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PENICILLIN-INDUCED EPILEPTIFORM ECoG ACTIVITY IN GERBILS: EFFECTS OF PHYSICAL EXERCISE AND A *DIOSPYROS KAKI* EXTRACT

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Mongolian gerbils (28 males) were divided into four groups, control (C), treadmill-exercised (Ex), treated with the extract of *Diospyros kaki* (Dk), and treated with the Dk extract plus exercised (Ex+Dk) groups. Animals of the respective groups were running-exercised for 30 min per day during 8 weeks, and the Dk extract (dose 20mg/kg) was given by gavage during five days per week within the same period. After the treatment and exercise period, an epilepsy model was produced by penicillin G injection (500 IU) into the left somatomotor cortex, and electrocorticogram (ECoG) was recorded during 120 min. The mean frequency of spike/wave complexes was significantly smaller in the Ex and Ex+Dk groups from the 65th min of the observation period and, in the Dk group, from the 75th min than the respective value in the C group ($P < 0.01$, $P < 0.05$, and $P < 0.01$, respectively). The differences in the amplitude values and latency to onset of the spike/wave events among all groups usally did not reach the significance level ($P > 0.05$), but, visin late stages of the observation period, an antiseisure effect of the Dk extract was obvious. Thus, both the running exercise and Dk extract applications inhibit penicillin-induced epileptiform activity by altering the spike/wave frequency or severity of seizures observed in ECoG recordings. Further studies are needed to determine the effects of physical activity of different intensities and forms and to analyze the active compounds in the Dk extract.

Keywords: physical treadmill exercise, *Diospyros kaki* (Dk), penicillin-induced epileptiform activity, electrocorticography (ECoG), gerbils.

INTRODUCTION

Epilepsy is a widely distributed neurological disease, affecting about 1% of the general world population. The disease is manifested in excessive, abnormal, and hypersynchronous electrical discharges of neuronal groups in cortical and subcortical regions of the CNS and (usually) in repetitive behavioral seizures [1]. The pathophysiological mechanisms of epileptic seizures still have been studied to a limited extent, and the etiological approach to the treatment of this disease has not been developed in many cases. Thus, the treatment of this disease is usually performed pharmacologically, by using antiepileptic drugs providing suppression of the seizures [2].

A number of mechanisms responsible for the pathogenesis of epilepsy has been suggested. Although at present there is no absolutely effective and safe pharmacological treatment of epilepsy, important pharmacotherapic developments for the disease have been appeared within last years. In the treatment of this disease, some alternative options, except for "standard" antiepileptic drugs, began to be applied. [3–5]. About 20-30% of patients suffering from epilepsy are resistant to drug treatment. Thus, a search for novel therapeutic methods helpful in the treatment of epilepsy is at present rather urgent [6, 7]. The tolerance to the drugs used and the development of significant side effects are frequently observed. It has been reported that a number of factors, in particular regular physical exercise activities [5, 8], some vitamins (E, C, and B6), supply with magnesium, manganase, taurine, and dimethylglycine,

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nutrients containing omega-3 fatty acids, and certain antioxidant agents, may help physicians to reduce the seizure intensity in many cases of epilepsy [4, 9–11]. Thus, some natural curative approaches can appear significant supplementary measures for at least a part of the patients suffering from this disease.

Fruits of *Diospyros kaki* (Dk, Japanese, or Chinese, Persimmon) are rich in carbohydrates (14 to 20 g per 100 g of their mass) and in vitamins A, B, and C [12]. This product also contains significant amounts of terpenoids, carotenoids, flavonoids, tannins, napththoquinone, steroids, amino acids, minerals, and lipids [13, 14]. It has been shown that the extract obtained from leaves of Dk exerted a protective effect against excitotoxic injury caused by excessive glutamate in hippocampal and cortical neurons, neuronal injury resulting from ischemia-reperfusion, and that related to middle cerebral artery infarction; this was demonstrated in both *in vivo* and *in vitro* studies [15, 16]. Besides, Dk products contain proanthocyanidins, a flavonoid oligomer, tannin, phenolic acid, and catechins. It has been reported that these substances have a potential to play an important role in protecting against diseases related to oxidative stress [17, 18].

