ISSN No:-2456-2165

The Cost Effectıveness and Effect of Web-Based and Indıvıdualızed Educatıon Provıded to Classroom Teachers on the Preventıon of the Rısk of Type 2 Dıabetes*

The İmpact of Education on Diabetes Risk and Cost

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Where the study was conducted: Classroom teachers working in primary schools in Gaziantep, TURKEY

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**This paper is presented as a poster presentation at the 12th European Diabetes Congress in Berlin on 15-17 September 2016*

DISCLOSURE
The authors have no financial disclosures to declare and no conflicts of interest to report. This study was financed by no means. The manuscript has not been published elsewhereand is not under submission elsewhere. There is no conflict of interest or, alternatively, disclosing any conflict of interest that may exist.

AUTHOR CONTRIUTIONS
H.S.K. and S.Ö. designed the study; H.S.K. carried out the data collection; H.S.K. and S.Ö. conducted the data analysis; H.S.K. prepared the manuscript;and H.S.K. and S.Ö. have given final approval of the version to be published.

Abstract:-
Background: Type 2 diabetes is a disease with an increasing incidence. Lifestyle education has an important place in preventing diabetes and shifting its onset forward.
Aim: The purpose of this study was to determine the cost-effectiveness and effect of web-based and individualized education providedto classroom teachers on diabetes risk prevention.
Methodology: The study conducted as randomized controlled study. The sample consisted of 53 classroom teachers, divided into 27 teachers who received web-based education and 26 teachers who received individualized education.The data collection tools comprised of information forms, the Finnish Diabetes Risk Score, and a record book that detailed the expenditures for the groups.
Results: The FINDRISC for the web-based education group was 16.48±1.57 before the education program and 13.40±2.002 ($p<0.05$) after the education program, whereas the same scores for the individualized education group were 16.34±1.29 before the education program and 13.65±2.38 ($p<0.05$) after the education program. T The average cost of the education program for each classroom teacher was 43.66±3.36 TL (€17) for the web-based education group and 85.33±11.31 TL (€34) for the individualized education group ($p<0.05$).
Conclusions: It was determined that both educational methods were effective in preventing the risk of type 2 diabetes, but that web-based education was more cost-effective.

Keywords: *Diabetes Mellitus Type 2, Health Education, Risk Reduction Behavior, Cost*

I. INTRODUCTION

Type 2 diabetes is one of the 21st century's most serious health problems, increasing in prevalence and decreasing in age of onset [1]. According to the 2015 data of the International Diabetes Federation (IDF), one in 11 adults has diabetes. In 2015, there were 415 million people with diabetes in the world, and this is projected to reach 642 million by 2040 (IDF, 2015). Eighty percent of the increase in the number of people with type 2 diabetes is seen in low and middle-income countries (IDF, 2013). Studies conducted in Turkey have shown that the prevalence of type 2 diabetes in the adult population ranges between 7.4% and 13.7% (Republic of Turkey Ministry of Health,2014). Nearly 3,679,000 people are living with type 2 diabetes and this will exceed 6 million in 20 years' time according to IDF projections. The 2010 Turkish Diabetes, Hypertension, Obesity and Endocrine Diseases Prevalence (TURDEP-II) Study shows that the numbers projected for 20 years' time have nearly been reached (IDF, 2013; TURDEP 2011).

