Development of a Software for Meal Planning

C. AbinayaPriya

(16PFD001)

Thesis Submitted to

Avinashilingam Institute for Home Science and

Higher Education for Women,

Coimbatore – 641043.

In Partial Fulfillment of the Requirements for the

Degree of Master of Science
in
Food Service Management and Dietetics

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Certified as a Bonafide Research Work

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Supervisor

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Signature of the
Head of the Department

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INTRODUCTION

The word ‘Menu’ originated from a French word meaning ‘small’ or ‘detailed list’. Many scholars have defined menu in different contexts.

Meal planning software could be a potential tool to offset time scarcity and therefore encourage home meal preparation, which has been linked with an improved diet quality. However, to date, meal planning has received little attention in the scientific literature. In this context a study was framed to develop software for meal planning (Ducrot *et al.,* 2017).

Menu planning determines the style of service to be set up. Forms the basis for the calculation of food and labor costs, overhead expenses and desired profits. Reflects the type of customers the establishes wishes to attract. Satisfies the needs of the customers for nutrition, hunger, as well as social and psychological needs. Introduces food combinations to customers, and through specially foods imparts knowledge of the foods eaten in different states, countries and cultures. Provides a means of developing good eating habits in people (Allegretti *et al.,* 2017).

According to (seljak *et al.,* 2009) meal planning is art that often learns by a costly heuristic or trial-and error process. A well-trained professional can easily manage with the complexity of regular mean planning, to meet the needs of diverse groups, control costs and quality, and to the utilization of maximum labor and equipment time, the probability of success diminishes.

Planning meals ahead of time is a great idea; there are many other beneficial aspects that come along with it. Meal planning affects different aspects of life, including time as well as financial situation. Meal planning helps every individual of the family to eat healthy meals everyday on a budget. It also gives more time and spends less money when a family is together (Neelima, 2009).

Abbot *et al.,* (2010) stated that meal planning is a key component of nutrition counseling by planning meals ahead of time, clients are able to modifies their diets to manage their body weight or diet-related diseases, such as diabetes and renal disease. (Delahanty *et al.,* 2002), (Keeley *et al.,* 2002)

Those who are healthy and simply want to eat more nutritiously can have meal planning to improve their diet. For instance, greater intakes of fruits and vegetables make the meal planning more advances.

Due to few limitations in computers, satisfiable menus can be automatically or semi-automatically generated by efficient software (SW) techniques, but it can be done only if the menu-planning process is well defined (Seljak, 2009).

Gurinovic *et al., (*2010) opines that the meal planning module is used for the calculation of dishes, meals and menus. The main aim of the module is to calculate the nutrient composition of different dishes, meals and menus. By getting information from the client by 24 hours recalled method, the menu has been planned according to the RDA value.

Eating at home has many health benefits, but more importantly it gives you the options of what ingredients should be included or not to be included in our meals. In casual dining restaurant they use unknown ingredients which is not known by us, however when we cook in home we use natural ingredients and which are basic (Neelima, 2009).

Study done by (Seljak, 2009), introducing a computer-based method for menu planning, which applies evolutionary computation. The n-day menu-planning problem is sub divided into several sub levels as daily-menu and meal-planning level. So those problems can be reduced to a multi-dimensional problem.

To have a self-directed home kitchen makeover demonstration meal planner project was targeted on mothers with children (ie, less than 12 years old) who had the primary food preparation responsibilities in their homes. For organizing the food into meals, the meal planner was developed to create a single tool which helps the mothers to use as a menu, grocery list, and plan. To have stresses meal preparation, the meal planner appears to be a useful tool to assist the mothers of young children. Nutrition professionals can also use this meal planner tools to operate the educational message by helping the clients to create meal plans for their families which is agreed with nutrition

recommendations as well as family food preferences and available with resources (Abbot *et al.,* 2010).

A database has been developed for daily menu planning. It includes information concerning all the foods and recipes available in a hospital, as well as their analysis, in micro- and macro-nutrients. It also includes rules like foods that should be allowed or prohibited in specific clinical cases and to have proper food combinations (Doina *et al.,* 2004).

Benefits of planned meals include cost savings, more efficient grocery shopping, and fewer food shopping trips to purchase forgotten items. When meal planning helps to make mealtimes more relaxed and minimize the negative effects associated with chaotic mealtimes, such as increased anxiety and depression in children are reduced. (Boutelle *et al.,* 2003); (Crawford *et al.,* 2007); (Henry *et al.,* 2003); (Fiese *et al.,* 2006) Meal planning can improve the family members to eat meals together and thereby reap the myriad of nutritional (eg, higher intakes of fruit, vegetables, fiber, calcium, and several vitamins, and reduced intake of soft drinks and saturated fat) (Boutelle *et al.,* 2001); (Field *et al.,* 2003); (Larson *et al.,* 2006); (Sztainer *et al.,* 2003); (Videon *et al.,* 2003) and social benefits (eg, reduced risk of substance abuse and disordered eating, enhanced psychosocial well-being, better academic performance) which are associated with family mealtimes(Eisenberg *et al.,* (2004); Sztainer *et al.,* (2004) and Abbot *et al.,* 2010).

Fruh *et al.,* (2013) stated that some factors contribute to the infrequency of family meals, which includes the high cost of healthy meals, lack of access to grocery stores which offer healthy food, and reliance on the convenience of fast food restaurants (Drewonwski *et al.,* 2004). Inagami *et al. (*2007) Studies where mainly focused on the frequency of family meals, suggest that families share fewer family meals compared to other racial/ ethnic groups. A higher percentage (42%) of participants reported that they ate 2 or fewer family meals in the past days, eating fewer than the optimal number of 5 per week.

Meal planning levels that are composed of a breakfast and a morning snack, a lunch and an afternoon snack, and a dinner and a light snack before bedtime, and menu (Seljak, 2009).

Targeting to mothers with children (that is less than 12 years old) who have the responsibilities to prepare the primary food in their home the meal planner was developed as part of a self-directed home kitchen. The mothers to use as a menu, grocery list, and plan for organizing the food into meals as a single tool the meal planner was developed. The meal planner is created as a grid, where the first column is specified for the menu and subsequent columns for listing food items needed to prepare the menu (Seljak, 2009).

According to Begum, (2008) a menu is virtually a list of dishes planned for production in a catering operation and many include full meals snacks or beverages. It performs a number of functions: Introduces the establishment to the customer. Authorizes production of meals in the kitchen. Helps to prepare shopping lists for foods and ingredients and is the basis for establishing purchasing procedures. Determines the type of equipment, staff skills and the type of supervision required, helps to organize spaces and work in stores, kitchens and services areas.

Planning menus becomes essential when food has to be bought, prepared and served in large quantities to people of varying tastes and requirement. The advantages gained from planning are: (a) Planning meals helps to determine requirements accurately. Food buying can thus be controlled through advance buying, because quantities are calculated beforehand. (b) Planning ensure that food is not wasted because any leftovers can be creatively incorporated in the next day's menu which is already planned out. (c) Time and effort spent on haphazard ordering, shopping and receiving of food materials is saved to a large extent. (Sethi *et al.,* 2013)

Selja *et al.,* (2009) introduced a computer-based method for menu planning, which applies evolutionary computation. First, they formalize the *n*-day menu-planning problem, decomposing it into several sub-problems at the daily-menu and meal-planning level.

Meal pattern varies with age, occupation and life stage of the family members. A family meals should cater to the needs of the different members. A growing adolescent boy may need variety of foods to satisfy appetite, whereas a young child may require soft and bland diet. Pregnant women require more greens in the diet. A heavy worker requires more calories and B vitamins than members of the family. The family meal must offer children enough fat and flexibility in caloric density so that their energy needs are met. (Srilakshmi, 2014)

Objectives

By considering the above facts the study was framed with the following objective

Primary Objective:

- Improve the health status of an individual by proper meal planning

Secondary Objectives:

- Development of software package for meal planning
- Evaluating of the software package and incorporation of corrections.

II. REVIEW OF LITERATURE

Review of literature pertaining to the study on "**Development of a software for meal planning**" is discussed under the followed headings

A. What is Meal Planning

B. Importance of Meal Planning

C. Factors to Be Considered While Meal Planning

D. Software for Meal Planning

E. Advantages of Meal Planning

F. Food Intake and Life Style / Life style Disease

A. What is Meal Planning

Menu planning is art that one often learns by trial – and error process. A well – trained professional can easily manage with the complexity of regular menu planning, to meet the needs of diverse groups, control costs and quality, and to the utilization of maximum labor and equipment time, the probability of success diminishes (Seljak *et al.,* 2009).

Meal planning is combined with a healthier diet and less of obesity. Although no causality can be inferred from the reported associations, these data suggest that meal planning can prevent obesity. The result highlighted that individuals planning their meals were more likely to have a better dietary quality, by following higher nutritional guidelines as well as with increased food variety. Additionally, meal planning was associated with lower odds of being obese in men and women and overweight (Ducrot *et al.,* 2017).

Laura *et al.,* (2012) stated that outside the laboratory, meals are often planned in advance and then consumed. We sought to explore the extent to which the variety effect is anticipated in this pre-meal planning. Participants were shown two food images, each representing a first or a second course of a hypothetical meal. The two courses were either, (i) exactly the same food, (ii) different foods from the same sensory category (sweet or savoury), or (iii) different foods from a different sensory category.

Food exchange lists are essential to achieve the goal of meal planning. These lists were user-friendly guides that enable individuals to exchange foods without upsetting energy or macronutrient contents. They also can compare dishes for their macronutrient contents to make better choices. Most nutrition epidemiology research takes into account individuals' food intake. This study helps with analyzing data and interpreting results in the context of carbohydrate, protein, and fat content (Bawadi *et al.,* 2008).

When it comes to eating well, meal planning is one of the easiest thing to set yourself up for success. The key is just to start and to set aside a little bit of time each week to do it. There are so many ways to approach meal planning that, after practicing just once or twice; you'll begin to find what works for you and your family (Penner, 2017).

Outside the laboratory, meals are often planned in advance and then consumed in their entirety. We sought to explore the extent to which the variety effect is anticipated in this pre-meal planning. Participants were shown two food images, each representing a first or a second course of a hypothetical meal (Wilkinson *et al.,* 2013).

According to Keenan *et al.,* (2015) daily menu follows this pattern: breakfast, optional snack, lunch, optional snack, dinner, optional snack. Each meal in the menu can fit different patterns. To generate a menu, PRISM successively refines patterns, filling general pattern slots with specific foods.

The dietetics practitioner involved with menu planning in hospitals, nursing homes, schools, prisons, and other settings where focused on health and quality which is balanced with budget restraints has always been challenged with providing the best product for the money. The dietetics practitioners also confronts that even greater difficulty as the demand for food and energy across the globe has resulted in rapid price increases, food shortages, and increased transportation and delivery costs (Grill, 2009).

B. Importance of the Meal Planning

Importance of menu planning is gathered from the fact that menu planning starts before the conceptualization of any food and beverage operation, and it serves as a base for all other activities of major hotel

departments such as purchase and store, service, production etc. Menu provides ideas of how the facility must be planned, what type of skilled staff is required, what will be the equipment's, what type of raw material is to be purchased (Keenan, 2015).

A family health meal index (Healthfulness of Meal (HOM) index) was developed to assess the quality of foods served at the family meals. The HOM index assesses the following components: Fruit, Vegetables, Dark Green Vegetables, Dairy, Protein, Sodium, and Added Sugars. Component scores are summed, and the maximum total score is 9, indicating a higher quality meal. A comprehensive description of the HOM index development (Trofholz *et al.,* 2015).

Menu planners were able to collaborate and state their menu planning needs, which contributes to the development of resources which, in turn, was expected to control and confidence with the menu planning process (Baum, MacDougall, and Smith, 2006; Wandersman and Florin, 2003). By means of online questionnaires and collaboration group sessions, the researchers listed the needs and expectations of the menu planners; ensured the standards were addressed; developed the appropriate resources; consulted, tested, and revised; and implemented the resources using the desired information technology (Mann, 2013).

According to Abbot (2010) the meal planner appears to be a useful tool for assisting mothers of young children in planning meals and reduces stress while preparing meals. Nutrition professionals can use this tools such as the meal planner to operate the educational messages they present by helping participants create meal plans for their families that are congruent with nutrition recommendations as well as family food preferences and available resources.

There are some lower odds which is associated with meal planning like being obese in men and women and overweight in women. Interventional or prospective research can be conducted in order to infer causality, with these data, it can suggest the potential interest of promoting meal planning to improve dietary quality and prevent overweight. Such a tool can have could

issue like time scarcity which can be reported by consumers for meal preparation and, might therefore encourage home cooking (Ducrot *et al.,* 2017).

According Frush *et al., (*2013) meal planning has a positive impact on nutrition, health, family communication, and the emotional development of children and teens. In contrast, improper planning promotes unhealthy eating behaviors involving processed foods and fast foods.

C. Factors to be Considered While Meal Planning

Regardless of type of menu, the basics of menu planning remain the same. There are a number of factors, e.g. management objectives, type of client, space, availability of raw material, skilled labor and equipment's, and the type of menu which should be considered while planning any menu (Malik *et al.,* 2012).

Caffree (2009) stated that the next factor to be considered when menu planning is the type of food service one has—buffet, self-service, cafeteria-style, sit-down, room delivery, or satellite (some school districts have a central kitchen, where all the food is prepared, and then they send it to the schools). Not every menu item does well with every service type.

According to Trofholz *et al.,* (2017) while family meal frequency and emotional atmosphere during the family meal have been strongly associated with child and weight and weight-related behaviors, there are other factors that might reduce the protective nature of family meals on these behaviors. Additionally, a study examining electronic media use during mealtimes found that more frequent media use was associated with lower family communication and lower family meal importance (Fulkerson *et al.,* 2014).

Outside the laboratory the majority of self-selected meals are planned and usually eaten in their entirety, and decisions around meal size tend to be resistant to modification once eating begins (Fay *et al.,* 2011). This indicates that meal size is often governed by cognitive activity (planning) before a meal begins. Consistent with this idea, pre-meal expectations and plans around a food(assessed using computer-based measures) are directly related tosubsequent food intake (Wilkinson *et al.,* 2013).

According to (Malik *et al.,* 2012) importance of menu planning can be gauged from the fact that menu planning starts before the conceptualization of any food and beverage operation, and it serves as a base for all other activities of major hotel departments such as purchase and store, service, production etc. Menu provides ideas about how the facility must be planned, what type of skilled staff is required, what will be the equipment's, what type of raw material is to be purchased.

A family meal has demonstrated that family meals are protective for many aspects of child and adolescent health. It is unclear that distractions at family meals, such as watching TV, are associated with child weight and weight-related behaviors, the emotional atmosphere at the meal, or family meal healthfulness. One has to consider these parameters while planning a menu (Trofholz *et al.,* 2015).

Seljak (2009) Stated that the evolutionary method outperformed professionals in terms of time and quality. While it takes an experienced nutritionist or dietician from 30 min to 3 h to manually plan a daily menu for an individual or a group of individuals, a computer (1.7 GHz Pentium M, 512 MB RAM, Apache/PHP) needed from several minutes to a couple of hours to design a well-converged and well-distributed Pareto-optimal front of well-balanced optimal 21-day menus, depending on the complexity of the problem instance.

Menu must take into account the equipment and staff one have to work with. The person need to take a look at what the facility can provide,from a production standpoint and a cost standpoint," and "Just because one want to put something onthe menu, doesn't necessarily mean that it has be added or the staff to be able to cook and deliver that (Caffree, 2009).

To complete the meal planner, mothers were instructed to begin by visualizing the meals they wanted to serve, keep good nutrition and family food preferences in mind, and consider the resources (eg, time, money, food preparation skill, help from family members) they have to prepare each meal. Mothers were encouraged to emphasize grains, fruit, and vegetables in meals; use low-fat dairy products; choose lean, protein-rich food; and keep

portion sizes of meat small. Then, they listed their planned menus and identified all food items needed to make each meal (Abbot *et al.,* 2010).

Several factors are associated with family meals, including employment-related variables, socioeconomic and demographic factors, family structure, child age, and psychosocial constructs. Qualitative work suggested that barriers to consider in future interventions include time and scheduling challenges, cost, food preference, and adolescents' beliefs. Increasing youth involvement in mealtime, tailoring interventions to family characteristics, and providing support for families to experience time-related barriers are suggested strategies for future research (Ranzenhofer *et al.,* 2013).

Brunstrom (2010) highlights that expected satiation and expected satiety are influenced by the physical characteristics of a food (e.g. perceived volume). However, they are also learned, these findings show that important elements of control (discrimination and learning/adaptation) are clearly evident in plans around portion size. Since most meals are eaten in their entirety, understanding the nature of these controls should be given high priority (Brunstrom, 2010). Unlike energy expenditure, energy intake occurs during discrete events: snacks and meals. The prevailing view is that meal size is governed by physiological and psychological events that promote satiation towards the end of a meal.

The evolutionary method for menu planning has already been applied to the redesign of sample menus for children, workers and patients with special nutrition needs, which have recently been published in the Slovene Guidelines for Child Nutrition (Hlastan *et al.,* 2008), the Slovene Guidelines for Workplace Nutrition (Pokorn *et al.,* 2008), and the Slovene Recommendations for Clinical Nutrition and Nutrition for Elderly People in Care Homes (Kozjek *et al.,* 2008), respectively. (Seljak, 2009).

D. Software for Meal Planning

Meal planning software's target users are dietitians, food producers, nutritionists, health professionals and researchers. This software is aimed at planning both individual and group menus (for example, catering departments,

hospitals, restaurants, schools, kindergartens). The second module is the calculation of dishes, meals and menus module. The aim of this module is to calculate the nutrient composition of different dishes, meals and menus. The possibilities of the different sub modules are listed below: (a) the dish option allows the calculation of the composition by combining single food products and includes details of the cooking process, retention and yield factors. (b) The meal option allows the calculation of the composition by combining single food products and dishes (Gurinovic *et al.,* 2010).

According to Moore *et al., (*2012) the computer implemented system and method for familial meal – planning decision support by analyzing user pre – defined inputs of constrains and priorities, reflecting their individual family size, nutritional concerns, tastes, as well as the use's constraints on time, budget, interest in experimentation, and variety, store preferences, etc.

Computerized assessment programs are often judged on the ease of data entry; ability to preview single nutrients while entering food names; optional expression of food portion by weight, volume, whether food lists can be edited; and the ability to compare results with a variety of dietary standards. The ease of averaging multiple days of intake and exporting data for statistical analyses maybe important as well (Lee *et al.,* 1995 and Yasmine *et al*., 2005).

A nutrition counseling and meal management web expert system with time-series analysis, e-food exchange and data transition were based on the internet. It is composed of recommended meals and user-created meals. The food, menus and meals are the fundamental data to assess the nutrient analysis (Hong, 2008).

The development of the "DIET" software has been an attempt for the development and implementation of a nutritional care computerized system. Improved safety and quality of nutritional care, decreased errors, continuous monitoring of patients, increased employees' productivity and automatic calculations of cost per meal on a daily, weekly and monthly basis, were some of the most important manifestations of the "DIET" software (Skouroliakou, 2009).

According to Skuroliakou *et al*., (2009) software was developed for preparing dietary prescriptions in clinical settings. This has the ability to calculate the nutritional requirements and to produce daily menus of patients and a healthy individual automatically. Its use resulted in a decrease of the error percentages, concerning appropriate food choices, data recording and calculations of daily nutrient requirements; from 12 per cent to 1.5 per cent.

According to Neelima, (2009) Planning meals over a time will save a lot of time. When you visit your grocery store, take a list with you that show everything you need for your weekly meals. This way there will be no return visits to the grocery store for something you forgot, and you won't waste any time deciding what you are going to have for dinner that night. Forgetting a key ingredients or having to fight in long lines at the grocery store can be very frustrating, but meal planning can completely eliminate that. (Neelima, 2009).

Meal planner is user-friendly software programmer with multiple functions: individual and group nutrition planning, recipe calculation, creating food labels, diet planning and nutrient intake assessment. This paper describes the newly developed software and its features (Gurinovic *et al.,* 2010).

A software development by Doina *et al.,* (2015) supports the student in carrying out the nutrition care process and allows to create and analyses food menus and recipes. It guides through the information gathering process and all the steps to complete in order to successfully provide nutritional services.

Abbot *et al.,* (2010) stated that the meal planner software was developed as part of a self-directed home kitchen makeover demonstration project which was targeted on mothers with children (ie, less than 12 years old) who had the primary food preparation responsibilities. The meal planner was developed to create a single tool that mothers can use as a menu, grocery list, and plan for organizing the food into meals.

Computer-assisted menu planning is still not widely used. Human experts consistently outperform computers at this difficult task, which Eckstein characterized as an art and a science. The field of computer science that specializes in problems more readily solved by people than by computers is

artificial intelligence. An artificial intelligence system that attempts to model the processes a human expert uses to perform a difficult task is called an expert system. Different types of expert systems model different kinds of expertise. A rule-based expert system formalizes the rules an expert follows in performing a task, such as planning a menu. A case-based expert system represents past experiences an expert has had, such as previously planned menu. In the past decade, both case-based and rule-based expert systems for menu planning have been built (Inga-Britt and Gustafsson, 2004)

Doina *et al., (*2015) opines that meal planning software is a valuable tool for health professionals, which offer support for practitioners, students and public. This kind of software will be useful both for learning and practice, which gathers relevant scientific information, equations and tools necessary for providing nutritional services and structures them along the recommended steps.

According to Skuroliakou *et al., (*2009) a software was developed for preparing dietary prescriptions in clinical settings. This has the ability to calculate the nutritional requirements and produce daily menus for the patients and a healthy individual automatically. It resulted in a decrease of the error percentages, concerning appropriate food choices, data recording and calculations of daily nutrient requirements; from 12 per cent to 1.5 per cent.

The menu planning software supports the student in carrying out the nutrition care process and allows creating and analyses food menus and recipes. It guides through the information gathering process and all the steps has to complete in order to successfully provide nutritional service. By working with it and having to continuously make decisions; the student is prompted not only to learn, but also to understand the nutrition care process. Last, but not least, by automatically doing all the necessary calculations, the software allows the student to focus on the information and the quality of decisions and recommendations, as well as to try different types of intervention or menu plans, in order to obtain the best results (Doina, 2015).

E. Advantage of Meal Planning

Menu planning software is an essential tool to prevent malnutrition. The risk of malnutrition increases with ageing, resulting in poorer health and higher risk of disease. Eating difficulties are important risk factors for malnutrition. Moreover, independence in relation to food and meals is highly rated by the elderly and has been associated with health and well-being. The purpose of this literature overview was to provide insights into nutritional status, food choice and preferences as well as the meal situations (Nyberg *et al.,* 2014).

Meal planning has a positive impact on nutrition, health, family communication, and the emotional development of children and teens. In contrast, improper planning promotes unhealthy eating behaviors involving processed foods and fast foods (Frush *et al.,* 2013).

According to Sethi *et al.,* (2013) advance planning removes a lot of anxiety for the planner, and enables clear – cut instructions to be given to staff. This also helps to create harmony among people at work. Meal planning helps in the accurate calculation of food costs and inclusion of items that can be profitably sold. It also becomes far easier to fix selling prices in advance for the information of the customer.

Interventions to promote family meals are limited. America is a nation of far too many obese people, and obesity leads to diet-related chronic diseases. To effectively develop programs to teach healthy eating, first the barriers of preplanning and healthy meal preparation need to be explored, and factors that facilitate permanent changes in dietary behavior need to be identified. Efforts must be made to inquire about family meal patterns and include education on the importance of preplanning family meals. Encouraging family meals is one of the important measures for improving dietary intake, decreasing obesity, and strengthening family units. (Fruh, 2013).

The majority of meals are planned in advance for people tend to select a portion to eat and then clean their plate (Fay *et al.,* 2011; Wilkinson *et al.,* 2012). Portion size were often governed by the ‘expected satiety’ of a food, a concern to select an amount that is sufficient to stave off

hunger (the desire to eat) in the interval between meals (Brunstrom and Rogers, 2009; Brunstrom, Shakeshaft, and Scott-Samuel, 2008). Anticipated meals timings probably influence these decisions. (Zimmerman *et al.,* 2017)

Meal planning software may act as a protective factor for many nutritional health related problems during childhood and adolescence, including issues of overweight, unhealthy eating, and disordered eating. Findings have been found with some studies that reported strong relations to health outcomes such as obesity, whereas others have reported no relation. (Fulkerson *et al.,* 2008), (Mamun, *et al.,* 2005) these inconsistencies make it difficult to inform parents of the relation between family meals and health outcomes. (Hammon *et al.,* 2011).

