Original scientific paper
UDC 613.2:[621.375.721.5:004455.1

BALANCED DIET CALCULATOR - DEVELOPED ANDROID APPLICATION

Pavle Stojanovski[1*], Saso Koceski[1]

[1]Faculty of Informatics, Goce Delcev University,
Krste Misirkov 10-A, 2000 Stip, Republic of Macedonia

[*]e-mail: stojanovskipavle@gmail.com

Abstract

Due to the fast development of smart phones in the last couple of years, each day a large dynamics in the application stores is noticed as well, a large number of academic papers have been written in that area. On the other hand, based on a many epidemiological studies, the World Health Organization makes a classification of the risks for getting different diseases associated with excess body mass. For this purpose, we recognize needs for developing a new smart phone application for individual balanced diet calculation based on personal data.

In the first phase of this work was defined medical scientific literature for the accurate definition of the basic necessary parameters. Furthermore, for all calculations, a widely medical recommendation was used. The Eclipse with Android Development Toolkit, which supports plenty of libraries for application developing, was used.

In the developed application for balanced diet, each individual has to enter his/her own parameters: gender, height (cm), mass (kg), and a desired goal of mass decrease/increase expressed in percentage (%). Important parameter which is taken into consideration in the daily food intake recommending is personal physical activity. Based on the entered data, basal metabolic rate (BMR) due the algorithm is calculated. Furthermore, on the screen the recommended daily intake of proteins, carbohydrates and fats is showed.

Today's generation of smart phones and their originality, mass usability, and computer characteristics, represents an ideal platform for the calculation of the required nutritional intake in a way which is available and acceptable almost to everyone, and has a potential for a significant positive effect on people's healthy life.

***Key words**: BMR, Diet, Android Application.*

1. Introduction

Several leading health risk factors: smoking, alcohol consumption, high blood pressure and cholesterol, obesity, low fruit and vegetable intake as well physical inactivity were identified for nearly 60% of the European population diseases [1]. In healthcare system of any country, prevention and managing of these health risks are included. Taking into account, the complexity of the problem, individual effort is principal in disease prevention i.e., managing the risks before they develop into serious health problems.

Based on a large number of published epidemiological papers, the World Health Organization makes a classification of the risks for getting different diseases associated with obesity and overweight [2]. Obesity is defined as a medical condition that causes abnormal accumulation of fat in the body [2]. The analysis of the population of the Republic of Macedonia show that overweight is more than actual problem for health system. The results show that 60.5% male and 47.8% female older than 20 year are overweight and more than 20% of adult in the country has problem with obesity [3, and 4]. Since the primary cause of obesity and overweight is an energy imbalance between energy consumed and energy expended, appropriate body weight may be achieved by balanced diet and physical activity.

Adequate balanced diet requires the estimation of energy requirements on daily base in order to prevent under nutrition and over nutrition. The daily energy expenditure involves basal expense, and thermic effect of food physical expense. The basal expense represents 60 to 75% of the daily energy expenditure and includes the energy spent with the maintains of the organism's vital functions. The energy spent with physical activities represents 15 to 30% of the daily energy expenditure and changes according to the individual's physical activity level [5]. Basal metabolic rate (BMR) is the rate of energy expenditure by humans in the rest, expressed in calories per hour per kg body mass.

At the same time, the pace of life of the modern man is increasingly faster, whereas his physical activity is less frequent. In order to save time, people use vehicles, they do not take walks, and the additional physical activities such as sports have become real luxury. Another important characteristic of modern life is the growing presence of smartphones in people's everyday lives. It is provided by the fact that, in the past few years, smart phone sales have grown intensively. As of November 2014, Android has dominant smart phone market share, with nearly 85% of the market share in the second quarter of 2014 [6]. The Android operating system provides the core smart phone experience, but much of the user experience relies on the third-party applications. To this end, Android has numerous marketplaces where users can download third-party applications that enable easy access for various purposes.

Also the modern technology allows developments of the smart phones offer giving the possibility for undertaking such researches. Android applications have been reported by developers and academic community. These smart phone applications have found their place in different areas of science. For example, besides their importance for IT alone [7, 8], they were increasingly researched and applied for health purpose. There are various applications that help an individual to manage health habits on a daily basis. Some of them are citied in many references given below [9, 10, 11 and 12].

From above mentioned information, the idea for developing a new smart phone application and the development of this application served as a base of this paper. The major goal was to develop application for calculating a balanced diet for each user based on individual data. In order to define all necessary parameters in application, the appropriate scientific literature were used. It is also worth mentioning that this application is in Macedonian language and it will help users to better understand their eating habits. Another advantage is possibility for nutrition's, using the individual data for research purposes. The developed application for balanced diet already published on Android market is presented in this paper.

