participants' highest education level was secondary education level (49.1%). Around one-third of the participants had a household income of RM800 – RM2,000 (38.2%) (Table 1).

Most of the participants fell in the good category of the Healthy Eating Assessment (89%) from this study. The data collected also showed that most participants engaged in a high physical activity (46.1%) (Table 2).

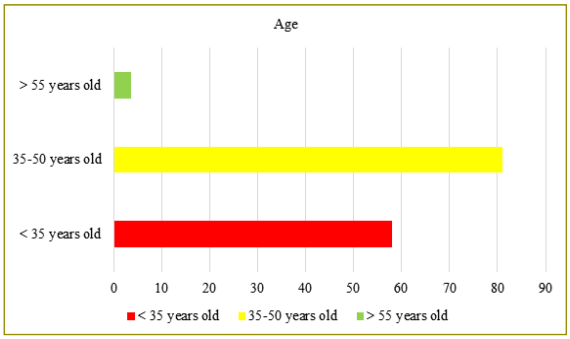

Figure 2 Age distribution of the participants

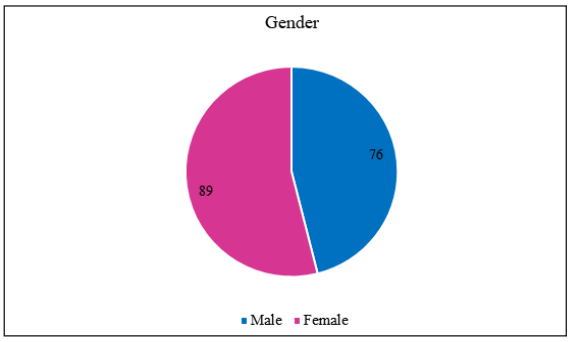

Figure 3 Gender of the participants

Table 1 Other demographic characteristics of the participants (n = 165)

Marital status		
Married	121	73.3
Unmarried	44	26.7
Educational level		
Less than primary school	22	13.3
Primary school	21	12.7
Secondary school	81	49.1
Tertiary	41	24.8
Household income		
< RM800	55	33.3
RM800 – RM2,000	63	38.2
> RM2,000	47	28.5

Table 2 Healthy eating assessment and international physical activity among the participants (n = 165)

Healthy eating assessment		
Needs improvement	0	0
Fair	9	5.5
Good	147	89
Excellent	9	5.5
International Physical Activity Questionnaire		
Low (< 600 MET min/week)	23	13.9
Moderate (600 – 2,999 MET min/week)	66	40
High (≥ 3,000 MET min/week)	76	46.1

Body Weight Perception

Table 3 shows an inconsistency between perceived and actual body weight status in rural communities. Kappa test was done to determine the degree of agreement between perceived and actual body weight status (Kappa statistic (k) = 0.163; 95% CI: –0.156 to 0.482; p < .0005). The strength of the agreement between perceived and actual body weight status was significantly slight.

Table 3 also shows that among those who were overweight or obese (n = 118), 41% of them misperceived themselves as normal or underweight.

Table 3 Bodyweight perception of adults aged 18 – 69 years (n = 165)

		Actual body weight status				Total
		Underweight	Normal	Overweight	Obese	
Perceived body weight status	Underweight	4	9	2	1	16
	Normal	3	24	36	9	75
	Overweight	0	4	24	33	61
	Obese	0	0	2	11	13
	Total	7	40	64	54	165

Association of Sociodemographic Factors, Dietary Habit and Physical Activity with Overweight and Obesity

Table 4 shows the odds ratio and 95% CI of sociodemographic factors associated with overweight and obesity. There were higher odds of being overweight and obese among the middle-aged group (35 – 55 years) compared to the younger group (< 35 years) (OR = 3.575; 95% CI: 1.667, 7.667; p < 0.05). There were also higher odds of being overweight and obese among the married group than the unmarried group (OR = 2.196; 95% CI: 1.057, 4.565; p <0.05). However, among gender, education level, and household income, the differences in the odds ratio of being overweight and obese were non-significant (p > 0.05).

