ORIGINAL ARTICLE

Readiness to Change for Weight Loss in Adults With Type 2 Diabetes With Obesity: Determinants in a Cross-sectional Study

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ABSTRACT

Introduction: The high prevalence of obesity in adults with type 2 diabetes (T2D) has become a major public health burden. This study explored the readiness to change for weight loss in adults with T2D with obesity, examining its association with sociodemographics, health status, dietary self-efficacy, and social support for physical activity and diet. **Materials and methods:** This cross-sectional study involved 381 adults with T2D with obesity in Kemaman, Terengganu. The stages of change were dichotomized into 'not ready' and 'ready'. The self-efficacy was measured using the Weight Efficacy Lifestyle Questionnaire (WEL-Q), and the social support for physical activity was measured using the Social Support Scale for Diet and Physical Activity Questionnaire. **Results:** More than half of the participants (50.4%) were still not ready to change for weight loss. Multiple logistic regression showed patients who are not married ($p = 0.011$), obtained tertiary education ($p = 0.018$), have a higher score in self-efficacy for social pressure ($p < 0.001$) and received better family support for physical activity ($p = 0.001$) tend to be ready for weight loss efforts. **Conclusion:** This study identified marital status, academic background, self-efficacy for social pressure, and family support for physical activity as the determinants in influencing the readiness to change for weight loss in adults with T2D with obesity. The results highlight the importance of targeting the large proportion of adults with T2D who are not ready to lose weight, providing valuable insights to improve obesity interventions within this population.
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Keywords: Stages of change, Behaviour, Obesity, Body weight, Glucose intolerance

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INTRODUCTION

Obesity is defined as an abnormal or excessive accumulation of fat that may impair health (1). According to the recent Clinical Practice Guideline on the Management of Obesity by the Ministry of Health (MOH) Malaysia, a body mass index (BMI) of 23 kg/m2 or greater is classified as overweight (pre-obese), while a BMI of 27.5 kg/m2 or greater is classified as obese (2). The lower cut-off points of BMI are adopted due to the higher morbidity and mortality associated with lower BMI levels in the Asian population (3). Obesity in individuals with type 2 diabetes (T2D) is associated with poor metabolic control, an elevated risk of complications, and diabetes-related death (4). Obesity and T2D is known as intertwined epidemics. In Malaysia, majority of T2D patients are either overweight or obese, with this trend increasing to 84% by 2019 (5). This worrying trend underscores the importance of weight reduction in this population. Previous studies have demonstrated that a weight reduction of 5 – 10 % can yield beneficial effects, including improved glycaemic control, reduced blood pressure and cholesterol level, and a decreased risk of diabetes complications and related mortality (6–9). Additionally, such weight loss may contribute to diabetes remission (10).

Lifestyle modification is the first line of treatment for adults with T2D with obesity where they should be offered comprehensive and structured lifestyle interventions (11). Unfortunately, weight loss interventions are often given with the assumption that all patients are ready to adopt a healthier lifestyle regardless of their readiness for behavioural change (12). To manage obesity effectively, the current guidelines emphasize on the importance of behaviour change strategies but detailed implementation plans was observed to be lacking (2,11). In Malaysia, weight loss interventions are integrated into diabetes education and support, facilitated by the establishment of "Diabetes Resource Centres" in most hospitals and primary healthcare facilities (13). The Kemaman district has also adopted these methods to fit its local context. These services are delivered through a collaborative effort by a multidisciplinary team consisting of doctors, diabetes educators (including paramedics and nurses), dietitians, and pharmacists. Among the main activities of these centres include health education and routine

screening for diabetes-related complications (13). MOH has published health education manuals aimed to be used as guidance to structure and content of diabetes education nationwide (14). While this module highlights the behavioural and psychosocial aspects of diabetes management, the behavioural modification component to address obesity in this population was observed to be lacking.

One factor contributing to the success of individuals in adopting lifestyle modifications could be their progression through various stages of behaviour change as outlined in the Transtheoretical Model (TTM) (15). This concept was proposed by Prochaska and DiClemente in the 1980s where people change through a series of stages; precontemplation (do not intend to change e.g. lose weight), contemplation (planning to lose their weight within 6 months), preparation (planning to lose their weight over next 30 days), action (have been making an effort by dieting and exercising to lose their weight for less than 6 months), or maintenance (had successfully maintained their desired weight for more than 6 months (16). These five stages are often dichotomized into two phases: the initial three stages (precontemplation, contemplation, preparation) are grouped into the 'not ready' phase, as individuals in these stages are not actively making actions to change. In contrast, the final two stages are labelled the 'ready' phase, characterizing individuals who have initiated or actively maintained behavioural changes (17,18).

