

The Effect of Calorie Tracking on Eating Behaviors of University Students

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ABSTRACT This paper aims to determine whether tracking calories using a mobile application without any nutrition education has a positive effect on the eating behaviors of university students. The concurrent design, one of the mixed methods designs, was used to compare the quantitative and qualitative data analysis results. The participants are 108 university students who voluntarily agreed to participate in the study. In the quantitative part of the study, a calorie tracking form was used; in the qualitative part, an interview form was used to determine eating behaviors. The students were not given any information about healthy nutrition and were only asked to track calories. The change in body mass index values obtained from the calorie tracking form is presented with the Wilcoxon signed ranks test. In evaluating the data obtained from the interview form determining eating behaviors, the data were categorized by content analysis, and the categories were presented as percentage values. According to the data obtained, it has been observed that positive behavioral changes in terms of nutrition can be created even without giving any information about healthy nutrition to the students, just by making them track calories. As a result of the activity, they became aware of which foods would make them gain weight and which would not and gained positive eating behaviors. Based on the results obtained from this study, recommendations for future studies and public health were made.

Keywords Calorie tracking, healthy eating, eating behaviors

1. INTRODUCTION

Nutrition is an essential part of our life and the basis of health. Due to the well-known link between nutrition and health, improving healthy eating behaviors by establishing the principles of a healthy lifestyle is an essential priority in public education. Therefore, acquiring healthy living behaviors such as healthy eating and physical activity is important.

Protection of health can be ensured with effective and correct nutrition education (Oran, Toz, Küçük & Uçar, 2017). When the age groups in which healthy eating behaviors are observed are analyzed, it is seen that the group with the highest risk is university students (Polat, Yücel, Genç & Meteris, 2005). According to Özdoğan, Yardımcı & Özçelik (2012), the nutritional behaviors of university students are not as desired, and changing these behaviors can increase their quality of life and reduce nutrition-related health problems that may occur in the future. Many researchers have extensively studied that university students pay little attention to developing healthy eating behaviors. In addition, it has also been observed that the behaviors of the same age group affect each other while

forming nutritional behaviors in the young age group (Pelletier, Graham & Laska, 2014).

During the youth period, known as the period of preparation for life and maturation, some changes are observed in the lifestyle of university students. However, these changes also bring risky health behaviors such as stress management, not taking responsibility for their health, and malnutrition (Baban, 2010; Cohn, Macfarlane, Yanez & Imai, 1995; Sapmaz & Yercan, 2015). Determining students' eating behaviors is also important in terms of regulating these behaviors and preventing problems caused by malnutrition (Baş, Aşçı, Karabudak & Kızıltan, 2005).

There is no doubt that education is the most effective way to correct unwanted behaviors. While this research argues that nutrition education is the most effective way to correct negative eating behaviors, it also suggests that additional activities are needed to support nutrition education. Although previous research on nutrition education has concentrated on classroom activities, rather

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less attention has been paid to calorie tracking as a supportive activity to improve nutrition education.

As the place of smartphones in our lives has increased, applications have emerged to facilitate individuals' activities in various fields (Güler, 2015). In their daily lives, individuals use these applications to calculate their daily calorie intake, remind them to drink water, do step counters, do menstrual cycle tracking, do fitness exercises, and do sleep schedules. Mobile applications are essential in creating behavior change and improving and changing unhealthy habits that people develop due to bad habits (Burke et al., 2012, Kumar et al., 2013, Pope, Halford, Turnbull & Prichard, 2014). There is some previous research on mobile apps and healthy habits or mobile apps and nutrition (Chua et al., 2014, Giridher, Wasilewska, Wong & Rekhi, 2010, Shen et al., 2017). However, no studies have investigated how calorie tracking affects individuals' eating behaviors. Therefore, this paper aims to determine whether tracking calories using a mobile application without any nutrition education has a positive effect on the eating behaviors of university students.

2. METHOD

In this study, the convergent design, one of the mixed methods designs, was used to compare the results of the quantitative and the qualitative data analysis with the intent of obtaining a complete understanding of a problem, to validate one set of findings with the other and to determine if participants respond similarly (Sözbilir, 2017). In the quantitative part of the study, a calorie tracking form was used; in the qualitative aspect, an interview form was used to determine eating behaviors. The students were not given any information about healthy nutrition and were only asked to track calories.

2.1 Sample

The participants are 108 students from a Turkish University who voluntarily agreed to participate in the study, and there isn't any ethical issue about this. They are at the end of their education, and these students have one semester left before graduation. The sample was selected by convenience sampling method providing easy access, speed, and practicality to the research (Yıldırım & Şimşek, 2006).

