

## Using Mobile Application to Improve the Cultural and Nutritional Status of Underweight Patients”

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### Abstract

This study aims to gain weight and raise the cultural and nutritional awareness of underweight patients. The study sample consisted of 86 underweight female students at the Assiut university, from 19 to 23 years. They were divided according to their body mass index into two groups, the first group suffered from moderate underweight, and their number was 36 students. Their BMI was  $17 \leq 18,4$  and the second group suffer from extreme underweight, as their body mass index is less than or equal to 17, and their number reached 50 thin patients. The diet has been prepared that includes breakfast, lunch, dinner and snacks. This diet is an essential part of the electronic application called (**Diet 4 Underweight**). The cultural and nutritional awareness of underweight patients was also raised through conducting an electronic nutritional educational course, through which underweight patients were provided with information on how to prepare an integrated nutritional meal, introducing them to healthy and unhealthy foods, trying to change their unhealthy food habits and introducing them to how to calculate calories for the meals they eat and others. Adhering to this diet and following it for 3 months; results in increasing their weight and reaching their weight at the normal rate.

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All this information has been placed within the application (**Diet 4 Underweight**) in the part of the nutritional library. The results showed a highly significant ( $p \leq 0.001$ ) in weight and cultural and nutritional level, as the weight before following the diet and the nutritional educational course was  $48.35 \pm 5.49$  and after their followers, it became  $56.19 \pm 5.68$  as well as for the indicator Body mass before the diet and nutritional education session was  $18.65 \pm 2.10$  and then became  $21.65 \pm 2.09$ .

**Keywords:** Mobile application, Underweight, Nutritional status, and Cultural status.

### Introduction:

It is worth noting that despite the spread of nutritional obesity of its various types in recent times, it cannot be forgotten that the rates of thinness and underweight among children in the school-age stages and adolescents and adolescent girls have significantly increased as a phenomenon worthy of study (**Mohamed, 2011**).

Being underweight is a common disease caused by poor nutrition or genetic causes, and it can also be divided according to body mass index into first:

moderate underweight (18.4-17), where their percentage in 2014 in the Arab Republic of Egypt was 6.3%, while their percentage in Assiut Governorate in the same year was 1.9%, and secondly: extreme underweight ( $<17$ ), where their percentage in the Arab Republic of Egypt for the year 2014 (4.9%) while their percentage in Assiut governorate reached 1.2%, thus the total percentage of underweight in the Arab Republic of Egypt for 2014 became (11.2%), while the same year was (3.1%) (**Nicola et al., 2019**).

Here, underweight (thinness) can be defined as a term describing a person whose weight is less than their healthy weight. Being underweight is associated with many negative health consequences such as nutritional deficiency, osteoporosis, and poor pregnancy outcomes for women of childbearing age (**Afaf et al, 2014**). Such as the elderly, the disabled, the chronically ill, the homeless, refugees, and people affected by war and natural disasters.

Being underweight is also a major problem in some poor developing countries where it is a recognized permanent problem (**Stella, 2016**). Many individuals suffer from thinning for a variety

of reasons, but the main reason is many cases are not obtaining a sufficient and large amount of calories. The other reasons include genetic reasons and following wrong diets such as weight loss and continuation to the point of reaching underweight and psychological reasons.

The nutritional treatment of an underweight patient is to encourage the person to take sufficient quantities, both in quality and quantity of food, while working to prevent it from easily reaching the desired goal. The age, height, and previous weight status of each underweight patient are also taken into consideration in order to determine the high-energy meal and must be gradual, otherwise, the person may not be able to tolerate the sudden increase (**laila El-Sibai, 2011**).

Recently, the use of technology has spread significantly among all different age groups, as the percentage of using technology and its various media in 2014 in the Arab Republic of Egypt reached 59.9%, while the percentage of its use in Assiut Governorate for the same year was 9.6% (**Nicola et al., 2019**).

Accordingly, computer applications and mobile applications have gained popularity and are therefore integrated into diet management (**Billy, 2021**). Information and communication technology have become a powerful allies in promoting the lifestyle and health of individuals, taking into account nutrition intake, levels of physical activity, provision of nutrition, and measurement. Automatic food intake and energy expenditures, in addition to personal counseling and educational services (**Rocco et al., 2008**). With the proliferation of mobile phones and tablets, there is an increase in the number of software applications aimed at improving nutrition and fitness and simple digitization of important and useful inputs and data but these devices have built-in capabilities that can increase the accuracy of data collection and reduce process time burden and biases potential (**Rodrigo, 2016**).