Helping adults with T2D and obesity to change for weight loss is more difficult than the normal adults. Weight loss in T2D patients is often difficult due to factors such as insulin resistance, metabolic abnormalities, medication side effects, and unhealthy lifestyle habits (19,20). Frequent relapses and failures in losing weight can lead to frustration of both the patients and healthcare practitioners. Therefore, by identifying their readiness to change for weight loss, healthcare providers can customize interventions according to individual readiness for behaviour change, thus reducing the frustration during the change process (21).

Many studies have shown a growing interest in exploring the readiness for weight loss and the factors facilitating behavioural change among obese individuals. Previous studies highlight that self-efficacy for healthy diet is a key facilitator in initiating behaviour change for weight loss and sustaining the maintenance stage, leading to consistent weight reduction (22,23). In addition, a supportive social environment is also crucial for encouraging obese individuals to actively engage in weight loss (24). Nonetheless, negative influence by family, friends, and colleagues can act as barriers to being ready for weight loss among adults with obesity (25). Unfortunately, most of the studies did not focus on T2D population despite the majority of them being either obese of overweight. Clearly, there is a need to explore their readiness to change for weight loss. By exploring the readiness for weight loss, a stage-matched approach can be offered to enhance the quality of obesity care among T2D patients for a better outcome.

The study aimed to determine the prevalence of readiness to change for weight loss in adults with T2D with obesity. The secondary aims were to determine the factors associated with the readiness stage of change for weight loss, specifically on (i) sociodemographic factors (ii) health status factors (iii) self-efficacy for healthy diet (iv) social support for weight loss.

MATERIALS AND METHODS

Study Design and Population

This was a cross-sectional study conducted among adults with T2D with obesity who seek care from the government's health clinics in Kemaman district, Terengganu, Malaysia. Kemaman district was selected because it has the largest number of diabetes patients in Terengganu (26). It is one of the eight districts in Terengganu state with an estimated population of 215,000 in 2021 (27). The Malay ethnic group constitutes around 95.6% which is comparable to 97.2% for the whole state of Terengganu (28). Kemaman district was documented to have the highest mean of monthly household income of MYR 7,854 (29). Twelve health clinics are currently operating under the management of Kemaman District Health Office. Diabetes care is provided by ten health clinics, managing approximately 4600 T2D patients. This study was conducted in all ten health clinics which provide diabetes care services.

The inclusion criteria for our respondents were:
i. Both males and females
ii. Age between 20 – 60 years old
iii. Malaysian citizens
iv. Diagnosed with T2D
v. Seeking diabetes care in the government health clinics in Kemaman, Terengganu
vi. Has body mass index (BMI) of more or equal to 23 kg/m2
vii. Able to read, write, and understand Malay language.

We excluded those who were:
i. Pregnant patients
ii. Had defaulted follow-up more than 6 months before the study
iii. Newly diagnosed diabetes (less than 6 months before the study)
iv. Unable to walk or unfit to stand up, and patients with advance mental conditions which disrupt the ability to understand the questionnaires.

Sample size, Sampling and Data Collection Methods

The sample size was calculated using a single proportion formula from Open Epi version 3. The calculation was based on an expected proportion of

60% of precontemplation stage from a Malaysian adult study and the latest clinical audit report of Kemaman district National Diabetes Registry, which estimated 2010 patients with BMI of more than 23 (30). Using a 95% confidence interval and a precision of ± 5%, the minimal sample size was 312. Considering 20% non-response rate, the final sample size required was 374. All ten health clinics in the district were included in the study.

During the data collection day, the patients with T2D were selected based on systematic random sampling from the clinic attendance sequence. A random starting point within the first interval (1 to 4) was determined using a random number generator of Microsoft Excel. This is based on selecting a sample size of approximately 400 from a population of 2,000, resulting in a sampling interval (k) of 4. For example, if the random start is 3, the selected patients would be the 3rd, 7th, 11th, and so on, every 4th individual in the population list. Therefore, every 4th patient with T2D who attended their appointment at the health clinics during the data collection period was sequentially chosen and screened for eligibility based on the inclusion and exclusion criteria. No sampling frame was used. Figure 1 illustrates the participant recruitment flow process during the data collection. Eligible patients were explained about the study and selected as respondents once written consent was obtained. Data was collected using a self-administered questionnaire, whereas the health status parameters were copied from the patient's latest medical records in the health clinics. Data were collected by the principal investigator and the appointed research assistants who were given training prior to the data collection process.

