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Tailored Support for Weight Loss: A Personalized Smartphone Application for Weight Loss

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Abstract: Obesity and overweight are major public health concerns in Lebanon, affecting a large proportion of the population. Recent studies show that 39.9% of adult women (aged 18 and up) and 30.5% of adult men suffer from obesity. Lebanon's obesity prevalence is higher than the regional average of 10.3% for women and 7.5% for men, these alarming figures place Lebanon among the countries with the highest obesity rates in the MENA region. Faced with this concerning issue, a partnership between the biomedical engineering department and the nutrition department at the Lebanese German University resulted in the development of an innovative weight reduction application "NutriTrack". This research describes the creation of this application, concentrating on its usefulness in assisting users to lose weight in a healthy and sustainable manner in the setting of Lebanon. The app will harness the capabilities of digital technology to deliver nutritional advice, facilitate meal preparation and track functionalities which allows individuals to follow a suitable dietary plan. This user-friendly interface contains a vast database of recipes, dietary plans, nutritional information and advice provided by the nutrition department that will help individuals in choosing the suitable option tailored to their needs in alignment with their preferences and restrictions. Additionally, "NutriTrack" encourages users to adopt better dietary practices, supports greater nutrition management, and inspires them to choose healthier foods. Users of the program may increase their understanding of nutrition, which is one of its main advantages. The app will include instructional materials on a variety of nutrition-related subjects, including macronutrients, portion management, and designing well-balanced meal plans. Through engaging features like quizzes and informative articles, users can actively enhance their understanding of healthy eating principles and improve their overall nutritional knowledge. The overarching goal of the app is to drive positive health outcomes.

Keywords: Healthy lifestyle, Nutritrack, Dietary plan, Lifestyle improvement, Nutritional advice.

Introduction

Vigorous eating, practicing physical exercises, getting enough sleep and reducing stress are key points to obtaining a healthy weight. If Individuals do not manage their health lifestyle in an appropriate way, they risk

becoming subject to serious diseases and health conditions. In order to obtain an optimal living, taking care of your body's needs is a must! A balanced diet plan that contains multiple nutrients plays an important role in managing your weight as well as following regular physical activities and getting sufficient sleep while making sure that the human body is getting rid of all the unnecessary stress (Johns Hopkins Medicine et al, 2024). A good diet is a foundation for health, well-being, optimal development and growth that offers defense against all types of malnourishment. Unhealthy diets are one of the biggest reasons behind illness, mostly for noncommunicable diseases including cancer, diabetes, and cardiovascular disease (World Health Organization, 2024).

In recent years, a mixture of technology and health management services have emerged seeking to control obesity. Most of them have taken the shape of mobile and web-based applications (Ghelani et al., 2020). "NutriTrack" was created out of purpose to revolutionize the way people approach a better lifestyle by allowing them to insert their personal information such as name, last name, age, gender, weight and height .By inputting such data users will be able to unlock a special diet that meets their requirements. One of the standouts features of the application is the availability of diverse recipes, meals, snacks and drinks options that makes it easier to find healthy yet delicious nutrients. An array of sports video links, routine exercises and tips are available! It is important to understand that physical activity is as important as following a healthy dietary plan when improving a lifestyle.

Motivation and Background

Since 1990, the global obesity rate has more than quadrupled, highlighting the need of having strategies and resources in place to assist unhealthy and obese individuals (World Health Organization, 2024). The purpose of this project is to design and build an application that promotes individuals to live better lifestyles. According to several research, as shown in (Figure 1.), the United States, China, and India have the highest rates of obesity in their populations. Obesity rates are on the rise, which is a concerning issue that must be addressed immediately. Obesity is a chronic complex disease defined by excessive fat deposits that can impair health. Obesity can lead to increased risk of type 2 diabetes and heart disease, it can affect bone health and reproduction, it increases the risk of certain cancers. (World Health Organization, 2024).