We tested the effects of the two above-mentioned factors (physical exercise and Dk extract) on an experimental penicillin G-induced epilepsy model in gerbils using electrophysiological methods. According to our knowledge, this aspect has not been observed in any study of neuroprotective actions against convulsive disorders. The penicillin model of experimental epilepsy was preferred because it reproduces relatively adequately the epilepsy-related seizures observed in humans [19].

METHODS

Animals, Dk Plant Material, and Extraction. Twenty-eight 10-week-old male Mongolian gerbils (mean body mass 41 ± 7 g) were supplied by the Medical and Surgical Research Center of the Abant Izzet Baysal University.

Fruits of Dk were collected from Trabzon (Turkey). The fruits were peeled, freeze-dried and lyophilized using a freeze-dryer at –65°C, and then ground into a powder. The powdered plant fruit material (330 g) was extracted by 900 ml of ethanol in a water bath at 45°C for 18 h and then filtered. The filtrate was evaporated under vacuum using a rotary evaporator at 65°C, then dissolved in 20 ml of distilled water and lyophilized. The dry extract was stored at –20°C prior to the experiments. In the latter, it was dissolved in saline and given to the animals by gavage five days per week during two months; the daily dose was 20 mg/kg.

Experimental Groups and Exercise Training Program. A CE (Conformité Européenne)-certified four-lane animal treadmill (Commat, Turkey), having adjustable settings for the rate, distance, running time, speed, and inclination and provided with built-in memory to store the data, was used in the experiments. In order to avoid any stress that may possibly arise in the course of physical exercise, all gerbils were preliminarily subjected to a conditioning exercise series at a lowest speed 5-min-long sessions during 10 days. The animals were randomly divided into four groups (n = 7 in each group), namely sham (control, C), treated with the Dk extract (Dk), exercised (Ex), and exercised plus the extract (Ex+Dk) ones.

To prevent avoidance reactions, the animals were subjected to incremental electrical shocks (1–6 mA) to continue running behavior on the treadmill. After the treadmill adaptation period, control-group gerbils were put in cages with the standard conditions until surgery, while the exercised groups were continued to be trained according to the treadmill exercise protocol [21]. Gerbils in the exercised groups were forced to run on the treadmill for 30 min once a day for eight consecutive weeks. The exercise workload consisted of running at the speed of 2 m/min for the first 5 min, 5 m/min for the next 5 min, and then 8 m/min for the last 20 min with a 0 degree inclination.

Penicillin G-Induced Epilepsy Model and Electrocorticography. Gerbils were anesthetized with 1.25 g/kg urethane (Sigma Aldrich, USA, i.p.) and placed in a stereotaxic frame (Harvard Apparatus, USA) under spontaneous respiration. Incision regions were infiltrated with prilokain hydrochloride, to prevent possible occurring of pain. A 3 cm incision was created on the skull in the rostro-caudal direction; soft tissues were removed, and the bregma (reference point) was identified. Under stereotaxic guidance, two stainless-steel screws were placed over the left somatomotor cortex (the first screw 3 mm lateral and 4 mm rostral to the bregma, and the second screw 3 mm lateral and 4 mm caudal to that), and a bipolar electrode was connected to the screws. After examination of brain basal activity with a Power Lab data acquisition system, a 1-mm-hole (1.5 mm left lateral and 1.5 mm caudal to the bregma) was opened in the skull. Penicillin G potassium salt (Sigma Chemical, USA, 500 IU dissolved in sterile

