

Body Weight Satisfaction: Association with Weight Control Practices among Type 2 Diabetic Patients

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ABSTRACT

Introduction: The recommendation to lose weight has been the guiding principle in the treatment of type 2 diabetic patients. However, to facilitate this process, it is vital to understand factors associated with personal feelings about body weight and related behaviour. **Methods:** The objectives of this cross-sectional study were (1) to determine mean BMI and weight of satisfaction and (2) to measure the association between body weight satisfaction vs. sex, BMI, glycaemic control (as measured by Fasting Blood Glucose (FBG), and attempts to lose weight among type 2 diabetic patients. Descriptive statistics and non-parametric tests were employed (SPSS 16). A total of 67 subjects were recruited from Klinik Kesihatan Bandar Kuantan (age = 54.1 ± 8.1 years; female = 62.7%; Malay = 73.1%; overweight/obese = 62.7%) who completed a set of self-administered questionnaires. **Results:** The mean BMI and weight of satisfaction were 27.9 ± 5.3 kg/m² and 62.7 ± 10.9 kg respectively. A greater proportion of women (65.0%) reported dissatisfaction with their body weight. Patients with higher BMI generally reported greater dissatisfaction with body weight compared to those with lesser BMI ($p = 0.090$). There was no significant difference in the glycaemic control of patients who were satisfied or dissatisfied with their weight ($p = 0.839$). There was also no significant association between body weight satisfaction and diet ($p = 0.957$), physical activity ($p = 0.517$) or both ($p = 0.734$). **Conclusion:** This study implies that body weight satisfaction alone is not a strong factor that may drive type 2 diabetic patients to control their body weight.

Keywords: Body weight satisfaction, type 2 diabetics, weight control practices

INTRODUCTION

Obesity has reached epidemic proportions globally, with more than 1 billion adults being overweight and at least 300 million of them clinically obese (WHO, 2009a). People with excess weight have an increased risk of developing diabetes (Wang *et al.*, 2005).

Data show that approximately 85% of people with diabetes are type 2, and of these, 90% are obese or overweight (Mahan & Escott-Stump, 2004). In Malaysia, as the prevalence of obesity has increased, so has that of type 2 diabetes. The First National Health and Morbidity Survey (NHMS I) conducted in 1986 reported a 6.3% prevalence of diabetes

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among adults of age ≥ 35 years old. After a decade, the figure had risen to 8.3% among adults of age ≥ 30 years old as recorded in NHMS II, (Zanariah *et al.*, 2006). For the latest statistics, NHMS III documented a further one-third increment in the prevalence of diabetes mellitus to 11.6% among adults of age ≥ 18 years old (Letchuman *et al.*, 2010). Together with the increasing prevalence, disease complications are also becoming significant. It is noted that 50% of people with diabetes die of cardiovascular disease whereas another 10-20% of people with diabetes die of kidney failure (WHO, 2009b). This rapidly increasing trend of diabetes cases and its complications reflect the urgent need for formulation of effective prevention strategies since diabetes is costly in both human and monetary terms.

Weight management appears to be the most important therapeutic task when it comes to dealing with this lifestyle disease since most patients are either obese or overweight (Gregg *et al.*, 2004). Obesity may result in negative physical and mental health consequences. Therefore it is important to understand the factors associated with an individual's feelings about body weight and its related weight loss behaviour. While numerous studies of adults have evaluated components of body image and related socio-demographic factors, only some have specifically examined body weight satisfaction (Millstein *et al.*, 2008) especially among the vulnerable type 2 diabetic community. Satisfaction with weight indicates the personal feelings or thoughts about one's weight (Millstein *et al.*, 2008). It constitutes one of the attitudinal components of body image in which its assessment is valuable for effective weight loss intervention. If people are dissatisfied with their weight, it may 'motivate' them to lose weight, which would consequently increase the likelihood for a successful lifestyle alteration.