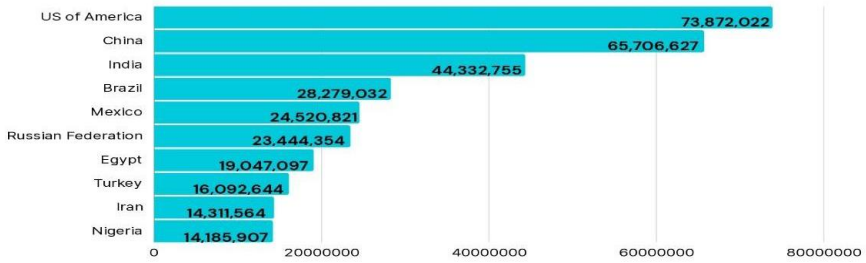

Figure 1. Rank of countries by obese population in 2017

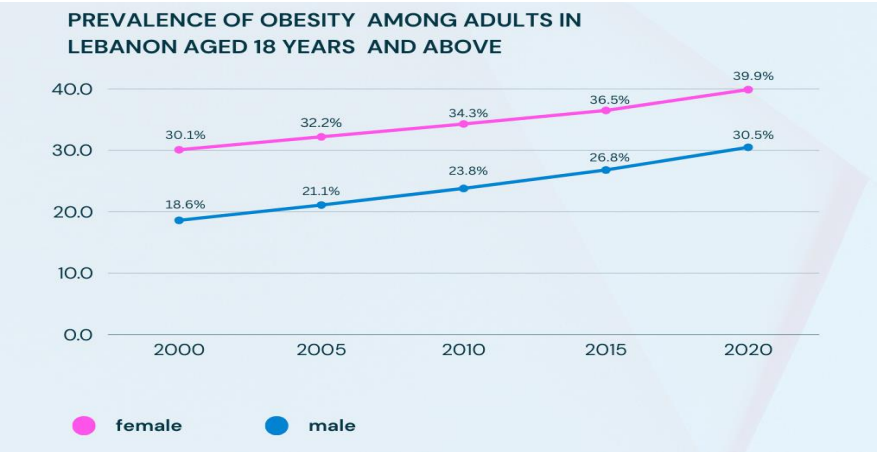

Figure 2. Prevalence of obesity among adults in Lebanon over the years

According to the World Health Organization (WHO), chronic illnesses account for approximately 40 million deaths annually, with 15 million occurring in individuals aged 30 to 69. Cardiovascular diseases, cancer, diabetes, and chronic respiratory illnesses collectively account for 82% of global fatalities. In Lebanon, chronic diseases represent 85% of total mortality, driven by risk factors such as tobacco use, physical inactivity, hazardous alcohol use, and poor diets. In 2014, over 1.9 billion individuals were classified as overweight globally, with Lebanon reporting a prevalence of obesity and overweight at 65.4% (27.4% obese, 38% overweight) (Bardus et al, 2018). Obesity and overweight are primarily caused by an energy imbalance between caloric intake and consumption. This imbalance is caused by global trends of greater availability and consumption of energy-dense foods high in sugar and saturated fats, as well as insufficient physical exercise as a result of the sedentary character of many kinds of labor, modes of transportation, and urbanization (Mansour et al,. 2019). All of these behavioral risk factors are avoidable, since they may be addressed by certain adjustments. We will talk about what made us want to do this study below.

Our main source of motivation is an intense desire for bettering people's lives and preventing obesity's negative impacts. Millions of people worldwide are influenced by the obesity pandemic. The data shown in (Figure 2.), was a powerful call to action for us because this concerning trend emphasizes the need for a comprehensive strategy to address the root causes of obesity and promote healthy lifestyles among the Lebanese people so we set out to design a system that would enable individuals to take charge of their diet and make sustainable behavioral changes. "NutriTrack" was developed to give people an accurate and customized approach to nutrition. We truly think that when it comes to addressing the many requirements and difficulties people have in controlling their weight and general health, one-size-fits-all strategies are unproductive. To combat this, "NutriTrack" creates customized meal plans based on the most recent research and technology, each of which is suited to the individual needs of the user. The urge to remove obstacles and enable everyone to have access to nutrition management has motivated us into creating "NutriTrack".

Literature Review

The World Health Organization defines obesity as an abnormal or excessive buildup of fat that creates a health concern (Bazán et al., 2018). Since obesity is a significant health issue it has now been regarded as a chronic and progressive disease, causing high morbidity and death rates due to associated multiple medical conditions, social issues, and low quality of life (Demir & Bektas, 2017). Scientific evidence is the base of nutritional guidelines in order to improve general health and avoid chronic illnesses. These principles give a broad assessment for users into making informed food decisions and maintaining a healthy diet. The following section describes major hypotheses referring to the design and operation of the NutriTrack application. According to the Health Belief Model, people are more likely willing to participate in practices that promote health if they feel they are at risk of developing a serious health condition and that the advantages of taking action exceed the costs (Haller et al., 2008). According to The Theory of Planned Behaviors, the most important predictor of a behavior is the individual's intention of executing it. NutriTrack believes that knowing consumers' attitudes toward healthy eating, the social obstacles they face, and their own capacity to modify their nutritional patterns is essential (Bosnjak et al., 2020). By addressing these aspects, the app can help users create and achieve their nutritional objectives. The rates of obesity continue to rise, demanding new and effective intervention measures to tackle the epidemic. In our effort to create a health management application for weight loss, we researched existing literature reviews and insights from two important studies. Study 1: "Use of technology-based ınterventions in the treatment of patients with Overweight and Obesity: A Systematic Review" (Rumbo-Rodríguez et al., 2020) and Study 2: "Understanding User Preferences in Nutrition Apps: A Qualitative Study" (Vasiloglou et al., 2021).

