

Changes of Health-Affecting Behavior in Adolescents With Type 1 Diabetes Mellitus

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Key words: type 1 diabetes; adolescent; education program; health behavior.

Summary. The objective of this study was to analyze changes in adolescents' diabetes habits associated with nutrition, physical activity, smoking, and alcohol consumption before the diagnosis of diabetes and 3, 6, and 12 months after the diagnosis of diabetes.

Material and Methods. The study was conducted in the Department of Pediatric Endocrinology, Hospital of Lithuanian University of Health Sciences. In total, 90 13- to 17-year-old adolescents with diabetes participated in an anonymous questionnaire survey. Pretest and posttest design was used to conduct the study. The Wilcoxon paired sample test was used to determine the difference in groups.

Results. The study revealed that 46% of those who participated in the study did not eat regularly before the diagnosis of diabetes. However, 3, 6, and 12 months after the diagnosis of diabetes, the number of patients eating regularly increased significantly. Before the diagnosis of diabetes, 5.6% of the adolescents did not attend any sports. When the survey was repeated after 3 months, 63% of the surveyed claimed that they did not do any additional sports. After 6 and 12 months, the number of the adolescents not doing any sports decreased to 20% ($P < 0.05$). Before the diagnosis of diabetes, 42.8% of the adolescents were smoking. However, 3 months after the diagnosis of diabetes, 22.7% were smoking; after 6 months, 30.4%; and after 12 months, 39.7%. Before the diagnosis of diabetes, 26.7% of the surveyed consumed alcohol. After 3 months, 7.9% of the patients admitted that they consumed alcohol during the last 3 months, i.e., after diabetes was diagnosed ($P < 0.05$). After 6 and 12 months, 20% of the patients admitted that they consumed alcohol.

Conclusion. Three months after the diagnosis of diabetes mellitus, most of the adolescents ate regularly, there were fewer smokers and alcohol consumers, and the lowest number of those who exercised when compared with the findings of the surveys conducted before the diagnosis and after 6 or 12 months.

Introduction

After having been diagnosed with type 1 diabetes mellitus, adolescents and their family members are trained at a diabetes school. Before this training begins, it is important to find out what eating habits adolescents acquired before the diagnosis. It is essential to establish how many times per day and what products a patient liked to eat. Children and adolescents who ate irregularly did not have breakfast and consumed products defined as junk food before the disease are likely to have difficulties in changing their eating habits after being diagnosed with diabetes (1, 2). When insulin therapy is started, good control of the blood glucose level depends on a suitable dietary plan. In order to support a normal blood glucose level, it is recommended to eat regularly, consume more products that have complex carbohydrates and fiber (brown bread, grain) and fresh vegetables, and limit the consumption of sweets and fatty meals (2, 3). It is necessary to have

information on the history of the patient's physical activity. Increased physical activity can cause a low blood glucose level and provoke hypoglycemia in patients with diabetes mellitus; therefore, it is important to adjust the amount of carbohydrates in food and the insulin dose to the intensity of physical exercise. In cases when a sportive adolescent is diagnosed with type 1 diabetes, it is recommended not to cease physical exercise, but to pay more attention to the development of self-control skills (2, 4, 5).

Before a training plan is developed, it has to be established whether adolescents are affected by negative health effects. There is no doubt that smoking negatively affects the adolescents' development of body and health in those diagnosed with diabetes mellitus. Smoking can cause an increase in blood glucose as nicotine leads to the narrowing of arteries and has a negative impact on the insulin reception at the place of injection. Alcohol consumption may provoke hypoglycemia in patients with type 1 diabetes mellitus.

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It is necessary to find out whether patients consumed alcohol before their diagnosis and warn them about potential consequences of its consumption and influence on the control of this disease (6, 7).

In Lithuania, research has been done on the quality of life among children with diabetes mellitus (8). However, behavioral changes that influence their health status have not been studied yet. The findings of this study presented here focus on the lifestyle of adolescents before being diagnosed with type 1 diabetes mellitus and on the changes in their lifestyle 3, 6, and 12 months after the diagnosis. An analysis of the results of this study will draw attention of nurses and diabetologists to the changes in the lifestyle of adolescents and will help to understand them better and to prepare for the continued training of these patients. Adolescents with type 1 diabetes mellitus is a group of patients with increasing independence from the family and parents in the sense of their disease and self-care; so, this period of life is critical to consolidate their awareness and health behavior habits. The findings of this study will be employed to prepare a uniform national training program for children and adolescents with type 1 diabetes mellitus.

