# Development and Validation of the Malaysian Healthy Lifestyle Index

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**ABSTRACT**
The healthy lifestyle index is corresponding to an individual's quality of life. It is believed that a higher healthy lifestyle index may cause a higher quality of life.
**Aim**. To develop and validate the instrument for the Malaysian Healthy Lifestyle Index that could measure Malaysians' health behaviour, which comprises five domains: physical activity, non-smoking behaviour, unhealthy alcohol intake, mental health, and eating behaviou**r.**
**Methods**. Involved in six stages; conceptualization, item generation, assessment of comprehensibility or pre-testing, index calculation, pilot testing, and data analysis. A 136-item questionnaire was developed and evaluated for content validity by an expert panel, and then administered to respondents. Face validity and construct validity were measured in a pretest. Internal consistency and test-retest reliability were evaluated through a validation study. The study utilized an online survey with a sample size of 492 from various regions in Malaysia.

**KEYWORDS:** Alcohol intake, Eating behaviour, Healthy lifestyle index scores, Mental health, Smoking

## 1. INTRODUCTION

The healthcare system bears a significant burden from lifestyle-related diseases. Individuals will probably experience at least one chronic ailment during their lifetime, such as heart disease, diabetes, lung cancer, and stroke (Ng et al., 2019). These conditions are often associated with one's habits related to smoking, alcohol consumption, diet, and physical activity (Nyberg et al., 2020). Studies suggest that a healthy lifestyle index (HLI), or a single score based on lifestyle criteria that people practice, has a significant link with the prevalence or incidence of hypertension (Livingstone & McNaughton, 2017). The HLI captures the effects of a good deal of health-related behaviours that coexist and correspond to an individual's quality of life. Lifestyle factors are believed that a higher healthy lifestyle index may cause a higher quality of life, which is linked to higher scores in Health-Related Quality of Life (HRQOL) (Aljohani & Al-Zalabani, 2021; Livingstone & McNaughton, 2017). Many studies have shown that a lower HLI or score may lead to a higher risk of certain diseases, including chronic diseases. Lifestyle factors including aerobic physical activity, diet, smoking, and alcohol drinking, were correlated with the occurrence and severity of a lower lifestyle index (Duan et al., 2022). Chronic diseases affect an individual's quality of life (Puteh et al., 2019). Leong et al. (2018) stated in a study involving 2,466 participants, found that each 5-point rise in the baseline healthy lifestyle index score (HLIS) was correlated with a 1.7 higher score in the transition from the baseline to follow-up in the physical health-related quality of life (HRQoL) component and a 2.5 higher score in mental HRQoL.

In a study conducted in Portugal, a mere 1.4% adolescents meet the criteria for being classified as leading a healthy lifestyle (Kraus et al., 2007). This study shows that adolescents who practice healthy behaviours, such as daily physical activity, sufficient sleep, regular fruit and vegetable consumption, abstinence from alcohol, and not smoking, had higher levels of HRQoL compared to those who did not. It is also found that higher HRQoL is associated with the number of positive health-related behaviours achieved by an individual, with adolescents who have more than three positive health-related behaviors showing higher HRQoL levels (Puteh et al., 2019). Thus, an individual's quality of life may depend on their lifestyle behaviors (Hautekiet et al., 2022).

Several countries have developed health index tools based on community needs for intervention. Each tool had a different focus, including mental health, non-communicable diseases, and the general population (Aljohani & Al-Zalabani, 2021; Arthur et al., 2018; Development Board, 2019; Krauss et al, 2007; National Population and Family; Hautekiet et al., 2022; Fukunaga et al., 2020). The tools used to assess mental health include the Happiness Index (Musikanski et al., 2017), which comprised 12 domains, and the Bhutan Index of Wellbeing (Biswas-Diener et al., 2015), which comprised 9 domains with 33 indicators. Both tools use similar items to evaluate mental health. Mental well-being is associated with spirituality and religion, both of which are fundamentally rooted in the context of interpersonal connections (Cook, 2020). Krauss et al. (2007) emphasised that religious personality will give spiritual impacts on the believer of each religion, thus influencing one's mental health. Another tool used to assess mental health index was Board National Population and Family Development (National Population and Family Development Board, 2019), which focused on family well-being. A study by Hautekiet et al. (2022) showed that living a healthy lifestyle was positively associated with mental health and well-being. Smoking is associated with a higher prevalence of depression and anxiety, and a correlation exists between mental health, exposure to stress, and alcohol consumption (Eastman et al., 2021; Byeon, 2015) .