In recent years, technology has been viewed as a possible helper in weight management, providing new methods for people to embark on their health journey (Hinchliffe et al., 2022). The first study looks at the empirical data supporting the use of technology in promoting weight reduction in obese people. Obesity prevalence has increased dramatically from 1975 till 2014, with rates increasing from 3.2% to 10.8% among adult men and from 6.4% to 14.9% among adult women which requires immediate effective solutions. Forty-seven studies from reliable resources, such as PubMed, ScienceDirect, Cochrane Library, and MedLine, were carefully reviewed. The focus was on different innovations in technology, such as cell phones, mobile applications, and the Internet.

The results demonstrated that around 47% of these therapies resulted in considerable decreases in weight for patients. Furthermore, the study revealed that technology-enhanced weight loss programs for overweight or obese individuals appear to be more effective than traditional approaches in enhancing therapy through self-

monitoring mechanisms, resulting in better weight reduction outcomes. However, the study did identify a key drawback that shows the ongoing challenge of effectively reducing obesity in modern culture, such as a lack of user interaction and individualized feedback (Rumbo-Rodríguez et al., 2020). In recent years, digital technologies, particularly mobile apps, have developed quickly. About 3.7 billion apps were downloaded in 2017, with about 325,000 being mobile health (mHealth) apps that were fitness and health-related (Bosnjak et al., 2020). The second study targets the understanding of user preferences in nutrition apps. Mobile apps lower medical expenses, boost public health information transmission, and improve patient-provider communication (Demir & Bektas, 2017). A multidisciplinary team developed and assembled the survey. Eighteen end users were part of a pilot test before it was released. Eventually, a 19-question survey was established and translated into one of the six languages: Greek, Italian, German, French, Spanish, and English. A total of 3587 people saw the survey. A total of 2382 participants, of which 79.4% were female and 19.9% were male, were analyzed. Roughly 50% of the individuals have previously utilized a nutrition application (Vasiloglou et al., 2021). The following graphs in (Figure 3.) & (Figure 4.), illustrates the poll results while highlighting the reasons that may prevent people from using the App as well as the factors that encourage them to use a nutrition application.

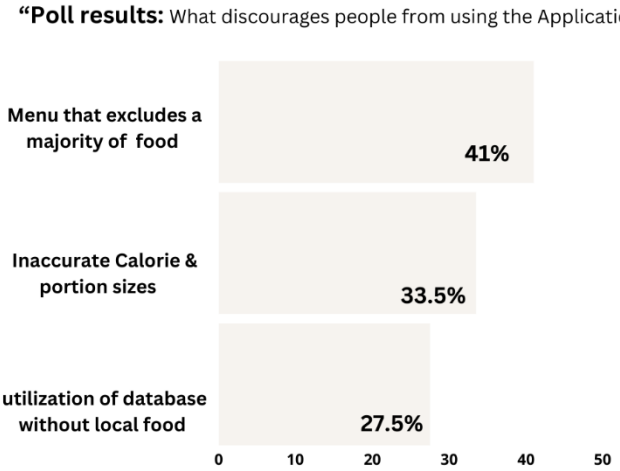

Figure 3. Poll Results of the factors preventing users from choosing an application

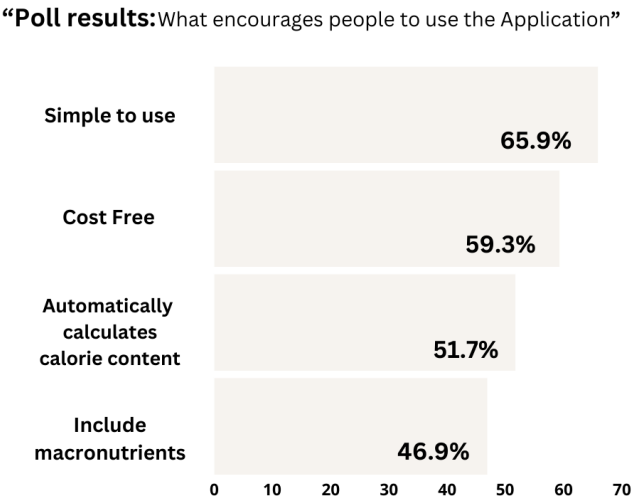

Figure 4. Poll Results of the factors encouraging users to choose the application