Davis *et al.,* (2010) found that a meal replacement diet plan of a fixed macronutrient composition yielded clinically significant weight loss for 93% of obese participants. This is roughly twice as much as the rate demonstrated in controlled clinical trials of currently approved pharmacologic agents for obesity treatment. Also, the intervention with meal replacements yielded changes in body composition that favorably impacted many cardiovascular health outcomes. This data suggested that the meal replacement diet plan evaluated is an effective strategy for producing robust initial weight loss and for achieving improvements in a number of health parameters during weight maintenance, including inflammation and oxidative stress, two key factors recently understood to underlie our most common chronic diseases.

Individuals planning their meals were more likely to have a better dietary quality, including a higher adherence with nutritional guidelines as well as an increased food variety. Additionally, meal planning was associated with lower odds of being obese in men and women and overweight in women only (Ducrot *et al.,* 2017).

Meal planning tool could partly address the issue of time scarcity reported by consumers for meal preparation and, might therefore encourage home cooking. Given the potential benefits of meal planning identified, it would be interesting that future research evaluate the appropriation and the

impact of applications designed to help individuals planning their meals (Ducrot *et al.,* 2017).

F. Food Intake and Life Style / Life Disease

Susmitha (2015) opined that consumption of restaurant and fast food, large portion sizes, and sugar-added beverages increase energy intake, creating a positive energy balance. These behaviours are positively associated with overweight and obesity. Conversely, fruit and vegetable consumption and healthy breakfast consumption are negatively associated with overweight and obesity.

Merkiel *et al.,* (2009) suggested that n-3 PUFA (poly unsaturated fatty acids) play an important role in weight status and abdominal obesity. Results of their study revealed that Body Mass Index, waist circumference and hip circumference are inversely correlated with PUFA in the obese group. They concluded that higher plasma levels of total n-3 PUFA are associated with healthier BMI.

A review of the results from 28 clinical trials that studied the effects of reduction in the amount of energy from fat in the diet showed that a reduction of 10 per cent in the proportion of energy from fat was associated with a reduction in weight of 16 g/d. Dietary fat plays a role in the development of obesity. To reduce the prevalence of obesity, there must be an increase in energy expenditure, a reduction in total energy intake, or both. This goal can be facilitated by reducing the amount of fat in the diet (Fischer, 2003).

Most epidemiological studies show an inverse relationship between carbohydrate intake and BMI (Gaesser, 2007). Whole-grain intake is generally inversely associated with BMI. Ma *et al*., (2005) reported that Body Mass Index was found to be positively associated with glycaemic index. Glycaemic index influences hunger and therefore may be related to overeating. Because the overall dietary quality tends to be higher for high-carbohydrate diets, a low-fat dietary strategy with emphasis on fiber-rich carbohydrates, particularly cereal fiber, may be beneficial for health and weight control (Shivaprakash and Joseph, 2014).

Higher BMI gain in early childhood and adolescence was associated with adult adiposity and central adiposity (Sachdev *et al.,* 2005). Frisancho (2003) has reported that in the developing nations obesity is associated with short stature resulting from developmental undernutrition, while in the developed countries obesity is associated with tall stature. Studies by Maddah *et al.,* (2003) Khan and Kraemer (2009) and Hermann *et al.,* (2011) found significant association with level of education and BMI (Shivaprakash and Joseph, 2014).

Cleland *et al.,* (2008) found relationship between television viewing and abdominal obesity in young adults. Association between TV viewing and overweight was partially explained by food and beverage consumption during TV viewing. Chhabra and Chhabra (2007) and Bose *et al.,* (2007) state that the economic status had a significant impact on the nutritional status with the economically better-off subjects being more likely to be overweight or obese and those with the lowest income were more likely to be underweight.

NFHS-3 (2005-2006) reports state that over the last three decades there has been a progressive decline in undernutrition and some increase in over nutrition both in urban and in rural areas of India. Prevalence of both undernutrition and over nutrition are higher in women as compared to men. Undernutrition is particularly serious in the lower wealth quantile those with no education. Overweight and obesity are most common in older adults, those in urban areas, the well-educated and those in the highest wealth quantile. In most of the states with low energy intake, undernutrition rates are high (Bihar).

The Nutrition and Media Literacy report (2009) revealed that children see approximately 7600 food commercials a year on television. Between 35 to 45 per cent of commercials on children's television are for food. Almost all advertised food is unhealthy. Commercials increase preference for advertised foods and increase children's requests to parents for those foods.

Mislang *et al.,* (2018) did a cross sectional study among 1203 Bengali adults in India which showed that frequency of under nutrition was higher among females (31.7%) compared to males (23.6%). There existed significant relationship between the level of formal education and nutritional status.

Overall the frequency of chronic energy deficiency (43.5%) was much higher than overweight (7.0%) among subjects with no formal education.

Intervention strategies like eat less, eat on time and walk more have to be included to save citizens from developing these present day disorders. Pragmatic life style intervention can definitely delay and / or prevent diabetes and a host of other disorders (Mehta *et al.,* 2009).

Harrison (2005) found that children eat more high-calorie, low-nutritious foods when watching commercial TV with advertisements for such products. Feldman, *et al.,* (2007) argued that adolescents watching TV were found to have lower intakes of vegetables, dark green/ yellow vegetables, calcium-rich food and grains; and a higher intake of soft drinks compared to adolescents not watching TV during meals.

Ramesh and Jareena (2009) found out that in Kerala standard of living and age are positively and significantly associated with overweight and obesity and negatively related to under nutrition. Further it has been observed that Muslim and Christian women are more likely to be overweight or obese than Review of Literature 37 Hindu women. This is related to differences in diet, physical activity and socio- economic status. (Syamala, 2013)

Thankappan *et al.,* (2013) reported that physical inactivity and alcoholism were associated with greater prevalence of overweight and abdominal obesity and smoking was associated with a lower prevalence of the same in Kerala.

Ramesh (2010) stated that, in the past 10 years there has been a tremendous growth in Kerala in the number of fast food joints. This has changed the diet to a high fat, high sugar, low fiber diet which in turn resulted in increased prevalence of overweight. Rosen and Rosen (2012) opined that even though the increase in fat cell number in early years of development is due to gene and environment, the increase in fat cell size during later years is primarily due to diet. Therefore the fundamental cause of obesity is consequence of positive energy balance.

Rahi *et al.,* (2016) found that a 1 g/kg protein intake was associated with a lower prevalence of frailty, after adjusting for socio demographic and

clinical factors. In a multicenter cross-sectional study that explored the association between protein or amino acid intake and frailty, Kobayashi, *et al.,* 2013 showed that a higher intake of total protein was significantly associated with a lower prevalence of frailty among women, regardless of the protein source (animal sources: fish and shellfish, meat, eggs, and dairy products; plant sources: cereals, pulses, potatoes, confectionaries, fruits and vegetables), or the amino acid that composed the protein (leucine, isoleucine, valine, methionine, cysteine, branched chain amino acids, sulfur amino acids, and essential amino acids).

Eight studies met the inclusion criteria, including two randomized controlled trial studies (from the same intervention), one cohort study, two pre-post studies, and three cross-sectional studies. All but two studies found home-delivered meal programs to significantly improve diet quality, increase nutrient intakes, and reduce food insecurity and nutritional risk among participants. Other beneficial outcomes include increased socialization opportunities, improvement in dietary adherence, and higher quality of life (Huichen 2014).

Over the last three decades, there have been substantial changes in the socio-economic status of people, some increase in the dietary intake of men and women especially of the affluent segments in rural and urban areas. Ready availability of fast foods, ice creams and other energy rich food items at affordable costs have resulted in increased energy consumption. There has been some reduction in under-nutrition and some increase in obesity over the last two decades. Over the last two decades there have been a growing number of reports that Indians are a very high-risk group for cardiovascular diseases and diabetes (Government of India Planning commission, 2002-2007).

A study conducted among adolescents of Thriuvanthapuram district by Unnithan and spiller (2002). Reported that when compared to the prevalence studies done before two decades or more in Kerala, it was found that the rate of underweight to be reducing but at the same time overweight and obesity are increasing. The results of the study expose the fact that the percentage of overweight and obesity were seen more in boys, severe underweight were

more among girls indicating an increasing trend in the percentage of overweight in boys compared to girls.

Simple dietary and lifestyle interventions like exercise, increased consumption of fruits and vegetables and abstinence from tobacco and alcohol can make a substantial dent in the problem of non-communicable diseases in Kerala. According to Raj *et al.,* (2007) observations in the trend of increasing overweight in Kochi indicates that unless effective interventions and preventive strategies are instituted at the local and national level, the trend of increasing cardiovascular disease in adults observed in recent decades will accelerate even further. These trends are disturbing and call for concerted efforts targeted at improving lifestyles. Moli and Mini (2012) state that the level of overweight or obesity among adults in Kerala points out, a need for change in their lifestyle, dietary habits and increase in the level of physical activity.

Anhoj and Jensen (2004) reported that there is a need for a receptive attitude toward a Web-based program that supports people who want to improve their life style and health. According to Brug et al. (2005) the research into the effectiveness and applicability of interventions provided through the internet is still in its infancy and the evidence for the effectiveness of web-based nutrition education is very limited.

According to Ware *et al.,* (2008) internet-based physical activity (PA) and weight management programs have the potential to improve employees' health in large occupational health settings. A Web-based PA and weight management programme showed high levels of engagement across a wide range of employees, including overweight or obese workers, shift workers, and those who do not work with computers. Weight loss was observed at both office and manufacturing sites. The use of monitoring devices to capture and Review of Literature 49 send data to the automated Web-based coaching program may have influenced the high levels of engagement observed in this study.

A comparative study in Kolkata, India by Mukhopadhyay *et al.,* (2005) of 215 sedentary (no regular physical exercise undertaken) and 313 physically

active (regular physical exercise undertaken) Bengali boys aged 10-17 years was undertaken to investigate the differences in overall adiposity (body mass index), subcutaneous adiposity (skinfolds) and body composition (percent body fat, fat mass and fat mass index). Both groups had a similar age. The results revealed that boys who did not undertake regular physical exercise (NPE) had a significantly greater mean body mass index (BMI) compared with those who undertook regular physical exercise (PE); $p < 0.001$. The means for all the skinfolds as well as percent body fat (PBF), fat mass (FM) and fat mass index (FMI) were significantly higher among the NPE group.

Stang and Story (2005) conveyed that prior to puberty; nutrient needs are similar for boys and girls. It is during puberty that body-composition and biological changes (e.g., menarche) emerge which affect gender-specific nutrient needs. Nutrient needs for both males and females increase sharply during adolescence. Nutrient needs parallel the rate of growth, with the greatest nutrient demands occurring during the peak velocity of growth.

Chakravarty and Sinha (2002) felt that even though they are required in very small amounts, micronutrients-the vitamins and minerals found in food—are of profound importance for physical growth and mental development. Average Indian diets, especially those of the people of poor socioeconomic groups, are often deficient in a number of vitamins, namely vitamin A, riboflavin, folic acid, and vitamin C, as well as essential minerals such as iron, iodine, and calcium.

Dallman *et al.,* (1980) concluded that following early childhood (<2 yrs) during the adolescent growth spurt, the risk of iron deficiency and anaemia reappears for both boys and girls, after which it subsides for boys but remains for girls because of menstrual blood loss. Beard (2001) and Yip (2002) proposed that iron deficiency is reported to be the most prevalent nutritional problem in the world today with an estimated 2.5–5 billion people so afflicted.

Srihari *et al.,* (2007) stated that In India, approximately 19 per cent (190 million) of the growing population comprises school-aged children of whom 30 per cent (48 million) currently reside in urban India. A significant and increasing number of these children belong to middle and high socioeconomic

groups. Developing countries are undergoing nutrition transition due to increased economic development and market globalization leading to rapid changes in lifestyle and dietary habits. Poor dietary habits combined with decreased physical activity have led to an increase in overweight and obesity among adults and children. Overweight and obese children are not only at risk for insulin resistance syndrome, hypertension, dyslipidemia and hypertryglyceridemia, but also for poor micronutrient status.

Chaturvedi and others (1994) assessed the nutritional status of 941 adolescent girls, aged 10-18 years belonging to scheduled caste communities in rural Rajasthan. It was found that the diets were deficient in calories by 30% to 40%, in proteins by 25% to 37%, in iron by 39% to 55%, and in vitamin A by 10% to 34%. Nearly 78% of the subjects suffered from various grades of anaemia and 40% of the subjects had B complex deficiency, as per their study.

Yadav (1999) conducted a cross sectional survey among tribal children of Bihar to assess the nutritional status and dietary intake. The result of the study reveals that intake of protein was broadly in line with recommended dietary allowances (RDA). However, the average intake of energy and other nutrients was lower as compared to RDA. Calorie deficiency was 38% whereas protein deficiency was about 19%. In conclusion author stated that nutritional status and dietary intake of tribal children is very poor and urgent remedial measures are required.

Regan *et al., (*2017) studied the socio-demographic factors, diet and health profile of 320 elderly men and women of the three income groups of urban Baroda. Nutrient intake data of elderly men of all the income groups revealed lower consumption of carbohydrates, proteins, iron and beta-carotene, whereas fats and vitamin C intakes were higher as compared to the RDA. The study reveals striking differences in diet, health and disease profile with advancing age.

Regan *et al., (*2017) has brought out that a large proportion of adolescent boys and girls in both rural and urban areas are undernourished but severe under-nutrition is not much evident in the study population. Further,

socio-economic differentials in under-nutrition among adolescents are not substantial, though economic factors seemed to have some bearing on it. It is found that vitamins and minerals-rich food items like green leafy vegetables and fruits and protein-rich food items like pulses, milk and milk products and non-vegetarian foods are not frequently consumed by the adolescents and thus they are prone to suffer from protein-energy malnutrition as well as deficiency of various micronutrients including anaemia. It appears that improvements in economic status of households and changes in food habits of adolescents are required for bringing about improvements in the nutritional status of adolescents.

Regan *et al., (*2017) conducted a study in Benin to identify the dietary pattern of urban adults with a sample size of 200 men and women aged 25-60 years. Two distinct dietary patterns emerged: a 'traditional' type (66% of the subjects) and a 'transitional' type (34%). Subjects with a 'transitional diet' were predominantly from the upper socioeconomic status or born in the city. Compared with the traditional type, the 'transitional diet' had a significantly higher per cent age of energy from fat (17.6 vs 15.5%), saturated fat (5.9 vs 5.2%) and sugar (6.3 vs 5.0%). It was also significantly higher in cholesterol and lower in fibre.

Story *et al.,* (2005) undertaken a study on Finnish adults to find out the contribution of snacks to the daily energy intake through a 48 hour dietary recall method. The results of the study revealed that the snack-dominated eating pattern has increased in adults from 2002 to 2007, significantly in men. Higher alcohol intake in men and higher sucrose intake with lower fibre intake in women were associated with the snack-dominated eating pattern.

Kobayashi *et al.,* (2013) examined the variation in fruit and vegetable consumption among adults in the United Kingdom, with particular reference to consumers with high and low reported intakes. A sample size of 1087 men and 1110 women were included in the study. Consumption of fruit and vegetables was estimated. The sample was divided by sex into four quarter groups according to fruit and vegetable consumption. There were significant similarities between quarter groups in fruit and vegetable and other food intake, nutrient intake, physiological measures, and socioeconomic,

demographic and behavioral variable. Being married was associated with increased fruit and vegetable intake and being single or divorced/separated was associated with low fruit and vegetable intake.

Lumeng *et al.,* (2008) carried out a study on Nutrient intake patterns, body mass index, and vitamin levels in patients with rheumatoid arthritis and the results of the study showed deficient vitamin levels and poor nutrient intake patterns were prevalent among the study population.

Letamo (2004) estimated the calcium and vitamin D intakes from food and supplements in men and women. Data were collected from 9423 randomly selected subjects aged 25 years or older, who were participating in a longitudinal study on osteoporosis. The results showed the mean (standard deviation) daily intake for calcium was estimated to be 1038 (614) mg for women and 904 (583) mg for men; for vitamin D, mean intakes were 5.6 (5.9) microgram 32 and 4.8 (5.5) microgram for women and men, respectively and the study concluded that the mean intakes for calcium and vitamin D in men and women under age 51 were close to the adequate daily intake levels.

Pereira (2002) conducted a study to investigate the relative contribution of dietary calcium intake on bone mineral density (BMD) and biochemical bone turnover markers in rural Thai women. A cross-sectional investigation was designed in 255 rural Thai women. The results revealed that an average daily calcium intake in the study was 265 mg/day. Two hundred and thirty three out of 255 women (87%) consumed dietary calcium less than half of the recommended value and only 3% of women had calcium intake > 800 mg/day. Finally the study concluded that a habitual diet of the rural Thai population might not provide enough calcium as needed for bone retention and for prevention of bone loss in the following years.

Stone *et al.,* (1997) carried out a study among 48 patients to determine the adequacy of calcium, folic acid, vitamin E, zinc, and selenium intake in patients with rheumatoid arthritis (RA). The findings of the study revealed that the percentage of patients who achieved the RDI was 23% for calcium, 46% for folic acid, 29% for vitamin E, 10% for zinc, and only 6% for selenium. Patients on methotrexate had a significantly reduced intake of folic acid as a

per cent age of RDI compared with those on other therapies. In contrast, dietary intake of iron and protein was largely adequate and unrelated to anemia. The study suggested that patients with RA should receive dietary education or supplementation to bring their intake of calcium, folic acid, vitamin E, zinc, and selenium up to the RDI

According to FAO (2006), given current economic and social trends, observed changes in dietary patterns are likely to continue and combined with changes in lifestyle, particularly the decrease in physical activity will exacerbate emerging problems of over nutrition and diet-related chronic disease. The challenge is to develop effective programmes and policies aimed at preventing and controlling both aspects of the 'double burden'. That is a task not only for nutritionists but also for everyone working in food production, processing and marketing, as well as food safety and education.

According to Ginter (2008) vegetarians form a non-homogenous group consisting of semi-vegetarians (plant food, dairy products, eggs and fish), lacto-ova vegetarians (plant food, dairy products, eggs) and vegans (plant food only). According to pure vegetarian ideologists, people consuming vegetarian diet have better health and live longer than non-vegetarians.

Parents and other role models define the first childhood environment that will affect a child's preferences, pickiness, and quantities consumed (Lumeng, 2008). It is essential that these children be educated about nutrition to be able to avoid childhood food related diseases such as obesity has risen intensely in the last decade and this has provoked the interest of scientists to try and find the causative factors.

Kowieska (2009) noted that the intake of micronutrients in daily diet is far from satisfactory and largely less than 50 per cent RDA is consumed by over 70 per cent of Indian population. The loss due to micronutrient deficiency costs India one of its GDP. This amounts to a loss of Rs. 27,720 crores per annum in terms of productivity, illness, increased health care costs and death.

It is during these first years of life that children attain many of the physical features and the social and psychological qualities of life through learning and exploring (BMA "Preventing childhood obesity" 2005). As children grow, unhealthy lifestyle patterns may persist into later years of life

(Boulton *et al.,* 1995), so it is vital to aim early in life for a healthy diet with the RDA of food and nutrients to be able to stay healthy.

According to (Slavin, 2003) preschoolers are recommended to consume five servings of grains per day, such as one serving at every mealtime, and some can be consumed as snacks. Grains provide energy that is needed for growth and movement. Grains also deliver a variety of vital nutrients. It is recommended that children at this age are encouraged to try a variety of grains. Whole grains are a better alternative to white/refined grains but should be consumed now and again and not always, as they fill up a person very quickly due to the high fiber content, and so the children will not get their full energy needs.

Protein foods deliver essential nutrients such as iron, zinc, vitamins B and vitamin D and it is essential that preschool children get these nutrients from their diet. Serving suggestions for children aged 3-5 years old are two servings per day. Some examples of a single serving include a small piece of pork or a lamb chop, two slices of roast beef, two slices of poultry, a medium fillet of fish, two eggs, and six tablespoons of baked beans, peas, or lentils. When serving protein, it is beneficial to offer a drink rich in vitamin C such as fruit and vegetable drinks or fruit and vegetable juices as they help the body absorb iron, especially for vegetarians because iron from plant protein is not as easily absorbed as from animal protein (www.nutrition.org).

Wholegrain wheat contains approximately 3 % lipids, and wholegrain oats contain approximately 7·5 % lipids and these reduce serum cholesterol and are a vital element of a heart-healthy diet (Spiller, 1995). Grain lipids are composed of 75% oleic and linoleic acid in equal amounts and 1–2 % of linolenic acid. Palmitate is the chief unsaturated fat .There are about 2 grams unsaturated lipid in every 100 grams of whole-wheat and about 5·5 grams of unsaturated fat in every 100 grams of whole oats.

Research has shown that cereal containing fiber reduced the risk for DM. The larger the consumption of whole grains, the lower insulin levels drop. Whole grain intake was found to be associated with the regulation of body weight (Pereira, 2002). In research, whole grains were found to be inversely associated with Body Mass Index (BMI) and waist: hip ratio at baseline and seven years later.

III METHODOLOGY

The research design pertaining to the study "**Development of a Software for Meal Planning"** is presented under the following heads.

PHASE I

A. **Collection of Material for the Development of Package**

B. **Developing Screens using Resource Materials**

C. **Development of a software for Meal Planning**

PHASE II

A. **Selection of Subjects for Evaluation**

B. **Preparation of the Interview Schedule for Evaluation of developed Software Package**

C. **Evaluation of the Developed Software Package and Feedback.**

PHASE I:

A. Collection of Material for the Development of Package

First step in the development of the software package consisted of charting out an effective plan. The first step of the plan involved reviewing and synthesizing various materials on meal planning and integrating them towards developing an interactive package. Towards this, reliable information was collected from various literatures. Finally, before framing the package, software developers were consulted and the necessary guidelines were obtained.

B. Developing Screens using Resource Materials

After collecting the resources materials script was prepared in a note book indicating each slide in one page with necessary diagrammatic representations wherever required. In the next step screens were developed using Software developing text and all the texts were typed in text boxes, and pictures scanned were copied to the slides and each screens was developed by adjusting the font size, colour of the text, fore colour and background colour of the screens. On the whole 42 screens were developed.

C. Development of a Software for Meal Planning

The software was developed by using **visual basic.net**

The propose for the research was reviewed and approved by the Institutional Human Ethics Committee (IHEC) IHEC/17 – 18/FSMD/01 of Avinashilingam Institute for Home Science and higher Education for Women. The study participants were informed about the study. A copy of the IHEC clearance certificate is closed as Appendix – 1.

Visual Basic.Net 2010

Visual Basic.Net has revolutionized windows programming windows programming and with an object based, event driven approach to software designs. Visual basic.Net applications act as a front end to the database. Visual basic.Net application provides the interface between the user and the database. Sophisticated features that make the language truly object oriented and interfaces it with the latest in the database technology.

.NET provides a new, object-oriented API as a set of classes that will be accessible from any programming language. This book describes this framework of classes and provides a reference to what is available and how you can use this framework to write Windows applications in the brave new world of .NET.

Microsoft .NET Framework is a computing platform for developing distributed applications for the Internet.

Following are the design goals of Microsoft .NET Framework:

1. To provide a very high degree of language interoperability
2. To provide a runtime environment that completely manages code execution
3. To provide a very simple software deployment and versioning model
4. To provide high-level code security through code access security and strong type checking
5. To provide a consistent object-oriented programming model

6. To facilitate application communication by using industry standards such as SOAP and XML.
7. To simplify Web application development

Visual basic.net lets the user to add menus, text boxes, command buttons, option buttons, check boxes, list boxes, scroll bars, and file directory boxes to blank windows. Visual basic.net has many different tools.

Overview of .NET

The .NET Framework is designed for cross-language compatibility. Simply put, it means that .NET components can interact with each other no matter what language they were originally written in like the Microsoft C++ or any other .NET language.

The level of cross-language compatibility is possible because of the common language run time. When a .NET application is compiled, it is converted from the language it was written in (Visual Basic .NET, any other .NET compliant language) to Microsoft Intermediate Language (MSIL or IL). It is a low-level language designed to be read and understood by the common language run time. Because all .NET executables and DLLs exist as intermediate language, they can freely interoperate.

The Common Language Specification defines the minimum standards that .NET language compilers must conform to, and thus ensures that any source code compiled by a .NET compiler can interoperate with the .NET Framework.

The CTS ensures type compatibility between .NET components. Because .NET applications are converted to IL prior to deployment and execution, all primitive data types are represented as .NET types.

