



UNIVERSITI PUTRA MALAYSIA

***DEVELOPMENT OF A DIET QUALITY INDEX AND ASSESSMENT OF
ITS
RELIABILITY AND VALIDITY AMONG STUDENTS AT A MALAYSIAN
PUBLIC
UNIVERSITY***

WAQIA BEGUM FOKEENA

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BERILMU BERBAKTI

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UNIVERSITY**

By

WAQIA BEGUM FOKEENA

**Thesis Submitted to the School of Graduate Studies,
Universiti Putra Malaysia, in Fulfilment of the
Requirement for the Degree
of Master of Science**

April 2016

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Abstract of thesis presented to the Senate of Universiti Putra Malaysia in fulfilment
of the requirement for the degree of Master of Science

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WAQIA BEGUM FOKEENA

April 2016

Chair :Rosita binti Jamaluddin, PhD

Faculty :Medicine and Health Sciences

Despite that university students are at risk of having a poor diet quality, there is no reliable and valid instrument to measure the diet quality of Malaysian university students. The objectives of this study were to develop and validate a diet quality index among a sample of university students, to assess their diet quality and to determine its relation to physical activity level and socio-demographic factors.

The Malaysian Dietary Guidelines and Malaysian Food Pyramid were used in the formulation of a 12-item diet quality index. A cross-sectional study was conducted among 320 students at a Malaysian public university. Data collected through face-to-face interview was used to determine the internal consistency reliability, construct validity, concurrent validity and validity with relation to body weight status of the index. Test-retest reliability was measured among 31 students from the sample.

A Cronbach's alpha value of 0.780, mean inter-item correlation of 0.353 and corrected-item total correlation above 0.3 were found after five items were deleted from the index. The intra-class correlation for test-retest reliability was above 0.7. Principal component analysis revealed the presence of four components with eigenvalues exceeding 1. Only one component explaining 41.7% of variance was retained. With consideration to the outcomes of internal consistency and construct validity, the 7-item diet quality index consisting of Wholegrain cereals, Fruits, Vegetables, Fish, Fat-rich foods, Salt-rich foods and Sugar-rich foods was used to address the other study objectives.

The mean total diet quality score of participants was 18.7 ± 3.42 . Diet quality scores showed significant negative correlation with sugar intake, and significant positive correlation with intakes of fibre and nine micronutrients. The correlation coefficients

were less than 0.3 and ranged from 0.128 to 0.242. Diet quality scores did not significantly correlate with body weight status.

Using a cut-off value of 16.5, the proportion of participants at risk of poor diet quality and at lower risk of poor diet quality were 23.1% and 76.9% respectively. Overall, above 80% of participants did not meet the dietary guidelines for wholegrain cereals, fruits, vegetables and fish. Significant differences in dietary guideline adherence were observed for fish, fat-rich foods, salt-rich foods and sugar-rich foods and students at lower risk of poor diet quality showed better adherence.

Among the socio-demographic factors, only gender was significantly associated with diet quality scores ($p=0.006$). Females had higher diet quality scores as compared to males. There was no significant correlation between diet quality scores and physical activity level.

The 7-item diet quality index is a valid and reliable instrument to measure diet quality of students at the selected Malaysian public university. Nevertheless, caution need to be taken when using the index to evaluate diet quality as several important food groups do not form part of it. Students in general require improvement in their diet with respect to wholegrain cereals, fruits, vegetables and fish. Excessive intake of fat, salt and sugar and inadequate intake of fish may place students at risk of poor diet quality. Males require more focus than females as they may be at greater risk of poor diet quality.

Abstrak tesis yang dikemukakan kepada Senat Universiti Putra Malaysia sebagai memenuhi keperluan untuk ijazah Sarjana Sains

PEMBENTUKAN INDEKS KUALITI DIET SERTA PENILAIAN KEBOLEHPERCAYAAN DAN KESAHIHANNYA DI KALANGAN PELAJAR DI UNIVERSITI AWAM MALAYSIA

Oleh

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Walaupun pelajar universiti berisiko mempunyai kualiti pemakanan yang tidak sihat, tidak ada instrumen yang boleh dipercayai dan sah untuk mengukur kualiti pemakanan pelajar universiti di Malaysia. Objektif kajian ini adalah untuk membangunkan dan mengesahkan indek kualiti pemakanan di dalam sampel pelajar universiti, menilai kualiti pemakanan mereka dan menentukan hubungannya dengan tahap aktiviti fizikal dan faktor sosio-demografi.