On the other hand, evidence suggests that individuals have become more tolerant

of higher body weights over time (Johnson-Taylor *et al.*, 2008). While many women and men desire to weigh less, not everyone who is overweight or obese actually makes an attempt to lose weight. There are complex associations between body size satisfaction and weight-loss practices which depend on a variety of factors, such as actual or perceived body size, psychological factors, and health status, and these factors may differ by age, race and sex (Millstein *et al.*, 2008). With the escalating proportion of overweight/ obese individuals in our society who are generally satisfied with their weight, the drive and motivation to lose weight may not be as high as desirable. Therefore, it is vital for these problems to be properly addressed especially for diabetic patients in which weight control practices are important to prevent disease complications. Thus this study aimed to evaluate body weight satisfaction and its role in influencing weight control practices in type 2 diabetic population. As such, the objectives for the study were set as follows: (1) to determine mean BMI and weight satisfaction of type 2 diabetic patients and (2) to find the association between body weight satisfaction of type 2 diabetic patients with the following factors: sex, BMI, glycemic control, and attempt to lose weight reflected by specific weight loss practices (diet, physical activity or both)

METHODS

Study design and patient selection

Permission to conduct this study was received from the research and ethical committee of the faculty which has considered its appropriateness in terms of research design as well as the patients' welfare and ethical issues. This is a cross-sectional investigation conducted on type 2 diabetic patients recruited from the outpatient department (OPD) Klinik Kesihatan Bandar Kuantan (KKBK). Convenience sampling was applied since it

was a single-centre study in which limited allocation of time (two months only) and resources (no specific budget and only one research assistant) were available. Type 2 diabetic patients and its complications were confirmed through written diagnosis in the patients' medical record. Type 2 diabetic patients aged 35 to 75 years, attending outpatient department of KKBK from August 2009 to September 2009 were set as the inclusion criteria. Pregnant women and type 2 diabetic patients with major complications (i.e. diabetic nephropathy, diabetic neuropathy and cardiovascular diseases) were excluded from this study. Pregnancy status was determined using self-reported information.

Instruments and data collection

Data was collected by the administration of written questionnaires. Self-reported questionnaires, administered in Bahasa Malaysia were given to the respondents during their visit to the study location. A pilot study had been carried out prior to the usage of the questionnaires in this study which confirmed its feasibility and validity. Subjects completed the questionnaires under the supervision of investigators, which were later collected all at once. The questionnaire was divided into 3 sections: (1) socio-demographic and anthropometric characteristics; (2) body weight satisfaction; and (3) weight control practices. Further descriptions are provided below.

Socio-demographic and anthropometric characteristics

Self-reported information on age, sex, race/ethnicity, marital status, highest level of education, employment status and duration of diabetes was collected from all participants. With the exception of age and duration of diabetes, the rest of the information was recorded on categorical scales. BMI was computed from weight and height measurements from patients'

medical records and expressed as kg/m². BMI was then categorised as normal weight (BMI 18.5-24.9kg/m²), overweight (BMI 25-29.9kg/m²) or obese (BMI ≥30kg/m²) (WHO, 2000). Besides, medical diagnosis and Fasting Blood Glucose (FBG) (mmol/L) were also documented from patients' most recent biochemical readings.

Body weight satisfaction

Two items were selected from a previous study to assess body weight satisfaction (Millstein *et al.*, 2008). The first question asked; "What is your perception towards your current body weight?" Possible answers ranged from *very thin*, *thin*, *right body weight*, *overweight*, or *obese*. The responses to this question were then collapsed into two categories: satisfied (right body size) and dissatisfied (very thin, thin, overweight, or obese). The participants were also additionally asked: "What body weight do you feel is suitable for you." This open-ended question intended to explore their self-perceived body weight which was considered as appropriate for them assuming that they have already understood the concept of ideal body weight (which would have been provided in a diabetic counseling session during their visits).

Weight control practices

Generally, participants were asked about their weight control practices using a question "Are you now trying to lose weight, gain weight, stay about the same or are you not trying to do anything about your weight?" (Millstein *et al.*, 2008). Patients' answers were then collapsed into two categories: *trying* or *not trying to lose weight*. Other than those who answered *trying to lose weight*, the rest of the responses were categorised as *not trying to lose weight*. Weight control practices were further assessed through two domains; dietary practices and physical activity. Provided with dichotomous responses, a total of 12

items using a list of specific dietary behaviours for weight control (Raynor *et al.*, 2008) were used in assessing dietary practices of the respondents. Having any 'yes' response to these lists would be scored as 1 while 0 for 'no' (summated domain range: 0-12). Respondents with at least 70% of this summated score were considered as practising a diet. Further, physical activity carried out by the respondents were also assessed using a domain comprising a list of 14 common physical activities. Respondents were required to report the physical activity they had most frequently participated during the preceding one month together with its corresponding duration and frequency. They were considered as being engaged in physical activity if their cumulative time for these activities was at least 150 minutes per week. This consideration was based on our national guidelines, requiring at least 30 minutes or more of physical activity on most or all days of the week (Ikram Shah *et al.*, 2004). If the respondents satisfied both criteria of dietary practices and physical activity, they were considered as practising both.