There was no significant association of lifestyle factors, namely dietary habits and physical activity, with overweight and obesity (p > 0.05).

Table 4 Association of sociodemographic factors, dietary habits, and physical activity with overweight and obesity (n = 165)

		Overweight and Obesity		X^2	p-value (< .05)	OR [95% CI]
	Total (n = 165)	Yes n (%)	No n (%)			
Age group				11.927	**0.003***	
<35	58	32 (55.2%)	26 (44.8%)			1.00
35 – 55	81	66 (81.5%)	15 (18.5%)			3.575 [1.667, 7.667]
>55	26	20 (76.9%)	6 (23.1%)			2.708 [0.949, 7.731]
Gender				0.015	0.903	
Male	76	54 (71.1%)	22 (28.9%)			1.00
Female	89	64 (54.2%)	25 (28.1%)			1.043 [0.530, 2.054]
Marital status				4.547	**0.033***	
Unmarried	44	26 (59.1%)	18 (40.9%)			1.00
Married	121	92 (76%)	29 (24%)			2.196 [1.057, 4.565]
Educational level				3.267	0.352	
Primary	21	12 (57.1%)	9 (42.9%)			1.00
Secondary	81	62 (76.5%)	19 (23.5%)			0.622 [0.179, 2.163]
Tertiary	41	29 (70.7%)	12 (29.3%)			0.523 [0.542, 4.282]
Others	22	15 (68.2%)	7 (31.8%)			1.128 [0.367, 3.461]
Household income				1.936	0.380	
<800	55	39 (70.9%)	16 (29.1%)			1.00
801 – 2,000	63	42 (66.7%)	21 (33.3%)			0.659 [0.265, 1.635]
>2,000	47	37 (78.7%)	10 (21.3%)			0.541 [0.226, 1.294]
Healthy eating assessment				0.233	0.890	
Needs Improvement	0	0 (0%)	0 (0%)			
Fair	9	6 (66.7%)	3 (33.3%)			1.00
Good	147	106 (72.1%)	41 (27.9%)			1.293 [0.309, 5.413]
Excellent	9	6 (66.7%)	3 (33.3%)			1.00 [0.141, 7.099]
Physical activity				1.668	0.434	
Low	23	15 (62.5%)	8 (34.8%)			1.00
Moderate	66	45 (68.2%)	21 (31.8%)			1.143 [0.419, 3.114]
High	76	58 (76.3%)	18 (23.7%)			1.719 [0.627, 4.709]

DISCUSSION

The study indicated a high prevalence of overweight and obesity among the rural communities in Northern Borneo at 71.5%. The high prevalence of overweight and obesity in rural communities in Sabah was also indicated in a study in the Kiulu district of Sabah, where 42.9% of 42 participants were obese (Zarkasi et al., 2018). Moreover, according to a survey, approximately every one in two people in Malaysia was obese (Chan et al., 2017). This result was reflected more severely in our study finding in which more than half of our participants were overweight and obese.

Our study showed a significant inconsistency between perceived and actual body weight status in which 41% of overweight or obese adults misperceived themselves as normal or underweight. Kappa statistic showed that k = 0.163, indicating that the agreement strength was only slight. Underestimation of own body weight status found in this study correlates with another research done among Nigerian rural communities, which stated that 30% of participants underestimated their body weight (Akinpelu et al., 2015). Another study among children and adolescents in China also showed a mismatch between BMI and body weight perception. Kappa tests revealed poor BMI and body weight perception (Wang et al., 2018). Bodyweight misperception might be due to the high prevalence of overweight and obesity among rural communities. Some longitudinal studies supported this, which showed the increasing tendency of failure to identify adiposity with increasing population obesity prevalence. It is also stated that exposure to obesity leads to the normalization of larger body sizes, contributing to the failure among the population to recognise overweight and obesity according to a visual normalisation theory (Oldham & Robinson, 2016). On the contrary, based on three surveys of the Spanish adult population, it was reported that there was 26.9 to 28.4% over-perception of overweight or obesity, with the most significant percentage of misperceived overweight in the normal BMI (Gutiérrez-Fisac et al., 2002).