Thus, a Visual Basic Integer represented in IL code as a System.Int32. Because both languages use a common and interconvert able type system, it is possible to transfer data between components and avoid time-consuming conversions or hard-to-find errors.

The Common Language Runtime

The CLR is the mechanism through which .NET code is executed. It is built upon a single, common language into which source languages are compiled and includes mechanisms for executing the compiled code. This includes code verification and just-in-time (JIT) compilation, garbage collection and enforcement of security policies, and the provision of profiling and debugging services.

The CLR provides a lot of added value to the programs it supports. Because it controls how a .NET program executes and sits between the program and the operating system, it can implement security, versioning support, automatic memory management through garbage collection, and provide transparent access to system services

The integrated development environment

One of the most significant changes in visual basic.net 2008 is the integrated development environment (IDE). IDE is a term commonly used in the programming world to describe the interface and environment that we use to create our applications. It is called integrated because we can access virtually all of the development tools that we from one screen called an interface. The IDE is also commonly referred to as the design environment or the program.

Features

- The application is a graphical user interface.
- Client-Server architecture benefits picture and image box can be easily handled using bit mapped files and icons.
- Bit mapped files and icons are used as simple debugging tools.
- With the advent of .NET, Microsoft has introduced many new technologies that make writing component-based distributed systems easier, more flexible, and more powerful than ever before.
- It is now easier than it has ever been to write components in any programming language that can interoperate with components on other machines, which may not be Windows-based at all.

Ms-Access 2007

Microsoft Access allows us to manage all our dimensions from a single database file. Microsoft Access is a relational database management system. It is a set of two-dimensional table in which data is represented in rows and columns. An access database consists of objects such as table, form, query and report.

Menus and toolbars are completely programmable. Move the mouse over a variable or expressions while your code is suspended and access will automatically display its current value. Access is a relational database, which means that it allows data that has been stored in different places to be linked.

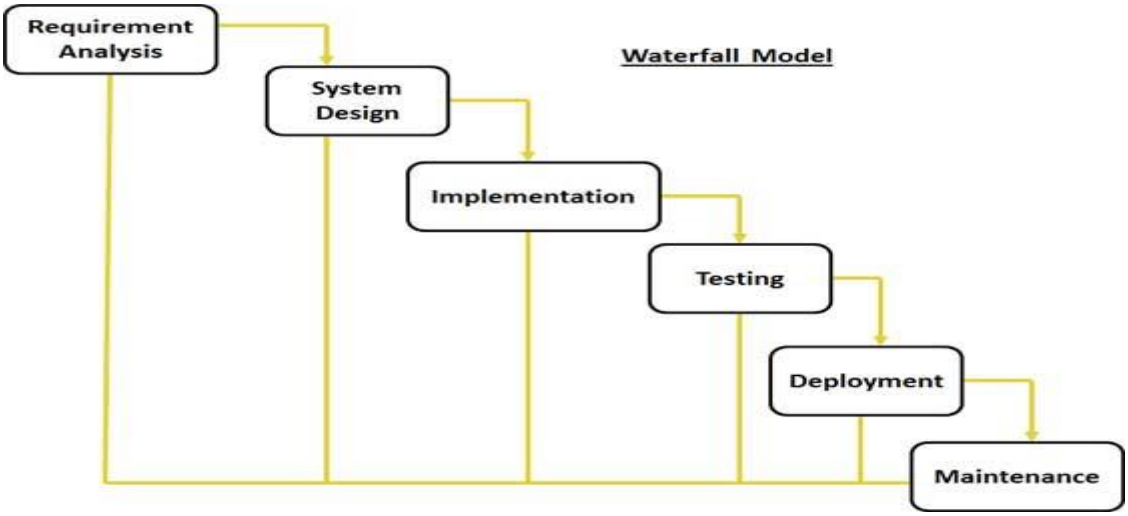
Features

- Access share Microsoft office programmability and data access object.
- Access form loads and executes faster.
- Use tools, toolbars, create and customize both menus and toolbar. When code is suspended place the mouse on expression and it will automatically display its current values.
- Controls are access objects that help you display, print and use your data.
- Macros are tools that can help to automate complex or time-consuming repetitive manual task.

Water/Fall Model

Waterfall approach was first SDLC Model to be used widely in Software Engineering to ensure success of the project. In "The Waterfall" approach, the whole process of software development is divided into separate phases. In Waterfall model, typically, the outcome of one phase acts as the input for the next phase sequentially.

Following is a diagrammatic representation of different phases of waterfall model.



The sequential phases in Waterfall model are:

- **Requirement Gathering and analysis:** All possible requirements of the system to be developed are captured in this phase and documented in a requirement specification doc.
- **System Design:** The requirement specifications from first phase are studied in this phase and system design is prepared. System Design helps in specifying hardware and system requirements and also helps in defining overall system architecture.
- **Implementation:** With inputs from system design, the system is first developed in small programs called units, which are integrated in the next phase. Each unit is developed and tested for its functionality which is referred to as Unit Testing.
- **Integration and Testing:** All the units developed in the implementation phase are integrated into a system after testing of each unit. Post integration the entire system is tested for any faults and failures.
- **Deployment of system:** Once the functional and non functional testing is done, the product is deployed in the customer environment or released into the market.
- **Maintenance:** There are some issues which come up in the client environment. To fix those issues patches are released. Also to enhance the product some better versions are released. Maintenance is done to deliver these changes in the customer environment.

All these phases are cascaded to each other in which progress is seen as flowing steadily downwards (like a waterfall) through the phases. The next phase is started only after the defined set of goals are achieved for previous phase and it is signed off, so the name "Waterfall Model". In this model phases do not overlap.

Waterfall Model Application

Every software developed is different and requires a suitable SDLC approach to be followed based on the internal and external factors. Some situations where the use of Waterfall model is most appropriate are:

- Requirements are very well documented, clear and fixed.
- Product definition is stable.
- Technology is understood and is not dynamic.
- There are no ambiguous requirements.
- Ample resources with required expertise are available to support the product.
- The project is short.

  Waterfall Model Pros & Cons

Advantage

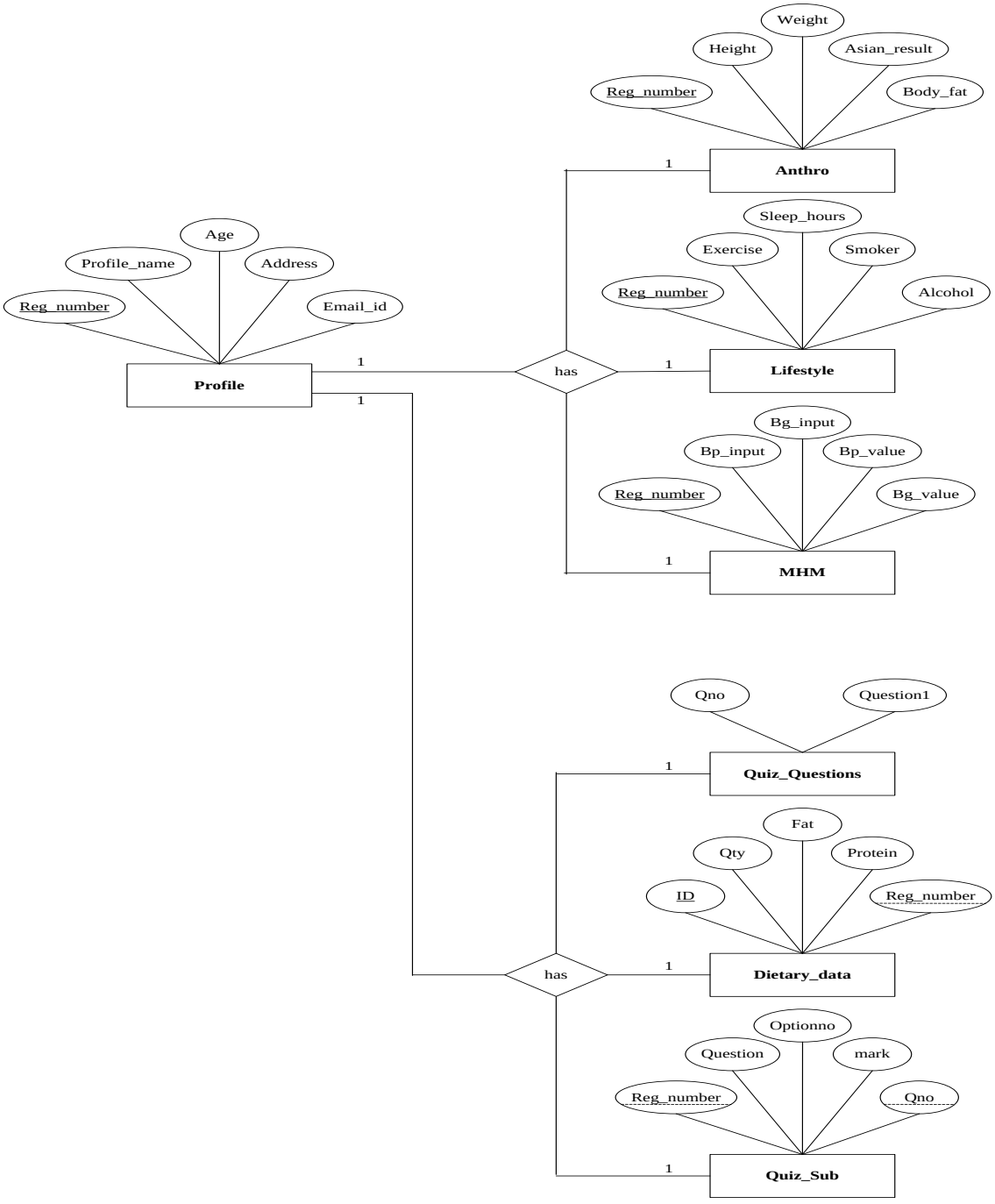
The advantage of waterfall development is that it allows for departmentalization and control. A schedule can be set with deadlines for each stage of development and a product can proceed through the development process model phases one by one.

Development moves from concept, through design, implementation, testing, installation, troubleshooting, and ends up at operation and maintenance. Each phase of development proceeds in strict order.

Disadvantage

The disadvantage of waterfall development is that it does not allow for much reflection or revision. Once an application is in the testing stage, it is very difficult to go back and change something that was not well-documented or thought upon in the concept stage.

ER Diagram



Data Flow Diagram

The data flow diagram (DFD) is a graphical tool used for expressing system requirements in a graphical form. The DFD also known as the “bubble chart” has the purpose of clarifying system requirements and identifying major transformations that will become programs in system design. Thus DFD can be stated as the starting point of the design phase that functionally decomposes the requirements specifications down to the lowest level of

detail. The DFD consists of series of bubbles joined by lines. The bubbles represent data transformations and the lines represent data flows in the system

Rules Used For Constructing a DFD

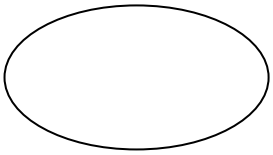
Process should be named and numbered for easy reference. Each name should be representative of the process. The direction of flow is from top to bottom and from left to right. That is data flow should be from source to destination. When a process is exploded into lower level details, they are numbered. The name of the data stores, sources and destinations are written in capital letters. Process and data flow names have the first letter of each word capitalized. The DFD is particularly designed to aid communication. If it contains dozens of process and data stores it gets too unwieldy. The rule of the thumb is to explode the DFD into a functional level. It is best to take each function separately and expand it to show the explosion in a single process. If a user wants to know what happens within a given process, then the detailed explosion of that process may be shown.

A data flow diagram is a graphical representation or technique depicting information flow and transform that are applied as data moved from input to output. The DFD are partitioned into levels that represent increasing information flow and functional details. The processes, data store, data flow, etc are described in Data Dictionary.

Data flow:

Data moves in a specific direction from an origin to destination

Process:

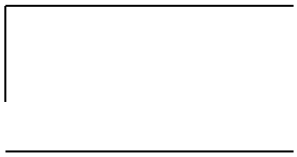


Procedure, people or devices that are used or transform data

External entity:

This defines a source (originator) or destination of system data.

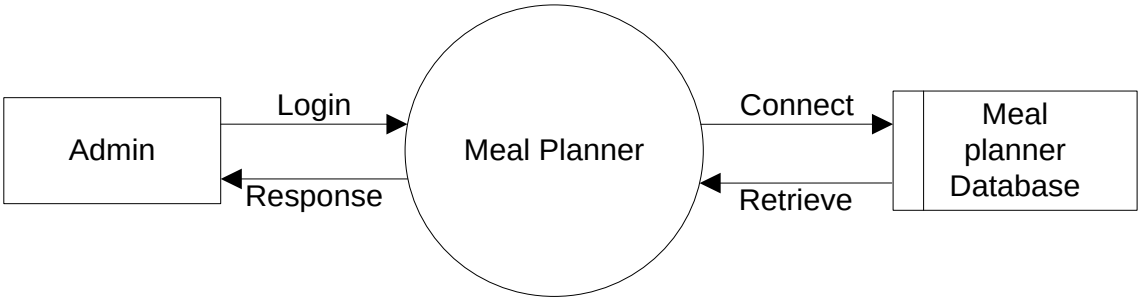
Data Store:



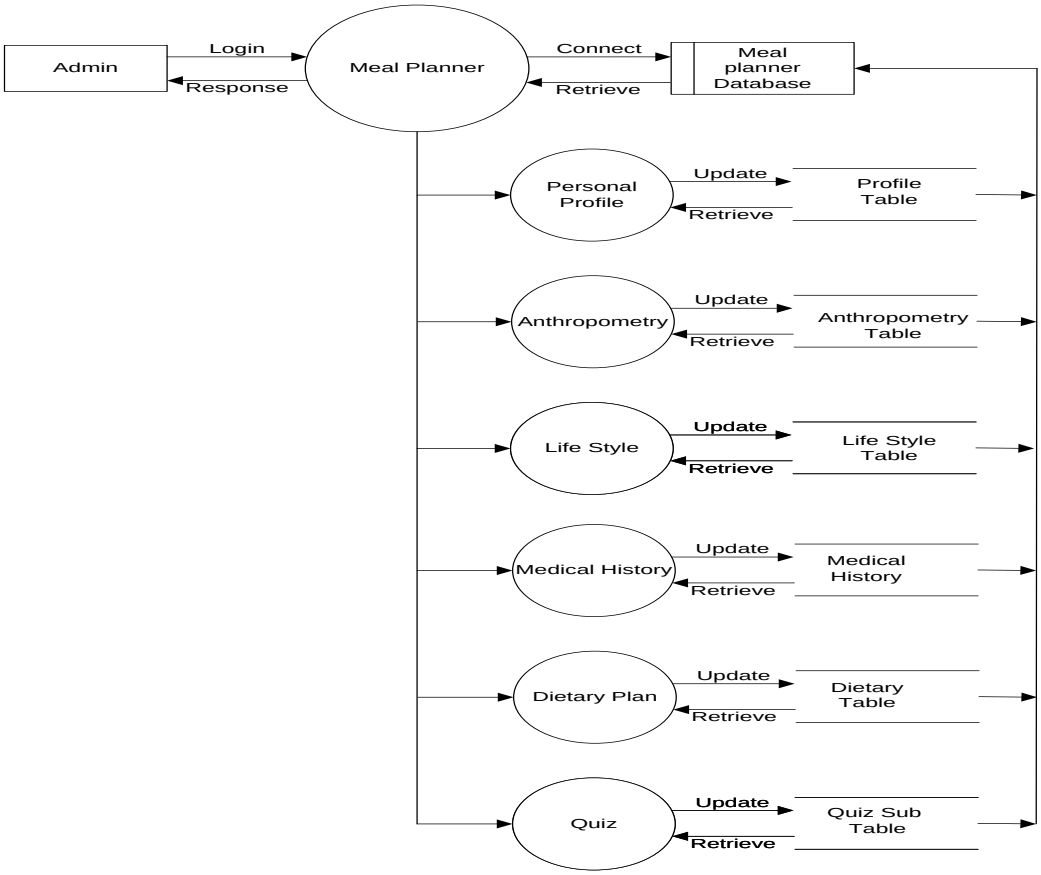
This indicates where data is stored in the system.

Data Flow Diagram

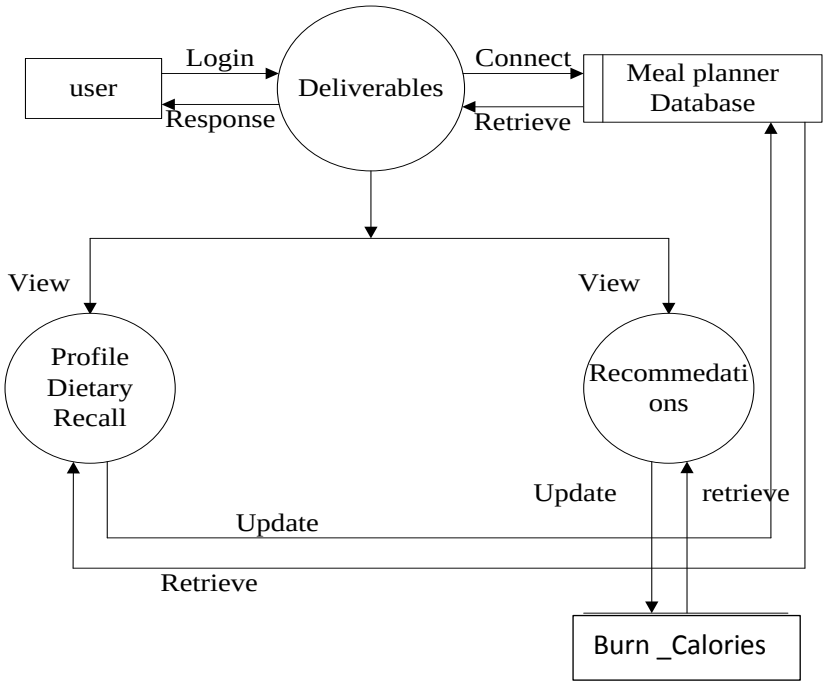
Level 0:



Level 1:



Level 2: Dietary Results



The software thus developed consists of the following contents

Login Form

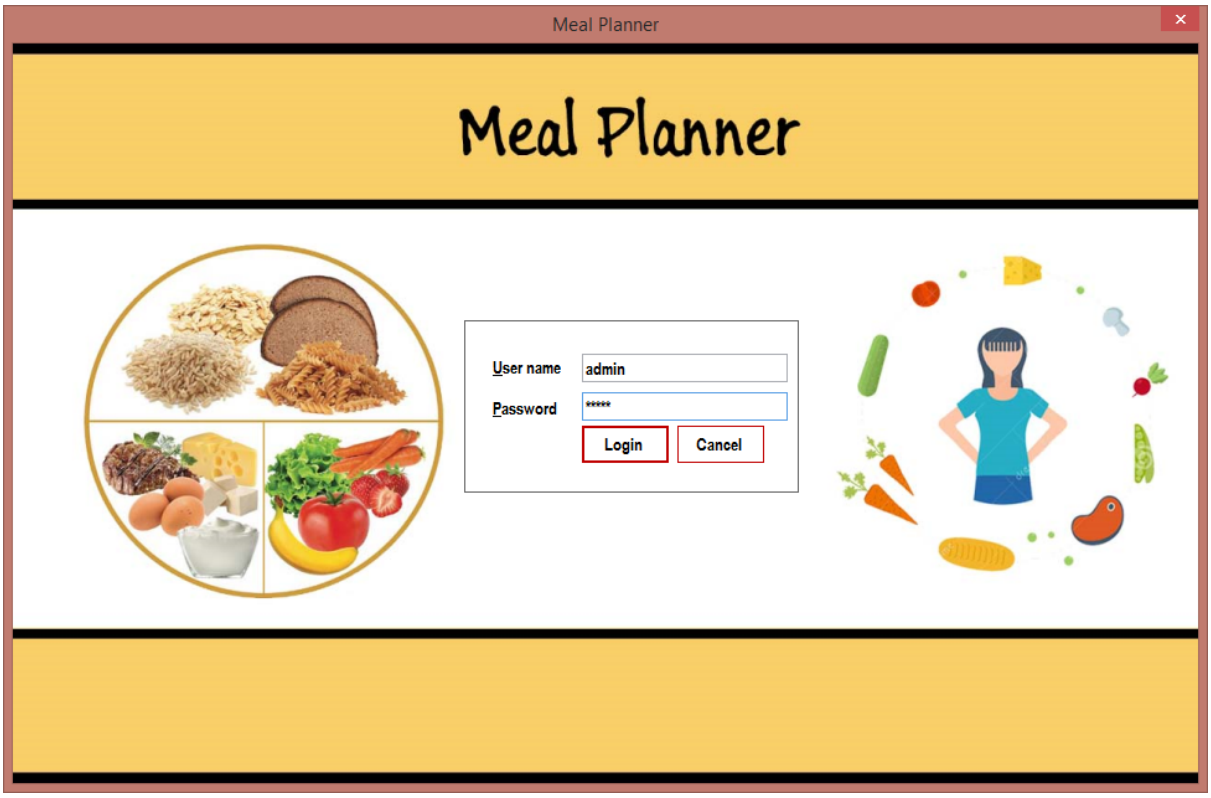


Figure 1: Login Form

The Initial step involved logging in to the software by entering the user name and password.

Entry of the Register Number

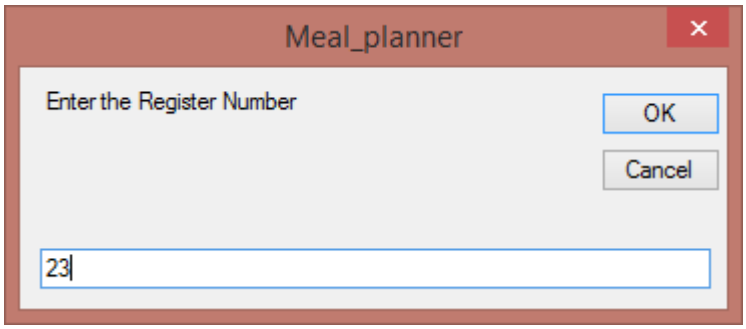


Figure 2: Entry of the Register Number

After login, the next step is to get in to the Home screen page by entering the register number.

Home Screen

Figure 3: Home Screen

The Home page of the Software was designed as shown above and consisted of the details such as the ones below

- Personal information
- Anthropometric measures
- Lifestyle
- Medical History
- Nutrition intake assessment
- Quiz
- Help
- Deliverables

Personal Information

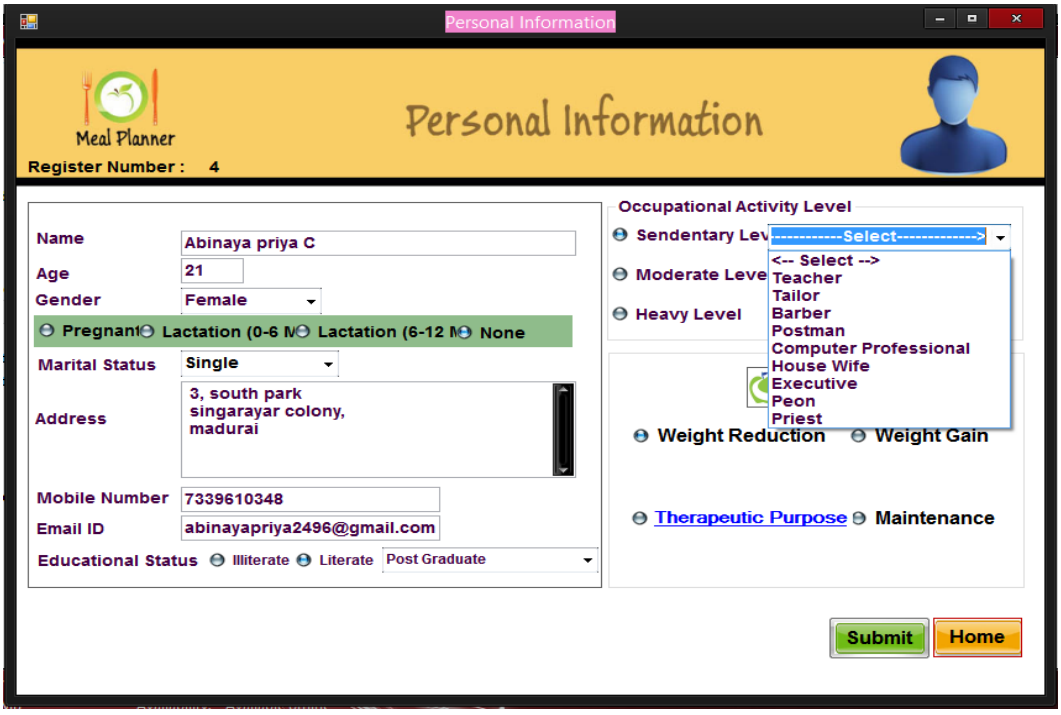


Figure 4: Personal Information

In the personal information, an automatic register number would be generated to maintain the personal information individually. Then the user would have been allowed to enter the details such as name, age, gender (if the gender is female, she should mention whether she is pregnant, Lactating 0 -6 months, Lactating 6-12 months or none), Marital status, address, mobile number, email id, educational status such as illiterate or literate, literate like (High school, Higher Secondary school, Diploma, Under Graduates, Post Graduates, Professional, others) occupational activity level such as sedentary level, moderate level or heavy level which refer to the WHO standards. After finishing the above step, the user has to select the goal listed in it such as weight reduction, weight gain, therapeutic purpose and or maintenance.

