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Tinea Pedis Tedavisinde, Anadolu Propolis Kullanımının, Tinea Pedis Hemşirelik Eğitiminin ve Geleneksel Tıbbi Tedavinin Değerlendirilmesi: Üç Kollu Randomize Çalışma

Combination Treatment with Conventional Medical Therapy with External use of Anatolian Propolis or Nursing Education for Tinea Pedis: A Three-Arm Randomized Controlled Trial

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ÖZET

Amaç: Bu çalışmada; tinea pedis tedavisinde, Anadolu propolis ekstresinin topikal kullanımının, hemşirelik eğitiminin ve geleneksel tıbbi tedavinin değerlendirilmesi amaçlanmıştır.

Yöntem: Bu üç kollu, randomize, kontrollü bir klinik çalışmadır. Örneklem büyüklüğü (n:96) güç analizi ile belirlenmiştir. Bir gruba plasebo, birine propolis, diğerine ise propolis eğitimin uygulanmıştır. Katılımcılar tinea pedis tanısı alan yetişkin hastalardır. Araştırma için gerekli izinler ve katılımcılardan yazılı onamlar alınmıştır. Veri toplama araçları sosyodemografik veri formu, hekim ve hasta genel değerlendirme formu, Türk Dermatolojik Yaşam Kalitesi İndeksi'dir.

Bulgular: Hasta ve doktor değerlendirmelerine göre tinea pedis lezyonlarında en fazla iyileşmeyi "eğitim" (%71,9) ve "propolis" (%87,1) grupları göstermiştir. Dermatolojik Yaşam Kalitesi İndeksi puan ortalamaları ilk ve son değerlendirmelerde farklı bulunmuştur. Hesaplanan etki büyüklüğü d>0,5 olarak bulunmuştur. Hastaların değerlendirmesinde eğitim grubu "büyük bir iyileşme" (%71,9) yaşadıklarını belirtmiştir. Doktorun değerlendirmesine göre Anadolu propolisi uygulanan grup %78,1 oranıyla "en fazla gelişme" göstermiş olup, her iki değerlendirmede de gruplar arasındaki fark anlamlı bulunmuştur. (p<0,05).

Sonuç: Çalışmaya dahil edilen üç grubun dermatolojik yaşam kalitesi ile hasta ve doktorun değerlendirmeleri arasında farklılık bulunmaktadır. Hastaların ayak bakımı konusunda eğitilmesi sağlığın korunması ve geliştirilmesi açısından önemlidir.

Anahtar Kelimeler: Propolis, ayak bakımı, hemşirelik eğitimi, ayak mantarı

ABSTRACT

Objective: In this study; it was aimed to evaluate the external use of Anatolian propolis extract and the effect of nursing education in patients diagnosed with tinea pedis.

Methods: This is a three-arm, randomized, controlled clinical trial. Sample size (n=96) was determined by power analysis. One group received placebo, another received propolis, and the third received education Participants were adult patients diagnosed with tinea pedis. Necessary permissions for the study and written consent were obtained from the participants. Evaluation tools are sociodemographic data form, physician and patient global evaluation form, and The Turkish Dermatological Quality of Life Index.

Results: According to patient and doctor evaluations, the "education" (71.9%) and "propolis" (87.1%) groups showed the greatest improvement in tinea pedis lesions. Dermatological Quality of Life Index score averages were different in the first and last evaluations. The calculated effect size was found to be d>0.5. As a result of the research, it was determined that the education group experienced a "great improvement" (71.9%). According to the doctor's evaluation, the group that received Anatolian propolis showed the "greatest improvement" with a rate of 78.1%, and the differences between the groups were significant in both evaluations (p<0.05).

Conclusion: There is a difference between the dermatological quality of life of the three groups included in the study and the evaluations of the patient and the doctor. Educating patients about foot care is important for the protection and development of health.

Keywords: Propolis, podiatry, nursing education, tinea pedis

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INTRODUCTION

Tinea pedis is a fungal infection that occurs on the soles, between the toes, and on the nails of the feet (Kara Polat et al., 2017). Foot hygiene and moisture are two important factors involved in fungal infections that develop on the feet (Shemer et al., 2016; Toukabri et al., 2016). Sharing showers, bathrooms, pools, shoes, socks, and personal care products, along with inadequate foot care, contributes to the development of tinea pedis (Akdemir et al., 2020). The medical treatment of tinea pedis is often tailored to the patient, and accordingly, imidazole, allylamine and benzylamine groups, and other antimycotic pharmacological agents are used. In addition to medical treatment, alternative treatment methods are recommended. One such product used as an alternative treatment for tinea pedis is Anatolian propolis extract (Kara Polat et al., 2017).

Propolis is a substance derived from honeybees, consisting of a mixture collected from tree bark, plant buds, and sprouts (Oryan et al., 2018). This extract protects the honeybee colony from diseases and microbial infections, creating a hygienic habitat by covering the hive walls and larval cells (Karabaş et al., 2020; Silici et al, 2019). Several dermatological studies have demonstrated the antiseptic, antibacterial, antifungal, and analgesic properties of this extract (Lima Cavendish et al., 2015; Kurek-Gorecka et al.,2020; Mohdaly et al., 2015; Veiga et al. 2018). The antifungal property of the extract is due to its components, which include pinocembrin, pinobanksin, quercetin, kaempferol, caffeic acid, p-coumaric acid, and terpenes (Kurek-Gorecka et al., 2020).