Despite the increasing prevalence that began as a result of lifestyle changes in society and is also due to prolonged lifespans, it is not possible to completely cure type 2 diabetes with treatment (Coşansu , 2009). However, it has been shown that type 2 diabetes is strongly associated with lifestyle factors and could be delayed or prevented by up to 40-58% through early detection of individuals at high risk and by providing education on healthy living (Pan et al., 1997; Li et al., 2008; Tuomilehto et al., 2001). Today, health education programs are provided in order to reduce both the risk factors and the recurrence rate of the disease, to prevent the risk of individuals developing type 2 diabetes, and to ensure permanent behavioral changes in individuals at high risk of type 2 diabetes (Besler, 2006). It is important that individuals take more responsibility for their health with adequate and balanced nutrition and increased physical activity to help prevent the disease (Coşansu , 2009). Interventions to prevent type 2 diabetes should be selected from cost-effective methods that can also make a positive contribution to a person's quality of life and lifespan from a health point of view. It has been found that educating people on healthy lifestyle choices is inexpensive and effective in preventing type 2 diabetes. Global expenditure on diabetes and associated diseases was $548 billion in 2013 (IDF, 2013). Despite such high expenditure on type 2 diabetes, it has been shown that $15,700 can be saved for each case of diabetes that has been prevented through the Diabetes Prevention Program in the United States (Roset et al., 2006). Although the cost of diabetes is high, prevention is also easier and cheaper. This study was conducted to determine the cost effectiveness and effect of the web-based and individualized education programs provided to classroom teachers on the prevention of the risk of type 2 diabetes.

➢ *Hypothesis*

The study was designed to test two hypotheses at 0.05 level of significance.

H1: Web-based education is more effective than individual education in preventing the risk of type 2 diabetes.

H2: Web-based education in preventing the risk of type 2 diabetes is more cost effective than individual education.

II. METHODOLOGY

➢ *Sampling and Data Collection*

This study was a randomized controlled experimental study conducted between September 2013 and September 2014 on classroom teachers working in primary schools in the Şahinbey District of Gaziantep, Turkey. The Finnish Diabetes Risk Score (FINDRISC) was applied to 2,342 classroom teachers, who constituted the study population, and the mean FINDRISC was found to be 7.57±4.13. The sample of the study consisted of all classroom teachers (56) who scored 15 and higher on the FINDRISC questionnaire. The study was completed with 53 subjects (27 subjects in the web-based education group and 26 subjects in the individualized education group), as one subject was appointed to a school in another region, one subject was diagnosed with type 2 diabetes, and one subject was suffering with a psychiatric disorder. Using MedCalc software, the teachers were randomly assigned to the web-based and individualized education groups by taking their personal characteristics into account (Table 1) ($p>0.05$).

➢ *Instrumentation*

In accordance with the literature, a questionnaire form that consisted of 23 questions concerning personal and professional characteristics and the health of the classroom teachers was used in the data collection process (Besler, 2006; Kural Aydın, 2009), and record books that detailed the daily expenditures incurred for the classroom teachers were used for the FINDRISC and cost-effectiveness analysis.

Finnish Diabetes Risk Score (FINDRISC) Questionnaire: Approved by the Society of Endocrinology and Metabolism of Turkey (TEMD), FINDRISC is a questionnaire form that consists of eight questions (TEMD,2014). It was developed in order to identify individuals at high risk of type 2 diabetes and can be used in a social sphere (Finnish Diabetes Assocation, 2012. This form, translated into Turkish in the guidelines published by the TEMD, is recommended for Turkey (TEMD,2014). A different weight was assigned to each question. The FINDRISC questionnaire is a simple, easy, and coherent questionnaire that can be completed by individuals themselves, and that provides information about the risk factors for type 2 diabetes (Turkey Endocrinology and Metabolism Association, 2014). It provides an estimation regarding a person's risk of developing diabetes within the ensuing 10 years (Finnish Diabetes Association, 2012). The FINDRISC questionnaire contains questions about age (scored 0, 1, 2, 3, and 4 points), body mass index (scored 0, 1, and 3 points), waist circumference (different values for males and females, scored 0, 3, and 4 points), history of physical activity (scored 0 and 2 points), fruit and vegetable consumption (scored 0 and 1 points), history of antihypertensive treatment (scored 0 and 2 points), history of hyperglycemia (scored 0 and 5 points), and familial history of diabetes (scored 0, 3, and 5 points). The highest score for this scale is 26 (TEMD,2014). The FINDRISC assessment includes five degrees of risk. There is increased risk for individuals with a score of 15 and higher, and it is recommended that these individuals begin a prevention program (Take Action toPreventDiabetes, 2012).

➢ *Cost-Effectiveness Analysis*

Record books that recorded the daily expenditures incurred for the classroom teachers included in the web-based and individualized education groups were used for the cost-effectiveness analysis. Daily expenses incurred for each group were recorded in these books.