Numerous indexes have been developed to predict the susceptibility and severity of non-communicable diseases (NCDs) within communities. This include Healthy Lifestyle Index (HLI) for hypertension (Fukunaga et al., 2020), HLI for cancer (Arthur et al., 2018), HLI or International Diabetes and Hypertension Index (IDHI) for cardio-metabolic diseases (Wang et al., 2020) and the Healthy Eating Index (HEI) for diabetes (Liu et al., 2018). The fundamental domains in these tools were physical activity, dietary intake, alcohol consumption, and tobacco use. Only those tools that intend to measure the health index with cardiovascular diseases included stress management and sleep pattern domains (Wang et al., 2020) . Several tools, such as the Singapore HLI (Lenz et al., 2013). 28-item Mediterranean Lifestyle Index (MEDLIFE-derived) (Aljohani & Al-Zalabani, 2021) and AIA Healthy Living Index (2018), have been designed to measure healthy lifestyle indexes in the general population. These tools were developed based on the distinct health concerns of each population, which eventually increases the relevance of the data obtained for the health intervention program.

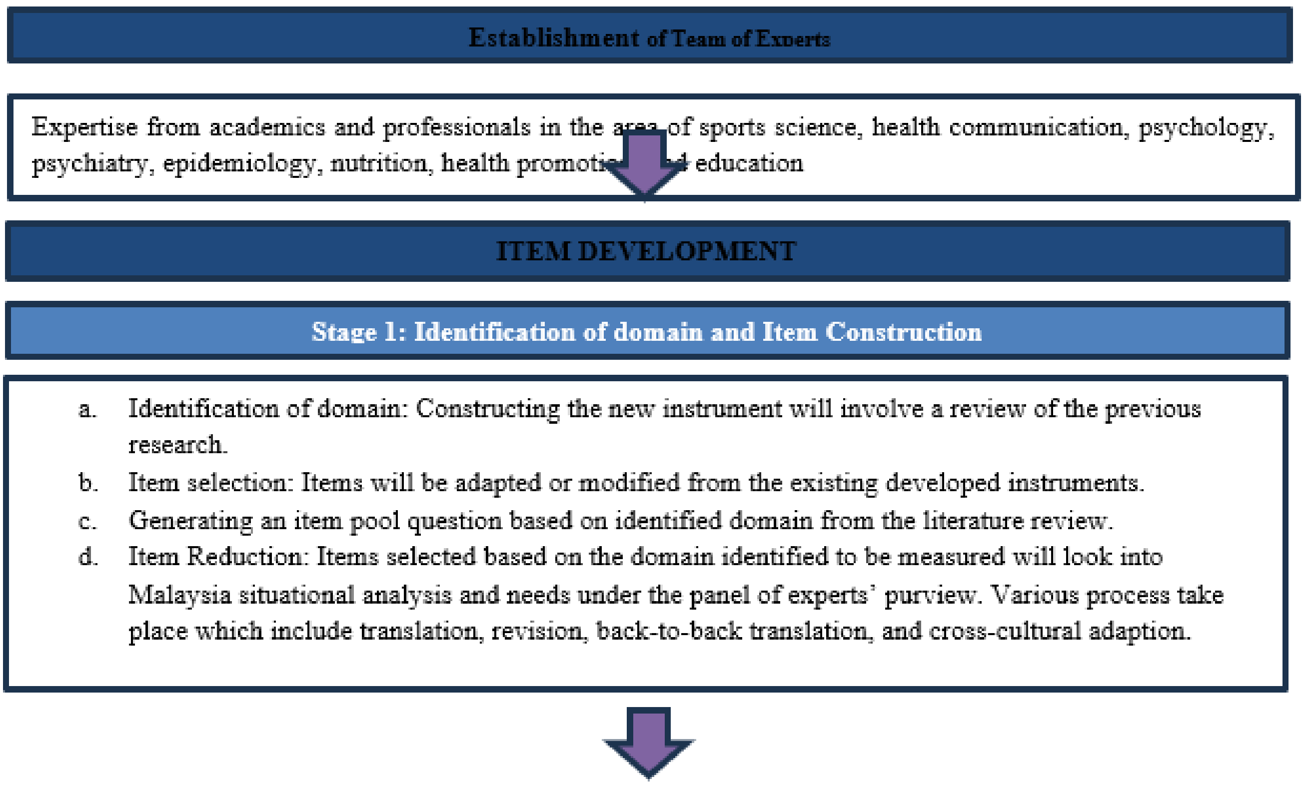
This study aims to develop and validate an instrument for the Malaysian Healthy Lifestyle Index. The instrument measure Malaysians' health behaviour, comprising five domains: physical activity, smoking behaviour, alcohol intake, mental health, and eating behaviour. Policymakers can use this tool to develop strategies that align with community needs, allowing for disease management, primary, and secondary prevention by having specific data on lifestyle behavior and patterns, ultimately leading to a reduction in the incidence of NCDs.