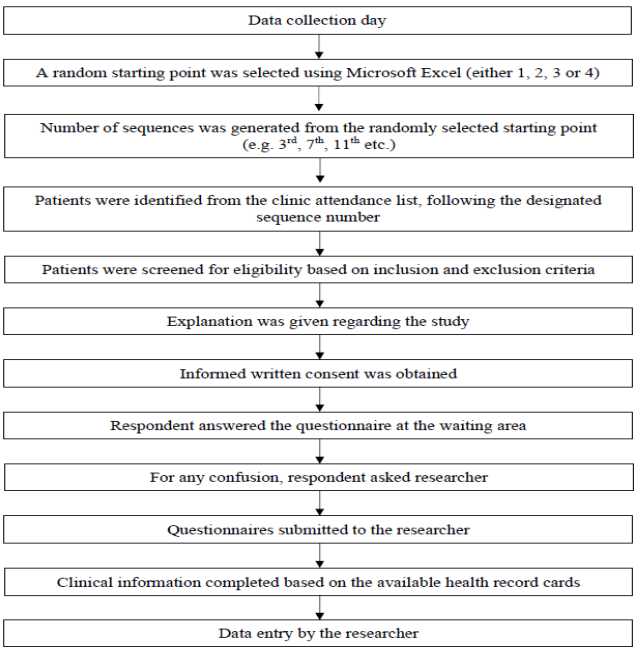

Figure 1: Participants Recruitment Flow Chart During the Data Collection

Study Instruments and Variables

The questionnaire were in Malay language and consists of five sections which were sociodemographic information (age, gender, race, marital status, educational status, and monthly household income), readiness to change (validated Malay version S-weight Questions) (31), dietary self-efficacy (Weight Efficacy Lifestyle Questionnaire) (32), social support for dietary control and physical activities (Social Support Scale for Diet and Exercise Questionnaire) (33,34) and health status characteristics (age of diabetes, other co-morbidities, latest BMI, blood pressure, HbA1c, serum cholesterol, estimated Glomerular Filtration Rate and latest medical treatment received). To assess participants' perceptions of their BMI, a single question was posed with four response options. The question, "How would you describe your current weight status?" offered the choices: Underweight, Normal or Ideal Weight, Pre-obese or Slightly Overweight, and Obese or Severely Overweight. These self-assessments were then compared with the most recent BMI measurements from medical records to evaluate the accuracy of participants' weight perceptions. Participants were classified as having an incorrect perception if their self-assessed weight status did not align with their actual BMI category, as determined by the latest BMI cut-off values adopted in the MOH guidelines.

The outcome variable in this study was the stage of readiness to act for weight loss which was measured based on the validated Malay version of the S-weight questionnaire (31). It is a brief series of self-report questions assessing weight loss intentions and current activities. It has five mutually exclusive items each representing the five stages of change which are pre-contemplation, contemplation, preparation, action, and maintenance (35). Prior studies have categorized the five stages of change into two primary phases: 'not ready to change', which includes the precontemplation, contemplation, and preparation stages, and 'ready to change', which comprises the action and maintenance stages (17,18,36). In this study, we adopted the dichotomize of the five stages into two groups: 'not ready' (precontemplation, contemplation, and preparation) and 'ready' (action and maintenance).

A validated Malay version of the Weight-Efficacy Lifestyle Questionnaire (WEL-Q) was used to assess dietary self-efficacy for weight loss. It is used to measure an individual's confidence to control eating in specific situations. It consists of 20 items which are divided into five subscales (four questions for each subscale) which are (i) negative emotions (ii) availability (iii) social pressure (iv) physical discomfort and (v) positive activities. It used a Likert-like scale ranging from 0 (not confident) to 9 (very confident). The total score of each subscale is in the range of 0 to 36 i.e., the summation of four items in the subscale. The higher the score, the higher the confidence level to control diet for weight

loss in specific circumstances. This questionnaire was tested among the Malaysian diabetes population, which shows acceptable reliability parameters of Cronbach's α of 0.893, item-total correlations of r>0.700, p<0.01, and inter-item correlations of r<0.500, p<0.01 (32).

