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Developing a Scale to Make Suggestions to Overweight People for Efficient Weight Loss and Weight Management

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Abstract

BACKGROUND/AIMS: To develop a scale to assess potentially adequate suggestions which can be made to overweight individuals to aid in their weight loss.

MATERIALS and METHODS: In this cross-sectional study, a scale of 28 items was initially prepared from a pool of potential items. Using the Davis technique and content validity index assessment, a scale of 14 items was prepared. A 3-Likert type scaling method was used for response assessment. A total of 77 overweight individuals were recruited to participate in this survey two times within an interval of three weeks. To assess the reliability of the scale, the test/re-test technique and Cronbach's alpha parameter were employed. IBM SPSS version 22.0 was used for statistical analysis. For all tests, the confidence interval and p-value were set at 95% and ≤0.05, respectively.

RESULTS: The content validity index for the 14 items was 80% or higher. The reliability correlation coefficient for the scale, using the test/re-test method, was 0.763 (p=0.001). The overall Cronbach's alpha score was 0.737, which did not decrease after eliminating any of the items. The Kaiser-Meyer-Olkin measure was calculated to be 0.631, which was acceptable. The VARIMAX rotated factor analysis yielded five factors with 64.33 percent of the variance. On loading the 14 items on these five factors, the item loading values ranged from 0.505 to 0.849.

CONCLUSION: The 14-item scale showed good validity and fairly acceptable reliability. It can be used to provide adequate and useful suggestions to overweight individuals in order to aid in their weight loss program.

Keywords: Overweight, obesity, nutritionists, weight reduction programs, cross-sectional study

INTRODUCTION

Obesity is defined as the excessive or abnormal accumulation of fat in the body which poses a health risk. According to recent World Health Organization guidelines, an individual with a body mass index (BMI) more than or equal to 25 kg/m^2 is considered to be overweight, and those with BMI more than or equal to 30 kg/m^2 are considered to be obese.[1] During the past few decades, with increases in the consumption of processed food and sedentary lifestyles, the prevalence of obesity has markedly increased. Several studies have shown that obesity adversely affects the health of individuals.[2] It leads to several physiological problems and physical disabilities. It also increases the risk of several non-communicable diseases, such as cancer, diabetes, cardiovascular disorders, hypertension, depression, metabolic syndromes, neurological illness, etc.[1,2] Several studies have also demonstrated that obesity is associated with higher rates of admission to hospitals and intensive care units.[3] Recent studies have also shown that high BMI is directly associated with worse outcomes among coronavirus disease-2019 (COVID-19) patients.[3,4] It has previously been reported that even a 10% reduction in the weight of individuals with severe obesity can lead to

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significant improvements. However, in most cases, even after various pharmacological and surgical interventions, such as bariatric surgery, overweight individuals seem to revert back to their previous obese conditions.[5,6]

The rise in healthcare expenses has brought about a dire need to employ and adopt preventive management strategies in order to facilitate early disease prevention, especially in the current era of novel disease variants and bio-terrorism.[7] By definition, preventive medicine refers to the implementation of strategies to prevent any serious health problems in the future via the early detection and prevention of adverse health conditions. Such a management approach is essentially the most cost-effective way to reduce the risk of more critical comorbidities.[7] Preventive medicine is the most basic feature of primary health care services. While implementing prevention techniques for obesity, family practitioners play a critical role.

It is noteworthy that psychological and behavioral instincts majorly impact the eating habits of an individual. These factors also influence the outcomes of weight loss strategies. Several researchers have previously used self-reported measures in order to assess the potential behavioral predictors among obese individuals.[8]

Current eating habits and environmental changes have collectively affected the overall physical, physiological, and psychological well-being of people worldwide. With this in mind, we hypothesized that developing a scale involving both the internal factors of patients, such as their eating habits, and the external factors, such as expert support and environmental influences, would help health care providers and overweight individuals to focus on the efficient management of their weight loss programs. This study aimed to develop a 14-item scale in three different domains in order to assess the potential markers and suggestions which can help in weight reduction and long-term weight management.