## 2. METHODS

### 2.1 Focus Group of Experts

To create the Malaysian Healthy Lifestyle Index, a technical working group of 23 subject matter experts, including stakeholders from the Ministry of Health Malaysia, academicians, and government agencies officers, was appointed to develop a comprehensive and user-friendly assessment tool to measure the healthy lifestyle behaviour of Malaysians. The experts from universities and ministries were chosen based on their specialization within the research domains, including health education, mental health, healthy eating, physical activity, spiritual well-being, and related areas. Their selection was grounded in their expertise and experience within these specific fields. Various discussions were conducted to formulate a framework for evaluating the healthy lifestyle behavior of Malaysians and assigning an associated index. The index consists of six dimensions: (1) health literacy, (2) Physical Activity, (3) Eating Behaviour, (4) Smoking, (5) Alcohol Intake, and (6) Mental Health. A team of experts then determined the items to be measured for each dimension to develop the Malaysian Healthy Lifestyle Index.

**Figure 1. Steps of instrument development**



**Stage 2: Assessment of Comprehensibility**

a. Content Validity: Content validity refers to the adequacy of the items in measuring the domain in terms of content relevance and representation with 4-point scale choices to rate the comprehensibility of each item, with 1=not relevant, 2=somewhat relevant, 3=quite relevant, and 4=highly relevant [27], [28], [45]
b. Face Validity: Face validity is an assessment of the instrument by non-experts in terms of feasibility, readability, consistency of style and formatting and the clarity of language used [46]

**Stage 3: Pre-Testing Questions**

a. To ensure that respondents understand and can answer the developed questions, it is important to assess the comprehensiveness of the questions before administering the pilot test. Any confusing and problematic questions were identified and improved for clarity.

**IMPLEMENTATION**

The instrument will be launched to 9200 respondents to measure their healthy lifestyle behaviour.

**Stage 1: Item Development**

The measurement instrument developed for this research was based on existing measurements and scales from various journal articles and relevant publications as in the Table 1 indexed in databases such as Scopus, Emerald, Google Scholar, and ScienceDirect. The chosen items were selected based on the identified domains, Malaysia's situational analysis and were under the panel of experts' purview. Once the relevant measurement was determined, it was carefully evaluated based on operational definitions of variables and relevant components that comprised the measurement.

**Table 1 : Measurements instrument developed**

| Domain being studied | Index | Items |
|---|---|---|
| Mental Health Index | Happiness Index [14] | There are 12 domains which consist of:<br>1. Cantril Ladder<br>2. Satisfaction with Life<br>3. Psychological Well-Being<br>4. Health<br>5. Time balance |

| Domain being studied | Index | Items |
|---|---|---|
| | | 6. Lifelong Learning, Arts, and Culture<br>7. Community<br>8. Social support<br>9. Environment<br>10. Governance<br>11. Standard of Living/Economy<br>12. Work |
| | Religiosity Personality Inventory (MRPI) Religious Personality [9] | In total, there are 99 items in the adapted questionnaire, in which 35 items were revised, three were removed, and one was added. The domains being studied were:<br>1. Pro-social behaviour<br>2. Ritual behaviour<br>3. Anti-social behaviour<br><br>Score: 5 Likert scale points; 1 never to 5 always |
| | Bhutan Index of Wellbeing [15] | The index has nine domains and 33 indicators.<br>1. Psychological well-being<br>2. Health<br>3. Time use<br>4. Education<br>5. Cultural diversity and resilience<br>6. Good Governance<br>7. Community vitality<br>8. Ecological diversity and resilience<br>9. Living standard |
| | Malaysian Family Wellbeing Index [10] | 1. Family And Religion/Spirituality<br>2. Family And Community<br>3. Family Relationships<br>4. Family Safety<br>5. Family Health<br>6. Housing And Environment<br>7. Family Economics<br><br>The score for Malaysian Family Wellbeing Index among the parents was 7.55. Based on seven domains, Family and Religion/Spirituality domain has the highest score, which was 8.25, followed by Family and Community domain (7.83), Family relationship |