❖ *Intervention*

➢ *Educational Booklet*

The educational booklet to be used in the education program provided to both groups was prepared in the same format by the researcher and included information regarding the significance of diabetes, risk factors, and prevention in accordance with data from the literature (Republic of Turkey Ministry of Health,2014 TURDEP-II, 2011; Coşansu, 2009; TEMD,2014). The diet lists that were distributed to the classroom teachers were prepared by a nutrition and dietetics

specialist and included different calorie requirements for males and females.

➢ *Educational intervention:*

The data was collected using two different methods for the web-based and individualized education groups.

a) For the individualized education group, an appointment was made on the phone with the classroom teachers before each interview and visits were arranged. Classroom teachers were visited three times at their workplace by the researcher. The FINDRISC questionnaire and questionnaire form were administered on the first visit. The education was provided in one 90-minute session period and an educational booklet was provided on the second visit. At the end of the second visit, a suitable date 13 weeks later was determined for the third visit to take place, during which the FINDRISC questionnaire was again administered.
b) For the web-based education group, an appointment was made by phone with the classroom teachers before the interview and a visit date and time was arranged. Classroom teachers were visited once at their workplace by the researcher. During this visit, the teachers were provided with information regarding the purpose of the study and a 40-minute educational session on how to use the web program was carried out. In this educational session, the participants were informed about the significance of the study, how to log in to the system, how to use the system, ways to access presentations and educational material, and how to fill out the forms. The participants logged in to the system using unique user names and passwords. The web environment included the educational content and booklet, as well as the questionnaires and question forms. Forms were completed by the classroom teachers in the web environment during the first and final follow-ups.
c) For the cost-effectiveness analysis, record books detailing the daily expenses incurred by the classroom teachers included in both education groups were used. Costs were calculated using the costs recorded at the time of the data collection and educational sessions (Eraydın, 2008). Expense items in the study are listed below:

- **Education:** The costs of the education were calculated by taking into account the fee of the researcher for each educational session. The researcher charges 12.28 TL (Turkish lira) for each educational session. The education provided to the web-based education group was completed in 18 hours (18 x 12.28=221.04 TL) (€88.42). The education provided to the individualized education group was completed in 52 hours (52 x 12.28=638.56) (€255.42).
- **Communication:** Cell phones were used to communicate with the classroom teachers. Thirty-two phone calls were made to the classroom teachers in the web-based education group (18 TL) (€7.2), and 98 phone calls to those in the individualized education group (80 TL) (€32).
- **Travel:** The distance taken to visit the classroom teachers was recorded in kilometers. Fuel costs were determined by calculating the average fuel consumption of the researcher's car in a city environment. Transportation costs were as follows: 230 TL (€92) for the web-based education group and 700 TL (€280) for the individualized education group.
- **Program Materials:** The educational booklets that were used for the classroom teachers in the individualized education group were color printed and cost 600 TL (€240). Questionnaire sheets were photocopied in black and white. Technical assistance was obtained for the web page that was designed to be used for educating the classroom teachers in the web-based education group and a fee for building the web page was paid on one occasion totaling 650 TL (€260). Subsequently the web page was used for all educational sessions.
- **Other Expenses:** The personal expenses of the researcher during the education comprised of items such as food, water, and tea. The researcher incurred expenses of 40 TL (€16) for the web-based education group and 200 TL (€80) for the individualized education group.
- **Total:** The total expenses were 1179.04 TL (€471.62) for the web-based education group and 2218.56 TL (€887.42) for the individualized education group. The cost per person was calculated by dividing the total costs by the number of teachers in each group.

In this study, the communication, travel, education, program material, and researcher costs resulted in a decremental effect in the post-education FINDRISC. For the cost-effectiveness analysis, costs that provided one unit of change in the FINDRISC of each classroom teacher, and the ratio of the total change of this parameter during the education program to the cost of the education were used (Başer Çakmak, 2012).

