Association of mobile health applications usage with eating behaviour and physical activity among young adults in Malaysia

Associação do uso de aplicativos móveis de saúde com o comportamento alimentar e a atividade física entre jovens adultos na Malásia

Asociación entre el uso de aplicaciones móviles de salud y el comportamiento alimentario y la actividad física entre los adultos jóvenes de Malasia

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ABSTRACT
Mobile health applications (mHealth Apps) are useful technology for personal health management. However, evidence in health improvement is lacking in mHealth Apps usage with eating behaviour and physical activity (PA) in Malaysia. This study aims to investigate the association between mHealth Apps usage with eating behaviour and PA among young adults with different Body Mass Indices (BMI) in Malaysia. A cross-sectional study was conducted. 280 samples were recruited using convenience sampling. An online questionnaire comprised of sociodemographic characteristics, anthropometry measurements, mindful eating behaviour questionnaire, International Physical Activity Questionnaire (IPAQ), and acceptance of mHealth Apps use were distributed. Among the 280 respondents (78.2% female, 18–28-year-old, BMI=21.5±3.79kg/m²), 22.1% were mHealth Apps users. Underweight respondents had the highest mindful eating behaviour score (2.84±0.25), while lowest in obesity Class II (2.57±0.06). Majority of the respondents (68.6%) were not practicing sedentary lifestyle (sitting<8hours). Underweight and obesity Class I respondents were inactive, whereas normal weight and overweight were moderately active. Besides, there is a significant mean difference between mHealth Apps usage with eating behaviour (p=0.048), but not PA level (p=0.134) and sedentary behaviour (p=0.759). The six motivating factors that significantly (p<0.05) influence the acceptance of mHealth Apps usage were: perceived usefulness, perceived ease of use, social influence, facilitating conditions, self-efficacy, and behavioural intention to adopt. The mHealth Apps usage is associated with eating
behaviour but not physical activity. Our findings suggested potential for related stakeholders to promote mHealth Apps targeting in young adults to improve health outcome.

**Keywords:** mobile health applications, eating behaviour, physical activity, young adults, acceptance of mHealth Apps.

**RESUMO**
Os aplicativos móveis de saúde (mHealth Apps) são uma tecnologia útil para o gerenciamento da saúde pessoal. No entanto, faltam evidências sobre a melhoria da saúde no uso de aplicativos de saúde móvel com o comportamento alimentar e a atividade física (AF) na Malásia. Este estudo tem como objetivo investigar a associação entre o uso de aplicativos de saúde móvel com o comportamento alimentar e a atividade física entre jovens adultos com diferentes índices de massa corporal (IMC) na Malásia. Foi realizado um estudo transversal. Foram recrutadas 280 amostras por meio de amostragem de conveniência. Foi distribuído um questionário on-line composto por características sociodemográficas, medidas antropométricas, questionário de comportamento alimentar consciente, Questionário Internacional de Atividade Física (IPAQ) e aceitação do uso de aplicativos de saúde móvel. Entre os 280 entrevistados (78,2% do sexo feminino, 18-28 anos, IMC=21,5±3,79kg/m2), 22,1% eram usuários de aplicativos de saúde móvel. Os entrevistados abaixo do peso tiveram o maior escore de comportamento alimentar consciente (2,84±0,25), enquanto o menor foi registrado na obesidade Classe II (2,57±0,06). A maioria dos entrevistados (68,6%) não praticava estilo de vida sedentário (ficar sentado por menos de 8 horas). Os entrevistados com baixo peso e obesidade Classe I eram inativos, enquanto os com peso normal e sobrepeso eram moderadamente ativos. Além disso, há uma diferença média significativa entre o uso de aplicativos mHealth e o comportamento alimentar (p=0,048), mas não o nível de AF (p=0,134) e o comportamento sedentário (p=0,759). Os seis fatores motivadores que influenciam significativamente (p<0,05) a aceitação do uso de aplicativos de saúde móvel foram: utilidade percebida, facilidade de uso percebida, influência social, condições facilitadoras, autoeficácia e intenção comportamental de adotar. O uso dos aplicativos de saúde móvel está associado ao comportamento alimentar, mas não à atividade física. Nossos resultados sugerem que as partes interessadas relacionadas têm potencial para promover o direcionamento de aplicativos de saúde móvel em jovens adultos para melhorar os resultados de saúde.