| Domain being studied | Index | Items |
|---|---|---|
| | | domain (7.82), Family relationship domain (7.39), Family Health domain (7.38), Housing and Environment domain (7.28) dan Family Economics domain (6.90).<br>The three main difficulties faced by families in Malaysia were financial, communication and physical health problems, with 67.9%, 44.6% and 44.3%, respectively.<br>Among the children, the score of Malaysian Family Wellbeing Index was 7.70. Based on specific domains, the highest score was Family and Religion/Spirituality domain with score 8.18, and followed by Family relationship domain (7.90), Family Safety domain (7.66), Family Economy domain (7.65), Family and Community domain |

| Domain being studied | Index | Items |
|---|---|---|
| | | (7.65), Family Health domain (7.61) and Housing And Environment domain (7.29). |
| Index built to predict susceptibility or severity of non-communicable diseases | HLI and lower hypertension prevalence among the participants [12] | Comprised of 5 lifestyle factors:<br>1. Physical activity: low risk group engaged in ≥150 minutes/week of moderate intensity physical activity or ≥ 75 minutes/week of vigorous-intense physical activity.<br>2. Smoking status: low risk group: non-smokers.<br>3. Alcohol consumption: Low risk group: ≤ 2 drinks/day for men and ≤ 1 drink/day for women.<br>4. Fruit and vegetable consumptions: Low risk group: ≤ 2 servings/day of fruit and ≤ 3 servings/day of vegetables.<br>The index was categorized into three groups: 0–2 (low), 3 (middle), and 4–5 (high). |

| | | |
|---|---|---|
| | Sub-cohort study on the association of HLI with the risk of women's NCD such as breast, endometrial, and ovarian cancers [13] | Healthy lifestyle index (HLI)<br>1. Diet<br>2. Smoking<br>3. Alcohol consumption<br>4. Physical activity<br>5. BMI<br>Range of final score: 0 (poorest behaviour) to 20 (healthiest behaviour), which was characterised by consuming a healthy diet (5th quintile), avoiding smoking, low alcohol intake (< 6.0 g/day), high physical activity level (5th quintile), and a normal BMI (18.5–24.9 kg/m2). |
| | International Diet-Health Index (IDHI)- to determine and compare the health consequences of dietary quality between populations. The effects of dietary factors on cardiometabolic diseases and country-specific cardiometabolic disease profiles [19] | The impact of 11 foods or nutrients on 12 cardiometabolic diseases, the mediation of health effects of specific dietary intakes through blood pressure and body mass index and background disease. |
| | Healthy Eating Index- to assess the diet quality of participants with type 2 diabetes [20] | 10 dietary factors were included in the score, including vegetables, fruits, whole grains, nuts, polyunsaturated fatty acids, long-chain omega-3 fatty acids, red and processed meats, trans fat, sugar-sweetened beverages, and sodium. Each component was scored from 0 to 10 based on consumption level. 10: most adherence and 0: least adherence. Higher scores in lifestyle factors indicated that the respondents have healthier lifestyles. |
| | HLI for the cardiovascular risk reduction program. To develop a method to quantify multiple | Composite Lifestyle Index - consisted of 6 lifestyle components.<br>1. Physical activity<br>2. Fruit and vegetable consumption<br>3. Adequate sleep |