Statistical analysis

The Statistical Package for the Social Science (SPSS, Version 16.0, 2007) was used for data compilation and statistical analysis. For the first objective, descriptive statistics were used to determine the mean BMI and weight satisfaction of study population. Initial normality test carried out utilising the BMI and FBG as dependent variables showed that normality requirements were violated (Shapiro-wilk test = $p < 0.05$; data was positively skewed). Therefore, in assessing the subsequent objectives, Mann-Whitney U test was carried out to observe differences between groups for continuous data and the chi square test was performed to evaluate the association between two categorical variables. The probability of committing type 1 error was set at 5% level.

RESULTS

Respondent characteristics

Of the total 67 respondents, 25 were males (37.3%) and 42 were females (62.7%) with a mean age of 54.1 ± 8.1 years. The respondents were multi-ethnic in composition, comprising 49 Malays (73.1%), 10 Chinese (14.9%) and 8 Indians (11.9%) representing the three main ethnic groups in Malaysia. The majority were married (91%). Most of the respondents had formal education in which more than half had completed secondary schooling (61.2%). Some of the subjects were either housewives or retirees (64.2%). The median duration of diagnosis among subjects was 4.0 ± 6.0 years with the range of duration being from 2 month to 25 years. About 35.8% of the respondents reported experiencing weight reduction after being diagnosed with diabetes. The baseline characteristics of the subjects are described in Table 1.

Mean BMI and weight of satisfaction

Over half of the sample (62.7%) was classified as being overweight (29.9%) or obese (32.8%). Overall, 35.8% of the respondents reported being dissatisfied with their body weight. Table 2 shows the mean BMI and weight satisfaction of respondents according to sex. The mean BMI of the subjects was 27.90 ± 5.27 kg/m² with males being 27.45 ± 4.45 kg/m² and females 28.12 ± 5.74 kg/m² ($p > 0.05$). The mean weight of satisfaction reported by participants was 62.74 ± 10.85 kg in which males significantly reported a higher value compared to females ($p < 0.001$).

Body weight satisfaction vs sex, BMI and glycemetic control

A greater proportion of women (65.1%) reported dissatisfaction than men (34.9%), yet there was no significant association between body weight satisfaction and sex (Table 3).

Table 1. Baseline characteristics of respondents

Characteristics	Frequency <i>n</i> =67	Percentage (%)	Mean (sd)	Median (IqR)
Age			54.1 (8.1)	
<40 years	2	3.0		
40-49 years	18	26.9		
50-59 years	33	49.3		
60-69 years	11	16.4		
>69 years	3	4.5		
Sex				
Male	25	37.3		
Female	42	62.7		
Ethnicity				
Malay	49	73.1		
Chinese	10	14.9		
Indian	8	11.9		
Marital Status				
Married	61	91.0		
Single	6	9.0		
Education level				
Never attended school	7	10.4		
Primary	16	23.9		
Secondary	41	61.2		
Tertiary	3	4.5		
Occupation				
Employed	24	35.8		
Housewife /Pensioner	43	64.2		
Duration having diabetes				4.0 (6.0)
< 1 years	8	12.0		
1-10 years	52	77.6		
> 10 years	7	10.4		
Weight after Diabetes				
Reduced	24	35.8		
Gain	3	4.5		
Fluctuate	18	26.9		
Maintain	22	32.8		

Table 2. Mean BMI and weight satisfaction according to sex

Variable	Males Mean (s.d)	Females Mean (s.d)	Mean difference (95% CI)	t-statistic (df)	p-value
BMI (kg/m ²)	27.45 (4.45)	28.12 (5.74)	-0.713(-3.39, 1.96)	-0.533 (65)	0.596
Weight of satisfaction (kg)	69.95 (10.50)	58.15 (8.37)	11.8(6.62,16.98)	4.571 (52)	<0.001