GOALS

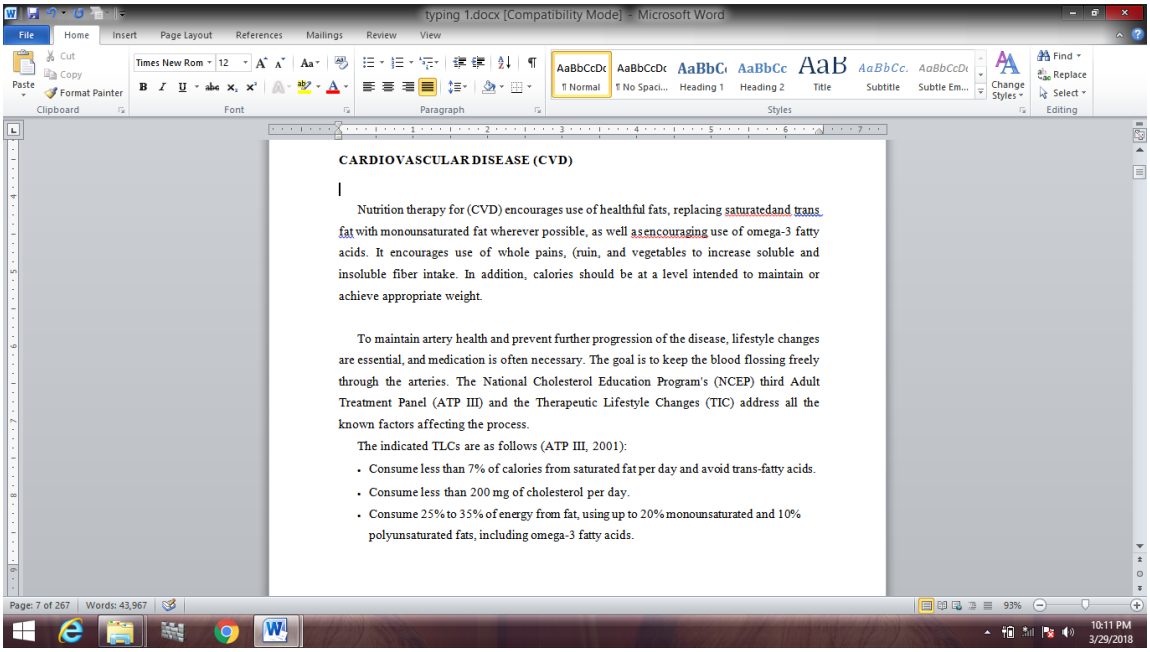


Figure 5: Goals

The software has been designed with four goals namely weight reduction, weight Gain, therapeutic purpose and maintenance diet. The First two goals of weight reduction and weight gain are connected to physical activity and calories consumed/ burnt.

Therapeutic diet is connected with the principles of diet for disease conditions like Alzheimer's disease, Swallowing Difficulty, Reduced Appetite, Depression, Constipation, Dehydration, Cardiovascular Disease, Cerebrovascular Accident (CVA) stroke, Chewing or swallowing problems, Vision or mobility impairment, food/drug interaction, heart disease and diabetes, chronic obstructive pulmonary disease (cops).

It also has diets to maintain a healthy weight: controlling fluid balance, maintain a healthy weight: controlling fluid balance: abdominal discomfort, maintain a healthy weight: controlling fluid balance, abdominal discomfort, oxygen saturation, congestive heart failure, ulcers, dehydration, adults with diabetes, high and low bloods sugar levels, Diet Therapy for General/ normal subjects, Therapeutic Treatment for Type 1 Diabetes, Dehydration Diet, Therapy diet for Type 2 Diabetes, etc.. The Maintenance Diet includes

information on Dietary Carbohydrate, Dietary Protein, Dietary Fat and diet plans for the type of activity like sedentary, moderate activity level and heavy activity levels. It also has suggestive diets according to age group and gender in order for them to maintain their health through maintenance diet.

Anthropometry

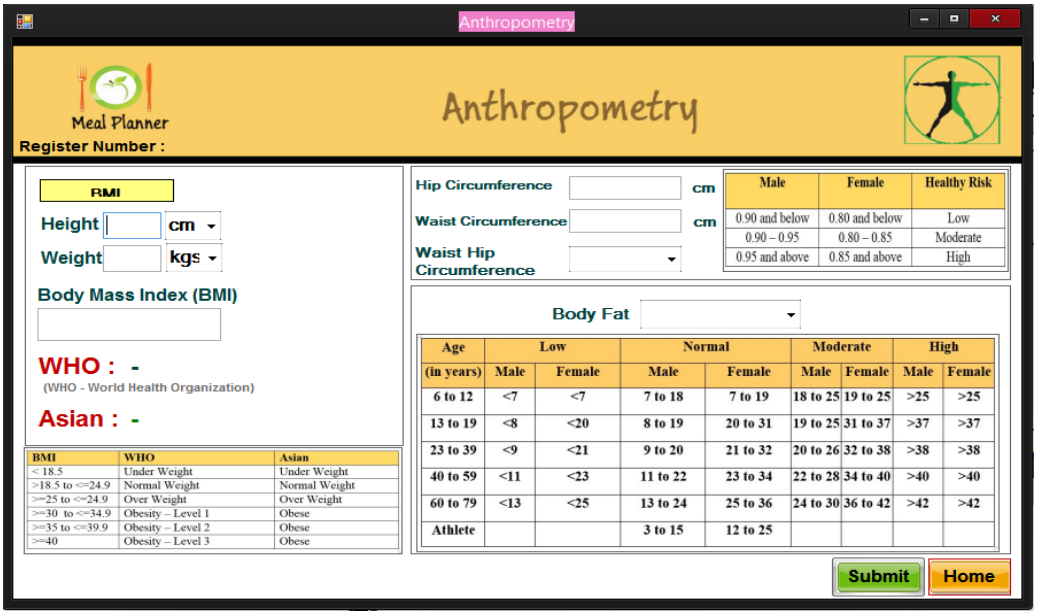


Figure 6: Anthropometry

In the anthropometry form, the user has to enter their height in cm and weight in kilograms. Based on the entered data, the Body Mass Index (BMI) would get calculated and displayed and a comparison with the WHO and Asian BMI standard would also be made. Similarly, the user has to enter the Hip circumference and waist circumference. The waist to hip circumference ratio would get calculated and the remarks like low, medium or high would be indicated. Additionally, the user would get the quantum indication of the body fat to show whether it is low, medium or high.

Lifestyle

Figure 7: Lifestyle

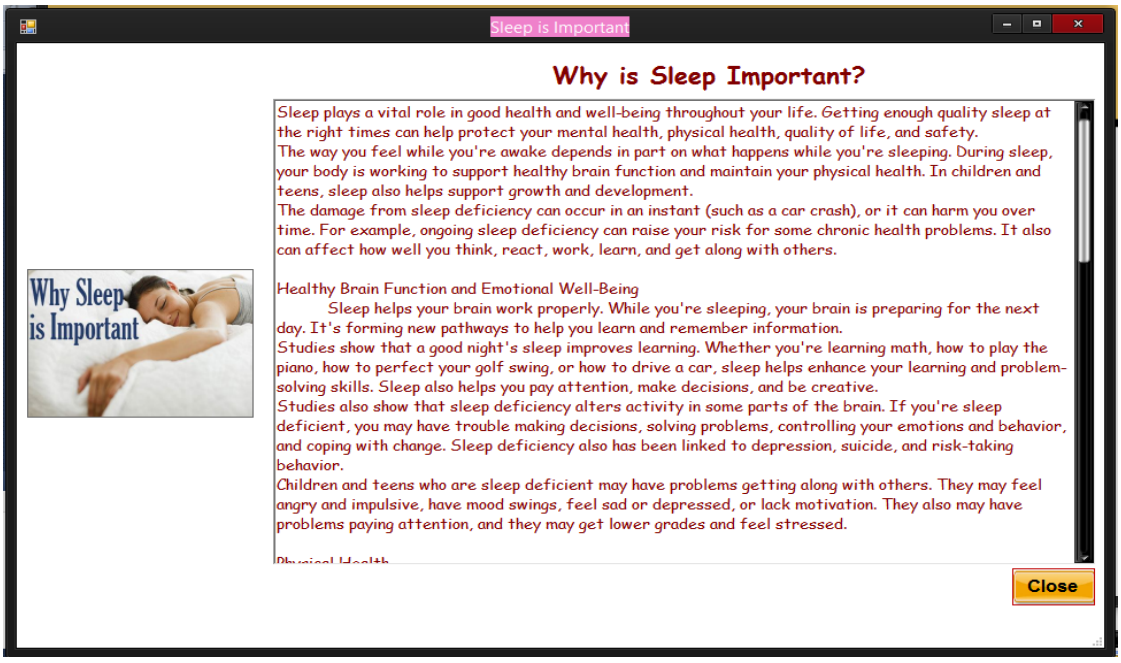


Figure 8: Why is Sleep Important

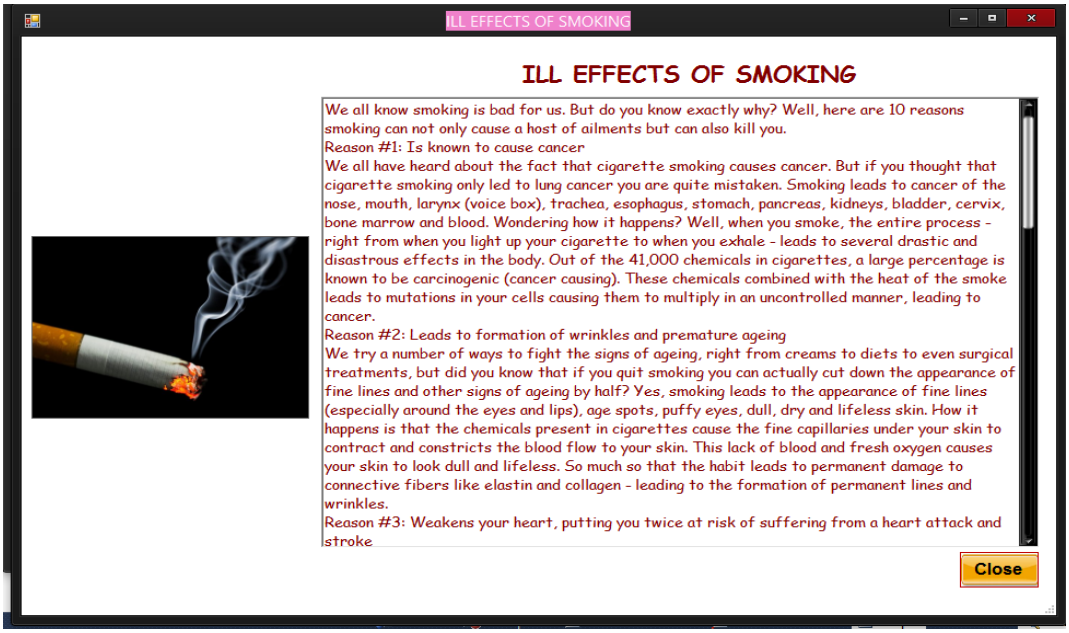


Figure 9: Ill Effects of Smoking

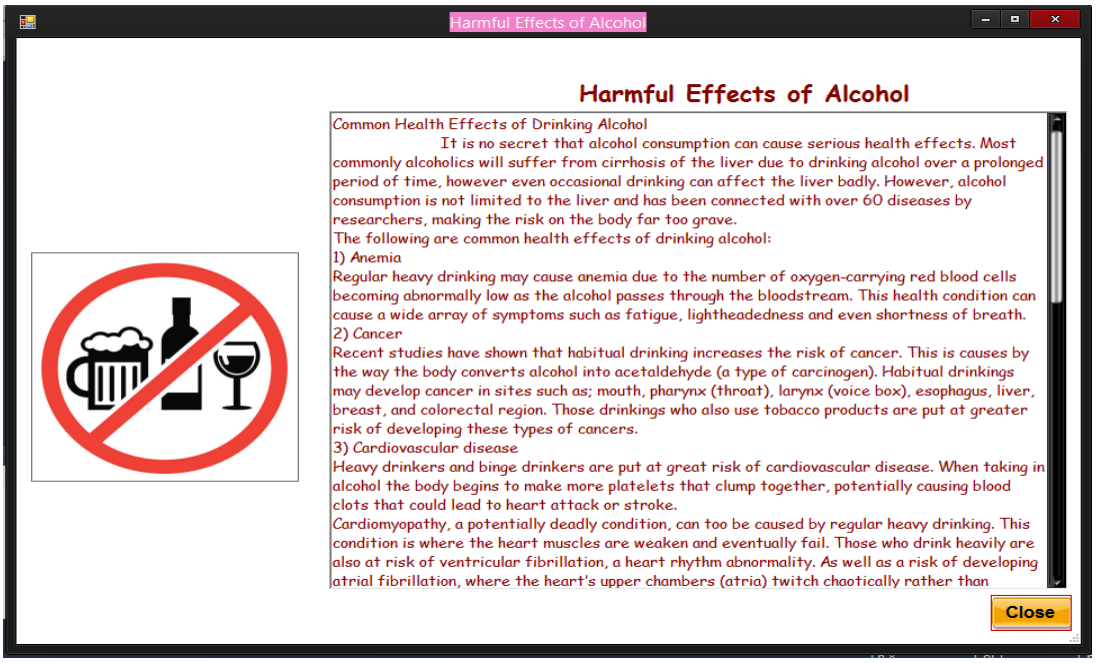


Figure 10: Harmful Effects of Alcohol

In the lifestyle screen, the user has to select the physical activity level along with duration, and then the calories burnt through that physical activity would get displayed. There are screens to emphasize the importance of physical activity.

If one enters the average number of hours slept per day, it would suggest whether it is sufficient or not depending on the age, activity level etc. Then there is a screen to elicit information on the smoking habit/pattern (Yes, No), number of cigarettes smoked per day and time interval between them etc. There is material on the ill effects of smoking as well .One can click on the "Yes" button to go through the ill effects.

Next option on the life style pattern is the alcohol consumption. Upon answering the (Yes, No) button, it would prompt and ask whether the user would like to go through the literature on Harmful effects of alcohol consumption. It would also request for the quantity consumed and the frequency as well. Then the screen moves on to the "athlete type" details like the activity level, sport played, duration of play, frequency per week etc… Then ranking is done on whether a person is involved in Skill based sport, skill level, Mixed activity level (3 – 5 days per week), strength/ power, Intermittent, Team based, Endurance, Ultra Endurance, no physical activity etc.. The details about the lifestyle of the person collected are stored in the database.

Medical History

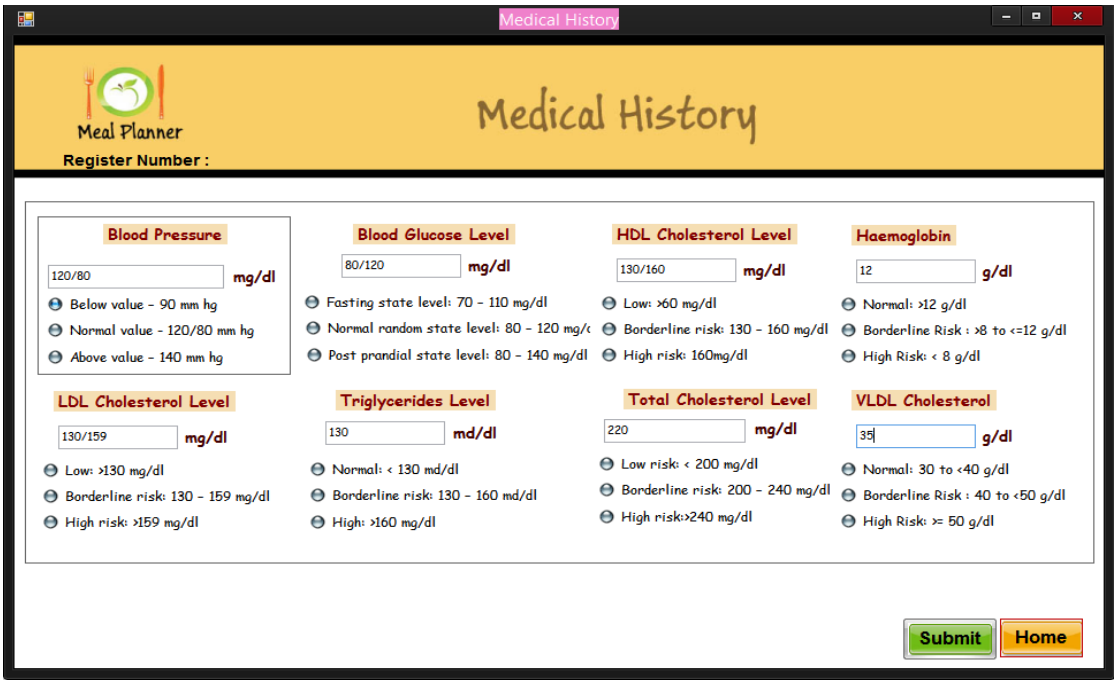


Figure 11: Medical History

Quiz

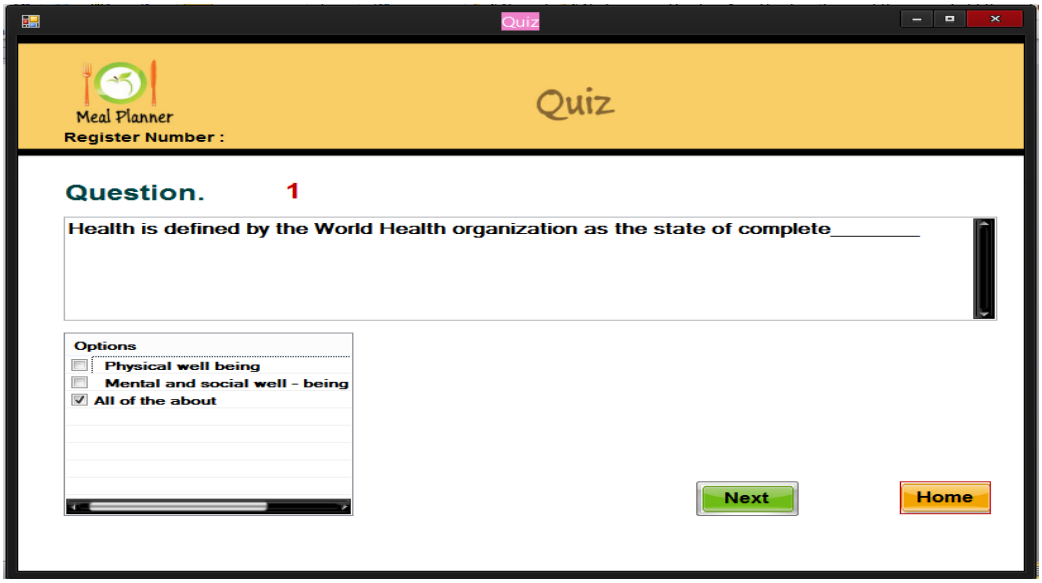


Figure 12: Quiz

In the medical history details about the user such as his Blood Pressure level, Blood Glucose level, HDL Cholesterol level, LDL Cholesterol level, Triglycerides level and the total cholesterol level, Hemoglobin, VLDL cholesterol are obtained and recorded. All data are stored in the Centralized database.

Nutrient Intake Assessment

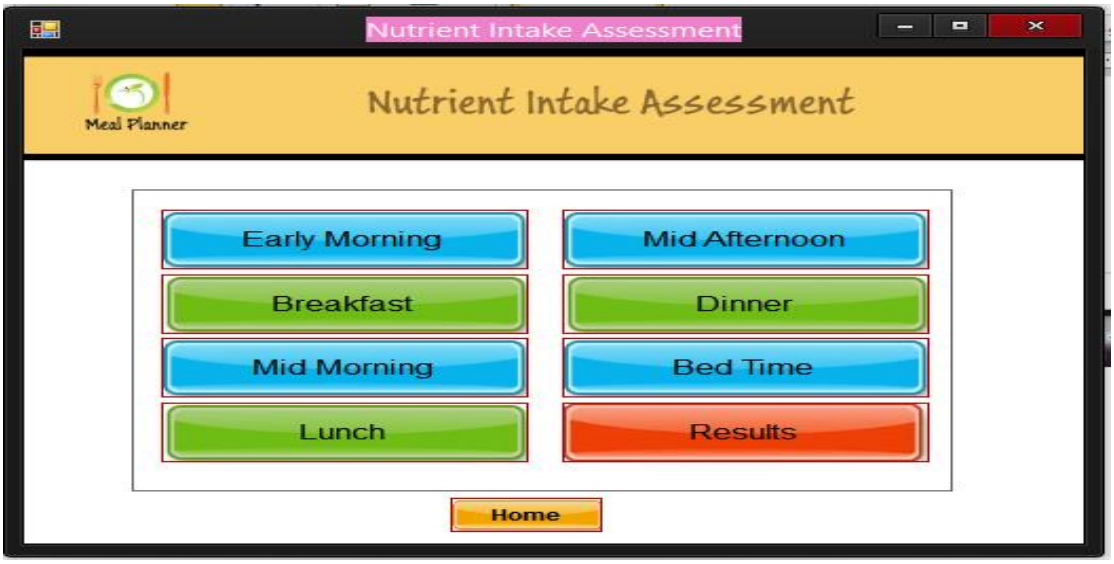


Figure 13: Nutrient Intake Assessment

In the dietary entry form, the food partaken in the form of main meals and the sub meals are collected from the user side. Seven type of meals like Early Morning, Breakfast, Mid-Morning, Lunch, Mid – Afternoon, Dinner and Bed – Time are recorded along with the frequency.

Early Morning

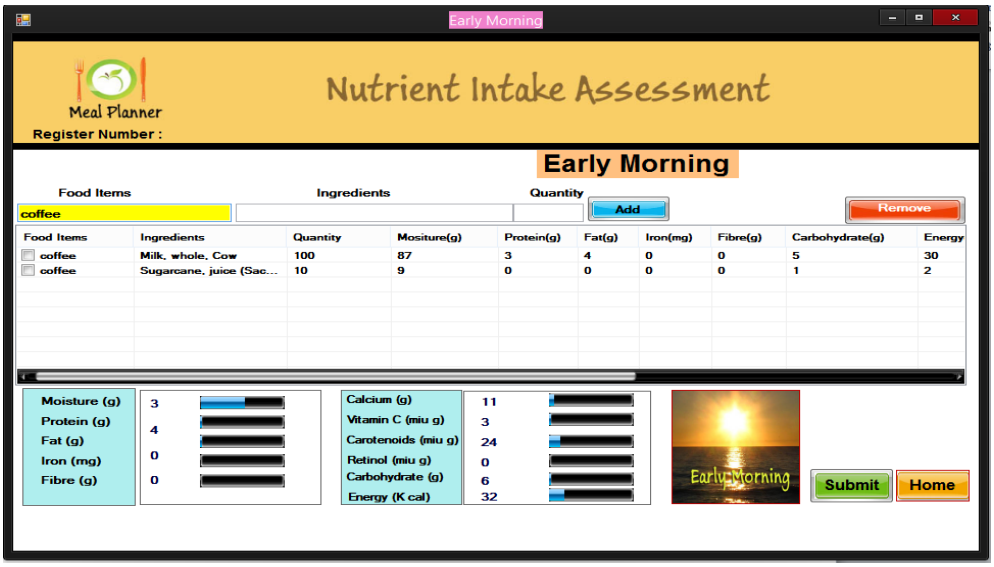


Figure 14: Early Morning

For accessing the early morning dietary intake, the user has to enter the name of the food item , main ingredients of the food item and the quantity of each ingredient in grams/ml and click the add button. The added ingredients and the nutritive value of such nutrients like Moisture(g), Protein(g), Fat(g), Iron(mg), Fibre(g), Calcium(g), Vitamin C (µg), Carotenoids(µg), Retinol (µg), Carbohydrate (g) and energy (Kcal) will be displayed in the tables shown. After verifying all the ingredients, the subjects have to click the submit button.