Cost-effectiveness ratio = (net cost of implementing a policy) / (improvement in health due to the new policy)

$$\text{Cost-effectiveness ratio of web-based education} = \frac{\text{Cost of the web-based education group}}{\text{Decrease in FINDRISC}}$$

$$\text{Cost-effectiveness ratio of individualized education} = \frac{\text{Cost of the individualized education group}}{\text{Decrease in FINDRISC}}$$

Decrease in FINDRISC

Incremental Cost-Effectiveness Ratio = Cost (A) - Cost (B) / Effect (A) - Effect (B)

Web-based education Group	Individualized education group
Cost=1179.04	Cost=2218.56
Effect=3.07	Effect=2.69

The cost required to obtain one unit of benefit is 2735.57 TL (€1094.23) The decrease in the post-education FINDRISC was calculated in percentages (%) with direct proportionality in order to calculate the effectiveness of the education (Eraydın, 2008).

The dependent variables of the study were pre- and post-education mean FINDRISC and the expenditures for the web-based and individualized education groups. The independent variables of the study were age, gender, marital status, occupation, number of children, eating habits, exercise habits, and perception of health.

- *Statistical analysis:*

The data obtained in the study was analyzed using IBM SPSS 21.0. Skewness and kurtosis values were used to assess the suitability of data for normal distribution. The chi-square test and independent groups t-test were used in order to test the homogeneity of the groups. Quantitative data was provided with arithmetic mean and standard deviation values, while categorical data was provided in numbers and percentages. Pearson's chi-square test was used in the statistical analysis of categorical data, and an independent groups t-test and one-way ANOVA test were used in the analysis of quantitative data. A t-test of the difference between two paired groups was used to compare the pre- and post-education mean values for the teachers, whereas an independent groups t-test was used to compare the mean differences between pre- and post-education values and to compare the average costs of the education provided to classroom teachers.

- *Ethical Consideration:*

The study was approved by the Clinical Trials Ethics Committee of Erciyes University (2012/321) and written approval was obtained from the Gaziantep Provincial Directorate of National Education. Informed consent was obtained from each participant after explaining the participant information sheet before data collection.

III. RESULTS

According to this study, the difference between the pre- and post-education waist circumference, BMI, and mean FINDRISC of the classroom teachers included in the web-based and individualized education groups was statistically significant ($p<0.05$) (Table 2).

There was no statistically significant difference between the web-based and individualized education groups in terms of the pre- and post-education waist circumference of the male and female classroom teachers ($p>0.05$). The difference between the pre- and post-education BMIs of the classroom teachers was 1.43±1.21 in the web-based education group and 1.59±1.29 in the individualized education group ($p>0.05$). The difference between the pre- and post-education FINDRISC of the classroom teachers was 3.07±1.20 in the web-based education group and 2.69±1.61 in the individualized education group. Consequently, the difference between the two groups was not statistically significant ($p>0.05$) (Table 3).

The total cost of the web-based education group was 1179.04 TL and the total cost of the individualized education group was 2218.56 TL. The effectiveness of the education provided to classroom teachers was 18.63% for the web-based education group and 16.46% for the individualized education group. The average cost-effectiveness ratio was 384.05 TL for the web-based education group and 824.74 TL for the individualized education group, whereby the incremental cost-effectiveness ratio of web-based education compared to individualized education was -2735.57 TL. The total cost of the web-based education group was 1179.04 TL and the total cost of the individualized education group was 2218.56 TL. The effectiveness of the education provided to classroom teachers was 18.63% for the web-based education group and 16.46% for the individualized education group. The average cost-effectiveness ratio was 384.05 TL for the web-based education group and 824.74 TL for the individualized education group, whereby the incremental cost-effectiveness ratio of web-based education compared to individualized education was -2735.57 TL (Table 4).