**Palavras-chave:** aplicativos móveis de saúde, comportamento alimentar, atividade física, adultos jovens, aceitação de aplicativos mHealth.

**RESUMEN**
Las aplicaciones sanitarias móviles (mHealth Apps) son una tecnología útil para la gestión de la salud personal. Sin embargo, en Malasia faltan pruebas sobre la mejora de la salud derivada del uso de aplicaciones sanitarias móviles en relación con el comportamiento alimentario y la actividad física. Este estudio tiene como objetivo investigar la asociación entre el uso de aplicaciones móviles de salud con el comportamiento alimentario y la actividad física entre los adultos jóvenes con diferente índice de masa corporal (IMC) en Malasia. Se realizó un estudio transversal. Se reclutaron 280 muestras mediante un muestreo de conveniencia. Se distribuyó un cuestionario en línea consistente en características sociodemográficas, mediciones antropométricas, cuestionario de comportamiento alimentario consciente, Cuestionario Internacional de
Actividad Física (IPAQ) y aceptación del uso de aplicaciones móviles de salud. De los 280 encuestados (78,2% mujeres, 18-28 años, IMC=21,5±3,79kg/m2), el 22,1% eran usuarios de aplicaciones móviles de salud. Los encuestados con bajo peso tenían la puntuación más alta de comportamiento alimentario consciente (2,84±0,25), mientras que la más baja se registró en la obesidad de clase II (2,57±0,06). La mayoría de los encuestados (68,6%) no practicaban un estilo de vida sedentario (permanecían sentados menos de 8 horas). Los encuestados con bajo peso y obesidad de clase I eran inactivos, mientras que los de peso normal y sobrepeso eran moderadamente activos. Además, hubo una diferencia media significativa entre el uso de aplicaciones mHealth y el comportamiento alimentario (p=0,048), pero no el nivel de AF (p=0,134) y el comportamiento sedentario (p=0,759). Los seis factores motivadores que influyeron significativamente (p<0,05) en la aceptación del uso de aplicaciones sanitarias móviles fueron: utilidad percibida, facilidad de uso percibida, influencia social, condiciones facilitadoras, autoeficacia e intención conductual de adopción. El uso de aplicaciones móviles de salud se asocia con el comportamiento alimentario, pero no con la actividad física. Nuestros resultados sugieren que las partes interesadas pueden promover el uso de aplicaciones móviles de salud entre los adultos jóvenes para mejorar los resultados en materia de salud.

Palabras clave: aplicaciones móviles de salud, conducta alimentaria, actividad física, adultos jóvenes, adopción de aplicaciones de mHealth.

1 INTRODUCTION

In this modern technology era, mobile health applications (mHealth Apps) are getting more popular [1]. The mHealth Apps plays a significant role in reduce the burden of healthcare expenditures by providing solution or information about health, tracking and record data for self-management of health to public [13]. The type of health apps includes goal setting, exercise, education, coaching, tracking, therapy, diet and nutrition [3]. However, mHealth Apps is still new in this era, as there was only 23.71% researches on eHealth and mHealth Apps which focus on young adults. Majority of the researches are published from high-income countries (96.9%), as compared to research of eHealth and mHealth Apps in Malaysia (n=7) [2]. The awareness of using mHealth Apps is still low in the public, but study reported willingness to use mHealth Apps for health management in Malaysia [14]. Thus, this research can provide insight on the prevalence of mHealth Apps usage among young adults in Malaysia.

