DEVELOPMENT AND VALIDATION OF THE MOTIVATION FOR HEALTHY EATING BEHAVIOR SCALE (MHEBS) IN THE BENGALI-SPEAKING ADULTS

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ABSTRACT

Purpose: This study aimed to develop and validate a scale to assess the motivation for healthy eating behavior in Bengali-speaking adults.
Methodology: The study was cross-sectional in nature and was conducted online via Google Forms. A total of 220 Bengali-speaking adults participated in the study. A literature review was conducted to generate an item pool regarding motivation for healthy eating. The content validity of the items was evaluated by an expert panel from related fields. Based on their responses, the items were modified, and 15 items were assessed for face validity. The scale's construct validity was assessed by performing an Exploratory Factor Analysis (EFA). The reliability of the scale was examined using the internal consistency reliability coefficient or Cronbach's alpha. To establish the convergent and divergent validity of the scale, the Satisfaction with Life Scale (SWLS) and Fear of COVID-19 Scale (FCV-19S) scale were used.
Major Findings: The MHEBS showed good content and face validity. The internal consistency reliability of the scale was in the acceptable range with Cronbach's alpha value of 0.820. The EFA suggested a three-factor scale structure, and the factors were "*benefits of healthy eating*", "*external regulation*", and "*affordability*". The scale also showed acceptable convergent and divergent validity with SWLS and FCV-19S respectively.
Implications: MHEBS — a 15-item 5-point Likert scale — is the first developed scale to measure the motivation for healthy eating behavior in the Bengali-speaking adult population. The scale would help identify what motivates Bengali adults to for maintaining healthy eating behavior. In addition, it would aid program planners to effectively design health promotion strategies as well as health practitioners and dietitians to counsel patients before applying dietary behavior change interventions.

KEYWORDS: Motivation; Healthy Eating Behavior; Development, Validation; Bengali-speaking adult

Introduction

A healthy diet is generally considered to contain all the essential macronutrients (i.e., carbohydrates, proteins, and fats) and micronutrients (i.e., vitamins and minerals) in such proportions that are appropriate to support our body and physiological needs (Cena and Calder, 2020). A growing body of nutritional epidemiological evidence highlights the importance of regular consumption of healthy and nutritious diets as they are hypothesized to play a vital role in preventing major non-communicable diseases (NCDs) along with varying forms of malnutrition (Appel *et al.*, 1997; Koene *et al.*, 2016; Yu *et al.*, 2016). The 2017 Global Burden of Disease Study systematically analyzed the health effects of dietary risks and attributed one in five adult deaths to poor diets (Afshin *et al.*, 2019). According to the World Health Organization (WHO), 80% of the risk of NCDs such as diabetes, cardiovascular disease, obesity, cancer, and hypertension occur due to unhealthy dietary behavior and a sedentary lifestyle (World

Health Organization, 2013). Furthermore, a healthy diet, including diversified animal-based and plant-based foods, is stated to be the best strategy to boost the body's immunity and protect it against infections (Calder *et al.*, 2020).

However, factors such as urbanization, food industry marketing, and liberalized trade policies have resulted in shifts in the dietary pattern of the world's population, facilitating the process of "nutrition transition" (Kearney, 2010). People nowadays are more inclined to eat foods that are high in energy, fat, free sugar, and sodium rather than their traditional homemade foods. Excess consumption of such unhealthy items is usually coupled with an inadequate intake of healthy foods (e.g., fruits and vegetables), resulting in poor overall diets.

Given the importance of healthy diets to promote health and reduce diet-dependent risk factors of NCDs, global health initiatives include strategies and evidence-based interventions to improve diets (World Health Organization, 2013). However,

people's food choices are multidimensional and are influenced by a range of interconnected factors, namely biological, cultural, economic, geographical, psychological, and marketing factors such as food prices and affordability. Eating food may also relate to the emotional states of an individual, the desire to nurture oneself, and strengthening feelings of social connection. In fact, according to Guine et al. (2020), eating behavior is contextual, dynamic, and integrated into our daily lives (Guina *et al.*, 2020). Measurement of what motivates individuals to eat, and more precisely, what motivates them to eat healthily, therefore, must be based on culture-specific tools before designing any interventions aimed at improving dietary behavior.