The average cost of the education program for each classroom teacher was 43.66±3.36 TL for the web-based education group and 85.33±11.31 TL for the individualized education group. The difference between the two groups was statistically significant ($p<0.05$). The average cost of fuel was 8.51±2.83 TL for the web-based education group and 26.92±11.12 TL for the individualized education group ($p<0.05$); the mean number of visits was 1.00±0.00 for the web-based education group and 3.23±0.42 for the individualized education group ($p<0.05$); the mean education fee was 8.18±0.00 TL for the web-based education group and 24.56±0.00 TL for the individualized education group ($p<0.05$); the mean number of phone calls was 1.33±0.48 for the web-based education group and 3.76±0.42 for the individualized education group ($p<0.05$); the average phone bill was 0.66±0.24 TL for the web-based education group and 3.07±0.27 TL for the individualized education group ($p<0.05$); and the average stationary cost was 0.74±0.25 TL for the web-based education group and 23.07±0.27 TL for the individualized education group ($p<0.05$). These differences between the two groups were statistically significant ($p<0.05$) (Table 5).

IV. DISCUSSION

Schools are appropriate places to present health-oriented interventions, as well as to encourage individuals to improve and maintain their health. In this study conducted on classroom teachers working in primary schools, the mean FINDRISC were significantly lower in the post-education period compared to the pre-education period in both the web-based and individualized education groups. It has been proven that in this day and age health education programs reduce risk factors and disease recurrence rates (Besler, 2006). The findings from this study support this fact, wherein the decrease was higher in the web-based education group compared to the individualized education group. Previous studies report FINDRISC ranging between 8.5 and 16.6 (Lindström et al., 2008; Absetz et al., 2009; Hellgren et al., 2012; Saaristo et al., 2010). However, in contrast with this study, the FINDRISC were only measured once before the educational sessions in previous studies, and it was reported that the education given to those with a high risk reduced the risk of diabetes (Lindström et al., 2008; Absetz et al., 2009; Saaristo et al., 2010). The risk of developing type 2 diabetes

within 10 years is 1/3 in individuals with a FINDRISC of 15 and higher, whereas the risk is lower for those with a lower score (TEMD, 2014; Finish Diabetes association, 2012; Take action to, 2012). In our study, the FINDRISC was reduced by 3.07±1.20 in the web-based education group and by 2.69±1.61 in the individualized education group after the education program was carried out ($p>0.05$). Although the difference was not significant, the decrease was higher in the web-based education group. In both cases, the FINDRISC of the participants fell below 14, and the classroom teachers' risk of developing type 2 diabetes within 10 years fell to 1/6 (TEMD, 2014). The classroom teachers became aware of their risk of developing type 2 diabetes through both educational methods, which resulted in them engaging in daily exercise, increasing their fruit/vegetable consumption, decreasing their BMI values and waist circumference, and hence lowering their FINDRISC. The decrease in the web-based education group was higher than that in the individualized education group, which is an important finding as it indicates that the web-based education was more effective.

Another noteworthy finding is that post-education BMI values were significantly lower than pre-education BMI values for both the web-based and individualized education groups ($p<0.05$). This is important as it shows that education, regardless of the method, is effective in reducing obesity, which is one of the modifiable risk factors for type 2 diabetes. Obesity has become one of the most important causes of disease in recent years, with increasing prevalence within the adult population, and it is known that obese individuals have a 3.7-fold higher risk of developing type 2 diabetes (Arslan & Ceviz, 2007). Sakanel et al. (2011) conducted a three-year study to investigate the effectiveness of lifestyle changes in subjects with IGT (impaired glucose tolerance) and found that BMI values dropped from 24.8 to 24.3 at the end of three years. Although not statistically significant, in this study the decrease in BMI values in the web-based education group was 1.43 kg/m^2, while it was 1.59 kg/m^2 in the individualized education group. Studies that have aimed to decrease body weight with web-based education have reported a decrease in body weight ranging between 1.41 and 4.27 kg (Moore et al., 2008; Park et al., 2009; Bennett et al., 2010; Fritz et al., 2013; Çakmakçı, 2009). In addition, lifestyle education studies conducted to prevent type 2 diabetes have reported a decrease in BMI ranging between 0.5 and 2.1 kg/m^2 (Besler, 2006; Absetz et al., 2009; Saaristo et al., 2010; Fritz et al., 2013; Çakmakçı, 2009; Kramer et al., 2011). This study also showed decreased BMIs, similar to the literature. It is known that the risk of developing type 2 diabetes can be reduced by lowering the BMI value, and it has been reported that type 2 diabetes could be prevented by reducing body weight by 5-7% (Republic of Turkey Ministry of Health, 2014). The most important factors in maintaining a healthy lifestyle and preventing type 2 diabetes are diet and physical activity. As a result of the education, classroom teachers engaged in more physical activity, ate healthier diets and lost weight, which resulted in decreased BMI values.