Panduan Diet Malaysia dan Piramid Makanan Malaysia telah digunakan dalam penggubalan 12 item indek kualiti pemakanan. Satu kajian keratan rentas telah dijalankan di kalangan 320 pelajar di universiti awam Malaysia. Data dikumpul melalui temu bual bersemuka telah digunakan untuk menentukan kebolehpercayaan keseragaman dalaman, kesahihan membina, kesahihan serentak dan kesahihan berhubung status berat badan dengan indek tersebut. Kebolehpercayaan ujian dan ujian semula telah diukur daripada sampel 31 orang pelajar.

Nilai *Cronbach's alpha* ialah 0.780, purata korelasi antara item ialah 0.353 dan jumlah perkaitan item yang diperbetulkan melebihi 0.3 telah dijumpai selepas lima perkara telah dipadam daripada indek tersebut. Perkaitan antara kelas untuk kebolehpercayaan ujian-ujian semula melebihi 0.7 untuk kedua-dua markah komposit item dan individu. Analisis komponen utama mendedahkan kehadiran empat komponen dengan nilai eigen melebihi 1. Hanya satu komponen yang menerangkan 41.7% *variance* telah dikekalkan. Ia terdiri daripada tujuh kumpulan makanan yang sama dipilih selepas penilaian kebolehpercayaan keseragaman dalaman. Oleh itu, dengan mengambil kira hasil keseragaman dalaman dan kesahihan membina, indek kualiti diet dengan 7 item terdiri daripada bijirin penuh, buah-buahan, sayur-sayuran, ikan, makanan kaya dengan lemak, makanan kaya dengan garam dan makanan kaya dengan gula telah digunakan untuk menyasarkan objektif-objektif lain kajian ini.

Jumlah purata markah kualiti pemakanan peserta adalah 18.7 ± 3.42 . Markah kualiti pemakanan menunjukkan korelasi negatif yang signifikan dengan pengambilan gula dan korelasi positif yang signifikan dengan pengambilan serat, dan sembilan mikronutrien. Perkaitan pekali adalah kurang 0.3 dan berjalatkan di antara 0.128 sehingga 0.242. Markah kualiti pemakanan tidak berkait secara signifikan dengan status berat badan.

Dengan menggunakan nilai potongan 16.5, peratusan peserta berisiko dengan kualiti pemakanan yang tidak sihat dan berisiko dengan kualiti pemakanan yang tidak sihat yang rendah, masing-masing adalah 23.1% dan 76.9%. Secara keseluruhan, lebih 80% daripada peserta tidak memenuhi garis panduan pemakanan untuk bijirin penuh, buah-buahan, sayur-sayuran dan ikan. Perbezaan yang signifikan di dalam pematuhan garis panduan pemakanan telah diperhatikan untuk pengambilan ikan, makanan kaya dengan lemak, makanan kaya dengan garam dan makanan kaya dengan gula dan pelajar-pelajar yang berisiko kualiti pemakanan yang tidak sihat yang rendah telah menunjukkan pematuhan yang lebih baik.

Di antara faktor sosio-demografi, hanya jantina berkait dengan signifikan dengan markah kualiti pemakanan ($p=0.006$). Perempuan mempunyai markah-markah kualiti pemakanan yang lebih tinggi berbanding lelaki. Tidak terdapat juga hubungan yang signifikan di antara markah kualiti pemakanan dengan tahap aktiviti fizikal.

Indek kualiti pemakanan dengan 7 item ini adalah instrumen yang sah dan boleh dipercayai untuk mengukur kualiti pemakanan pelajar yang dipilih daripada universiti awam Malaysia. Namun begitu, perlu diberi perhatian apabila menggunakan indeks untuk menilai kualiti diet apabila beberapa kumpulan makanan penting tidak menjadi sebahagian daripadanya. Pelajar secara amnya memerlukan penambahbaikan di dalam diet mereka berkenaan dengan bijirin penuh, buah-buahan, sayur-sayuran dan ikan. Pengambilan lemak, garam dan gula berlebihan dan kurang pengambilan ikan boleh meletakkan pelajar-pelajar berisiko mempunyai kualiti pemakanan yang tidak sihat. Lelaki memerlukan lebih tumpuan berbanding perempuan kerana mereka mungkin mempunyai risiko tinggi untuk mempunyai kualiti pemakanan yang tidak sihat.