On the other hand, there was a significant association between age with overweight and obesity, especially among middle-aged adults (35 – 55 years old). The strong association is due to an increased amount of body fat in the body naturally with ageing, where men often gain weight until the age of 55 whereas females until the age of 65 (Starr & Bales, 2015).

Our study also exhibited a significant association between marital status with overweight and obesity. Married adults have a higher chance of being overweight and obese than unmarried (single, widow, widower or divorcee) adults. This outcome is supported by a study in 2009 that found that married respondents had a higher prevalence of generalized obesity (18.6%) than unmarried (6.9%) respondents (Sidik & Rampal, 2009). Another study also showed that marriage was associated with two-year weight gain, whereas divorce was associated with two-year weight loss (Jeffery & Rick, 2002). Among married women, the increase in BMI could be due to parity, as childbearing was suggested to contribute to the development of obesity.

In terms of gender, there was no association between gender with overweight and obesity. This contradicts a previous study stating that the gap between the prevalence of obesity between women and men had widened (Lim, 2016). Besides, our study found no association between educational level with overweight and obesity, which is inconsistent with the investigation in three countries of central and Eastern Europe, showing that the level of education was inversely associated with the prevalence of obesity (Pikhart et al., 2007).

Our study demonstrated no significant association between household income with overweight and obesity. Finding the association between household income

and BMI was difficult as other factors such as education level, household size, and socioeconomic status might influence this association (Ahmad et al., 2018).

Besides, our study showed no significant association between dietary habits with overweight and obesity due to recall bias. Response bias might also occur when the participants tended to answer the perceived correct answer.

Lastly, there was no significant association between physical activity with overweight and obesity. The physical activities performed by the participants included farming and doing house chores, which were done daily. A review concluded that the evidence of physical activity as a measure to control weight was inconclusive (Cook & Schoeller, 2011). On the other hand, a previous study is consistent with our study where the finding showed that there was no significant association observed between self-reported total physical activity and BMI as they were unable to determine if physical activity could directly affect BMI because it was a cross-sectional study with a limited duration (Lee et al., 2019). Moreover, there might be the presence of certain biases such as recall bias or social desirability bias while answering the IPAQ short form.

This study defined overweight and obesity based on BMI. However, higher BMI among rural communities does not always equal obesity. The participants might have large muscle mass due to their everyday engagement with increased physical activities such as farming, gardening, and other labour-intensive activities (Cheah & Poh, 2014). Therefore, proper waist circumference measurement is suggested in further studies to assess central obesity among rural communities. Still, the study's high percentage of body weight misperception may indicate the need to correct their perception as the first step to initiating weight control behaviour.

Our study showed that marital status was significantly associated with obesity or overweight. This can be due to married couples tending to have the same dietary habits and thus result in similar weight status. Our study shows that middle-aged adults were more likely to be overweight and obese. This is similar to the results shown in NHMS 2015, in which adults aged from 40 to 60 years old were reported to have the highest prevalence of overweight or obesity. This may be due to increased fat with increasing age.

CONCLUSION

The alarmingly high prevalence of overweight and obesity among rural communities in Sabah needs an urgent call for action. Prompt and effective intervention must be implemented to initiate adequate, profound, and sustainable weight control. Empowering the rural communities to recognise their actual body weight may be the first and foremost step in starting severe weight control behaviour and tackling the health issues of overweight and obesity among rural communities.

CONFLICT OF INTEREST

The authors declare that they have no competing interests in publishing this article.