Table 3. Association between body weight satisfaction and sex

Variable	Satisfied group (n=24)No. (%)	Dissatisfied group (n=43)No. (%)	Chi-square statistic (df)	p-value
Sex				
Male	10 (41.7)	15 (34.9)	0.303 (1)	0.582
Female	14 (58.3)	28 (65.1)		

Table 4. Association between body weight satisfaction vs BMI and FBG

Variable	Satisfied Median (IqR)	Dissatisfied Median (IqR)	Test statistic value	z-value	p-value
BMI (kg/m ²)	24.9 (4.1)	28.8 (9.1)	6.865	-1.694	0.090
FBG (mmol/l)	9.85 (5.3)	9.20 (5.2)	1.446 x 10 ³	-1.203	0.839

As shown in Table 4, body weight dissatisfaction was reported at a higher median BMI of 28.8 kg/m² with median difference of 9.1kg/m² compared to the satisfied group at BMI of 24.9 kg/m² with a median difference of 4.1kg/m² ($p > 0.05$). Furthermore, glycemic control as represented by median FBG level had no significant difference ($p > 0.05$) in satisfied (9.9mmol/l with median difference of 5.3mmol/l) and dissatisfied groups (9.2mmol/l with median difference of 5.2mmol/l). However, the results of this study revealed that 83.6% of the respondents experienced poor blood glucose control (FBG level ≥ 6.1 mmol/l).

Body weight satisfaction vs trying to lose weight

The percentages of respondents who were trying or not trying to lose weight were rather comparable, 53.5% and 46.5% respectively for the respondents who were dissatisfied with their body weight. There was no significant association between

body weight satisfaction and weight loss strategies practiced by the respondents as shown in Table 5. For the respondents who were not satisfied with their weight, 53.5% were practising diet control, 32.6 % were involved in physical activity and only 18.6% practised both a combination of diet and physical activity.

When weight control practices were assessed independently, 53.7% of the respondents claimed that they were dieting, defined as intentional caloric restriction to reduce body weight (Wadden, Butryn & Byrne, 2004). The three most prevalent dieting strategies among study samples were eating less meat (95.5%), cutting out sweet foods and beverages (91.9%) as well as taking breakfast daily (86.6%).

In this study, three-quarters of the respondents reported using physical activity as a means to lose weight; however less than half of our study population (47%) reported exercising 150 minutes or more per week, the minimal level of physical activity recommended in national guidelines. The

Table 5. Weight control practices related to body weight satisfaction

^a Variable	Satisfied group (n=24) No. (%)	Dissatisfied group (n=43) No. (%)	Chi-square statistic (df)	p-value
Trying to lose weight				
Yes	7 (29.2)	23 (53.5)	3.685 (1)	0.055
No	17 (70.8)	20 (46.5)		
Diet				
Yes	13 (54.2)	23 (53.5)	0.003 (1)	0.957
No	11 (45.8)	20 (46.5)		
Physical activity (PA)				
Yes	6 (25.0)	14 (32.6)	0.420 (1)	0.517
No	18 (75.0)	29 (67.4)		
Both practices (diet + PA)				
Yes	3 (12.5)	8 (18.6)	-	0.734
No	21 (87.5)	35 (81.4)		

^aAll variables were assessed independently

median duration of the physical activity was 90 min/week with a median difference of 160min/week. Males were significantly more likely to report exercising or being involved with physical activity (65%, $p<0.05$). The descending ranking of physical activities were jogging (23.9%), gardening (19.4%) brisk walking (14.9%), aerobic (7.5%) and playing games (9%). Only 16% of the respondents engaged in both dieting and physical activity.

DISCUSSION

The association of obesity with type 2 diabetes is well established and well known. A higher percentage of overweight and obese individuals among type 2 diabetes patients may relate to the fact that the likelihood of developing type 2 diabetes rises steeply with increasing body fatness (Ikram Shah *et al.*, 2004). Consistent with the findings of this study, a local study on the anthropometry of type 2 diabetic out-patients also reported that on average, their patients were overweight (Ming & Suriah, 2002).