The study shows that users pick diet and nutrition applications that are simple to use, free, and accurately determine food's energy and nutrient content. Choosing a nutrition app can be challenging due to inadequate nutritional databases that exclude important foods, inaccurate calorie and nutrient estimates, and a lack of specific options and validation. Researchers from different kinds of fields need to comprehend the user's perspective to construct and develop applications that meet users' expectations and requests. By relying on insights from these studies, we were able to identify the critical points and step backs present in current platforms. NutriTrack was designed to address the barriers highlighted while enhancing each user's experience. Our App, allows users to receive tailored recommendations based on their preferences , follow a specialized dietary plan that includes the right amount of portion of food that their body should take , contact experts,

browse multiple recipes mostly local ones, engage in quizzes and scroll through a vast section of physical activities without any financial barrier as it is cost free. In summary, we aim to fill the gaps noticed in existing studies by addressing these limitations in NutriTrack (Vasiloglou et al., 2021).

Methodology

Our research project seeks towards developing a nutritional program that encourages healthy food choices and helps users manage their well-being better. In order to achieve our objectives and for the development of "NutriTrack", we adopted a thorough strategy that included intensive study, questionnaires, and coordination with the Nutrition Department in gathering nutritional data and dietary guidelines. All of this data was incorporated into the app, providing users with accurate and dependable information.

To establish a solid foundation, quantitative methodologies were used to assess the prevalence of obesity and overweight, analyze user data and comments for tailored experiences and for rapid prototyping. A review of previous studies was undertaken to assess the prevalence of obesity and overweight. This review was eye-opening since it identified many danger factors that we felt the need to address when developing the App. Surveys and user analytics were used to collect information about users' interests and activities. This information was necessary to personalize the app's features and suggestions to the users' individual needs. A group of three people utilized the Jotform platform to prototype and create the App. This approach of development allowed the creation of a user-centered design process based on the fast adjustments possible in response to user feedback and analytical insights.

To supplement the quantitative data , qualitative methodologies were also employed to acquire deeper insights into user experiences and expert validation. We established a partnership with the nutrition branch in the Lebanese German University to advantage from their revel in and assets. The Biomedical technology crew performed several communication sessions with the head of the nutrition department RD Marielle Mansour, to gain beneficial facts on nutritional tendencies and practices. This partnership provided us with correct dietary facts, nutritional regimens, and recommendations that had been essential for the app's development. During App development, user feedback was requested to influence design and functionality. This engagement with people enabled the discovery of our weak points, which were then used to improve the overall user experience . NutriTrack's strong methodology, combining research, surveys, expert collaboration, and user feedback, ensures that it provides accurate, personalized and effective nutritional information to its users.

Design and Development

The design and development of the NutriTrack obesity management application occurred in two distinct phases. The initial phase focused on defining the application's scope through the collection of detailed food information, including meal composition and quantity. This relevant data was sourced from the Nutritional Department at the Lebanese German University, providing a robust dataset that includes nutritional information for essential food items such as vegetables, tubers, legumes, fruits, fish, and meats. These food components were categorized and structured to facilitate the creation of complete meals based on user-preferred recipes. During this phase, we prioritized user functionalities, enabling users to create personalized profiles and receive tailored meal plans with calorie and nutrient recommendations based on their individual data. Users can easily log the foods they consume and track their calorie intake. Additional features considered included meal planning, recipe management, and physical exercise capabilities, such as browsing and bookmarking healthy food ideas. Integrated fitness tracking, educational resources, and assistance were also designed to enhance the overall user experience.

The second phase involved selecting the appropriate platform and programming languages for the application. Typically, applications are designed for specific operating systems, such as iOS, Android, or Windows. In our case, we opted for a web-based application to maximize accessibility. This choice allows users to download data captured by the app and access it on various operating systems or through any internet-connected device, including those without smartphones. The app functions similarly to web pages, enabling users to access it via their mobile device's web browser. Since JotForm is a form-building platform we used 4 programming languages:

- HTML to arrange the layout and content of the app's many pages, including the personal information form, the sections displaying the computed **BMI (Body Mass Index = amount of body fat you have), BMR**

(Basal Metabolic Rate = number of calories required for basic functions at rest), BFP (Body Fat Percentage = measure of fitness level), and **TDEE (Total Daily Energy Expenditure)**, and the diet plan creation.

- Cascading customize Sheets (CSS) to customize the visual look of the app, such as the layout, colors, fonts, and other design aspects.
- JavaScript to construct the logic for calculating the **BMI, BMR, BFP,** and **TDEE**, as well as producing the diet plan depending on the user's preferences (for example, whether to include or exclude milk).
- JotForm API we linked the app with JotForm's functionality, such as handling form submissions, accessing form data, and perhaps automated diet plan production depending on user inputs.