Another important finding of this study was the fact that waist circumference was significantly lower after the education program in both groups and for both genders. Today, waist circumference is an indicator known to be closely associated with type 2 diabetes. The risk of developing type 2 diabetes is 10.3-fold higher in individuals with abdominal obesity (Arslan & Ceviz, 2007). Both groups recorded a lower waist circumference at the conclusion of this study, which is important in terms of showing that lifestyle education is an effective way of intervening in the modifiable risk factors for type 2 diabetes. Studies conducted on women have recorded waist circumferences ranging from 85.78 to 98.31 cm (Arslan & Ceviz, 2007; Keskin et al., 2009; Kitiş et al., 2010). In this study, the mean waist circumference was higher compared to that of other studies. This may be due to the fact that our study group consisted of individuals at risk of type 2 diabetes, as well as due to a gradual weight gain observed across the Turkish population and hence higher waist circumferences. The mean waist circumference decreased after the education program in both groups and in both genders, although the difference was not statistically significant. According to studies in the literature regarding the decrease in waist circumference, Bond (2006) achieved a decrease of 5.83 cm as a result of a web-based study, Saaristo et al., (2010) achieved a decrease of 1.3 cm, Park et al., (2009) achieved a decrease of 2.8 cm as a result of a cell phone and internet-based obesity intervention program for individuals with hypertension, Fritz et al., (2013) achieved a decrease of 4.9 cm as a result of a four-month exercise program in overweight individuals, and Kramer et al., (2011) achieved a decrease of 5.33 cm in waist circumference. In a group that received education and were at high risk according to their FINDRISC, Çakmakçı (2009) demonstrated that waist circumference was reduced by 6.5 cm in females and 4.63 cm in males after nine months. As a result of the healthy lifestyle education conducted in this study, both BMI and waist circumference values were reduced. This decrease can also lead to a lower risk of developing type 2 diabetes. The decrease in waist circumference observed in this study is important. However, this decrease may be low due to the short follow-up period.

This study has shown that web-based education is cheaper and more effective in reducing FINDRISC compared to individualized education. Although the decrease in FINDRISC was not statistically significant in this study, it should be noted that web-based education is more effective as it is inexpensive and leads to a greater reduction in risk factors. Moreover, the web page only needed to be prepared once and was able to be used to educate many individuals in the web-based education program, whereas a separate document was required for each individual receiving individualized education, which subsequently raised costs. Factors such as the possibility of reaching more people, the ability to update and contact the educator when desired, cost-effectiveness, and the absence of time limitations render web-based education more appealing (Demir & Gözüm, 2011). In their study, Berger et al., (2009) educated patients independently from each other in order to determine the effects of web-based and face-to-face education and then compared the two groups. According to the study, there was

no significant difference between the level of knowledge among individuals who received face-to-face and web-based education, whereas it was reported that web-based education was more suitable due to reduced costs.

Around the world, it is accepted that preventing a disease is more cost-effective than treating it. In general, one of the most cost-effective strategies is a prevention program enabling the effective expenditure of health budgets to gain the highest benefit. Studies (Da Qing, DPP, DPS) have shown that diabetes could be prevented with a risk reduction of 44-58% or delayed in worst case scenarios simply by getting individuals to make healthy lifestyle changes (Pan et al., 1997; Li et al., 2008; Tuomilehto et al., 2001). In their study, Herman et al., (2012) showed that type 2 diabetes could be prevented for at least 10 years with intensive lifestyle intervention through the DPP (Diabetes Prevention Program) and its output the DPPOS (Diabetes Prevention Program Outcomes Study) in adults at high risk of developing type 2 diabetes. In this study, lifestyle education focused on the prevention of type 2 diabetes was provided through two different approaches. Of these, web-based education was found to be cheaper and more effective. In a study by Ferney & Marshall (2006), it was stated that for a low cost web pages could be used to deliver a high number of education programs aimed at bringing about behavioral health changes in adults, and websites could be used in user-centered physical activity interventions, interactive, and environmentally focused services. In their study, O'Reilly et al.,(2012) stated that computerized decision support systems were effective in improving patient care and reducing health costs for patients with type 2 diabetes. It was indicated that web-based models provided positive developments for long-term health outcomes and that they should be accepted and improved in terms of effectiveness as a means of cost-effective intervention in the treatment of patients with type 2 diabetes.

