# The Intensity Use of mHealth Apps and its Relation to Nutrition Knowledge, Healthy Eating Self-Efficacy, and Positive Body Image

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Aseel O. Ajlouni[1(✉)], Fatima Abd-Alkareem Wahba[2], Abdallah Salem Almahaireh[3]
[1]Al-Ahliyya Amman University, Amman, Jordan
[2]Middle East University, Amman, Jordan
[3]The University of Jordan, Amman, Jordan
a.ajlouni@ammanu.edu.jo

**Abstract—**In terms of mobile apps, mHealth technology might enhance public health. However, despite the development of hundreds of health-related mobile applications, few studies have studied their relationship to psychological constructs. This study aimed to evaluate the association between the intensity of mHealth app use and nutrition knowledge, healthy-eating self-efficacy, and positive body image among Jordanian students and to measure their levels. In the first semester of the academic year 2022–2023, a structured, self-administered web-based questionnaire containing valid and reliable measures (i.e., positive body image scale, healthy eating self-efficacy, general nutrition knowledge questionnaire, and the adopted intensity use of mHealth apps scale) was administered to 414 undergraduates. The findings reported that their usage of mHealth-related mobile applications was low, as they had inadequate nutrition knowledge, low healthy-eating self-efficacy, and a moderate positive body image. The Pearson correlation analysis revealed a significant and positive correlation between the degree of usage of health-related mobile applications and nutrition knowledge, healthy eating self-efficacy, and positive body image ($p < 0.01$). These findings underscore the need to promote healthy eating self-efficacy and positive body image among students and to improve their nutrition knowledge. In addition, these results advise decision-makers to encourage students to include mHealth applications in their daily routines to benefit their health.

**Keywords—**mobile application, nutrition knowledge, health, body image, health eating self-efficacy, mHealth

## 1 Introduction

Diet has a crucial role in illness prevention, whereas a bad diet is responsible for around fourteen million deaths annually [1]. Despite this, many people rely on canned foods, with a noticeable decrease in the intake of fresh foods such as vegetables. [2] Food intake increased dramatically after the announcement of the spread of the Corona pandemic on March 1, 2020 [3], which caused people to be concerned about their poor

eating habits [4]. Several studies have shown severe health effects of covid-19 [5–9], including a decrease in body image, body esteem, body dissatisfaction, form concerns, eating problems, and the incidence of obesity [10] which is a global public health concern; a study by [11] revealed a significantly high prevalence of obesity and overweight in the Middle East and recommended intervention strategies to address these problems. Similarly, previous studies found a prevalence of overweight and obesity in Arabic-speaking countries, such as Jordan [12–14], where obesity is on the rise [15], and a double burden of malnutrition is found, creating an urgent need for interventions and enhancing the nutritional knowledge of populations [16]. Furthermore, research has repeatedly demonstrated that obesity is connected with other disorders, such as body image dissatisfaction [17–19]; this emphasizes the need to address the obesity problem in Jordan.

Promoting nutrition knowledge, healthy habits, and healthy eating guidelines might promote better living and lower mortality rates. This might be accomplished through mobile technology, where hundreds of mobile health applications have been built and produced. Many individuals use mHealth apps, for instance, due to their simplicity and healthcare benefits, such as managing heart rate and promoting a healthy diet and physical exercise [20–24]. In contrast, a nutritious diet has been shown to reduce the risk of death [25]. Therefore, we should improve dietary intake by boosting nutrition knowledge; nevertheless, one of the key obstacles in improving it among individuals is individualized nutrition [26], which may be handled by the mHealth app connected to nutrition and diet since each user can adjust the app's options according to his health, objective, and specifications, such as his targeted dairy intake goal or physical activities.