The aim of the study was to compare the changes of health behavior in the lifestyle of adolescents with type 1 diabetes mellitus before and 3, 6, and 12 months after the diagnosis.

Material and Methods

The study was carried out from January 2005 until August 2008 with the permission No. BE-2-39 granted by the Kaunas Regional Ethics Committee for Biomedical Research. Having acquired parents' consent, 90 patients diagnosed with type 1 diabetes mellitus for the first time participated in the survey. Pretest and posttest design was used to conduct the study: the survey was repeated 3, 6, and 12 months later. The participants of the survey were 13- to 17-year-old teenagers ($n=90$) who were educated at the diabetes school of the Department of Pediatric Endocrinology, Hospital of Lithuanian University of Health Sciences (HLUHS), in accordance with the education program for persons with diabetes mellitus adopted in 2005 by HLUHS. The mission of this inpatient diabetes school is to teach children and their families about diabetes mellitus and to develop their skills of self-control. There were 46 boys (51.1%) and 44 girls (48.9%) who underwent their annual checkup in the hospital due to diabetes and took part in the survey. The mean age of the teenagers was 14.6 years (SD, 0.5). The following inclusion criteria were applied for the participants of the survey:

- Patients with type 1 diabetes mellitus aged from 13 to 17 years hospitalized in the Department of

Pediatric Endocrinology, HLUHS, and attending the diabetes school.

- Patients residing in Lithuania during the period of the research.
- Patients whose parents were acquainted with the parents' information form and signed consent to include their child in this research.

For the purposes of this study, a questionnaire of 14 questions composed by the authors and directed at collecting information on the characteristics of patients' lifestyle was used. In order to assess the comprehensibility of the questionnaire, 30 adolescents had been questioned before the survey took place, and subsequently several questions were amended.

The questionnaire aimed to establish whether there were changes in adolescents' eating habits, intensity of physical activity, smoking, and alcohol consumption before and after they were diagnosed with diabetes mellitus. Patients diagnosed with type 1 diabetes mellitus had completed the questionnaire before the training ($n=90$), and the survey was subsequently repeated after 3 ($n=88$), 6 ($n=82$), and 12 ($n=90$) months. To process the data, SPSS 17 program was used. To determine the difference among groups, the Wilcoxon paired sample test was applied. A difference was considered statistically significant when $P<0.05$.

Results

The survey showed that there was a statistically significant change in the behavior of the teenagers 3 months after they were diagnosed with type 1 diabetes mellitus.

Eating habits

It was established that 46% of the respondents used to skip breakfast before they were diagnosed with type 1 diabetes mellitus. About one-third (28.9%) of the teenagers used to have regular breakfast at home, while 26.1% of them reported not having breakfast every day. Sweet cheese, sweet cottage cheese, porridge, or pancakes with jam were indicated by 30.6% of the patients as the most frequent choice for breakfast. Only 14.4% of all the respondents did not choose any sweets for breakfast.

Before being diagnosed with diabetes mellitus, 51.3% of the adolescents used to eat vegetables once a day, and 29.7% indicated that they did not like vegetables. The results showed that 71.1% of all the respondents consumed sweets daily. Only 9.9% of the respondents indicated that they did not eat sweets every day. Products classified as junk food were consumed daily by 68.4% of the respondents, while 12.6% of the respondents indicated that they ate junk food only on special occasions. The survey was repeated 3 months after the diagnosis of

type 1 diabetes mellitus and initial training of patients. It aimed to establish whether adolescents diagnosed with type 1 diabetes mellitus changed their eating habits and started consuming healthier food. It emerged that a significantly larger proportion of the respondents had breakfast ($P < 0.05$). All the respondents indicated that they had breakfast, and 70.4% of them chose to eat brown bread sandwiches or porridge. A statistically significant proportion of the adolescents started to eat fresh vegetables. The majority (78.4%) of the respondents ate vegetables at least once a day ($P < 0.05$). There was a statistically significant decrease in the consumption of sweets ($P < 0.05$). Nearly half (43.1%) of the respondents indicated that they consumed sweets daily. The adolescents who had a habit of eating products defined as junk food attempted to resume their previous eating habits even after the training. Products classified as junk food were consumed almost daily by 29.5% of the respondents. Three months after being diagnosed with diabetes mellitus, 70.4% of the respondents claimed that they rarely ate junk food, i.e., only during visits and trips.