### **Aim of the study**

The research aims to:

- 1- Raise the nutritional culture awareness of underweight patients through the use of mobile phone applications.
- 2- Improving the Nutritional status of underweight patients through the use of mobile phone Applications.

3- Preparing a free integrated food program with high calories in English and Arabic language for underweight patients through the use of mobile phone Applications.

4- Providing food dishes with new proposed items with high calories through mobile applications.

### **The sample, materials, and methods:**

#### **The sample:**

This study was conducted on (110) female students at Assiut University, ranging from 19:23 years of age. The data was collected through a secure online survey. Students who suffer from being underweight as a result of malnutrition diseases were selected by conducting a test with some questions that clarify whether they suffer from being underweight as a result of genetic reasons or pathological reasons related to malabsorption and digestion, or malnutrition reasons. It became clear to us that the number of female students who suffer from being underweight as a result of malnutrition diseases reaches (86). Patients with underweight due to reasons other than malnutrition were excluded from the study sample, as their number reached 24. The study sample (86) was divided into two groups according to their body mass index, first: moderate underweight ( $17 \geq 18.4$ ), and second: extreme underweight ( $17 \leq$ ) (by Yvette, 2021).

#### **Materials:**

Several forms were used in this study, including:

1- The electronic (pre-test) form:

It was prepared in Arabic and sent to the students via their e-mail, and the data for the students was confidential and protected. This form included some questions that measured the cultural and nutritional level of underweight patients, and was applied to the study sample before conducting the health education course (Appendix 1 and 2).

2- Electronic nutritional educational course:

This nutritional educational course was also placed in the mobile phone application that is called (Diet 4 underweight). This course is through which dietary habits and cultural misinformation about nutrition and eating habits are improved based on the results of the pre-test form because through it the actual level of each student is determined. Through this course, food culture is improved and the

habits of eating meals are modified. By sticking to an integrated high-calorie diet it and the meals in it for a period of 3 months or more, the weight will be increased to the limit or the normal rate.

### 3- Electronic (post-test) form:

This form contains the same questions as in the pre-test form in order to be able to see if there are differences in the students' answers. This form included questions to measure the cultural and nutritional level after the nutritional education course. The presence of positive differences in the answers is evidence of the effectiveness and efficiency of the nutritional education course and of the student's commitment to following the diet (**Appendix 1 and 2**).

### 4- A digital scale:

This scale is used to measure body weight before and after the diet to know the extent of the difference in weight, It also has a tape measure attached to it measure the height.

## **Methods:**

The study sample was selected according to several criteria, the most important of which is the body mass index, which is one of the measurements used to measure obesity and underweight in individuals. The body mass index (BMI) is also known as a measurement used to assess the weight of an individual in relation to their height, It is also the first step that was performed on the study sample, which is (the measurement of weight, height and body mass index) (**Appendix 3**).It is calculated by dividing the weight in kilogrammes by the length in metres squared (**Aparna, 2018**). This indicator is to determine if the weight is less than the normal rate. If the body mass index is less than or equal to 18.5, this will be a person who suffers from being underweight, but if the body mass index is greater than or equal to 18.5 and less than 25, this person is in the normal range, if the body mass index is greater than or equal to 25 and less than 30, this person suffers from obesity of the first degree. (**Natalie, 2018**).

Based on the body mass index, when its value is less than or equal to 18.5, the individual suffers from being underweight, underweight is divided into moderate underweight ranging between 17-18.4 and extreme underweight when it is less than 17 (**Lucienne, 2014**). This study was applied to patients who were

underweight resulting from malnutrition only. The study applied to a sample of (86) female students from Assiut University, where the study was started with them through a form to sort the sample.

This form contained some questions that contributed greatly to identifying the students who suffer from underweight as a result of malnutrition, and then a pre-test (electronic form) was conducted. This form contains many questions that clarify (their eating habits, the number of meals they eat during the day, the type of food eaten, the extent of their nutritional culture, and methods of cooking food) and other questions, as This form was prepared electronically and the content of the questions inside it was in Arabic. This form was sent to each student via her e-mail and they were also provided with contact information in case they had questions or wished to discuss any aspect of the study.

