DEVELOPMENT OF SPORTS NUTRITION EDUCATIONAL TOOLS (NUTRISPORTEX™): A WEB-APPLICATION FOR MALAYSIAN NATIONAL ATHLETES

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Abstract

The use of electronics or technology, to improve the subjects' knowledge, attitude, and practice (KAP) in nutrition or their compliance in recording their diet, for general primary care is not uncommon. However, there are more to be explored to improve sports nutrition KAP. The objective of this study was to develop a web app tool for athletes to increases their KAP in sports nutrition and to test on their acceptance towards the web app tool. This study was divided into 3 phases. Phase I involves the development of the web app. In Phase II, a focus group of 20 people was recruited to test the web app tool. Phase III was to evaluate the effectiveness of the web app in increasing athletes' sports nutrition KAP and their acceptance of the web app. 30 athletes were recruited to use this web app for a week, a PRE- and POST-intervention KAP questionnaire were given. There was a strong correlation between athletes' attitude towards this tool and intention to use in the future (r = 0.675). The more this web app tool was perceived as useful, the more likely they will visit the web app (r = 0.589). Although the web app was well-accepted among the athletes, their KAP score was significantly reduced after the intervention (p= 0.011). The reduction of scores was due to the lack of consistent usage

on the web app. In conclusion, it requires more facilitating support from the coach, longer training time, reminders, and entertainment features for consistent usage, to improve the athletes' KAP in sports nutrition via the web app.

Keywords: Web app, education tool, KAP, sports nutrition, acceptance

Introduction

With a rising awareness on the importance of sports nutrition in improving athlete's performance, sports nutrition knowledge should be made readily accessible for the athletes to learn and apply it in their training routine. Sports nutrition knowledge such as food selection, timing, frequency and optimum intake can impact the performance of the athletes (Wolinsky & Driskell 2001). Although such books and printed materials are available, reading has been revolutionised from paper to reading off the screen. In this modern age of technology, translating knowledge has been made easier with the help of information technology (Holroyd et al., 2007). Books and journals are now made available in soft copies, allowing their readers to download into their laptops or tablet to read at their convenience. In a recent study done by Bonilla et al. (2015), it was shown that introducing an electronic-based dietary assessment can motivate and educate its subjects into adopting healthier eating habits. This is essential as it proves that by using the right technology to impart nutrition knowledge, the desired outcome had been materialised as there was a change in their lifestyle. Therefore, apart from the printed materials, sports nutrition information should be made accessible through the use of technology, in order to promote and enhance the athletes' knowledge in sports nutrition.

While educating the athletes is essential, it is also important that they apply it in their daily routine. One of the many ways to practice is to change their food intake, and this requires self-monitoring. Traditionally, daily food intake was recorded on papers. However, it was inconvenient for the user to have a paper and pen ready each time. This often results in low compliance in recording their actual food intake. Apart from this, some may try to record their daily intake later by relying on their memory, which often leads to inaccuracy in their reporting. Many studies had looked into developing an electronic base dietary assessment tool (Boushey & Harray, 2015; Lieffers & Hanning, 2012; Hongu et al., 2011). The common aim of these study was to provide an alternative solution from the conventional dietary assessment method, to a convenient and easily accessible dietary recording method for the subjects. These studies had shown that using an electronic tool can improve subjects' compliance to record their diet and can increase the accuracy in recording their diet intake. Hence, apart from educational purposes, the use of technology in sports nutrition can also help the users in their dietary self-monitoring activity.

Despite the promising effects of introducing the use of electronics or technology to improve the subjects' knowledge in nutrition and compliance in recording their diet, it is important to note that many of these were designed for general primary care. Currently, the popular existing electronic base dietary assessment tool such as MyFitnessPal has limited validated, local Malaysia's delicacies. Therefore, this study aimed to develop a

sports nutrition educational web app tool (NutrisportEx^TM) to improve the athletes' knowledge, attitude, and practice (KAP) and allow athletes to record and monitor their dietary intake online, using local delicacies.

Study design & Methods

This study was carried out in three phases. Phase I was the development of the web-app NutrisportEx^TM, which was based on the content from a sports nutrition booklet written by Ainaa and Norhasniza (2007). The sports nutrition knowledge in the book was uploaded to the web app, as a sports educational tool known as FoodExcel^TM. In addition to the sports educational tool, an online diet record feature was added into NutrisportEx^TM as well. The food database was provided by National Sports Institute (NSI), to ensure the food choices were applicable to athletes. Phase II was a focus group to test the functionality of NutrisportEx^TM among athletes. The results obtained from this focus group was used to modify and improve the web app. Phase III was to test the effectiveness of the web app in improving the athletes KAP score, using a pre-validated questionnaire, after using NutrisportEx^TM for one week. The acceptance of the athletes on the web app, NutrisportEx^TM was looked into as well.