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SHORT COMMUNICATION

A Beginner's Guide to Academic Writing for Healthcare Professionals: Citation and Referencing

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ABSTRACT

A significant amount of research has been found to have inaccurate references, reflecting the need to learn how to cite and reference effectively at the early stage of an academic writing career for junior healthcare professionals. Hence, this short communication serves as a beginner's guide to referencing by addressing key aspects, including relevant terminologies, reference styles, tools that facilitate the referencing process, and citation accuracy. Learning referencing skills can be a good start if a junior researcher does not know where to start in publishing.

INTRODUCTION

One of the important skills in academic writing is the ability to cite articles appropriately, i.e., referencing. Referencing includes detailed information on all sources consulted, both within the text and at the end of the work (Crawford, 2020). The purpose of referencing includes: (1) acknowledging the work of others which essentially avoids the problem of plagiarism; (2) facilitating the readers to identify the origin of the information; (3) substantiating arguments and ideas; and (4) providing an objective measurement of the impact of an article.

There are two important aspects of referencing: (1) using the correct format and (2) citing the content accurately. As much as 54% of studies were found to have problems with citation accuracy (Rivkin, 2020). The

implication of misquotation can mislead the readers significantly. Hence, it is prudent for a junior researcher in any healthcare profession to grasp the concept of referencing in the early stage of their academic career. This article aims to provide a beginner's guide on referencing.

Important Terminologies

There are two steps during referencing, i.e., citing them within the text and listing down all the references at a specific location in the text. Citations are paraphrased or summarised sentences that acknowledge other peoples' ideas in the paper. On the other hand, a quotation extracts another author's phrases, sentences, or paragraphs.

Footnotes and endnotes are extra texts that provide information for citations. The only difference is the placement, i.e., footnotes are placed at the bottom of each page, and endnotes are placed at the end of the paper. The advantages of using a footnote include the ease of locating and providing a detailed discussion, although it may disrupt the reading flow. Reference lists or bibliographies are a form of endnote (Warling, 1992). The reference list contains all the sources that have been cited directly in the paper. At the same time, the bibliography refers to the list of all the sources that help prepare the writing regardless of their citation. Endnotes make the paperless cluttered by concentrating all references in a single location, but the readers need to navigate constantly to get further information. Endnote in the form of reference is mandatory in all journals.

Style of Journal Referencing

There are numerous styles of journal referencing (Pears and Shields, 2019), including the American Psychological Association (APA) (Bopp et al., 2009), American Medical Association (AMA), Vancouver, Harvard, Oxford, etc. The styles are either named after the place of the conception of the style during an international meeting or the organisation that drafted it. New editions may be available from time to time. To complicate the matter, different academic institutions may create their own referencing styles for their students.

Despite the minor differences in punctuations and writing style, references are generally based on author-date (i.e., last name of the author(s) followed by the date) or numeric format. Before a manuscript is considered for review, conformity to the journal's referencing style is a prerequisite, and initial screening will be done by the system administrator or the journal's editor. Hence, the first job of academic writing is to ensure the referencing style adheres to the journal's prescription, which can usually be accessed in the guideline provided for authors by the journal. Numerous guides are available online to assist junior researchers with the most updated format prescribed by the respective organisations.

Tools in Referencing

With technological advancement, the process of referencing has been significantly simplified. There are two types of reference management software (RMS): web-based and application-based. The examples include Endnote™, Mendeley™, CiteULike™, RefWorks™, Zotero™ and etc (Gilmour and Cobus-Kuo, 2011). Although different RMS may offer different features that smoothen the process of academic writing, most RMS share the core feature of reference list generation with auto-formatting based on the list of built-in styles. For example, this article is prepared with the help of EasyBib™ as an add-on to Google Docs™. Other features include citation on the go, i.e., as a plug-in in a word document. These features can significantly improve writing speed as reference formatting is time-consuming.