After the student completed the answers to the form's questions, she would also send it. Based on the student's answers, the extent of their nutritional cultural awareness, as well as the nutritional habits they follow in their meal system, was determined. Accordingly, an electronic nutritional educational course was prepared that also addresses the lack of nutritional cultural awareness among the students and provides them with proper nutritional habits. Also, the course introduces them to the components of a healthy meal and how to create an integrated healthy meal.

The course included food programs that contain breakfast, lunch, dinner, and snacks between meals for several days as a model that required and followed weight gain. There was periodic follow-up with these girls via mail to check on them and to know the extent of their follow-up and commitment to following this diet. As they were followed up after the middle of the period, 1.5 months after adherence to the diet, their body mass index was calculated for them to know the amount of weight gain, the body mass index was also calculated at the end of the period, 3 months of following this diet.

The students were weighed to get an indication of the efficiency and effectiveness of this diet, and an anthropometric measurement was conducted, and there were differences in favor of the research results, which confirm the efficiency and effectiveness of the diet. All of this data has been saved and put all within the mobile

application equipped with many technologies that help raise awareness and food culture.

The first stages and steps of creating an electronic application are:

**a) The mobile application design (Diet 4 underweight):**

As it is one of the most important things to consider when designing an electronic application. The design of the application should be simple so that any new user can use it easily, and as I also used a responsive design in order for the application to be flexible and adjustable and work on operating systems such as the Android operating system, it must be ensured that its currency in different environments such as phones, tablets, and computers (Billy, 2021).

Grids were used in the design to maintain the consistency of the application design across multiple pages. Consistency in graphics, fonts, and icons makes the application appear professional. The application has been tested offline to ensure that most of the features work while offline (Leslie, 2018).

**b) The mobile application planning stage (Diet 4 underweight):**

The application was built through the following steps:

- Use sites that provide tools to help create the application, and the languages that helped to design the application include javascript g, C#, swift, and others.
- The application was selected using tools and software such as the SDK tool. Then publish the application on the App Store for free.

The (Diet 4 underweight) application is designed specifically for patients underweight, and it also has an effective role in raising the cultural and nutritional awareness of underweight patients, as the main page in the application clearly displays the idea of the application as it provides an overview of what the application can offer to the user (Figure1), and on the next page, it shows you the diet for underweight application how to calculate your BMI and categorizes for you whether you suffer from being very underweight or moderately underweight (Figure2). On the next page, it helps you calculate the calories that you eat in your different meals, as the calories of different foods were calculated per 100 grams, and the application was provided with this information, and the calories of the foods were calculated as follows: The user enters this exhibition and selects the food item that he ate in his meal by clicking on its image, where quantity

options appear. From the options that the application provides to you, the application then calculates the total calories in the meal as a whole.

It also displays on the next page of the application a nutritional library to help the user increase their nutritional awareness and education, as this library contains some articles such as how to determine the appropriate food, the conditions that must be met in human food, food groups and what they contain, how to create a nutritional meal integrated, signs of proper nutrition, and integrated diet that contains breakfast, lunch, dinner, and snacks. The last page of the application contains an alarm to remind you of the dates of meals, which the user adjusts (Figure 3).



Figure (1)



Figure (2)



Figure (3)

Figure (1): Home page of the mobile (Diet 4 underweight).

Figure (2): How to Calculate Your BMI.

Figure (3): Alarm clock for eating meals.

### Statistical Analysis:

Data were presented as the mean of duplicate  $\pm$  standard deviation (mean  $\pm$  SD). AT-test was used to establish the significance of differences among mean values at ( $p < 0.05$ ) (Steel et al., 1981).

### Results and Discussion:

Table (1): Evaluation of nutritional cultural status for underweight patient's pre and post nutritional education courses

Questions no.	Nutritional Educational Course						P. value
	Pre			Post			
	Yes n (%)	Sometimes n (%)	No n (%)	Yes n (%)	Sometimes n (%)	No n (%)	