Motivation is a psychological process such as desires, needs, or interests that drive individuals to achieve a certain goal. To identify what motivates individuals to healthy eating behavior, the "Motivation for Healthy Eating Scale (MHES)" was developed for the Japanese population. The scale with excellent psychometric properties identified six factors that motivate individuals to eat healthy foods (Kato *et al.*, 2013). Another validated scale named "Motivations to eat" determined four domains: coping, social, compliance, and pleasure, that motivate college students to maintain healthy eating behavior (Jackson *et al.*, 2003). However, these studies only developed and validated scales to assess the motivation of college students and female undergraduates. In addition, the scales were developed for the populations of Japan and the USA. Similarly, a study conducted with 11,960 participants in 16 countries showed six individual scales to identify the factors motivating food choices (Guina *et al.*, 2020). Thus, assessing the motivation of a certain population demands more cultural and context-specific research. Despite having great importance, no instrument has been developed till now for assessing the motivation for healthy eating behavior of the Bengali-speaking adult population.

With the view to doing this, the present study is the first one to develop and validate a "Motivation for Healthy Eating Behavior Scale (MHEBS)" to assess the motivation for healthy eating behavior among the Bengali-speaking adult population. The study also aimed to identify the domains that regulate the healthy eating behavior of the respective population.

Materials and Methods
Phase 1: Identification of Motivation for Healthy Eating Concepts from Existing Literature Literature review for generating item pool
A comprehensive literature search was carried out to identify the concepts of motivation for healthy eating behavior using PubMed, Google Scholar, and Directory of Open Access Journals. The search strategy included the keywords: "motivation," "healthy eating," "mindful eating," and "healthy eating behaviors" for the first stage of searching. The pearl-searching method was conducted to identify additional related works in the second stage. The articles were screened based on their titles and abstracts, followed by a full-text review independently by two authors.

Phase 2: Development of the Scale Item generation
The literature review resulted in articles that contained concepts of motivation for healthy eating and relevant questionnaires

(Jackson *et al.*, 2003; Kato *et al.*, 2013; Naughton, McCarthy and McCarthy, 2015; Guertin, Pelletier and Pope, 2020; Guina *et al.*, 2020; Román *et al.*, 2021). After using the concepts identified from the articles and existing related questionnaires, a pool of 35 items was generated. The responses for the items were on a 5-point Likert scale, ranging from 1 (strongly disagree) to 5 (strongly agree). These 35 items were presented to experts from various fields such as psychology, public health, and nutrition for review.

Content validity
For qualitative content validity, a panel of five experts (2 psychologists, 2 nutritionists, and 1 public health professional) examined the initial questionnaire. Five experts from different backgrounds were chosen as it is suggested to reduce the control over the chance agreement (Ghahramanian *et al.*, 2015). They were asked to rate the items on a scale of 1 to 4 based on their relevance, clarity, necessity, and simplicity. Based on their responses, the content validity of the scale was assessed using the item content validity index (i-CVI) and scale content validity index (s-CVI).
The i-CVI for each item was determined by the proportion of experts who rated each item with a 3 or 4 on the 4-point Likert scale. The s-CVI was measured by averaging all i-CVIs. The acceptable cutoff value for i-CVI with five experts was 0.79 and 0.8 for s-CVI (Yusoff, 2019). Later, the items with i-CVI values less than 0.79 were removed from the questionnaire.

Face validity
To assess the face validity of the scale, a pilot study with 20 adult representatives with similar characteristics to the study group was conducted. The individuals were interviewed to assess each item for their comprehensiveness, ambiguity, and complexity.