As rapid urbanisation occurred during socio-economic development, lifestyle changes indirectly modified dietary habits and physical activity negatively in Malaysian, which causes overweight and obesity [8]. WHO (2021b) [9] reported that there were 41 million of people die in worldwide, as well as in Malaysia, due to NCDs that caused by
overweight and obesity [6]. Young adults have increased risk of getting obesity and further lead to several health complications or NCDs, especially in their later life [9, 10]. A study reported that there is a need to reduce the prevalence of overweight and obesity in Malaysia through the intervention of diet and promoting physical activity [12]. In Malaysia, there was 28.3% of young adults were overweight, while 29.9% of them were obese, according to the BMI cut-off in Asian countries in 2019. There was more than half of young adults were abdominal obese, which aged from 30 to 34 (52.8%), and 35 to 39 years old (55.7%) [6].

Mindful eating refers to the awareness towards feeling, thoughts, and senses when approaching to foods. It promotes relationship with foods in healthier way and supports emotional eating by appreciating foods [4]. Improper eating behaviour can lead to overweight and obesity [5]. Physical activity (PA) is an effective way to improve health, quality of life, and well-being by prevent and manage weight and non-communicable diseases (NCDs) [7]. In Malaysia, the highest prevalence of inadequate fruits and vegetables intake was young adults who aged 18 to 19 years old (98.9%), whereas 25.1% of people who aged 18 years old and above are physically inactive or sedentary [6]. Thus, this study is carried out to address this issue through the determination of eating behaviour and PA among young adults in Malaysia.

Besides, the mHealth Apps that supports healthy behavioural changing among user are still in infancy, especially in relation of physical activity, sedentary behaviour, and diet or eating behaviour [1, 2]. There was only 12.68% of research in mHealth Apps. Also, only minor researches of eHealth and mHealth were conducted for diet or nutrition (36.27%) and sedentary behaviour (9.87%) [2]. Thus, this study may provide an insight for healthcare policy maker about the contribution of mHealth Apps to public. Nevertheless, young adults tend to use mHealth Apps more, as they are equipped with higher technology literacy skills compared to other age groups [17, 14]. The effective use of mHealth Apps for diet changing and physical activity among young adults may reduce the prevalence of obesity and overweight [18]. There is also limited research in the effectiveness and acceptance of mHealth Apps [19]. Therefore, this study can promote healthy lifestyle among young adults if mHealth Apps are claimed to be motivational, useful, and user-friendly in Malaysia.
2 MATERIALS AND METHODS

2.1 STUDY AND SAMPLING DESIGN

Cross sectional, convenient sampling was used. Online validated self-administered questionnaire was distributed, and the samples were randomly collected through social medias, such as Email, Facebook, WhatsApp, Instagram, Twitter, Microsoft Teams, and Discord. The inclusion criteria included young adults who aged from 18 to 39 years old, who lives in Malaysia, and is a mobile user with internet access, which were not limited to smoking and alcohol consumption. Exclusion criteria included non-mobile user without internet access, children (<18 years old) or adult (>39 years old), pregnant women, individual who has physical disability. There was 20.4% of mHealth Apps users who aged from 18 to 39 years old ($p = 0.204$) [14]. The sample size ($n = 250$) was estimated based on Cochran’s Formula [16]. The dropout rate was set to 10% [20]. To adjust the sample size, the expected dropout rate ($z_d$) was calculated ($N \approx 278$) [23].

2.2 MATERIALS OR MEASUREMENT TOOLS

The standard measurement guidelines were shown in the questionnaire with the aids of visual tools as reference [24–26]. All measurements were ensured to be taken for not more than 30 days. WC cut-off was not more than 90 cm for male and 80 cm for female [21]. BMI cut-off was underweight ($>18.5 \text{ kg/m}^2$), normal weight (18.5–22.9 kg/m²), overweight (23–27.4 kg/m²), obesity class I; II; III (27.5–34.9 kg/m²; 35–39.9 kg/m²; $\geq 40 \text{ kg/m}^2$) [27].