1 - Do you know which foods must be reduced to decrease your dietary intake of fat and cholesterol?	0 (0%)	24 (27.9%)	62 (72.1%)	0 (0%)	80 (93.3%)	6 (7.0%)	**
Mean ± Std.	1.28±0.45			1.93±0.26			**
2- Do you know what foods to eat to increase your fiber intake?	0 (0%)	18 (20.9%)	68 (79.1%)	0 (0%)	86 (100%)	0 (0%)	**
Mean ± Std.	1.21±0.41			2.00±.01			**
3 - Do you know the foods that you should limit your intake of sugars?	0 (0%)	8 (9.3%)	78 (90.7%)	0 (0%)	82 (95.3%)	4 (4.7%)	**
Mean ± Std.	1.09±0.29			1.95±0.21			**
4-Do you know the benefits that you can reap from eating a diet?	0 (0%)	16 (18.6%)	70 (81.4%)	0 (0%)	82 (95.3%)	4 (4.7%)	**
Mean ± Std.	1.19±0.39			1.95±0.21			**
5 - Do you know how much you should eat to satisfy your energy requirements?	0 (0%)	12 (14.0%)	74 (86.0%)	0 (0%)	86 (100.0%)	0 (0%)	**
Mean ± Std.	1.14±0.35			2.00±.01			**
6 - Do you know how to improve your diet?	0 (0%)	16 (18.6%)	70 (81.4%)	0 (0%)	14 (16.3%)	72 (83.7%)	**
Mean ± Std.	1.19±0.39			1.84±0.37			**

Mean of three replicates ± std. deviation.

\*\* ≤ P

0.00

The results in **Table (1)** showed the differences in favor of the post-test answers, It shows that nutrition culture plays a major role in forming an individual's dietary habits, as we find that the more an individual's nutrition culture increases, the more he has healthy eating habits. The underweight patients acquired nutritional knowledge and culture, and this is clear from the differences in the results of the pre and post-test, where the result in the pre-test was 1.28±0.45 and in the post-test 1.93±0.26, where the student's response to this question in the pre-test was (No) by 27.9%, and the response in the post-test became (sometimes) with a rate of 93.3%, which confirms the student's 'Knowledge of the foods for which the dietary intake of fats and cholesterol should be reduced, and the presence of fundamental differences in the results before and after conducting the nutritional training course, which indicates the

acquisition of nutritional culture for them. (Joyce et al., 2018) confirmed that excessive intake of fats and saturated and unsaturated fatty acids leads to coronary heart disease, which greatly affects the vital signs of the body.

Also, in question No. (2) in **Table (1)** we find that the results of the students' answers confirm their knowledge of the foods that increase the dietary intake of fiber, After the nutritional educational course, Therefore, they should reduce the intake of these foods rich in fiber, because the intake of dietary fiber is inversely correlated with body weight, body fat and body mass index, and this was confirmed by a study (Joanne, 2005).

The response to this question was (No) and reached 79.1% in the pre-test, in the post-test the response, was (sometimes) and reached 100.0%.

In question No. (3) **Table (1)** shows the extent to which the students benefit in identifying the foods that should be reduced and the food intake of sugar should be reduced after the nutritional educational course. As the food intake of sugar per person per day is about 140 grams of glucose, and the excessive intake of sugar leads to obesity, tooth decay, high blood pressure, and other diseases, and this was confirmed by a study (Joan, 2013). We noticed that the student's answers in the pre-test were  $1.09 \pm 0.29$  and in the post-test  $1.95 \pm 0.21$ , whereas, the student's response to this question was (No) and reached a rate of 90.7% in the pre-test and in the post-test the response was (sometimes) at a rate of 95.3%, after the nutritional educational course. The answers of the students in question No. (4) in **Table (1)** confirm their knowledge of the benefit of following a healthy diet as evidenced by the results of the pre-test Their knowledge of the amount of daily food intake of energy after the nutritional educational course, was  $1.19 \pm 0.39$  and the result of post-test  $1.95 \pm .21$ . The percentage of students' responses (No) to this question in the pre-test was 81.4%, and in the post-test, the response was (sometimes) as it reached 95.3%. (Jennifer, 2003), also clarified the importance of eating healthy food, as it has a role in enhancing the psychological state and mood of the individual, increasing physical activity, and athletic performance of individuals. Also, In question No. (5) in **Table (1)**, confirms their knowledge of the amount of daily food intake of energy, as the result of the pre-test was  $1.14 \pm 35.0$  and the result of

the post-test reached  $2.00 \pm 0.01$ . Likewise, the students response rate to this question (No) in the pre-test was 86.0%, and the response rate (sometimes) in the post-test was 100.0%. The study (**Rocco et al., 2008**) aimed to increase the intake of healthy foods that contain vegetables and fruits in exchange for not excessive intake of foods rich in energy so as to enjoy good health.

Also, in question No. (6) in **Table (1)** as well, the differences confirm the high cultural level of the students after the nutritional educational course. The results confirm that the students know how to improve their diet independently, whereas the pre-test result was  $1.19 \pm 0.39$  and, the post-test was  $1.84 \pm 0.37$ , the student's response to this question (No) was 81.4% in the pre-test, while their response in the post-test was (sometimes) 16.3%.