Recent studies have revealed a 25% rise in the installation of diet and nutrition-related mHealth applications [27]. However, youths, who play a crucial part in the economic growth of societies, have yet to be studied to determine the extent to which they utilize these applications. In addition, few studies are exploring the effect of mHealth applications on promoting health-related nutrition information, such as body image, dietary practices, or self-efficacy in healthy eating. A correlational investigation between the intensity of mHealth app use and nutritional knowledge, healthy eating self-efficacy, and body image is also required. These underlined the urgent need to undertake research illustrating the usage of mHealth Apps and determining if this intensity of use connects with Nutrition Knowledge, Healthy Eating Self-Efficacy, and Body Image among Jordanian undergraduates. This study, therefore, aims to address the following research questions: RQ1: What are the intensity levels of undergraduate usage of mHealth applications, nutrition knowledge, healthy eating self-efficacy, and positive body image? RQ2: Is there a statistically significant correlation between the intensity use of mHealth apps, nutrition knowledge, healthy eating self-efficacy, and positive body image?

The following section is a synopsis of the most recent research regarding mHealth apps, nutrition knowledge, healthy eating self-efficacy, and positive body image. In addition, it describes our methodology, the study's findings, the provided and debated conclusions, and the limits and suggestions for future research.

## 2 Literature review and theoretical framework

### 2.1 mHealth apps and nutrition knowledge

Daily use of mobile applications facilitates student learning and independence [28]. According to the literature on mobile applications, thousands of mHealth apps have been developed to encourage a healthy lifestyle, give guidance and advice, and assist users in monitoring or controlling their weight, physical activity, medications, and food, among other factors. Using mHealth applications might benefit those who wish to enhance their overall health [29–30]. Specifically, nutrition-related mHealth applications might benefit adolescents' health by increasing their nutrition knowledge and preventing obesity [31, 32].

Nutritional knowledge is the most crucial element influencing the nutritional status and behaviors of people and groups [33]. Moreover, public participation is advantageous for addressing obesity and ensuring a sustainable way of life [34]. However, despite the importance of nutrition knowledge, several studies have reported a lack of eating behavior among coaches, athletes, K-12 students, and undergraduates [35–39]; for example, [40] conducted a study in Kuwait that found Basic Education college undergraduates had a low level of nutrition knowledge. In addition, studies have demonstrated a correlation between Dietary Intake and Nutritional Status, such as the study by [41], which found that undergraduates with superior nutrition knowledge consumed less unhealthy fats; this highlights the significance of nutrition knowledge in consuming a healthy diet. In addition, researchers [42] discovered that teenagers who utilized mHealth applications (i.e., food, nutrition, health) had more excellent nutrition knowledge than those who did not.

In the absence of a literature review on the intensity of mHealth App-related nutrition use among undergraduates, we refer to studies conducted on mHealth apps in general; for instance, [43] conducted a study among healthcare workers in Saudi Arabia and found that they used the medical application infrequently and had negative attitudes toward its use. In addition, a survey done in France among university students indicated that most of them surf the internet for health information, utilize a few mHealth applications, and have very few wearable devices. In addition, a study of 1,487 undergraduates in the southern United States revealed that just 17% had downloaded a health app. Similarly, research with 132 Patients revealed that 68.4% felt utilizing medical apps was viable, but just 4.1% were using them. According to these data, mHealth app usage was minimal. In addition, previous research on nutrition knowledge has demonstrated a correlation between the use of mHealth applications and an increase in nutrition knowledge [42]. It is equally effective as a nutrition communication tool: enhancing nutritional knowledge through the transmission of nutrition messages improves eating perception, nutrition knowledge, motivation, and healthy eating behaviors [47–48].

### 2.2 mHealth apps and healthy eating self-efficacy

Self-efficacy is the belief that an individual can alter their life or achieve a specific goal [49]; it is crucial to comprehend and adjust healthy eating practices in the context of healthy eating self-efficacy [49], and it occurs when individuals feel they can achieve

and maintain a healthy eating routine [50]. Technology might stimulate adolescents' Self-Efficacy for Healthy Eating [51]; mHealth applications may raise self-efficacy, improve eating behavior, and provide behavioral support for healthy food coping strategies [30, 52, 53].