The results from this study showed that respondents with high BMI were more dissatisfied with their body weight. One pertinent issue is that it is possible that height was a factor associated with body weight satisfaction. However, during data collection, it did not appear that the respondents' answers to the body weight satisfaction question were associated with height. In fact, the link between high BMI and increasing burden of obesity-related illnesses is well documented (Looker, Knowler & Hanson, 2001; Zhao *et al.*, 2009), whereby excess weight is associated with adverse health consequences (Bessesen, 2008) suggesting that health concerns might be a vital factor linked to weight dissatisfaction at higher BMI.

Although a significant association between body weight satisfaction and gender was not established in this study, the results did uncover that males were more tolerant of their weight compared to females. In fact, women were approximately twice as likely as men to be dissatisfied with their body size (Millstein *et al.*, 2008). Studies on

perceptions of body weight commonly involved population of college students or young adults. Less is known about perceptions of weight in later life, backed by the assumption that body-related issues may not be the main concern among the elderly in whom the prevalence of type 2 diabetic is generally high. On the contrary, evidence suggests that concerns about aging and its effect on body weight and physical appearance are rather common in later life, especially among older women (Halliwell & Dittmar, 2003). Moreover, body weight concerns were prominent among elders who ranked body weight issues second behind memory loss (Schieman, Pudrovska & Eccles, 2007). Clarke (2002) discovered that weight-related issues are a major source of dissatisfaction among older women whereby the increased difficulty of losing weight proved to be highly frustrating. Pervasive cultural ideals of female thinness, the stigma associated with being overweight and traditional gender role differences in the importance of attractiveness appeared to be the reasons for the generally lower levels of weight satisfaction among women (Schieman *et al.*, 2007).

This study also highlighted the high frequency of poor blood glucose control among type 2 diabetic patients based on the current WHO cut-off point of impaired fasting glucose (IFG) at 6.1mmol/l. Clinical trials, including the Diabetes Control and Complications Trial (DCCT) and the U.K. Prospective Diabetes Study (UKPDS) have demonstrated that improving glycemic control can reduce the risk of macro- and micro-vascular complications in people with diabetes (Zgibor & Simmons, 2002; Franz *et al.*, 2002). Therefore, it is vital for all diabetic patients to attain and maintain blood glucose levels in the normal range or as close to normal as is safely possible to prevent or reduce the risk for complications of diabetes (Franz *et al.*, 2002). Although the importance of glycemic control is well documented, it is often not achieved. In fact, both satisfied and non-satisfied groups exhibited poor

blood glucose control. Our study outcomes suggest that body weight satisfaction was not a key factor affecting glycemic control among type 2 diabetic patients. A previous study has demonstrated that age, motivation, understanding of the disease, and compliance with diet and medications were related to diabetes control (Dalewitz, Khan & Hershey, 2000).

Evidence from previous studies indicated that obesity is generally difficult to manage in both diabetic and non-diabetic individuals. Even so, a weight-loss pattern usually would be seen after new diagnosis of type 2 diabetes (Looker *et al.*, 2001; Pi-Sunyer, 2005). A study conducted by Feldstein *et al.* (2008) had indicated that 12.2% of type 2 diabetes sufferers had a mean 3-year weight change trajectory which included a clinically significant mean weight loss (9.8% at 18 months). Nevertheless, evidence from the past discloses the difficulty of determining whether the weight changes were caused by voluntary (in response to medically prescribed dietary therapy) or involuntary weight loss (catabolic effects of severe hyperglycemia) (Feldstein *et al.*, 2008; Looker *et al.*, 2001). Despite that, losing weight for diabetic individuals can be a highly challenging task compared to non-diabetic individuals. In our diabetes cohort, it could be seen that the intention to lose weight was rather comparable even for those who were not satisfied with their weight. This event might have occurred due to several factors such as genetic or metabolic differences (Lean, 2003), fear of hypoglycemia, anti-diabetes medications, other medications, limited physical activity or diet fatigue (Anderson, Kendall & Jenkins, 2003; Zhao *et al.*, 2009). Psychological reasons such as fatigue from a long history of weight loss intervention attempts that have failed plus the feelings of failure, frustration, depression and anger may have lowered the drive for losing weight. Furthermore, diabetic patients with neuropathy, foot ulcers, heart disease, or other complications have a particularly

difficult time making attempts to increase physical activity. Weight gain with anti-diabetic medications is common and could be quite substantial with the evidence from the UKPDS which showed a gradual but impressive weight gain over a period of 15 years of drug treatment (Pi-Sunyer, 2005). All these issues suggest that there are several factors affecting the intention of diabetic patients in losing weight signifying the fact that body weight satisfaction alone may not be a strong factor in driving the respondents' motivation to lose weight.

