Research Article

DEVELOPMENT OF NUTRISPORTEX^{TM}-INTERACTIVE SPORT NUTRITION BASED MOBILE APPLICATION SOFTWARE

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ABSTRACT

NutriSportEx™ mobile application was developed for both Android and iOS platforms, as an open source and on Linux-based operating system for mobile devices such as smartphones. It calculates total energy requirement based on user's weight. It offers users the ability to plan and record their meals from a food database and provides nutritional information of the selected food. *NutriSportEx^{TM}* tabulates dietary intake and generates a nutritional analysis report in the form of infographics. The nutritional report covers details such as total calorie intake and macro-and micro-nutrients intake.

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The food excel feature which is an education module provides additional information such as dietary guidelines, micronutrients, macronutrients, food guide pyramid and food planning with sample meal set for 2400 and 3200 kcal. *NutriSportEx^{TM}* mobile application has great potential to be well accepted.

Keywords: sports nutrition; athlete; mobile application.

1. INTRODUCTION

Technology is constantly evolving and changing the world drastically. It has transformed almost every field through new technologies, globalization and innovation; nutrition education is no exception to this [1]. The sport nutrition educators needs to rethink their teaching and need to adapt to the fast changing need of the world and society [2]. In this regard, there is a need to explore how the sport nutrition education is currently taught, in particular, how available e-learning and technologies can be employed to enhance learning and teaching, as well as to embrace quality learning trends such as personalized and mobile learning.

The usage of smart phone and mobile data has grown exponentially in the last five years. This has resulted in a surge in mobile application usage [3]. Indeed, in 2016 alone, Apple Compant Inc. had declared that two million mobile applications were downloaded by more than 130 billion times [4]. In a similar trend, health education in the form of mobile tools has gained much popularity over the last decade. More importantly, these mobile tools have been found to be more effective, especially in promoting healthy dietary habits. There is also enough evidence to suggest that mobile learning or computer based nutritional education is more effective in changing people's eating habits and it is now being adopted by nutrition educators [5]. With technology based intervention such as web or mobile tool, it is possible to provide pertinent information that is based on personal trait such as eating behaviour, perceived barriers and attitude. Since these information is personally relevant and easily accessible, this can mimic "person" to "person" counselling [2].

Optimal nutrition enhances exercise performance and the recovery from strenuous exercise. Over the past two decades, various studies have clearly demonstrated the beneficial effects of

nutrition on exercise performance [6]. There are a lot of evidences to suggest that eating and drinking habits can affect health, body weight and composition, substrate availability during exercise, recovery time post-exercise, and overall athletic performance [7]. However, the diets of athletes were often reported to be nutritionally inadequate compared with sport nutrition and general population recommendations due to overly restrictive eating habits, misconception, social norms, fast food, obsession with weight and food preferences. In addition, athletes do not have sufficient knowledge on nutrition [8].

Athletes can acquire knowledge by variety of providers including coaches and athletic trainers, sport dietitians, nutritionists, sport scientists, medical practitioners and from a variety of sources including school or tertiary-education programs, books, sport-specific magazines, the mass media and increasingly the internet. However, the information provided may not be exhaustive and there is no mobile application available for Malaysian population [9]. In this regard, there is a growing need for sports nutrition counseling and education sessions to help athletes improve their eating habits [10]. There is also need to develop a suitable tool for intervention such as mobile application to educate and to act as a personal nutritional product resource guide that can be used by Malaysian national athletes when required. Hence, it is important to develop proper nutritional strategy in the form of mobile application which can help to improve nutritional knowledge, attitude and practice. This, in turn, helps athletes to improve their nutritional status, physical and physiological characteristics such as fitness and performance. In this article, we describe the aims, key features, software development of an exclusive Malaysian based nutrition application *NutriSportEx™*.

The objectives of this study is two folds; firstly to develop an interactive mobile application software called *NutriSportEx™* and secondly to address the limitations that arose while undertaking our previous web-based nutritional tools, which was also titled *NutriSportEx™-web based application*.