Construct Validity
For assessing the construct validity, a total of 220 participants participated in the study. Everitt's (1975) (Everitt, 1975) and Nunnally's (1978) (*Nunnally,* 1978) recommendation of sampling at least ten times as many subjects as variables was followed to determine the sample size for conducting the Exploratory Factor Analysis (EFA). As the scale contained 15 items, 220 participants were regarded as an adequate sample size. Participants aged 18 to 40 years who speak Bengali as their first language and have completed 12 schooling years were only included in the study.
The data was collected through Google forms from July 21, 2020, to July 27, 2020. The survey link of the Google form was distributed via email and social media like Facebook and WhatsApp. The google form contained the study instruments: consent form, background information form, MHEBS, the Satisfaction with Life Scale (SWLS), and Fear of COVID-19 Scale (FCV-19S). The consent form with a detailed description of the study was attached at the beginning of the questionnaire. Participants who agreed to take part in the study had to click on the "I agree to participate" option before filling out the questionnaire. The background information form included questions about participants' age, gender, country, and educational status. The study instruments were in Bengali and later translated into English for academic publication.
The construct validity of the scale was examined using EFA with varimax rotation and Principal Axis Factoring (PAF). EFA

was conducted to determine the number and nature of underlying factors in the scale. The varimax rotation was applied so that items with similar characteristics could be grouped into distinct factors. The Kaiser–Meyer–Olkin (KMO) and Bartlett's tests were carried out before the factor analysis. The KMO test was used to measure sample adequacy, and Bartlett's test of sphericity was used to assess the homogeneity of the variances among the items. The KMO value of >0.5 and Bartlett's test value of <0.05 indicated the suitability of running factor analysis. The number of factors was determined by each factor's eigenvalues, scree plot, and percent of explained variance. Factor loadings were used to keep or drop an item from the analysis. Moreover, the items that showed high correlation (>+0.9 or < -0.9) and low correlation (<±0.3) with other items were also deleted from the analysis.

Convergent and Divergent validity
To establish the convergent and divergent validity of the scale, the Satisfaction with Life Scale (SWLS) and Fear of COVID-19 Scale (FCV-19S) scale were used together with MHEBS. Pearson correlation was performed to assess the convergent validity with SWLS and divergent validity with FCV-19. The SWLS is a five-item 7-point Likert-type scale used to measure global cognitive judgments of participants' life satisfaction.(Diener *et al.*, 1985) The FCV-19S was used to measure fears, worries, and anxiety among individuals worldwide caused by COVID-19. It is a seven items 5 points Likert-type scale originally developed by Ahorsu et al. (2020) (Ahorsu *et al.*, 2020).

Reliability
The reliability of the scale was assessed by measuring the internal consistency reliability. The internal consistency was evaluated by calculating the Cronbach's alpha (α). A value of $\alpha=0.7$ was regarded as an acceptable reliability coefficient (*Nunnally, 1994*)

Ethical consideration
The study took informed consent from each of the participants. A detailed consent form describing the objective, method, risks, benefits, and data confidentiality was attached at the beginning of the Google form. Participants who wanted to participate in the study had to put an electronic signature on the form and click the option "I agree to participate."