The data about the height, weight, Body mass index (BMI), and Basal metabolic rate (BMR) of the candidates participating in the study are given in Table 1. All the participants were between 18 and 24 years of age.

2.2 Data Collection

The data are based on a form comprising two parts; one consisted of a daily calorie tracking form on which students could fill in their daily calorie intake for seventy days, and the other had a semi-structured interview form prepared by two experts in the field used to determine how eating behaviors changed before and after calorie tracking. One more form was given at the beginning of the study to gather

participants' current height, weight, and ages to calculate their body mass index and basal metabolic rate to estimate how many calories they can eat per day; at the end of the study to gather participants' weight to calculate their body mass index to see the change.

Table 1 Some anthropometric data of participants

Gender		N	Min.	Max.	Mean	SS
Boy	Height (cm)	38	168	187	178.10	5.39
Girl		70	151	176	163.55	5.72
Boy	Weight (kg)	38	59	104	76.55	11.73
Girl		70	40	85	58.27	8.98
Boy	BMI	38	19.50	34	24.15	3.73
Girl		70	16	27.80	21.71	2.66
Boy	BMR	38	1581	2200	1861.73	172.35
Girl		70	1231	1700	1414.10	95.38

The data of the students' calorie tracking forms were recorded daily for 70 days by the students using Google Forms (Figure 1). The researchers obtained the semi-structured interview form, which determines eating behaviors, by interviewing the students one by one after the calorie tracking was completed. Some of the questions asked in the semi-structured interview are as follows: "Do you avoid eating too many sweets and fatty foods?" "Can you find out the calorie values of the foods you eat?"

Figure 1 Daily calorie tracking form

The quantitative data are collected through the calorie tracking form, and the qualitative data collected through the interview form combined to provide a complete understanding of the research question and to validate the quantitative data with the qualitative data.

2.3 Analysis

Body mass index is most commonly used to assess body weight because it is practical, accessible, low-cost, and reproducible for adults of all ages and genders. Body mass index (BMI) is a method used to assess body weight and the risk of health problems related to body weight. Basal metabolic rate, or BMR short, has been studied as the amount of energy expended in the name of only vital work when people are at rest. With this meaning, it is also

expressed as resting metabolic rate. An equation called the Harris-Benedict formula is used to calculate the basal metabolic rate (Pavlidou, Papadopoulou, Seroglou & Giaginis, 2023). This formula is calculated separately for men and women based on weight, height, and age information. To track calories, students were provided with ready-made websites or mobile applications (Figure 2) that specialized dietitians frequently use. Mobile apps for calorie calculation allow people to track their daily calories by recording what they eat and drink and calculating how

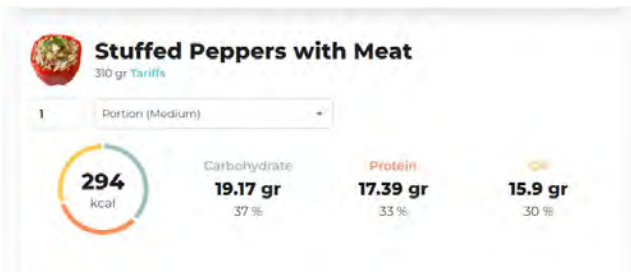


Figure 2 Calorie tracking mobile application (example: calorie count of one serving of stuffed peppers with meat is shown)

many calories they take daily.

Since the data did not show normal distribution, the Wilcoxon signed ranks test, one of the nonparametric tests, was used. The change in body mass index values obtained from the calorie tracking form is presented with Wilcoxon signed ranks test. In evaluating the data obtained from the interview form determining eating behaviors, the data were categorized by content analysis, and the categories were presented as percentage values.

The quantitative data collected through the calorie tracking form and the qualitative data collected through the interview form were combined to provide a more complete understanding of the research question and validate the quantitative data with the qualitative data.

3. RESULT AND DISCUSSION

The students reported the benefits of tracking calories under ten different categories. Table 2 shows the percentage values of categorized data of semi-structured interviews after calorie-tracking ended based on the number of students.