2.3 QUESTIONNAIRE

There were four sections (sociodemographic, eating behaviour, PA, and acceptance of mHealth Apps) in this questionnaire. Eating behaviour section was adopted from Mindful Eating Questionnaire (MEQ) [29]. All items were categorised into disinhibition, awareness, external cues, emotional response, and distraction. The Likert scales ranged from scoring 1 to 4. Respondents may choose not applicable (0) in certain cases. Higher scores of MEQ indicates more mindful eating and lesser BMI of the respondent [30]. The PA section used validated short self-administered International
Physical Activity Questionnaire (IPAQ) [31]. It was categorised into walking, moderate intensity, vigorous intensity, and sitting [32]. The respondent’s sedentary lifestyle was assessed through IPAQ sitting question. It was classified into sitting for less than eight hours per day as sedentary behaviour, while sitting for at least eight hours per day as non-sedentary lifestyle [31]. Research claimed that sitting for at least eight hours per day increased the risk of all-cause mortality [33]. The acceptance of mHealth Apps use questionnaire was adopted from validated Partial Least Squares-Structural Equation Modelling (PLS-SEM) [34]. The determinants were performance expectancy or perceived usefulness, effort expectancy or perceived ease of use, social influence, facilitating conditions, self-efficacy, physical risk, surveillance anxiety, perceived privacy and security, and behavioural intention to adopt. A five-point Likert scale ranged from strongly disagree (1) to strongly agree (5) was used. The higher the score, the more they agree of the determinant as the motivating factor or perceived barrier of the mHealth Apps use.

2.4 STATISTICAL ANALYSIS

Independent-sample t-test was used to compare the mHealth Apps usage with eating behaviour, while the usage with PAL and sedentary behaviour by Pearson’s Chi Square test. Besides, one-way Analysis of Variance (ANOVA) was used to examine the relationship between the use of mHealth Apps and the acceptance of mHealth Apps. The confidence level was established to 95%, ($p < 0.05$) to be significant. All the data analysis was performed by Statistical Package for Social Science (SPSS).

3 RESULTS AND DISCUSSION

3.1 SOCIODEMOGRAPHIC CHARACTERISTICS

A total of 280 responses were used in this study. From the results (Table I), 78.2% were female, more than half of them were normal weight, while had the least of obesity Class II respondents. Furthermore, 165 female participants were below WC cut-off (<80 cm), whereas there was 52 of male participants were below 90 cm.
Table 1: Sociodemographic Characteristics of Respondents (n = 280)

<table>
<thead>
<tr>
<th>Sociodemographic Characteristics</th>
<th>n (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>61 (21.8)</td>
</tr>
<tr>
<td>Female</td>
<td>219 (78.2)</td>
</tr>
<tr>
<td>Alcohol drinker</td>
<td></td>
</tr>
<tr>
<td>Drinker</td>
<td>87 (31.1)</td>
</tr>
<tr>
<td>Non-drinker</td>
<td>193 (68.9)</td>
</tr>
<tr>
<td>Smoking</td>
<td></td>
</tr>
<tr>
<td>Smoker</td>
<td>3 (1.1)</td>
</tr>
<tr>
<td>Non-smoker</td>
<td>277 (98.9)</td>
</tr>
<tr>
<td>Family history of obesity</td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>46 (16.4)</td>
</tr>
<tr>
<td>No</td>
<td>197 (70.4)</td>
</tr>
<tr>
<td>Not sure</td>
<td>37 (13.2)</td>
</tr>
<tr>
<td>BMI&lt;sup&gt;1&lt;/sup&gt; Classification</td>
<td></td>
</tr>
<tr>
<td>Underweight</td>
<td>&lt; 18.5</td>
</tr>
<tr>
<td>Normal weight</td>
<td>18.5 – 22.9</td>
</tr>
<tr>
<td>Overweight</td>
<td>23 – 27.4</td>
</tr>
<tr>
<td>Obesity Class I</td>
<td>27.5 – 34.9</td>
</tr>
<tr>
<td>Obesity Class II</td>
<td>35 – 39.9</td>
</tr>
<tr>
<td>WC&lt;sup&gt;2&lt;/sup&gt; Classification</td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td></td>
</tr>
<tr>
<td>Normal</td>
<td>&lt; 90</td>
</tr>
<tr>
<td>Obese</td>
<td>≥ 90</td>
</tr>
<tr>
<td>Female</td>
<td></td>
</tr>
<tr>
<td>Normal</td>
<td>&lt; 80</td>
</tr>
<tr>
<td>Obese</td>
<td>≥ 80</td>
</tr>
<tr>
<td>Total</td>
<td>280</td>
</tr>
</tbody>
</table>

<sup>1</sup> Body Mass Index. (Source: Ismail et al., 2004).
<sup>2</sup> Waist Circumference. (Source: WHO et al., 2000).