Propolis has been used in different areas due to its antifungal effect (Aljuboori et al., 2022; Cerqueiraet al., 2022; Dursun et al., 2019; Ünal & Erdal, 2020). One of them is fungal infections in the urinary system (Aljuboori et al 2022). In dermatological problems, medical treatments may be insufficient, necessitating supplementary therapeutic approaches. One of the recommended products in this case is propolis (Ünal &Erdal, 2020). It has been explained that propolis has an antifungal effect, especially in skin diseases. (Cerqueira et al., 2022). Anatolian propolis has this chemical content (Dursun et al., 2019).

A contributing factor for the occurrence of tinea pedis is inadequate and inappropriate foot care (Türkal et al., 2019). Hence, providing education regarding this factor is recommended and considered an important component for ensuring the quality of life of individuals (Karaca et al, 2022). Nursing education regarding foot care considerably contributes in reducing issues associated with tinea pedis as well as in the recovery of the patients (Hemmati et al., 2017; Singh et al., 2020). General trends of nursing education reducing mortality and morbidity, supporting recovery (Kruse et al., 2017; Moriyama et al., 2013; Xu et al., 2017), and reducing complications and treatment costs have also been observed (McLendon et al., 2017;, Park et al., 2014). Additionally, nursing education regarding self care enables individuals to gain the desired behavior changes and improve their quality of life (Fazio et al., 2019; Kivelave et al., 2014; Sherifali et al., 2016). Furthermore, it is recommended to evaluate the dermatological quality of life along with the general quality of life of individuals, especially since difficulties arising because of tinea pedis can adversely affect the quality of life (Atay, 2019). Hence, it is recommended to educate individuals regarding foot care to prevent the development of foot problems (Adiewere et al., 2018).

Research Purpose

In this study, it was aimed to evaluate the external use of Anatolian propolis extract and the effect of nursing education in patients diagnosed with tinea pedis. The hypotheses of this study are as follows:

H1: There is a difference among the dermatological quality of life of the three groups after treatment

H2: There is a difference between the patient evaluations of the three groups after treatment

H3: There is a difference between the doctor's evaluations of the three groups after treatment

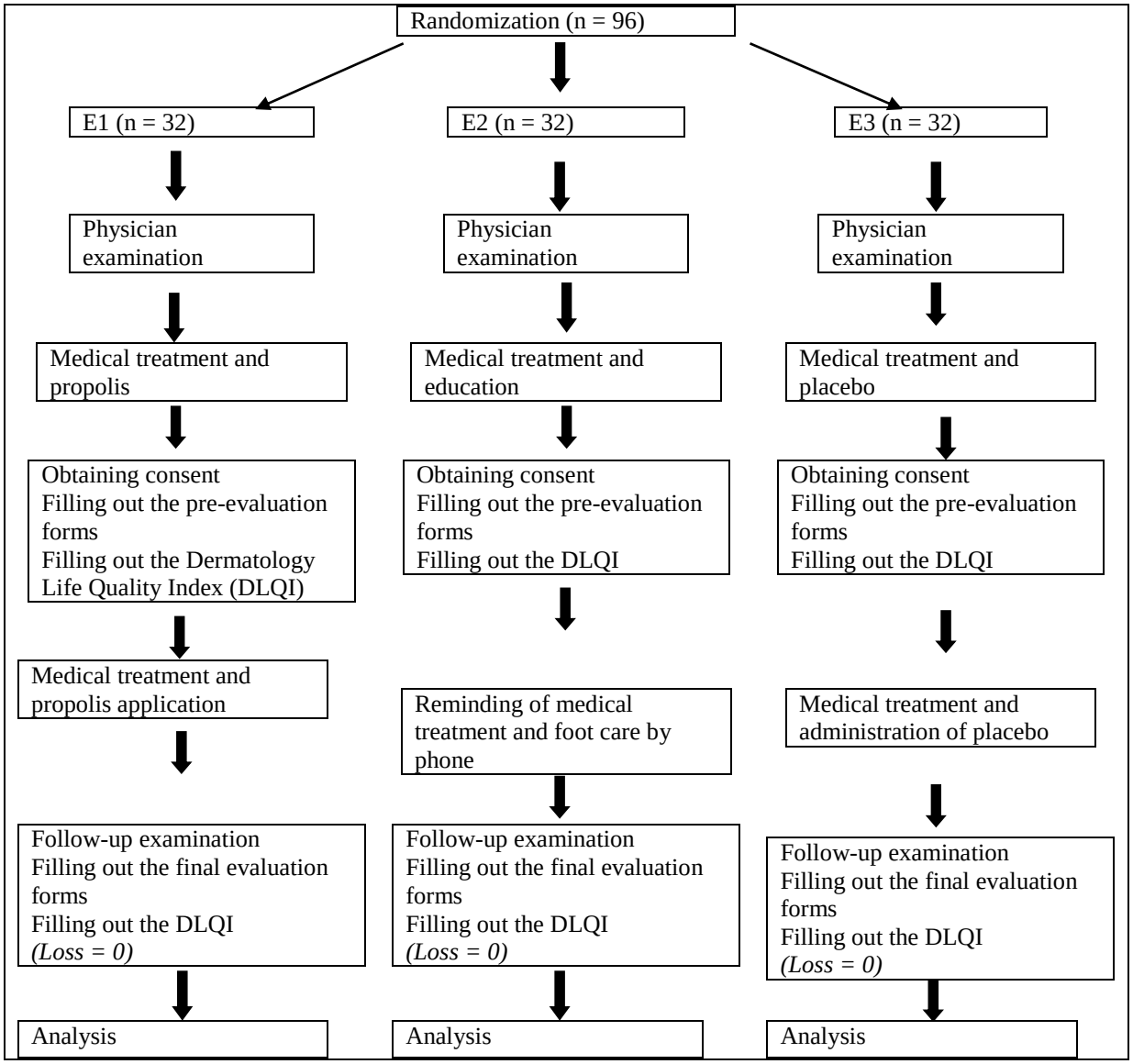
METHOD

Research type

This study was planned as a randomized placebo-controlled clinical trial.