A critical consideration of which RMS to choose is the balance of functionality and affordability. Some RMS have a basic version that is free to use, including Mendeley™

(Fenner, 2008). Most academic institutions do subscribe to specific RMS, and it is always helpful to find out from the respective libraries (Hensley, 2011). With an active subscription to RMS, training workshops on the use of RMS may be conducted by the library.

Accuracy of Referencing

Types of errors in referencing can include factual (i.e., the assertion that differs from the source) or source errors (citing the wrong article), with varying degrees of impact (Mogull, 2017). While the abstract provides an overview and the most significant findings of a research, more in-depth information is only accessible in the main text of an article. Thus, junior researchers are encouraged to avoid shortcuts but read the full text to prevent information from being taken out of context. An inaccurate assertion of reference may also arise during paraphrasing, which is an essential step to avoid plagiarism unless it is a direct quote—the responsibility for the accuracy of referencing lies on both authors and peer-reviewers.

Tips for Junior Researchers

The process of referencing can begin as soon as the literature review starts. The optimal use of RMS can help a junior researcher collect useful articles that will be readily incorporated into the reference list according to the intended format. With the advancement of online resources, videos on the use of RMS are easily accessible, including YouTube™.

CONCLUSION

A good understanding of how to cite and produce a reference list at the early stage of an academic writing career helps in time management. Attaining referencing skills can be a good start for a junior researcher looking to begin writing their first research paper.

CONFLICT OF INTEREST

The authors declare that they have no competing interests in publishing this article.

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SHORT COMMUNICATION

Stress Intervention Among University Students: Online Medical Tune Competition

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ABSTRACT

This innovative health intervention aimed to reduce stress among university students through interaction with music and developing awareness of the effect of music in stressful situations such as the current COVID-19 pandemic. The setting for this intervention was an online Instagram community with Universiti Malaysia Sabah (UMS) students as participants. For research, a cross-sectional observational health promotion design was used for this online health intervention, in conjunction with the Diffusion of Innovation Theory. The Medical Tune Competition was open to students from all university faculties. Process evaluation was done using the RE-AIM framework, while impact evaluation was conducted via a non-experimental post-test only design. A Google feedback form was distributed to the participating students, and descriptive analysis was performed using SPSS version 26. In total, 21 contestants participated whereby 85% of the feedback responses indicated that the programme had been enjoyable. All respondents were made aware that music could make them happy, and they stated that they would advise their friends or relatives to sing or enjoy music when stressed, 90.5% of the respondents felt music helped them relieve stress (4.43 ± 0.67), 85.7% believed that the Instagram platform was appropriate for this contest, and 14.3% suggested using Facebook or YouTube as a platform. The conclusion was that an online music competition held during the COVID-19 pandemic could be adopted and likely to be effective in raising awareness of music for stress management. In the future, innovators could develop and grow their own innovative e-health intervention programmes modelled on the Medical Tune initiative.

INTRODUCTION

At the beginning of 2020, the world first became aware of the SARS-CoV-2 when it emerged in Wuhan, China, and spread globally, creating a pandemic in only a few months. It also spread to Malaysia, and preventive public health measures have been applied to develop behavioural and environmental changes to break the transmission of SARS-CoV-2 through aerosol droplets. The Movement Control Order (MCO) was brought into effect on 18th March 2020. This intervention was an opportunity to create an innovative idea utilising the potential of music to control stress during the COVID-19 pandemic. The soothing power of music is well-known: it has a unique link to our emotions and thus could be an extremely effective stress management tool. Listening to music can have a tremendously relaxing effect on prolonged and gentle classical music on our minds and bodies. Music can act as a powerful stress-relieving tool in our lives (Collingwood, 2016). It is a remedy for the worries and woes of daily life. Recently, scientific studies encourage coordination and communication and improve the quality of life. Listening to music on headphones reduces stress and anxiety in hospital patients before and after surgery (Collingwood, 2016). In addition, the practice can relieve depression and increase self-esteem. Actively making music can reduce burnout and improve mood among nursing students. It can also help us focus on tasks by relaxing our minds and allowing our subconscious to manage some of the work (Cockerton & Moore, 1997). When jazz musicians improvise, they are typically in a flow state, channelling inner emotions and rendering them into a beautiful melody (Deepak & Kabir, 2017). Diffusion of Innovation Theory was used in this community-level intervention. The theory states how innovation is communicated through specific channels over time among members of a social system (National Cancer Institute, 2003). Loneliness directly impairs the immune system, making us less resistant to diseases and infections. Indeed, feeling lonely and having few friends can result in an inferior immune defence system (Danilo, 2020).