Also, to manage the diet well, the individual must have a nutritional culture, and must have knowledge of what the diet means, as the study (**Giulia, 2013**) explained that A healthy diet is one in which energy is consumed in the same quantities as it is expended, and which contains all essential dietary nutrients (e.g. protein, vitamins, and minerals). The total amount of energy an individual should consume will vary depending on gender, age and exercise habits. All people should source their energy from a variety of food groups and include plenty of fruits, vegetables, whole grain cereals, and only small amounts of fat.

All of the results in **Table (1)** show that there is a high significance ( $p \leq 0.001$ ) between the thin patient's pre and post-nutritional educational course cultural dietary level, confirming the improvement in the level after the nutritional educational course.

These results are in agreement with those (**walid et al., 2015**). Nutritional culture plays an important and main role in controlling the food habits and behaviours of an individual. Many studies and research have been conducted to explain the effect of food culture on individuals eating habits and how they choose the foods they eat. Eating habits among young people are a public health concern (**Lucas et al., 2018**).

### **Table (2): Evaluation of nutritional status of underweight patient's pre and post nutritional education course**

Questions no.	Nutritional Educational Course						P. value
	Pre			Post			
	Yes	Sometimes	No	Yes	Sometimes	No	
n (%)	n (%)	n (%)	n (%)	n (%)	n (%)		
1 - Do you always eat breakfast?	12 (14.0%)	68 (79.1%)	6 (7.0%)	80 (93.3%)	6 (7.0%)	0 (0%)	**
Mean ± Std.	2.06±0.53			2.93±0.26			**
2 - Do you eat at least two fruits a day?	4 (4.7%)	52 (60.5%)	30 (34.9%)	82 (95.3%)	4 (4.7%)	0 (0%)	**
Mean ± Std.	1.70±0.56			2.95±0.21			**
3 - Do you eat vegetables daily?	18 (20.9%)	38 (44.2%)	30 (34.9%)	70 (81.4%)	12 (14.0%)	4 (4.7%)	**
Mean ± Std.	1.86±0.74			2.77±0.53			**
4 - Do you usually eat cake or sweets for breakfast?	12 (14.0%)	30 (34.9%)	44 (51.2%)	74 (86.0%)	8 (9.3%)	4 (4.7%)	**
Mean ± Std.	1.62±0.72			2.81±0.50			**
5 - Do you usually eat breakfast, lunch and dinner every day?	34 (39.5%)	44 (51.2%)	8 (9.3%)	78 (90.7%)	6 (7.0%)	2 (2.3%)	**
Mean ± Std.	2.30±0.64			2.88±0.39			**
6 - Do you drink at least one cup of milk or eat at least one cup of yogurt?	16 (18.6%)	26 (30.2%)	44 (51.2%)	82 (95.3%)	4 (4.7%)	0 (0%)	**
Mean ± Std.	1.67±0.78			2.95±0.21			**
7 -Do you drink at least a literanda half of water a day?	24 (27.9%)	34 (39.5%)	28 (32.6%)	56 (65.1%)	20 (23.3%)	10 (11.6%)	**
Mean ± Std.	1.95±0.79			2.74±0.49			**

Mean of three replicates ± std. deviation.

\*\* ≤ P

0.001

The data in **Table (2)**, showed that healthy nutrition plays an essential role in building a healthy body. In **Table (2)**, we find that underweight patients have increased nutritional knowledge, and we note this from their answers to some questions after the nutritional educational course. In the first question do you always eat breakfast? We find that their answers in the pre-test were  $2.06 \pm 0.53$  and after the nutritional educational course, their result was in post-test  $2.93 \pm 0.26$ . The student's response to this question in the pre-test was (sometimes) at a rate of 79.1%, and in the post-test it

became (yes) at a rate of 93.3%. This confirms the knowledge of underweight students of the importance of breakfast. In the study **Irina, (2017)** emphasized the importance of eating breakfast and that Skipping breakfast is a frequent and unhealthy habit linked to an increased risk of cardiovascular disease.