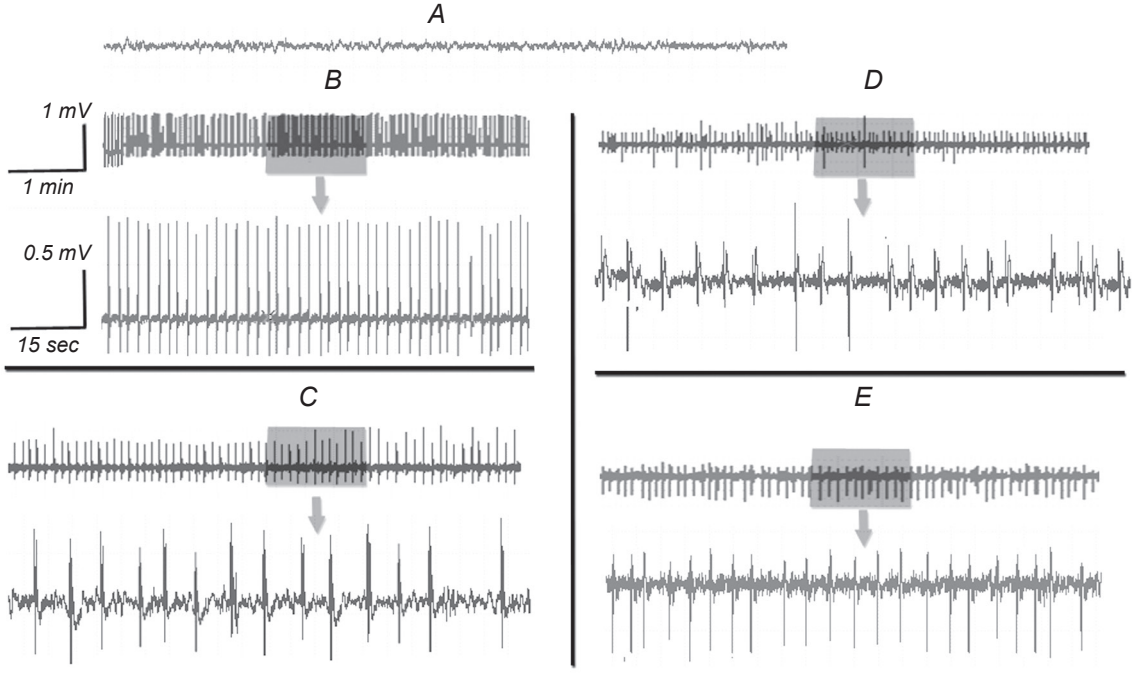
physiological saline) was injected into the opening (1 mm vertical with respect to the brain surface) by a Hamilton microsyringe (volume 2.5 µl). The drug dosage was determined according to Miao et al. [16].

The ECoG recordings were taken by two Ag-AgCl ball electrodes. These electrodes were placed over the left motor cortex (2 mm lateral to the sagittal suture, 1 mm anterior, and 5 mm posterior to the bregma). The common reference electrode was fixed on the left pinna. The ECoG signals were amplified by a BioAmp and transferred to a Power Lab 8/SP (both from AD Instruments, Australia) data recording system. The ECoG activity was continuously recorded during 120 min, displayed, and stored using a computer. The frequency (min^{-1}) and amplitude (mV) values of spike/wave complexes and the latency (sec) of onset of the first spike/wave event for each animal were automatically measured using a data acquisition Chart v.5.1.1 system (Power Lab software; AD Instruments, Australia) and analyzed offline.

Statistical Analysis. The frequency (number/min), amplitude (mV) of spike/wave complexes, and latency (sec) to onset of the first spike/wave event were gathered from animals of all groups and converted to a scaling percentage in a time-dependent manner. All statistical procedures were performed using the Statistical Package of SPSS, version 21 (SPSS Inc., USA) software. The normality of the data distributions was tested with the one-sample Kolmogorov–Smirnov test before analyses. After verifying the normality, one-way analysis of variance (ANOVA) and the Tukey–Kramer *post-hoc* test for multiple comparisons were performed. Numerical data are expressed below as means ± s.e.m. For all statistical comparisons, $P < 0.05$ was considered significant.

RESULTS

We used the penicillin model of epilepsy, which was previously used in the Medical and Surgical Research Center of the Abant Izzet Baysal University [4]. As was already observed in previous studies, intracortical (i.c.) injection of 500 IU/2.5 µl penicillin induced a clear epileptiform activity approximately 5 min after injection. The activity reached a constant level in 30 min and lasted for 3–5 h. Such ECoG activity was characterized by the presence of bilateral spikes and spike/wave complexes generated against the baseline activity; ECoG was recorded during 2 h (Fig.1).



F i g. 1. Examples of ECoG activity in the control and experimental groups. A) Baseline ECoG activity before penicillin applications or injections of saline; B–E) EcoG activity after penicillin applications in the control group (B), animals treated with the extract of *Diospyros kaki* (Dk, C), exercised by treadmill running (Ex, D), and subjected to a combined influence of the Dk extract and exercise (Dk+Ex, E). Segments of the records shown in grey in upper panels are presented in lower panels at a faster sweep.