There was an increase in the number of complaints and causes of stress and anxiety noted in on-campus clinic records during the MCO period. Some students went back to their hometowns and studied from home via online learning. Both categories of students experienced similar levels of stress during the pandemic. In this intervention, music was promoted as a tool for relieving stress and loneliness, staying healthy, and ensuring mental wellbeing with the slogan "Music is a remedy for the worries and woes of daily life." The event was titled "Medical Tune Competition." The competition was designed to enhance the awareness of the power of music to counter stress or loneliness during the COVID -19 pandemic by implementing an online medically-themed tune competition from 25 May 2020 to 9 June 2020. The RE-AIM framework evaluated the process, quality, and impact of the intervention by a non-experimental post-test only design. The competition was open to students from all UMS faculties. The announcement was posted to all university students with access to the Da Vinci Club Instagram account one week before the event. The number of 'likes' for all the videos was recorded, with winners for this category then chosen. Time was given for the judges to select the winners for the Judges' Pick category.

After evaluating the post-intervention online feedback responses, it was clear that the desired outcome had been achieved. Good leadership, teamwork, commitment, technical proficiency, and attractive prizes are required to sustain the programme effectively.

A non-experimental post-test-only design was used for the impact evaluation on a scale of 1 to 5, indicating the lowest to highest score. The results showed that 71.4% of the respondents were contestants, and

66.7% were from the Faculty of Medicine and Health Sciences (FMHS), among seven other faculties at the university. While 85% of the respondents responded that the programme was delightful (Figure 1), all affirmed that they were now aware that music could make them happy and that they would sing or play songs whenever they were under stress.

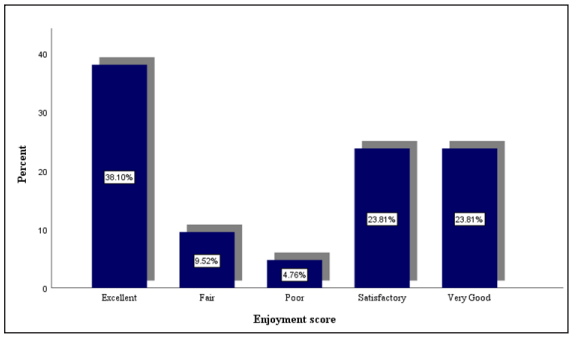

Figure 1 Distribution of respondents according to the enjoyment of the Medical Tune Competition

Furthermore, they agreed to advise their friends or relatives to sing or enjoy music when stressed (4.38±0.75) (Figure 2).

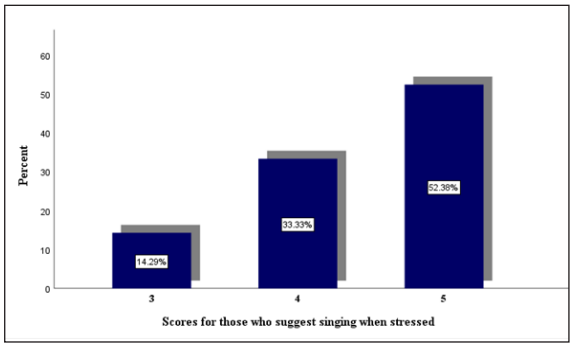

Figure 2 Distribution of respondent scores according to who would suggest to their loved ones to sing when stressed

In addition, 95.2% of the respondents agreed that music influenced their health and wellbeing. A significant 76% rated the Medical Tune Competition 2020 highly on a scale of 1 lowest to 10 highest (7.67±1.74) (Figure 3).