2. METHODOLOGY

2.1. Material and Methods

The prototype of this software application was developed by customizing the calorie

specification and dietary intake details according to serving size of local Malaysian foods. Additionally, this application was designed to able to work offline and also containing additional features such as energy requirement, total food/energy intake, nutrient analysis and food excel.

2.2. NutriSportEx^{TM}- Development of Sport Nutrition Based Mobile Application

The *NutriSportEx™* web application was well accepted and perceived as useful, but it was not a convenient tool as it needs internet accessibility and laptop/ smartphone to access the web page. In addition, features like reminders and other entertainment features were lacking. To address these issues, *NutriSportEx™* Mobile Application was developed.

NutriSportEx™ is an application developed in the Android and iOS platform, an open source and Linux-based operating system for mobile devices such as smartphones. By using Android as its platform, *NutriSportEx™* offers a unified approach to usage for mobile devices which means that the application will be able to run on different devices powered by Android. The source code for *NutriSportEx™* was available for free under open source software licenses for Android applications (Apache License version 2.0 and the rest, Linux kernel changes under the GNU General Public License version).

NutriSportEx™ was distributed via an Android Package Kit (APK), a package file format used by the Android operating system for distribution and installation of mobile applications and middleware. All parts of the software were compiled as *NutriSportEx™* application which includes resources, assets, certificates and manifest file. A user can install the *NutriSportEx™* APK file directly to a device from a desktop computer using a communication program such as adb (Android Debug Bridge) or from within a file manager application in a process known as side loading.

The prototype was developed by customizing the calorie specification and dietary intake details according to serving size of the local Malaysian foods. Additionally, this Mobile application can work offline and have additional features such as energy requirement, total food intake and nutrient analysis. The final version of this interactive mobile application has been developed and being validated. Once installed, the user can access the application and use it for the intended purposes. Upon completion of registration, the user will be able to

calculate total energy requirement based on his/her weight. Based on the user's dietary intake, the system will calculate actual energy intake and provide details on macro/micro nutrients. The information gathered will be used to tabulate a report for the user on his/her dietary requirements. This mobile application will also alert the user with calories of the diet chosen and provide useful tips related to dietary intake each time they access the application and its pages.

Data captured by the user using the *NutriSportEx™* is stored as delimiter-separated values in a text file within the application. These data are stored within the user's mobile phone and will then be transferred via the internet to a virtually hosted database through a sync facility. The database is hosted in this domain: http://nutrisportex.org/.

Researcher can then access the back end admin system developed in http://nutrisportex.org/ via a given user ID and password. The admin panel enables the researcher to analyze the data collected from the user's application.

3. RESULTS AND DISCUSSION

NutriSportEx™ a mobile based application has been developed in Android and iOS platforms have been completed and are available in two languages i.e. English and Malay within the mobile application. It consists of user profile, calorie requirement, menu plan, pre- and post-training diet plan menu and food intake analysis. Data synchronization to the server has been successfully integrated and the application was fully functional. A web administrator page has been developed for management of user data by institutions. The application is currently made available on Google Play and Apple App Store platforms.

3.1. Nutrisportex^{TM} Features

3.1.1. User Profiles

The prototype for *NutriSportEx™* mobile application starts with user's registration with their particulars such as username, password and email address. The user needs to select drop down list under various categories such as athlete category, type of sport, education level, nutrition info source, injuries and health status etc. to complete their profile.

Upon registration, the user will be directed to the home page. The home page will display the

username with energy requirement and total energy intake. In addition, it has a feature to record the food and weekly weight monitoring. The weekly weight will be displayed in the form of infographic which is easy to follow. An additional feature in the home page is quick links for educational module. This includes fat, protein, carbohydrate and the number of servings that should be consumed.

Apart from these quick links, the home page also has a feature of useful education tips. These are short sentences related to dietary intake each time it appears as the user access the application and its pages.