Literature in mHealth has proved its advantages for promoting healthy eating self-efficacy; for instance, [54] performed a descriptive study demonstrating that nutrition-related mobile applications enhance motivation to consume a healthy diet, self-efficacy, and healthy behavior. Similarly, [55] finds that nutrition apps may be effective public health tools for improving users' views of healthy eating obstacles. Similarly, [56]'s study implies that mobile applications might successfully promote purchasing healthier foods. Moreover, [57] found that more significant usage of mHealth applications was associated with improved ratings of goal attainment among individuals with poor self-efficacy to consume nutritious meals. The findings of this study imply that mHealth applications might be a beneficial resource for individuals who struggle to reach their dietary objectives. In addition, a survey of 81 undergraduates indicated that 43.90% moderately to strongly agreed that utilizing mobile applications alters their behavior and increases their awareness of how they spend their time.

In conclusion, healthy eating self-efficacy plays a significant role in people's health because it impacts the individual food choice and dietary intake, which are connected to an individual's health; nevertheless, a lack of recently completed research aiming to assess the degree of healthy eating self-efficacy among undergraduates using sophisticated measures rather than a perspective questionnaire, the one we found was of Habiba and, his team [59] who did a study among undergraduates has been discovered.

### 2.3 Health apps and body image

Positive body image is a multifaceted concept encompassing an overall love, respect, and appearance pleasure for the body [60–61]. In contrast, body image disorders include a perceived lack of physical appearance [62]. Positive body image is one of the primary concerns of young people, as seen by their interest in the reactions of others to their looks [63]; numerous aspects, such as cognitive, emotional, or personal traits, influence body image, ultimately contributing to mental health or illnesses [64]. In addition, past research has demonstrated their link with other domains that influence human health (i.e., self-efficacy, depression, and weight) [65–68]. Therefore, an integrated effort must be made to promote a positive body image [64].

Prior studies concentrated on body image disorders, but considerably less research was undertaken on positive body image; for example, a study conducted in Jordan, Al-[69] among female college students revealed a moderate degree of body image among students. Moreover, [70] examining the relationship between body image and dietary knowledge revealed a strong positive link between them. On the other hand, literature on body image linked to the intensive use of mHealth apps was nonexistent, but [71] performed a study that intended to explore the effectiveness of cognitive training based on the mobile application on lowering body dissatisfaction among young girls at high risk for body image disorders. The result indicated that mHealth apps might decrease symptoms of body image disorders and body dissatisfaction connected to eating disorders, which encouraged more research.

# 3 Methodology

## 3.1 Study design, participants, and procedures

During the first semester of 2022–2023, undergraduates at a big Jordanian public university participated in this quantitative study. A web-based, anonymous, self-reported questionnaire was utilized to gather data. The questionnaire consisted of four sections: a) demographic factors, including gender, GPA on a scale of 4.0, academic year, and importance; b) nutrition knowledge test; c) healthy food eating self-efficacy scale; and d) positive body image scale. It required about 40 minutes to respond to the questions. First, researchers distributed the URL for the online survey to the school of educational sciences faculty, then released it on the e-learning platforms for undergraduates. The study was open to all school of educational sciences (SOES) undergraduates enrolled in the first semester of the academic year 2022–2023.

Before initiating the study, permission from the University's Ethics Committee was acquired. In the last month of the first semester, the research participants completed the web-based questionnaire anonymously. The informed consent of all participants was obtained. A Pearson correlation analysis was conducted to examine the association between variables [72] (ie. the intensity of mHealth app use and nutrition knowledge, healthy eating self-efficacy, and body image).

