Dietitian and Information Technology System Prototype

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Abstract- ***The developed Informative system provides expertise in nutrition consulting. It offers a wide range of advices about nutrients quantity that meet the basic needs of the body; such nutrients as proteins, vitamins, fiber, and some kind of minerals. Also, the system helps the users to make a decision to increase or decrease their weight by knowing their body type. Moreover, nutrition system will provide you with meal plans and the foods you need to eat for your particular body type. In addition, the Dietitian and Information Technology system will save time instead of going to the human expert. Also, the nutrition system is available all the time and can be used in any place. Our system integrates and captures the nutrition and diet knowledge and information in easy, clear, and understandable way for the users. However, the developed nutrition and diet Information system prototype had some technical and presentation limitations such as not covering everything about nutrition, some unclear solutions for average people, and lack of guidance how to measure waist circumferences. The revised Information system should fix these limitations and incorporate the several users' recommendations related to technical, knowledge, and presentation issues such as: Make it more interesting with images, provide the function to how compute BMI, provide examples of food for each solution, provide easy understandable advice for the user, identify health risk factors associated with obesity, and provide the system with other language (Arabic).***

I. INTRODUCTION

According to WHO(2020), consuming a healthy diet throughout the life-course helps to prevent malnutrition in all its forms as well as a range of non-communicable diseases (NCDs) and conditions. However, increased production of processed foods, rapid urbanization, and changing lifestyles have led to a shift in dietary patterns. People are now consuming more foods high in energy, fats, free sugars, and salt/sodium, and many people do not eat enough fruit, vegetables, and other dietary fiber such as whole grains. The exact make-up of a diversified, balanced, and healthy diet will vary depending on individual characteristics (e.g., age, gender, lifestyle and degree of physical activity), cultural context, locally available foods and dietary customs. However, the basic principles of what constitutes a healthy diet remain the same.

Unhealthy diet and lack of physical activity are leading to global health risks. Healthy dietary practices start early in life; breastfeeding fosters healthy growth and improves cognitive development, and may have longer term health benefits such as reducing the risk of becoming overweight or obese, and developing NCDs later in life. Energy intake (calories) should be in balance with energy expenditure. To avoid unhealthy weight gain, total fat should not exceed 30% of total energy intake (Hooper, Abdelhamid, Bunn, Brown, & Summerbell, 2015; Bunn, 2017). Intake of saturated fats should be less than 10% of total energy intake, and intake of trans-fats less than 1% of total energy intake, with a shift in fat consumption away from saturated fats and trans-fats to unsaturated fats (Bunn, 2017), and towards the goal of eliminating industrially-produced trans-fats.

Limiting intake of free sugars to less than 10% of total energy intake is part of a healthy diet. A further reduction to less than 5% of total energy intake is suggested for additional health benefits. Keeping salt intake to less than 5g per day (equivalent to sodium intake of less than 2g per day) helps to prevent hypertension, and reduces the risk of heart disease and stroke in the adult population (Uauy, 2013).WHO Member States have agreed to reduce the global population's intake of salt by 30% by 2025; they have also agreed to halt the rise in diabetes and obesity in adults and adolescents as well as in childhood overweight by 2025 (WHO, 2020).

- Healthy Diet

- For Adults

A healthy diet includes the following:

i. Fruit, vegetables, legumes (e.g., lentils and beans), nuts and whole grains (e.g., unprocessed maize, millet, oats, wheat and brown rice).
ii. At least 400g (i.e., five portions) of fruit and vegetables per day (Uauy, 2013), excluding potatoes, sweet potatoes, cassava and other starchy roots.
iii. Less than 10% of total energy intake from free sugars (Uauy, 2013; Mann, 2015), which is equivalent to 50g (or about 12 level teaspoons) for a person of healthy body weight consuming about 2000 calories per day, but ideally is less than 5% of total energy intake for additional health benefits (Mann, 2015). Free sugars are all sugars added to foods or drinks by the manufacturer, cook or consumer, as well as sugars naturally present in honey, syrups, fruit juices and fruit juice concentrates.
iv. Less than 30% of total energy intake from fats (WHO, 2020; Uauy, 2013; Bunn, 2017). Unsaturated fats (found in fish, avocado and nuts, and in sunflower, soybean, canola and olive oils) are preferable to saturated fats (found in fatty meat, butter, palm and coconut oil, cream, cheese, ghee and lard) and trans-fats of all kinds, including both industrially-produced trans-fats (found in baked and fried foods, and pre-packaged snacks and foods, such as frozen pizza, pies, cookies, biscuits, wafers, and cooking oils and spreads) and ruminant trans-fats (found in meat and dairy foods from ruminant animals, such as cows, sheep, goats and camels). It is suggested that the intake of saturated fats be reduced to less than 10% of total energy intake and trans-fats to less than 1% of total energy intake (Engell, 2018). In particular, industrially-produced trans-fats are not part of a healthy diet and should be avoided (Nishida & Uauy, 2008).
v. Less than 5g of salt (equivalent to about one teaspoon) per day (Uauy, 2013). Salt should be iodized.