For example, if the user consumed coffee in the early morning, then he has to enter the details as below

- Food Item - Coffee
- Ingredients * Quantity
  - Milk 100 ml
  - Sugar 10g
  - Coffee powder 5g

After entering all data, the list of ingredients along with nutritive value will be displayed as shown in the above Figure 7.1

The calorie count of the entire meals per day would be calculated and it would be compared to RDA allowances to figure out whether it is less than adequate (deficit) or just right or in excess.

From each meal the percentage of all nutrients consumed (score) will be displayed. Also its adequacy could be checked by comparing with the RDA The sample screens of all the meals are displayed below

Break- Fast

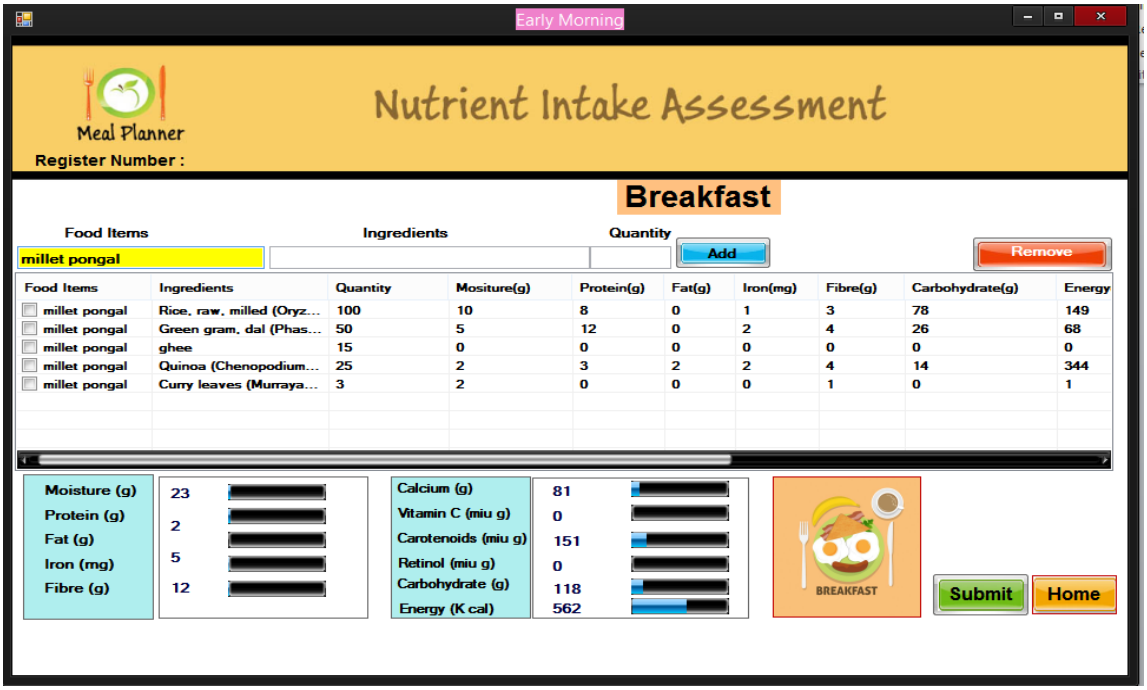


Figure 15: Break- Fast

Mid – Morning

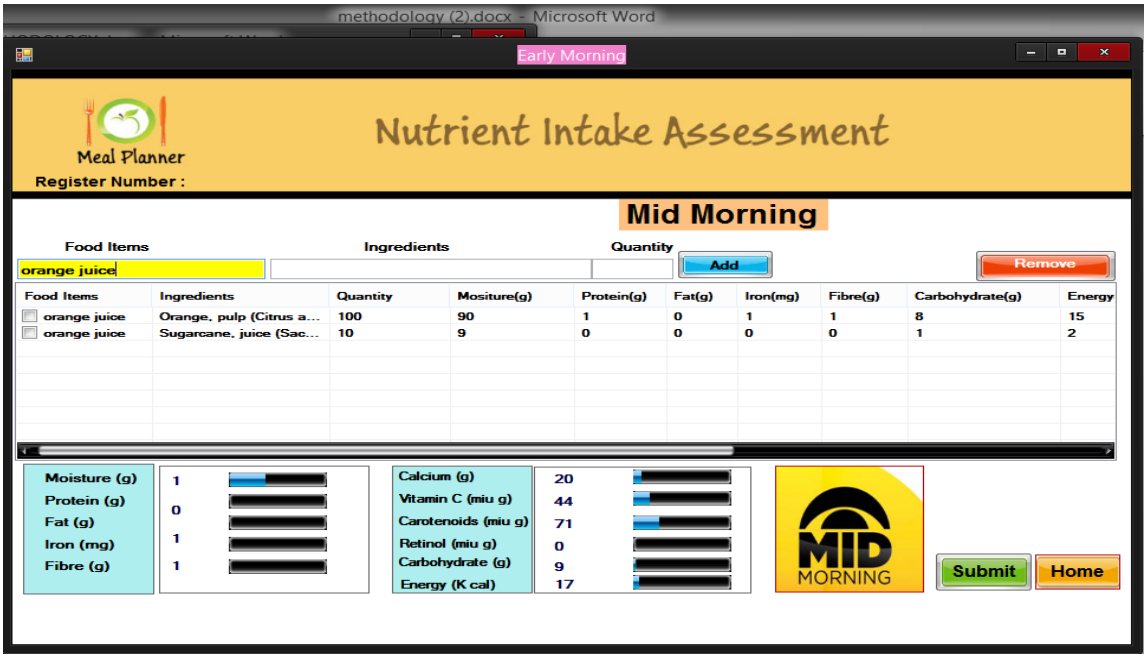


Figure 16: Mid – Morning

Lunch

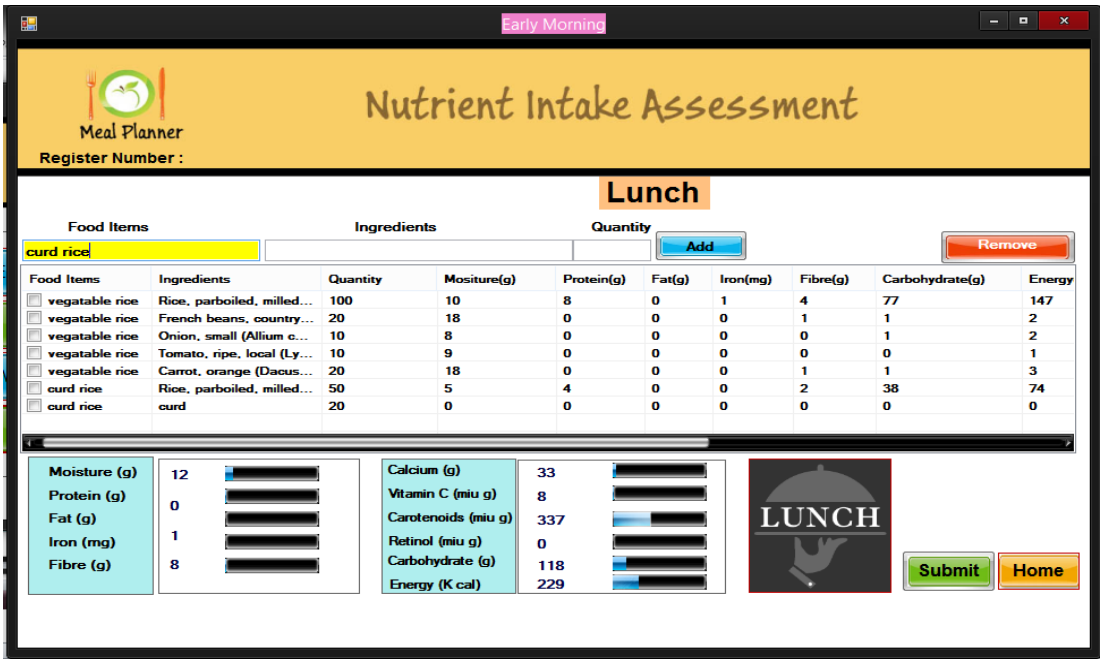


Figure 17: Lunch

Mid – Afternoon

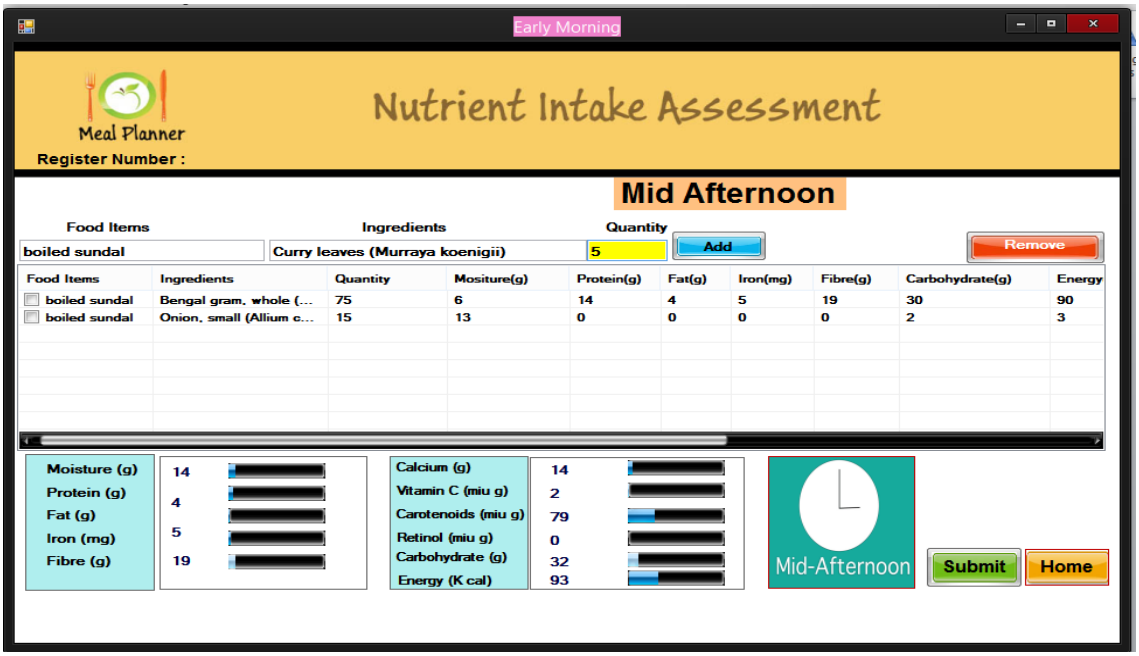


Figure 18: Mid – Afternoon

Dinner

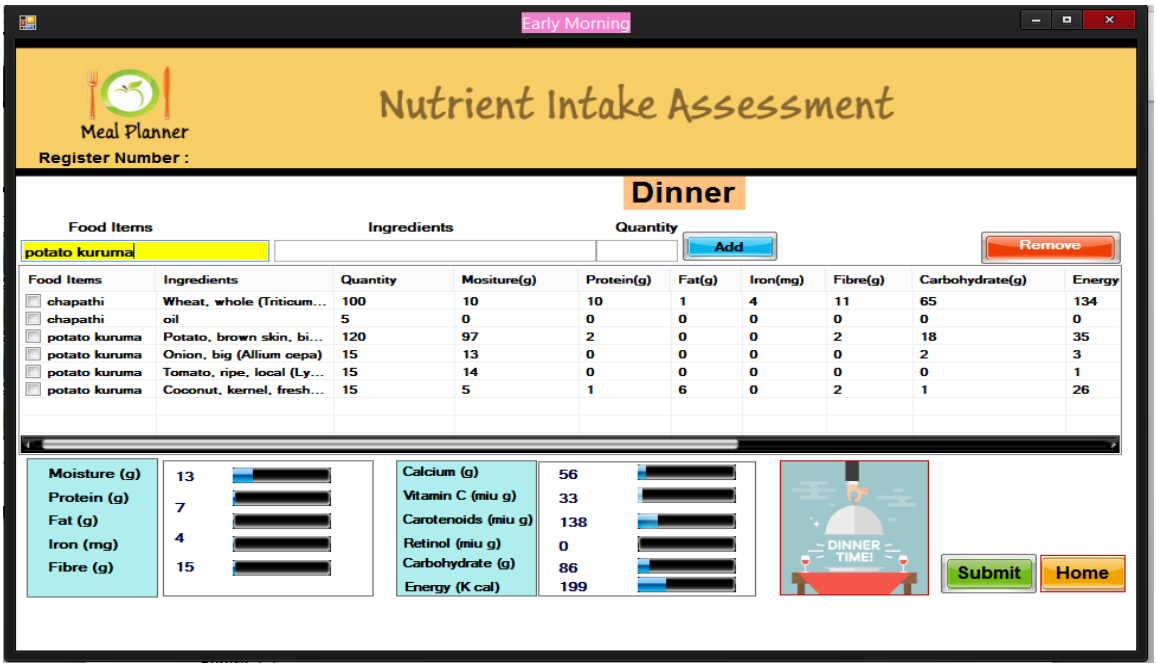


Figure 19: Dinner

Bed time

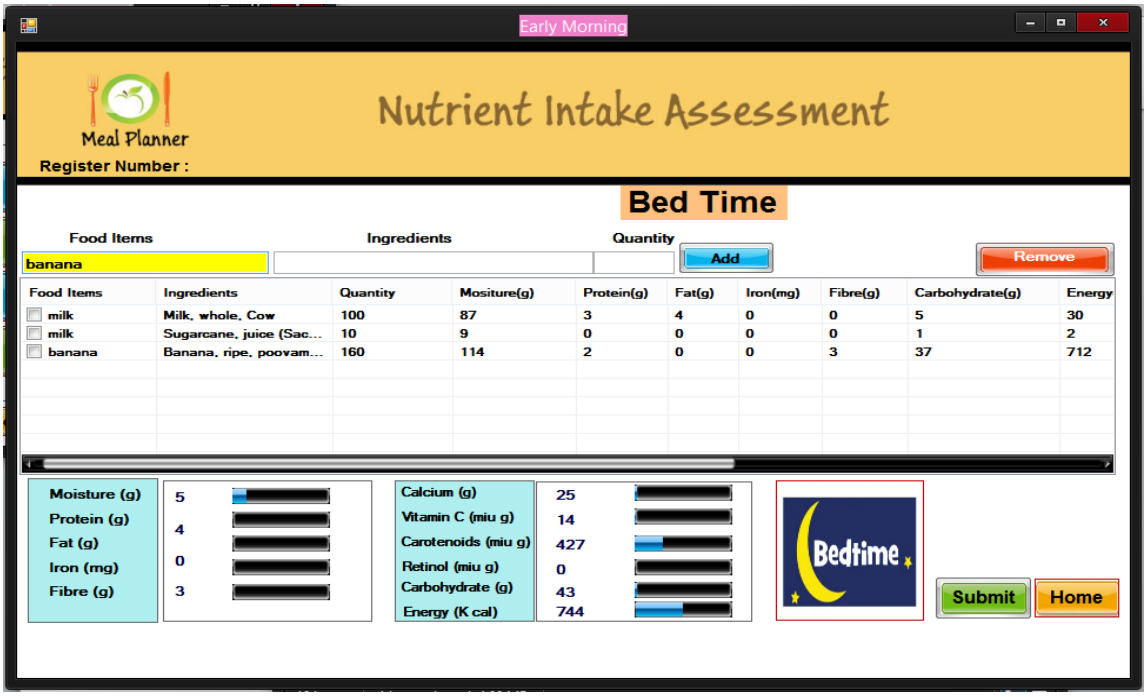


Figure 20: Bed time

Quiz

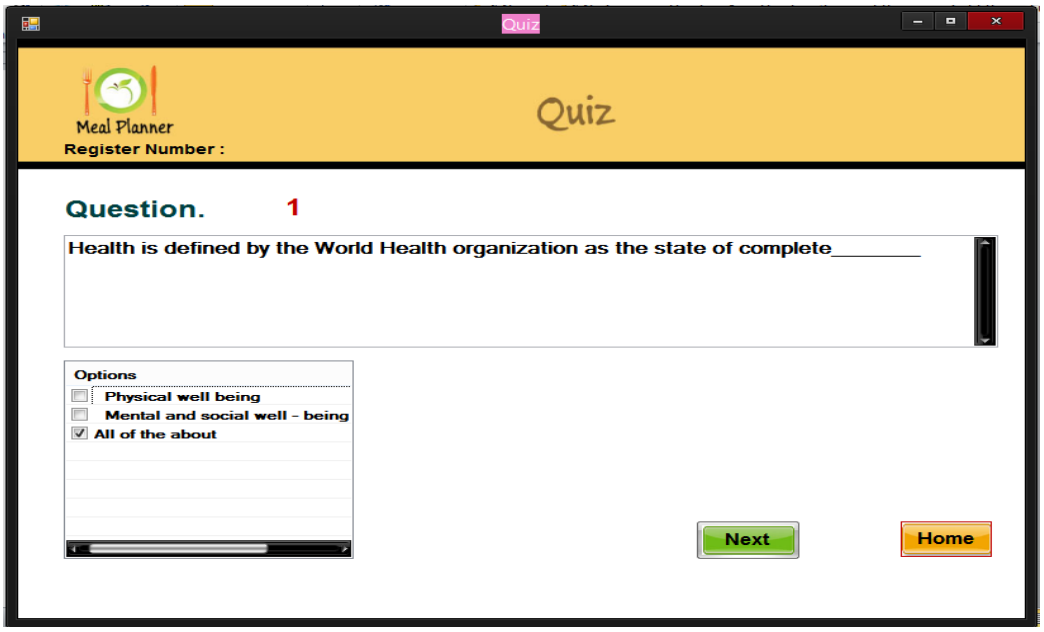


Figure 21: Quiz

To test and enhance the knowledge levels of the participants/users, a quiz with 50 questions related to diet, food for various age & ailments, nutritive

vales of different foods, meal planning etc were displayed. The user can answer the questions and then view their score as well as the right answers for all the questions in the “Deliverables” section, which is shown in the following figure: 29.

Help

In the help page, a lot of importance is given to the therapeutic diets, herbal remedies and natural home remedies

A user would be able to know in depth details about the ailment they currently have, dietary recommendations for the particular ailment they suffer, natural herbal remedies to improve/ manage their ailments etc.. It also gives the natural home remedies which can be used by any one.