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This thesis was submitted to the Senate of Universiti Putra Malaysia and has been accepted as fulfilment of the requirement for the degree of Master of Science. The members of the Supervisory Committee were as follows:

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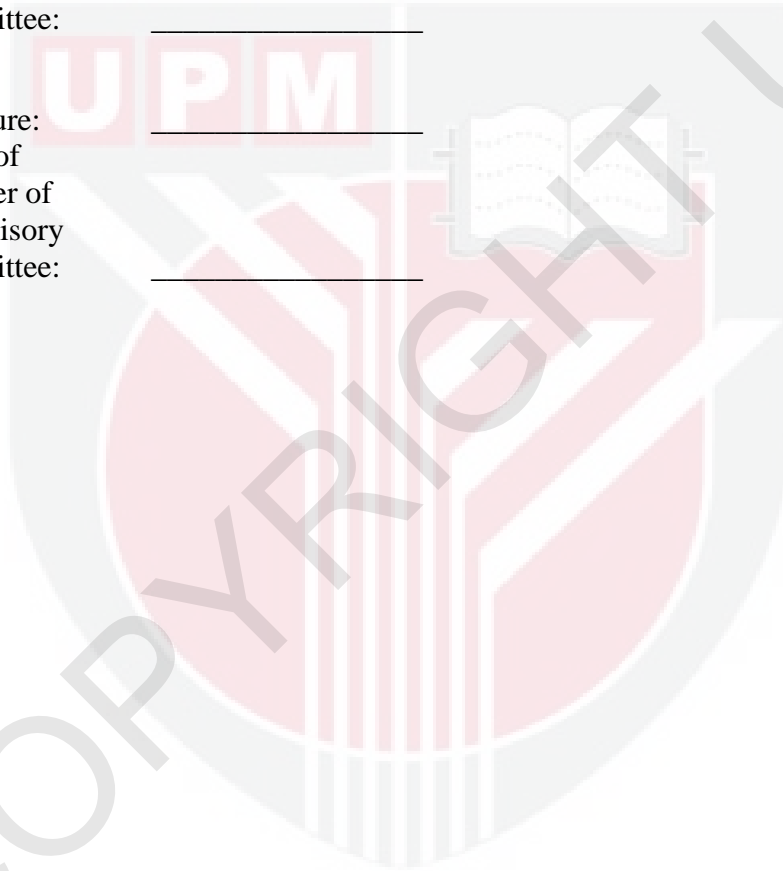


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LIST OF ABBREVIATIONS

AHEI	Alternative Healthy Eating Index
Aust-HEI	Australian Healthy Eating Index
BMI	Body mass index
CDC	Centre for Disease Control and Prevention
DASH	Dietary Approach to Stop Hypertension
DGI	Dietary Guidelines Index
DQ	Diet quality
DQI	Diet Quality Index
DQI-I	Diet Quality Index international
DQI-R	Diet Quality Index Revised
DQS	Diet Quality Score
FBQI	Food-Based Quality Index
FFQ	Food frequency questionnaire
HDI	Healthy Diet Indicator
HEI	Healthy Eating Index
HFI	Healthy Food Index
IPAQ	International Physical Activity Questionnaire
KM	Key message
KMO	Kaiser-Meyer-Olkin
KR	Key recommendation
LDL	Low-density lipoprotein
MANS	Malaysian Adult Nutrition Survey
MAR	Mean adequacy ratio
MDG	Malaysian Dietary Guidelines
MDS	Mediterranean Diet Scale
MET	Metabolic equivalents
MFP	Malaysian Food Pyramid
MOE	Ministry of Education
MOHE	Ministry of Higher Education
MYR	Malaysian Ringgit

NAR	Nutrient adequacy ratio
NCCFN	National Coordinating Committee on Food and Nutrition
NCD	Non-communicable diseases
NHMS	National Health and Morbidity Survey
ODI	Overall Dietary Index
PCA	Principal component analysis
RNI	Recommended Nutrient Intake
ROC	Receiver Operating Characteristic
SD	Standard deviation
SPSS	Statistical Package for Social Sciences
UPM	Universiti Putra Malaysia
USDA	United States Department of Agriculture
WHO	World Health Organisation



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CHAPTER 1

INTRODUCTION

1.1. Background of Study

Since the past years there has been an increasing debate on the most appropriate way to analyse the human diet and relate it to diet-related disease risk. Traditionally, the focus has been on associating the intake of single nutrient or individual food to risk of chronic diseases (Hu, 2002). However, such an approach towards disease promotion and prevention is being overruled in the field of nutrition epidemiology. It is being increasingly recognised that the human diet is a complex amalgam of foods and each food component itself consists of several different nutrient and non-nutrient components that interact with one another (Kant, 1996). In the advent of all these considerations, an alternative strategy that would consider the diet as a whole in predicting diet-disease relationships was in need. The term dietary pattern then came into effect.