The Malay-validated version of the Social Support Scale for Diet and Physical Activity Questionnaire was used to measure the perceived social support specifically from family members and friends related to healthy diet and physical activity. The diet construct consists of 20 items, which can be further divided into four subscales: (i) family support for a healthy diet (ii) family hurdle for a healthy diet (iii) friend support for a healthy diet, and (iv) friend hurdle for a healthy diet. Each item has 5-point response options ranging between 1 (never) and 5 (very often). The summation within each subscale ranges from 0 to 25. The higher the score implied a higher level of support or hurdles received by respondents from their family members or friends. The reliability of this tool is proven by the test-retest of 0.55-0.86 and the internal consistency of Cronbach's 0.61 – 0.91(33).

The physical activity construct has 24 items (12-items perceived support from family members and 12 items perceived support from friends). It has a 5-point scale ranging from 1 (none) to 5 (very often). The summation of the scale ranges from 0 to 60 for each family and friend support. The higher the score, the higher the level of support perceived by respondents. The reliability of this tool is proven by composite reliability scores of 0.918 and 0.919, test-retest reliability of 0.920 (95% CI, .887, .943, p-value <0.001), and 0.984 (95% CI, .997, .989, p-value <0.001), and internal consistency with Cronbach's alpha of 0.940 and 0.936 for family and friend support, respectively(34).

The questionnaire was pre-tested for face validity to identify any ambiguous and confusing question by involving two subject matter experts and three members of the target population. No pilot study was done.

Data Management and Statistical Analysis

The data was entered into IBM Statistical Package for the Social Sciences (SPSS) version 26.0 software. The data was cleaned for missing, redundant data or wrong coding. For redundant data, only one of the data was selected. For missing data, the diabetes educator was contacted by the respective health clinic to fill in the missing data. The remaining missing data ranged from 0.3% to 11.5% where the highest missing variable was the average monthly household income. Little's MCAR test revealed a *P*-value of more than 0.05, thus, the missing data occurred completely at random and can be ignored.

For the descriptive statistics, the categorical data was presented in frequency (n) and percentage (%). For the numerical data, the results were expressed in mean and standard deviation for the normally distributed data, whereas for the not normally distributed data was described using median and interquartile range.

As for the inferential statistics, the factors that influence whether participants were 'not ready' or 'ready' to lose weight were first screened using simple logistic regression (SLogR) analysis. The factors with *P*-values of 0.25 and less in SLogR were selected and included in the multiple logistic regression (MLogR) analysis using the forward LR method to determine the independent factors after controlling the confounders. The factors associated with the 'not ready' or 'ready' phase were expressed as adjusted odds ratio (aOR) and 95% confidence intervals.

All assumptions for MLogR were fulfilled. The assumptions checked include (i) Linearity for all continuous data, (ii) Interaction and multicollinearity between the significant independent variables (iii) Model assumption based on the Hosmer Lemeshow goodness-of-fit test (iii) The prediction model for sensitivity, specificity, receiver operating characteristics (ROC) curve and (iv) Absence of outliers. A P-value<0.05 is considered statistically significant with a 95% confidence interval that does not include 1.

RESULTS

The study involved 381 responses, predominantly from Malays (78.2%), females (71.9%), and married individuals (86%), with the majority holding a secondary level of education (71.1%) and belonging to the B40 income group with a median income of RM2000 (IQR= RM2700). For the health status, 57.5% were diagnosed with T2D within the last five years, having a median duration of 5 years (IQR = 6). A significant 95.5% reported at least one comorbidity, mainly dyslipidemia (86.4%) and hypertension (66.1%). The median BMI was 30.67 kg/m2 (IQR = 6.74). Most respondents did not achieve clinical targets for control, with only 15% achieving optimal glycaemic control with a median HbA1c of 8.8% (IQR = 3.3%). Moreover, over 80% exhibit suboptimal diastolic blood pressure control with a mean of DBP 83.95mmHg (SD = 8.7 mmHg), with less than half (45.4%) achieved target total cholesterol levels with a mean total cholesterol of 5.53 mmol/L (SD = 1.51 mmol/L). Similarly, only a quarter met the target LDL levels (25.2%) with a mean LDL of 3.61 (SD = 1.32 mmol/L). Counselling-wise, the majority were already informed about their weight problem by doctors (68.8%), received health education on weight

management from diabetes educators (70.3%), while fewer were counselled on dietary control (47.0%) and physical activity related to weight management (20.7%). According to the five stages of change, the highest proportion was from the action group (34.4%) followed by contemplation (23.6%) and pre-contemplation (16.5%). This information is illustrated in Figure 2. When dichotomized into 'not ready' and 'ready', more than half of the respondents (50.4%) were reported to be not ready for weight loss-related behaviour change. Table I summarized the sociodemographic and health status characteristics, as well as the univariate analysis of the associated factors on readiness to change for weight loss by using Simple Logistic Regression.