Study population and sampling

Sample size was calculated using data from a reference study. In this study, the coping status with small wounds on the feet of the participants who were given podiatry education was examined. The score of those who have a secondary education level is 2.20±0.56. The number of participants in the study was 33 in the experimental groups and 30 in the control group. kopUsing these data, η 2was calculated as η 2= t2/ t2 +(n1+n2-2)=0,09. Study's sample via G*Power (3.1.9.4, Repeated measures, within- between interaction). Program was determined to be 27 people with a 0.05 margin of error, 85% power, and 0.314 effect size. Considering possible losses, the number was increased by 18% according to the literature (31) and the sample size was determined to be 96, with at least 32 people in each group. There were no changes in the research results after the start of the research. During the pandemic, individuals avoided hospital visits unless absolutely necessary. Therefore, the collection of data took longer than planned. No participants were lost from the groups, and the study was successfully completed with 96 individuals The post-hoc power of the study is 93%.



Scheme 1: Randomization (55)

Randomization

The randomization table was made by an independent statistician. A "Random.Org" web page was used for the application.

Randomization type

Stratification was not performed simple randomization was applied. Each patient diagnosed with tinea pedis was assigned a sequential number starting from 1. Patient 1 was assigned to E1 (Experimental 1), patient 2 to E2 (Experimental 2), and patient 3 to E3 (Experimental 3). This sequence was continued in the same order.

Inclusion Criteria: The inclusion criteria of the study were patients diagnosed with tinea pedis by a dermatology specialist, aged 18 years or older, who consented to participate and were accessible by phone.

Exclusion Criteria: The exclusion criteria of the study included receiving oncological treatment, not using the phone actively, being pregnant, breastfeeding, experiencing health problems (dementia, Alzheimer's disease, psychiatric problems, etc.) that would negatively affect communication, understanding, and perception, having an immunosuppressive health problems, receiving systemic steroids, and dermatological problems that may affect the treatment process of the study (psoriasis, dermatitis, contact, etc.).

Dependent Variables: The global assessment scores of the doctor and patients at the last examination are considered the Dermatology Life Quality Index (DLQI) score.

Independent Variables: The independent variables comprised age, sex, body mass index (BMI), chronic diseases, educational status, and site of the lesion.

Allocation concealment mechanism

After patients were diagnosed in the outpatient clinic, they were recorded by the doctor by giving numbers. The secretary was given a pre-formed randomization table (E1: 1,4,7,10...94, E2: 2,5,8,10,14...95, E3: 3,6,9,12,15.. .96). The secretary of the outpatient clinic referred the patient to the nurse according to this table. The dermatologist and nurse were not involved in the assignment of patients to the groups; however, they were aware of the patient groups after randomization. The nurse was aware of which group the patient was in because the patient to whom she was supposed to provide education was referred to her. The dermatologist learned the patient group after the study was completed and the patients were checked. Statistical analysis of study data were performed by an independent statistician.

Implementation

1. The patient was examined by the doctor in the dermatology outpatient clinic.
2. After diagnosis of tinea pedis, if the patient met the criteria, their consent was obtained by the doctor and the first questionnaires were administered. The patient was assigned a participant number by the doctor.
3. The same patient was referred to the secretary. The secretary looked at the randomization chart, directed it to the nurse by sequence number. Informed the nurse in which group the patient belonged.
4. The nurse applied the appropriate intervention (propolis, education, placebo) to the patient.
5. The nurse took the phone number of the patient in the "education" group and spoke on the phone every two weeks, supporting the podiatry education.
6. The patients came for control after 8 weeks (the duration of medical treatment). The final questionnaires were administered to the patients who came for control.

Blinding

The data were sent to the statistician according to groups (E1, E2, E3), so that the people who assigned the patients to the groups and the statistician were blinded. The dermatologist was blinded in the examination; however, blinding was not possible during the control examination. The nurse and patients were not blinded. The secretary of the polyclinic was not blinded, she was not involved in the research. Therefore, this was an open-label, randomized, placebo-controlled clinical trial (Scehemer et al., 2016).

Data Collection Forms

Patient data were collected between February

2021 and February 2022 at a public hospital's dermatology outpatient clinic using the socio-demographic data form, it completed by doctors and patients and The Turkish Dermatological Life Quality Index.

Socio-Demographical Data Form: It consisted of 15 questions regarding the socio-demographic characteristics (age, sex, educational status), as well as the health status and clinical problems of the patients, including chronic disease, erythema, itching, maceration, and fissures on the foot, ıt was created by the researchers based on previous literature (Afkhamizadeh et al 2017; Fazio et al., 2018; Hemmatiet al., 2018;Kara Polat et al., 2017).