Results
Demographic Characteristics of the Study Participants
Among 220 study participants, females accounted for 45% and men for 55% of the total participants (Figure 1). The participants were aged between 18 to 40 years with a maximum population belonging to the age group of 20-25 years (66%). All the participants had completed 12 years of schooling years, and most of them were university undergraduates (54%).
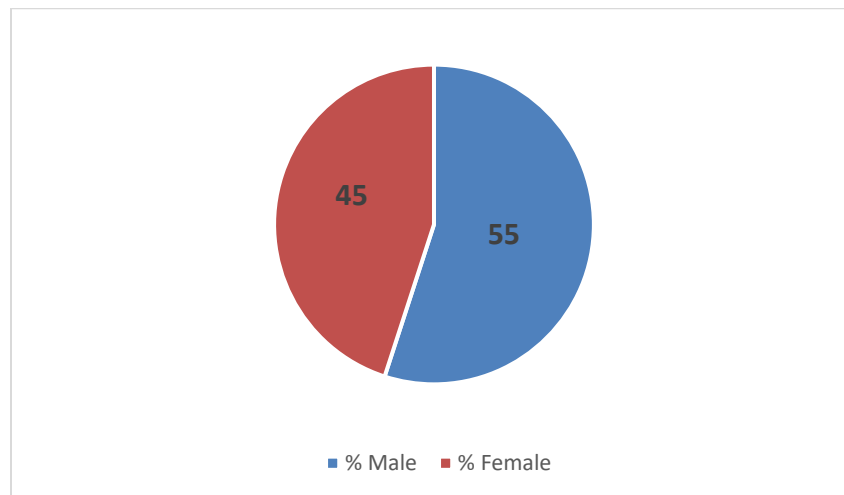
Figure 1. Percentage of male and female participants

Content Validity and Face Validity
The items with i-CVI values less than 0.79 were removed. Thus, 20 items were deleted from the initial questionnaire, and a list of 15 items was finalized. 15 items had an s-CVI value of 0.85 which was within the acceptable range. All participants of the pilot study reported that all 15 items were easy to read and understandable. This denoted that the scale had an acceptable level of face validity. It took around 15-20 minutes to complete the survey.

Item Total Statistics and Reliability
The items of the scale had a good corrected item-total correlation ranging from 0.345 (item 3) to 0.686 (item 9). This indicated that there was good coherence between an item and the other items. The scale also had good internal consistency reliability with Cronbach's alpha value of 0.820 (Table 1), which is much higher than the acceptable value of the reliability coefficient ($\alpha=0.7$).

Table 1. Item total statistics and Reliability of the scale.

Items	Corrected Item-Total Correlation (n=15)	Cronbach's alpha (n=15)
Item 1	.584	
Item 2	.577	
Item 3	.345	
Item 4	.464	
Item 5	.375	
Item 6	.361	
Item 7	.515	
Item 8	.656	.820
Item 9	.686	
Item 10	.495	
Item 11	.563	
Item 12	.589	
Item 13	.391	
Item 14	.678	
Item 15	.551	

Construct Validity

The KMO test showed sample adequacy (0.848), and Bartlett's test confirmed factor analysis was appropriate ($\chi2=959.452$, df=105, and P < 0.0001). The factor analysis revealed three factors that had an eigenvalue of >1. The factors explained 33.12, 10.86, and 7.14 percent of the variance, respectively. The percentage of total variance explained by these factors was 51.12%. (Table 2).

Table 2. Factors with total explained variance.

Factor	Percentage of variance	Total variance (%)
Factor 1	33.12	
Factor 2	10.86	51.12
Factor 3	7.14	

The items were divided into three domains based on the factor loadings, with domain 1 measured by 9 items and domains 2 and 3 each by 3 items. The domains were labeled as *benefits of healthy eating*, *external regulation*, and *affordability* (Table 3).

The domains had an eigenvalue of greater than 1, and the factors loaded into these domains had a minimum factor loading of 0.45.

Table 3. Factor loading matrix of the items.

Items	Factor loading		
	D1	D2	D3
I eat healthy foods because they help to boost my immunity.	.715		
I eat healthy foods to visit doctors less.	.717		
I believe healthy foods would give me essential vitamins.	.636		
I believe eating healthy would give me long-term health benefits.	.632		
I believe healthy food makes my body strong.	.627		
Healthy foods give me liveliness all day long.	.611		
I eat healthy foods because junk foods are harmful to health.	.548		
Healthy foods help to control my body weight	.545		
I eat healthy foods because they are rich in nutrients.	.484		
I eat healthy food to look good in front of others.		.720	
People around me suggest keeping healthy eating habits.		.647	
Healthy eating is expected of me.		.468	
I eat healthy foods because I can afford them.			.757

Even some inexpensive foods are healthy.   .674

I eat healthy foods because they need less spending than

                                                                              .458

unhealthy foods.