According to the findings obtained from the semi-structured interview, well over half of the participants consumed excessively high-calorie foods, learned the calories of the food they ate, changed their eating habits positively, and kept their weight under control. Well, over half of the participants stated that they changed their eating habits positively and they could keep their weight under control. According to the data obtained as a result of the quantitative analysis of the calorie tracking forms after the calorie tracking of the students, it is seen that 71% of the students approached their ideal weight. Accordingly, their body mass indexes returned to normal levels. These results

Table 2 Changes in students after calorie tracking

Categories	Percentages
Avoiding eating too many sweets	%46
Avoiding excessive fatty foods	%34
Avoiding extremely high-calorie foods	%57
Avoiding foods with an extremely high glycemic index	%47
Stopping eating at any time	%22
Learning the caloric value of the food they eat	%85
Starting exercise to burn calories	%36
Improving their eating habits positively	%84
Starting to keep their weight under control	%91
Approaching their ideal weight	%71

show the effectiveness of the calorie tracking forms used in the study.

Moreover, with the activity used in this study, student participation was actively ensured, and the students were motivated in this way. Using calories from foods in such an activity attracted students' attention. In this way, students' awareness increased. Thanks to the action, they gained positive eating behaviors by noticing which foods make you gain weight and which do not.

The change in body mass index values obtained from the calorie tracking form is presented in Table 3.

Table 3 The change in body mass index values

Gender	N	Mean Ranks	Sum of ranks	Z	p
Boy	BMI-38	17,64	370,50	-2,003	,045
	pre 38	14,32	157,50		
Girl	BMI-70	28,46	683	-0,189	,085
	pre 70	23,81	643		
	BMI-post				

When the BMI of girl and boy students are evaluated separately, a difference is observed in the BMI of only boy students before and after the application.

The study's results revealed several positive behavioral changes in the participants' nutrition habits. The students reported benefits from tracking calories, including avoiding excessive sweets, fatty foods, highly high-calorie foods, and foods with a high glycemic index. They also reported positive changes in eating habits, learning the caloric value of the food they consume, starting exercise routines to burn calories, and maintaining control over their weight. Additionally, most participants approached their ideal weight, and their BMI values returned to normal.

Interestingly, the study found that the effect of calorie tracking on BMI values was significant only among male students, while no significant difference was observed among female students. This gender-based difference suggests that the impact of calorie tracking on eating

behaviors and BMI may vary between male and female university students.

The study also highlights the potential benefits of incorporating mobile apps and digital tools, such as calorie tracking, into nutrition education. It suggests that even without providing explicit information about healthy nutrition, tracking calories alone can lead to positive changes in eating behaviors among university students. The study emphasizes the importance of adopting innovative approaches to nutrition education, using technology-integrated tools to equip students with the knowledge and skills needed to make informed decisions about their health.

A few similar studies have been found that support the results of this study. A cross-sectional study by Bawazeer et al. (2021) examines the impact of calorie labeling on consumer food choices. It concludes that calorie labeling can lead to reduced calorie intake and healthier food choices, indicating the potential effectiveness of calorie tracking as a behavior change tool.

A systematic review by Direito et al. (2018) examines the effectiveness of mobile health apps in promoting behavior change across various health-related domains. While not specific to calorie tracking, the study highlights the potential of mobile apps in supporting behavior change interventions, which include tracking calories and promoting healthier eating habits.

Chua et al. (2014) supported the development of a health monitoring system with features such as a valid cost and ease of data collection. Their study aims to provide individuals with dietary responsibility and exercise habits through continuous monitoring of body mass index, blood pressure, and calorie intake. Although not focused on calorie-tracking apps, this review explores different dietary assessment methods, including self-reporting and mobile apps. It provides insights into the effectiveness and limitations of various approaches to tracking dietary intake, which can be relevant for understanding the utility of calorie-tracking apps.

In a study Raby Powers, Struempfer, Guarino & Parmer (2005) suggest that nutrition education programs that teach positive dietary messages can potentially improve dietary behavior and increase nutrition knowledge in children. Giridher, Wasilewska, Wong & Rekhi (2010) designed two applications. The first application, Calorie Meter, focused on ensuring the individual's physical well-being. This application aims to motivate people to keep track of their calorie intake by showing that it is possible to meet their calorie needs without exceeding the calorie allowance for a given day. In addition, in this study, BMI measurements of the students were made before and after the application, as well as the semi-structured interview. When the BMI of girl and boy students are evaluated separately, a difference is observed in the BMI of only boy students before and after the application. According to the data from the study

conducted in our country, men's physical activity was higher than women's (Baysal & Bas, 2008). In a survey conducted in 2007, it was found that gender was an essential criterion in terms of maintaining the weight given between the two groups that supported and did not maintain the weight given to determine the parameters related to healthy weight loss. The results of the research showed that men were more successful than women in weight loss (Kim, Park & Lim, 2007).