MATERIALS AND METHODS

Questionnaire

Ethical approval for this study was obtained from the Ethics Committee of Private Hürrem Sultan Hospital (approval number: 2020-39, date: 13.11.2020). Initially, we prepared a "pool of items" which overweight people must do in their daily life to lose weight. Then, we prepared a scale of 28 items from this pool. The items were divided into three major domains: namely "*Requiring expert support*" (expert support), "*Regulation of habits*" (habits), and "*Regulation of environmental factors*" (environment). The *expert support*, *habits*, and *environment* sections contained seven, thirteen, and eight items, respectively. This scale was then sent to five dieticians. Then, the Davis technique was applied and, based on the suggestions of dieticians and authors, 14 items were determined to be unsuitable and were removed from the scale.

From the domain of *expert support*, one item was removed:

"*I expect my psychologist to solve my problem about weight*"

From the domain of *habits*, seven items were removed:

"*It is necessary to do sports every day*", "*It is necessary to not eat at night*", "*You should not eat too much bread*", "*Meals should not be skipped*", "*You should not eat in times of sadness or trouble*", "*You need to spend as little time as possible in front of the TV/computer*", and "*It is necessary to have snacks*".

From the domain of *environment*, seven items was removed:

"*There should be less variety in the house*", "*It is necessary to follow the advice of people who have lost weight*", "*You should not drink alcohol*", "*You should not accept invitations*", "*You should not accept treats*", "*It is useful to see before/after pictures of people who have lost weight*".

The remaining items were as follows:

Expert support domain:

1. Dietician's advice should be followed,

2. I expect my dietician to motivate me,

3. The doctor's advice should be followed,

4. I expect my doctor to motivate me,

5. The psychologist's advice should be followed,

6. I must learn correct nutrition,

Habits domain:

7. Serving plates should be small,

8. A role model is needed to be motivated,

9. Eating too quickly is bad,

10. The mouthfuls of food must be small,

11. One should restrain from eating junk food,

12. One should restrain from too much sweet food,

Environment domain:

13. One shouldn't eat with people who have large appetites,

14. No other activities should be done while eating.

The content validity index for items 1-10 and 14 was 100% and for items 11-13, it was 80%.

Study Participants

Initially, we recruited 14 individuals to participate in a trial survey in order to obtain feedback regarding whether it was difficult to understand any item. Once all the individuals confirmed that they did not experience any difficulty, a total of 77 individuals were enrolled into this study. The sample size was determined after multiplying the number of questions by 5.

Number of questions was 14 and so;

14x5=70 participants

Following this, taking into account people dropping out, an extra 10% of the number of participants was added.

70 + (10% of 70)=77 total participants.

Inclusion Criteria

The inclusion criteria of the participants included being aged between 18 and 65 years, having a BMI more than or equal to 25 kg/m^2, including obese individuals, and the ability to participate in both of the surveys conducted 3 weeks apart.

Exclusion Criteria

The exclusion criteria included not able to participate in both of the surveys "on time", being aged less than 18 years or more than 65 years, having a BMI less than 25 kg/m^2 or suffering from a cognitive defect which impaired the ability to understand the scale and fill the questionnaire. All the participants provided informed consent.

Survey

The participants were asked to undertake the survey twice at an interval of three weeks. The average time for completion of the survey was 3 minutes. In order to ensure the validity of the survey, we obtained the opinions of five dieticians, we employed a content validity method, and a translation validity method. Additionally, in order to ensure the reliability of our results, we employed the method of repeating the form.

