

# Investigating the Effects of Education on Diabetic Foot: An Interventional Study from Turkey

## Diyabetik Ayakta Eğitimin Etkisinin Araştırılması: Türkiye'den Bir Müdahale Çalışması

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### ABSTRACT

**Introduction:** Diabetic foot wounds are one of the most important causes of long duration hospitalizations regarding diabetic patients. Lower extremity amputation risk is 15 to 40 times higher in diabetics compared to normal population. Methods for preventing diabetic foot wounds are providing good blood glucose regulation, appropriate shoe wearing, foot care, toe-nail care, regular foot examinations and patient education. We aimed to investigate the effects of education level of the patients and the caregivers on the diabetic foot wound.

**Methods:** 67 patients having diabetic foot wound applying to General Surgery, Internal Medicine and Diabetes outpatient clinics of Izmir Tepecik Education and Research Hospital in 2009 and 57 caregiver caring for these patients were analyzed prospectively with a face to face questionnaire for a correlation between education levels of patients and caregivers and Wagner staging of patients' diabetic foot wounds and foot examination findings.

**Results:** It was found that education levels of patients and caregivers did not affect Wagner staging of the wounds ( $p=0.167$ ), but patients with regular follow-up and previously educated for diabetic foot wounds had a lower stage of wound ( $p=0.021$ ).

**Conclusion:** Education level of patients and caregivers was not found to be effective on the stage of the wound, but regular clinical follow-up and patient education had an decreasing effect on the stage of wound. Whatever the patients' education levels are, educations on diabetic foot care and providing regular follow up of patients at risk for diabetic foot will decrease the rates of extremity amputations.

**Keywords:** Care Givers, Diabetic Foot, Education/Nursing, Wagner Grade

### ÖZET

**Giriş:** Alt ekstremité amputasyonu yapılan hastaların yaklaşık %40-60'ını diyabetik hastalar oluşturmaktadır. Diyabetik ayak yaraları, diyabetik hastaların hastanede uzun süre yatışlarının en önemli nedenlerindedir. Diyabet hastası olanlarda, normal popülasyona nazaran alt ekstremité amputasyon riski 15-40 kat daha fazladır. Yara oluşmadan yapılacak profilaksi ve oluşmuş olan diyabetik ayak yaralarının tedavisi, amputasyonları ve morbiditeyi %50 azaltmakta ve maliyeti düşürmektedir. Diyabetik ayak yaralarını önlemeye yönelik yöntemler; kan şekeri regülasyonu sağlanması, uygun ayakkabılar giyilmesi, ayak bakımı, ayak tırnağı bakımı, düzenli ayak muayenesi ve hasta eğitimidir. Diyabetik ayak yarası üzerinde, diyabetik ayak hastası ve bakıcısının öğrenim düzeylerinin etkisini araştırmayı amaçladık.

**Yöntem:** 2009 yılında İzmir Tepecik Eğitim ve Araştırma Hastanesi Genel Cerrahi, Dahiliye ve diyabet polikliniklerine başvuran, diyabetik ayak yarası olan toplam 67 hastanın ve bu hastalara evde bakım yapan 57 bakıcının öğrenim düzeyi ile, Wagner sınıflamasına göre hastalardaki diyabetik ayak yara evresinin ilişkisi ve ayak muayenesi prospektif olarak yüz yüze anket metodu ile araştırıldı.

**Bulgular:** Hastaların ve bakıcılarının öğrenim durumlarının, Wagner sınıflamasına göre diyabetik ayak yarası Wagner evrelerini etkilemediği ( $p=0.167$ ) fakat diyabet izlemlerini düzenli yaptıran ve daha önce diyabetik ayak yarası hakkında bilgilendirilen hastaların yara evrelerinin daha düşük olduğu saptandı ( $p=0.021$ ).