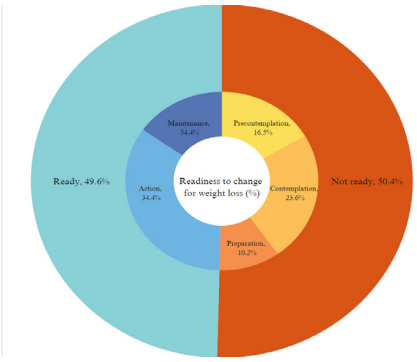

Figure 2: Descriptive statistics of the stages of change for weight loss and their dichotomous categorization (N = 381).

Table I: Sociodemographic and health status characteristics: descriptive statistics and univariate analysis of factors influencing readiness to change for weight loss (n = 381)

Variable	Mean (SD) or Median (IQR)[ǂ]	Frequency n (%)	B (SE)	Wald (df)	OR (95% CI)	*P*-value[a]
Age (years)	48.0(12.00) [ǂ]		-0.01 (0.01)	0.65 (1)	0.99 (0.97, 1.01)	0.419
Gender						
Male		107 (28.1)	Ref	-	-	-
Female		274 (71.9)	-0.20 (0.23)	0.80 (1)	0.82 (0.52, 1.28)	0.372
Marital status						
Married		331 (86.9)	Ref	-	-	-
Not Married		50 (13.1)	0.78 (0.32)	5.98 (1)	2.18 (1.17, 4.06)	0.014*
Highest Education Level						
Secondary		273 (71.7)	Ref	-	-	-
Tertiary		108 (28.3)	0.65 (0.23)	7.87 (1)	1.92 (1.22, 3.02)	0.005*
Job status						
Not Working		184 (48.3)	Ref	-	-	-
Working		197 (51.7)	0.05 (0.21)	0.07 (1)	1.06 (0.71, 1.58)	0.794
Average monthly household income						
B40 (< RM4720)		273 (71.7)	Ref	-	-	-
M40 and T20 (≥ RM4720)		64 (27.1)	0.68 (0.29)	5.67 (1)	1.97 (1.13, 3.45)	0.017*
Disease duration (years)						
0 – 2	5.00 (6.00) [ǂ]	97 (25.5)	0.46 (0.26)	3.16 (1)	1.58 (0.95, 2.63)	0.075*
3 – 5		122 (32.0)	0.44 (0.24)	3.29 (1)	1.55 (0.97, 2.49)	0.070*
> 5		162 (45.5)	Ref	-	-	-
Presence of co-morbidities						
Hyperlipidemia						
No		51 (13.6)	Ref	-	-	-
Yes		330 (86.4)	-0.43 (0.31)	1.98 (1)	0.65 (0.36, 1.18)	0.159*
Hypertension						
No		129 (33.9)	Ref	-	-	-
Yes		252 (66.1)	0.05(0.22)	0.05 (1)	1.05 (0.69, 1.60)	0.830
Chronic kidney disease						
No		350 (91.9)	Ref	-	-	-
Yes		31 (8.1)	-0.19 (0.38)	0.27 (1)	0.82 (0.39, 1.72)	0.606
BMI (kg/m^2)	30.67 (6.74) [ǂ]		-0.01 (0.02)	0.05 (1)	0.99 (0.96, 1.03)	0.825
BMI perception						
Incorrect		248 (65.1)	Ref	-	-	-
Correct		133 (34.9)	0.33 (0.22)	2.27 (1)	1.38 (0.91, 2.11)	0.132*
HbA1c (%)	8.80 (3.30) [ǂ]		-0.13 (0.05)	7.69 (1)	0.88 (0.81, 0.96)	0.006*
SBP (mmHg)	132.46 (14.36)		0.01 (0.01)	0.01 (1)	1.00 (0.99, 1.01)	0.988

CONTINUE

Table I: Sociodemographic and health status characteristics: descriptive statistics and univariate analysis of factors influencing readiness to change for weight loss (n = 381). (CONT.)