Scale response: In survey studies, several types of response assessment tools are used, such as 5- or 7-Likert scaling. However, such large assessment tools exhibit lower performance than smaller tools, such as 3-Likert scaling.[9] Thus, in this study, we used the 3-Likert type scale to assess the responses as shown below:

1 point - *No* or *not at all*

2 points - *Partly* or *sometimes*

3 points - *Yes* or *always*

Statistical Analysis

The recorded data was compiled and analyzed using Microsoft Excel 2010 and IBM SPSS version 22.0 (SPSS Inc., Chicago, Illinois, USA). We used Cronbach's alpha and test-retest reliability analysis to evaluate the reliability of our scale. Factor extraction was conducted using principal component analysis. For all tests, the confidence interval and p-value were set at 95% and ≤0.05, respectively.

The purpose of the scale developed was to assess the understanding of obese people regarding weight loss and thereby provide appropriate suggestions and motivation for them. A 3-Likert scale was used for the assessment where points were assigned to the responses as follows:

- *No* or *not at all* = 1 point

- *Partly* or *sometimes* = 2 points

- *Yes* or *always* = 3 points

A cut-off point was not set in the current study. It was avoided in order to eliminate the polarization of responses and thus a loss of information.[10] Rather, the responses were analyzed over the complete range of the scale.

RESULTS

Reliability Assessment

Reliability analysis showed that the inter-item correlation coefficients ranged from -0.11 to 0.553. Item-total correlation coefficients ranged between 0.152 and 0.484. The Cronbach's alpha coefficient was 0.737, which did not increase when deleting any items (Table 1).

Furthermore, the test-retest reliability assessment revealed a correlation coefficient of 0.763 (p=0.001) which was acceptable (Table 2).

Factor Analysis

The ratio of observations to variables was approximately equal to 5.5:1 in the present study (sample size = 77, number of items = 14). The minimum acceptable ratio according to Hair et al.[11] is 5:1. Thus,

Table 1. Reliability analysis

Questionnaire items	Corrected item total correlation coefficients	Alpha if item deleted	Cronbach's alpha
Requiring expert support			
The dietician's advice should be followed	0.454	0.708	
I expect my dietician to motivate me	0.484	0.705	
The doctor's advice should be followed	0.385	0.717	
I expect my doctor to motivate me	0.352	0.719	
The psychologist's advice should be followed	0.379	0.716	
I must learn correct nutrition	0.484	0.711	
The regulation of habits			
Serving plates should be small	0.331	0.721	**0.737**
A role model is needed to be motivated	0.283	0.729	
Eating too quickly is bad	0.152	0.737	
Mouthfuls must be small	0.328	0.722	
One should restrain from eating junk food	0.187	0.737	
One should restrain from eating too much sweet food	0.201	0.733	
The regulation of environment			
One shouldn't eat with people who have strong appetites	0.435	0.709	
No other activities should be done while eating	0.433	0.709	

the ratio of observations to variables in our study satisfies the above criteria. Also, the data matrix should have sufficient correlations to justify the application of factor analysis techniques. An examination of the correlation matrix did not reveal any values equal to or above 0.90, which indicates that the data does not have any major collinearity issues. The Bartlett's test is significant at a level of 0.001 which suggests the overall significance of the correlation matrix. Another measure which checks for the appropriateness of the factor analysis is the Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy. The value for KMO in the present study was equal to 0.631, which falls in the acceptable range (above; 0.50). Principal Component analysis which considers the total variance was used to extract the factors. The latent root criterion of retaining factors with eigenvalues equal to or greater than 1 in combination with the screen test (Figure 1) was employed in order to determine the number of factors to be retained for interpretation. In order to improve the interpretation, orthogonal (VARIMAX) rotation was applied to the factor matrix. Before extracting the factors, the factor-loading matrices and the communalities were examined in order to evaluate the different items for possible deletion. The items with factor loadings below ±0.4, substantial cross-loadings or communalities less than 0.40 were considered for deletion. Based on this, none of the items needed to be deleted. The VARIMAX rotated factor analysis of the set of 14 items as shown in Table 3 yielded five factors which accounted for 64.33 percent of the variance. All 14 items were loaded on these 5 factors. The item loadings ranged from 0.505 to 0.849 (Table 3).