The population of the study was 2,112 undergraduates (7.4% male and 92.6% female) who enrolled in the SOES at the University of Jordan in the first semester of the academic year 2022-2023. The sample of the study was 414 individuals which was representative and sufficient to conduct the Pearson correlation analysis. The required sample size for this study is 326, which was determined using Thompson's [73] equation (with a 95% confidence interval and a 5% margin of error because the pilot sample had 45 individuals). Table 1 shows the characteristics of the participants.

**Table 1.** Characteristics of the study sample (N = 414)

| Variable | Value | F | P |
|---|---|---|---|
| Gender | Male | 42 | 10.1% |
| | Female | 372 | 89.9% |
| GPA | Excellent | 92 | 22.2% |
| | Very good | 225 | 54.3% |
| | Good or less | 97 | 23.4% |
| Academic Level | Freshman | 119 | 26.5% |
| | Sophomore | 110 | 28.5% |
| | Junior | 118 | 28.5% |
| | Senior | 67 | 16.2% |
| Majors | Classroom teacher | 89 | 21.5% |
| | Library and information science | 36 | 8.7% |
| | Early childhood education | 36 | 8.7% |
| | Counseling and mental health | 141 | 34.1% |
| | Special education | 112 | 27.1% |

*Note:* P: Percentage; F: Frequencies.

### 3.2 Study measures

Several measures were employed to collect data for the study; some were adopted, while others were translated from the original English form into Arabic, as Arabic is the official language of Jordan. Initially, nine experienced specialists in Arabic and English assessed the accepted and translated measures, measurement and evaluation, psychology, and counseling and mental health from various Jordanian universities. Then, the questionnaire was presented to a pilot sample (n = 45) to evaluate its psychometric qualities (i.e., validity and reliability).

**Nutrition knowledge questionnaire.** The revised general nutrition knowledge questionnaire (GNKQ-R) for adults was used to assess the nutrition knowledge of undergraduates. It was adopted by [74] for the young adult Arab population. The Arabic version of the GNKQ for adults was created by [75]. The GNKQ-R had 86 questions split over four domains: a) Dietary recommendations (18 questions), b) Food groups and nutrient sources (36 questions), c): Healthy food choices (13 questions), and d) Associations between diet–diseases, and weight (21 questions). It is composed of both multiple-choice and checkbox questions. The correct answers were awarded 1 point, while the incorrect ones were awarded 0 points. The GNK-R score was added for all domains to get an overall SNK score out of 86; the range for the Total score is between and (0–86).

The validity and reliability of the GNKQ-Rs were validated among undergraduates from the United Arab Emirates and Jordan [74]. In addition, a pilot sample of 45 students was administered the test to validate its psychometric properties. As a consequence, Cronbach's alpha achieved 0.83, indicating that the internal consistency of the GNKQ-R was adequate for this study [76].

**The healthy eating self-efficacy scale.** The healthy eating self-efficacy scale (HESE) was created by [50]. It consisted of 11 items spread over two subscales: a) Consumption of healthy foods (7 items) and b) – Healthy weight (4 items). Response options ranged from 1 = strongly disagree to 5 = strongly agree on a 5-point Likert scale. The HESES score range varied between and (11 to 55), these scores represent the healthy eating self-efficacy of participants; a higher score suggests that respondents have a greater healthy eating self-efficacy. A pilot sample of (45) students was administered the HESES to validate its psychometric properties. All of the Pearson's correlation coefficients between each scale item and the total score were statistically significant ($P < 0.05$) and ranged between and (0.971–0.930). Concerning internal consistency, Cronbach's coefficient was determined to be 0.99, suggesting. These findings confirm the reliability and validity of the HESE [76].