To illustrate an example of this programming find below the flowchart in **(Figure 5.)**

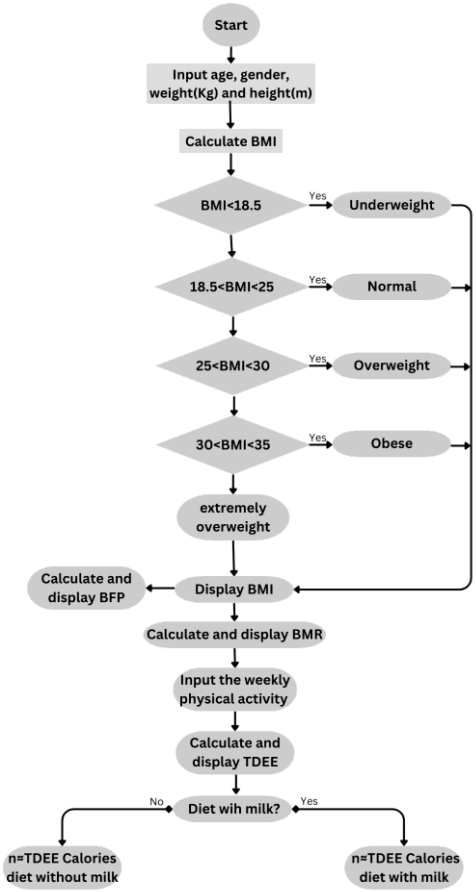

Figure 5. Flow diagram demonstrating the BMI, BMR, BFP and TDEE calculations to display a diet plan

For example, if we have a 30 year old male that weighs 85 kg and height 1.75 cm, the system will calculate the user's **BMI,** which is in the overweight range ($25 \leq BMI < 30$). Based on this, the system classifies the person as overweight. The application then calculates and shows the user's **BFP** and **BMR.** Next, the user enters their weekly physical activity level, which the system utilizes to compute and show their **TDEE**. Later on, the user is asked if they wish to incorporate milk into their diet plan or not. If the user chooses not to include milk, the system generates a diet plan with the appropriate calorie intake based on the **TDEE.** If the user chooses to include milk, the system generates a diet plan with the appropriate calorie intake that accounts for the inclusion of milk.

The visual aesthetics of the app such as logo, templates of diet plans, recipe meals, snacks, detox juices … were designed using an online graphic design tool **[CANVA].** This ensured a professional and appealing look, enhancing user engagement and overall experience. Below, **(Figure 6.)** highlights key aspects of the app's design, including the logo, templates for diet plans, and the overall visual style. These elements work together to create a welcoming and motivating environment for users as they embark on their journey toward healthier eating habits.

Figure 6. Example highlighting key aspects of app's design

To further illustrate the personalized diet recommendation process, we will include several visual representations. **(Figure 7.)** & **(Figure 8.)** shows respectively how the app generates diet plans based on the user's TDEE and their preference regarding milk inclusivity and the diet displayed in the app, showing how it aligns with the calorie calculations detailed in **(Figure 5.).** The following will provide a clear example of how NutriTrack translates nutritional data into actionable meal plans for users.

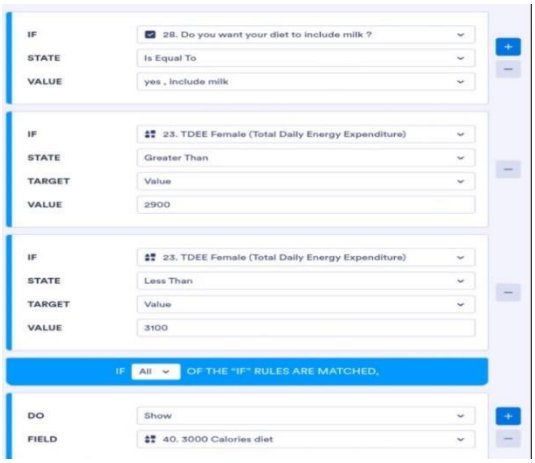

Figure 7. Personalized diet recommendation logic

Figure 8. Example of diet displayed in the app with caloric ınformation

Results

Developed over an 8-month period, NutriTrack offers users a comprehensive approach to support their weight loss journey. Users are able to report considerable changes in their diet quality and accomplish their desired weight reduction or maintenance while reporting higher levels of motivation, self-efficacy, and mental well-being as a result of continuously recording their progress and participating in a supportive health community.

The workout features set advances in physical strength, cardiovascular health, and flexibility. All interested users improve their exercise thanks to the training videos, progress monitoring, and social features that keeps them motivated and interested in their fitness routines also discovering new types of exercise they love while browsing the app's vast workout library. The app's simplicity and diversity of recipes help in keeping up to the tailored meal plans and nutritional guidelines.