In examining the particular weight loss practices, the findings from this study are supported by studies conducted among US adult populations with or without diabetes (Serdula *et al.*, 1999; Zhao *et al.*, 2009). The results showed that among persons trying to lose weight, eating less fat or reducing calorie intake was the most common strategy. Females were more likely to report dieting thus requiring further investigation to identify the reasons behind this likelihood as well as the factors for not using physical activity or both strategies to lose weight. Furthermore, regular consumption of breakfast has been associated with lower BMI in overweight individuals with type 2 diabetes (Raynor *et al.*, 2008). Eating breakfast may improve weight control by preventing excessive consumption which might occur with an irregular eating pattern. These findings suggest that patients with type 2 diabetes use weight control practices which help them meet their dietary recommendations.

Regular physical activity is another key factor in successful weight loss and long-term weight maintenance. However, only several respondents reported conducting these activities and yet they were mostly not in accordance with the recommended national guidelines. This suggests a need for better communication by healthcare professionals to facilitate the adoption of physical activity for weight control especially among type 2 diabetes. One of the possible effective strategies is by

encouraging most-desired types of physical activity reported in this study as they would be easier to comply with.

Consuming fewer calories and practising regular physical activity play an important role for successful weight loss (Pi-Sunyer, 2005). Data from this study demonstrates that only a minority were using the recommended combination practice of diet and physical activity. In order to determine whether this discrepancy reflects a lack of knowledge about weight control methods or an inability to employ these methods effectively or both, the answer could not be provided via this study. Results from previous studies have shown that people trying to lose weight engaged in behaviour that created a negative energy balance by eating less or by increasing their physical activity (Lee *et al.*, 2004; Serdula *et al.*, 1999; Zhao *et al.*, 2009). It was possible that overweight or obese people with diabetes were not pro-actively practising this recommended combination because they were not in a severe condition, leading them to regard weight management as not very important in controlling their diabetes. However, given the huge benefits of weight loss on improved glucose tolerance and insulin sensitivity in the diabetes population, it is consistently important to educate and encourage these patients to lose excess weight through appropriate practices.

This study inevitably has several limitations. First, it has employed convenience sampling in which only volunteers participated. They could thus be representing those who were more concerned about their disease and therefore might not reflect the general practices of diabetic patients. Nevertheless, our data has generally included representatives of the intended communities. Second, the small sample size was due to the restricted data collection time (2 months) the location permitted (only one centre). Despite these restrictions, we still succeeded in recruiting almost 50% of the registered patients within this study period even before considering

non-response and those excluded. Third, disease status and weight control behaviour were self-reported, hence they were subjected to recall bias. Moreover, there might be under- or over-estimation of weight control practices. This is because unstructured activities such as housework or on-the-job activities were not particularly assessed. Also, the survey did not include an in-depth dietary assessment, thus calorie and fat reduction could not be exactly quantified. Due to lack of information on certain weight control practices, less frequent weight loss strategies such as eating food supplements, taking diet or water pills or taking diuretics have also not been evaluated in this study. These weight loss strategies may have been adopted by those who reported trying to lose weight but neither adopted a low fat or low calorie diet nor engaged in physical activity. Nevertheless, the list of specific weight control strategies that was included in the questionnaires were based on prior studies concerning weight loss practices thus, reducing the effects of outliers.

CONCLUSION

In summary, body weight dissatisfaction was more commonly reported by women as well as respondents with higher BMI. Poor glycemic control was clearly exhibited in both, satisfied and dissatisfied groups indicating that body weight satisfaction is not a key factor influencing type 2 diabetic patients to manage their disease. The percentages of respondents who were trying or not to lose weight were mostly comparable for the satisfied and dissatisfied group signifying the fact that body weight dissatisfaction was not a prominent factor in motivating the respondents to lose weight. There was no significant association between body weight satisfaction and the weight loss strategies practised by respondents. This study implied that body weight satisfaction alone is not a strong

factor that may drive type 2 diabetic patients to be involved in weight control practices. Therefore there is a need for future research to explore the concrete factors associated with weight control practices for effective weight loss interventions in individuals with type 2 diabetics.

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