Energy requirement: *NutriSportEx™* calculates total energy requirement based on user's weight. Actual energy and nutrient intakes is estimated from user's dietary intake profile. *NutriSportEx*^{TM} tabulates dietary intake and generates a nutritional analysis report in the form of infographics as shown in Fig. 1.
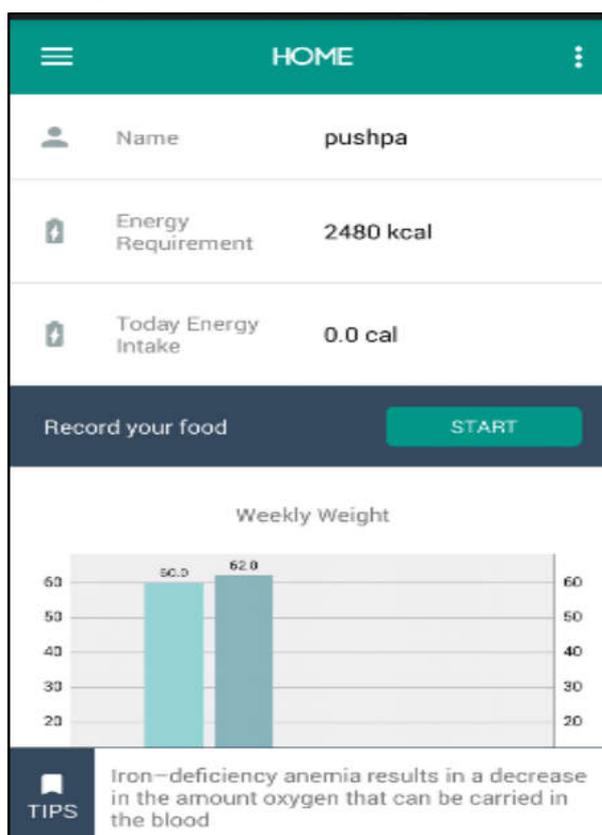
Fig.1. Home page of the *NutriSportEx*^{TM} mobile application

3.1.2. Food Log

NutriSportEx™ also offers users the ability to plan their meals from the food database. It was developed as a dynamic feature, so that users are allowed to mix and match the given food

menu sets from different food category database provided in the mobile application. Since different users have different energy requirements depending on their profile, the energy requirement value is displayed as reference for menu planning activity. The nutritional information includes calories, macro and micronutrients of the selected food. It also varies according to serving size (Fig. 2).
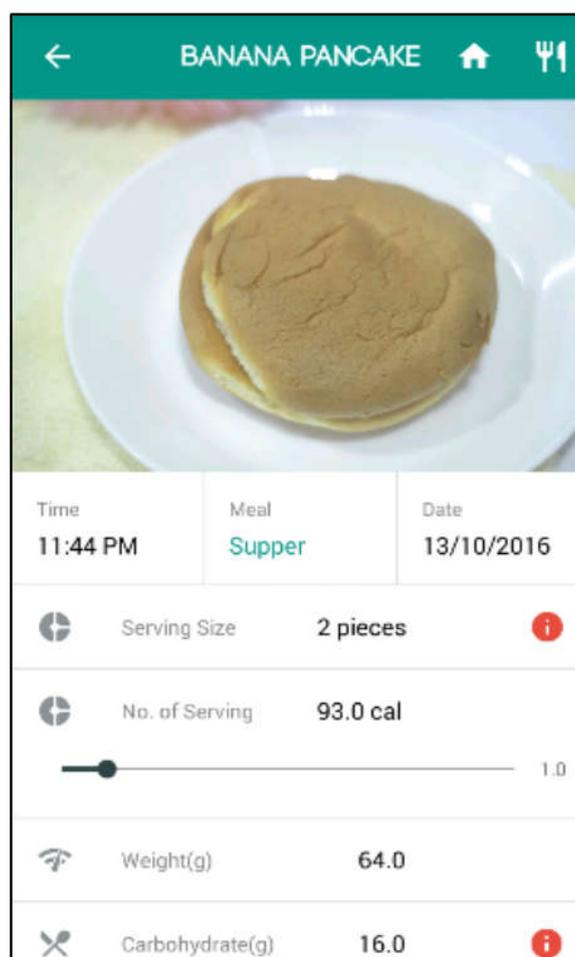
Fig.2. Nutritional information for banana cake as displayed in the NutrisportEx mobile application