Phase I: Development of NutrisportEx^TM

There was two major development site for the web app tool. Firstly, the sports educational tool, FoodExcel^TM which aims to improve the users' KAP. Secondly, the web app works as an online diet record for the user. The prototype for NutrisportEx^TM online food recording system starts with user's registration, where their weight information was extracted to calculate their goal energy requirement with formula from Wong et al. (2013), and macro/ micro nutrients. Then the user was directed to online dietary intake record page, where the server calculated the actual total energy intake, macro and micro nutrients. The system will make a comparison with the goal requirement and tabulate a report for the user. After the user completed the report, they can visit the FoodExcel^TM page to retrieve additional sports nutritional information (Figure 1). The final output of this system was to generate a report on athletes' dietary intake, against the benchmark module.

Phase II: Focus group

A sample of 15 athletes, 3 sports dietician, 2 IT technicians from NSI were recruited, referral sampling was applied. Dietitians and IT technicians of NSI were invited to participate to ensure the feasibility of the web app tool. The athletes involved in this focus group study were active athletes that have an average of 3 years of involvement in their respective sports. All athletes owned a smart mobile phone or laptop. The types of smart phone software were irrelevant as NutrisportEx^TM was a web app that can be accessed via any internet tool. A short 30 min demonstration on how to use the web app tool was given at the beginning of the focus group, followed by 30 min free time to explore the web app. The comments made by all of the athletes were recorded (Figure 2). The result from this focus group study was used to improve the web app.
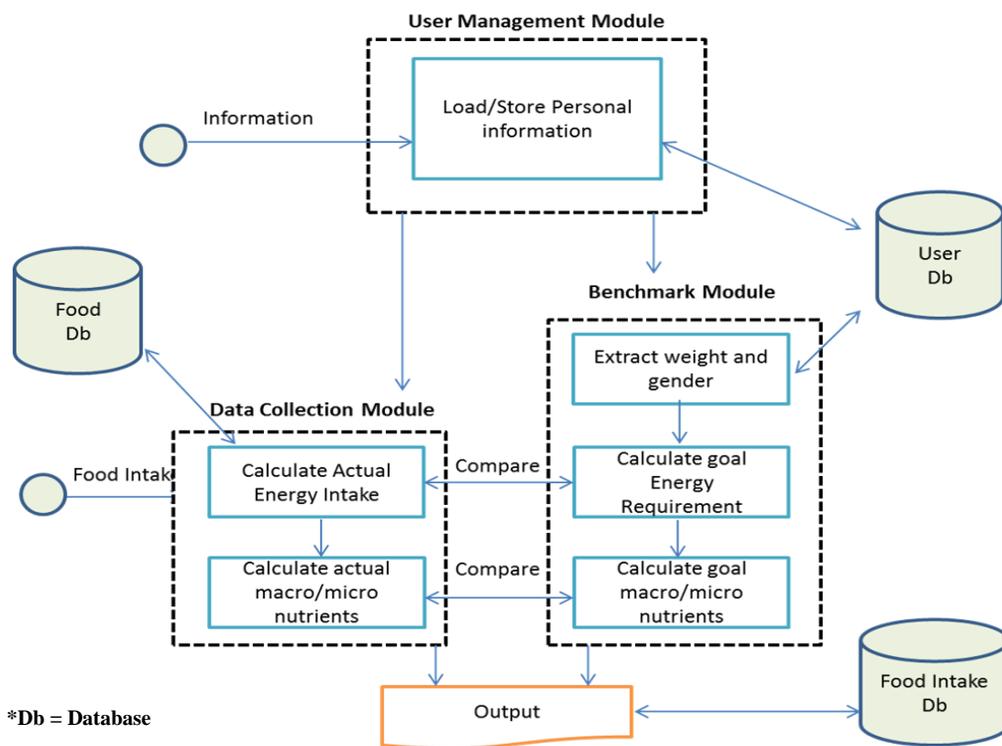
Figure 1: Architecture of NutrisportEx™

Theme 1- What do you think of the food or information content? [Content]
  i.   Finds it hard to locate the food that they want to key in
  ii. Some of the food that they want was not there
  iii. Lempeng & Kuey Tew missing
  iv. Please add up more sports
  v.   Monthly income should be lower, start with RM 500 and below