**Positive body image scale.** The Body Appreciation Scale-2 (BAS2), created by [60], was used to collect data on positive body image, which is suitable for research and clinical settings. It consisted of 10 statements based on a 5-point Likert scale, with response possibilities ranging from (1 = Never, 2 = Rarely, 3 = Occasionally, 4 = Frequently, and 5 = Always). The range of BAS2 values varied between and (10 to 50). These ratings represent the positive body image of participants; a higher score suggests that respondents have a more positive body image. A pilot sample of (45) students was administered the BAS2 to validate its psychometric properties. It was determined that Pearson's correlation coefficients between each scale item score and the overall

score were all statistically significant ($P < 0.05$) and varied between and (0.920–871). Cronbach's coefficient was 0.97 as well. These results demonstrate the reliability and validity of the BAS2 instrument [76].

**Intensity use of mHealth app scale.** The intensity usage of the mHealth app related to nutrition (IUMARN) Scale was adapted from the intensity of WeChat use on mobile phones scale developed by [77]. It sought to evaluate the intensity use of mHealth applications on food or nutrition, as opposed to all health apps, such as those for controlling performance activities, medicine, and others. The accepted IUMARN scale included ten components. Each item required respondents to answer questions regarding their intensive use of mHealth applications that focused on nutrition or diet, such as: "How much time do you spend per day using a health mobile application that is related to nutrition or diet?" and "mobile apps related to nutrition or diet had become a daily part of my life." Applicants were selected using a 5-point Likert scale. The intensity of mHealth app use concerning nutrition scores varied between and (10 to 50). These ratings show the participants' level of usage of the nutrition-related mHealth app; a higher score implies more intensity of use of the mHealth app by respondents. The IUMARN was administered to 45 students to validate its psychometric features. It was determined that Pearson's correlation coefficients between each item of the scale and the scale's total score were all statistically significant ($P < 0.05$) and varied from (0.60 to 0.92), and that Cronbach's coefficient was 0.95. These results demonstrate the reliability and validity of the IUMARN [76].

### 3.3 Data analysis

The descriptive statistics mean and standard deviation were collected from the study variables to address the first research question. In addition, a Pearson correlation analysis was used to address the second study question and determine if the intensity of undergraduates' usage of health-related mobile applications correlates substantially with the independent variables (i.e., nutrition knowledge, healthy eating self-efficacy, and positive body image). These investigations were conducted with the aid of the SPSS software.

## 4 Findings and discussion

***The intensity use of mHealth applications, nutrition knowledge, healthy eating self-efficacy, and positive body image levels among undergraduate students.***

To address the first research question, "What are the levels of intensity use of mHealth apps, nutrition knowledge, healthy eating self-efficacy, and positive body image among undergraduates?" the researchers calculated the means and standard deviations of intensity use of mHealth apps, nutrition knowledge, healthy eating self-efficacy, and positive body image.

On a 5-point Likert scale, the intensity of undergraduates' usage of mHealth applications was measured. From 1.0 to 2.66, indicating a low level, 2.67 to 4.33, indicating a moderate level, and 4.34 to 6.0, indicating a high level, the total IUMARN score was divided into three categories. The precise ranges were also utilized to classify the

students' healthy eating self-efficacy, and positive body image, as they all utilize the 5-point Likert scale.

The overall nutrition knowledge score of undergraduates was classified into three levels based on Bloom's cut-off points [78; 40] as follows: between 80% and 100% (68.8–86 points) indicated a high level of nutrition knowledge, between 60% and 79% (51.6–68.7 points) indicated a moderate level. Less than 60% (less than 51.6 points) indicated a low level of nutrition knowledge.

Table 2 displays descriptive data on students' answers to the mHealth app intensity scale. Although the lowest mean scores were for question 9: "Browse mobile health apps related to nutrition or/and diet as part of my daily activities," the total mean score was 2.28, showing that students had a moderate use of mHealth applications related to nutrition or diet. This conclusion is similar to earlier research in numerous countries, including Saudi Arabia, France, and the southeastern United States, which indicated low-intensity use of mHealth applications [43–46]. Therefore, undergraduate at SOSE must be aware of mHealth applications and their benefits to embrace them and utilize them to promote and preserve their health.