Global assessment of the patient: The patient was expected to evaluate the severity of condition (severe, moderate, mild) during the first examination. During the follow-up examination, the patient was asked to rate their own improvement on a scale of 1–5, with each point representing the following statements, respectively: much worse, slightly worse, no change, slight improvement, and significant improvement and significan (Kara Polat et al., 2017).

Physician's global assessment: This evaluation enabled the dermatologist to assess the patients' problem. During the first assessment the doctor evaluated the lesion as observed. During the follow-up examination, the physician scored the change in the lesion and made an evaluation as cleared (100% regression), excellent (99%–90% regression), good (50%–89% regression), moderate (25%–49% regression), or unchanged/worse (<25% regression). In the follow-up of the clinical status of the patients, each item was evaluated as "mild," "moderate," or "severe" during the first assessment and as "same," "mild," or "absent" during the last examination (Kara Polat et al., 2017).

Turkish Dermatological Life Quality Index: This scale was developed by Gürel et al. (2004). The scale comprises six subdimensions of dermatological problems, including social life (fifth and seventh questions), emotional life (first, second, and fourth questions), daily activities (third and eleventh questions), symptoms (sixth question), cognitive functions (ninth and tenth questions), and sexual life (eighth question). It enables the evaluation of the problems experienced by the patients in the last month. The five-point Likert-type scale comprises 11 questions. All questions are answered using options such as "all the time/always," "often/frequently," "occasionally/sometimes," "rarely," and "at no time/never." The score range for each item is 0–4 and the total score varies between 0 and 44. The Cronbach's α coefficient of the scale was 0.77–0.84. A low score indicates high quality of life (33). In this study, the Cronbach's α coefficient was 0.91 during the first measurement and 0.95 during the last measurement.

Study Settings

Patient data were collected between December 2021 and February 2022. Data collection took place at the dermatology outpatient clinic of a state hospital in Anatolia

Intervention

Each patient who applied to the outpatient clinic was first examined by a dermatologist and medical treatment was recommended. If the patient met the inclusion criteria, the patient was informed about the study by the dermatologist. The patient was given 30 minutes to decide whether to participate in the study. After the patient announced that he agreed to participate in the study, the dermatologist obtained the patient's written consent and filled in the forms used in the initial examination for the study. During the first examination, all patients were prescribed the same medical treatment regardless of their group (sertaconazole nitrate (2%), 1×1, externally; terbinafine hydrochloride (250 mg), 1×1, orally), which they were adviced to continue until the follow-up date. Sertaconazole nitrate is a topical cream containing 20 mg of sertaconazole nitrate. Terbinafine hydrochloride is a tablet containing 250 mg of terbinafine hydrochloride, administered orally.

The patients were then directed to the outpatient clinic secretary who randomized them into different groups and conveyed the information

to the nurse. Based on the patients' randomized group assignments, the nurse provided Anatolian propolis, placebo, or foot care education to the different groups.

Application of Anatolian Propolis

Anatolian propolis was applied to the E1 patient group. The product used in the study was BEE'O UP (BEE&YOU) 30% Propolis Extract. It is an ethanol–water–propolis extract containing Anatolian propolis. The product comprised pinosembrin (1036.2 mcg/ml), quercetin (186.3 mcg/ml), caffeic acid (15.20.0 mcg/ml), p-coumaric acid (406.8 mcg/ml), which are known to possess antifungal properties. The product was formulated at the company's research and development center (BEOPropolis). In the E1 group, propolis extract was provided in ready-made droppers and recommended to be applied to fully cover the affected area (preferably using two–five drops) twice a day in intervals of 12 hours. The Anatolian propolis extract was kept ready for each patient in 20 ml, opaque droppers and was applied by the research nurse who provided necessary information regarding its use to the patients. It was stated that Anatolian propolis extract and pomades prescribed during the medical treatment should be applied at separate times.

Implementation of Nursing Education

Nursing education was provided to the E2 patient group. First, a patient education booklet was created by the researchers, which included information on foot hygiene, such as daily washing with warm water, trimming nails in a straight line, treating calluses and wounds appropriately, selecting proper shoes and socks and maintaining their hygiene, and correctly applying creams and moisturizers. The bookled had a readability index of 82, indicating suitability for fifth and sixth graders (Ateşman et al., 1997). The "multiple peer-reviewed content validity" method was used for evaluating the patient education booklet. To evaluate its validity, the booklet was reviewed by ten faculty members who are experts in their respective fields, and it received their approval. The booklet's content validity was assessed using the Davis technique, in accordance with professional judgments (Güleç et al., 2013). The content validity of the items varied between 0.80–1.00, and the total content validity score was 0.91.A preliminary application was made with eight patients to determine whether the prepared booklets and data collection forms were understandable. The preapplication patients were not included in the study. The education booklet was utilized by the nurse to provide foot care education to the patients. The patients were followed-up via phone by a nurse every 15 days after the education and were continued to be informed regarding the regime and had their questions answered as well. Each patient was called by the nurse four times until the day of the face-to-face follow-up.

A preapplication of the prepared booklets and data collection forms was performed in eight patients in the hospital where the application was subsequently conducted. The preapplication patients were not included in the study. The training booklet was utilized by the nurse to provide foot care training to the patients. The patients were followed-up via phone by a nurse every 15 days after the training and were continued to be informed regarding the regime and had their questions answered as well. Each patient was called by the nurse four times until the day of the face-to-face follow-up.

