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Nutritional assessment application for mobile phones with Android system

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Abstract

New nutritional guidance tools have been used by various health professionals. Among these are health-oriented cell phone applications with several resources that can help the user maintain a healthy diet. In this context, this study had as main objective to build a nutritional assessment application for mobile phones with Android system. An app called *Diet Help* was developed, with seven screens: "User Profile", "Food Record", "Summary of the day", "Diet history", "Food calories", "Healthy Eating" and "Delete User". The main programming languages used were Android Java, Javascript and SQlite for database. *Diet Help* allows calculation of body mass index, nutritional status according to age and sex, informs recommended daily energy intake, the amount of calories and nutrients consumed in each meal and if consumption (ou intake) is in accordance with the recommended levels for the user age and sex. It also allows users to find the amount of calories and nutrients per 100g of any food and provides information on healthy eating based on the *Food Guide for the Brazilian Population* [*Guia Alimentar para a População Brasileira*].

Key words: Nutritional Assessment. Patient. Diet. Cell Phones.

Introduction

For a healthy life, adequate food and nutrition as well as regular physical activity are indispensable.[1] The dietary pattern of an individual may define his or her health status, growth and development throughout life.[2] Adopting healthy eating habits based on national and international nutrition parameters can reduce the risk of diseases, such as non-communicable diseases (NCD), which include some kinds of cancer, diabetes and cardiovascular diseases.[3]

Scientific and technological advances in the past decades have increased foods availability and facilitated consumption, allowing stressful and time-consuming tasks to be performed in a short period of time and with minimum energy expenditure, resulting in time and money savings. In principle, such changes would improve the nutritional status of the world population, contributing to their longevity and quality of life. However, what can be seen is an increased consumption of fats (especially saturated fats) and sodium, in detriment of fruits and vegetables, added to more physical inactivity. [4]

Modernity led people to seek for diversity, represented by new products, services and eating places, which is associated with the desire of optimizing the meal time. Examples include processed products and self-service restaurants.[5] Eating out of the home is also a factor that contributes to an increased prevalence of NCDs, because most of the meals offered in these places are less healthy, with more calories, sugars, salt and fats, and low in dietary fibers and rich in sodium, when compared do home-cooked foods.[6]

To help individuals expand their awareness on appropriate food choices and prevent the development of NCDs, new tools, such as the Internet, have been used by various healthcare providers to disseminate information on healthy eating and diseases prevention. Among the new tools, mobile phones have gathered a variety of features, and making or receiving calls is no longer the only use of these devices.[7] The resources found in today's mobile phones are fast and easy to use, providing an easier access to information and better support for multimedia applications.[8] Most of the applications are free, which enables experimentation of diverse products. In addition, health-related applications are among the most popular features.[9]

In this context, the main objective of this study was to develop a nutritional assessment application for mobile phones with Android operating system.

Methodology

This is a study through which an application for nutritional assessment was developed, to be downloaded and installed in Android cell phones. To develop it, the following languages were used:

- *Android Java*: standard language for the development of apps for Android platform. Used for the software initial upload.
- *Apache Cordova*: a set of APIs (application programming interface) which allow that an Android app runs in the native form and yet be developed using only HTML, CSS and Javascript.
- *JavaScript* and *JQuery Mobile*: uses Javascript (via JQuery Mobile library) to implement the system functions as well as the interaction with the user.
- *HTML* and *CSS*: HTML is a mark-up language used to create graphical interface. HTML allows to define the content to be presented, and CSS to determine the visual presentation of the content.
- *SQLite*: database used in mobile apps.

The application consists of an initial screen, where the user has six options:

First option: it allows users to fill out the **User's profile** with personal data, such as: sex (female/male), date of birth (dd/mm/yyyy) and degree of physical activity (sedentary, lightly active, active, and very active). The user is also asked to provide information on weight (kg) and height (m) for calculation of the body mass index (BMI) by means of the formula BMI (Kg/m2) = W/H^2. BMI is classified according to the growth curves described by the Ministry of Health, if the user age is between 10 and 18 years.[10] If the user age is between 19 and 60 years, classification is according to the World Health Organization,[11] and if it is over 60 years, the individual is classified according to the Pan-American Health Organization.[12]

When the user accesses the system for the first time, completion of the profile is mandatory. Any further alteration will be at the user's discretion. In this same screen, the user can edit the input data. There is also the option to enter a new profile if there is another individual using the same mobile phone. Other users' profiles have the same options that the main user has.