3.1.3. Pre- and Post-Training Food Menu

NutrisportEx™ will provide food planning (sample meal set for 2400 and 3200 kcal) with four different sets of menu (Set A, B, C and D) for pre- and post-training under 2400 and 3200 kcal as shown in Fig. 3.

Fig.3. Pre-training menu for 2400 Kcal

3.1.4. Food Intake Analysis

The diet of athletes are often reported to be nutritionally inadequate compared with general population recommendations due to certain dietary practices limited by athlete's lack of knowledge on nutrition [11]. Maintenance of lean tissue mass, immune and reproductive function and optimum athletic performance is achieved by maintaining proper energy balance. Energy balance is defined as a state when energy intake (the sum of energy from food, fluids and supplement products) equals energy expenditure (the sum of energy expended as resting metabolism, the thermic effect of food and any voluntary physical activity) [12].

The nutrient analysis report is generated as mean of the best three calorie intakes in a week and covers details such as energy intake, macro- and micro-nutrients. The under-reporting day is indicated with red color, while normal or over reporting are indicated in blue. If the reporting status does not meet the criteria, the analysis is will not be performed. Meeting energy needs is the first and foremost nutritional priority of all athletes (Fig. 4).
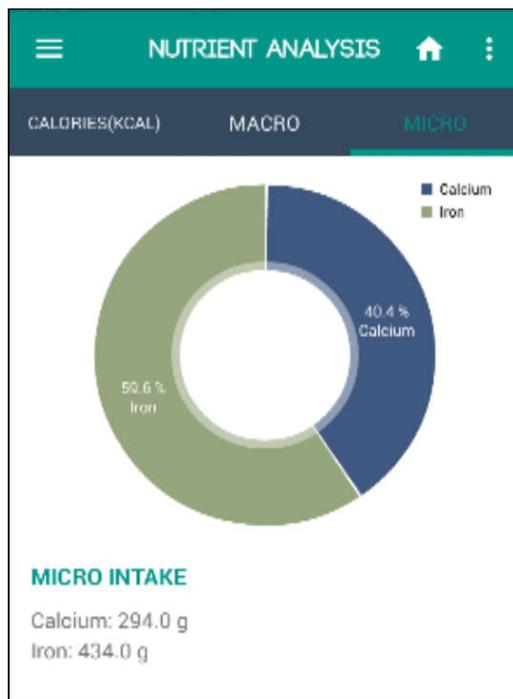
Fig.4. Nutritional analysis report (micronutrient)

3.1.4. Food Excel

The food excel feature covers the education module and it contains additional information such as dietary guidelines, micronutrients, macronutrients, food guide pyramid and food planning as shown in Fig. 5.
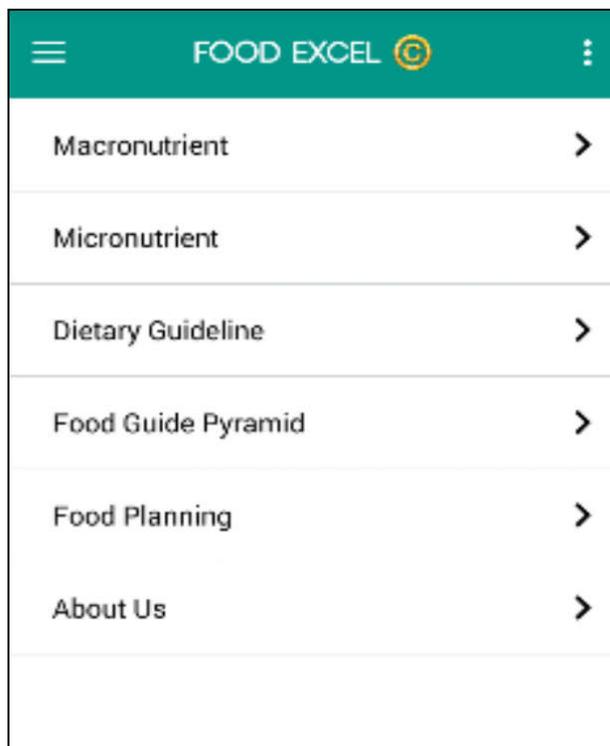
Fig.5. Food excel