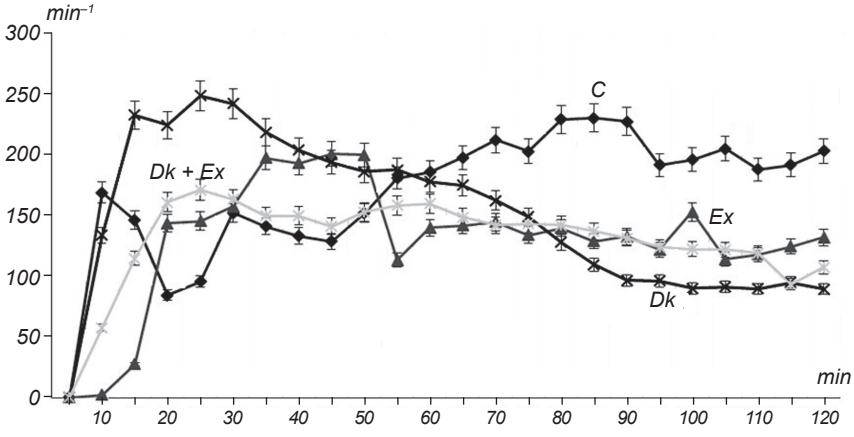
Р и с. 1. Приклади ЕКоГ-активності в контрольній та експериментальній групах.

T a b l e 1. Mean Frequencies of the Spike/Wave Complexes (min^{-1}) during the Observation Period (120 min) in the Control and Experimental Groups

Т а б л и ц я 1. Середні частоти виникнення комплексів пік/хвиля (хв$^{-1}$) протягом періоду спостереження (120 хв) у групі контролю та експериментальних групах

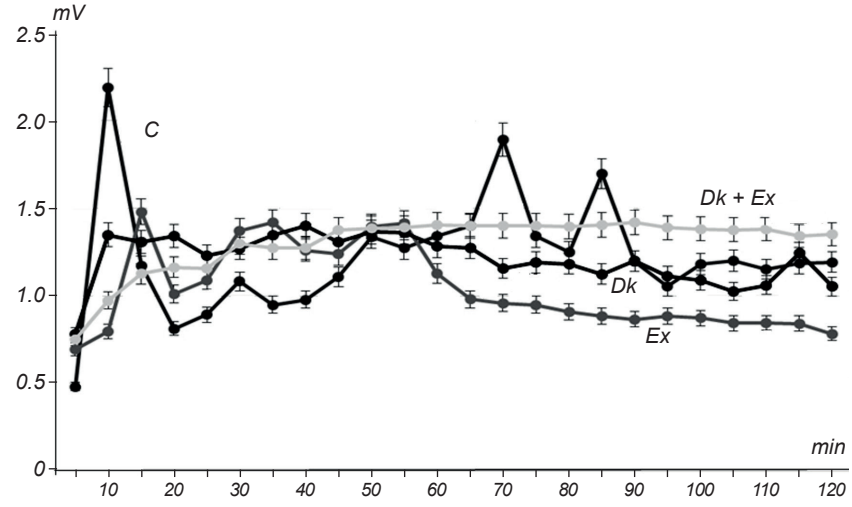
Time, min	Control (C) (n = 7)	Exercise (Ex) (n = 7)	*Diospyros kaki* (Dk) (n = 7)	Ex+Dk (n = 7)
5	0.0 ± 0.0	0.0 ± 0.0	0.0 ± 0.0	0.0 ± 0.0
10	169.2 ± 12.3[a]	2.0 ± 3.1[a]	133.8 ± 11.4[b]	57.5 ± 8.6[b]
15	146.3 ± 13.2[a]	27.3 ± 6.2[a,c,d]	233.0 ± 21.6[c]	114.7 ± 12.6[d]
20	84.5 ± 8.9	143.7 ± 9.1	224.8 ± 24.6[e]	161.2 ± 11.5
25	95.7 ± 6.6	145.7 ± 8.6	249.0 ± 22.5[e]	171.3 ± 19.4
30	152.5 ± 12.6	157.3 ± 11.6	242.5 ± 28.9[e]	163.5 ± 11.5
35	141.3 ± 11.7	197.7 ± 14.8	218.8 ± 18.7	149.7 ± 12.3
40	133.3 ± 14.9	193.3 ± 11.6	204.2 ± 20.3	150.0 ± 13.4
45	128.7 ± 10.8	201.0 ± 12.7	194.2 ± 18.6	141.2 ± 14.1
50	152.2 ± 12.1	200.0 ± 18.7	186.5 ± 21.7	153.0 ± 8.2
55	180.8 ± 15.1	113.3 ± 14.6	187.8 ± 11.2	158.5 ± 17.6
60	186.2 ± 12.3	140.0 ± 15.1	178.2 ± 14.7	160.0 ± 13.8
65	198.0 ± 11.6[a,f]	142.0 ± 21.6[a]	175.2 ± 14.7	148.7 ± 11.6[f]
70	212.5 ± 24.6 [a,f]	144.7 ± 22.2[a]	162.7 ± 15.2	142.2 ± 16.0 [f]
75	203.0 ± 21.9[g]	134.0 ± 19.4	149.0 ± 15.0	143.3 ± 17.0
80	229.5 ± 22.9[g]	139.7 ± 12.3	128.0 ± 9.7	142.3 ± 19.8
85	230.5 ± 17.2[g]	129.0 ± 9.6	109.5 ± 10.8	137.2 ± 14.7
90	227.8 ± 10.3[g]	132.7 ± 16.6	96.7 ± 8.8	131.5 ± 14.6
95	191.8 ± 11.6[g]	122.0 ± 14.0	96.2 ± 9.5	124.2 ± 16.6
100	196.3 ± 13.9[g]	153.0 ± 14.4	90.0 ± 11.5	122.5 ± 20.0
105	205.3 ± 19.7[g]	114.0 ± 11.0	91.3 ± 10.6	121.8 ± 21.9
110	188.3 ± 21.1[g]	118.0 ± 16.9	89.7 ± 8.2	119.2 ± 14.4
115	192.0 ± 22.0[g]	124.7 ± 11.9	95.0 ± 10.6	93.3 ± 10.4
120	203.3 ± 11.9[g]	132.0 ± 10.7	89.5 ± 8.7	107.3 ± 13.6