Every time a new profile is entered, the user will receive the following notice: "The information and suggestions contained in this application are merely informative and do not replace the nutritionist' advice and monitoring."

Based on the age, sex, weight, height and physical activity (FA), the Estimated Energy Requirement – EER is calculated using the formulas described in the *Dietary Reference Intake* (DRIs).[13] If the patient is within the normal range, EER is calculated with the informed weight, but if the user is in the range of malnutrition and overweight, the ideal weight is calculated by the following formula: Ideal weight = $21.7/H^2$. If the user is in the Class 1 obesity range, the ideal weight is calculated as follows: ideal weight = $27.4/H^2$. If the user is in the Class 2 obesity range, the ideal weight is calculated by the formula: ideal weight = $32.4/H^2$. And if the user falls in the range of morbid obesity, the ideal weight is calculated by the formula: ideal weight = $54.9/A^2$.

Distribution of the macronutrients is made according to the DRIs, being 45-65% of carbohydrates in the total calorie intake, proteins (10-35%) and lipids (20-35%). These data are shown to the user in the icon below the EER value.

Second option: used to complete the **Food Record**. The individual is required to inform the meal (breakfast, morning snack, lunch, afternoon snack, dinner and supper), which food was eaten and respective amount (grams or home cooking measure). As the user enters a new food, the system informs the amount of calories consumed until that moment. To calculate the calories and other nutrients consumed, as well as for reference of home cooking measures, the application uses the Table of Nutritional Composition of Foods Consumed in Brazil – IBGE.[14] The amount of calories is calculated by the following formula: Kcal = carbohydrates (g) * 4 + proteins (g) * 4 + lipids (g) * 9.

Third option: it is the **Summary of the Day**, where the user has access to all information relating to the food consumed, including the amount of calories, percentage of calories that corresponds to carbohydrates, proteins and lipids, quantity of cholesterol, dietary fiber, vitamins and minerals. The app assesses the fat-soluble vitamins (A, D, E and K), water-soluble vitamins (thiamine, riboflavin, pyridoxine and niacin), vitamin C and minerals (calcium, iron, sodium and potassium).

Fourth option: consists of the **Diet History.** The user has access to all data relating to the foods consumed until that moment, separated by date. In this option, the user can identify whether the intake of nutrients is above or below the levels recommended by the DRIs. If the intake is according to recommendation, data will be informed in the green color; if inadequate, they are displayed in red.

Fifth option: used to check for the calories intake (**Food Calories**) of any food, according to the IBGE Table. [14] It also informs the amount of proteins, carbs, lipids, cholesterol, dietary fiber, fat-soluble vitamins (A, D, E and K), water-soluble vitamins (thiamine, riboflavin, pyridoxine and niacin), vitamin C and minerals (calcium, iron, sodium and potassium) per 100 grams of food.

Sixth option: used to access the **Healthy Foods** screen, where the user has information about the program objectives, functionalities and hints for a healthy diet, based on the *Food Guide for the Brazilian Population* (*Guia Alimentar para a População Brasileira*) including the "Ten Steps for a Healthy Diet" described in the same document.[15]

When the system is inactive for 48 hours, i.e., the user has not completed the food record in this period, the following notice is displayed: "Be sure to record your diet".

All users' data are sent via the Internet and stored in a server, where the users receive an identification code to preserve their identity.

Results and discussion

An app for nutritional evaluation for Android mobile phones was successfully developed and was named *Diet Help*.

To develop it the following programming languages were used: *Android Java*, *Apache Cordov*, *Java Script*, *JQuery Mobile*, *HTML*, *CSS* and *SQLite*. Most of the languages used in this app was also used by Fernandes et al.,[16] when they developed a web software and mobile devices to help users follow a healthy diet, combined with the practice of physical exercises.

The app offers seven functionality options to the users, as shown in Figure 1.

Figure 1. Main menu of the application. São Paulo, 2014.