When the survey was repeated 6 months after the diagnosis, it was established that all the adolescents who participated in the survey had breakfast daily. Two-thirds (60.9%) of the respondents indicated that they had food rich in complex carbohydrates for breakfast. They chose to eat porridge or brown bread sandwiches. Only 35.3% of the patients said that they were not hungry in the morning; however, in order to be able to have an insulin injection, they ate sweets. Half (51.2%) of those with diabetes mellitus ate vegetables at least once a day, and 51.2% of the adolescents indicated that they ate sweets every day, while junk food was consumed by 34.1% of the patients.

Twelve months after the diagnosis, there was no decrease in the number of the patients who had breakfast daily. There was an insignificant decrease in the number of those who chose to eat brown bread sandwiches or porridge for breakfast every day (54.4%). Nearly half (43.3%) of the adolescents continued to eat sweets for breakfast. There was an increase in the number of the patients who consumed vegetables at least once a day (55.5%). There was an insignificant decrease in the daily consumption of sweets; however, there was an increase in the number of the respondents who consumed junk food.

Physical Activity

After the survey was carried out, it turned out that before being diagnosed with type 1 diabetes mellitus, 5.6% of the teenagers did not attend physical education classes due to other diseases and did not exercise at home. None of the respondents indicated that they exercised in accordance with a

special program. It was established that 74.4% of the respondents exercised only during the physical education classes, 13.3% of the respondents had extra exercise 2 or 3 times per week, and 6.7% of the respondents claimed that they exercised on a daily basis.

When the survey was repeated after 3 months, there was a significant decrease in the level of physical activity among the teenagers. It turned out that 63.2% of the respondents ($P < 0.05$) ceased to attend physical education classes and to exercise, and 22.7% exercised at school either irregularly or in accordance with a special program. Only 5% of the respondents had extra exercise 2 or 3 times per week.

Six months later, it was established that more teenagers realized how to control their blood glucose level during the period of increased physical activity and started to exercise. Only 20.7% of the respondents did not exercise at all, 22.7% exercised at school either irregularly or in accordance with a special program, 36.5% exercised in accordance with a regular school program, but only during physical education classes, and more respondents had extra exercise 2 or 3 times per week (18.2%).

Having collected the data on the patients' physical activity 12 months after the diagnosis, it was noted that 20% of the respondents did not attend physical education classes, and 28.8% of the respondents exercised at school either irregularly or in accordance with a special program. There was an insignificant decrease in the number of those who exercised during physical education classes (34.4%) and those who had extra exercise 2 or 3 times per week (16.6%).

Smoking and Consumption of Alcohol and Narcotic Substances

Before the initial course in the diabetes training takes place, it has to be assessed whether teenagers smoked, consumed alcohol, and used narcotic substances. During the survey that was carried out before the initial training, 42.8% of the teenagers admitted that they smoked, and 26.8% of these smoked on a daily basis.

Three months after the initial training, the survey aimed to find out whether the patients understood the harms caused by smoking and if the number of smokers decreased. After the survey was carried out, it turned out that compared with the number of smokers before the diagnosis, there was a statistically significant decrease in the number of teenagers who smoked ($P < 0.05$). Only 22.7% of the respondents admitted that they smoked, and 13.6% of these smoked on a daily basis.

Six months later, it was established that the number of the teenagers who smoked was lower compared with the number of smokers before the

diagnosis. Only 30.4% of the teenagers admitted that they smoked, and 23.1% of these smoked on a daily basis.

According to the data of the survey carried out 12 months after the diagnosis, 39.7% of the respondents indicated that they failed to comply with the recommendations and admitted to smoking; 24.4% of these smoked daily.

It is important to find out if patients consumed alcoholic beverages before the diagnosis and to warn them about potential consequences. Before being diagnosed with type 1 diabetes mellitus, 26.7% of the respondents used to drink various alcoholic beverages, while 73.3% of the respondents claimed that they did not consume any alcohol.