DISCUSSION

Obesity is a direct reflection of changing and irregular eating behaviors perceived from social, environmental and emotional factors.[12] Psychological factors also play a critical role in weight gain in an individual. These are essentially the most important factors in determining the outcome of weight loss measures.[8] Emotional eating behavior arises due to negative emotions such as sadness and anger as a result of poor physiological outcomes. Mindless food intake has been associated with higher anxiety and stress levels.[12] Previously, several self-reported measures have been developed to elucidate the association of obese individuals with food, such as their age of onset of obesity, their weight cycling history, the power of food scale, the modified Yale Food Addiction Scale, the Barratt Impulsiveness Scale, the three-factor eating questionnaire, etc. Also, there have been studies on the prevalence of obesity in corporate organizations considering five major risk factors, namely, *unhealthy diet*, *physical inactivity*, *stress*, *alcohol consumption* and *smoking*. Out of these five risk factors, only two, *unhealthy diet* and *physical inactivity*, were found to have significant relationships (p<5%) with being overweight and obesity.[13]

Different scales focus on different parameters for the assessment and management of obesity. Here, we focused on three major domains, namely, *expert support*, *habits*, and *environment*. The eating behavior of an individual has been demonstrated to be a complex process which is affected by both internal (internal homeostasis) as well as external (social and environmental influences) factors.[14] The energy homeostasis of our body aims to equate the energy intake with its overall needs. However, due to the influence of external factors, such as palatability and availability, the net food intake might be higher than is needed, which leads to excess energy intake.[15]

The development of any new scale incorporates the verification of its validity and reliability. The validity of any new scale is evaluated via its validity/correlation coefficient. The value of this coefficient varies between +1.0 and -1.0 and is directly associated with the validity of the scale.[9] The validity of any scale comprises of internal validity, which represents the actual meaning of the items, and external validity, which indicates the generalizability potential of the scale. Here, we used the content validity method, which is a type of translation validity method. In order to achieve this, we applied the Davis technique in order to validate the content of our scale. In this technique, each item was given a grade of 1 to 4 by each dietician, where the grades of 1, 2, 3, and 4 referred to "*item appropriate*", "*item should be reviewed slightly*", "*item should be reviewed seriously*", and "*item not appropriate*", respectively. The first two grades were considered as positive and the last two as negative. For each item, the content validity index was calculated as follows:

Content validity index = (the number of positive grades achieved/the total number of experts)*100

Those items with a content validity index of more than or equal to 80% were included in the survey and rest were omitted.[16] Based on this calculation, 14 items were determined to be valid and were included in the scale.

Furthermore, the reliability of a scale essentially refers to the consistency in the results even after repetition. In this context, the time elapsed between repetitions plays an important role. For instance, if the time between the two assessments is too short, it leads to an inaccurate increase in the reliability because of the recall of the previous answers given by the participants. On the other hand, if the time elapsed is too long, it often leads to changes in the measurement parameters or conditions, which leads to a decrease in reliability. In addition, another

Table 2. Assessment of test-retest reliability by correlation of pre-test and post-test scores

	Post-test	
	Correlation coefficient	p-value
Pre-test	0.763	0.001*

Test applied: Pearson's correlation test, *indicates statistically significant correlation.

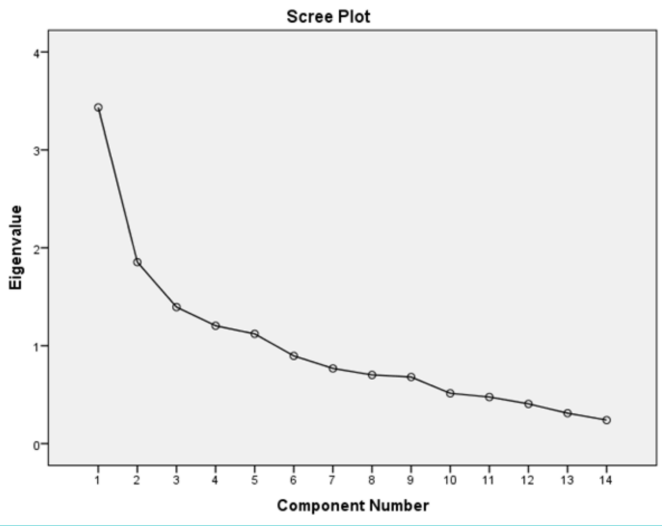


Figure 1. Scree plot.