**Sonuç:** Hastanın ve bakıcısının öğrenim seviyesinin, yara evresi üzerine etkisi olmadığı fakat düzenli klinik takip ve hastanın eğitiminin yara evresini iyi yönde etkilediği ortaya çıkmıştır. Diyabetik ayak için risk altındaki hasta grubuna, öğrenim düzeyi ne olursa olsun diyabetik ayak hastalığı hakkında bir eğitim programı uygulamak ve düzenli izlemlerinin yapılmasını sağlamak ekstremité amputasyonlarının oranlarını azaltacaktır.

**Anahtar kelimeler:** Bakıcı, Diyabetik Ayak, Eğitim/Bakıcılık, Wagner Evrelemesi

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## INTRODUCTION

Diabetes Mellitus (DM) is a chronic and progressive disease that is characterized by hyperglycemia and disorders of carbohydrate, protein, lipid metabolism. It is formed as a result of absolute or relative deficiency of pancreatic insulin secretion or ineffectiveness of insulin molecules. It is a heterogeneous syndrome with genetic and clinical feature (1). Although DM is a preventable disease; it affects many organs. Hence, with its foot complications, it disrupts life quality (2). To reduce morbidity and mortality in diabetes, information and education awareness of health professionals and patients, must be increased (3).

Diabetic foot (DF) wounds are one of the most important reasons for hospitalizations and long hospital stay (4). Approximately 40 to 60% of lower extremity amputation cases are diabetic patients. Over 80 % of these amputation cases have deep foot wounds with gangrenation and superimposed by infection (5). Such conditions have a high cost due to the treatment or extremity amputation of severe wound, long duration of hospitalization, rehabilitation, home care and loss of working capability, and also patient's income is decreased. Preventative measures for diabetic foot wounds and treatment decreases the rate of amputations and death up to 50% and prevents severe financial losses (5). Mortality rates, duration of hospitalization and postoperative complication rates are similar in amputation cases related to diabetes compared to cases not related to diabetes in cases without an additional diabetic complication. The only difference is that amputations related to DF could be prevented (4).

An American diabetologist Dr. Elott P. Joslin pointed to preventative measures that the physician and the patient could apply for DF to avoid amputations in 1934 saying: "Diabetic gangrene is not a disease sent from heavens, it begins in this world" (6). In St. Vincent Declaration published in the 90ties in Germany it was put forth that only a coordinated serious battle could reduce amputations (7). It was observed that appropriate shoes and patient education decreased the rate of new diabetic wound formation especially in patients with previous amputations (8). A DF care protocol consisting of a careful blood glucose control and foot care together with standard diabetic treatment was shown to reduce DF complications and was also shown to be cost effective. It is obvious that preventative measures for diabetic foot not only improves foot health and psychology of the patient, but it also provides social and economical gains (9). Nations with low education status may need renewal of treatment and follow up protocols of chronic illnesses with long term effects. Education level of the patient and caregiver is the leading factors among the important factors effecting the development and clinical course of DF disease.

In this study it was aimed to investigate a correlation of education level of diabetic foot wound patients and their caregivers with the Wagner stage of the wound.

## METHODS

The study was conducted with patients diagnosed to be diabetes mellitus (DM) with clinical and laboratory findings applying to the General Surgery, Internal Medicine and Diabetes outpatient clinics of Turkish Republic (TR) Health

Ministry Izmir Tepecik Education and Research Hospital between January- July 2009.

67 diabetic foot wound patients were included. Patients were selected using simple randomization sampling method. Diabetic patients with no callus formation, no new bony protrusion or no sensory neuropathy and patients without these findings having well palpable dorsalis pedis pulse were evaluated to consist another risk group for DF wound, and were not included in the study.