Dietary pattern considers the whole diet as a single entity and can be examined using two different approaches namely, score-based approach (*a priori*) and data-driven approach (*a posteriori*) (Moeller et al., 2007). The score-based approach is based on existing dietary guidelines and scientific evidence on the role of nutrients in disease prevention. The second type relies on statistical methods such as factor or cluster analysis to reduce a set of food items into one factor or cluster which is found to be associated to health outcomes (Kant, 1996). Diet quality is assessed using dietary indices and it falls under the score-based approach (Kant, 1996).

Indices are tools which group, measure and quantify several related variables such as human behaviours as one single entity. Each component of the index is given scores and the total score is then used to describe behaviours, attitudes or health conditions. The development and use of indices are common in the field of social as well as health sciences (Kourlaba & Panagiotakos, 2009). Few examples of commonly used indices and scales include the Quality of Life Index which analyses health, psychological, socio-economic and family aspects of life (Ferrans & Powers, 1984), the Depression, Anxiety and Stress Scale (Lovibond & Lovibond, 1995) and Beck Depression Inventory (Beck & Steer, 1987).

As the holistic approach of analysing the diet was gaining more recognition, the field of nutrition epidemiology experienced the development of several dietary indices too. Some common examples of diet quality indices developed previously are the Diet Quality Index (DQI), Healthy Eating Index (HEI), Alternative Healthy Eating Index (AHEI), Recommended Food Score (RFS), Dietary Guidelines Index (DGI), Healthy Diet Indicator (HDI), Dietary Quality Score (DQS) and MedDietScore among others. Several of these indices have been revised over time as changes were brought to the dietary guidelines underlying their development (Kourlaba & Panagiotakos, 2009).

Before any newly developed scale or index is used, it has to be thoroughly verified in order to avoid erroneous interpretation of the outcomes they are measuring (Anthoine, Moret, Regnault, Sbille, & Hardouin, 2014). In other words, the psychometric properties of the index needs to be established. This is of extreme importance as in most cases the parameters being assessed would guide clinical decisions and health policies (Roach, 2006). Psychometric properties include the determination of reliability, validity and responsiveness of instruments. This is an important step to follow not only to avoid incorrect interpretation of outcomes but for an instrument to obtain recognition and for its wide use (Anthoine et al., 2014).

1.2. Problem Statement

The number of students pursuing higher education is rapidly increasing nowadays. According to latest statistics, from 2000 to 2013 there was a record increase of 6.5 million students in American colleges and universities (Roy, Kelly, Rangan, & Allman-Farinelli, 2015). The enrollment in Malaysian public universities has experienced constant rise in the past few years, climbing from 437,420 in 2009 to 467,780 in 2010 (Ministry of Higher Education, 2011) and 560,356 in 2014 (Ministry of Education, 2014).

Besides being an enjoyable period of their life, university students are faced with several problems and challenges such as new environment, accommodation problem, lack of cooking experience and facilities, time constraint, autonomous decisions on food selection, economic insufficiency, high work load, inadequate sleep, stress. These challenges may lead to inadequate nutritional status that may compromise their physical and mental health and lead to an increase risk of acquiring chronic diseases later in life (Doygun & Gulec, 2012).

As expected, studies on the diet quality of university students have unanimously found that their diet quality is either poor or in need of improvement. Studies in Spain, United Kingdom and Puerto Rico have all reported that the majority of university students were not following the recommended dietary guidelines and consequently there was a very high prevalence of poor diet quality among them (Cooke & Papadaki, 2014; García-Meseguer, Burriel, García, & Serrano-Urrea, 2014; Amaral Alves, Hernández Regidor, Basabe Baraño, Rocandio Pablo & Arroyo Izaga, 2012; Moreno-Gómez et al., 2012).

There is very limited valid data on the diet quality of Malaysian university students. Lee, Norimah and Safiah (2011) attempted to develop a Healthy Eating Index for Malaysian adults but the index was not tested for reliability or validity. Previous studies in Malaysian university students have focused mostly on their nutritional status and eating habits. Insufficient intakes of certain nutrients (Abdull Hakim, Muniandy, & Danish, 2012), fruits and milk, and excessive intake of sodium has been reported among them (Gan, Nasir, Zalilah, & Hazizi, 2011).