2. Materials and Methods

This application was developed using an Android Software development kit (SDK) and a compatible software development environment. The Android SDK provides developers with the necessary set of tools and libraries needed to build, test and debug applications on the Android platform. It was downloaded from the Android official website (https://developer.android.com/sdk/index.html?hl=i).

The Android SDK provides an emulator, which is a virtual mobile device, which runs on the computer and enables the user debug and test applications without a physical device. The specification of the emulator is defined, and can be edited, by the developer using the Android virtual devices ((AVD) manager, which is a graphical user interface used to configure and manage AVDs.

This project was built in the Eclipse software development environment, which supports multiple programming languages and operating systems, and it is free to use under the Eclipse Public License.

The Following architectural diagram shows the different modules that make up the Balanced diet calculator application.

The proposed android architectural framework and module development as presented above encompasses four modules: (1) Basal metabolism rate calculator (BMR). (2) Goal defined. (3) Balanced diet calculator. (4) Meal planer.

Figure 1. Android architectural framework and module development

(1) Basal metabolism rate (BMR) calculator module

Those module calculate the basal metabolism rate (BMR) in calories for person based on the body mass, height, age and gender using the Harris and Benedict equations [13]:

Men: BMR = 66.473 + (13.7516 x *m*) +
+ (5.0033 x *h*) – (6.7550 x *T*)

Women: BMR = 655.0955 + (9.5634 x *m*)
(1.8496 x *h*) – (4.6756 x *T*) (1)

Where, *m* is body mass in kg; *h* is body height in cm; *T* is age in years.

(2) Goal defined module

In this module the basal metabolism rate values according to individual physical activity is corrected. In the Table 1 the correction coefficients [14] are shown for man and women separately.

Table1. Coefficients for physical activity

	Light exercise	Moderate exercise	Heavy exercise
Man	1.55	1.78	2.1
Women	1.56	1.64	1.82

Next step of this module is computes the caloric values BMR for the actual body mass as well for the defined goal. User defined the goal on the interactive menu with choice one of six options. There are the possibilities: just losing the mass and next five choices are the losing mass specified in %. As a result, this module give the daily calories intake for kipping body mass on the same value as well daily calorie intake for specified goal. Furthermore frequencies of losing mass in kg on weekly, monthly and yearly base is given.

(3) Balanced diet calculator module

Based on the computation of the BMR, and the users specification of the dally frequency of nutrition's in %, Balanced diet calculator calculate daily intake on separate nutrition's on daily base in grams.

(4) Meal planer module

This module presents to user the daily intake of nutrition's in grams per meal. The number of meals per day as well is defined by the user. At the end this module, according to mass and energetic values of nutrition give to user one example of menu.

Figure 2. Interfaces of the android application

3. Results and Discussion

On the Figure 2 all interfaces appeared in the application are shown. The results were obtained when this application was successfully installed and ran on smartphones due the testing procedures.

Functional testing was performed to ensure that the all functions in the application work properly. Usability testing was performed to ensure that the application receives a favorable response from the group voluntary user. Installation testing and Compatibility testing were performed by installing the application on few types of smartphones: Samsung Galaxy S5, Samsung Galaxy S4, Samsung Galaxy S3, Samsung Galaxy S2, Galaxy Tab, HTC Desire, Sony XPERIA Z3, SONY XPERIA M2.

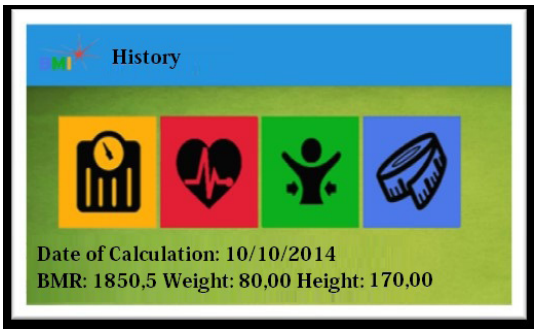
When results are stored, using the option menu on the application the history of calculations stored in the phone is listed. Furthermore, the obtained data can be exported due the email in comma-separated values *(csv)* format as shown in Figure 4.