The screen shots are given below

Therapeutic purpose

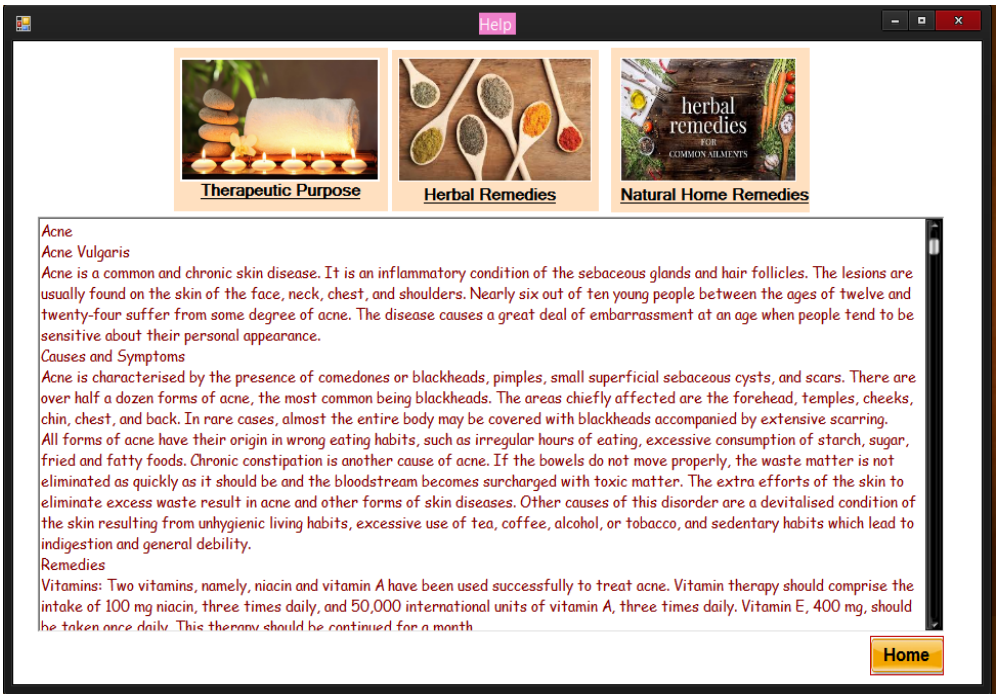


Figure 22: Therapeutic purpose

Herbal Remedies

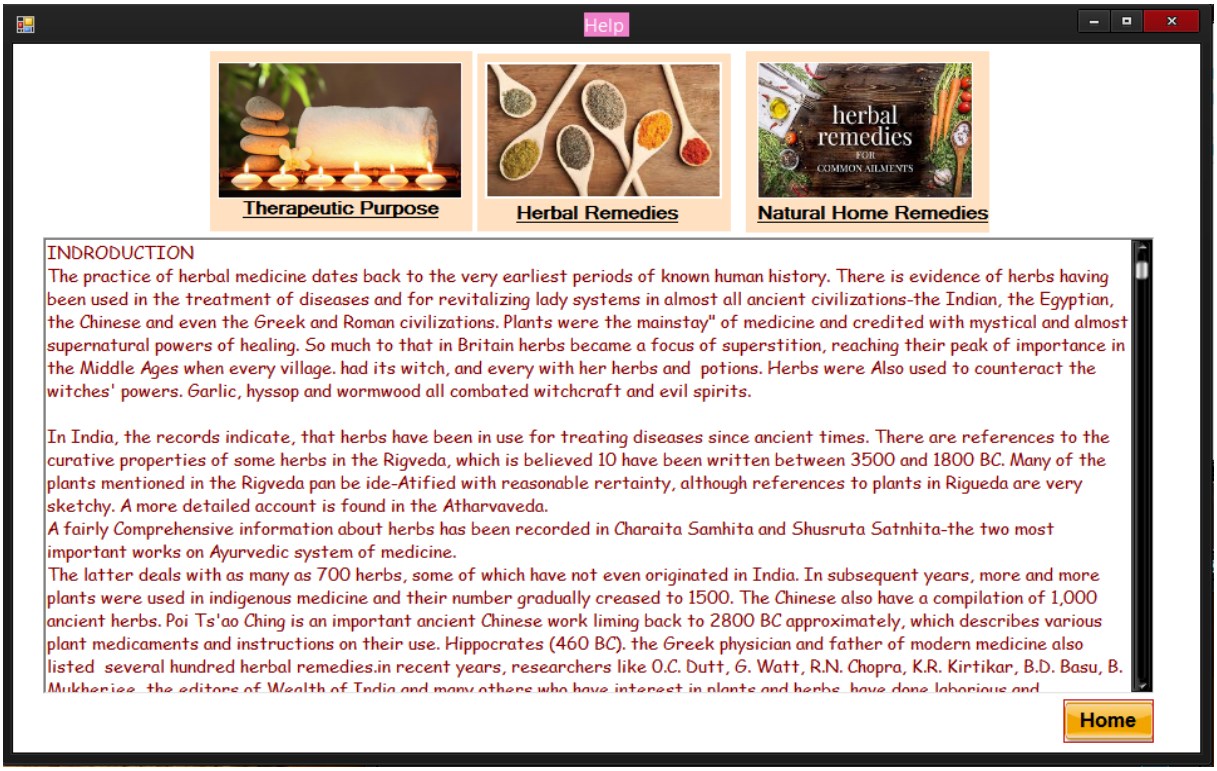


Figure 23: Herbal Remedies

Natural Home Remedies

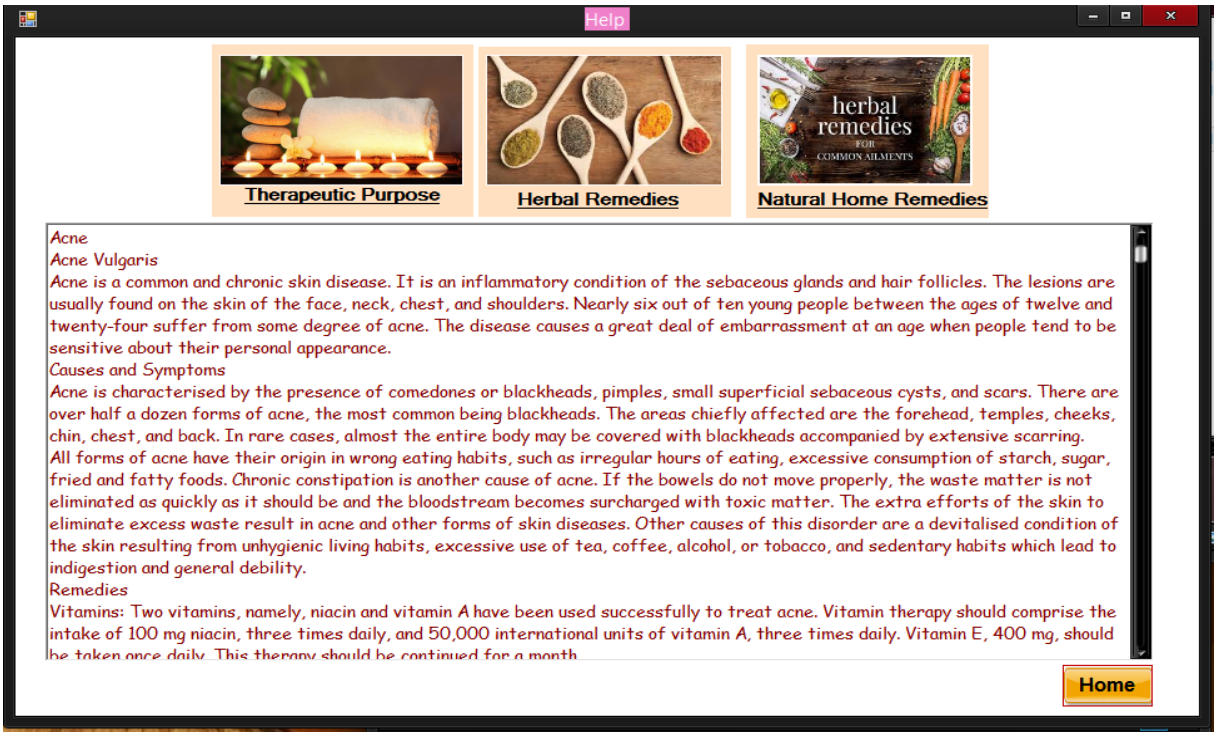


Figure 24: Natural Home Remedies

Deliverables

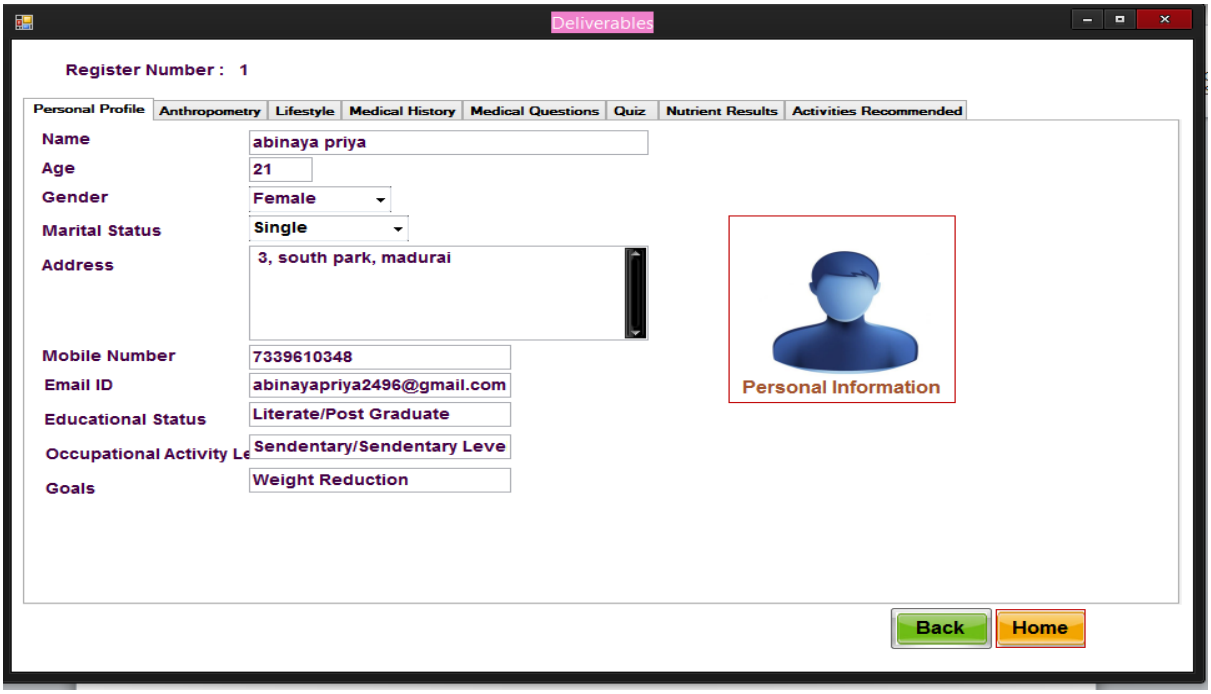


Figure 25: Personal Profile

In the deliverable page/ screen, complete information/ history of the users which were entered by them like

- Personal profile
- Anthropometry
- Lifestyle
- Medical History
- Medical questions
- Quiz
- Nutrient results
- Activities recommended

  Would be displayed as shown in the figure no: 24. The subjects can then click on any icon to view the entered/ derived details and the recommendations.

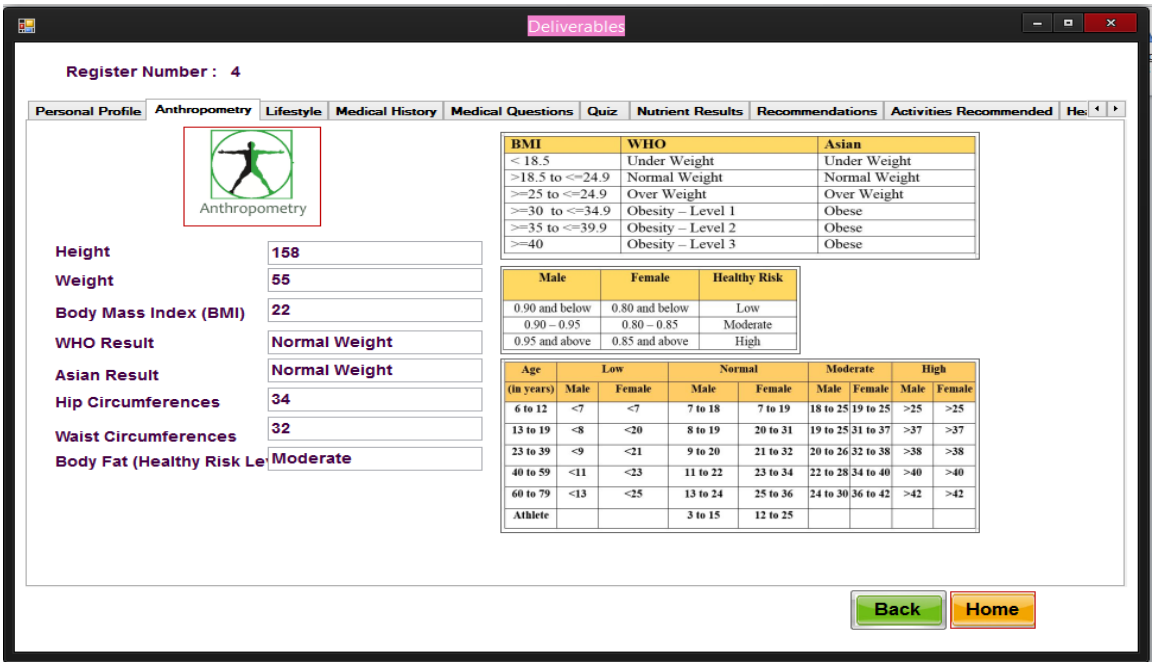


Figure 26: Anthropometry

Upon providing the user name and password, a subject can click on any icon shown above.

The first is the profile verification wherein all personal information is stored/displayed. The next tab is anthropometry which displays the data of the person for verifying as fed in the figure 26.

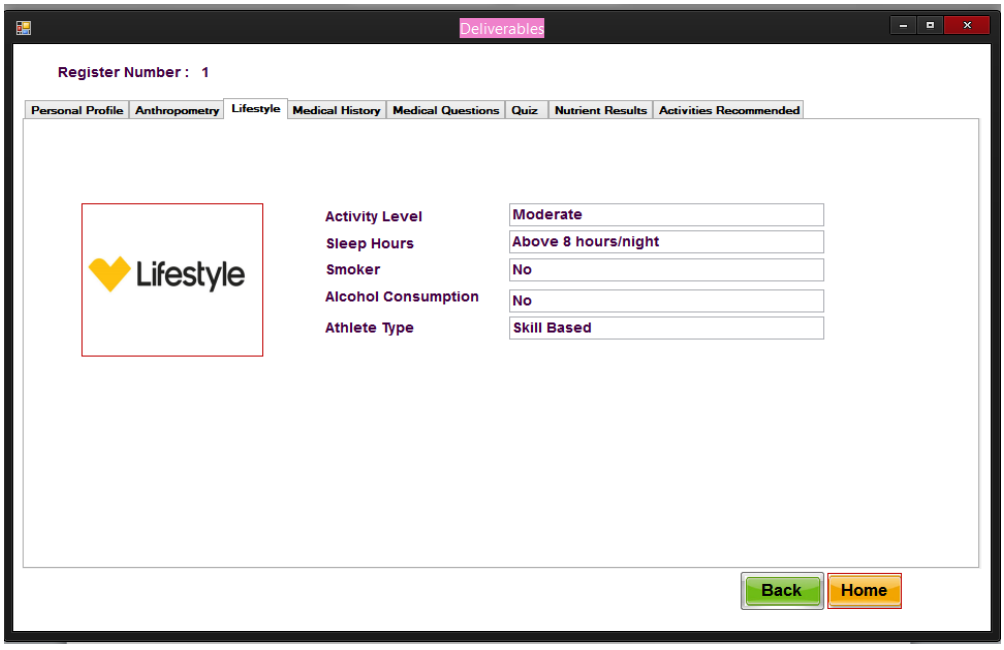


Figure 27: Life Style

The next is lifestyle tab which reveals the activity level, average number of hours slept per night, smoker, alcohol consumption if any and type of athlete.

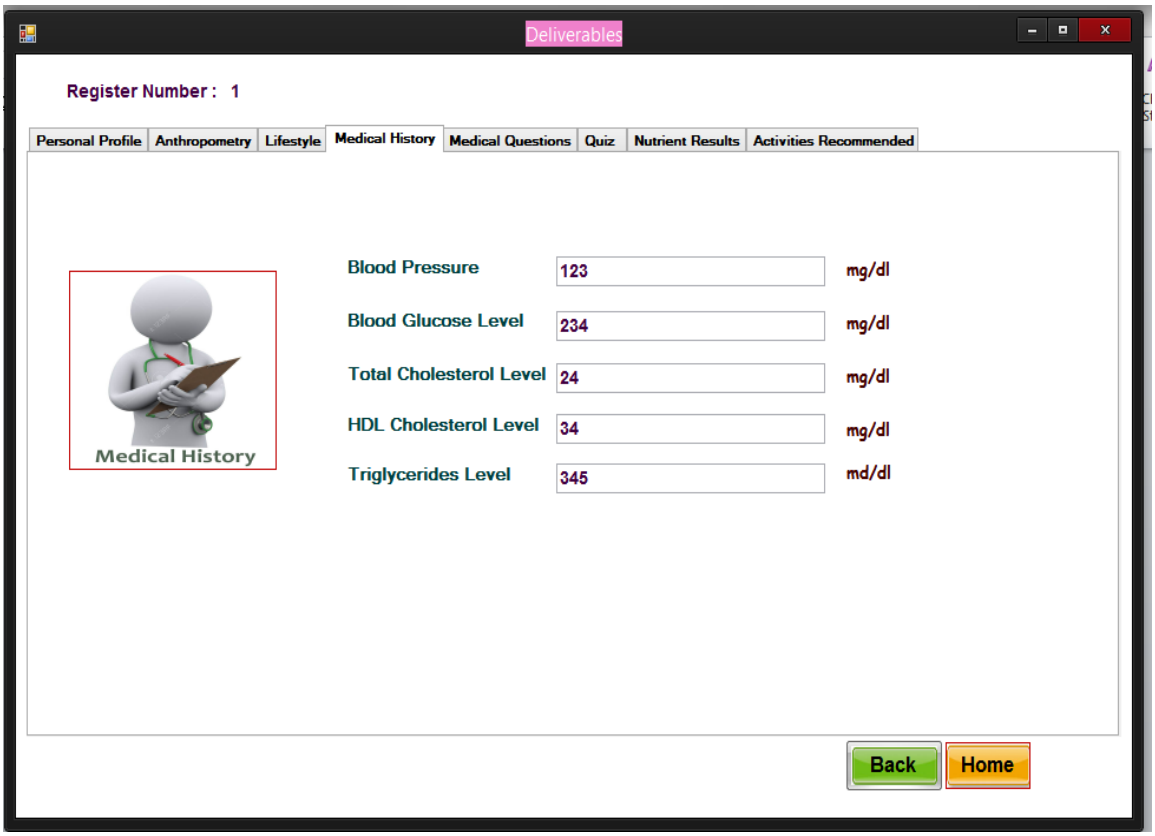


Figure 28: Medical History

The medical history lists the results of bio-chemical parameters of the subject.

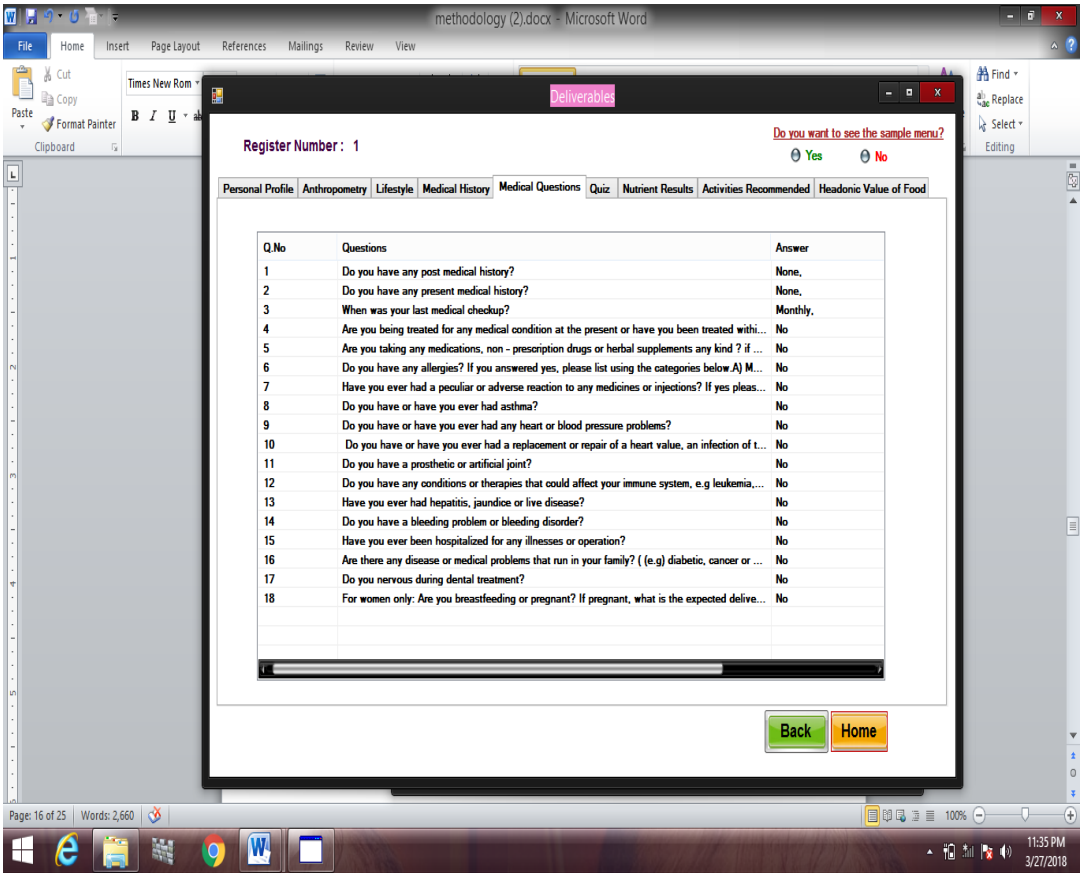


Figure 29: Medical Questions

The medical history section is nothing but a set of questions to elicit the information on the medical condition of the subject. The medical questions would be displayed along with the answers given by the users.

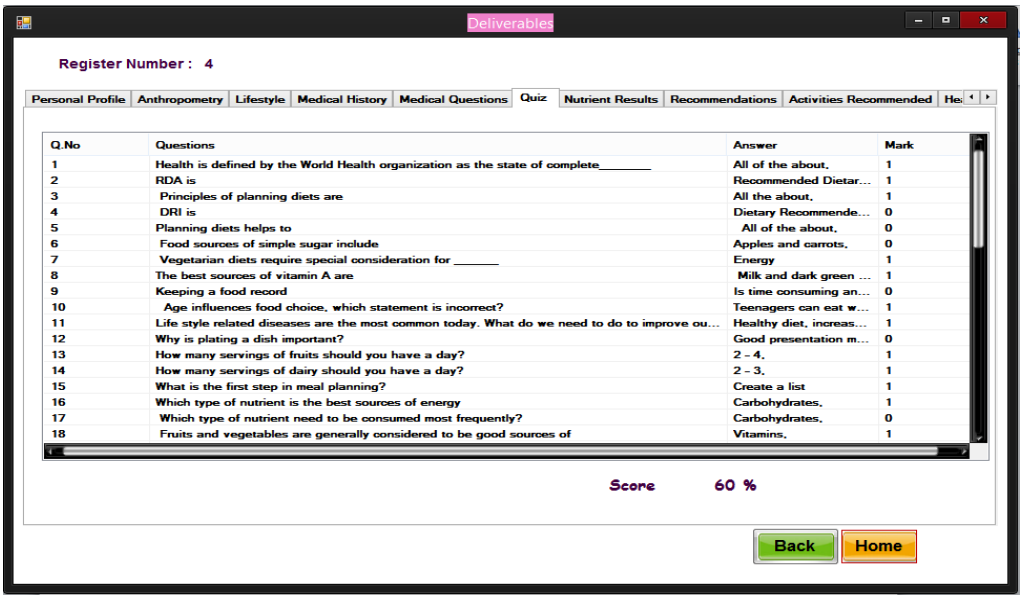


Figure 30: Quiz

The next screen is where the subjects can know their knowledge levels after answering the Quiz. The score along with the correct answers to the questions would be shown in this screen.

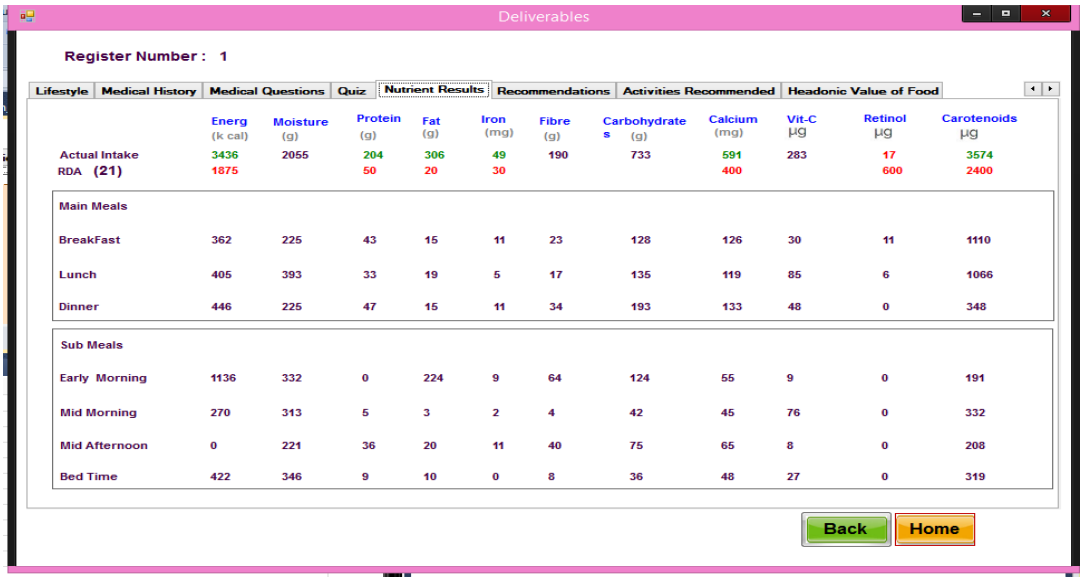


Figure 31: Nutrients Results

In the nutrient result tab, the quantum of each nutrient consumed by the subject in each meal (breakfast, lunch etc.) is displayed along with the RDA values. One can really understand their deficit or adequacy or excess of nutrients they are consuming against the recommendations.

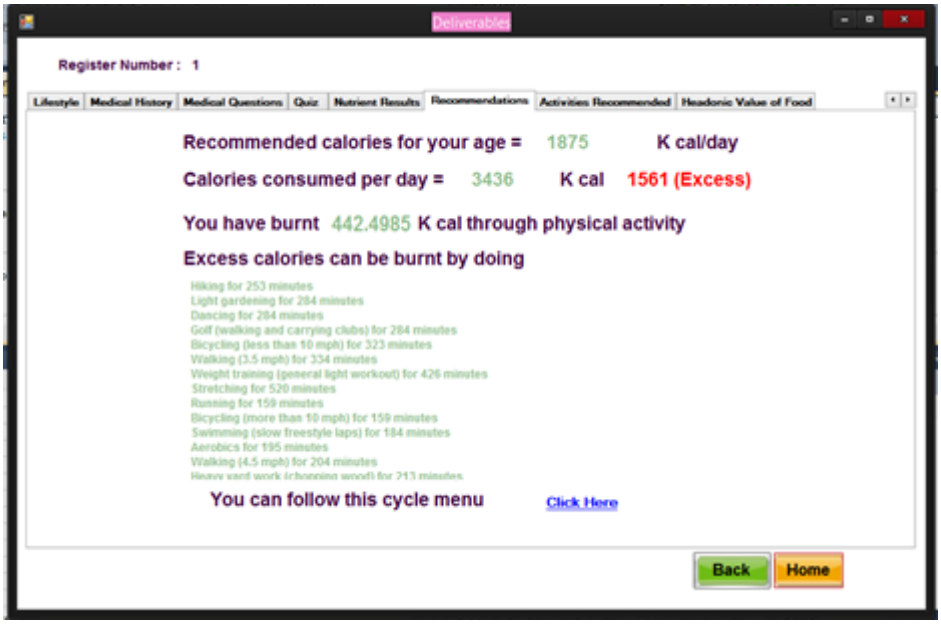


Figure 32: Recommendations

According to the age, the standard calorie values are displayed which includes the calories recommended per day, the calories consumed per day by the person, calories burnt and the recommended activities to burn the extra calories are displayed in the window.