| | | |
|---|---|---|
| | lifestyle behaviours into a single index value [22] | 4. Stress management<br>5. Alcohol consumption<br>6. Tobacco use |
| | A web-based healthy lifestyle index related to cardiovascular health and metabolic syndrome indices [23] | Web-based Healthy Lifestyle Index – 4 domains combined into a single index.<br>1. Active life<br>2. Healthy diet<br>3. Low stress<br>4. Not smoking<br>Three HLI groups: poor (red), moderate (yellow), and good (green). |
| HLI for general public | Singapore HLI intended for Singapore's population [24] | Consisted of 10 health domains. It aims to improve health behaviours, decrease the risk of disease, increase life quality, lower healthcare use, and higher productivity among all Singaporeans. The participants can obtain the questionnaire online or by printed paper. |
| | 28-item Mediterranean Lifestyle index (MEDLIFE-derived) [25] | Consisted of three blocks:<br>i. Mediterranean food consumption (15 items).<br>ii. Mediterranean dietary habits (7 items).<br>iii. Physical activity, rest, social habits, and conviviality (6 items).<br><br>Score for each item: 0 for not meeting the cut-off established for the item and 1 for meeting it.<br>A higher score of MEDLINE reflects a greater adherence to a Mediterranean lifestyle. |
| | The AIA Healthy Living Index 2018 [21] | To highlight prevailing health trends and indicates areas in which individuals and communities can move towards sustaining healthier lifestyles. It consisted of satisfaction with health and how frequently the individuals performed healthy behaviours, including exercising regularly, consuming healthy food, sleeping properly and getting frequent medical check-ups.<br><br>A higher score signifies increased satisfaction and greater consistency in adopting healthy behaviours. |

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**Stage 2: Validation of the Instrument**

**Content Validation**

Content validity refers to how well an instrument measures the intended subject matter. The Subject-Matter Expert (SME) role involved assisting the team in selecting appropriate items as potential instruments and evaluating the initial version of the instrument for the domain being studied. The proposed SME panel for this project included public health specialists, family medicine specialist, psychiatrist, biostatisticians, academician in the field of research methodology, psychologists, sports science expert and communication experts. They were formally invited from their respective divisions at MOH and State Health Department, universities, and relevant agencies as SMEs for this project.

The subject matter experts (SMEs) were involved in the monthly discussion and workshop, particularly during Stage 1, which was item generation. Apart from giving their consultation via email or telephone to their respective domain, the experts were required to evaluate the adequacy and clarity of each item using the Likert scale points to obtain a content validity index score. The purpose of content validity analysis was to determine whether the language, content, and structure of the instrument were adequate to measure the healthy lifestyle index among respondents from the selected target population (Cazorla-Calderón et al., 2022). Their feedback resulted in some refinement of the instrument, including adding, deleting, and rephrasing some questions.

The process of content validity involved when the instrument accurately measures the construct of interest through relevance and representativeness. It was recommended to have a minimum of three experts rate the items on a 4-point scale, with 1=not relevant, 2=somewhat relevant, 3=quite relevant and 4=highly relevant (Polit & Beck, 2006; Yusoff, 2019). According to Pilot & Beck (2006), the Content Validity Index (CVI) has been used to analyse content validity, which consists of I-CVI and S-CVI as shown in Table 2.

**Table 2 : Content validity index and the objectives**

| **Type of Content Validity Index (CVI)** | **Objective** |
|---|---|
| Item Level Content Validity Index (I-CVI) | • To define the content of individual items<br>• The proportion of 0.78 or above indicates acceptable content validity |
| Scale Level Content Validity Index (S-CVI) | • To determine the content validity of overall scale<br>• Average item scores between 0.8 to 0.9 or greater |

**Face validity**

Face validity is an assessment of the instruments, so it looks valid to the examinees who take them (Hardesty & Bearden, 2004). As suggested by scholars, the minimum sample size requirement for the pretest should be at least 30 respondents (Perneger et al., 2015). Previous dengue pre-test studies required 12-50 respondents (Sheatsley, 1983; Sudman, 1983). For this study, face validity was assessed by a purposive sample of 15 respondents from the target population. They completed 6 sets of instruments and commented on the cognitive comprehension (language, difficulty level, clarity, relevance of the questions), and ease of using the instrument. The face validity was assessed by participants from the pretest. This included 15 respondents from various races (Malay, Chinese, Indian, and others) and a combination of 5 respondents per age category; Category 1: 18 - 25 years, Category 2: 26 - 40 years and Category 3: 41 - 60 years.

**Reliability Test**

To assess the reliability of the index component, the researcher used Cronbach's coefficient alpha to evaluate internal consistency and temporal stability, which measures how well different index components capture the same underlying, unidimensional, latent construct (Bellmore et al., 2011). Cronbach’s alpha can be less than 0.7 in short scales (below ten items) (Hinton et al., 2004). However, Field (2009) stated that Cronbach's alpha is one of the most common tests that examines internal consistency.