Convergent and Divergent Validity
The MHEBS was significantly and positively correlated with SWLS (*r*=.226), which indicated an acceptable convergent validity. On the other hand, the scale was negatively correlated with FCV-19S (*r*=-.052), indicating an acceptable divergent validity (Table 4).

Table 4. Correlation of motivation for healthy eating behavior scale with SWLS* and FCV-19S*

Motivation for Healthy Eating Behavior Scale	*r*
FCV-19S	-0.52
SWLS	.226**

Note: * Satisfaction with Life Scale (SWLS), Fear of COVID-19 Scale (FCV-19S)
**P <0.01, r= Pearson Correlation Co-efficient

Discussion

This study is the first attempt to develop and validate a motivation for healthy eating behavior scale in the Bengali-speaking adult population. The purpose of the study was to develop an instrument for quantitively measuring the motivation for healthy eating behavior and identify the factors behind the motivation. To develop the scale, this study conducted an extensive literature review, generated relevant items, and assessed the psychometric properties of the scale. According to the results, the MHEBS showed good content and face validity. The internal consistency reliability coefficient of the scale was within the acceptable range, and EFA identified a three-factor scale structure. The scale also showed a positive correlation with the SWLS and a negative correlation with FCV-19S.

The scale demonstrated good reliability with a Cronbach's alpha value of 0.820. This value was similar to a study that developed a scale to assess the motivation for healthy eating in the Japanese population, where *α* was reported to be 0.71 (Kato *et al.*, 2013). Later the authors developed a shorter version of the scale and its correlation with biological indicators of metabolic syndromes was assessed (Kato *et al.*, 2023). The scale showed higher levels of internal consistency compared to the results from the eating motivation survey in Brazil which reported reliability over 0.60 for 14 among the 15 motives scale (Sproesser *et al.*, 2019). These findings lend support to the MHEBS as a reliable scale for measuring motivation for healthy eating behavior in the Bengali-speaking adult population. Although DeVon et al. (2007) stated that the optimum value for Cronbach's alpha varies throughout the literature (Devon *et al.*, 2007), Bland and Altman (1997), in their study, considered a value >0.7 as the most commonly accepted one (Bland and Altman, 1997).

The study's sample size was fixed by following the ratio of ten samples per item. There has been a lot of debate about the sample size for conducting EFA. Some authors suggested using absolute numbers such as a minimum of 100, while others suggested using minimum ratios of sample to the number of variables. For example, Cattell (1978) suggested using three to six subjects for each variable (Cattell, 1978), and Gorsuch (1983) (*Gorsuch,* 1983) suggested taking five subjects per variable. In 1992, Comrey and Lee provided a scale for sample size adequacy where they classified 50 as very poor, 100 as poor, 200 as fair, 300 as good, 500 as very good, and 1,000 or more as excellent sample size (Comrey and Lee, 1992). Thus, this study had a fair sample size for performing EFA according to the classification.

EFA is a multivariate statistical method used to identify hypothetical constructs commonly known as factors or domains (Ruscio and Roche, 2012). EFA is conducted when a researcher wants to develop a new scale and intends to identify a new scale structure. As this study aimed to develop a new scale and measure the latent variable "motivation," EFA was considered the appropriate method. The EFA in this study revealed a three-factor scale structure labeled as *benefits of healthy eating*, *external regulation*, and *affordability*. Similarly in the "motivation to eat scale," EFA was used to identify a four-scale structure (Jackson *et al.*, 2003).