Table 3. Distribution of items according to components

Item	Component				
	1	2	3	4	5
1. I expect my doctor to motivate me	0.700				
2. I expect my dietician to motivate me	0.803				
3. The doctor's advice should be followed	0.681				
4. The psychologist's advice should be followed	0.583				
5. The dietician's advice should be followed	0.716				
6. I must learn correct nutrition	0.505				
7. A role model is needed to be motivated		0.615			
8. One should restrain from eating too much sweet food				0.849	
9. One should restrain from eating junk food					0.789
10. Eating too quickly is bad				0.618	
11. Mouthfuls must be small			0.833		
12. No other activities should be done while eating			0.805		
13. One shouldn't eat with people who have large appetites		0.789			
14. Serving plates should be small		0.728			

Items included in: 1st Component: Q.1 to Q.6, 2nd Component: Q.7, Q.13, Q.14, 3rd Component: Q.11, Q.12, 4th Component; Q.8 and Q.10, 5th Component: Q.9.

parameter, known as agreement/compliance, also facilitates in the assessment of the reliability of a scale. In this parameter, multiple observers conduct the same analyses. The higher the number of similar observation results and observers is, the higher is the reliability of the scale is. Ideally, all the items of a scale must contribute to enhance the reliability of the scale. It is noteworthy that high reliability does not imply high validity, but a tool with high validity also has a high reliability.[17] Here, we employed the form repetition method, also known as the test-retest method (invariance over time) in order to verify the reliability of our scale. We surveyed the same population of participants using the same scale with an interval of 2-4 weeks.[9] Then, the measured values obtained from the surveys were correlated and the values of the correlation coefficients were determined. The value of these correlation coefficient varies from -1.0 to +1.0. The higher the value of the coefficient, the higher the correlation between the measured values is, which indicates good reliability. For a scale to show good reliability, the value of the reliability correlation coefficient must be at least 70%.[17] Our results showed an overall correlation coefficient of 0.763 (p=0.001) among the measured values of the two surveys, which indicated acceptable reliability (Table 2). In addition, we observed that the item-wise Cronbach's alpha scores varied from 0.705 for item 2 (*I expect my dietician to motivate me*) to 0.737 for items 9 (*Eating too quick is bad*) and 11 (*One should restrain from eating junk food*). Overall, the Cronbach's alpha score of the scale was 0.737, which indicated fairly good reliability. The deletion of any of the 14 items did not increase the Cronbach's alpha score and reliability of the scale. The corrected-to-total item correlations were generally strong, which indicated that the items on the same factor represented a common concept or construct and the adoption of the aggregate score, as a proxy for the common factor.

Several factors contribute to the incidence of obesity. It is necessary to implement preventive measures at an early stage. Medical practitioners and dieticians play a crucial role in this regard. To the best of our knowledge, this is the first study which incorporates both expert support and eating habits domains within the same scale. In a recent review, Mastrocola et al.[18] (2020) demonstrated that training programs conducted around the world for medical students and residents are insufficient in providing adequate obesity education. They suggested that medical schools should work on the inclusion of obesity education programs in their curricula. For optimal obesity management, it is necessary to provide appropriate education and training to graduate and undergraduate medical students.[18]