**Table 2.** Descriptive statistics for the undergraduates' responses on the IUMARN scale

| Item | SD | M | Level |
|---|---|---|---|
| 1 | 1.339 | 2.54 | Low |
| 2 | 1.367 | 2.62 | Low |
| 3 | 1.305 | 2.42 | Low |
| 4 | 1.230 | 2.26 | Low |
| 5 | 1.283 | 2.38 | Low |
| 6 | 1.330 | 2.39 | Low |
| 7 | 1.351 | 2.52 | Low |
| 8 | 1.364 | 2.58 | Low |
| 9 | 0.811 | 1.38 | Low |
| 10 | 1.272 | 1.72 | Low |
| Total | 1.062 | 2.28 | Low |

*Note:* M: Mean, SD: standard deviation.

As illustrated in Table 3, the students needed to gain awareness of dietary guidelines, food types and nutrient sources, and healthy food choices, as they failed to detect the links between diet, illnesses, and weight. The total mean score for nutrition knowledge among students was 40.4, indicating inadequate nutrition knowledge and placing them at risk of adopting improper diets that might negatively impact their health. This conclusion is consistent with [40]'s findings that Kuwaiti pupils have a limited understanding of nutrition.

**Table 3.** Descriptive statistics of the undergraduates' responses on GNKQ-R

| Sub-Scale | SD | M |
|---|---|---|
| Dietary recommendations | 2.76386 | 8.9130 |
| Food groups and nutrient sources | 5.63086 | 18.3116 |
| Healthy food choices | 2.33173 | 6.1256 |
| Associations between diet–diseases and weight | 2.55606 | 7.0411 |
| Total nutrition knowledge | 10.23816 | 40.3913 |

This finding demonstrates a risk consideration in undergraduate nutrition education at the University of Jordan's School of Educational Sciences, highlighting the urgent need to improve their nutrition knowledge, which plays a crucial role in their dietary intake choices and healthy food consumption [77–82]. In addition, further research [42, 47–48] has proved the benefit of mHealth applications in boosting nutrition awareness among their users. Therefore, this lack of nutrition awareness among undergraduates might be remedied by employing various tactics, such as providing online nutrition intervention programs or encouraging students to utilize nutrition-related mobile applications to increase their understanding.

As shown in Table 4, the means for the healthy eating self-efficacy measure for undergraduates ranged from 2.26 to 2.43, which are all low. Item 7 scored lowest: "When I feel hungry, I am able to easily choose healthy food over less healthy ones," indicating that they lack confidence in picking nutritious foods. The mean for the total healthy eating self-efficacy was 2.28, showing a low degree of healthy-eating self-efficacy among students; this indicates that they do not have the capacity and belief in their commitment to healthful eating, and they cannot regulate themselves and their thoughts about healthy eating in terms of the quality of excellent and nutritious food; this may be due to a lack of nutrition knowledge. This conclusion is consistent with [59] findings indicating undergraduates in the United Arab Emirates have low self-efficacy towards healthy eating.

This conclusion motivates decision-makers at the University of Jordan's Department of Mental Health to provide counseling programs such as cognitive behavioral therapy (CBT) for undergraduates in the school of educational sciences to improve their healthy eating self-efficacy. Also, technology such as mHealth applications might be leveraged to promote healthy eating among undergraduate students [30, 51–53].