- For infants and young children

WHO in (2020) wrote that in the first 2 years of a child's life, optimal nutrition fosters healthy growth and improves cognitive development It also reduces the risk of becoming overweight or obese and developing NCDs later in life? They also advised on a healthy diet for infants and children is similar to that for adults, but the following elements are also important:

1. Infants should be breastfed exclusively during the first 6 months of life.
2. Infants should be breastfed continuously until 2 years of age and beyond.
3. From 6 months of age, breast milk should be complemented with a variety of adequate, safe and nutrient-dense foods. Salt and sugars should not be added to complementary foods.

- Practical advice on maintaining a healthy diet
- Fruit and vegetables

Eating at least 400 g, or five portions, of fruit and vegetables per day reduces the risk of NCDs (Uauy, 2013)and helps to ensure an adequate daily intake of dietary fiber.

Fruit and vegetable intake can be improved by:

i. always including vegetables in meals;
ii. eating fresh fruit and raw vegetables as snacks;
iii. eating fresh fruit and vegetables that are in season; and
iv. eating a variety of fruit and vegetables.

- Fats

Reducing the amount of total fat intake to less than 30% of total energy intake helps to prevent unhealthy weight gain in the adult population (WHO, 2020; Bunn, 2017; Uauy, 2013). Also, the risk of developing NCDs is lowered by:

1. reducing saturated fats to less than 10% of total energy intake;
2. reducing trans-fats to less than 1% of total energy intake; and
3. replacing both saturated fats and trans-fats with unsaturated fats (Bunn, 2017; Uauy, 2013)in particular, with polyunsaturated fats.

Fat intake, especially saturated fat and industrially-produced trans-fat intake, can be reduced by:

i. steaming or boiling instead of frying when cooking;
ii. replacing butter, lard and ghee with oils rich in polyunsaturated fats, such as soybean, canola (rapeseed), corn, safflower and sunflower oils;
iii. eating reduced-fat dairy foods and lean meats, or trimming visible fat from meat; and
iv. Limiting the consumption of baked and fried foods, and pre-packaged snacks and foods (e.g., doughnuts, cakes, pies, cookies, biscuits and wafers) that contain industrially-produced trans-fats.

- Salt, sodium and potassium

Most people consume too much sodium through salt (corresponding to consuming an average of 9–12g of salt per day) and not enough potassium (less than 3.5g). High sodium intake and insufficient potassium intake contribute to high blood pressure, which in turn increases the risk of heart disease and stroke (Mozaffarian, Fahimi, Singh, Micha, Khatibzadeh, & Engell, 2014). Reducing salt intake to the recommended level of less than 5g per day could prevent 1.7 million deaths each year (Mozaffarian, et al., 2014).People are often unaware of the amount of salt they consume. In many countries, most salt comes from processed foods (e.g., ready meals; processed meats such as bacon, ham and salami; cheese; and salty snacks) or from foods consumed frequently in large amounts (e.g., bread)(Uauy, 2013). According to him, salt is also added to foods during cooking (e.g., bouillon, stock cubes, soy sauce and fish sauce) or at the point of consumption (e.g., table salt).

He also claimed that salt intake can be reduced by:

i. limiting the amount of salt and high-sodium condiments (e.g., soy sauce, fish sauce and bouillon) when cooking and preparing foods;
ii. not having salt or high-sodium sauces on the table;
iii. limiting the consumption of salty snacks; and
iv. choosing products with lower sodium content.