Theme 2- What do you think of the web app? [User Interface]
  i.   Too complicated and it takes too long to fill in the registration form
  ii. If want to add food, need to go to home page and click on the date again
  iii. Select hour should have a scroll down bar.
  iv. No log out button

Theme 3- [Improving subjects' eating habits]
  i.   It helps the athletes nowadays and allows them to compete with other countries.
  ii. Give good information
  iii. It helps a lot

Figure 2: Response from focus group. Based on 3 themes: content, user interface, improving patient's eating habits

From the small group, it was discovered that the user hardly accessed to FoodExcel™. Most of the user exited NutrisportEx™ once they retrieved the report. This was undesirable, as they were not exposed to the sports nutrition knowledge and defeats the purpose of the

web app tool. Therefore, quick links were added at the NutrisportEx^{TM} home page that leads the user to FoodExcel^{TM}.

Apart from this, short and straightforward quick facts were added throughout the web app to increase the users' exposure of the sports nutritional facts. Additional links to the FoodExcel^{TM}, in their report that was unique to the area that they need improvement, were also added (Figure 3). Most of the user has no problem with using the online diet record system.
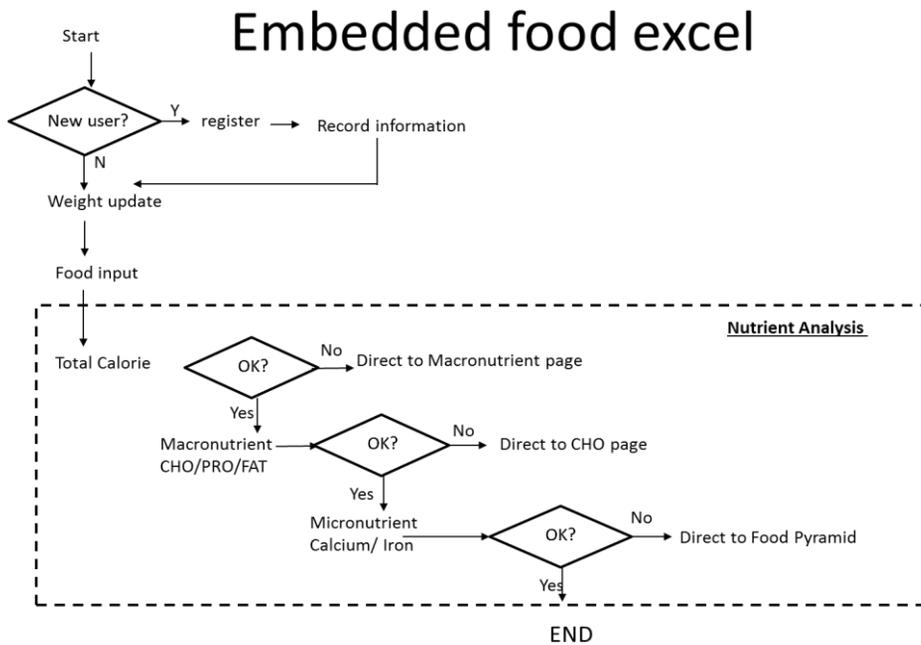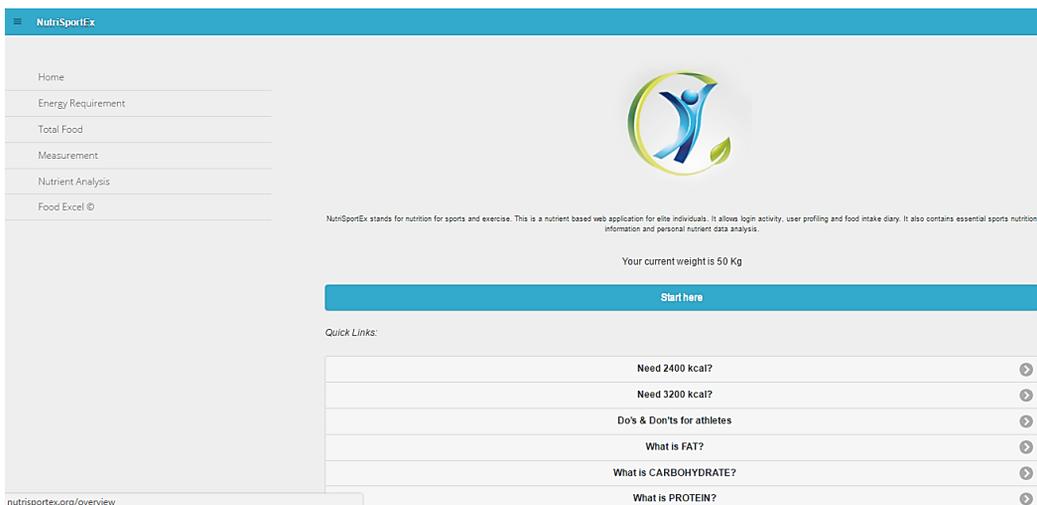