Placebo

The E3 patient group was subjected to a placebo. The product used as the placebo was sterile distilled water, which was provided to the E3 patient group in droppers and recommended to be dripped on the affected area so as to completely cover it (preferably two to five drops) twice a day at intervals of 12 hours. The patients were instructed that the use of the placebo should not coincide with that of pomades. Sterile distilled water was kept ready for each patient in 20 ml, opaque droppers and provided to them by the research nurse who also provided them with the necessary information regarding its use. The placebo was recommended to be used till the date of the follow-up.

It was ensured that all the groups applied the recommended treatment during the medical treatment period (approximately 2 months). Thus, the treatment flow of the patient, date of the follow-up, etc. were not affected. At the end of the treatment period, the final evaluations of the patients were performed using the final examination forms. The differences between the initial and final situation of the lesions within and among the groups were compared.

Primary and secondary outcome measures; the physician's global assessment, the patient's global assessment, and the patient's dermatological quality of life. The first evaluation was made at the first examination and the final evaluation was made at the examination after 8 weeks. It was evaluated with the forms followed in this interval.

Data Analysis

SPSS (Statistical Package for the Social Sciences) version 25.0 was used to analyze the study data. Descriptive statistics were analyzed using frequency, percentage, mean, standard deviation, and minimum and maximum values. Skewness and kurtosis values were examined for normality distribution. While age, BMI, sex, and educational status were normally distributed, chronic disease status, site of the lesion, the degree of problem of the patients, severity of the lesion according to the patient and doctor, and the first and last total DLQI scores were not normally distributed. Per the normality of distributions, analyses were performed using one way ANOVA, Kruskal–Wallis, Fisher–Freeman–Halton exact (Bonferroni correction), and Wilcoxon signed-rank tests. In the first and last DLQI scores of the groups, the Cohen's effect size was separately calculated for each of the three groups.

Groups' characteristics were compared using one way ANOVA and Kruskal–Wallis and Pearson chi-square tests, while descriptive statistics were given as numbers and percentages. The Fisher Freeman Haldon Exact test was applied because more than 20% of expected values in the chi-square analysis were below 5% (Özdamar, 2018). The Bonferroni correction was applied to minimize Type 1 error (Donald et al., 2015). Although the patients' first and last mean DLQI scores, their chronic disease status, and disease-related problems differed ($p>0.05$), their other parameters were similar ($p<0.05$).

RESULTS

The total number of participants in this study was 96. Each group consisted of 36 participants, and there were no dropouts. The study was conducted between February 2021 and February 2022.The data collection phase of the study was terminated when the planned number of participants. No complications were observed in any of the participants. The results are presented below with tables and explanations.

The mean age of the whole group participating in the study was 51.55±13.78 years, and the mean BMI was 27.35±4.52. The participants consisted of individuals without chronic disease (70%), primary school graduates (67.7%), those with lesions between their toes (56.3%), those experiencing itching (69.8%), and individuals with mild lesions (56.3%) and severe erythema (51.0%). Group data are presented in Table 1. In the first and last DLQI scores of the groups, differences between the emotional life, daily activities, symptoms, and cognitive processes subdimensions and total scores were observed ($p<0.05$). The placebo group scored higher in all the subdimensions. The last total DLQI scores were the highest in the placebo group and the lowest in the education group. No significant difference was observed in the first total DLQI scores ($p>0.05$); however, there was a significant difference in the last total DLQI scores among the groups ($KW=14.132$, $p=0.001$). The Wilcoxon signed-rank test was applied to compare the first and last DLQI scores of the groups, revealing a significant difference in mean scores ($Z=-5.169$, $p<0.001$) (Table 2).

Cohen's d effect size was calculated for the mean the total last total DLQI scores (Cohen's dPropolis-education=0.502578; Cohen's dPropolis-placebo = 0.681548; Cohen's dEducation-placebo = 0.890523).

Table 1: Distribution of the characteristics of all the groups (n = 96)

		E1 (Propolis, n = 32)		E2 (Education, n = 32)		E3 (Placebo, n = 32)		Test and p value
Variables		**x̄ ± SD [Min–Max]**		**x̄ ± SD [Min–Max]**		**x̄ ± SD [Min–Max]**		
Age (years)		53.59 ± 11.31 [26–83]		50.69 ± 15.29 [18–83]		50.38 ± 11.31 [26–71]		F=0.525 p=0.593[a]
BMI		27.08 ± 3.50 [18–37]		27.19 ± 5.23 [17–39]		27.78 ± 4.75 [19–38]		F=0.216 p=0.806[a]
		n	**%**	**n**	**%**	**n**	**%**	
Sex	Female	20	62.5	20	62.5	21	65.6	x̄ = 0.090 p = 0.956[c*]
	Male	12	37.5	12	37.5	11	34.4	
Educational status	Illiterate	3	9.4	2	6.3	6	18.8	x̄ = 4.514 p = 0.608[c*]
	Primary education	20	62.5	24	75.0	21	65.6	
	Secondary education	6	18.8	3	9.4	3	9.4	
	Higher education	3	9.4	3	9.4	2	6.3	
Chronic disease status	No	17	53.1	25	78.1	26	81.3	x̄ = 13.968 p = 0.030[c*]
	DM	4	12.5	5	15.6	4	12.5	
	COPD	6	18.8	2	6.3	1	3.1	
	Other	5	15.6	0	0.0	1	3.1	
Site of the lesion	Finger	19	59.4	20	62.5	15	46.9	x̄ = 2.933 p = 0.817 [c*]
	Between the fingers	8	25.0	7	91.9	12	37.5	
	Sole of the foot	3	9.4	3	9.4	4	12.5	
	Multiple sites	2	6.3	2	6.3	1	3.1	
Patient's problems	Itching	25	75.0	24	75.0	19	59.4	x̄ = 12.975 p = 0.043[c*]
	Pain	5	15.6	5	15.6	11	34.4	
	Hemorrhage	0	0.0	3	9.4	2	6.3	
	Other	3	9.4	0	0.0	0	0.0	
Severity according to patient	Minor	24	75.0	17	53.1	13	40.6	x̄ = 9.407 p = 0.052[c*]
	Middle	5	15.6	13	40.6	14	43.8	
	Severe	3	9.4	2	6.3	5	15.6	
Problem according to doctor	Erythema	17	53.1	14	43.8	18	56.3	x̄ = 1.273 p = 0.866[c*]
	Maceration	11	34.4	14	43.8	10	31.3	
	Fissure	4	12.5	4	12.5	4	12.5	