Footnotes: All values are shown as means ± s.e.m. for each group; n is the number of examined rats. Comparisons: (a) C vs. Ex group (P < < 0.01); (b) Dk vs. Ex+Dk group (P < 0.01); (c) Ex vs. Dk group (P < 0.01); (d) Ex group vs. Ex+Dk group (P < 0.01); (e) Dk vs. other groups (P < 0.05); (f) C vs. Ex+Dk group (P < 0.05); (g) C vs. other groups (P < 0.01).



F i g. 2. Dynamics of the mean frequency of the spike/wave complexes (min^{-1}) within the observation period, min, in the control and experimental groups; 1–4) control (C), Dk, Ex, and Dk+Ex groups, respectively.

Р и с. 2. Динаміка середньої частоти виникнення комплексів пік/хвиля (хв$^{-1}$) протягом періоду спостереження в групі контролю та експериментальних групах.



F i g. 3. Dynamics of the mean amplitude of the spike/wave complexes (mV) in the control and experimental groups. Designations are similar to those in Fig. 2.

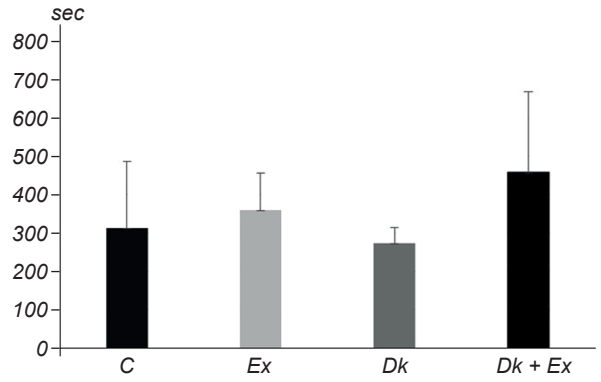
Р и с. 3. Динаміка середньої амплітуди (мВ) у групі контролю та експериментальних групах.