Some food manufacturers are reformulating recipes to reduce the sodium content of their products, and people should be encouraged to check nutrition labels to see how much sodium is in a product before purchasing or consuming it. Potassium can mitigate the negative effects of elevated sodium consumption on blood pressure. Intake of potassium can be increased by consuming fresh fruit and vegetables.

- Sugars

In both adults and children, the intake of free sugars should be reduced to less than 10% of total energy intake (Uauy, 2013). A reduction to less than 5% of total energy intake would provide additional health benefits (Uauy, 2013).Consuming free sugars increases the risk of dental caries (tooth decay). Excess calories from foods and drinks high in free sugars also contribute to unhealthy weight gain, which can lead to overweight and obesity. Recent evidence also shows that free sugars influence blood pressure and serum lipids, and suggests that a reduction in free sugars intake reduces risk factors for cardiovascular diseases (Morenga, Howatson, Jones, & Mann, 2014).

According to Morenga, Howatson, Jones, and Mann, (2014) Sugars intake can be reduced by:

1. limiting the consumption of foods and drinks containing high amounts of sugars, such as sugary snacks, candies and sugar-sweetened beverages (i.e., all types of beverages containing free sugars these include carbonated or non-carbonated soft drinks, fruit or vegetable juices and drinks, liquid and powder concentrates, flavored water, energy and sports drinks, ready-to-drink tea, ready-to-drink coffee and flavored milk drinks); and
2. eating fresh fruit and raw vegetables as snacks instead of sugary snacks.

- How to promote healthy diets

WHO, in (2020) said diet evolves over time, being influenced by many social and economic factors that interact in a complex manner to shape individual dietary patterns. These factors include income, food prices (which will affect the availability and affordability of healthy foods), individual preferences and beliefs, cultural traditions, and geographical and environmental aspects (including climate change). Therefore, promoting a healthy food environment – including food systems that promote a diversified, balanced and healthy diet – requires the involvement of multiple sectors and stakeholders, including government, and the public and private sectors.

Governments have a central role in creating a healthy food environment that enables people to adopt and

maintain healthy dietary practices. Effective actions by policy-makers to create a healthy food environment include the following:

1. Creating coherence in national policies and investment plans – including trade, food and agricultural policies – to promote a healthy diet and protect public health through:
   i. increasing incentives for producers and retailers to grow, use and sell fresh fruit and vegetables;
   ii. reducing incentives for the food industry to continue or increase production of processed foods containing high levels of saturated fats, trans-fats, free sugars and salt/sodium;
   iii. encouraging reformulation of food products to reduce the contents of saturated fats, trans-fats, free sugars and salt/sodium, with the goal of eliminating industrially-produced trans-fats;
   iv. implementing the WHO recommendations on the marketing of foods and non-alcoholic beverages to children;
   v. establishing standards to foster healthy dietary practices through ensuring the availability of healthy, nutritious, safe and affordable foods in pre-schools, schools, other public institutions and the workplace;
   vi. exploring regulatory and voluntary instruments (e.g., marketing regulations and nutrition labeling policies), and economic incentives or disincentives (e.g., taxation and subsidies) to promote a healthy diet; and
   vii. encouraging transnational, national and local food services and catering outlets to improve the nutritional quality of their foods – ensuring the availability and affordability of healthy choices – and review portion sizes and pricing.

2. Encouraging consumer demand for healthy foods and meals through:
   i. promoting consumer awareness of a healthy diet;
   ii. developing school policies and programs that encourage children to adopt and maintain a healthy diet;
   iii. educating children, adolescents and adults about nutrition and healthy dietary practices;
   iv. encouraging culinary skills, including in children through schools;
   v. supporting point-of-sale information, including through nutrition labelling that ensures accurate, standardized and comprehensible information on nutrient contents in foods (in line with the Codex Alimentarius Commission guidelines), with the addition of front-of-pack labelling to facilitate consumer understanding; and
   vi. providing nutrition and dietary counselling at primary health-care facilities.

3. Promoting appropriate infant and young child feeding practices through:
   i. implementing the International Code of Marketing of Breast-milk Substitutes and subsequent relevant World Health Assembly resolutions;
   ii. implementing policies and practices to promote protection of working mothers; and
   iii. promoting, protecting and supporting breastfeeding in health services and the community, including through the Baby-friendly Hospital Initiative.