NutriTrack automatically calculates essential health metrics such as **BMI, BMR, BFP, and TDEE**. These metrics are determined based on user inputs like height, weight, age, and activity level, enabling users to understand their current body type (underweight, normal, overweight, or obese) and make informed health choices. The following section outlines essential health metrics and their corresponding formulas, which serve as the foundation for assessing body composition and daily energy requirements.

Body Mass Index (BMI) is calculated using the metric formula:

$$BMI = \frac{weight\ (kg)}{height\ (m)^2}$$

BMI is used to estimate the **body fat percentage** using the formulas:

$$BFP(Male) = (1.20 \times BMI) + (0.23 \times Age) - 16.2$$

$$BFP(Female) = (1.20 \times BMI) + (0.23 \times Age) - 5.4$$

Basal Metabolic rate (BMR) is calculated using Mifflin Formula:

$$BMR\ (male) = 10 \times weight\ (in\ kg) + 6.25 \times height\ (in\ cm) - 5 \times age\ (in\ years) + 5$$

$$BMR\ (Female) = 10 \times weight\ (in\ kg) + 6.25 \times height\ (in\ cm) - 5 \times age\ (in\ years) - 161$$

Total daily energy expenditure (TDEE) is the daily calorie needs based on activity level and calculated using the formula:

$$TDEE(Male) = BMR(Male) \times Physical\ activity\ level$$

$$TDEE(Female) = BMR(Female) \times Physical\ activity\ level$$

The diet plan will be displayed according to the calculated TDEE. The app generates personalized diet plans that offer specific daily calorie targets, recommended food items, and portion sizes tailored to users' goals. Users can choose to include or exclude milk from their plans, accommodating personal preferences and dietary restrictions.

Figure 9. Screenshots on an iPhone device showing how app's functionality and features

NutriTrack includes tools for logging food intake, helping users effectively monitor their dietary habits. Users can manually log all food and beverage intake, select meal type (breakfast, afternoon snack, etc.), estimate calorie content, and even take photos of their meals. After logging, food will be saved in a spreadsheet for easier tracking. This feature enhances logging accuracy and helps users remember portion sizes.

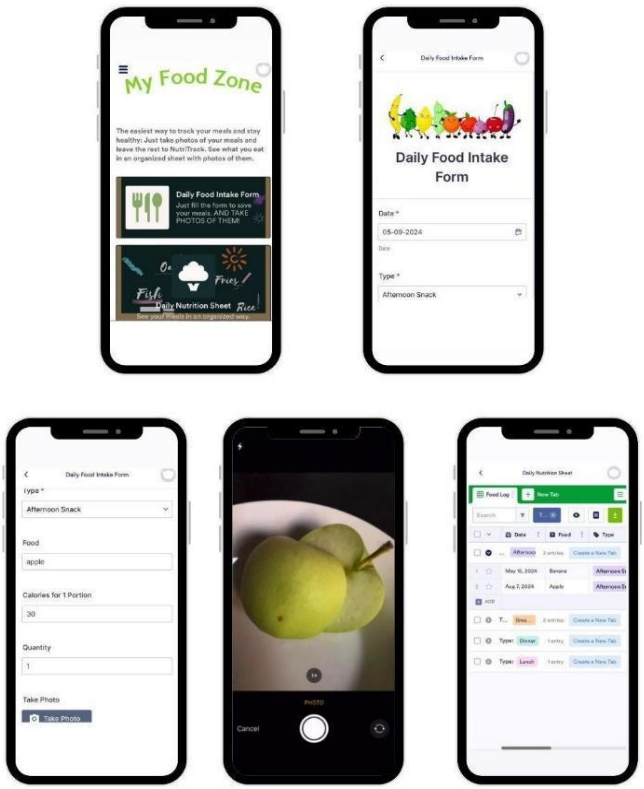

Figure 10. Screenshots taken on an iphone device showing the option of logging food ıntake

On the fitness side, users can log daily physical activities, including cardio and strength training exercises. For cardio, users can track duration, distance, intensity, and estimated calories burned. For strength training, they can record exercise names, sets, reps, weights used, and calories burned, providing a clear record of their fitness routines.