The passage into higher education is often associated with changes in body weight

status. Observational studies have found that as students enter university from secondary school, they have a tendency to gain weight faster than the general population (Vadeboncoeur, Townsend, & Foster, 2015). There is also evidence on the independent association between diet quality and obesity from cross-sectional (Guo, Warden, Paeratakul, & Bray, 2004) as well as prospective studies (Wolongevicz et al., 2010).

The progression from secondary school to university is also associated with a decrease in physical activity level and an inclination towards sedentary lifestyles (Irwin 2004; Deforche, Van Dyck, Deliens, & De Bourdeaudhuij, 2015). Previous research has found that diet quality is positively associated with physical activity level (Woodruff & Hanning 2010). As a matter of fact, the coexistence of poor diet quality and inadequate physical activity can be an even stronger risk factor for obesity and chronic diseases later in life (Irwin 2004; Ng et al., 2014; Ashton et al., 2015). Besides, knowledge on the socio-demographic factors associated with diet quality is valuable in selecting target groups in need of intervention. Socio-demographic factors such as age, gender, ethnicity, income and education have been found to influence diet quality (Guo et al., 2004; Hiza, Casavale, Guenther, & Davis, 2013).

Despite that the fact that university students are at risk of poor diet quality and the need to assess the diet as a whole is being increasingly recognised, there is limited data on the diet quality of Malaysian university students. No reliable and valid instrument was developed previously. Alongside the diet quality of Malaysian university students, related factors such as body weight status, physical activity level and socio-demography were yet to be clarified.

1.3. Significance of Study

This study was undertaken to develop and validate a diet quality index. The primary outcome of this study was an easy-to-use, quick, reliable and valid instrument that could be used to measure the diet quality of students at a Malaysian public university. This study would be beneficial since it would help to categorise university students into at risk or at lower risk of poor diet quality. Findings generated would be helpful to determine the group of students at risk of poor diet quality based on socio-demographic factors. Results would also clarify whether a poor diet quality could be contributing to the body weight status of participants and whether there was a clustering of diet quality and physical activity level in this population. Data generated could be helpful for corrective measures to be taken so as to improve the diet quality of students at the selected university who are in need and protect them from future health problems. Additionally, this study would provide the basis of a diet quality index whose application may be extended to Malaysian students of other Malaysian universities as well as to Malaysian adults in general after external validation.

1.4. Study Objectives

1.1.1. General Objective

To develop and to validate a diet quality index among a sample of students at a Malaysian public university.

1.1.2. Specific Objectives

The specific objectives of the study are as follows:

- i. To develop a diet quality index and to establish its reliability and validity based on the following:
 - Internal consistency reliability
 - Test-retest reliability
 - Construct validity
 - Concurrent validity
 - Validity through relation to health outcome (body weight status)
- ii. To assess diet quality using the diet quality index among a sample of students at the selected Malaysian public university
- iii. To compare the nutrient intake of students who are at risk of poor diet quality and those who are at lower risk of poor diet quality
- iv. To compare the adherence to dietary guidelines between students who are at risk of poor diet quality and those who are at lower risk of poor diet quality
- v. To analyse the relationships between diet quality scores, socio-demographic factors and physical activity level among a sample of students at the selected Malaysian public university.

1.5. Research Questions and Hypotheses

Question 1: Is the diet quality index a reliable and valid instrument to measure diet quality?

Hypothesis: The diet quality index is a reliable and valid instrument to measure diet quality.

Question 2: What is the proportion of participants at risk of having a poor diet quality?

Hypothesis: The proportion of participants at risk of poor diet quality will be more than the proportion of participants at lower risk of poor diet quality.

Question 3: Is there differences in nutrient intakes between participants who are at risk of poor diet quality and those who are at lower risk?

Hypothesis: There are significant differences in nutrient intake between participants who are at risk of poor diet quality and those who are at lower risk.

Question 4: Is there a difference in dietary guideline adherence between participants who are at risk of poor diet quality and those who are at lower risk?

Hypothesis: There are significant differences in dietary guideline adherence between participants who are at risk of poor diet quality and those who are at lower risk.

Question 5: Is there a significant relationship between diet quality scores and age, gender, ethnicity, academic status, monthly allowance, and physical activity level?

Hypothesis: There is significant relationship between diet quality scores and age, gender, ethnicity, academic status, monthly allowance, and physical activity level.