**Stage 3: Pilot Test**

A total of 492 questionnaires were administered to individuals from various regions in Malaysia. The sample included 44.3% male and 55.7% female participants, with an age range of 20 to 67 years (M = 37.09, SD = 9.79). Of the sample, 65.7% were Malays, 20.3% were Bumiputera Sabah, 4.3% were Bumiputera Sarawak, 4.5% were Indians, 2.6% were Chinese, and 2.6% were others. A total of 202 respondents held either a certificate or diploma, 152 respondents have completed education at degree and above level, 135 respondents had secondary education, while only 2 respondents had primary education, and 1 respondent had no formal education.

## 3. RESULTS

### 3.1 Content Validity

Following experts' evaluation of content validity, further modifications were made to the questionnaire. Calculation of the content validity index revealed an average of 89% for all items. The modifications mainly involved rephrasing the questions and word choices. The Content Evaluation Form by the Experts Panel used in this study was adapted from past research (Vakili & Jahangiri, 2018). and evaluated items as Essential, Useful but not Essential, and Not Essential. To make it simpler for the respondents to grasp, most of the items in the mental health category were paraphrased. The word choices for the elements in the physical activity domain also underwent several revisions to fit the domain's goal. To help the respondents understand the questions better, the majority of those on fostering an active lifestyle culture were rephrased and given better examples. Regarding the healthy eating behaviour domain, the example images were altered to make them either clearer or more noticeable. Items on the supportive environment were rephrased for the healthy without smoking behaviour and healthy without drinking domains to make them clearer and easier to grasp. A total of 136 items were identified by experts to be used in MHLI. The content validity was validated by the theoretical analysis, stakeholders' involvement, and expert classification in the questionnaire development phase. The Content Evaluation Form was used to measure content validity, and the results revealed an average of 89% for all items, indicating satisfactory content validity.

### 3.2 Face Validity

A total of 15 respondents were involved in assessing the MHLI. Overall, the respondents agreed that the MHLI covered relevant aspects of a healthy lifestyle. The language used was clear and the number of response categories was satisfactory. However, a few respondents mentioned that the questions on mental health covering religious aspects a bit confusing as they could not connect mental health with religious belief to be more specific. In summary, the face validity was judged satisfactory by the informants, although the questions on mental health caused some uncertainty. Most respondents in Category 1 found certain terms in the mental health domain difficult to understand due to their perceptions regarding mental health concepts, as some found that religious belief is not part of mental health.

Face validity was used to assess participants' understanding of the questionnaire items and their comments, although it did not cause any major change to the questionnaire. However, it helped improved the wording of questions that caused ambiguity, as seen in other studies (Feren et al. 1998). The Pearson correlation coefficient was employed to assess the inter-correlation between the domains of the items. Significance was determined based on values of ($p < 0.01$), and only these significant values were utilized to evaluate the association between the variables (Zhu, 2016).

### 3.3 Reliability Test

To assess reliability, a total of 492 questionnaires were administered. The reliability for overall items that

include ranging between 0.983. A value of 0.70 and higher is considered the criterion for internally consistent established factors (Hair et al., 1998). Since Cronbach's value for each factor is above 0.50; both factors are accepted as being reliable for the research.
Table **3** shows the items selected under the variables and sub-dimension assigned with the calculated values for each items:

**Table 3 : Cronbach's alpha for each factor**

| Dimensions | Sub-dimension | Number of Items (n) | Cronbach's alpha (Pre-test) |
|---|---|---|---|
| Health literacy related to healthy lifestyle | Seeking health information<br>Understanding the information<br>Evaluate the information<br>Judging the information<br>Making decision<br>Act upon the decision | 18 items | 0.98 |
| Physical activity | Willingness to spend money for physical activity<br>Will to get active<br>Usage of medium for physical activity<br>Volunteerism | 6 items | 0.53 |
| Healthy eating | Portion of foods intake<br>Taking of fried foods<br>Taking of sweet foods and beverages<br>Drinking of plain water<br>Taking of process food | 17 items* Exlcude items no. 16 | 0.83 |
| Healthy without smoking | Supportive environment<br>Healthy living culture without smoking | 4 items* Exlude items no. 20 | 0.70 |
| Mental health | Psychological health<br>High risk behavior<br>Social well-being<br>Supportive environment<br>Healthy living culture with good mental health<br>Spiritual well-being | 15 items<br>4 items<br>9 items<br>3 items<br>7 items<br>7 items | 0.89<br>0.92<br>0.76<br>0.70<br>0.79<br>0.91 |