[a]One way ANOVA, [b]Kruskal–Wallis test, [c]Fisher–Freeman–Halton exact test, *Bonferroni correction
BMI, body mass index; DM, diabetes mellitus; COPD, chronic obstructive pulmonary disease

According to Cohen's d effect size, the effect size was medium in the propolis-education and propolis-placebo comparisons, while it was strong in the education-placebo comparison. A significant difference was observed among all groups; however, the difference between the education and placebo groups was the most pronounced. The change in the total test scores is shown in Figure 1. The Fisher-Freeman-Halton exact test and Bonferroni correction were used to compare patients' and physicians' evaluations of the lesions after medical treatment. In the patients' subjective evaluation, the education group stated that they experienced "a major improvement" (71.9%). According to the doctor's evaluation, the group receiving Anatolian propolis showed the "most improvement" with a rate of 78.1%. The difference between the groups was significant in both the evaluations ($p<0.05$) (Table 3).

Table 2: Distribution and comparison of the 1st week and 8th week DLQI scores and subdimensions of the groups

Variables	E1 (Propolis)		E2 (Education)		E3 (Placebo)		Test and p value	Test and p value
	x̄ ± SD	Mean rank	x̄ ± SD	Mean rank	x̄ ± SD	Mean rank		
1st week DLQI	8.46 ± 5.83	46.50	8.71 ± 9.00	42.72	15.12 ± 13.44	56.28	KW = 4.055 p = 0.132	Z = −5.169[b] p = 0.000
8 st week DLQI	6.34 ± 4.01	54.86	3.65 ± 6.42	33.66	13.40 ± 14.09	56.98	KW = 14.132 P = 0.001	
Subdimensions								
Social life–first	0.90 ± 1.32	44.36	1.40 ± 2.02	47.11	2.15 ± 2.64	54.03	KW = 2.473 p = 0.290	Z= −1.950[b] p = 0.051
Social life–last	0.68 ± 1.02	46.38	0.78 ± 1.58	43.19	2.18 ± 2.63	55.90	KW = 4.614 p = 0.100	
Emotional life–first	3.68 ± 2.71	48.36	3.28 ± 3.40	43.11	4.84 ± 3.96	54.03	KW = 2.502 p = 0.286	Z = −4.680[b] p = 0.000
Emotional life–last	2.68 ± 1.90	52.14	1.65 ± 2.65	35.27	4.50 ± 4.17	58.09	KW = 12.161 p = 0.002	
Daily activities–first	1.31 ± 1.89	44.39	1.12 ± 1.64	42.44	2.65 ± 2.59	58.67	KW = 7.316 p = 0.026	Z = −2.795[b] p = 0.005
Daily activities–last	0.84 ± 1.13	45.73	0.62 ± 1.18	40.31	2.31 ± 2.55	59.45	KW=9.705 p=0.008	
Symptoms–first	1.06 ± 1.21	43.09	1.18 ± 1.35	44.84	1.93 ± 1.60	57.56	KW = 5.591 p = 0.061	Z=−5.001[b] p = 0.000
Symptoms–last	0.75 ± 0.76	54.22	0.18 ± 0.73	34.16	1.28 ± 1.52	57.13	KW = 17.200 p = 0.000	
Cognitive functions–first	1.21 ± 1.21	46.13	1.37 ± 2.21	42.53	2.75 ± 2.90	56.84	KW = 5.073 p = 0.079	Z = −3.342[b] p=0.001
Cognitive functions–last	1.09 ± 1.08	55.13	0.25 ± 0.80	35.06	2.12 ± 2.79	55.31	KW = 14.821 p = 0.001	
Sex life–first	0.28 ± 0.45	46.95	0.34 ± 0.60	47.67	0.78 ± 1.36	50.88	KW = 0.576 p = 0.750	Z = −0.194[c] p = 0.846
Sex life–last	0.28 ± 0.45	49.17	0.15 ± 0.62	40.65	1.00 ± 1.45	55.66	KW = 8.613 p = 0.013	

KW: Kruskal–Wallis H Test; DLQI: Dermatology Life Quality Index; SD: standard deviation
[a]Wilcoxon Signed-Rank Test; [b]Based on positive ranks; [c]Based on negative ranks.