**Table 4.** Descriptive statistics for the undergraduates' responses on the HESE scale

| Item | SD | M | Level |
|---|---|---|---|
| 1 | 1.656 | 2.39 | Low |
| 2 | 1.632 | 2.43 | Low |
| 3 | 1.539 | 2.30 | Low |
| 4 | 1.598 | 2.39 | Low |
| 5 | 1.553 | 2.29 | Low |
| 6 | 1.554 | 2.28 | Low |
| 7 | 1.541 | 2.26 | Low |
| 8 | 1.594 | 2.31 | Low |
| 9 | 1.601 | 2.34 | Low |
| 10 | 1.572 | 2.31 | Low |
| 11 | 1.640 | 2.37 | Low |
| Total | 1.528 | 2.33 | Low |

As indicated in Table 5, the positive body image ratings for undergraduates varied from 1.26 to 1.46 and were all moderate. Item 1 had the greatest score: "I respect my body," while item 5 received the lowest score: "I am attentive to my body's needs." This suggests they require assistance to be more sensitive to their requirements. The overall mean score for positive body image was 3.52, showing that students have a somewhat favorable body image. This answer suggests that they were reasonably satisfied with their body image and respect, love, and appreciate their bodies, having a moderate notion of beauty and taking care of their bodies in terms of health and happiness.

However, this level of body image falls within the lower moderate range, indicating that these children are at risk and require assistance to improve their body image. This conclusion is consistent with a study by [69] that revealed female college students in Jordan to have a moderate degree of body image. Therefore, this study proposes preventative counseling programs, such as CBT, to students to preserve and enhance their body image [83].

**Table 5.** Descriptive statistics of the undergraduates' responses on the positive body image scale

| Item | SD | M | Level |
|---|---|---|---|
| 1 | 1.435 | 3.69 | Moderate |
| 2 | 1.414 | 3.49 | Moderate |
| 3 | 1.370 | 3.48 | Moderate |
| 4 | 1.409 | 3.55 | Moderate |
| 5 | 1.451 | 3.36 | Moderate |
| 6 | 1.436 | 3.53 | Moderate |
| 7 | 1.427 | 3.49 | Moderate |
| 8 | 1.400 | 3.49 | Moderate |
| 9 | 1.443 | 3.50 | Moderate |
| 10 | 1.463 | 3.57 | Moderate |
| Total | 1.269 | 3.52 | Moderate |

***Relationships between intensity use of mHealth app, nutrition knowledge, healthy eating self-efficacy, and positive body image.***

For the second study question, "Is there a statistically significant correlation between the intensity of mHealth app use, nutrition knowledge, healthy eating self-efficacy, and positive body image?" a Pearson correlational analysis was undertaken. Table 6 displays the findings of the correlation analysis between the research variables and the intensity use of mHealth applications.

**Table 6.** Correlations between the intensity use of mHealth mobile apps and study variables

| Variables | Nutrition Knowledge | Health Eating Self-Efficacy | Body Image |
|---|---|---|---|
| Intensity use of mHealth app | 0.825** | 0.419** | 0.289** |

*Note:* **Correlation is significant at the 0.01 level (2-tailed).

This research revealed that the intensity use of mHealth app was positively associated with nutrition knowledge, healthy eating self-efficacy, and positive body image ($p < 0.01$). Moreover, the Pearson correlation value between the intensity of use of health-related mobile apps and nutrition knowledge was statistically significant: $r = 0.825$, which is considered a strong correlation [84], indicating that as the level of mHealth app use increased, so did nutrition knowledge; this is consistent with the findings of [85], who discovered a positive association between using health applications and nutrition knowledge. Additional research has indicated that mobile applications can enhance users' objective and subjective knowledge regarding healthy meals [48].

Furthermore, the correlation coefficient between the intensity of mHealth app use and healthy eating self-efficacy was statistically significant: $r = 0.419$, as shown in Table 6. This demonstrates that the intensity of mHealth app use and healthy eating self-efficacy are likely to increase in reaction to one another; nevertheless, their link is modest. These positive correlation results indicate that healthy eating self-efficacy increases with the intensity of mHealth app use. This conclusion is consistent with the findings of [54], who discovered a correlation between diet/nutrition apps and health-related behavior modification. In the context of the effect of mHealth apps on self-efficacy to consume healthy food, the study by [58] indicated that mobile applications increased users' self-awareness and altered their behavior. Similarly, [54] indicated that these nutrition-related applications influence motivation to consume a healthy diet, self-efficacy, and health behavior modification. It also helps individuals overcome obstacles to achieve their dietary objectives [57]. In addition, the systematic study confirmed that mobile applications might be helpful to weight reduction tools [86].