We also find in the second question in **Table (2)** a noticeable increase in the knowledge of underweight patients about the minimum daily amount of fruit, which was the result of the pre-test  $1.70 \pm 0.56$  and after the nutritional educational course, the result of the post-test, was  $2.95 \pm 0.21$  this difference in the result of the pre-test the dimension is evidence of an increase in nutritional knowledge among underweight patients. The response of students to this question was (sometimes) by 60.5% in the pre-test and in the post-test the response was (yes) by 95.3%. **Dhandevi and Rajesh, (2015)** confirmed the importance of eating fruits daily. A sufficient amount of fruits and vegetables was also associated with a lower risk of chronic diseases and weight management body, but the exact mechanism is unknown. Adults should consume at least five servings Organization and the Food and Agriculture Organization of the United Nations.

The third question in **Table (2)** shows that the result of the pre-test was  $1.86 \pm 0.74$  and the post-test was  $2.77 \pm 0.53$ . The results of underweight patients for this question pre and post-nutritional educational course confirm their knowledge of the importance of eating vegetables daily. Also, the response of the students who are underweight to this question was (sometimes) in the pre-test with a percentage of 44.2%, and in the post-test, it was (yes) with a percentage of 81.4%. **Ramya, (2019)** showed that no vegetables are indispensable for equilibrated diets since they contribute a crucial source of nutraceuticals in daily human life. Nutraceuticals are substances found as a natural component of foods or other ingestible forms that have been determined to be beneficial to the human body in preventing or treating one or more diseases or in improving physiological performance beyond adequate nutritional effects in a way that is relevant to either improved state of health and well-being and reduction of risk of disease. These components can be beneficial antioxidants, natural colorants (e.g. carotenoids), minerals, and vitamins, which often have added advantages. Vegetable intake has been highly correlated with improved

gastrointestinal health, reduced risk of heart attack, some types of cancer, and chronic ailments such as diabetes. This chapter gives a review and discusses the health benefits of commonly used vegetables. And also the fourth question in **Table (2)**, states: Do you usually eat cakes and sweets for breakfast? We notice in the answers of underweight patients to this question a decrease in their nutritional knowledge before the nutritional educational course. Their answers were in the pre-test  $1.62 \pm 0.72$  and in the post-test  $2.81 \pm 0.50$  and this shows the efficiency and effectiveness of the educational course, **Mike, (2018)** showed that breakfast has a role in controlling weight, cardiac risk factors, metabolism, and cognitive performance, as the answers of underweight patients to this question in the pre-test, were (No) by 51.2% and in the post-test it was (yes) by 86%, which confirms that gaining knowledge of the importance of breakfast and what to eat during it.

The fifth question in **Table (2)** measures the extent to which the underweight patients know the importance of eating breakfast, lunch, and dinner. In the pre-test  $2.30 \pm 0.64$  until their nutritional knowledge increased after the nutritional educational course. In the post-test, the result of this question was  $2.88 \pm 0.39$ . The response of underweight students to this question (sometimes) was 51.2% in the pre-test, while their responses in the post-test were (yes), at a rate of 90.7%. This question explains the importance of eating all meals. **Jesus et al., (2019)** confirmed that the timing of meals has an impact on weight gain or loss.

"Do you drink at least one cup of milk or eat at least one cup of yogurt?" This is what the sixth question states in **Table (2)**, as this question emphasizes the importance of consuming milk products. In the results of this question, it is clear that there are differences in favor of the post-test, where the result was  $2.95 \pm 0.21$  and this is after the nutritional educational course. As for the result of the pre-test, it was  $1.67 \pm 0.78$ . **Ujjwainee et al., (2017)** confirmed the importance of eating yogurt, as it is rich in essential amino acids, calcium, vitamin B6 and riboflavin It also reduces the level of cholesterol in the blood and helps prevent osteoporosis, high blood pressure and obesity, and the response of thin students to this question in the pre-test was (No) by 51.2% and in the post-test (yes) by 95.3% .

The seventh question in **Table (2)** was also the result of the pre-test in it  $1.95 \pm 0.79$  and the post-test it was after the nutritional educational course  $2.74 \pm 0.49$  as this question states: Do you drink at least a liter and a half of water per day? Stressing in this question is the importance of drinking water. The response of the students who are underweight to this question in the pre-test was (sometimes) at a rate of 39.5%, and in the post-test, their responses became (yes) at a rate of 76.7%. **Evan, (2018)** emphasized the importance of water and that it is essential for metabolism, transmembrane substrate transport, cellular homeostasis, temperature regulation, and circulatory function.

All the results in **Table (2)** indicate that there is a high significance. ( $p \leq 0.001$ ) between the nutritional level of the underweight patient's pre and post-nutritional educational course confirms that the level improved after the nutritional educational course (**Giovanna, 2008**).