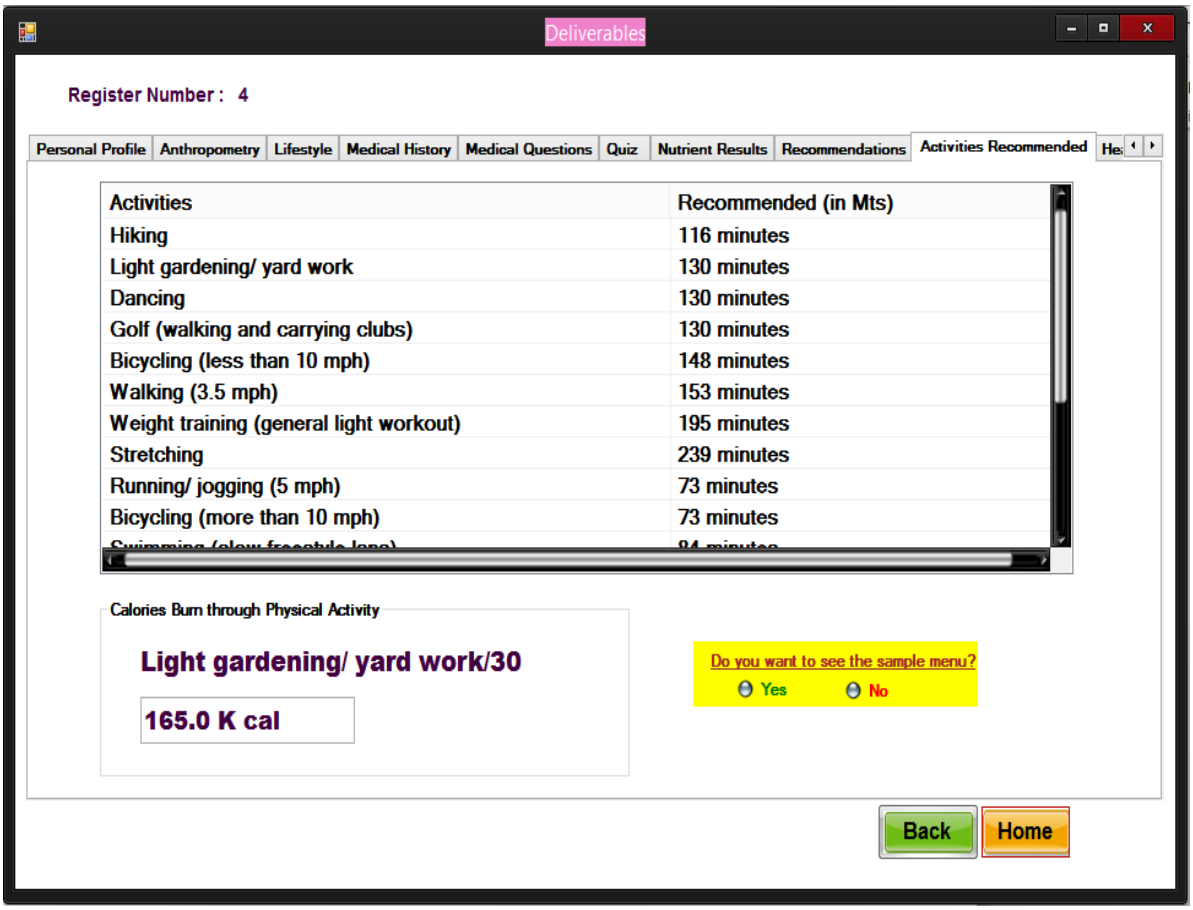
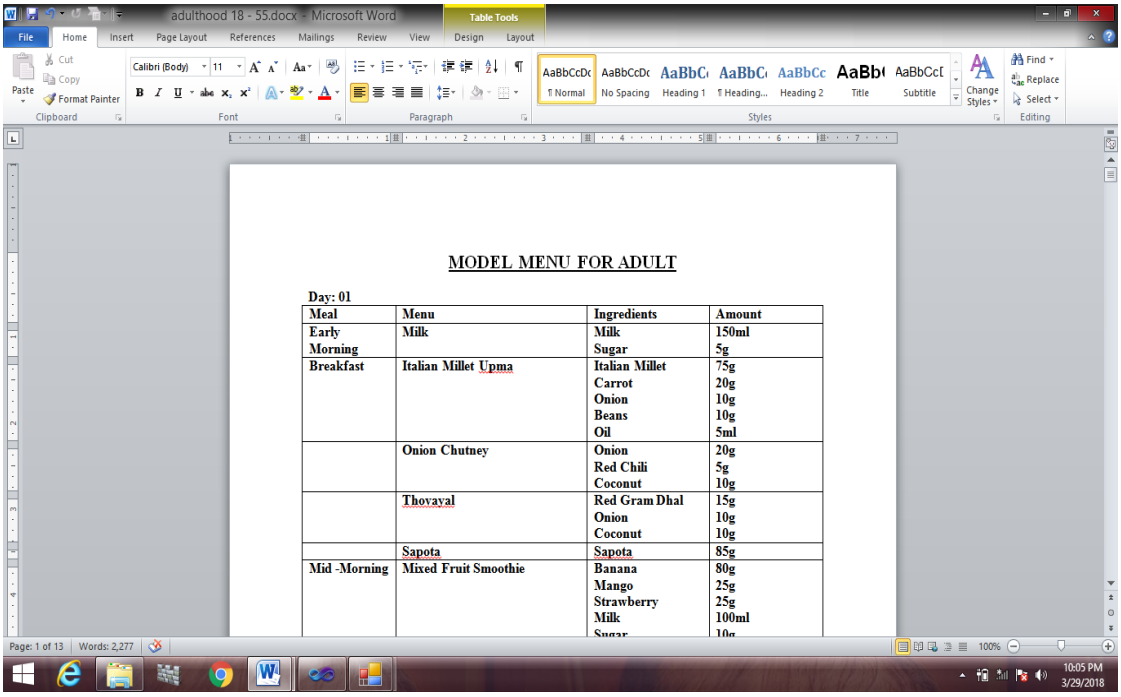


Figure 33: Activities Recommended

According to the physical activity, the approximate calories burnt are displayed in the next screen (shown above). A person can choose an activity of their convenience to burn the extra calories.

Sample Menu for Age Group



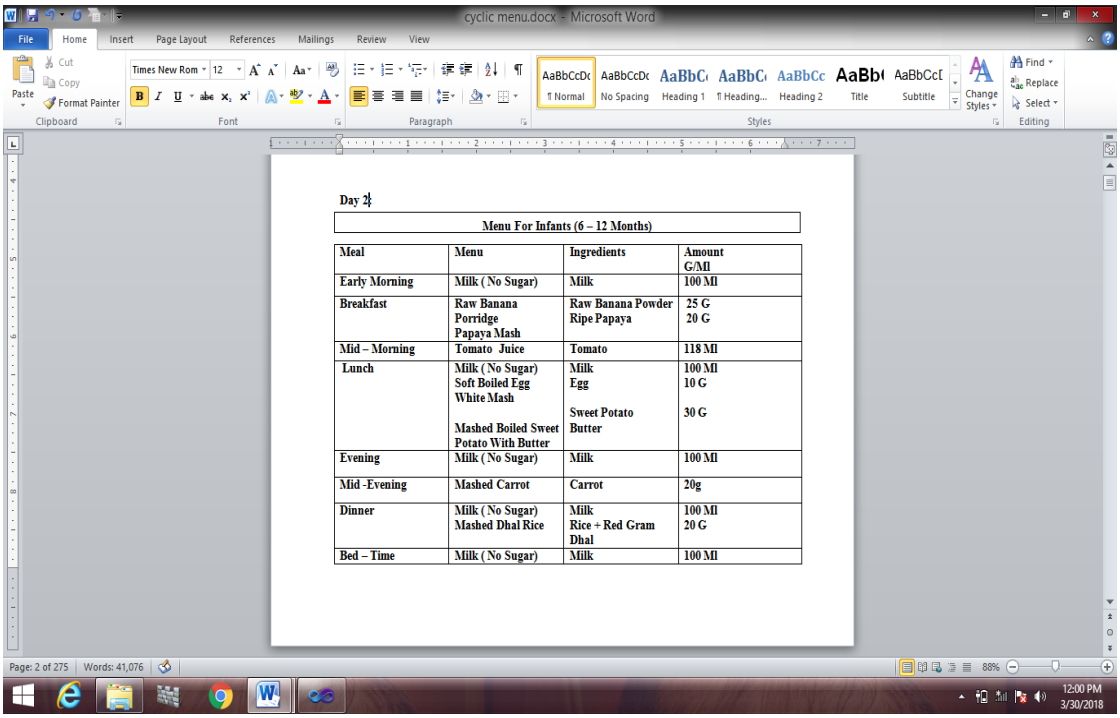
MODEL MENU FOR ADULT

Day: 01

Meal	Menu	Ingredients	Amount
Early Morning	Milk	Milk Sugar	150ml 5g
Breakfast	Italian Millet Upma	Italian Millet Carrot Onion Beans Oil	75g 20g 10g 10g 5ml
	Onion Chutney	Onion Red Chili Coconut	20g 5g 10g
	Thovayal	Red Gram Dhal Onion Coconut	15g 10g 10g
	Sapota	Sapota	85g
Mid -Morning	Mixed Fruit Smoothie	Banana Mango Strawberry Milk Sugar	80g 25g 25g 100ml 10g

Figure 34: Sample Menu for Age Group

Infants



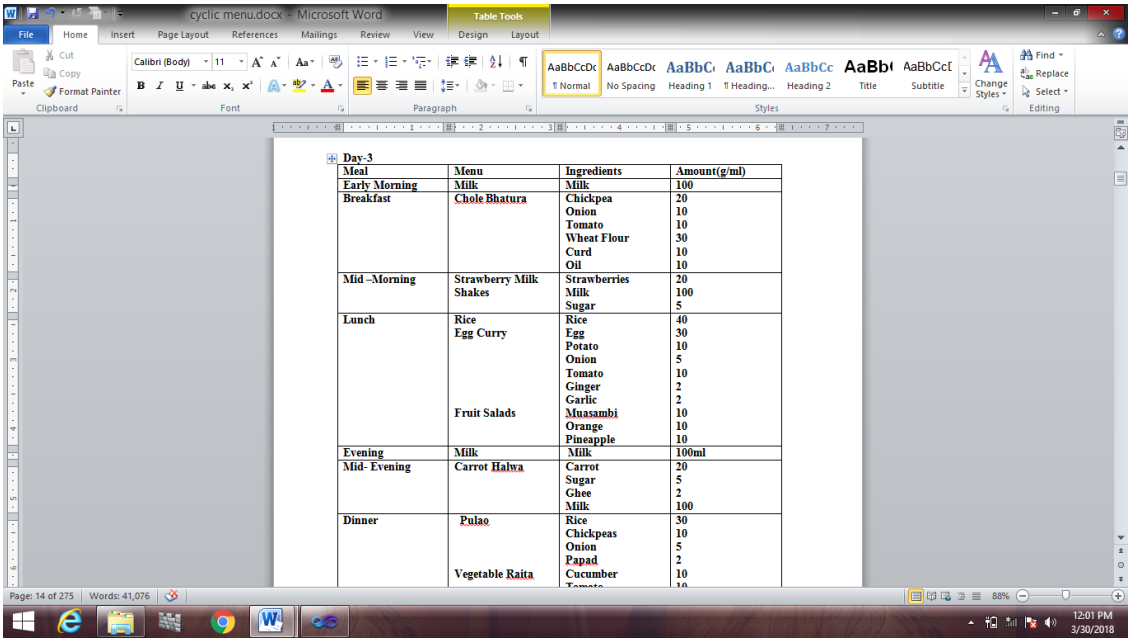
Day 2

Menu For Infants (6 – 12 Months)

Meal	Menu	Ingredients	Amount G/Ml
Early Morning	Milk (No Sugar)	Milk	100 Ml
Breakfast	Raw Banana Porridge Papaya Mash	Raw Banana Powder Ripe Papaya	25 G 20 G
Mid – Morning	Tomato Juice	Tomato	118 Ml
Lunch	Milk (No Sugar) Soft Boiled Egg White Mash Mashed Boiled Sweet Potato With Butter	Milk Egg Sweet Potato Butter	100 Ml 10 G 30 G
Evening	Milk (No Sugar)	Milk	100 Ml
Mid -Evening	Mashed Carrot	Carrot	20g
Dinner	Milk (No Sugar) Mashed Dhal Rice	Milk Rice + Red Gram Dhal	100 Ml 20 G
Bed – Time	Milk (No Sugar)	Milk	100 Ml

Figure 35: Sample Menu for Infants

Pre- School

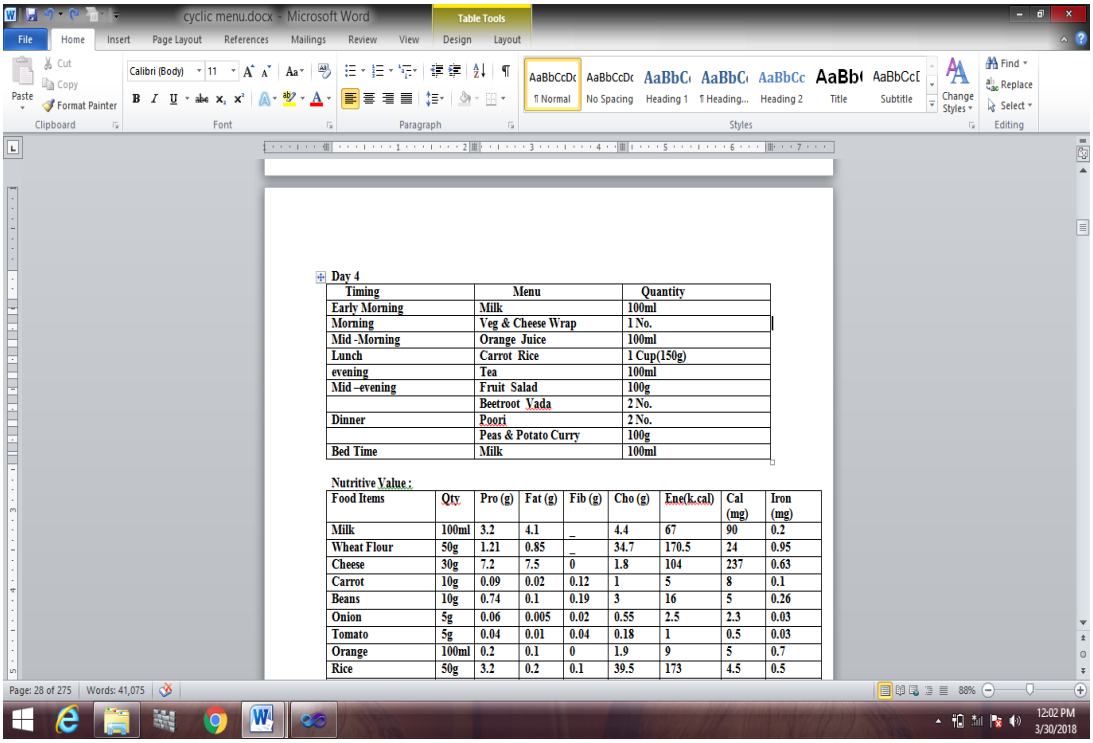


Day-3

Meal	Menu	Ingredients	Amount(g/ml)
Early Morning	Milk	Milk	100
Breakfast	Chole Bhatura	Chickpea	20
		Onion	10
		Tomato	10
		Wheat Flour	30
		Curd	10
		Oil	10
Mid –Morning	Strawberry Milk Shakes	Strawberries	20
		Milk	100
		Sugar	5
Lunch	Rice	Rice	40
	Egg Curry	Egg	30
		Potato	10
		Onion	5
		Tomato	10
		Ginger	2
		Garlic	2
	Fruit Salads	Muasambi	10
		Orange	10
		Pineapple	10
Evening	Milk	Milk	100ml
Mid- Evening	Carrot Halwa	Carrot	20
		Sugar	5
		Ghee	2
		Milk	100
Dinner	Pulao	Rice	30
		Chickpeas	10
		Onion	5
		Papad	2
	Vegetable Raita	Cucumber	10

Figure 36: Sample Menu for Pre -School

Adolescent



Day 4

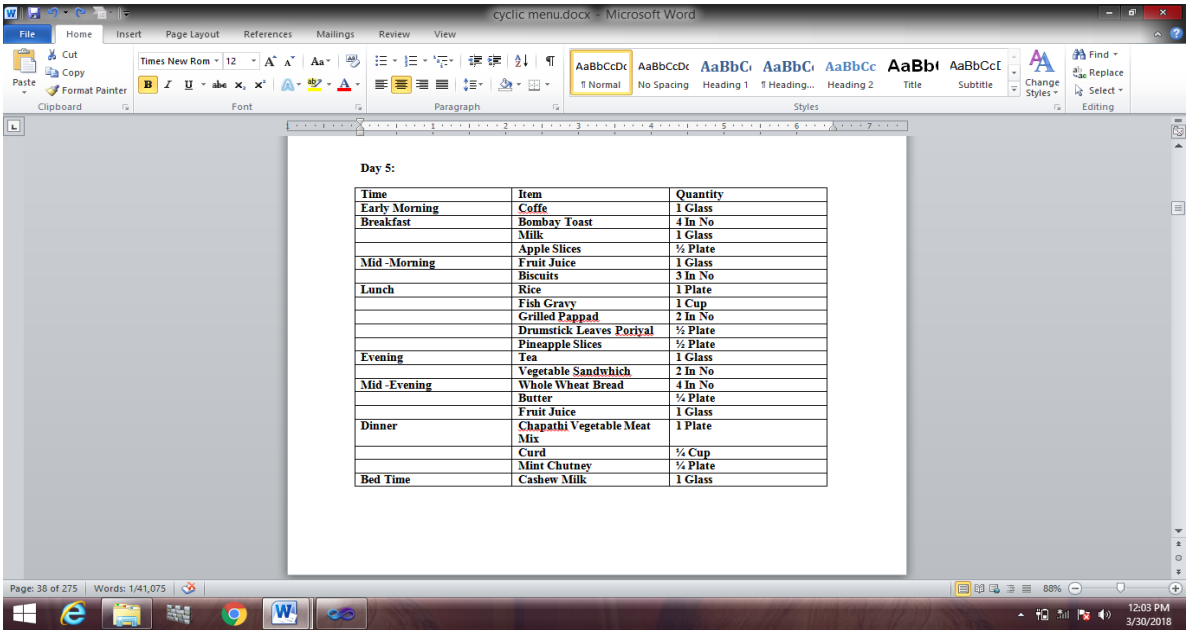
Timing	Menu	Quantity
Early Morning	Milk	100ml
Morning	Veg & Cheese Wrap	1 No.
Mid -Morning	Orange Juice	100ml
Lunch	Carrot Rice	1 Cup(150g)
evening	Tea	100ml
Mid –evening	Fruit Salad	100g
	Beetroot Vada	2 No.
Dinner	Poori	2 No.
	Peas & Potato Curry	100g
Bed Time	Milk	100ml

Nutritive Value :

Food Items	Qty	Pro (g)	Fat (g)	Fib (g)	Cho (g)	Ene(k.cal)	Cal (mg)	Iron (mg)
Milk	100ml	3.2	4.1	_	4.4	67	90	0.2
Wheat Flour	50g	1.21	0.85	_	34.7	170.5	24	0.95
Cheese	30g	7.2	7.5	0	1.8	104	237	0.63
Carrot	10g	0.09	0.02	0.12	1	5	8	0.1
Beans	10g	0.74	0.1	0.19	3	16	5	0.26
Onion	5g	0.06	0.005	0.02	0.55	2.5	2.3	0.03
Tomato	5g	0.04	0.01	0.04	0.18	1	0.5	0.03
Orange	100ml	0.2	0.1	0	1.9	9	5	0.7
Rice	50g	3.2	0.2	0.1	39.5	173	4.5	0.5

Figure 37: Sample Menu for Adolescent

Adulthood

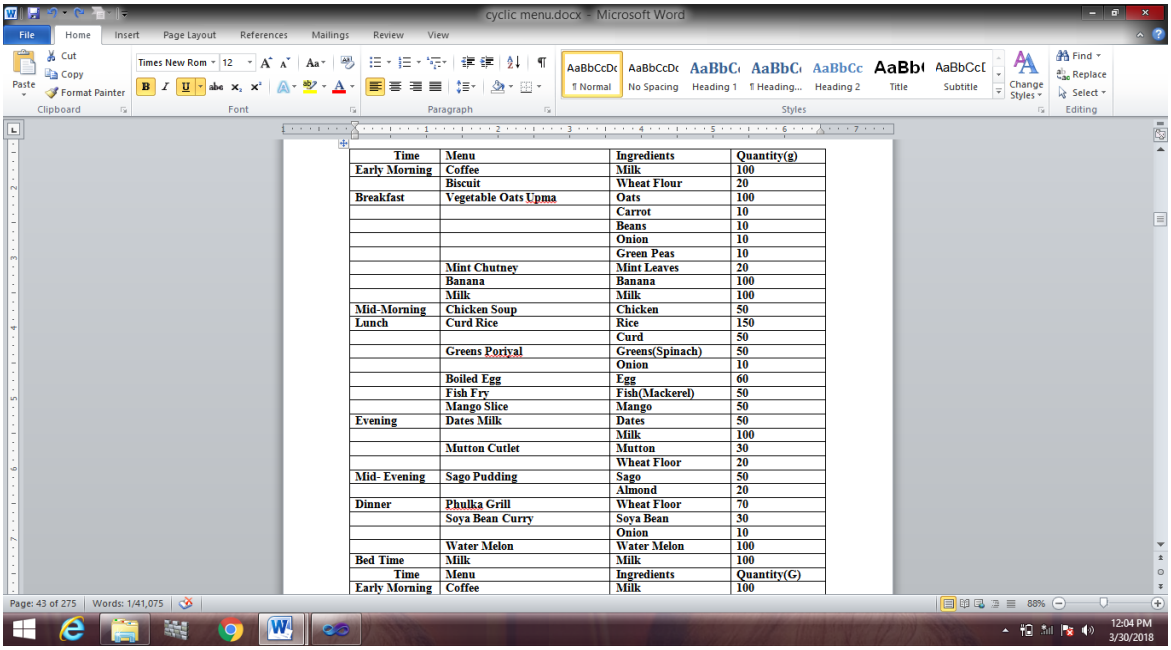


Day 5:

Time	Item	Quantity
Early Morning	Coffe	1 Glass
Breakfast	Bombay Toast	4 In No
	Milk	1 Glass
	Apple Slices	½ Plate
Mid -Morning	Fruit Juice	1 Glass
	Biscuits	3 In No
Lunch	Rice	1 Plate
	Fish Gravy	1 Cup
	Grilled Pappad	2 In No
	Drumstick Leaves Poriyal	½ Plate
	Pineapple Slices	½ Plate
Evening	Tea	1 Glass
	Vegetable Sandwhich	2 In No
Mid -Evening	Whole Wheat Bread	4 In No
	Butter	¼ Plate
	Fruit Juice	1 Glass
Dinner	Chapathi Vegetable Meat Mix	1 Plate
	Curd	¼ Cup
	Mint Chutney	¼ Plate
Bed Time	Cashew Milk	1 Glass

Figure 38: Sample Menu for Adulthood

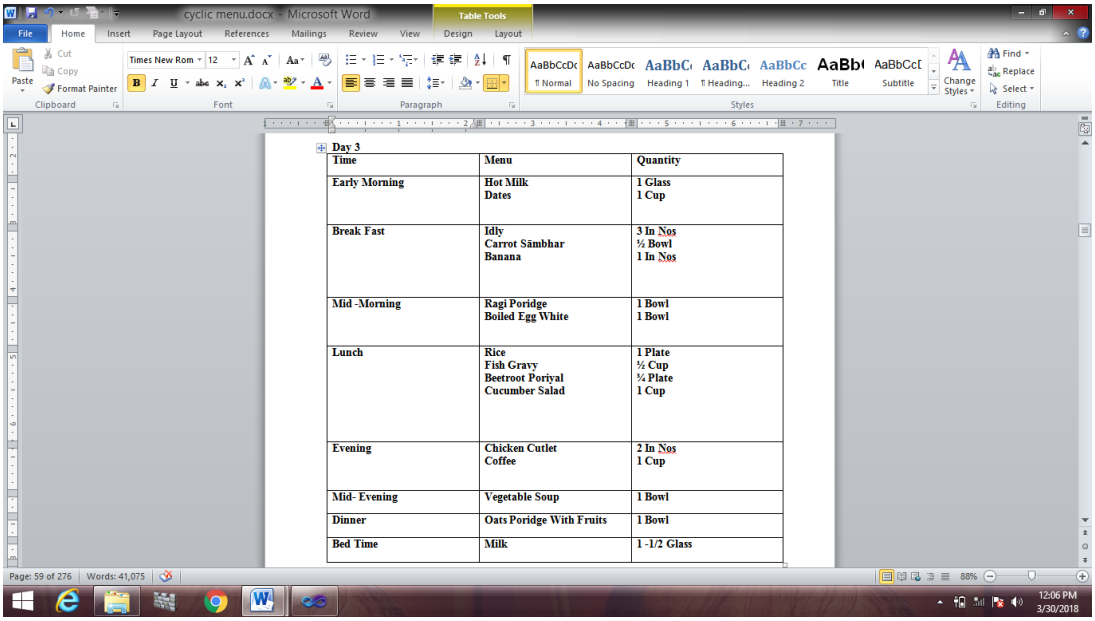
Pregnancy



Time	Menu	Ingredients	Quantity(g)
Early Morning	Coffee	Milk	100
	Biscuit	Wheat Flour	20
Breakfast	Vegetable Oats Upma	Oats	100
		Carrot	10
		Beans	10
		Onion	10
		Green Peas	10
	Mint Chutney	Mint Leaves	20
	Banana	Banana	100
	Milk	Milk	100
Mid-Morning	Chicken Soup	Chicken	50
Lunch	Curd Rice	Rice	150
		Curd	50
	Greens Poriyal	Greens(Spinach)	50
		Onion	10
	Boiled Egg	Egg	60
	Fish Fry	Fish(Mackerel)	50
	Mango Slice	Mango	50
Evening	Dates Milk	Dates	50
		Milk	100
	Mutton Cutlet	Mutton	30
		Wheat Floor	20
Mid- Evening	Sago Pudding	Sago	50
		Almond	20
Dinner	Phulka Grill	Wheat Floor	70
	Soya Bean Curry	Soya Bean	30
		Onion	10
	Water Melon	Water Melon	100
Bed Time	Milk	Milk	100
Time	Menu	Ingredients	Quantity(G)
Early Morning	Coffee	Milk	100