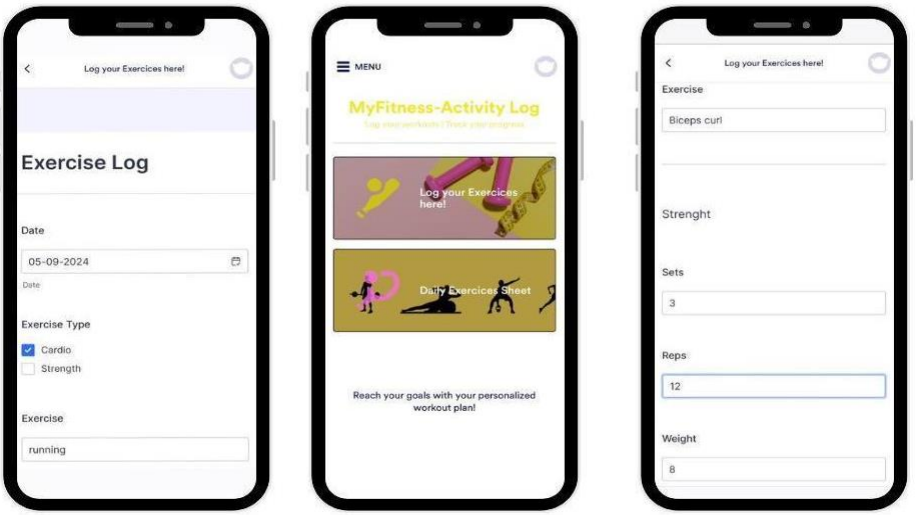

Figure 11. Screenshots taken on an iphone device showing the option for logging physical actvity exercises

The app features a curated collection of healthy meals, detox juices, and nutritious desserts. Each recipe includes detailed instructions and ingredient lists, ensuring users have the necessary information to replicate dishes at home. Recipes are developed by registered dietitians, guaranteeing a balance of macronutrients and essential micronutrients.

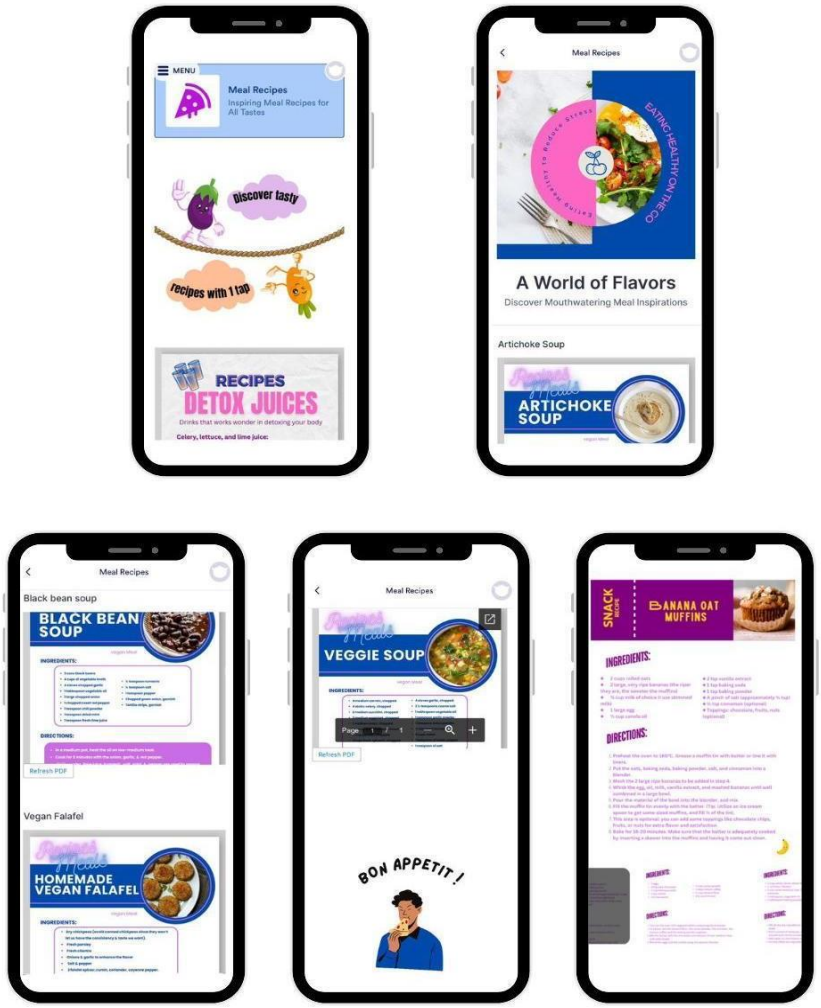

Figure 12. Screenshots taken on an iPhone device showing the vast recipe library of nutritrack

NutriTrack provides a variety of educational resources covering general nutrition recommendations. Users can explore topics such as macronutrients, portion control, and balanced diets. The Interactive quizzes feature helps in assessing users' nutrition knowledge, identifying areas where they may need more information.