**Table (3): Evaluation of anthropometric measurements for underweight patients before and after the nutritional educational course**

Anthropometric measurements	Nutritional Educational course		P. value
	Pre	Post	
	Mean $\pm$ std.	Mean $\pm$ std.	
Height	161.62 $\pm$ 5.71		-
Weight	48.35 $\pm$ 5.49	56.19 $\pm$ 5.68	**
Body Mass Index (BMI)	18.65 $\pm$ 2.10	21.65 $\pm$ 2.09	**

Mean of three replicates  $\pm$  std. deviation. \*\*  $\leq P 0.001$

The results in **Table (3)** mean that there is a significant increase in weight, as the weight of underweight patients before the nutritional education course is  $48.35 \pm 5.49$  and after the nutritional education course, as a high-calorie diet for a period of time (3 months) helped weight gain, which led to a noticeable increase in weight, and this is evidence of the efficiency of the nutritional education course, as the weight ratio increased to  $56.19 \pm 5.68$ . With regard to height, the height pre and post-nutritional educational course are the same and the height does not change by

increasing or decreasing weight (Frank, 2015), since the height is pre before and post the educational nutritional course  $161.62 \pm 5.71$ .

We also find an increase in the body mass index, if the BMI is less than the normal rate ( $\geq 18.5$ ) in this case the person suffers from underweight, but if it is at the normal rate ( $\leq 18.5$  and  $< 25$ ) the person's weight is ideal and does not suffer Of being thin or obese, (Mika et al., 2022). re- nutritional educational course. the percentage of body mass index for underweight patients was  $18.65 \pm 2.10$  and post the nutritional educational course, it  $21.65 \pm 2.09$ . This shows the increase in weight and the arrival of thin patients to the ideal weight rate.

**Table (4): Classification of BMI for underweight patients before and after the nutritional educational course**

Underweight		Nutritional Educational Course		P.value
		Pre	Post	
		Mean $\pm$ std.	Mean $\pm$ std.	
Moderate	Height	$163.50 \pm 5.10$		**
	Weight	$53.63 \pm 5.30$	$59.19 \pm 5.33$	**
	(BMI)	$19.76 \pm 1.39$	$22.65 \pm 2.88$	**
Extreme	Height	$160.40 \pm 5.85$		**
	Weight	$45.22 \pm 2.29$	$54.41 \pm 5.18$	**
	(BMI)	$17.99 \pm 2.19$	$21.04 \pm 1.15$	**

Mean of three replicates  $\pm$  std. deviation. \*\*  $\leq P \leq 0.001$

Table (4) presents the results of the group of students who suffer from moderate and extreme underweight. The World Health Organization defines G2 underweight in adults as a body mass index of less than 17. Also known as first-degree underweight in adults as a body mass index, this ratio ranges between 17:18.4, according to a study (Tim et al., 2007). In our study, weight was reached in the preliminary test  $53,63 \pm 5,30$ , and in the post-test  $59, 19 \pm 5,33$ . There is also a significant increase in BMI after following the diet and the nutritional educational course, which became  $22.65 \pm 2.88$ , while in the test the pretest rate reached  $19.76 \pm 1.39$  where the height remains constant and does not change before and after following the diet  $163.50 \pm 5,10$ . Table (4) also showed that the group of female students who suffer from



extreme underweight reached their weight in the pre-test at  $45.22 \pm 2.29$  and it became  $54.41 \pm 5.18$  in the post-test after the nutritional educational course. **Lucienne, (2014)** showed that being extreme underweight has several risks, the most important of which is that it causes death. In our study, their body mass index became  $21.04 \pm 1.15$  compared to the previous test  $17.99 \pm 2.19$ , Their weight gain is evidence of the efficiency of the diet they followed, and we note that their height remains stable because it is not affected by increasing or decreasing weight as it reached  $160.40 \pm 5.85$  before and after the nutritional education course.