3.2 MINDFUL EATING BEHAVIOUR AND PAL WITH DIFFERENT BODY MASS INDEX (BMI) CATEGORIES

Overall, BMI had no relationship with the eating behaviour ($p = 0.392$). The overall mindful eating behaviour score among respondents were $2.81 ± 0.29$. Previous study showed that mindful eating was effective to sustain healthy eating behaviour compared to healthy eating literacy [35]. Mindful eating not only promoted healthy eating, but also able to manage weight and disordered eating [36]. In this study, underweight respondents scored the highest mindful eating behaviour ($2.84 ± 0.25$), while obesity Class II had the lowest score ($2.57 ± 0.06$), which was similar result with another study [39].

The result showed that no significant differences between BMI and PA was observed ($p = 0.061$). Majority of respondents were classified as low PAL (43.2%), which consists of most of the underweight and nearly half of obesity Class I. Besides, the sedentary lifestyle among different BMI category was not significantly different ($p = 0.827$). Most of them (68.6%) sat for less than 8 hours. In Malaysia, most of the Malaysian adults aged 20 years old to 65 years old had low to moderate PAL [40]. In another study, Saudi young adults, which were students were not walking after dinner regardless of any
BMI category [41]. As the data collected was self-reported through self-administered online questionnaire, the participants in this study may over-reported their PAL and under-reported their sedentary behaviour. Thus, future study is suggested to adopt appropriate instruments, such as accelerometer or pedometer to analyse the PAL more accurately.

3.3 PREVALENCE OF MOBILE HEALTH APPLICATIONS (MHEALTH APPS) USAGE

There was no association among mHealth Apps use and the BMI classification ($p = 0.508$). Same goes to other study, no significant association were observed among mHealth Apps usage with BMI [18]. In this study, 164 Malaysian young adults were not using mHealth Apps (58.6%), while only 62 participants (22.1%) were using it (Table IV). This result was similar to other researches [17, 42]. In another study among young adults, there was 40% were mHealth Apps users. However, many of them discontinued to use it due to technical issues or lack of interest. The result also showed that the respondents preferred wearable device as compared to mHealth Apps to monitor their PA [43].

The mean age of mHealth Apps users (43.61 ± 15.20) were significantly younger as compared to non-users of mHealth Apps (53.02 ± 16.03) [17]. Young adults in Malaysia claimed that they were willing to use mHealth Apps with further training and educating them [14]. In Selangor, Malaysia, there was also only 20.2% of them who mostly consist of young adults (39 years old and below) were using mHealth Apps. Majority of Malaysians (62%) did not have the awareness and knowledge regarding mHealth Apps [18]. The awareness and use of mHealth Apps not only low in patients that diagnosed with certain diseases, but were also low among healthcare professional such as pharmacists [44]. This might be due to lack of understanding, motivation, and interest of mHealth Apps in Malaysians. They think that mHealth Apps was unnecessary for them [45]. The lower rate of mHealth Apps users might also be due to the uncertainty to choose the suitable mHealth Apps to be used [45].
3.4 RELATIONSHIP BETWEEN THE USE OF MHEALTH APPS AND EATING BEHAVIOUR

There were significant higher MEQ scoring among mHealth Apps user compared to categorised non-user ($p = 0.048$) (Table II). Two studies claimed that mHealth Apps related to healthy eating such as fitness and nutrition improved mindful eating behaviour in a healthier way among mHealth Apps users. Besides, previous research reported that non-users of mHealth Apps with very high BMI had lower mindful eating behaviour scoring as compared to mHealth Apps users with normal BMI [46,47]. The mHealth Apps use was found to improve mindful eating behaviour and reduced emotional and uncontrolled eating among users in a RCT study [48].