The number of the respondents who consumed alcoholic beverages significantly decreased 3 months after the diagnosis. The majority (92%) of the adolescents recalled having classes about the dangers of alcohol consumption for patients with diabetes mellitus. Only 7.9% of the patients admitted to alcohol consumption during the last 3 months, i.e., after they were diagnosed with diabetes ($P<0.05$). The number of the patients who failed to stand up to peer pressure with respect to alcohol consumption increased after 6 months. When the survey was repeated after 12 months, the number of those who consumed alcoholic beverages remained almost the same, namely 20%.

The use of narcotic substances aggravates the control of diabetes mellitus. Before the training, none of the adolescents admitted to the use of narcotic substances. The results were the same when the survey was repeated 3, 6, and 12 months after the diagnosis. It is possible that adolescents who participated in this study did not use narcotic substances or did not want to provide any information on this point. Changes in the eating habits, physical activity, smoking, and alcohol consumption among the adolescents are presented in Fig.

Discussion

The training course on the self-care for adolescents with diabetes mellitus at a diabetes school may positively affect behavior of patients. The news of the disease comes as a shock to both a teenager and his or her family members. Information on the control of the disease provided during the course may bring hope and encourage adolescents to take care of their health and to change a lifestyle (1, 9).

Healthy or unhealthy nutrition of adolescents depends on their health status, financial status of a family, and educational background of parents. Healthy nutrition consists of the frequent consumption of raw vegetables, fruits, grain, and low-fat protein products. Unhealthy nutrition is characterized by frequent consumption of sweets, fat dairy products, and fatty fried food. Unhealthy nutrition does not influence the development of type 1 diabetes mellitus; however, once diabetes is diagnosed, it is necessary to change one's eating habits (2, 10).

Before being diagnosed with diabetes mellitus, the adolescents who participated in the survey used to eat irregularly and consumed many sweets. Supply and advertisement of foods of low nutritional value as well as the eating habits of family and peers might have influenced such a choice among the teenagers (10). Three months after being diagnosed with type 1 diabetes mellitus, the respondents had more regular eating habits and mostly consumed products classified as healthy food. Insulin therapy may be linked with adolescents' breakfast. Following the prescription of insulin, patients were informed of the relationship between eating habits and effects of insulin. Having spent the first weeks following the diagnosis in the hospital, the patients and their parents started to consume more food rich in complex carbohydrates, namely brown bread, porridge, and legumes. They were trained and encouraged to eat similar food at home. The frequent intake of vegetables might be connected with the patients'

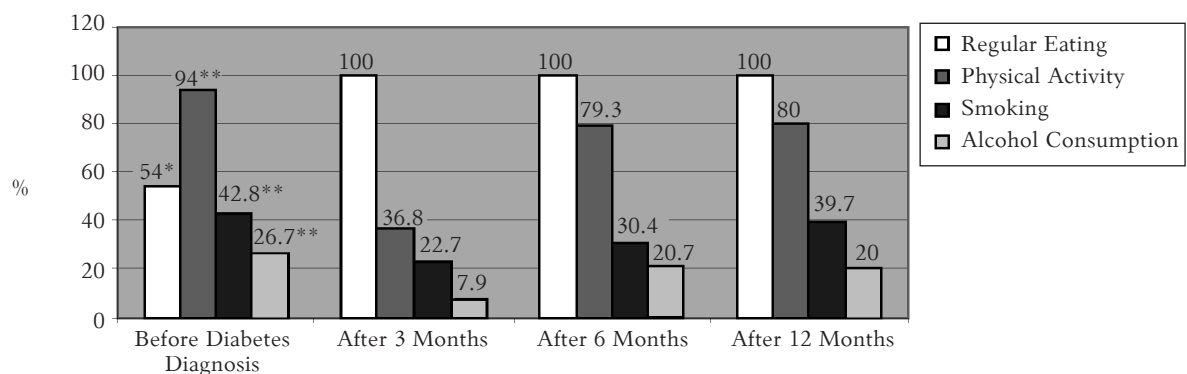


Fig. Changes in habits of nutrition, physical activity, smoking, and alcohol consumption among adolescents with diabetes mellitus

* $P<0.05$ compared with the data 3, 6, and 12 months after the diagnosis; ** $P<0.05$ compared with the data 3 months after the diagnosis.

aim to have more food without increasing their blood glucose level. Since fresh vegetables have little carbohydrates, they do not affect the fluctuation in blood glucose and are recommended to patients with diabetes mellitus (2, 3, 10).