With completion the process of all type testing and then when all errors were removed, the next step was the final stage in which we have created the installation files of the application as well free distribution in the application store:

http://slideme.org/application/%D0%BA%D0%B0%D0%BB%D0%BA%D1%83%D0%BB%D0%B0%D1%82%D0%BE%D1%80

Since the application was published online as freeware software, the first feedbacks from the end users were

Figure 3. Storing information



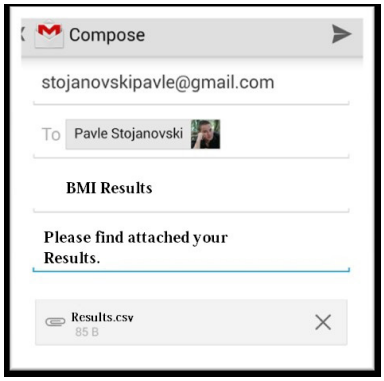


Figure 4. Exporting information

received. Thirty users have reported that the application is user friendly and easy to use. They have also reported that the application gives accurate results and gives positive outcomes for their health condition.

4. Conclusions

- Today's generation of smart phones and their originality, mass usability, and computer characteristics, represents an ideal platform for the calculation of the required nutritional intake in a way which is available and acceptable almost to everyone, and has a potential for a significant positive effect on people's healthy life.

- This project presented useful guidance and health recommendations for smart phones users who have installed the android applications. The proposed model generates recommendations for different categories of people who are underweight, overweight or obese due to a computation of their daily balanced nutrition's intake.

- It specifies certain exercise regimen types that are appropriate for these different kinds of people.

- Furthermore, this application can be applicable for creating cumbersome data of many users in future nutrition research. The research with traditional methods up until now, such as food diaries, questionnaires and interviews are a bit more complicated and take away more time, for both the participants and the researchers. Also, these methods have a relatively small percentage of accuracy because there are based on the participants' memory, their honesty and ability to accurately calculate how much they eat. Thus, this application makes research out of the typical test rooms or laboratories possible; at the same time it enables the tested individuals to take the test in their own terms, as long as they are in the frame of the established rules.

- Besides, speaking in technical terms, using a platform of open source as Android, gives important knowledge, useful for the introduction in the professional world. And it is free software; it allows easy integration with other implementations and platforms, something that does not happen with proprietary systems.

5. References

[1] WHO (2005). *The European health report 2005*. Public health action for healthier children and populations, WHO, Copenhagen, Denmark, pp. 129.

[2] WHO (2000). *Obesity: preventing and managing the global epidemic*. WHO Technical Report Series 894. WHO. *Global Health Observatory Data Repository*. <URL:http://apps.who.int/gho/data/node.main.A900?lang=en. Accessed 18 October 2014.

[3] Petreska T. (2007). *Obesity* (in Macedonian). Pharmaceutical informatory, 6, (13), pp. 56-58.

[4] Schneider P., and Meyer F. (2005). *Are basal metabolic rate prediction equations appropriate for overweight and obese adolescents?* Rev. Bras. Med. Esporte, Vol. 11, No 3, http://dx.doi.org/10.1590/S1517-86922005000300008.

[5] International Data Corporation (IDC). *Smartphone OS Market Share, Q2 2014*. <URL:http://www.idc.com/prodserv/smartphone-os-market-share.jsp. Accessed 08 September 2014.

[6] Pergler E. (2012). *Automated motive – based user review analysis in the context of mobile app acceptance: Opportunities and applications*. JIOS 36: No.1, pp. 55-67.

[7] Magliocchettia D., Gielowb M., De Vigilia F., Contia G., De Amicisa R. (2011). *A Personal Mobility Assistant based on Ambient Intelligence to Promote Sustainable Travel Choices*. Procedia Computer Science, 5, pp. 892-899.

[8] Kranz M., Möller A., Hammerla N., Diewald S., Plötz T., Olivier P., Roalter L. (2013). *The mobile fitness coach: Towards individualized skill assessment using personalized mobile devices*. Pervasive and Mobile Computing, 9, (2), pp. 203-215.

[9] Abbate S., Avvenuti M., Bonatesta F., Cola G., Corsini P., Vecchio A. (2012). *A smartphone-based fall detection system*. Pervasive and Mobile Computing, 8, (6), pp. 883-899.

[10] Sowah R., Nkrumah-Budadu J., Fiawoo Y. S. (2013). *Design and development of a personal health monitoring system on android mobile platform*. International Journal of Engineering Science and Technology, 8, pp. 1313-1320.

[11] Arshad U., Mascolo C., and Mello M. Exploiting Mobile Computing in Health Care. <URL:www.cl.cam.ac.uk/~cm542/papers/iwsawc.pdf. Accessed 05 November 2014.

[12] J. Harris A. and Benedict G. F. (1918). *Biometric Study of Human Basal Metabolism*. Proceedings of the National Academy of Sciences, 4, (12), pp. 370-373.

[13] WHO (1985). *Energy and protein requirements*. Report of a Joint FAO/WHO/ UNU Expert consultation, Technical Report Series 724, Geneva, Switzerland.