T a b l e 2. Values of the Mean Amplitudes (mV) during the Observation Period (120 min) in the Control and Experimental Groups

Т а б л и ц я 2. Значення середніх амплітуд (мВ) протягом періоду спостереження (120 хв) у групі контролю та експериментальних групах

Time. Min	Control (C) (n = 7)	Exercise (Ex) (n = 7)	*Diospyros kaki* (Dk) (n = 7)	Ex+Dk (n = 7)
5	0.48 ± 0.1	0.69 ± 0.4	0.78 ± 0.3	0.75 ± 0.2
10	2.19 ± 0.2[a]	0.80 ± 0.2	1.35 ± 0.6	0.97 ± 0.3
15	1.17 ± 0.1	1.48 ± 0.3	1.31 ± 0.4	1.12 ± 0.6
20	0.81 ± 0.3	1.01 ± 0.4	1.34 ± 0.2	1.16 ± 0.4
25	0.89 ± 0.1	1.09 ± 0.9	1.23 ± 0.3	1.16 ± 0.5
30	1.08 ± 0.2	1.37 ± 0.6	1.27 ± 0.6	1.30 ± 0.8
35	0.95 ± 0.6	1.42 ± 0.3	1.35 ± 0.5	1.27 ± 0.1
40	0.98 ± 0.6	1.26 ± 0.6	1.40 ± 0.8	1.27 ± 0.3
45	1.11 ± 0.5	1.24 ± 0.5	1.31 ± 0.5	1.38 ± 0.6
50	1.34 ± 0.4	1.39 ± 0.4	1.36 ± 0.6	1.39 ± 0.5
55	1.27 ± 0.3	1.42 ± 0.5	1.36 ± 0.3	1.39 ± 0.8
60	1.34 ± 0.1	1.13 ± 0.6	1.28 ± 0.4	1.40 ± 0.7
65	1.40 ± 0.3	0.98 ± 0.3	1.27 ± 0.1	1.40 ± 0.6
70	1.89 ± 0.4	0.96 ± 0.2	1.16 ± 0.2	1.40 ± 0.5
75	1.34 ± 0.2	0.95 ± 0.4	1.19 ± 0.5	1.40 ± 0.4
80	1.25 ± 0.5	0.91 ± 0.6	1.18 ± 0.6	1.39 ± 0.1
85	1.70 ± 0.6	0.88 ± 0.3	1.12 ± 0.3	1.40 ± 0.3
90	1.20 ± 0.4	0.87 ± 0.3	1.20 ± 0.5	1.42 ± 0.5
95	1.05 ± 0.6	0.88 ± 0.4	1.11 ± 0.4	1.39 ± 0.3
100	1.18 ± 0.5	0.87 ± 0.6	1.09 ± 0.1	1.38 ± 0.2
105	1.20 ± 0.2	0.84 ± 0.5	1.03 ± 0.2	1.38 ± 0.5
110	1.15 ± 0.3	0.84 ± 0.4	1.06 ± 0.5	1.38 ± 0.6
115	1.18 ± 0.4	0.84 ± 0.5	1.24 ± 0.6	1.34 ± 0.1
120	1.19 ± 0.3	0.78 ± 0.6	1.05 ± 0.3	1.35 ± 0.5

Footnotes: designations are the same as in Table 1. Comparisons: (a) C vs. other groups ($P < 0.05$).



F i g. 4. Mean latencies (sec) of the first episode with the spike/wave complex after penicillin applications in the control and experimental groups. Means ± s.e.m. are shown. Designations of the groups are similar to those in Figs. 2 and 3.

Р и с. 4. Середні значення латентних періодів (с) першого епізоду з комплексом пік/хвиля після аплікацій пеніциліну в контрольній та експериментальній групах.

The spike/wave frequency and amplitude values and the latency to onset of the first spike/wave event were measured from the ECoG recordings. In the Ex and Ex+Dk groups, the spike/wave frequency was significantly lower than that in the C group from the 65th min until the end of recording (120th min; $P < 0.01$ and $P < 0.05$, respectively). In the Dk group, the spike/wave frequency was significantly ($P < 0.01$) lower than that in the C group from the 75th min to the end of the 120th min. Finally, the spike/wave frequency values were significantly ($P < 0.01$) smaller in the Ex, Dk, and Ex+Dk groups, as compared with the respective index in the C group (Table 1; Fig. 2).