"Diabetic foot questionnaire" consisting of 23 questions was prepared by investigators and applied to patients by face to face method. The aim and target of the study was explained to participants prior the questionnaire. Verbal informed consent was taken from all patients one by one. Questionnaire prepared for the study had three parts consisting of patient, caregiver and diabetic foot wound variations. Patients' sex, age, occupation, residence, education status, antidiabetic medications, smoking status, history of depression, duration of diabetic disease, follow up status, knowledge level on DF, presence of caregiver, sex, age, education status of caregiver if present and wound stage was questioned.

After the questionnaire foot examination was performed. If necessary 3 dimensional plain radiographic examination was performed and evaluated. Wagner staging was used to wound stage evaluation (Stage 0: bony protrusion with healthy skin, Stage 1: superficial wound, Stage 2: profound wound, Stage 3: profound wound with abscess formation or osteomyelitis, Stage 4: gangrene invading toes, Stage 5: unsaveable level of gangrene) (10).

Statistical analysis was performed using Statistical Package for Social Sciences (SPSS) for Windows 10.0 statistical pocket program. Qualitative variables were analyzed with X-square test. Results within 95% confidence interval and  $p < 0.05$  were taken to be statistically significant.

## RESULTS

Totally 67 patients were included in the study, 51 male (76.1%) and 16 female (23.9%) patients. Mean age of the patients was  $58.9 \pm 12.4$  (min: 37, max: 79) years and mean duration of diabetes since diagnosis was  $11.5 \pm 5.6$  (min: 1, max: 23) years. The mean age of the caregivers was  $53.9 \pm 11.0$  (min: 23, max: 73) years. Diabetic patients were developing diabetic foot by old ages, most of the study patients were males, but there was no statistically significant correlation between the duration of diabetes since diagnosis and Wagner staging of DF wound ( $p=0.159$ ).

65.7% of the patients were retired, 16.4% were housewives and 17.9% were still working. 89.6% of patients were urban, 10.4% were rural inhabitants. 57 of the patients (85.1%) had a caregiver, 10 (14.9%) had no caregiver. Among the 57 patients having a caregiver 46 (80.7%) was cared by their partners, 7 (12.3%) by a close relative, 4 (7%) by previously unknown person. 14 of the caregivers were male (24.6%), 43 were female (74.4%). Most of the diabetic foot patient caregivers were housewives. Among 67 study patients 9.0% ( $n=6$ ) were illiterate, 38.8% ( $n=26$ ) were primary school graduates, 22.4% ( $n=15$ ) were secondary school graduates and 29.9% ( $n=20$ ) were high school graduates. There were no university level graduate among them. Among 57 caregivers 5.3% were illiterate, 47.4% were primary school graduates, 19.3 % secondary school graduates, 21.1% high school graduates and 7% were university graduates (Table 1).

**Table 1. Sociodemographic Characteristics**

		<i>n</i>	%
Sex	Male	51	76.1
	Female	16	23.9
Occupational status	Retired	44	65.7
	Working	12	17.9
	Housewife	11	16.4
Habitation	City/town	60	89.6
	Rural	7	10.4
Smoking	Yes	35	52.2
	No	32	47.8
History of depression	Yes	17	25.4
	No	50	74.6
History of regular medications	Yes	34	50.7
	No	33	49.3
Regularly followed diabetes?	Yes	33	49.3
	No	34	50.7
Any treatment for diabetes before?	Yes	50	74.6
	No	17	25.4
Caregiver present?	Yes	57	85.1
	No	10	14.9
Relation of the caregiver	Partner	46	80.7
	Paid	4	7.0
	Relatives	7	12.3
Sex of the caregiver	Male	14	24.6
	Female	43	75.4
Anatomical location of the diabetic wound	Toes	49	73.1
	Sole	15	22.4
	Ankle	2	3.0
	Under the knee	1	1.5