Information in every section of the module is provided in the form of pictorial format that is easy to understand. Below is one such illustration of the macronutrient section which provides information on carbohydrates, proteins and fat (Fig. 6).
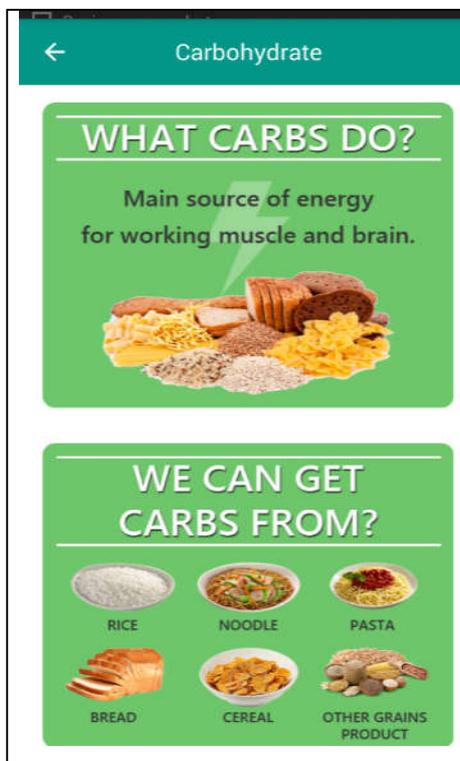
Fig.6. Information on carbohydrate

Learning by mobile is quite popular because of the lot of factors; mobile devices are portable, easily accessible and can be used as and when required. Hence, the researchers have also realized the potentials of mobile applications to enhance the learning among athletes [13]. Many existing mobile applications not only help to track food but it can also improve the knowledge and help in weight loss. Popular nutritional applications in this category are MyFitnessPal, MyPlate and Fat Secret etc. MyFitnessPal allows the user to select the food items from the largest food database and also saves the favorite foods. But, MyFitnessPal like other mobile applications works on the go. But if there is no wireless signal, it is impossible to log on to even record anything in the application. Additionally, many applications lack the information on the Malaysian local food [14].

In comparison with other applications, food database of *NutriSportEx™* is not large but includes all the food items which are served at National Sports Council (*Majlis Sukan Negara*) café and also include other locally available Malaysian food items. Since Malaysian athletes

who train at National Sports Institute (ISN) also consume the food which are served at MSN café, this mobile application offers users the ability to plan and record their meals from a food database and additionally provide nutritional information of the selected food. *NutriSportEx^{TM}* also tabulates dietary intake and generates a nutritional analysis report in the form of infographics. Infographic is very easy to interpret and will provide additional information such as calories consumed, details of micronutrients and macronutrients. Additionally, *NutriSportEx™* works offline hence it can be accessed everywhere and anytime. The food excel feature which is an education module, food guide pyramid and food planning with sample meal set for 2400 and 3200 kcal will be a value added features in comparison with existing mobile applications in the market.

4. CONCLUSION

NutriSportEx™ is convenient to access as a mobile-based application and could easily expand into public domain. Since it contains nutrient details of local Malaysian food, it will be a value added feature in comparison with existing mobile applications. *NutriSportEx™* can serve as a useful personal digital nutritional guide for Malaysian national athletes and other active individuals.

5. ACKNOWLEDGEMENTS

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