When we evaluated values of the spike/wave amplitude (mV), we found that these values were lower in the Ex, Dk, and Ex+Dk groups than that in the C group. These differences, however, did not usally reach the significance level ($P > 0.05$), except for that but, visin late stages of the observation period, where an antiseisure effect of the Dk extract was obvious (Table 2; Fig. 3).

The differences in the latency (sec) to onset of the first spike/wave complex among all groups also did not reach the significance level ($P > 0.05$; Fig. 4).

DISCUSSION

Results of experimental investigations of epilepsy in animal models provided important information regarding epilepsy pathogenesis [20]. The aim of our study was to identify the separate and common effects of physical treadmill exercise and treatment with the *Diospyros kaki* (Dk) extract on penicillin-induced epileptiform activity in Mongolian gerbils; ECoG recording was used for this purpose.

As was reported, flavonoids derived from bark and leaves of persimmon (*Diospyros kaki*) exerted favorable effects in the cases of brain damage, cerebral ischemia, and thrombosis [15, 16, 23, 24]. Bei et al. [15] found that a flavonoid obtained from the Dk extract, FLDk-P70, demonstrated a protective effect counteracting glutamate-induced excitotoxic neuronal death of cultured hippocampal neurons; it also reduced the dimension of lesions in the rat brain hemisphere. It was suggested [16] that flavonoids from persimmon leafs can elevate the tolerance to ischemia by reducing vascular endothelial injuries and inflammatory reactions. It was also demonstrated [23] that the extract exerts protective effects against oxidative stress at the level of cellular compartments and DNA.

Considering the above-mentioned findings, it was thought that active constituents of the Dk extract may help to reduce epileptiform activity because their strong antioxidant effects reducing the free radical production [24]. Our results allowed us to hypothesize that some agents, such as proanthocyanidins, a flavonoid oligomer, tannin, phenolic acid, and catechin found in persimmon (*Diospyros kaki*) fruit, might provide some reduction of epileptiform activity [17,18].

In literature, there were a number of reports that systematic physical activity can reduce, to some extent, epileptiform activity and suppress epileptic seizures [5, 26–29]. Silva et al. [5] found that preliminary treadmill exercise provided protective effects against oxidative stress after traumatic neuronal injury and against PTZ (pentylenetetrazol)-induced seizures in the respective epilepsy model. Similarly, Souza et al. [25] demonstrated that forced swimming training significantly increased the latency and alleviated the duration of generalized seizures in the PTZ-induced epilepsy model. These

authors found that physical exercise significantly decreased the spike/wave amplitude values in the above model [25]. In our study, the spike/wave frequencies (min^{-1}) in the Ex, Dk, and Ex+Dk groups were significantly lower than the respective index in the C group ($P < 0.01$; Table 1; Fig. 2). In addition, there were some differences between these groups in the amplitude values and latencies to onset of the spike/wave events, but such dissimilarities did not reach the level of statistical significance ($P > 0.05$; Table 2; Fig. 3 and Fig. 4). These data indicate that application of the Dk extract and treadmill exercise, both solely and in a combination, significantly decreased the spike/wave frequency in the epilepsy model tested, while the respective effects on the amplitude and latency of ECoG epileptiform events were noticeably weaker.

Arida et al. [26] reported that physical exercise provided reduction in the number of epileptic seizures in a pilocarpine-induced epilepsy model; this is a noticeable positive effect of nonpharmacological treatment preventing epileptic seizures. Additionally, Eriksen et al. [3] stated that regular physical exercise (such as aerobic dancing with strength training and stretching) significantly diminished the frequency of seizures in 15 women with a pharmacologically persistent epilepsy form. It is thought that a positive effect of physical exercise on epileptiform activity is a result of the increased cerebral blood flow and of intensified release of amino acids and endogenous peptides across the blood-brain barrier; these changes are formed due to certain stimulation-related modifications of cerebral neuronal mechanisms [27, 28]. Also, physical exercise prevents, to some extent, age-related degeneration of cerebral structures due to stimulation of plastic modifications in synapses and nerve endings [29]. So, forced treadmill exercise provided significant reduction of epileptiform activity manifested in terms of a decrease in the mean spike/wave frequency in gerbils in our model of epilepsy. These changes were most significant within certain time intervals (form the 65th min in the Ex and Ex+Dk groups and form the 75th min in the Dk group). Although the statistically significant reduction in the Dk groups was observed 10 min later than that the Ex group, more intense reduction of epileptiform spike/wave activity was found from the 80th min in the Dk group (Table 1; Fig. 2). In general, it was found that a combination of preliminary regular and programmed physical (treadmill) activity and phytothreapy (treatment with the Dk extract) more intensely inhibited penicillin-induced epileptiform activity by altering the mean spike/wave frequency.