**Table 2: Stage of foot wound according to the educational level of patients**

Educational level of patients	Stage of foot wound according to Wagner classification, <i>n</i> (%)					Total
	Stage1	Stage2	Stage3	Stage4	Stage5	
Illiterate	1 (7.7)	1 (7.7)	0 (0.0)	0 (0.0)	4 (50.0)	6 (9.0)
Primary school	6 (46.2)	2 (15.4)	9 (40.9)	7 (63.6)	2 (25.0)	26 (38.8)
Secondary school	4 (30.8)	4 (30.8)	5 (22.7)	2 (18.2)	0 (0.0)	15 (22.4)
High school	2 (15.4)	6 (46.2)	8 (36.4)	2 (18.2)	2 (25.0)	20 (29.9)
University	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
<b>Total</b>	13 (100)	13 (100)	22 (100)	11 (100)	8 (100)	67 (100)

**Table 3: Wagner stage distribution according to the educational level of caregivers**

Educational level of caregivers	Stage of foot wound according to Wagner classification, n (%)					Total
	Stage 1	Stage 2	Stage 3	Stage 4	Stage 5	
Illiterate	0 (0.0)	0 (0.0)	2 (10.0)	0 (0.0)	1 (12.5)	3 (5.3)
Primary school	5 (50.0)	4 (44.4)	8 (40.0)	4 (40.0)	6 (75.0)	27 (47.4)
Secondary school	1 (10.0)	2 (22.2)	4 (20.0)	4 (40.0)	0 (0.0)	11 (19.3)
High school	4 (40.0)	2 (22.2)	3 (15.0)	2 (20.0)	1 (12.5)	12 (21.1)
University	0 (0.0)	1 (11.1)	3 (15.0)	0 (0.0)	0 (0.0)	4 (7.0)
<b>Total</b>	10 (100)	9 (100)	20 (100)	10 (100)	8 (100)	57 (100)

There was no statistically significant correlation between the education status of the patients and the Wagner stage of the wounds ( $p=0.167$ ). 40.9% ( $n=9$ ) of 22 patients with Wagner stage 3 wound were primary school educated (Table 2).

Similarly there was no statistically significant correlation between the DF Wagner stage and education status of the caregivers ( $p=0.622$ , Table 3).

35 of the patients (52.2%) were smokers and 32 (47.8%) were non-smokers. There was a statistically significant relationship between the smoking status and the Wagner stage of the foot wound ( $p=0.002$ ). Depression history was also questioned. 25.4% of patients ( $n=17$ ) had a history of depression, 74.6% ( $n=50$ ) had not. There was no statistically significant relationship between the Wagner stage of the DF wound and a history of depression ( $p=0.076$ ).

50.7% ( $n=34$ ) of patients included in the study were using medications regularly and 49.3% ( $n=33$ ) were regularly followed up for diabetes. There was no statistically significant correlation between the follow up status of the patients and the Wagner staging of the wound ( $p=0.021$ ). Patient group consisting of regularly followed up patients had stage 3 wound level.

74.6% of the patients had treated previously for diabetic foot. Of 67 patients having a diabetic foot 30 (44.8%) were educated on their disease by a physician, 7 (10.4%) by a nurse, 2 (3.0%) by media and 5 (7.5%) by their friends and relatives. 23 (34.3%) of the patients had not received any education about their disease. No statistically significant correlation between a knowledge about the disease and the Wagner staging of the diabetic foot wound was detected ( $p=0.159$ ). Similarly there was also no significant correlation between the source of the knowledge and patients educational status ( $p=0.093$ ).

## DISCUSSION

Diabetic foot wounds are one of the most frequent reasons for applications to hospitals (5, 11) and are one of the most important causes of long hospital stay (5). Approximately 40 to 60% of lower extremity amputation cases are diabetic patients. Over 80 % of these amputation cases have deep foot wounds with gangrenation and superimposed by infection (5). Preventative measures for diabetic foot wounds and treatment decrease the rate of amputations and death up to 50% and prevent severe financial losses (5, 12).