1.6. Conceptual Framework

This study is about the assessment of diet quality through the use of a diet quality index which had been developed and tested for reliability and validity. **Figure 1.1** shows the conceptual framework of the study. Internal consistency reliability and test-retest reliability were used for reliability testing. Construct validity, concurrent validity and validity through relation to body weight status (body mass index, waist circumference) were employed to determine validity. Once reliability and validity was assessed, the diet quality index was used to determine the diet quality scores. The relationship between the scores and socio-demographic factors (age, gender, ethnicity, academic status, monthly allowance), and the scores and physical activity level was determined. Using the diet quality scores, participants were also classified into two distinct diet quality groups. The nutrient intake and dietary guideline adherence was also compared between the two groups of participants formed.

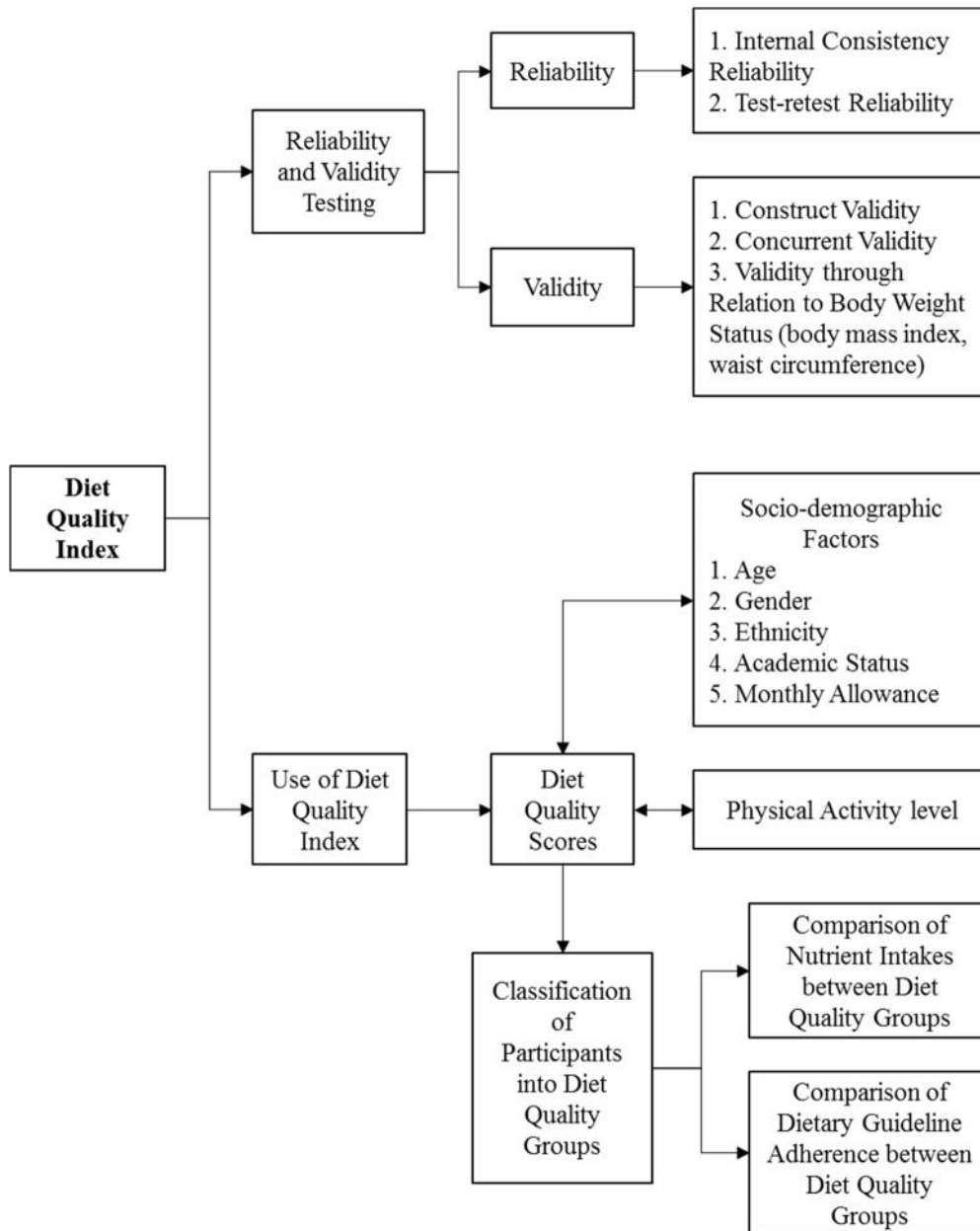


Figure 1.1. Conceptual framework

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