The increase of mindful eating behaviour is able to prevent and manage obesity as well as to reduce its comorbidities risk such as metabolic syndromes and NCDs among the mHealth Apps users [12,14,46]. The improvement of eating behaviour leads to weight reduction and indirectly decreased the blood lipid, blood pressure, and blood glucose profile of the obesity users. This can be explained by the high effectiveness of mHealth Apps in promoting health-related behaviour such as eating habit as well as self-efficacy among users [12,14]. The mHealth Apps users tend to practice healthy dietary habits as their awareness were increased to select proper food choices [11].

Table 2: Mindful Eating Behaviour (MEQ) Score Between Users and Non-users of mHealth Apps (n = 280)

<table>
<thead>
<tr>
<th>MEQ Score</th>
<th>mHealth Apps Use</th>
<th>n</th>
<th>M ± SD</th>
<th>Mean Difference</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>User</td>
<td>62</td>
<td>2.87 ± 0.30</td>
<td>0.08</td>
<td>0.048*</td>
</tr>
<tr>
<td></td>
<td>Non-user</td>
<td>218</td>
<td>2.79 ± 0.29</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Significant difference at $p < 0.05$.

1 Filtered data with combination of past user, non-user, and installed or downloaded but never use it into “Non-user”.

2 Basir et al., 2021.

3 Mean ± Standard Deviation.

3.5 ASSOCIATION BETWEEN THE MHEALTH APPS USAGE AND PA

In overall, there was no association between mHealth Apps usage and PA ($p = 0.134$), as well as sedentary behaviour ($p = 0.759$) (Table III). A study claimed the same result for PA [48]. The meta-analysis systematic review study shown that the mHealth Apps might reduce sedentary behaviour while increase PAL of users in short-term, but not statistically significant [28]. Although many mHealth Apps were available in market
to improve users’ PA or sedentary behaviour, it was found that most of them had limited behavioural change technique that can be sustained and practiced [47]. From the research of Kasirye et al. (2020), more than half (58.7%) of young adults in Malaysia had no knowledge on low PAL lead to obesity, while majority of them (86.2%) wished to lose weight [22]. Hence, the respondents in this study may had limited knowledge of the importance of PA reduces obesity risk. Thus, mHealth Apps users might not further increasing their PAL, despite they wished to lose weight. However, young adults were opened to accept mHealth Apps to reduce their weight.

Table 3: Association of Physical Activity Level (PAL) and Sedentary Lifestyle among Users and Non-users of mHealth Apps (n = 273, n = 204)

<table>
<thead>
<tr>
<th>Item, n (%)</th>
<th>mHealth Apps Usage, n (%)1</th>
<th>Total, n (%)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>User</td>
<td>Non-user</td>
<td>User</td>
</tr>
<tr>
<td><strong>PAL2</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low PAL</td>
<td>19 (7.0)</td>
<td>99 (36.3)</td>
<td>118 (43.2)</td>
</tr>
<tr>
<td>Moderate PAL</td>
<td>29 (10.6)</td>
<td>88 (41.1)</td>
<td>117 (42.9)</td>
</tr>
<tr>
<td>High PAL</td>
<td>11 (4.0)</td>
<td>27 (9.9)</td>
<td>38 (13.9)</td>
</tr>
<tr>
<td>Total</td>
<td>59 (21.6)</td>
<td>214 (78.4)</td>
<td>273</td>
</tr>
<tr>
<td><strong>Sedentary Behaviour2</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Less than 8 hours</td>
<td>28 (13.7)</td>
<td>112 (54.9)</td>
<td>140 (68.6)</td>
</tr>
<tr>
<td>At least 8 hours</td>
<td>14 (6.9)</td>
<td>50 (24.5)</td>
<td>64 (31.4)</td>
</tr>
<tr>
<td>Total</td>
<td>42 (20.6)</td>
<td>162 (79.4)</td>
<td>204</td>
</tr>
</tbody>
</table>

1 Filtered data with combination of past user, non-user, and installed or downloaded but never use it into “Non-user”.
2 Chan et al., 2017.