Considering the opportunities provided by mobile and internet technologies, it is possible to say that high quality, low cost, flexibility in terms of adaptability to conditions, and high benefit services are offered. With mobile/internet health services, health/illness conditions can be monitored remotely and accessed anywhere. With the increasing use of portable mobile devices, the number of applications developed for these devices has also increased (Güler, 2015). These applications are designed for private use outside a health institution and include applications measuring calories consumed and weight loss and applications with information about diseases and symptoms (Kopmaz & Arslanoğlu, 2018).

The increasing use of mobile technologies also leads to an increase in applications. When IOS and Android Application markets are examined, there are over 100,000 applications in the field of mobile health, and it is observed that there are more applications in the field of "Health & Fitness" and "medicine". 30.9% of the application market consists of Health & Fitness, 16.6% of medicine, 15.5% of fitness, 7.4% of nutrition, and 6.6% of medical condition management applications (Jahns, 2013). In a study conducted by Krebs & Duncan (2015) on using health apps among mobile phone owners in the US, exercise and diet were the most used health app categories. In a study by Ernsting et al. (2017), 44.5% of mobile health app users stated that they used apps to support smoking cessation. That was followed by diet, weight tracking, and exercise applications. The most common benefit that users saw from the applications was planning. It was followed by a reminder, motivation, and providing information. Döner Güner, Bölükbaşı, Kokaçya, Yengil & Özer (2018), in their study on the use of mobile health applications by university students, recorded 34.2% of those using health-related applications. While 11.5% of the participants used mobile health applications every day, 4.3% used mobile health applications once a month. Mercan, Dizlek, Süsim, Gürez & Akman (2020), in their study on internet use and mobile health applications for health purposes, found that approximately seven out of every ten students used the internet and mobile applications for health purposes and that diet and weight loss applications, calorie measurement applications, calorie-nutrient calendar applications were among the mobile health applications used through the internet.

4. CONCLUSION

According to the data obtained, it has been observed that positive behavioral changes in terms of nutrition can be created even without giving students any information about healthy food, just by making them track calories. One of the main measures to be taken in the fight against wrong eating behaviors is to increase young people's awareness about nutrition. Achieving and maintaining a healthy body weight is vital for a quality life. Many behavioral, environmental, and genetic factors affect an individual's body weight. Improper eating behaviors have become a health problem in all age groups from childhood to adulthood and old age. The attitudes and behaviors of young people, especially university-age individuals living separately from their families, are essential regarding healthy weight status. Since the modern understanding of education is a participatory understanding of education, it does not accept teacher-centered education. With various activities such as mobile applications, student participation is actively ensured, and students are motivated in this way. The most important factor that prevents forgetting what is learned is the use of what is learned and especially the fact that it responds to the daily needs of the learner. Using what was known in such an activity attracted the students' attention. In this way, students were more motivated, their awareness increased, and they had fun. As a result of the activity, they became aware of which foods would make them gain weight and which would not and gained positive eating behaviors.

Overall, the research offers a novel perspective on the relationship between technology and nutrition education, shedding light on the positive influence of calorie-tracking apps on the eating behaviors of university students. It provides valuable insights for educators and health professionals interested in leveraging technology to promote healthier habits among college students.

4.1 Suggestions

Based on the results obtained from this study, the following suggestions can be made for future studies and public health:

- As a result of this study, it is recommended that biology teachers should have their students track calories while teaching topics such as food, healthy nutrition, and healthy living, which are the subjects of both biology and health science course content at the high school level. It is thought that this will change the eating behaviors of their students in a much more positive way.
- This study includes an activity that requires calorie tracking. In addition to this activity, a physical activity for calorie expenditure can be designed.
- Although this study was applied to university students, it can be used by individuals at other educational levels, and the results can be compared.

- Access to accurate health information is also important in protecting and improving health. It is recommended that students use m-Health applications of the right resources to popularize internet use for health purposes and inform students about this issue.
- To increase the use of intelligent health applications, entrepreneurs should be encouraged, R&D projects should be supported, and society should be encouraged to accept and use smartphone applications.
- Communication infrastructure should be strengthened, and technology literacy should be increased.
- To spread and use mobile health in society, it is necessary to create a behavioral change in individuals. For this reason, to spread and use mobile health in the community, awareness raising and awareness raising activities should be carried out about mobile health. Health literacy should be increased.
- The public should be informed and encouraged to use mobile and smart health applications.

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