The calculation of the inter-domain correlation coefficient takes place after the computation of Cronbach's Alpha. All the inter-dimensions within the health literacy related to a healthy lifestyle exhibit a positive association ($p < 0.01$) between the dimensions, as depicted in
**Table 4**. Similarly,

**Table 5** reveals that all the inter-dimensions demonstrate a positive association between the variables. In the realm of healthy eating dimensions, all intercorrelations are significant ($p < 0.01$). Notably, the consumption of processed foods and healthy eating displays a weak negative correlation, as outlined in
**Table 6**. The portion of food intake and healthy eating, on the other hand, manifests a robust positive correlation between the dimensions.
In the context of health without smoking, as indicated in

**Table** *7*, all sub-dimensions display a positive association between variables.

**Table** ***8*** illustrates the dimensions of mental health within their respective sub-dimensions, leading to the conclusion that psychological health exhibits the highest positive correlation, followed by social well-being and spiritual well-being.

**Table 4 :Inter-domains correlation coefficient among dimensions Health Literacy Related to Healthy Lifestyle**

| Dimensions | Health Literacy Related to Healthy Lifestyle | Sub-dimension | | | | | |
|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 | 6 |
| 1. Health Literacy Related to Healthy Lifestyle | 1.000 | 0.733** | 0.706** | 0.948** | 0.856** | 0.670** | 0.606** |
| 2. Understand the information | 0.706** | 0.629** | 1.000 | 0.642** | 0.429** | 0.346** | 0.328** |
| | | | | | | | |
| 3. Evaluate the information | 0.948** | 0.653** | 0.642** | 1.000 | 0.777** | 0.516** | 0.455** |
| 4. Judging the information | 0.856** | 0.477** | 0.429** | 0.777** | 1.000 | 0.568** | 0.501** |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 5. Making Decision | 0.670** | 0.338** | 0.346** | 0.516** | 0.568** | 1.000 | 0.595** |
| 6. Act Upon Decision | 0.606** | 0.358** | 0.328** | 0.455** | 0.501** | 0.595** | 1.000 |

**p < 0.01

**Table 5. : Inter-domain correlation coefficient among dimensions Physical Activity**

| Dimensions | Physical Activity | Sub-dimension | | | |
|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 |
| 1. Physical Activity | 1.000 | 0.625** | 0.858** | 0.744** | 0.664** |
| 2. Willingness to Spend Money for Physical Activity | 0.625** | 1.000 | 0.298** | 0.465** | 0.337** |
| 3. Will to Get Active | 0.858** | 0.298** | 1.000 | 0.442** | 0.392** |
| 4. Usage of Medium for Physical Activity | 0.744** | 0.465** | 0.442** | 1.000 | 0.474** |
| 5. Volunteerism | 0.664** | 0.337** | 0.392** | 0.474** | 1.000 |

**p < 0.01

**Table 6: Inter-correlation coefficient among dimensions Healthy Eating**

| Dimensions | Healthy Eating | Sub-dimensions | | | | |
|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 |
| Healthy Eating | 1.000 | 0.754** | 0.201** | 0.353** | 0.513** | 0.135** |
| 1. Portion of Foods Intake | 0.754** | 1.000 | -0.170** | -0.158** | 0.178** | -0.297** |
| 2. Taking of Fried Foods | 0.201** | -0.170** | 1.000 | 0.406** | -0.093* | 0.371** |
| 3. Taking of Sweet Foods and Beverages | 0.353** | --0.158** | 0.406** | 1.000 | 0.008 | 0.498** |
| 4. Drinking of Plain Water | 0.513** | 0.178** | -0.093* | 0.008 | 1.000 | -0.019 |
| 5. Taking of Process Food | 0.135** | -0.297** | 0.371** | 0.498** | -0.019 | 1.000 |

| | | | | | | |
|---|---|---|---|---|---|---|
| 6. Supportive Environment | 0.517 | 0.232** | 0.114* | 0.101* | 0.213** | 0.060 |

**Table 7. : Inter-correlation coefficient among dimensions Healthy without Smoking**

| Dimensions | Healthy without Smoking | Sub-dimensions | |
|---|---|---|---|
| | | 1 | 2 |
| Healthy without Smoking | 1.000 | 0.896** | 0.792** |
| Supportive environment | 0.896** | 1.000 | 0.572** |
| Healthy living culture without smoking | 0.792** | 0.572** | 1.000 |