3.6 MOTIVATING FACTORS AND PERCEIVED BARRIERS TO ACCEPT AND USE THE MHEALTH APPS

On average, the scoring for the acceptance of mHealth Apps was 3.46 ± 0.25. Among the factors, participants were slightly more to agree with perceived usefulness (3.73 ± 0.86), perceived ease of use (3.78 ± 0.88), and self-efficacy (3.81 ± 0.89). Overall, there were six factors of the acceptance of mHealth Apps which significantly different among the use of mHealth Apps. These six factors were perceived usefulness ($p < 0.001$), perceived ease of use ($p < 0.001$), social influence ($p = 0.03$), facilitating conditions ($p = 0.002$), self-efficacy ($p < 0.001$), and behavioural intention to adopt ($p < 0.001$).

The mHealth Apps users had significantly and strongly agreed in perceived usefulness of mHealth Apps, compared to non-users ($p < 0.001$) and past users ($p = 0.01$), which only slightly agreed with it. Similarly, there were significant of strongly agreed among mHealth Apps users as compared with non-users ($p < 0.001$) and past users ($p =$
0.008) in the factor of perceived ease of use. Surprisingly, social influence factor had significantly shown to be agreed by users that installed but never use mHealth Apps, while neither agreed nor disagreed among past users of mHealth Apps ($p = 0.032$). The mHealth Apps users were more significantly agreed with facilitating conditions influence the acceptance of mHealth Apps whereas non-users had only slightly agreed with it ($p = 0.006$).

Furthermore, mHealth Apps users had the most significant agreed of behavioural intention to adopt influences acceptance of mHealth Apps, as compared to non-users ($p < 0.001$) and past users ($p = 0.005$), which were the least to agree of it. Self-efficacy was the most prominent factor for the acceptance of mHealth Apps, whereby each group of the responses holds different point of view. Significant strongly agreed were observed towards self-efficacy influenced the use of mHealth Apps among mHealth Apps users, as compared to non-users ($p < 0.001$) and past users ($p = 0.001$).

Different behavioural stages of mHealth Apps usage had different point of view and readiness towards the acceptance of mHealth Apps for health behavioural changes [34]. Ndayizigamiye et al. (2020) reported that perceived ease of use, perceived usefulness, facilitating conditions, social influence, as well as behavioural intention to adopt were the key elements that influenced the use of mHealth Apps [38]. A study conducted in Malaysia showed that both perceived benefits and barriers was significantly correlated with the intention to use mHealth Apps. In the study, perceived benefits were the only one that significantly predicts the intention to use mHealth Apps among Malaysian [37]. This can be explained by the users of mHealth Apps were satisfied with the effectiveness of the mHealth Apps [11]. When the users were satisfied with the use of mHealth Apps, the perceived barrier of using it will be automatically reduced and become lower [15].

Current study provided an up-to-date and novel insights about the usage of mHealth Apps among young adults in Malaysia. It also provided the motivation factors that influenced the use of mHealth Apps, which most of the young adults in Malaysia have the behavioural intention to adopt and use mHealth Apps. Moreover, this study provided data on the relationship between mHealth apps usage with eating behaviour and PA. This study mainly focused on young adults in Malaysia, but not the whole population who stayed in Malaysia. This might lead to unwanted bias and unable to generalise this sample study to a wider population in Malaysia, which includes elderly, children, or
pregnant women. The future studies were suggested to look into gender difference among the use of mHealth Apps, as well as their eating behaviour and PA.

4 CONCLUSION

In conclusion, 280 respondents who aged 18 to 39 years old participated in this study. The participants scored 2.81 ± 0.29 in average for mindful eating behaviour. Majority of them were non-users of mHealth Apps (58.6%), had low PAL (43.2%) and moderate PAL (42.9%), with sitting for less than eight hours (68.6%). All (6) motivating factors significantly influenced the acceptance and use of mHealth Apps ($p < 0.04$).

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