Figure 39: Sample Menu for Pregnancy

Lactating Women

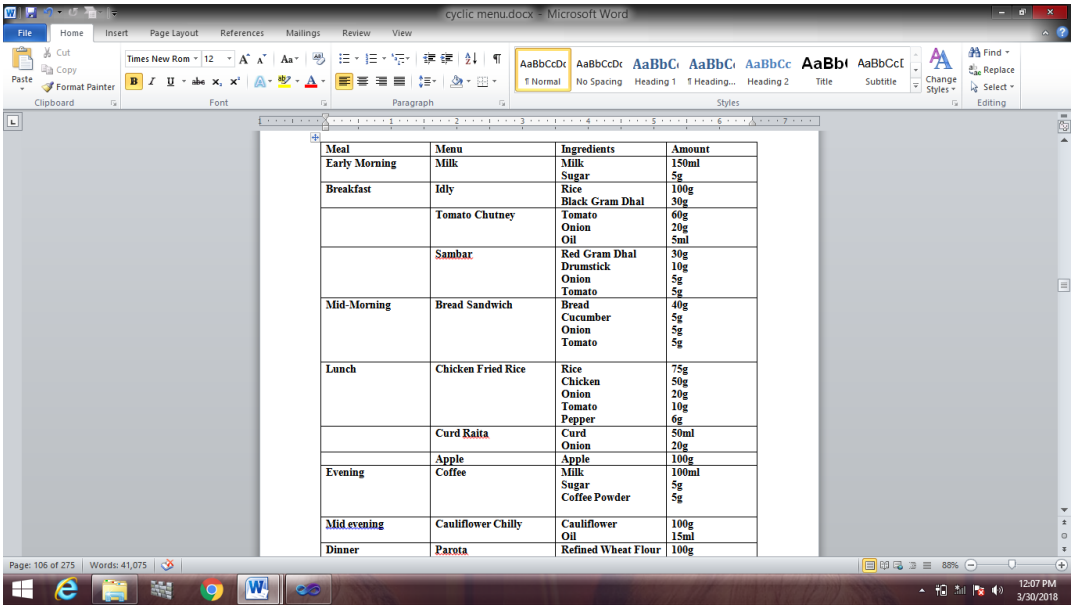


Day 3

Time	Menu	Quantity
Early Morning	Hot Milk Dates	1 Glass 1 Cup
Break Fast	Idly Carrot Sämbhar Banana	3 In Nos ½ Bowl 1 In Nos
Mid -Morning	Ragi Poridge Boiled Egg White	1 Bowl 1 Bowl
Lunch	Rice Fish Gravy Beetroot Poriyal Cucumber Salad	1 Plate ½ Cup ¼ Plate 1 Cup
Evening	Chicken Cutlet Coffee	2 In Nos 1 Cup
Mid- Evening	Vegetable Soup	1 Bowl
Dinner	Oats Poridge With Fruits	1 Bowl
Bed Time	Milk	1 -1/2 Glass

Figure 40: Sample Menu for Lactating Women

Old Age



Meal	Menu	Ingredients	Amount
Early Morning	Milk	Milk Sugar	150ml 5g
Breakfast	Idly	Rice Black Gram Dhal	100g 30g
	Tomato Chutney	Tomato Onion Oil	60g 20g 5ml
	Sambar	Red Gram Dhal Drumstick Onion Tomato	30g 10g 5g 5g
Mid-Morning	Bread Sandwich	Bread Cucumber Onion Tomato	40g 5g 5g 5g
Lunch	Chicken Fried Rice	Rice Chicken Onion Tomato Pepper	75g 50g 20g 10g 6g
	Curd Raita	Curd Onion	50ml 20g
	Apple	Apple	100g
Evening	Coffee	Milk Sugar Coffee Powder	100ml 5g 5g
Mid evening	Cauliflower Chilly	Cauliflower Oil	100g 15ml
Dinner	Parota	Refined Wheat Flour	100g

Figure 41: Sample Menu for Old Age

Once the user keys in their age and activity levels, sample menu for their category would be displayed. Menus are prescribed for all age categories like Infants, pre-school children, school going children, adults, pregnant women, lactating mothers, old age etc..

There is also a provision for Food exchange where the subjects can choose an alternate food/ ingredient for the foods prescribed in the menu if they are allergic or the prescribed food is not available in their locale. The exchange would suggest the possible alternate foods.

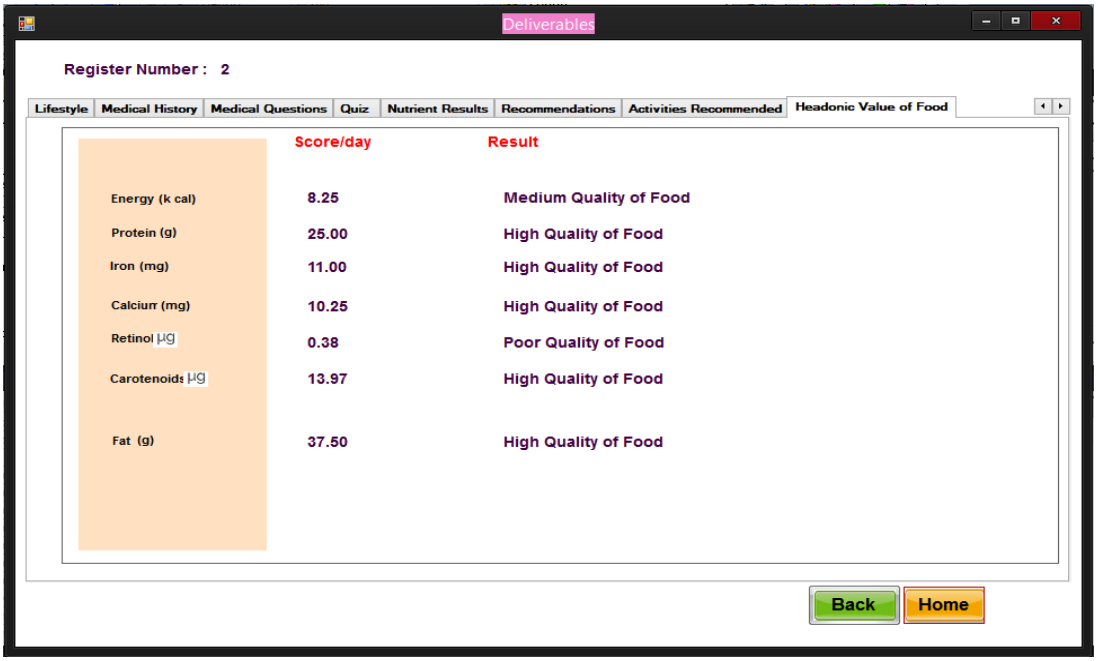


Figure 42: Hedonic Value of Food

Finally hedonic value/score of the foods consumed by the subjects is displayed for all the meals consumed by them. The score of the particular subject is compared by the software with the RDA values and results/ remarks like “Good Quality of food” or “Fair Quality of Food” or “Poor Quality of Food” is displayed against each nutrient.

PHASE II:

A. Selection of Subjects for Evaluation

For the evaluation of software package ten subjects in each of the following categories were selected (Academicians, dieticians, public, post graduate students and software developers) in and around the campus. A well-structured interview schedule was framed for the evaluation of the software package.

B. Preparation of the Interview Schedule for Evaluation of the developed Software Package

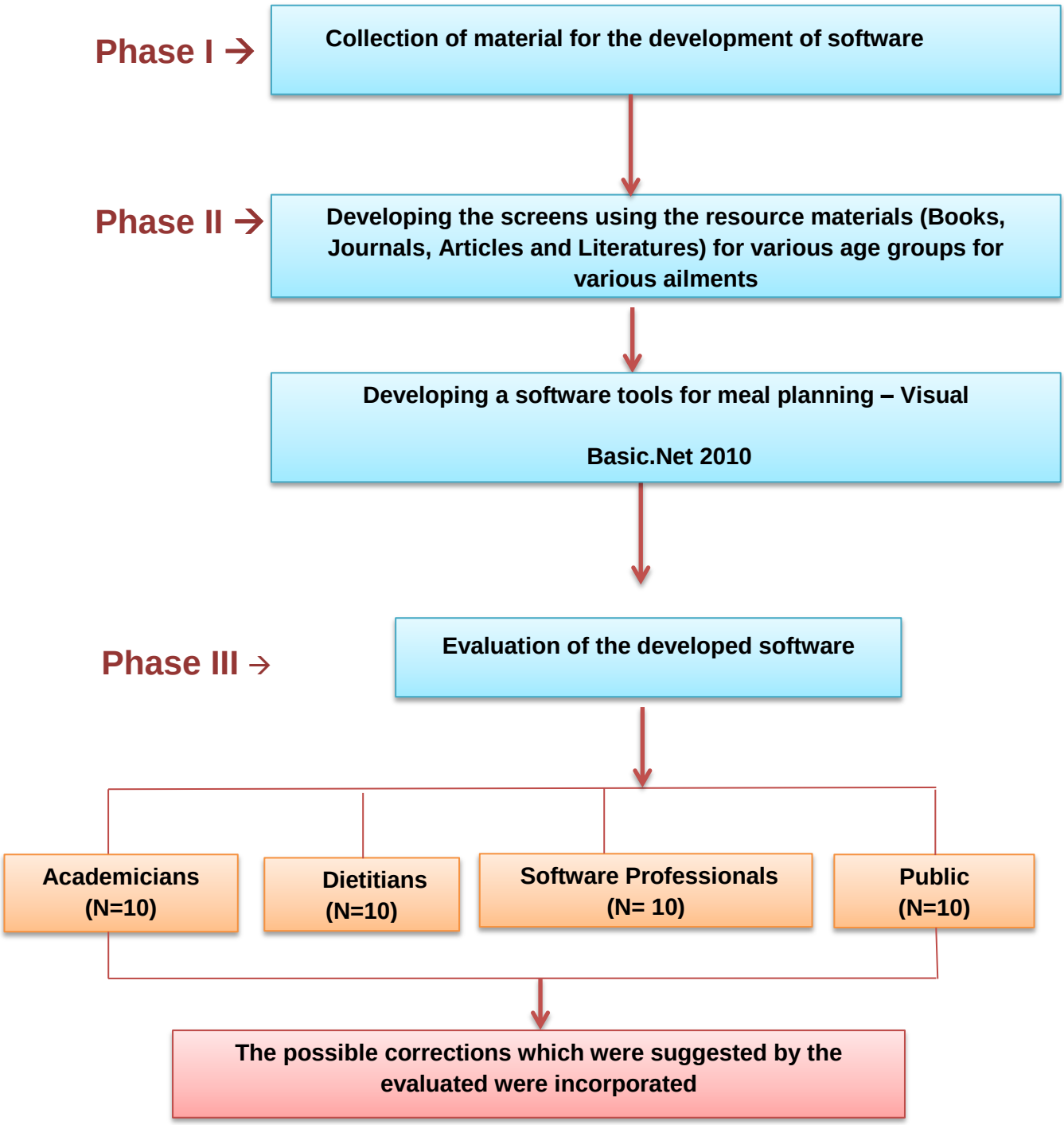
An interview schedule was prepared for the evaluation of the developed software package (Enclosed as Appendix II).

In the software package, questions like Does this software have adequate content?, Do you find any difficulty in understanding the software?, Is it time consuming?, Is this software useful to you?, Does the software have adequate pictorials?; Was the information on meal planning provided by the software useful/applicable to you? Is it user friendly?; Was the diet plan provided by the software easy for you to follow?; Are the ingredients included in the menu easily available?; Is the directions provided by software is easy to understand?; Are the fonts easy to read and understand?; Do the pictures make the package more interesting?; Does the package help in improving your knowledge on meal planning?; Whether the screen designing is good?; Does the package need further changes/improvements with respect to the following contents. Feedback

C. Evaluation of the Developed Software Package and Feedback

The applicability of the software for wider use was determined by collecting suggestions from the evaluators belonging to all categories including academicians, dieticians, public, post graduate students and software developers. The required modifications were then carried out.

Development of a software for meal planning



Research Design

IV. RESULTS AND DISCUSSION

The result of the study **"Development of a Software for Meal Planning",** were obtained in the form of a feedback from academicians, dietitians, software developers and general public.

The questions that were presented to the users/ reviewers are given below:

- Does this software have an adequate content?
- Is it time consuming?
- Do you find any difficulty in understanding the software?
- Is this software useful to you?
- Does the software have adequate pictorials?
- Was the information on meal plan provided by the software useful/applicable to you?
- Is it user friendly?
- Was the diet plan provided by the software easy for you to follow?
- Are the ingredients included in the menu easily available?
- Is the directions provided by software is easy to understand?
- Are the fonts easy to read and understand?
- Does the picture make the package more interesting?
- Does the package helps for improving your knowledge?
- Whether the screen designing is good?
- Are you able to trace the nutritive value of common foods?
- Does the package need further changes/improvements with respect to the following contents?

  A) Personal information

  B) Anthropometric measures

  D) Medical History

  C) Lifestyle

E) Dietary plan

F) Quiz

G) Help

H) Deliverables

The results of the Interview of the users have been compiled as below

Evaluation of the developed software (N=40)

Details on evaluation regarding meal planning	E_1		E_2		E_3		E_4	
	Yes	No	Yes	No	Yes	No	Yes	No
Does this software have adequate content?	7	3	9	1	7	3	9	1
Is it time consuming?	7	3	5	5	7	3	9	1
Do you find any difficulty in understanding the software?	2	8	10	0	3	7	2	8
Is this software useful	10	0	8	2	10	0	7	3
Does the software have adequate pictorials?	8	2	8	2	6	4	7	3
Was the information on meal plan provided by the software useful/applicable to you?	9	1	10	0	10	0	8	2
Is it user friendly?	10	0	10	0	10	0	10	0
Was the diet plan provided by the software easy for you to follow?	8	2	10	0	10	0	8	2
Are the ingredients included in the menu easily available?	10	0	9	1	10	0	9	1
Is the directions provided by software is easy to understand?	10	0	10	0	10	0	8	2
Are the fonts easy to read and understand?	10	0	10	0	10	0	10	0
Does the picture make the package more interesting?	10	0	9	1	7	3	8	2
Does the package helps for improving your knowledge?	10	0	10	0	10	0	8	2
Whether the screen designing is good?	8	2	10	0	10	0	9	1

Are you able to trace the nutritive value of common foods?	10	0	10	0	10	0	6	4
Does the package need further changes/improvements with respect to the following contents?								
A) Personal information	0	10	2	8	0	10	3	7
B) Anthropometric measures	1	9	0	10	0	10	2	8
D) Medical History	3	7	2	8	6	4	5	5
C) Lifestyle	2	8	2	8	5	5	4	6
E) Dietary plan	0	10	2	8	1	9	1	9
F) Quiz	2	8	3	7	0	10	2	8
G) Help	5	5	2	8	1	9	3	7
H) Deliverables	1	9	1	9	0	10	3	7

E1 –Academicians, E2 – Public, E3- Dietitians, E4- Software developers

From the above table it was evident and clear that 90 per cent of E2 – Public and E4 -Software developers felt that the software had adequate information, 70 per cent of Academics and Dieticians felt that the contents were adequate. 30 per cent of Academics and Dieticians felt that further additional information could have been provided.

As far as understanding the software, 80 per cent of the Academics and software developers felt that it was easy to understand. 70 per cent of the Dieticians felt that the software is not difficult to operate. However, 50 per cent of the public felt that it was difficult to navigate the software.

It was evident from the table that 90 per cent and 70 per cent of software developers and Dieticians respectively felt that it was relatively quick to use the software. However 50 per cent per cent of the Academics and Public felt that it was Time consuming to use the software. To learn anything new, it takes some time for some people. We call this the “Learning Curve” effect. Once they start using a couple of times, the familiarity would make it easier to use.

100 per cent of the Academics and Dieticians felt that the software was really useful. Eighty percent of the public felt that the software was useful.

About 80 per cent each among academics and Public felt that the software contained enough pictorials.40 per cent of the Dieticians and 30% software developers felt that there could have been more pictorials.

Entire Public and Dieticians who were interviewed felt that the Meal plan was useful and applicable to them. Also a majority of the academics (90 per cent) and software developers (80 per cent) also felt that the meal plan was really useful and applicable to them.

As far as the user friendly nature of the software was concerned, there was a unanimous decision from all the academics, public, dieticians as well as software developers wherein 100 per cent of all 4 value streams accepted that the software was user-friendly.

The Public and Dieticians voted in full numbers (100 per cent) to state that the Diet plan provided by the software was really useful. A majority of 80per cent academics as well as Software developers agreed that the Diet plan provided was really useful to them.

100 per cent of Academics and Dieticians as well as 90 per cent of Public and Software developers opined that the ingredients suggested in the diet-plan menu were easily available in the market. This reveals that special efforts were made to include locally available ingredients into the diet rather than imported foods from other regions/ countries.

There was a unanimous consensus (100 per cent) among the academics, public as well as Dieticians agreed that the directions provided in the software were easy to understand and navigate. Only 20 per cent of the software developers felt that some improvement is possible to make it even easier.

There was again a unanimous decision on the Font used in the software. All categories of experts agreed that the font was simple and easy to understand. There were no complications.

Again a majority of the subjects from all categories (100 per cent acasemics, 90 per cent Public, 80% software developers and 70 per cent Dieticians) agreed that the pictures provided in the software made it easier to understand the concepts and content being conveyed. It also made the software more interesting to the public.

As far as the Improvement in Knowledge was concerned, 100 per cent of the Academics, Public and Dieticians agreed that the software helped improve their knowledge. With Improved knowledge, one can expect the public at large to make wiser decisions when it comes to choosing their diet. The more the number of people who use the software, the better it is for the society, as it would lead to healthy diet and desirable lifestyle.

Once again a large majority (100 per cent public as well as dieticians, 90 per cent software developers and 80 per cent academics) agreed that the screen designing in the software is good as well as user friendly. This is good as a poor screen display would not encourage people to use the software. It was indeed heartening to note the feedback.

There was a unanimous agreement among the academics, public and dieticians (100 per cent of all 3 categories) that they were easily able to trace the nutritive value of the common foods.

A vast majority of all categories of experts opined that the personal information obtained were apt and adequate for the software. Very few felt a little reluctant to provide personal information due to their shyness.

100 per cent of the Public and Dieticians surveyed on the software remarked that the Anthropometric measurements taken/ reported were relevant and adequate. Only 10 per cent of the academics felt that the data needs little changes.

As far as medical history data was concerned, a low of 20 per cent public and a high 50 per cent software developers felt that the data needs improvement/ changes. The feeling was that if more provisions for complications are given and a library built for those conditions regarding the diet, the more useful it would be for people with health conditions which are not covered in the software already.

Similarly 20-40 per cent from each category of academics, public, dieticians and software developers felt that more/ comprehensive data on Lifestyle could be obtained and suggestions to improve could be dealt with in more detail.

As far as the Diet is concerned, a majority of all categories of experts concurred that the Diet plan provided in the software is adequate.

With respect to the Quiz, a majority accepted and appreciated the content/ questions put forth in the quiz. They unanimously agreed that it improved their knowledge levels.

Around 30-50 per cent of the experts opined that the Help screen can be Improved.

A vast majority of all four category experts agreed that the Deliverables part of the software was adequate and served the purpose.

V. SUMMARY AND CONCLUSION

The study was done with the objective of developing and evaluating a software for meal planning.

This software package has been done in Microsoft VB.Net 2010 as front end and visual studio as back end MS Access 2007is not a language it is server side scripting language are developed.

Materials were collected from books, journals, magazines, internet sources, pamphlets, and articles etc. After collecting the resources materials script was prepared in a note book indicating each slide in one page with necessary diagrammatic representations wherever required. Senior members, who are well versed in the field, evaluated the package and the necessary corrections indicated were incorporated.

The developed package was evaluated by ten experts each from the following categories - academicians, dieticians, public, and software developers.

An interview schedule was developed for the evaluation of the software package and feedback was collected from all the selected subject experts.

For general information based questions like “Is the software package user friendly for you?; Does the software package helps for improving your knowledge; Does it has adequate contents etc., were included. The evaluation results show that 100 per cent of all the experts felt that the software package is user friendly and content adequacy is good.

Majority of the evaluators felt that the software is time consuming; according to the suggestions given by them the package was modified.

From that evaluation process they revealed that the software package would be of immense help to the public in general as it would give them relevant information regarding their anthropometric measurement, help to compare it against standards. It would provide them with precious information on the life style, nutrients intake assessment, quiz, and help that they may have.

In the present day scenario, everyone wants to be healthy. However they do not know the importance of all facets that need to be followed to remain healthy.

This software tries to bridge that knowledge gap by providing a comprehensive plan in terms of recommended diet, physical activity (exercise) required desired Life style for various age groups, gender and people involved in various activity levels.

With the help of the software, it is possible for a person of any age group with any ailment to choose a Diet which would give him the desired calories and other nutrients required to accomplish his tasks.

The uniqueness of the software can be understood from the fact that a supreme athlete competing at the highest level as well as an old ailing person can design their diet according to their differing needs. Even lactating mothers or pregnant women can make use of the Meal plan to Design their Diet plan.

Also various options like Weight gain diet, Weight loss diet, and Maintenance diet are possible with this software. This clearly illustrates the flexibility of this software.

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APPENDIX – I

IHEC form

INSTITUTIONAL HUMAN ETHICS COMMITTEE

Avinashilingam
Institute for Home Science and Higher Education for Women
University
(Estd. u/s 3 of UGC Act 1956)

19th March 2018

To
Ms. Abhinaya Priya. C
Department of Food Service Management and Dietetics
Avinashilingam Institute for Home Science and
Higher Education for Women
Coimbatore – 641 043

Dear Abhinaya Priya,

Ref: Your proposal No. IHEC/17-18/FSMD/01 entitled "Development of a Software for Meal Planning" submitted for approval of the IHEC on 14th December.

The Institutional Human Ethics Committee of our University hereby grants approval to your research proposal No.IHEC/17-18/FSMD/01 entitled "Development of a Software for Meal Planning" submitted by you. The Approval number for the same is AUW/ IHEC/ FSMD - 17-18/XPD/01.

We wish you all the best in your research endeavours.

Regards,

S. Uma Mageshwari
Dr.S.Uma Mageshwari
Member Secretary

Institutional Human Ethics Committee

APPENDIX - II

INTERVIEW SCHEDULE TO EVALUATE THE EFFECTIVENESS OF THE SOFTWARE

1. Does this software have an adequate content?
   YES ☐ NO ☐
2. Is it time consuming?
   YES ☐ NO ☐
3. Do you find any difficulty in understanding the software?
   YES ☐ NO ☐
4. Is this software useful to you?
   YES ☐ NO ☐
   If yes specify

5. Does the software have adequate pictorials?
   YES ☐ NO ☐
6. Was the information on meal plan provided by the software useful/applicable to you?
   YES ☐ NO ☐
7. Is it user friendly?
   YES ☐ NO ☐
8. Was the diet plan provided by the software easy for you to follow?
   YES ☐ NO ☐
9. Are the ingredients included in the menu easily available?
   YES ☐ NO ☐
10. Is the directions provided by software is easy to understand?
    YES ☐ NO ☐
11. Are the fonts easy to read and understand?
    YES ☐ NO ☐
12. Does the picture make the package more interesting?
    YES ☐ NO ☐
13. Does the package helps for improving your knowledge?
    YES ☐ NO ☐
14. Whether the screen designing is good?
    YES ☐ NO ☐
15. Are you able to trace the nutritive value of common foods?
    YES ☐ NO ☐

16. Does the package needs further changes/improvements with respect to the following contents.

Sl.No	CONTENTS	YES	NO
1.	Personal information		
2.	Anthropometric measures		
3.	Lifestyle		
4.	Medical History		
5.	Dietary plan		
6.	Quiz		
7.	Help		
8.	Deliverables		

17. Any other suggestions you would like to give.