In addition, Table 6 demonstrated a slight positive association between the intensity of mHealth app use and a positive body image ($r = 0.289$). This indicates that the intensity of use of a mHealth app and positive body image tend to increase in response to one another, but the association between them is weak; this suggests that undergraduates with more intense use of a mHealth app are likely to have a more positive body image; however, no conducted studies have been identified that indicate an urgent need to examine the association between positive body image and the intensity of use of mHealth apps. Nevertheless, [70] found a substantial positive link between body image

and nutrition knowledge, whereas [85] found a correlation between nutrition knowledge and the usage of mHealth. However, no study revealed a correlation between the use of mHealth applications and body image.

The study results reveal that the intensity use of mHealth applications are correlated with nutrition knowledge and mental health regarding healthy eating self-efficacy and positive body image. Therefore, researchers recommend conducting more studies on the efficacy of mHealth applications focusing on nutrition or diet. In addition, these results suggest that MHealth applications may be a helpful health tool that favorably benefits public health.

## 5 Conclusion

This study has several strengths; first, it assessed the degree of intensity use of mHealth apps and analyzed its relationship to an essential variable that plays a key role in an individual's health (i.e., nutrition knowledge, healthy-eating self-efficacy, and positive body image) among undergraduates, who represent a valuable segment of the population that influences the economic and sustainable growth of the nation. Second, it closes the gap in mHealth literature usage intensity. In addition, it gives data that might assist in encouraging better lifestyles in the community based on study findings that could solve several health problems associated with obesity, malnutrition, self-efficacy, and body image.

The intensity use of the mHealth app was adopted, and a general nutrition knowledge test, health eating self-efficacy scale, and body image were choosen to measure the degrees of intensity usage of mHealth app-related nutrition, nutrition knowledge, and healthy eating self-efficacy, respectively. Consequently, undergraduate students at the School of Educational Sciences reported having inadequate nutrition knowledge, low healthy-eating self-efficacy, and a moderate positive body image. Therefore, to prevent individuals from being at risk, it is necessary to improve their nutrition knowledge and healthy eating self-efficacy and to preserve and support their positive body image. In addition, correlation analysis demonstrated a substantial and favorable relationship between the intensity use of mHealth apps and nutrition knowledge, healthy eating self-efficacy, and positive body image.

These findings suggest that university decision-makers evaluate these characteristics and strengthen them among undergraduates to improve the quality of their health by providing counseling preventive programs and CBT to maintain and improve their healthy eating self-efficacy and positive body image. In addition, encouraging students to use and install mHealth applications as part of their daily routine improves their nutrition literacy, which plays an essential role in their health. However, the study was limited by the fact that the sample was drawn from one college at a single university in Jordan, and the study sample consisted of only 10,1% male students due to the low percentage of male students who enrolled in the college of educational sciences at the university of Jordan (7.4%). Therefore, we urge a future study with a larger and more diversified sample size.

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## 7 Authors

**Aseel O. Ajlouni** is an assistance professor of Educational Technology in the department of curriculum and instruction at Al-Ahliyya Amman University. She earned her PhD in Educational Technology from the University of Jordan, Jordan in 2020. She has published several research papers on integrating technology in the classroom, online teaching and learning.

**Fatima Abd-Alkareem Wahba** is an Assistant Professor in the Education Technology department at Middle East University in Jordan. Her research interests include Artificial Intelligence in Education, Employing Technological Innovations, Smartphones and Multimedia Applications in Education.

**Abdallah Salem Almahaireh** is an associate professor in psychological and Educational counseling school of educational sciences at The University of Jordan.

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