Variable	Mean (SD) or Median (IQR)[ł]	Frequency n (%)	B (SE)	Wald (df)	OR (95% CI)	*P*-value[a]
DBP (mmHg)	83.95 (8.70)		0.01 (0.01)	0.25 (1)	1.01 (0.98, 1.03)	0.618
Lipid profile (mmol/L)						
TC	5.53 (1.51)		0.05 (0.07)	0.43 (1)	1.05 (0.92, 1.20)	0.513
TG	1.49 (0.70) [ł]		0.08 (0.11)	0.51 (1)	1.08 (0.88, 1.33)	0.476
HDL	1.31 (0.36)		0.37 (0.30)	1.52 (1)	1.45 (0.80, 2.61)	0.218*
LDL	3.61 (1.32)		0.08 (0.08)	0.92 (1)	1.08 (0.92, 1.26)	0.337
Pharmacological treatment						
Diet control ± OAD ± Insulin		180 (47.2)	Ref	-	-	
Diet control ± OAD		201 (52.8)	0.35 (0.21)	2.89 (1)	1.42 (0.95. 2.13)	0.089*
Counselling related to weight control						
Received diagnosis by doctor regarding weight problem.						
No		119 (31.2)	Ref	-	-	-
Yes		262 (68.8)	0.20 (0.22)	0.79 (1)	1.22 (0.79, 1.88)	0.373
Received health education regarding weight control by diabetes educator.						
No		113 (29.7)	Ref	-	-	-
Yes		268 (70.3)	0.10 (0.22)	0.21 (1)	1.11 (0.71, 1.72)	0.645
Received counselling regarding dietary control by nutritionists and/or dietitians.						
No		202 (53.0)	Ref	-	-	-
Yes		179 (47.0)	0.35 (0.21)	2.83 (1)	1.41 (0.94, 2.12)	0.092*
Received counselling regarding physical activity by occupational therapist and/or physiotherapist.						
No		302 (79.3)	Ref	-	-	-
Yes		79 (20.7)	-0.27 (0.25)	1.12 (1)	0.76 (0.47, 1.26)	0.290

[a]Statistical test: Simple Logistic Regression. Reference group for dependent variable: "Not ready"
*For variables with *P*-value ≤ 0.25 will be further analyzed using Multiple Logistic Regression.
For average monthly household income, the M40 group comprised 13.1% (50 participants) and the T20 group comprised 14.0% (14 participants); these categories were subsequently collapsed. SE: Standard Error; df: degree of freedom; OR: Odds Ratio; CI: Confidence Interval; BMI: Body Mass Index; HbA1c: Hemoglobin A1c; SBP: Systolic Blood Pressure; DBP: Diastolic Blood Pressure; TC: Total cholesterol; TG: Triglyceride; HDL: High-density lipoprotein; LDL: Low-density lipoprotein; OAD: Oral anti-diabetic drugs

Dietary self-efficacy for physical discomfort showed the highest median with a value of 23.00 (IQR = 12.00). Family support for a healthy diet had the highest median with a value of 16.00 (IQR = 9.00). Additionally, family support for physical activity was rated higher tham support from friends with a median value of 28.17 (IQR = 11.05). Table II illustrates the distribution of dietary self-efficacy, social support for a healthy diet, and physical activity, as well as the univariate analysis.

Table II: Dietary self-efficacy and social support for healthy diet and physical activity: descriptive statistics and univariate analysis of factors influencing readiness to change for weight loss using SLR (N=381)

Variable	Mean (SD) or Median (IQR) [ł]	B (SE)	Wald (df)	OR (95% CI)	*P*-value[a]
Dietary self-efficacy					
Positive activities	23.00 (13.00) [ł]	0.08 (0.01)	28.34 (1)	1.08 (1.05, 1.11)	<0.001*
Negative emotions	21.00 (11.00) [ł]	0.06 (0.01)	22.60 (1)	1.07 (1.04, 1.09)	<0.001*
Availability	21.00 (10.00) [ł]	0.08 (0.02)	28.72 (1)	1.09 (1.05, 1.12)	<0.001*
Social pressure	26.00 (11.00) [ł]	0.08 (0.02)	28.70 (1)	1.09 (1.05, 1.12)	<0.001*
Physical discomfort	23.00 (12.00) [ł]	0.07 (0.01)	27.79 (1)	1.08 (1.05, 1.11)	<0.001*
Social support for healthy diet					
Family support	16.00 (9.00) [ł]	0.11 (0.02)	25.57 (1)	1.11 (1.07, 1.16)	<0.001*
Family hurdle	12.16 (4.14)	0.02 (0.03)	0.36 (1)	1.02 (0.97, 1.07)	0.548
Friend support	12.60 (5.88)	0.05 (0.02)	8.18 (1)	1.05 (1.02, 1.09)	0.004*
Friend hurdle	13.00 (9.00) [ł]	-0.01 (0.02)	0.08 (1)	0.99 (0.95, 1.04)	0.776
Social support for physical activity					
Family support	28.17 (11.05)	0.05 (0.010)	26.47 (1)	1.05 (1.03, 1.08)	<0.001*
Friend support	23.00 (20.00) [ł]	0.03 (0.009)	9.44 (1)	1.03 (1.01, 1.05)	0.002*

[a]Statistical test: Simple Logistic Regression. Reference group for dependent variable: "Not ready"
*For variables with *p*-value ≤ 0.25 will be further analyzed using Multiple Logistic Regression.
SE; Standard Error, df; degree of freedom, OR; Odds Ratio, CI; Confidence Interval.