The number of the adolescents who consumed sweets daily decreased. Some respondents continued to eat sweets every day because they were undergoing a period of remission. The patients frequently had a low blood glucose level; therefore, they ate sweets in order to increase it. During the period of remission, the blood glucose level did not increase dramatically even if the dietary plan was not followed (2).

The survey was repeated after 6 and 12 months, and the teenagers noted that sweets rapidly increased their blood glucose level. Usually, the period of remission had already expired; therefore, when measuring the blood glucose level after having a meal, the patients could analyze how food affected the fluctuation in their blood glucose level (2).

Opinions of peers are very important in adolescence, and for this reason, patients with diabetes mellitus might have ignored the dietary plan and certain limitations not willing to stand out among others (11). Contemporary diabetology does not prohibit the consumption of sweets for persons with diabetes mellitus; however, the principles of healthy nutrition indicate that even healthy individuals should limit the intake of sugar (2, 3). The findings of this survey demonstrated that following each survey, there was an insignificant decrease in the number of the patients who consumed food with complex carbohydrates and an increase in the number of those who ate sweets. During the training course, teenagers should be reminded of the difference between complex and easily absorbed carbohydrates and their impact on the fluctuation of the blood glucose level. Although each respondent had breakfast, some of them still consumed sweets. Not every teenager tested the blood glucose level at school 2 hours after breakfast, and for this reason, the fluctuation in blood glucose might have gone unnoticed. Fresh vegetables give a feeling of fullness and do not affect the fluctuation in blood glucose; therefore, their consumption should be encouraged during the training course.

The patients claimed that the level of their physical activity decreased 3 months after the diagnosis of type 1 diabetes mellitus. The patients had no skills how to adjust nutrition and insulin dosage to physical exercise. Adolescents who engaged in sports before being diagnosed with type 1 diabetes mellitus should be recommended to continue with physical activity and learn how to control their blood glucose level during exercise (2, 4). In case of adolescents who actively exercise, it is necessary to estimate not

only physical activity itself, but also the impact of stress during sports competitions; therefore, only some of the respondents had extra exercise 2 or 3 times per week (5).

The survey conducted 6 and 12 months later demonstrated that the patients made progress in learning how to adjust physical exercise and diabetes control, but they attended physical education classes less frequently than before the diagnosis. This may be linked to both the fluctuation in blood glucose before or during physical education classes and increased hypodynamics among young adults (1, 12, 13). In the course of training for patients with diabetes mellitus, it would be beneficial to observe them during physical exercise and to provide immediate advice, as well as to pay more attention to rules of controlling blood glucose during physical exercise. Such training methods are applied in camps for patients with diabetes (14).

A negative impact of smoking on the teenager's developing body and the health status of a patient with diabetes was explained to the adolescents diagnosed with type 1 diabetes mellitus; therefore, 3 months after the training course, the number of smokers decreased. Research findings indicate that the distribution of smokers among patients with type 1 diabetes mellitus is similar to that among healthy individuals (2). It has been proved that smoking increases the risk of renal deficiency, eyesight damage, leg ulcers and amputation, and development of coronary heart disease. Smoking patients may have less effective insulin absorption at the place of injection and may develop insulin resistance. A regular insulin dose is less effective for blood glucose control in case of smokers (2, 6, 7).

Research has shown that people start smoking during adolescence when it is most difficult to resist peer pressure. It is not easy to quit smoking; therefore, diabetes clinics and centers provide consultations for patients who intend to drop this habit (7).

Alcohol consumption may provoke hypoglycemia and lead to death in case of patients with type 1 diabetes mellitus. Alcohol inhibits glucose production in the liver and reduces the concentration of cortisol and growth hormones. This effect lasts as long as it is necessary for the liver to process alcohol. An intoxicated patient has a diminished ability to recognize the symptoms of hypoglycemia and provide self-help (2, 7, 9). The survey showed that after the explanation about the impact of alcohol on the health status of those diagnosed with diabetes mellitus, the number of the teenagers who consumed alcohol decreased after 3 months; however, this number increased 6 months later. This indicates the need for the continued training and the formation of attitudes toward smoking and alcohol consumption among family members. During the training

course for children and adolescents with diabetes mellitus, the attention of parents has to be drawn to this question. According to Hanas, young adults are more likely to start smoking and drinking alcoholic beverages when family members are lenient on this matter. If parents forbid smoking and alcohol consumption, only 10% of adolescents ignore this ban. If parents do not forbid these activities, then at least 52% of young adults fall into the habit of smoking and alcohol consumption (2).