In this study, the effectiveness of the education provided to classroom teachers was 18.63% for the web-based education group and 16.46% for the individualized education group, wherein web-based education led to a greater decrease in the FINDRISC of the participants. In addition, it was found that web-based education was less expensive than individualized education. The cost-effectiveness ratio was 384.05 TL for the web-based education group and 824.74 TL for the individualized education group. The low cost of web-based education is noteworthy. In the United States, annual healthcare spending in 2007 amounted to $11,700 for a diabetic patient and $2900 for an individual without diabetes (Herman, 2011). The costs of treatment and healthcare services could be more than five times higher the costs of diabetes treatment if a diabetes patient develops micro and macro complications. Up-to-date IDF statistics for 2013 reveal that in Turkey the average annual treatment cost for a diabetic patient is $866 (International DiabetesLeadership Forum, 2013). The importance of fighting this disease becomes more apparent when one considers that the prevalence of the disease is increasing, which will ultimately lead to higher treatment and care costs. The mortality, economic, and social burden of the disease will continue to increase unless a global movement is initiated against type 2 diabetes (Republic of Turkey Ministry of Health,2014). Based on the exchange rate of the dollar and the effects of this disease, the importance of preventing type 2 diabetes has once more been demonstrated in this study. Web-based education stands out as a good alternative to expand this fight to include the entire world population due to its cost-effectiveness.

V. CONCLUSIONS

According to this study, web-based education was found to be more effective and less expensive compared to individualized education in preventing the risk of developing type 2 diabetes. Moreover, it was observed that both methods of education were effective in promoting improved metabolic control.

In accordance with these results, it is recommended to include risk screening scales in routine practice for the early detection of individuals who are at risk in primary healthcare institutions, to increase web-based educational opportunities due to ease of use and accessibility, and to use web-based education programs in the public and private workplace sectors in order to provide simple and effective education without time limitation and thereby prevent employees from developing type 2 diabetes.

The results of this study conducted on classroom teachers working for the Şahinbey District Provincial Directorate of National Education in Gaziantep may not be the same for the entire population of Turkey. It can only contribute to a generalized picture. Teachers in both groups came into contact with each other during break times, in their free time, or at the weekends when socializing (known as "teachers lodges", accommodation is often provided for teachers by the Turkish state). Therefore, this may have affected the objectivity of the study results due to contaminated information.

ACKNOWLEDGMENTS

I would like to present my deepest gratitude to the managers of Gaziantep provincial education directorate and to the classroom teachers working in primary schools in Gaziantep Şahinbey District. I owe you a debt of gratitude for your cooperation and devoted work during this process.

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Table 1 Distribution of the classroom teachers who received web-based and individualized education according to certain sociodemographic characteristics

Definitive Characteristics	**Groups**						*p**
	Web-based education group (*n*=27)		**Individualized education group** (*n*=26)		**Total** (*n*=53)		
	N	%	*n*	%	*n*	%	
Gender							
Female	17	63.0	16	61.5	33	100.0	0.915
Male	10	37.0	10	38.5	20	37.7	
Marital status							
Married	24	88.9	22	84.6	46	86.8	
Single	3	11.1	4	15.4	7	13.2	0.646
	$\bar{x}$ ±SD		$\bar{x}$ ±SD				*p***
Mean age	37.92±9.09		40.50±9.24				0.312
Duration of teaching experience (years)	14.55 ±9.20		15.38±7.33				0.719
Daily number of working hours	6.07±0.67		5.88±0.43				0.231
Weekly number of working hours	30.37±3.37		29.61±1.96				0.327
Mean number of children	1.51±1.18		2.11±1.14				0.068
Daily number of meals	2.51±0.70		2.92±0.84				0.063
BMI	28.36±3.54		28.00±3.68				0.720
FINDRISC	16.48±1.57		16.35±1.29				0.735