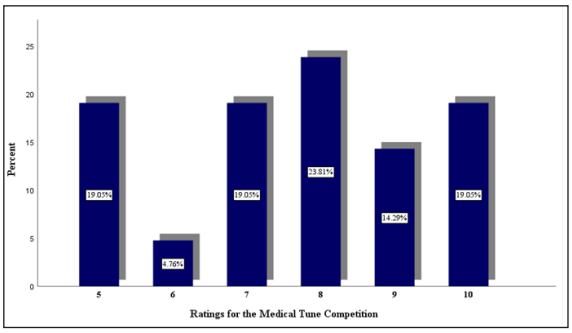

Figure 3 Distribution of respondent ratings for Medical Tune Competition

85.7% of the respondents thought that the Instagram platform was suitable for this contest, although 14.3% suggested Facebook or YouTube as a viable alternative. In addition, 90.5% stated that music helped them to relieve stress (4.43±0.67) (Figure 4).

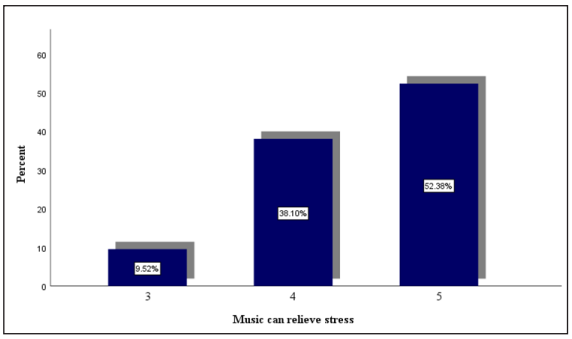

Figure 4 Distribution of responses to the statement that 'music can relieve stress'

Most of the feedback suggestions were positive (Table 1).

Table 1 Suggestions and positive feedback from participants.

1. This year was excellent! Online makes it less nervous about performing.
2. So far, so good.
3. The period of this competition would have been longer.
4. Keep it up.
5. Increase the time limit.
6. Overall, okay.
7. Maybe we can extend the video duration by more than 1 minute.
8. If you want to conduct online such as on Instagram, it is better to set a much longer time limit. One minute is too short for those playing instruments.

9. No, but I to say that live performance is better.
10. Shorter the competition day.
11. For live performance, I hope we will be using a better sound system (good mic, enough speakers, well-adjusted amplifier) and an excellent venue. If the future competition is conducted online, I suggest using Facebook as the platform. I think that's all I can offer for this competition. Thanks.
12. Make sure to be strict on rules. Some competitors use things that shouldn't.
13. I realized that some of the participants did not follow the rules and regulations as the time taken for video shoots exceeded the rules given.
14. Post the video on the same date.
15. Shorter the competition day.

The majority of the respondents agreed that music influenced their health and wellbeing. In addition, almost all respondents stated that music helped them relieve stress. Our findings support those of a study that concluded that music had therapeutic stress-reducing effects: although the effect sizes were small and variable, the results indicated that listening to music and musical improvisation could positively impact aspects of mood even in a short 5-minute intervention (Fallon et al., 2020). All participants affirmed that they were more aware that music could make them happy, and they would sing or play songs whenever they were under stress. Furthermore, they agreed to advise their friends or relatives to sing or enjoy music when stressed.

CONCLUSION

The format of the online music competition/ health intervention conducted during the MCO period of the COVID-19 pandemic can be replicated and be effective in raising awareness that singing, listening to music, and playing musical instruments are ideal forms of stress management. This innovative health intervention was developed to translate public health intervention and health promotion research into real-life practice. In the future, innovators can create their own innovative e-health intervention programmes based on the Medical Tune Competition.

CONFLICT OF INTEREST

The authors declare that they have no competing interests in publishing this article.