Various methods were investigated to prevent diabetic foot wounds. Generally accepted ones are providing good blood glucose regulation, appropriate shoe wearing, foot care, toe-nail care, regular foot examinations and patient education (13, 14). Many studies especially on patient education showed that

patients at high risk for DF wounds and with a low Wagner stage wound might be treated without extremity amputation (15-17). Medical and also economical outcomes of patient education are well (18). Many scanning and prevention programs were put forth to detect and prevent diabetic foot wounds and patients at risk (18-20).

Studies conducted in various centers showed that the rate of neuropathy, which is the most important risk factor for diabetic foot syndromes, was present 50 to 100% (21,2 2). Though diabetic foot develops related to an organic cause like vasculopathy or neuropathy, the developing of these causes and advanced diabetic wounds are also related to background risk factors like social and economical level of the population and cultural behavior (17, 23). According to the results of a study five per seven of the patients had neurological problems and 76% of this group had socioeconomical problems (17). In another case control study it was found that previous foot amputation, peripheral neuropathy, peripheral vasculopathy were factors affecting development of foot wounds and that social or economical factors had no role in the advance of foot wounds (24).

In some populations education levels of patients and caregivers are low related to low socioeconomical status. The hypothesis of patients' foot wound stages could vary related to their education status was investigated in this study. Education levels of patients and caregivers were compared with the Wagner staging of foot wound, but no statistically significant correlation was found ( $p>0.05$ ). In a multicentric study aiming epidemiological investigation it was detected that patients with an education status more than 5 years and with high income were less accepting foot health education, but were keeping regular follow up (25). In an investigation reviewing randomized clinical studies and cohort studies conducted between 1980-2004 it was put forth that patient education on DF wounds and regular foot examinations were effective methods preventing foot wounds (26). In a different study investigating the efficacy of patient educations on foot wounds, it was detected that DF education was beneficial, but knowledge was forgotten soon and educations lose their affectivity if not repeated (27).

In many different studies education status of patients and caregivers was found to be significantly correlated with the stage of DF wound; this was no so in our study and there maybe some reasons for this. Health stuff may think that a well educated patient having a diabetic foot wound or at risk of a diabetic foot wound would have enough knowledge on this subject and spend less time for education or oppositely they may spend more time to educate a patient with a low level of education and try more to educate the patient on diabetic foot.

On the other side a patient with a low educational status may attach more importance to the education given by health staff and care better. Patients included in this study were mostly illiterate or primary school graduate patients. There was no university graduate and a few high school graduates, this might have affected the results of the analysis. Decreased patient concordance, impaired regular dressing of wound by patient and impaired medication taking, not keeping physicians advice, trauma to the diabetic foot may also be some of the causes negatively affecting DF and statistical analysis besides education status.

## CONCLUSION

In the study it was found that education status of the patient and the caregiver had no effect on the stage of the wound, but regular follow up and patient education were improving factors regarding the stage of the wound. Diabetic foot is a disease with mortality, morbidity and treatment costs. It additionally causes working ability loss and damages social relations and causes psychological damage to the patient and his social environment. More than half of the lower extremity amputations maybe prevented with diabetic patient education and appropriate foot care, so it is necessary that patients and physicians be more careful on this subject. Lower extremity amputation rates are still high, because diabetic foot education is not very common in our country, patients and physicians give not enough care to the subject, and patients apply to a hospital after an advanced infection.

Whatever the education level is, a continuing patient education program on DF disease for patients at risk for diabetic foot wound, and providing regular follow ups will decrease the rates of extremity amputations.

Multicentric studies including more homogenous samples of population to a more correct representation are needed to detect if there is any correlation between diabetic foot wound stage and education status of patients or caregivers.

Diabetes disease initially should be recognized before the appearance of the complaints and attempts should be made in the early period for the prevention of complications. High-risk individuals must determined for early diagnosis and prevention whether to delay the appearance of diabetes, and this persons must be provided in accordance with a permanent change in behavior.

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