Figure 3: Embedded FoodExcel^{TM}

Figure 4: Homepage of NutrisportEx^{TM}

Phase III: Effectiveness of NutrisportEx^{TM}

The final phase of this study was to test the effectiveness of the web app with a pre-validated KAP questionnaire. The sample size calculation for this phase was calculated via GPower software (version 3.1), with 0.3 for effect size, $\alpha = 0.05$ and power = 0.80. The KAP questionnaire was used to evaluate the changes in athletes' Knowledge, Attitude in General Nutrition, Attitude in Sports Nutrition, Practice after using the web app for one week. On the first day, the KAP questionnaire was given out for PRE-intervention score, followed by 30 min of introduction on the web app. Then the athletes were encouraged to use the web app for a week. The same KAP questionnaire was given at the end of the one-week period for POST-intervention score. The result was analysed using SPSS software (IBM Corp, version 22), paired t- test was applied. An acceptance questionnaire of the web app tool adopted from Castaneda et al. (2007) was used to assess the acceptability of the web app based on their perceived ease of use, perceived usefulness, attitude towards web app and future intention to visit. Pearson Correlation test was used for this parameter.

Results

A total of 30 athletes were recruited for Phase III (Table 1). After the one week intervention of using the web app, there were no significant differences observed between the PRE- and POST-intervention score for each tested domain (Table 2). However, the total score was significantly reduced for Total Score with $p = 0.011$. There were significant differences between male and females' PRE-intervention score, in Attitude-Sports Nutrition and Practice domain. The total score for a PRE-intervention score between two genders was found to differ significantly. Table 3 shows that the higher the user perceived the web app as easy to use, the more useful the web app was to them ($p=0.021$). Apart from this, when the user perceived the web app as being useful, the more likeable the web app was to them ($p = 0.044$) and the higher users' intention to use the web app in the future ($p < 0.001$).

Table 1: Characteristics of participants

Characteristic	Participants
n	30
Gender	
Male	20
Female	10
Age (year)	20.1 ± 1.3
Height (cm)	166.4 ± 6.8
Weight (kg)	$62.7 + 7.8$

Table 2: Comparison of mean scores of KAP by sex

Domain	Mean (SD)		p
	Pre	Post	
Knowledge	8.72 ± 2.35	9.00 ± 2.57	0.609
Male	9.12 ± 2.63	9.19 ± 2.54	
Female	8.00 ± 1.66	8.67 ± 2.74	
Attitude-General Nutrition	44.56 ± 4.36	43.48 ± 3.37	0.140
Male	44.94 ± 4.57	43.31 ± 3.91	
Female	43.89 ± 4.14	43.78 ± 2.28	
Attitude-Sports Nutrition	44.16 ± 4.33	42.68 ± 4.67	0.090
Male	46.19 ± 3.75 [a]	43.81 ± 4.59	
Female	40.56 ± 2.65 [a]	40.67 ± 4.33	
Practice	45.56 ± 4.40	43.43 ± 5.89	0.05
Male	46.94 ± 3.44 [b]	44.25 ± 6.26	
Female	43.11 ± 5.04 [b]	41.67 ± 5.10	
Total score	143.0 ± 10.72	138.48 ± 8.59	0.011*
Male	147.19 ± 9.95 [c]	140.56 ± 9.40	
Female	135.56 ± 7.84 [c]	134.78 ± 5.65	

[a] significant difference between male and female score with p = 0.001; [b] significant with p = 0.034; [c] significant with p = 0.006; *significant difference (p<0.05) between PRE and POST score
Range of score: Knowledge (0-21); Attitude-General Nutrition (13-65); Attitude-Sports Nutrition (11-55); Practices (12-60); Total score (36-201)
Analyzed using paired t-test.