Therefore, results of our study demonstrated that the treatment with the Dk extract (containing a number of potentially active constituents) and systematic treadmill exercise significantly decreased the frequency of spike/wave complexes in epileptiform activity induced by penicillin applications on the cortex in gerbils. This preliminary study indicates that active agents present in persimmon (*Diospyros kaki*) fruits may be significant accessory means in the treatment of neurological diseases. According to our experimental findings, we suggest that the Dk extract should be further investigated from the aspect of its active ingredients and relationships among the latter, in order to explain the mechanisms of action of these ingredients on epileptiform activity. We think that a combination of intensified controlled and regular physical activity and certain diet programs including the respective food products (persimmon fruits, in particular) can improve, to a noticeable extent, the living standards of epilepsy patients. The results of our study may be useful in storing the experience with respect to effective phytotherapy of epilepsy using plant-derived products.

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All experiment protocols were in agreement with the Ethics Committe guidelines of the Abant Izzet Baysal University and also in accordance with the statements of the Guide for Care and Use of laboratory Animals of the National Institutes of Health.

The authors of this study, Y. Kayacan, A. Bahadir, A. Cetinkaya, H. Orallar, S. Cakir, E. Beyazcicek, A.C. Onal, and A. Yildirim, confirm that the research and publication of the results were not associated with any conflicts regarding commercial or financial relations, relations with organizations and/or individuals who may have been related to the study, and interrelations of co-authors of the article.

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ІНДУКОВАНА ПЕНІЦИЛІНОМ ЕПІЛЕПТИФОРМНА ЕКоГ-АКТИВНІСТЬ У ПІЩАНОК: ВПЛИВИ ФІЗИЧНИХ ВПРАВ ТА ЕКСТРАКТУ ХУРМИ СХІДНОЇ

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Р е з ю м е

Монгольські піщанки (28 самців) були поділені на чотири групи – контрольну (С), піддану тренуванню на тредбані (Ex), групу з уведенням екстракту *Diospyros kaki* (східної хурми, група Dk) та групу з уведенням вказаного екстракту, комбінованим із тренуванням (Ex+Dk). Тварин відповідних груп тренували, примушуючи бігати 30 хв на день протягом восьми тижнів; екстракт Dk (20 мг/кг) уводився перорально п'ять днів на тиждень протягом того самого періоду. Після періоду тренування та введення екстракту у щурів індукували модельну епілепсію за допомогою ін'єкції 500 МО пеніциліну G у ліву соматомоторну кору і відводили електрокортикограму (ЕКоГ) протягом 20 хв. У групах Ex та Ex+Dk середня частота виникнення комплексів пік/хвиля була вірогідно меншою, ніж у контролі, починаючи з 65-ї хв періоду спостереження; те саме відмічалося в групі Dk починаючи з 75-ї хв вказаного періоду ($P < 0.01$, $P < 0.05$ та $P < 0.01$ відповідно). Відмінності значень амплітуди ЕКоГ та латентного періоду до появи комплексів пік/хвиля в усіх групах звичайно не досягали рівня вірогідності ($P > 0.05$), але на пізній ділянці періоду спостереження антисудомний вплив екстракту Dk був очевидним. Отже, тренування бігом та уведення екстракту хурми східної пригнічує індуковану пеніциліном епілептиформну активність, змінюючи частоту комплексів пік/хвиля та інтенсивність судомної активності, що спостерігається в ЕКоГ. Потрібні подальші дослідження для того, щоб визначити ефекти фізичної активності різної інтенсивності та форми та проаналізувати активні компоненти екстракту хурми.

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