In the course of this study, no data on the use of narcotic substances were provided by the teenagers. Information about the harms of narcotic substances to patients with type 1 diabetes mellitus has to be repeated during the continued training. Patients with diabetes who use narcotics may fail to have an insulin injection or a meal, underestimate the state of hypoglycemia, and provide self-help (2, 7).

Conclusions

Health behavior of adolescents with type 1 dia-

betes mellitus is more significantly affected in short perspective after the education on health behavior although after a longer period, the influence of teaching intervention decreases. This study confirmed that 3 months after the diagnosis of diabetes mellitus, most of the adolescents ate regularly, there were fewer smokers and alcohol consumers and the lowest number of those who exercised when compared with the findings of the surveys conducted before the diagnosis and after 6 or 12 months. Such results indicate the necessity for more active repeated educational activities concerning health behavior of adolescents with type 1 diabetes mellitus. Diabetes camps and family seminars recently organized should be effective to improve the motivation of adolescents with type 1 diabetes mellitus and to influence their positive attitudes toward healthy behavior.

Statement of Conflict of Interest

The authors state no conflict of interest.

1 tipo cukrinio diabetu sergančių paauglių sveikatai įtakos turintys elgsenos pokyčiai

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Raktažodžiai: 1 tipo cukrinis diabetas, paaugliai, mokymo programa, sveika gyvensena.

Santrauka. *Tyrimo tikslas* – palyginti 1 tipo cukrinio diabetu sergančių paauglių mitybos, fizinio aktyvumo, alkoholinių gėrimų vartojimo ir rūkymo pokyčius po diagnozės nustatymo praėjus 3, 6 ir 12 mėn.

Tyrimo medžiaga ir metodai. Tyrimas atliktas Lietuvos sveikatos mokslų universiteto ligoninės Kauno klinikų Vaikų endokrinologijos skyriaus Diabeto mokyklėlėje. Anketinėje apklausoje dalyvavo 90 paauglių nuo 13 iki 17 metų, sergančių 1 tipo cukrinio diabetu. Skirtumams tarp priklausomų imčių nustatyti taikytas Wilcoxonio porinių imčių testas.

Rezultatai. Paaikėjo, kad, prieš susirgdami 1 tipo cukrinio diabetu, 46 proc. apklausoje dalyvavusių paauglių valgė nereguliariai. Praėjus 3, 6 ir 12 mėn. po cukrinio diabeto diagnozės nustatymo ($p < 0,05$), visi tiriamieji teigė, kad jų mityba buvo reguliari. Prieš susirgdami cukrinio diabetu, nesportavo 5,6 proc. paauglių. Pakartojus apklausą po 3 mėn., 63 proc. tiriamųjų teigė, kad nesportavo ($p < 0,05$), po 6 ir 12 mėn. nesportuojančiųjų sumažėjo iki 20 proc. Kol nesirgo cukrinio diabetu, 42,8 proc. paauglių rūkė. Praėjus 3 mėn. po diagnozės nustatymo, rūkė 22,7 proc. ($p < 0,05$), po 6 mėn. – 30,4 proc., o po 12 mėn. – 39,7 proc. Prieš susirgdami cukrinio diabetu, alkoholinius gėrimus vartojo 26,7 proc. tiriamųjų. Po 3 mėn. 7,9 proc. tiriamųjų prisipažino vartoję alkoholinius gėrimus po to, kai jiems buvo nustatytas cukrinis diabetas ($p < 0,05$). Po 6 ir 12 mėn. apie 20 proc. tiriamųjų prisipažino vartoję alkoholinius gėrimus.

Išvada. Praėjus 3 mėn. po cukrinio diabeto diagnozavimo, daugiausia tiriamųjų valgė reguliariai, mažiau rūkė, rečiau vartojo alkoholinius gėrimus, bet mažai sportavo lyginant su rezultatais prieš susirgiant ir praėjus 6 bei 12 mėn.

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