- Methods for Assessing Body Composition

- Body Mass Index (BMI)

Garrett and Lundin, (2020) defined Body Mass Index (BMI) is a number calculated from a person's weight and height. BMI is a fairly reliable indicator of body fatness for most people. BMI does not measure body fat directly, but research has shown that BMI correlates to direct measures of body fat, such as underwater weighing and dual energy x-ray absorptiometry (DXA). BMI can be considered an alternative for direct measures of body fat. Additionally, BMI is an inexpensive and easy-to-perform method of screening for weight categories that may lead to health problems.

- How is BMI used?

BMI is used as a screening tool to identify possible weight problems for adults. However, BMI is not a diagnostic tool. For example, a person may have a high BMI. However, to determine if excess weight is a health risk, a healthcare provider would need to perform further assessments. These assessments might include skinfold thickness measurements, evaluations of diet, physical activity, family history, and other appropriate health screenings. Calculating BMI is one of the best methods for population assessment of overweight and obesity. Because calculation requires

only height and weight, it is inexpensive and easy to use for clinicians and for the general public. The use of BMI allows people to compare their own weight status to that of the general population.

- Calculating BMI

BMI is calculated the same way for both adults and children. The calculation is based on the following formulas:

Table 4.3 Calculating BMI

Measurement Units	Formula and Calculation
Kilograms and meters/centimeters	Formula: weight (kg) / [height (m)] ² With the metric system, the formula for BMI is weight in kilograms divided by height in meters squared. Since height is commonly measured in centimeters, divide height in centimeters by 100 to obtain height in meters. Example: Weight = 68 kg, Height = 165 cm (1.65 m) Calculation: 68 ÷ (1.65) ² = 24.98
Pounds and Inches	Formula: weight (lbs.) / [height (in)]² x 703 Calculate BMI by dividing weight in pounds (lbs.) by height in inches (in) squared and multiplying by a conversion factor of 703. Example: Weight = 150 lbs., Height = 5'5″ (65″) Calculation: [150 ÷ (65)²] x 703 = 24.96

- Interpreting BMI for adults

For adults 20 years old and older, BMI is interpreted using standard weight status categories that are the same for all ages and for both men and women(Garrett & Lundin, 2020). For children and teens, on the other hand, the interpretation of BMI is both age- and sex-specific. The standard weight status categories associated with BMI ranges for adults are shown in the following Table 2.2.

Table 4.4: Interpreting BMI

BMI	Weight Status
Below 18.5	Underweight
18.5-24.9	Normal
25.0-29.9	Overweight
30.0 and above	Obese

- Reliability of BMI an Indicator of Body Fatness

The correlation between the BMI number and body fatness is fairly strong; however, the correlation varies by sex, race, and age. These variations include the following examples:

1. At the same BMI, women tend to have more body fat than men.
2. At the same BMI, older people, on average, tend to have more body fat than younger adults.
3. Highly trained athletes may have a high BMI because of increased muscularity rather than increased body fatness.

It is also important to remember that BMI is only one factor related to risk for disease. For assessing someone's likelihood of developing overweight- or obesity-related diseases, the National Heart, Lung, and Blood Institute guidelines recommend looking at two other predictors:

1. The individual's waist circumference (because abdominal fat is a predictor of risk for obesity-related diseases).
2. Other risk factors the individual has for diseases and conditions associated with obesity (for example, high blood pressure or physical inactivity).

- Other Methods for Assessing Body Composition

Other methods to measure body fatness include skinfold thickness measurements (with calipers), underwater weighing, bioelectrical impedance, and Dual-Energy X-ray Absorptiometry (DEXA). However, these methods are not always readily available, and they are either expensive or need highly trained personnel. Furthermore, many of these methods can be difficult to standardize across observers or machines, complicating comparisons across studies and time periods.

- Existing System

In the existing Information Diet Consultant system, you have to hire a dietitian in order to get advice. Hiring a nutrition doctor will not only waste your time and efforts for calling them, going to them and so on but also cost you very high as their charges per month are very high. The moment will also arrive when they will not available for you and you have to search for some other dietitian urgently. In this system, a fixed time period is defined for the repetitive scanning of the files in the system. After a specified period, the system calculates checksum for each and every file in the system, irrespective of whether it was accessed. Then the new checksum values are compared with the old or reference checksum values so as to determine if the file in the system is modified or not. For example, in the earlier dietitian has to collect user details for diet. Approving those user details takes lot of time.