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CLINICAL QUIZ

Sudden Onset of Paraplegia With Rapid Progression to Tetraplegia in a Middle-Aged Man: What is the Diagnosis?

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ANSWER

MRI revealed an owl-eyes sign at the axial view (Figure 1), anterior predominant pointed edge, and hyperintense lesion at the cervical and upper thoracic cord level (Figure 2). A magnetic resonance angiogram ruled out vertebral arteries and aorta dissection. Another stroke investigation for him was non-revealing. Antiplatelet and statin were initiated as secondary stroke prevention.

At one month post-event, there was a slight improvement in his upper limbs with MRC power of 2/5 distally, his reflexes became brisk, and blood pressure and heart rate have since normalized. His final diagnosis was ***anterior cord syndrome due to a spinal cord infarct***. The aetiology for his spinal cord infarct was unknown.

Anterior spinal cord infarction is a rare clinical entity, despite being commonly encountered in medical literature and board examination. The reported incidence of anterior spinal cord infarct was one per cent of all strokes (Diehn & Krecke, 2021). As a result, experience among clinicians for this stroke syndrome is limited, often leading to misdiagnosis (Romi & Naess, 2016).

The owl-eyes sign seen at the axial view of the spinal cord (Figure 1) is a result of anterior horns infarction. In the sagittal view of the spinal cord (Figure 2), the signal abnormality

occupied the anterior two-thirds of the cord with a tapering end, akin to the tip of a pencil (Saber & Gaillard, 2021). These imaging features coupled with acute tetraplegia; should alert the clinician to an anterior spinal cord infarct.

In doubtful cases, we suggest expert neurology and neuroradiology consult, with good clinical correlation. Other treatable mimickers, like inflammatory transverse myelitis, need to be considered while waiting for confirmatory testing (i.e., Aquaporin-4 antibody). The Aquaporin-4 antibody for this unfortunate man came back as negative.

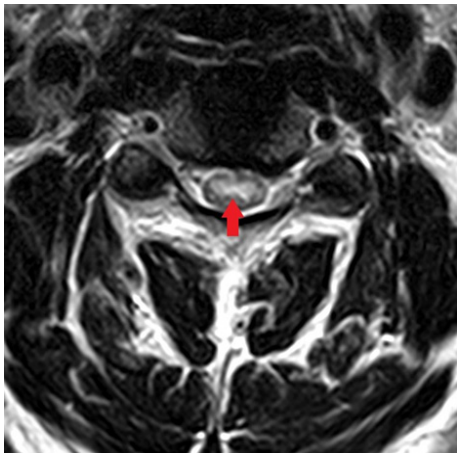

Figure 1 Axial T2WI MRI (magnified view) at the cervical cord level demonstrated the abnormal high T2 signal abnormality of the anterior spinal cord with the owl-eyes sign (red arrow)

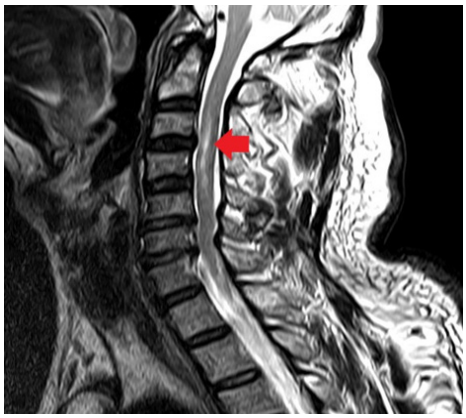

Figure 2 Sagittal T2WI MRI demonstrating abnormal high T2 signal intensity of the anterior cervical cord horns with 'tipping' at the upper end; a pencil sign (red arrow)

CONFLICT OF INTEREST

The authors declare that they have no competing interests in publishing this case.

CONSENTS

Written informed consent for this paper (including images, case history and data) was obtained from the patient for publication of this case. A copy of the written consent is available for review by the
Chief Editor.

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