*Chi-square ** T-test

ISSN No:-2456-2165

Table 2 Pre- and post-education distribution of the mean FINDRISC, waist circumference, and BMI of the classroom teachers who received web-based and individualized education

Measurements	**Groups**					
	Web-based education group (n=27)			**Individualized education group** (n=26)		
	Pre-education	**Post-education**	*p**	**Pre-education**	**Post-education**	*p**
Male waist circumference (cm)	102.90±5.93	100.80±4.51	**<0.001**	108.70±7.77	105.20±6.77	**0.002**
Female waist circumference (cm)	99.88±7.80	96.35±7.69	**<0.001**	93.68±7.64	91.06±7.98	**0.014**
BMI	28.36±3.54	26.93±2.92	**<0.001**	28.00±3.68	26.40±3.63	**<0.001**
BMI (male)	27.29±3.28	26.20±2.49	**<0.001**	30.19±2.73	28.74±2.34	**<0.001**
BMI (female)	28.99±3.63	27.36±3.14	**<0.001**	26.63±3.60	24.94±3.56	**<0.001**
FINDRISC	16.48±1.57	13.40±2.00	**<0.001**	16.34±1.29	13.65±2.38	**<0.001**

* T-test of the difference between two paired groups

Table 3 Comparison of the differences between pre- and post-education mean FINDRISC, waist circumference, and BMI of the classroom teachers who received web-based and individualized education

Measurements	**Groups**		*p**
	Web-based education group (n=27)	**Individualized education group** (n=26)	
Waist circumference (male) (cm)	2.10±2.13	3.50±2.59	0.204
Waist circumference (female) (cm)	3.53±2.06	2.62±3.79	0.398
BMI	1.43±1.21	1.59±1.29	0.634
BMI (male)	1.09±1.41	1.44±0.77	0.499
BMI (female)	1.63±1.08	1.69±1.54	0.896
FINDRISC	3.07±1.20	2.69±1.61	0.334

* Independent groups t-test

Table 4 Comparison of costs of the education and effectiveness ratios for the classroom teachers who received web-based and individualized education

Costs	**Groups**	
	Web-based education group *(n=27)*	**Individualized education group** (*n*=26)
Education costs (TL)	1179.04	2218.56
Pre-education FINDRISC	16.48±1.57	16.34±1.29
Post-education FINDRISC	13.40±2.00	13.65±2.38
Decrease in FINDRISC after education (effect)	3.07±1.20	2.69±1.61
Incremental effectiveness of web-based education in comparison to individualized education	0.38	
Effectiveness of education (decrease in FINDRISC after education, %)	18.63	16.46
Cost-effectiveness ratio (TL) (cost/effect)	384.05	824.74
Incremental cost-effectiveness ratio of web-based education in comparison to individualized education (TL)	-2735.57	

Table 5 Comparison of the average education costs for the classroom teachers who received web-based and individualized education

Education group	**Groups**		*p**
	Web-based education group (*n*=27)	**Individualized education group** (*n*=26)	
Average cost	43.66±3.36	85.33±11.31	**<0.001**
Kilometers	20.96±6.95	25.02±10.33	0.098
Fuel costs (TL)	8.51±2.83	26.92±11.12	**<0.001**
Number of visits	1.00±0.00	3.23±0.42	**<0.001**
Education fee (TL)	8.18±8.18	24.56±0.00	**<0.001**
Number of phone interviews	1.33±0.48	3.76±0.42	**<0.001**
Phone call costs (TL)	0.66±0.24	3.07±0.27	**<0.001**
Stationery costs (TL)	0.74±0.25	23.07±0.27	**<0.001**
Internet costs (TL)	24.07±0.18		

* Independent groups t-test