Nineteen variables with P-values ≤ 0.25 were further analysed in multivariable analysis using multiple logistics regression. The Forward LR method was used for variables selection for the preliminary main model. Linear in logit assumption was checked for continuous variables and was satisfied.

The Multiple Logistic Regression (MlogR) analysis revealed that unmarried respondents were 2.74 times more likely to be ready to lose weight compared to those who are married (95% CI: 1.26, 5.92). Respondents who have obtained tertiary education are 1.85 times more likely to be ready for weight loss (95% CI: 1.11, 3.08). For behavioural factors, respondents with a higher score for dietary self-efficacy to overcome social pressure are 1.08 times more ready for behaviour change (95% CI: 1.05, 1.12). Lastly, respondents who obtained a higher score in social support for physical activity received by family members were shown to be 1.04 times more likely to be ready to modify their behaviour (95% CI: 1.02, 1.06). The results of the MLogR analysis are illustrated in Table III.

Table III: Determinants of readiness for change for weight loss using multiple logistic regression analysis (MLogR)

Variables	B(SE)	Wald (df)	AOR (95% CI)	*p*-value[a]
Marital status				
Married	Ref			
Not married	1.01 (0.40)	6.50 (1)	2.74 (1.26, 5.92)	0.011
Highest educational level				
Secondary	Ref			
Tertiary	0.62 (0.26)	5.60 (1)	1.85 (1.11, 3.08)	0.018
Dietary self-efficacy Social pressure	0.08 (0.02)	19.12 (1)	1.08 (1.05, 1.12)	<0.001
Social support for physical activity Family support	0.04 (0.01)	11.17 (1)	1.04 (1.02, 1.06)	0.001

[a]Statistical Test: Multiple Logistic Regression
Method Forward Stepwise Likelihood Ratio; R^2: 0.152; B Constant: -3.150
Linearity in Logit assumptions for Dietary self-efficacy (Social Pressure construct) and Social support for physical activity (family support) are met. Model assumptions are met: No interaction between independent variable, no multicollinearity, no influential outliers.

DISCUSSION

The primary objective of this study was to determine the prevalence of readiness to change for weight loss in adults with T2D and obesity and to identify the determinants influencing this readiness, specifically on sociodemographic factor, health status, self-efficacy for a healthy diet and social support for weight loss. Our key findings revealed that 50.4% of T2D patients with obesity are not ready to change for weight loss, which provide significant insights into the current state of weight loss readiness among the population studied. This aligns with previous studies indicating a substantial proportion, ranging from 48.3% to 81.2%, not being ready for weight loss (30,37,38). Given the large proportion of individuals who are not ready to change for weight loss, it underscores the importance of understanding the underlying reasons contributing to this lack of readiness. These reasons include either lack of awareness, ignorance, denial of the problems, or being demoralised from previous failures of weight loss attempts (16). Elucidating the readiness and its factors is vital to address the specific causes that hinder them from acting for weight loss.

Furthermore, the implications of this large proportion of individuals not ready to change for weight loss extend beyond individual health outcomes to broader public health implications. Failure to engage in weight management efforts not only jeopardizes the diabetes outcomes and well-being of individuals, but also contributes to the increasing burden of obesity-related complications on healthcare systems. Therefore, addressing the root causes of this lack of readiness and developing a targeted intervention to promote behaviour change is critical to overcome this problem.

Additionally, our analysis identified several determinants associated with readiness to change for weight loss, including marital status, academic background, family support for physical activities, and dietary self-efficacy in social pressure subscale. These determinants influence the readiness to change of adults with T2D and obesity to pursue weight loss. Firstly, unmarried T2D patients are more likely to be ready for weight loss as compared to their married counterparts. Single, divorced, or widowed may have a higher awareness of their physical appearance, hence, making them more ready to embrace healthier weight-related behavioural modification. This observation is supported by research indicating that unmarried and divorced individuals display increased motivation to engage in physical activity and exhibit improved dietary discipline, driven by the desire to enhance attractiveness in the context of a potential spouse (39). Conversely, married individuals are less likely to be concerned about body weight, as they are not actively seeking spouses. In fact, they may engage in more frequent meals due to the assurance of companionship, indirectly contributing to unhealthy eating habits (22). Although the influence of marital status on weight-related behaviours is well-documented, reaffirming these findings within this study context is important. It provides insight into future interventions to address the unique challenges stemming from spousal dynamics and social support structures.