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### Appendix (1)

هل تعرف الاطعمة التي يجب الحد وتقليل المدخول الغذائي لها من الدهون والكوليسترول؟ ج- لا	أ- نعم ب- أحيانا	١- أ-
هل تعرف الاطعمة التي يجب تناولها لزيادة المدخول الغذائي من الالياف؟ ج- لا	أ- نعم ب- أحيانا	٢- أ-
هل تعرف الاطعمة التي يجب الحد وتقليل المدخول الغذائي لها من السكر ؟ ج- لا	أ- نعم ب- أحيانا	٣- أ-
هل تعرف فوائد اتباع نظام غذائي صحي ؟ ج- لا	أ- نعم ب- أحيانا	٤- أ-

٥-	هل تعرف مقدار ما يجب تناولة لارضاء متطلبات الطاقة ؟	أ- نعم	ب- أحيانا	ج- لا
٦-	هل تعرف كيفية تحسين نظامك الغذائي ؟	أ- نعم	ب- أحيانا	ج- لا

### Appendix (2)

١-	هل تتناول الفطور دائما ؟	أ- نعم	ب- أحيانا	ج- لا
٢-	هل تتناول ما لا يقل عن ثمريتين من الفاكهة يوميا ؟	أ- نعم	ب- أحيانا	ج- لا
٣-	هل تتناول الخضار يوميا ؟	أ- نعم	ب- أحيانا	ج- لا
٤-	هل تتناول عادة الكعك او الحلوى فى وجبات الإفطار ؟	أ- نعم	ب- أحيانا	ج- لا
٥-	هل تتناول عادة وجبات الإفطار والغداء والعشاء يوميا ؟	أ- نعم	ب- أحيانا	ج- لا
٦-	هل تشرب كوبا واحدا على الأقل من الحليب أو تاكل كوبا واحدا على الأقل من الزبادى ؟	أ- نعم	ب- أحيانا	ج- لا
٧-	هل تشرب ما لا يقل عن لتر ونصف من الماء يوميا ؟	أ- نعم	ب- أحيانا	ج- لا

### Appendix (3)

١-	الطول :
٢-	الوزن :
٣-	مؤشر كتلة الجسم :

"استخدام تطبيقات الهاتف المحمول لتحسين الحالة الثقافية والغذائية لمرضى النحافة"  
المستخلص:

تهدف هذه الدراسة إلى زيادة الوزن ورفع الوعي الثقافي والغذائي لمرضى النحافة. حيث تكونت عينة الدراسة من ٨٦ طالبة من مرضى النحافة من جامعة أسيوط ، من ١٩ إلى ٢٣ سنة ، تم تقسيمهن حسب مؤشر كتلة الجسم إلى مجموعتين ، المجموعة الأولى تعاني من النحافة المتوسطة ، وعددهن ٣٦ طالبة مريضة نحافة متوسطة ، حيث كان مؤشر كتلة الجسم ١٧-١٨,٤ والمجموعة الثانية الذين يعانون من النحافة الشديدة ، حيث أن مؤشر كتلة الجسم لديهم أقل من أو يساوي ١٧ ، وبلغ عددهن ٥٠ مريضة نحافة شديدة. تم إعداد نظام غذائي لهن يشمل الإفطار والغداء والعشاء والوجبات

الخفيفة. هذا النظام الغذائي هو جزء أساسي من التطبيق الإلكتروني لمرضى النحافة (Diet for underweight). ، كما تم رفع الوعي الثقافي والغذائي للمرضى الذين يعانون من النحافة من خلال إجراء دورة تثقيفية تغذوية الكترونية تم من خلالها تزويد المرضى النحيفين بمعلومات عن كيفية تحضير وجبة غذائية متكاملة وتعريفهم بالأطعمة الصحية وغير الصحية ومحاولة تغيير عاداتهم الغذائية غير الصحية وتعريفهم بكيفية حساب السعرات الحرارية للوجبات التي يتناولونها وغيرها. ومن خلال الالتزام بهذا النظام الغذائي ومتابعته لمدة ٣ أشهر ؛ يؤدي إلى زيادة وزنهم ووصول وزنهم الى المعدل الطبيعي. تم وضع كل هذه المعلومات في تطبيق النظام الغذائي لمرضى النحافة (Diet for underweight). أظهرت النتائج وجود فروق معنوية عالية ( $p \leq 0.001$ ) في الوزن والمستوى الثقافي والتغذوي ، مما يؤكد فعالية وكفاءة النظام الغذائي ودورة التثقيف الغذائي ، حيث كان الوزن قبل اتباع النظام الغذائي ودورة التثقيف الغذائي  $48,35 \pm$  و  $5,49$ . وبعد متابعتهم أصبح  $56,19 \pm$  وكذلك بالنسبة لمؤشر كتلة الجسم قبل دورة النظام الغذائي والتثقيف الغذائي كانت  $18,65 \pm$  ثم أصبحت  $21,65 \pm$ . ٢,٠٩.