The highest number of items loaded into factor 1 or factor named benefits of healthy eating. This means that people's motivation for maintaining healthy eating behavior is driven profoundly by the benefits they get from eating healthily (e.g., getting essential nutrients and vitamins). The results indicate that if people are informed more about the benefits of healthy eating, they would be more likely to be motivated to eat healthy foods. The second domain, called external regulation,

represents the behaviors that are controlled by external factors such as material rewards and external evaluation. Ryan (1985) defined external regulation as behaviors that are influenced by external sources of control, that is, behaviors compelled by punishment and contingencies (Deci and Ryan, 1985). For example, suppose a person eats healthy foods because a health professional or their parents told them to do so. In that case, the individual is likely to do this to obtain rewards (e.g., recognition from a health professional) or to avoid negative consequences (e.g., criticisms from their partner). Likewise, this scale, the Japanese Motivation for Healthy Eating Scale, also identified external regulation as a component under the extrinsic motivation domain (Kato *et al.*, 2013).

The third domain, named affordability, informs that people's motivation for healthy eating depends on their ability to purchase and afford healthy diets. Household income and the cost of nutritious foods are major driving factors for influencing food choices, especially for low-income consumers. In a recent study conducted in Bangladesh, the authors reported that only 43% of the total population can afford healthy diets (Islam *et al.*, 2023). Thus, to motivate people to eat healthy foods, governments, public health authorities, producers, and retailers should come forward to make healthy foods cheaper and available. Moreover, educating people about foods rich in nutrients, but cost low, is also a way to motivate them to eat healthily.

This study had limitations to acknowledge. First, the study was conducted online through self-reporting due to the physical restrictions of the Covid-19 pandemic. Sometimes, self-reporting may cause social desirability bias among the participants. Secondly, the study's cross-sectional nature does not account for data consistency over time. Considering the dynamic nature of people, their motivation levels for healthy eating may fluctuate over time. Future research is recommended to longitudinally measure Bengali-speaking adults' motivation for healthy eating behavior to address this limitation.

Despite the above limitations, MHEBS is the first validated scale to measure the motivation for healthy eating behavior in the Bengali-speaking adult population. Care was taken to ensure that the questionnaire was short in length, and avoided long sentences and leading questions. The strength of the scale is that it has good psychometric properties and can provide a quick assessment of the motivation for healthy eating behavior. Considering the questionnaire's short length, items that were related to topics and approved by the experts were only included in the scale. Future research may expand the questionnaire by adding more in-depth items. A more rigorous analysis with a larger sample size can be carried out in future studies. As the study's objective was to develop a new scale structure, it did not perform confirmatory factor analysis (CFA). Future studies may carry out CFA to evaluate the factor structure in similar populations. In addition, a scale for assessing motivation for healthy eating behavior among Bengali-speaking children and adolescents can be developed considering the rising prevalence of adolescent and childhood obesity.

Understanding the motivations underlying people's eating behavior would help to design health promotional campaigns that will deal effectively with people at the individual level and encourage them to adopt a healthy lifestyle. The scale would allow the program planners to identify what factors motivate the Bengali-speaking adult population to healthy eating

behavior. This may facilitate them to effectively design nutrition education messages/tools before adopting and applying dietary behavior change interventions. In clinical practice, the study findings may help dietitians to know what motivates people to eat healthy foods and counsel patients (e.g., overweight patients) to change their food consumption behavior. From a broader perspective, the study findings may support the concerned authorities/stakeholders while designing policies for sustainable healthy eating, such as adopting strategies for increasing the affordability of healthy foods.

Conclusion

The Motivation for Healthy Eating Behavior scale (MHEBS) is a 15-item 5-point Likert-type scale demonstrating good psychometric properties. It identified the *benefits of healthy eating*, *external regulation*, and *affordability* as factors for motivating adults for their healthy eating behavior. Thus, MHEBS is a reliable and valid instrument to assess the motivation for healthy eating behavior in Bengali-speaking adults.

Conflicts of Interest

The authors have no conflicts of interest.

Consent for publication

All authors give consent to publish the article and its data.

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