**p < 0.01
*p < 0.05

**Table 8. : Inter-correlation coefficient among dimensions Mental Health**

| Dimension | Mental Health | Sub-dimension | | | | | |
|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 | 6 |
| Mental Health | 1.000 | 0.741** | 0.326** | 0.502** | -0.102* | 0.567** | 0.422** |
| 1. Psychological Health | 0.741** | 1.000 | 0.444** | 0.051 | -0.156** | 0.169** | -0.033 |
| 2. High Risk Behaviour | 0.326** | 0.444** | 1.000 | -0.150** | -0.029 | -0.020 | -0.191** |
| 3. Social well-being | 0.502** | 0.051 | -0.150** | 1.000 | -0.126** | 0.333** | 0.298** |
| 4. Supportive Environment | -0.102* | -0.156* | -0.029 | -0.126** | 1.000 | -0.234** | -0.078 |
| 5. Healthy Living Culture with Good Mental Health | 0.567** | 0.169** | -0.020 | 0.333** | -0.234** | 1.000 | 0.133** |
| 6. Spiritual-Wellbeing | 0.422* | -0.033 | -0.191** | 0.298** | -0.078 | 0.133** | 1.00 |

**p < 0.01

The Pearson correlation coefficient was employed to assess the inter-correlation between the domains of the items. Significance was determined based on values of ($p < 0.01$), and only these significant values were utilized to evaluate the association between the variables (Zhu, 2016).

## 4 DISCUSSION

The purpose of this study was to develop and validate a Healthy Lifestyle Index instrument for the Malaysian population. The instrument was developed under the four domains of health behavior, which are physical activity, healthy eating, healthy living without smoking and mental health. The items were chosen for their relevance to a healthy lifestyle and their impact on health.

Constructing a single score based on lifestyle factors known to co-exist may capture the combined effects of multiple health-related lifestyles (Feren et al. 1998; Zhu, 2016). The lifestyle factors used to construct these healthy lifestyle Indices (HLIs) vary across studies, and previous studies have revealed a significant association between HLI and the prevalence (Livingstone & McNaughton,2017; Na et al, 2021) or the incidence of non-communicable diseases.

BMI, physical activity, smoking status, and alcohol consumption are commonly used to construct the HLI (Livingstone & McNaughton, 2017; Villegas et al., 2008). Whereas other factors are used only occasionally, including sedentary time, sleep duration, waist-hip ratio (Villegas et al., 2008), psychological distress (Nguyen et al., 2018), cardiorespiratory fitness (Victo et al., 2017) and the use of medication (non-narcotic analgesics and supplemental folic acid) (Nguyen et al., 2018). Several studies have incorporated dietary components to construct the HLI, but with different measures, e.g., fruit and vegetable consumption (Nguyen et al., 2018), and adherence to the Dietary Approaches to Stop Hypertension (DASH) diet (Francisco et al., 2020). Previous studies considered the combined effect of multiple lifestyles factors, (Nguyen et al., 2018), but this present study, but this present study includes all necessary factors in a composite index.

The results of this research revealed that the majority of the respondents (55%) had a very low score on the healthy lifestyle index, 24.0% obtained a low score, only 5% had high scores, and 16% had moderate scores. The findings of the Malaysian HLI index are similar to results of surveys from other countries on healthy lifestyle behaviour, such as one conducted in China between 2015 and 2019, which revealed that only 2.8% of the 0.9 million participants adhere to all four of the components of the domain being studied, including alcohol consumption, physical activity, a healthy diet, and smoking behaviour (Zhang et al., 2021). According to a different study by Matthew J. Reeves and Ann P. Rafferty (2005), the prevalence of healthy lifestyle indicators such as not smoking, maintaining a healthy weight, eating five servings of fruits and vegetables daily, and engaging in regular physical activity was only 3.0% among adults in the United States in 2000.

There is evidence from numerous studies that the healthy lifestyle index and health conditions like hypertension are related. In Sri Lanka, individuals with low HLI scores are significantly associated with lower rates of hypertension among community adults (Fukunaga A, 2020). A study performed in the UK among women with normal BMI found a link between the HLI score and breast cancer (Peila et al., 2022).

## 5 CONCLUSION

In conclusion, the validity and reliability of the Malaysian Healthy Lifestyle Index were tested on the Malaysian population. The results show that this instrument is a credible and reliable tool to evaluate Malaysians' healthy lifestyle behaviour. It will also be used as baseline data for evaluating the effectiveness of future healthy lifestyle campaigns.

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