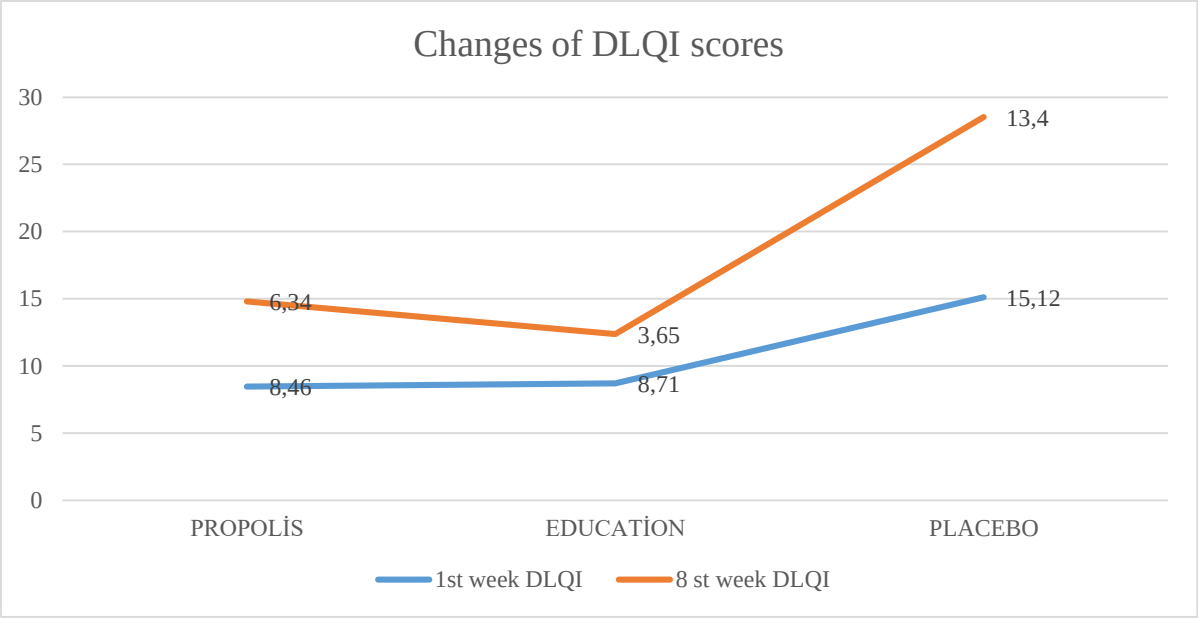


Figure 1: Changes in the first and last measurements of the Dermatology Life Quality Index (DLQI) scores of the groups

Table 3. Comparison of the doctor's and the patients' evaluations of the improvements in the lesions of the groups

		E1 (Propolis)		E2 (Education)		E3 (Placebo)		Test and p value
Variables		**n**	**%**	**n**	**%**	**n**	**%**	
Final assessment according to the patient	Major improvement	20	62.5	23	71.9	4	12.5	$\bar{x}$ = 26.891 p = 0.000[a]
	A little improvement	11	34.4	8	25.0	23	71.9	
	Same as before	1	3.1	1	3.1	5	15.6	
Final assessment according to the doctor	Excellent (90%–99% improvement)	25	78.1	12	37.5	2	6.3	$\bar{x}$ = 56.604 p = 0.000 [a]
	Good (50%–89%)	7	21.9	20	62.5	15	46.9	
	Moderate (25%–49%)	0	0.00	0	0.00	14	43.8	
	Worse/no improvement (<25%)	0	0.00	0	0.00	1	3.1	

[a] Fisher–Freeman–Halton exact test, Bonferroni correction

DISCUSSION

Patients diagnosed with tinea pedis often resort to various alternative treatment methods, such as cologne (27.0%), salt water (25.7%), vinegar (17.8%), henna (7.2%), and olive oil (6.6%). Generally, it has been reported that 55.9% of patients with tinea pedis use at least one alternative method for treatment purposes. One such product is propolis, which has been reported to accelerate foot wound healing (Chylińska-Wrzos et al., 2017).Regular use of propolis for four weeks resulted in a reduction in foot lesion size and an increased healing rate (Afkhamizadeh et al., 2017). Propolis extract exhibits regenerative, restorative, and protective properties against external factors such as microorganisms and irritation, while enhancing skin hydration (Sawicka et al.,2013). In addition, propolis has been reported to provide healing effects in 50% of toenail fungal infections because of its antifungal property (Veiga et al., 2018). It has been reported that red propolis is effective against candida infection in laboratory conditions in stomatitis occurring because of prosthesis (Sokolonski et al., 2021). Another study showed that Anatolian propolis was effective against fungi isolated from blood culture (Mutlu Sariguzel et al., 2016). This antifungal property is because of the presence of terpenyl esters (Dudoitet al., 2020), pinocembrin, chrysin, galangin, and coumaric acid (Wozniak et al, 2020). The antifungal effect of Anatolian propolis has been emphasized as a supplement to medical treatment, especially for dermatological disorders (Ünal et al., 2020). To the best of our knowledge, this is the first study wherein Anatolian propolis was used in the treatment of tinea pedis. At the end of 8 weeks, the doctor re-examined the patient and assessed lesionand appearance. In this study, according to the dermatologist's evaluation, the most improvement in the lesions was observed in the propolis-treated group. Hence, it can be concluded that propolis promotes healing in tinea pedis.