Secondly, this study revealed that adults with T2D who have received tertiary education are more likely to be ready to change for weight loss behaviour. Higher education levels provide a better understanding of obesity risks with increased accessibility to weight loss-related information, thus, supporting successful weight loss efforts (41). Addressing educational disparities and access to information is essential, especially in the context of developing health education in this study

population, where the majority of them came from lower academic backgrounds.

This study has also observed the effect of dietary self-efficacy for social pressure in influencing readiness to change for weight loss in adults with T2D. This reflects the confidence to resist eating in a few challenging circumstances such as saying "no" to others, even when they feel it was impolite to resist a second helping. Individuals with lesser self-efficacy to resist social pressure and poorer coping in high-risk circumstances such as family mealtime are more likely to lapse, thus leading to poor weight control (42). In contrast, individuals with higher self-efficacy are found to have a better ability to anticipate relapses in high-risk situations due to social pressure, allowing them to have better self-regulatory planning strategies during social eating (43).
The study also indicates that strong family support for physical activity will positively boost adults with T2D with obesity to be ready for weight loss. This support may encompass companionship, motivation, social interaction, facilitation, and instructions from the family members (44). Creating a supportive home environment for physical activity can help individuals' transition from sedentary habits to healthier lifestyles. Given the potential impact of family support on readiness for weight loss, incorporating family encouragement for physical activity may become a promising approach for obesity interventions in this population.

Nonetheless, several important factors such as age, gender, health condition characteristics, and weight-loss-related counselling were found not to have a statistically significant impact on the readiness to change for weight loss in the study population. The non-significant results do not necessarily mean that these factors have no effect; rather, they indicate that there is insufficient evidence to reject the initial null hypothesis. These may be due to sample size limitations or a true lack of association between the variables.

To the best of the researchers' knowledge, this is the first study exploring stages of change for weight loss focusing on adults with T2D in Malaysia. This study highlights the critical importance of understanding readiness to change for weight loss in individuals with T2D, the majority of whom are obese, and reveals the need for refining current interventions to better meet their specific challenges. Based on this study, determinants of readiness revolve around social support factors, suggesting that incorporating this factor as a strategic approach could be promising for more effective obesity intervention in this population.

As for study limitations, this study was carried out in a district with the majority of the population is from Malay ethnicity. Therefore, the study findings may not be generalized to other localities with different ethnic composition. Data collection involved self-administered questionnaires, potentially introducing information bias, particularly among those with lower academic backgrounds. To reduce the risk of bias, all participants received explanations regarding the questions and scoring system of the study instrument, with scripted instructions to ensure consistency across nine health clinics during the data collection. Additionally, the study's cross-sectional design limits its ability to establish temporal or causal relationships between stages of change and associated factors.

To advance the field, future research should explore additional factors like self-efficacy in physical activity and environmental influences to offer a more comprehensive understanding of the readiness to change for weight loss in this study population. To the best of our knowledge, to date, there is no ongoing local program that can help to accelerate the readiness to change for weight loss targeting the T2D patients. The existing interventions, such as I Fit and Eat Right (IFitER), My Body Fit and Fabulous (MyBFF@Home), and Komuniti Sihat Pembina Negara (KOSPEN), primarily target obese individuals and exclude those with T2D, despite these patients already engaging with MOH facilities (45–47). Therefore, it is highly recommended to explore on health interventions that integrate stage-matched and social support approach to improve the readiness to change, thereby enhancing the weight management plans for T2D.

CONCLUSION

The study findings highlight the substantial proportion of adults with T2D with obesity who are not ready to change for weight loss-related behaviours. The results also showed that specific factors such as marital status, academic background, self-efficacy for social pressure, and family support for physical activity are influential determinants of readiness for weight loss in the study population. Based on the results, we can conclude the crucial role of social support in either fostering or facilitating readiness to change for weight loss among adults with T2D with obesity. Ultimately, these findings may give valuable input in refining obesity management strategies in primary care settings, specifically targeting the substantial proportion of T2D patients with obesity who are not ready to commit to weight loss.

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