In the first screen of the application, each new user is registered and the following notice appears: "The information and suggestions contained in this application are merely informative and do not replace the nutritionist's advice and monitoring." This information was included in the application to meet the provision of the Code of Ethics for Nutritionists, chapter IV – on the professional responsibility, article 6, paragraph XVII: "Nutritionists cannot provide consultations, make nutritional diagnoses and prescribe diets over the Internet or any other communication means that cannot be deemed as in-presence assistance".[17]

After registration, the user completes the required information with personal data, which includes name, gender, date of birth, physical activity factor, weight, and height, and the application informs the user's BMI and the daily needs of energy and nutrients (Fig. 2).

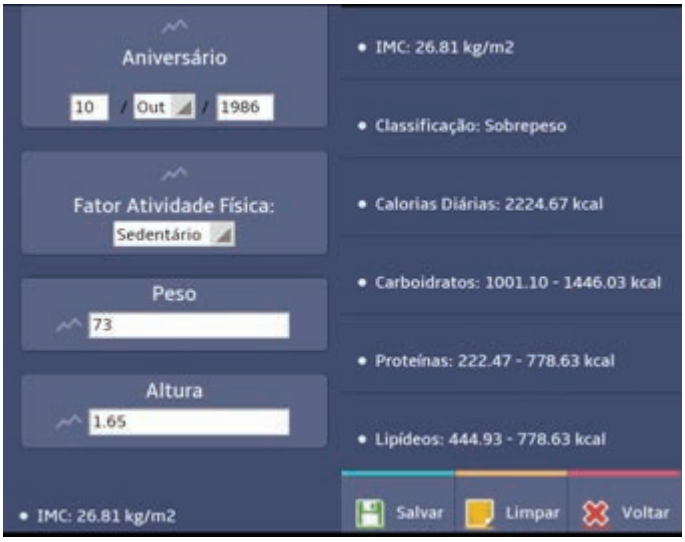

Figure 2. "User Profile" screen. São Paulo, 2014.

The *Diet Help* app calculates the energy needs, based on the equations proposed by the DRIs. Although this methodology is different from others used by researchers such as Lewandowski[18] and Trindade et al.,[19] who used the Harris and Benedict's formulas, we decided for the DRIs equations because they have been the most used method recently.

Fig. 3 shows the "Food Record". The food record is a tool that allows to assess the individuals' current diet and estimate their energy and nutrients intake. The user should enter all foods and beverages consumed in one or more days.[19]

Figure 3. "Food Record" screen. São Paulo, 2014.

The "Summary of the Day" shown in Fig. 4 allows users to visualize how many calories and nutrients they have consumed until that moment, according to each meal. The app also informs whether the counts are adequate or inadequate according to the recommended levels.

Figure 4. "Summary of the Day" screen. São Paulo, 2014.

"Diet History" (Fig. 5) is a compilation of the "Summary of the Day". It is possible to have access to all diets recorded by the users according to the days of the week. With data of three, five or seven days, preferably alternating, including one of the weekend days, it is possible to identify the characteristics of current food intake, with the types of foods and dishes, as well as the most frequent meal times.[20]

Figure 5. "Diet history" screen. São Paulo, 2014.

In the "Food calories" screen, the users find out how many calories, macronutrients and micronutrients per 100 g of any food included in the IBGE Table, as shown in Fig. 6. The work performed by Fernandes et al.[16] also allows users to search for foods and their nutritional properties – in this case, the foods record for this purpose is done manually by a nutritionist.

Figure 6. "Food Calories". São Paulo, 2014.

The option "Healthy Diet" comprises food guidance based on the recommended dietary allowances proposed in the *Food Guide for the Brazilian Population*[15]. This guide provides guidelines for a healthy diet with specific messages to the population, and can also be used by healthcare providers.[21] Finally, the user has the option to quit the application and may delete all information recorded in the *Diet Help*.

Thus, the developed application intends to be a tool for nutritional guidance to help users choose foods properly, help prevent the development of diseases and improve their quality of life.

Conclusion

A nutritional assessment app for mobile phones with Android system was successfully developed. This tool can help individuals learn how to make good food choices and prevent the development of NCDs.

The app was named *Diet Help* and used the following programming languages: JavaScript, JQuery Mobile, HTML, CSS and SQLite. It offers seven functionalities to the user, namely: User Profile, Food Record, Summary of the Day, Diet History, Food Calories, Healthy Eating and Delete User.

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