Foot problems affect an individual's dermatological quality of life. In patients with dermatological problems in their feet, the dermatological quality of life is adversely affected due to cosmetic, physical, and social problems. If the problem include fungal diseases, there are different reasons that adversely affect the dermatological quality of life of individuals (Stewart et al., 2021). One of these is the anxiety of recovery during the treatment process and the effect of as well as social, physical, and cosmetic problems (Lipner et al., 2019). Inadequate foot care has a significant effect on the development of foot problems. In a study by Aboelezz et al., 2019

the incidence of tinea pedis in the group with inadequate foot care behavior was 53.4%.It has been reported that self-management and foot hygiene are insufficient in individuals with foot health problems (Jiang et al., 2019; Subrata et al., 2020; Sulistyo et al., 2018). Inadequate foot care contributes to the development of tinea pedis, negatively impacting quality of life (Kang et al., 2019; Kara Polat et al., 2017).

The quality of life of these individuals can be increased with nursing foot care education. It has been reported that the dermatological quality of life of individuals with dermatological problems increases after foot care education is given and the continuity of the education positively affects the results (Şahin et al., 2022). It is also known that foot care education creates positive behavioral changes in individuals' foot care behaviors and that repetition of education increases this contribution (Rahaman et al., 2018). Foot care education covers feet, shoes (Liu et al., 2020) and hygiene (Farhan et al., 2021). Failure to comply with proper foot hygiene leads to the growth of microorganisms in the foot, fungal infection and the strong formation of the existing infection. Failure to comply with proper foot hygiene leads to the growth of microorganisms in the foot, fungal infection and the strong formation of the existing infection (Farhan et al., 2021). Foot care education includes feet, shoes (Liu et al., 2020) and hygiene (Farhan et al., 2021).

In our study, a group of patients was given foot care education and the patients were reminded of the education by phone every 2 weeks and their questions were answered. After the treatment, the DLQI scores of the three groups were examined and it was seen that the score of the group that received education was the lowest. The dermatological quality of life scale shows the extent to which the quality of life of individuals is affected by their dermatological problems. A decrease in the patient's score means that the quality of life is less affected (Gürel et al., 2005). In this study, the DLQI score decreased more in the education group and the difference between the groups was found to be significant. In addition, both the physician and the patient stated that the improvement was greater in the education group. It was thought that foot care education contributed positively to the dermatological quality of life by both improving.

A study that associated tinea pedis, which is an important public health problem, with education stated that 40% of the participants did not receive sufficient information regarding the disease and generally, were not well-informed about foot care. Education regarding proper foot care (washing, drying, moisturizing, nail cutting, etc.) was emphasized to increase awareness about the same in individuals (Kara Polat et al., 2017). In a study by (Frida et al., 2017) involving farmers, it was reported that while the rate of those exhibiting appropriate foot care behavior before receiving the foot care education was 38%, it increased to 67% after the education, thereby emphasizing the importance of the education. Tinea pedis is observed in up to 30% of patients who do not exhibit positive foot care behavior. In these patients, deficiencies in foot care pave the way for other infections and hinder the resolution of existing problems diabetic foot wounds, non-healing lesions, foot and nail infections, bad foot odor, etc.) (Işıkgoz Tasbakan et al., 2017). According to the results of our study, the group that received education showed the most improvement in foot lesions. Therefore, foot care education contributed to the recovery of the participants, and it was concluded that continuing the education with reminders made by phone increased awareness even more.

Study limitations

The limitation of the research is that the data collection process was prolonged since the study was conducted during the coronavirus disease 2019 pandemic. As a single-centered study, it cannot be generalized to society.

CONCLUSION

As far as we know, this is the first study in which Anatolian propolis was applied externally to individuals with tinea pedis who were given foot care education, and the results

obtained are valuable in this respect. According to the evaluation of the patients, the "major" improvement was in the group that received foot care education. According to the doctor's assessment, the "major" improvement was in the propolis group. The dermatological quality of life of the group who received foot care education increased. Propolis has contributed to the medical treatment of tinea pedis. The nursing foot care education given about foot care improved the dermatological quality of life of the patients.

For this reason, it may be recommended to provide foot care education to patients, to use technology to ensure the continuity of education, and to conduct further studies in which propolis is used in different areas. In addition, more specific results about the efficacy of propolis can be obtained with multicenter and longer-term studies.

Author contributions:

Conception: RB,DK,İÖ,MD,HK,İÖ
Design: RB,DK,MD,HK
Data collection: : İÖ
Analysis and interpretation of data: : RB,DK,MD,HK,İÖ
Drafting the manuscript: RB,MD,HK
Critical review: RB,MD,HK
All authors (RB,DK,İÖ,MD,HK,İÖ) reviewed the results and approved the final version of the article.

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Conflict of interest:

The authors report no actual or potential conflicts of interest (professional, financial and direct or indirect benefits).

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Ethics Committee:

Written permissions were obtained from a state hospital in Anatolia(09.09.2020), the GETAT Clinical Research Ethics Committee of a university (08.01.2021, E-95961207-604.01.01-543), and the TR Ministry of Health GETAT Ethics Committee (05.02.2021, 05.02.2021, 37106781-000-24307) for this study. Written consent was obtained from the participants. The research was planned, implemented, and reported according to the Helsinki Declaration and CONSORT criteria and followed the ethical standards of the country of Turkey. Submit article previously for publication elsewhere has not been.

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