Figure 13. Screenshots taken on an iPhone device showing the educational resources in the app

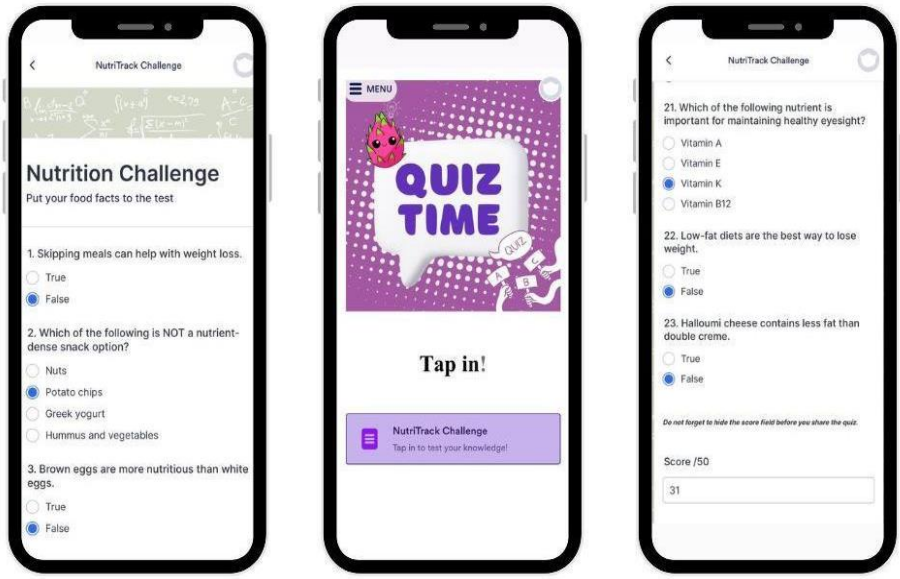

Figure 14. Screenshots taken on an iPhone device showing the quizz feature

The Expert Consultation feature allows users to communicate directly with qualified nutritionists for personalized guidance. Users can consult with registered dietitian Marielle Mansour to address specific dietary questions and concerns. Additionally, the option to schedule virtual consultations ensures users receive tailored advice and support.

The main advantages of this system are the following : Customized meal plans based on user preferences, dietary restrictions , Automatic calculation of key health metrics to assist users in their wellness journey , user-friendly design that makes it easy for users to navigate and simplifies meal/activity logging , access to a wide variety of healthy recipes that help users maintain variety in their diets , provides users with essential information on nutrition and portion control, direct connection to registered dietitian for personalized guidance and assistance and lastly as a web-based app, it can be accessed from any device or operating system, including iOS and Android, allowing users to monitor their health on-the-go.

However, this system has several limitations that will be addressed in future designs: The limitations we noticed such as the reliance on user's input, diligence and honesty to accurately log food and health metrics. Many features require an internet connection, which restrict usability in offline situations. The majority of the recipes in the current recipe library and diet plans are from Lebanon which may not suit all users' varied dietary preferences. Some users may find the meal plans too inflexible or not fully aligned with their preferences. Like any app, there may be bugs or technical difficulties that could disrupt user experience.

Conclusion

In this paper, we have described the process of developing a nutrition application called NutriTrack that attempts to improve diet and physical exercise lifestyle patterns. The dietary app is a promising collaboration between our team and the Department of Nutrition. Using the department's knowledge of evidence-based dietary standards and meal planning, we created a complete app that offers users individualized diet plans, nutritious recipes, and tools for tracking their nutritional consumption. The software distinguishes itself from other calorie-counting applications on the market by allowing users to build unique meal plans and recipes based on their tastes, dietary limitations, and health objectives. Moving ahead, we believe it has the potential to dramatically change people's eating habits and make a significant difference in their lives. The team's application is a potential step forward in tackling Lebanon's alarming surge in adult obesity rates. The early user testing findings are encouraging, with 50% of trial participants reporting a smooth download and functioning of the software. By providing individualized nutrition and wellness features, the app encourages users to take an active role in managing their health and living better lifestyles. The high level of user involvement seen during the initial testing phase suggests that the app's features appeal to the target population which establishes a solid foundation for on-going growth**.** As the prevalence of obesity in Lebanon increases, it is critical to use technology solutions

such as NutriTrack to offer individuals with the knowledge and assistance they need to make educated decisions about their nutrition and general well-being.

Moving forward, the team should prioritize increasing the app's user base, incorporating comprehensive data analytics to better understand user wants and preferences, and constantly upgrading content and features to ensure relevance and effectiveness. With a commitment to user-centric design and a focus on long-term habit change, the NutriTrack app has the potential to significantly improve the health and wellness of the Lebanese community.

Scientific Ethics Declaration

The authors declare that the scientific ethical and legal responsibility of this article published in EPSTEM Journal belongs to the authors.

Acknowledgements or Notes

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