Table 3: Participants Acceptance on NutrisportEx^{TM}

	Mean	S.D.	Correlations Coefficients			
			Ease of Use	Usefulness	Attitude	Intention
Ease of Use	7.6	2.2	1.000			
Usefulness	10.0	2.2	0.021[a]	1.000		
Attitude	10.4	2.3	0.315	0.044[a]	1.000	
Intention	9.9	2.1	0.311	0.000[b]	0.000[b]	1.000

[a] significant difference at p < 0.05. [b] significant difference at p < 0.01
Analysed using Pearson Correlation

Discussion

The acceptance of the website tool among the athletes was high in this study. The higher the user perceived NutrisportEx^{TM} as easy to use, the more useful (perceived usefulness) the web app was to them. However, there was no link between the ease of use and the user's likeability of the web app and future intention of use. The result in this study supported findings from previous studies that suggested perceived ease of use was a strong predictor of perceived usefulness (Castañeda et al., 2007; Schepers & Wetzels 2007; Shang et al. 2005) but not as the predictor to develop satisfactory attitude and warrant their intentions to use the web app tool in the future.

Perceived usefulness is defined as ''the degree to which a person believes that using a particular system would enhance his or her job performance" (Davis, 1989). The result showed that when the user perceived the web app as being useful, the more likeable the

web app was to them and the higher users' intention to use the web app in the future. This result was in line with previous studies that looked into the perceived usefulness as the most influential predictors of IT adoption (Kim et al., 2007; Venkatesh & Brown, 2001; Yu et al., 2005). However, despite the user gave a positive feedback on the web app, most of the subjects did not revisit the web app after the introduction of the workshop.

This study showed that the pre-intervention scores in KAP score for male were significantly higher as compared to female and there was no significant difference in their KAP score after the introduction of NutrisportEx^TM. It was discovered in the record that there was a lack of revisit to the web app after the introduction web app. The lack of revisits can be explained with the following reasons, such as the lack of support to continue using the web app tool, short training time and the lack of entertainment to attract the users to continue the use of the web app.

The lack of support around the users played a role in discontinuing the utilisation of the web app tool. In a review done by Brouwer et al. (2011), it was reported that the more peer supports the user received, the longer time was spent on the intervention web app. Apart from that, it also reported in the Brouwer et al. (2011) study that when the subjects talked about their targeted behaviour with their respective nutrition counsellor, although not significant, had shown a positive relationship with the time spent on the intervention web app. During the introduction of NutrisportEx^TM, in the presence of the coach and other subjects, the subjects had shown a much enthusiastic on using the web app. However, there was little visits to the web app tool after the introduction was over. It was believed that the user might have faced some difficulty in using the web app and there was no one to ask for help at that moment of time. Apart from this, there was a lack of encouragement to use the web app from the couch, as the coach was not part of the intervention process. Therefore, as showed in the previous study, the lack of peer support and counsellor support in the use of NutrisportEx^TM were believed to be part of the reason for the lack of visits to this study's intervention web app tool.

Another reason for the lack of visits to the intervention web app tool in this study may be due to the brief training that was provided in this study. In a study conducted by Boushey and Harry (2015), they taught their participant to take images of food with a mobile food record over a meal session. They suggested that longer training may be required to ensure the information that was given was adequate to aid the user. The total training time provided in this study was approximately 30 min and a short, one-page web app manual was provided. Similar to the study by Boushey and Harry (2015), it might be the lack of sufficient training time that caused the web app to be ineffective. Although the web app manual was provided, it was believed that manual might not be appealing or enough to aid the users to use the web app tool on a daily basis. It was possible that the manual was difficult to carry around and not convenient to the users. Not only so, but a lack of online tutorial in the web app itself may also hinder the use of such intervention web app tool.

The introduction of entertainment that comes with the food recording intervention has shown successful results (Boushey & Harray 2015). However, unlike the previous studies, only the web app tool was introduced in this study. There were no entertainment, games or extra incentives were given throughout the study. It was believed that the users may feel

bored and unmotivated to use the tool. During the one-week period, no reminder was given to the subjects to remind them to visit the web app. Brouwer et al. (2011) suggested that email or phones might be useful in promoting repeated visits. Other notification through social media such as Facebook, Twitter are also encouraged. It will also encourage interactions and encourage the user to continue using the web app tool.

While this study illustrated a few limitations, the strength of this study was the use of pre-validated KAP questionnaire, specifically for athletes, in its intervention. Apart from this, as of this publication, we believe that this was the first study that looks into the effectiveness of a web app in improving athletes KAP in sports nutrition. This study set a good foundation for future research in developing an effective web app tool that can be used to enhance athletes' performance by improving the athlete's knowledge and practices in sports nutrition.

Conclusions

In conclusion, although the web app was well received by the athletes in terms of usefulness, it was not effective in improving the athletes' KAP score. The lack of continuity in using this web app, insufficient social support, short training time, no reminders and lack of entertainment features may be the reason for such result. For future studies, we recommend the participation of the coach/ dietitian, a minimum one hour of training or adding some game features to ensure the continuity in using a web app.

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