Considering the domain of *expert support*, constant assistance from the dietician or doctor and a focus on good mental health to attain a good psychological balance might help patients to adhere to weight loss interventions and motivate them for continued weight management. A study by Dicker et al.[19] found that motivation at 4 weeks could decide the further adherence towards self-management and so help the individual to adhere to a target of a further 16 weeks of weight loss. Empathy is used in motivational interviewing, which has been suggested to enhance weight loss outcomes. Hence, incorporating different aspects of social behaviors such as empathy, can expedite weight loss outcomes. Additionally, motivational nutrition programs and training for patients can be employed to assess their nutritional literacy in a form of cognitive-behavioral approach and to improve their health through weight reduction, lower cardiovascular risk and other physiological functions.[20] Reforming eating habits also leads to improvements in physiological balance. This significantly improves sticking to eating timetables and also regulates the circadian rhythm. It also leads to a reduction of oxidative stress and preserves hormonal balance. An observational study on nutritional psychiatry investigated the role of individual dietary factors and overall dietary patterns regarding reductions in depression, anxiety, and sleep disorders.[21] Engaging in social activities also discourages individuals from unhealthy diets and also influences others in terms of healthy eating and regular physical activity. This leads to better weight management.[22] There were a few limitations of this study. We did not classify the participants on the basis of their age, gender, sociodemographic characteristics, or occupation. Sociodemographic characteristics and occupations directly or indirectly affect the psychological state of an individual. As stated earlier, the eating behavior of an individual is significantly affected by their psychological well-being. Furthermore, when faced with the same

problems, males and females often react and compensate differently, which also contributes to their habits of excess eating. Some previous studies have shown that individuals who encounter obesity at an early age face a much larger problem in tackling this condition and often revert back to an obese condition at a later stage in life. Simmonds et al.[23] reported that individuals who developed obesity at an early age were about five times more likely to exhibit obesity during adulthood compared to those who did not. Furthermore, we observed that the scale showed only fairly acceptable reliability. We propose the use of this scale with a larger study sample in order to further elucidate its degree of reliability.[23] In a clinical set-up, this scale can be used to assess the awareness and receptiveness of obese people to various facts and suggestion regarding their weight loss. Based on their responses, an effective weight loss program can be customized. Additionally, during a weight loss program, the survey can be re-taken in order to check whether the individual requires more assistance and suggestions, which were not required at the beginning. For public health, this survey can be used to assess the understanding of the general public regarding their awareness regarding weight loss and weight management and thereby provide appropriate suggestions for them.

CONCLUSION

Here, we developed a novel scale to determine potentially useful suggestions which can be given to overweight individuals in order to aid in their weight loss. The items in this scale were validated using the content validity method and Davis technique, which led to the formation of a 14-item scale. The reliability of this scale was assessed using the test-retest method, which revealed an acceptable reliability correlation coefficient. The Cronbach's alpha score and corrected-to-total item correlation scores also indicated fairly good reliability.

MAIN POINTS

- Our goal was to develop a scale to assess potentially appropriate suggestions which can be offered to overweight individuals in order to aid in their weight loss.
- In this cross-sectional study, a scale of 28 items was initially prepared from a pool of potential items.
- A total of 77 overweight individuals were recruited to participate in this survey two times within an interval of three weeks.
- The 14-item scale showed good validity and fairly acceptable reliability and so can be used to provide adequate and useful suggestions to overweight individuals to aid in their weight loss program.

ETHICS

Ethics Committee Approval: Ethical approval for this study was obtained from the Ethics Committee of Private Hürrem Sultan Hospital (approval number: 2020-39, date: 13.11.2020).

Informed Consent: All the participants provided informed consent.

Peer-review: Externally peer-reviewed.

Authorship Contributions

Surgical and Medical Practices: Ü.D., A.M., Concept: Ü.D., Design: Ü.D., Data Collection and/or Processing: Ü.D., A.K., Analysis and/or Interpretation: Ü.D., A.M., Writing: Ü.D., A.M., A.K.

DISCLOSURES

Conflict of Interest: No conflict of interest was declared by the authors.

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