Dietitian and user have to consult each other directly if any information is needed. If any new user come for diet schedule, dietitian and his staff has to search the user details and they have to find the dietitian schedule for that particular diet. Here searching for eligible diet takes lots of time. And sometimes some users' details may be missed.

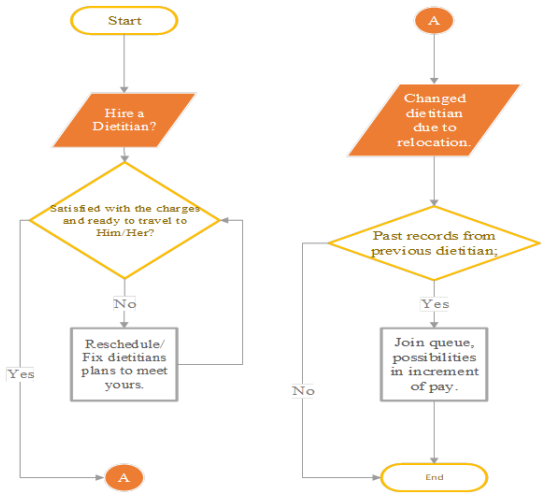

Figure 5.0: Current Dietitian Model (Researcher, 2021)

- Gaps

Husain, Wei, Cheng, and Zakaria, in (2018) asserted that cancer is a very severe disease. It is occurring frequently nowadays. Some systems are available in market which suggests diet for cancer but they are not sufficient. These systems only suggest one or two food items which help to secure from disease. This system provides a complete diet plan for cancer. cancer is a disease which is not curable. It needs chemo therapy which has side effects. Therefore, the one and only solution to this is to take proper diet to prevent from getting such type of disease. Abbas and Zain,(2017) in their work, described the diet plan for diabetic patients. This system is based on a virtual dietician concept. a chat bot is designed which works as a dietician. The history and view of chat bot is provided in this system. Diet plan for diabetic patients is given using this chat bot. this system is the interface between man and machine. Chat bot concept provide interface that gives the diet plan for diabetic patients.

Barnett, Harricharan, Fletcher, and Gilchrist, in (2016) their work provides diet plan for obese people. As obesity is a major health problem proper diet is very essential. To lose weight for obese people is a very difficult task. There are certain ranges of BMI which decides normal, underweight or overweight. The BMI above30 is refer as BMI for overweight people. This paper provides a system which manages weight and provides a good diet to lose weight. There is face to face consultation between dietician and a person. Because of this dietician get clients automatically and

clients get the proper advice without wastage of time for travelling to dietician. Carl, et al., in (2016) Obesity is a major health problem. Each and every one should take care of his/her health and should maintain a proper health condition. This system provides a diet plan to the user to lose weight. As today's world is internet world and there is Gmail service available, this work gives a system which uses the emailed of the user. Based on email id of user the system sends the diet plan to him/her on their respective email ids.

Glintborg, Brandt, Toubro, Arendal, Brandt, & Pedersen, (2018) their work provides an intelligent agent which will give a diet plan to user. Eating habits of different person are different therefore their diet plan should be different. Lifestyle of each person is different. The different tensions are there for different professions. Because of this stress a proper diet is essential to follow. This work gives a proper diet which is different for each person. The user has to enter the information about his lifestyle and according to that, the diet plan will be displayed.

Hitesh, Pruthi, Hardik, Rawool, and Philip, in (2017) their research work describes a website. This website contains all the data about various health issues and their remedies. The required all information about health maintenance is provided in the website. This website is easily accessible to all people from lower age to higher age no issues. Admin and user are two important keywords in this website. The user is a common people who want to take some information. A unique login id is given to each user from which he/she can login to the website. the website is linked with different gyms from which gym book is taken and provided to each user.

CONCLUSION

One can's really give a single divination for a healthy diet. There are however demands for food system to support health and wellbeing. In this, innovation is targeted nutrition control and growth. Which on a larger scale continue to evolve. Influences health and poor diets drive up healthcare technology for individuals and society in the present century and in the very near future. There have been multiple governmental programs and advocacy aimed to educate citizens about diet choices, resulting in documented successes. The literature review has been able to give wonderful insight on how information technology systems can assist dietitians, individual and the society to make healthy decision as it concern their health and wellbeing.

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