

Investigation of the Effect of Exercise on Headache in Migraineurs Using a Smartphone Diary

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Dear Sir,

Regular exercise is necessary for maintaining healthy lives and has been recommended as a lifestyle modification for migraineurs [1]. But migraine can also be aggravated by performing physical activities, and several studies have reported that exercise could be a trigger for migraine [2, 3]. This study aimed to determine the influence of exercise on the severity and impact of headache in migraineurs using a smartphone application-based headache and exercise diary (SHED).

We enrolled the participants who met the inclusion criteria at the neurology clinics of 2 university hospitals. The details of inclusion and exclusion criteria were described in a previous study that analyzed factors triggering migraine [4]. The duration of exercise was recorded, respectively, using 2 categories depending on the intensities [1] (vigorous intensity: activities such as heavy lifting, digging, or cycling rapidly/moderate intensity: activities such as light lifting, playing tennis, or cycling at a moderate pace). The good physical activity (GPA) was defined if the patients performed exercise with moderate or vigorous intensity of more than 150 min/week using

the recommendation provided by WHO [1]. Based on the total amount of exercise recorded in SHED, the participants were divided into 2 groups, GPA and N-GPA. In addition, the difference between characteristics of headache and disability was evaluated depending on whether exercise was performed or not performed in the total headache days.

A total of 142 participants were enrolled. Thirty-four were dropped out before the end of the study. We finally analyzed a total 6,104 SHED data entries from 82 participants who filled out the diary more than 50% of the study period (Fig. 1). The mean age, gender and duration of illness are 37.4 ± 8.3 years, 69/13 (female/male), and 9.9 ± 8.5 years respectively. According to the SHED analysis, 19 (23%) out of 82 patients were categorized into GPA and 63 patients were categorized into the N-GPA group. There were no significant differences between the headache characteristics including frequency, duration, intensity between GPA and N-GPA group. However, GPA group showed lower Headache Impact Test-6 score compared to the N-GPA group (53.6 ± 7.2 vs.

58.0 ± 6.7 , $p = 0.018$). GPA group also showed lower Migraine Disability Assessment Scale score compared to non-GPA group, but there was no statistical difference observed (7.8 ± 8.5 vs. 16.5 ± 23.6 , $p = 0.124$; Table 1).

Among a total of 1,491 records of headache days in SHED, 251 (16.8%) counts belonged to days with exercise. Among 4,613 recorded days without headache, 913 (19.8%) were counted as days with exercise. Headache days with exercise had a shorter duration (8.1 ± 5.8 vs. 7.3 ± 5.4 h, $p = 0.033$) and were less severe according to a visual analogue scale (4.0 ± 2.0 vs. 4.4 ± 2.2 , $p = 0.017$), compared to the headache days without. On these days with exercise, headaches also caused less impairment (32.3 vs. 47.6%, $p < 0.001$), and less abortive medication was used (45.8 vs. 59.9%, $p < 0.001$; Table 2). The major point of this study suggested that exercise compatible to GPA standard may have beneficial influence on the impact of headache.

Our study is limited in terms of its higher dropouts and also because the quantum of exercise performed is measured only by subjective judgement.

Table 1. Comparison of headache characteristics of the participants based on the presence of GPA

	Participants without GPA (n = 63)	Participants with GPA (n = 19)	p value
Headache occurrence on SHED, n (%)	24.2 (13.2)	26.6 (19.0)	0.605
Duration of illness, years	9.5 (8.2)	11.1 (9.6)	0.482
Headache days per month	5.6 (3.3)	6.6 (5.0)	0.437
Headache duration, h	7.4 (3.7)	7.4 (3.7)	0.997
Pain intensity, VAS	3.5 (1.6)	3.5 (1.9)	0.923
Abortive treatment per month	3.4 (2.5)	3.1 (2.1)	0.610
Prophylactic medication, %	42.9	47.3	0.730
Initial HIT-6 scores	63.0 (6.3)	62.5 (7.5)	0.790
Initial MIDAS scores	22.2 (23.8)	15.4 (16.6)	0.249
Final HIT-6 scores	58.0 (6.7)	53.6 (7.2)	0.018
Final MIDAS scores	16.5 (23.6)	7.8 (8.5)	0.124

Values are mean (SD).

GPA, good physical activity; VAS, Visual Analogue Scales; HIT-6, Headache Impact Test-6; MIDAS, Migraine Disability Assessment Scale; HADS-D, Hospital Anxiety Depression Scale-Depression Part; HADS-A, Hospital Anxiety Depression Scale-Anxiety Part.

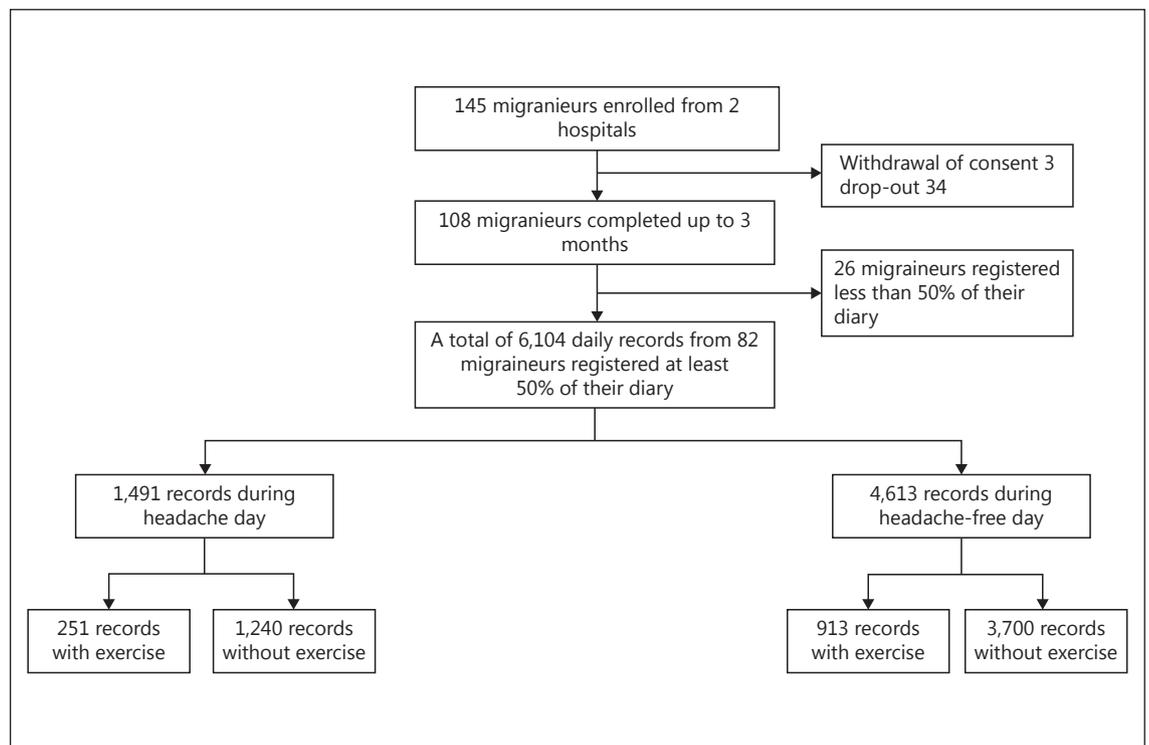


Fig. 1. Flowcharts of the participation of subjects and headache and exercise diary records.

Table 2. Comparison of headache characteristics based on the presence of exercise in accordance with the 1,491 headache day records

	Headache on the day without exercise (<i>n</i> = 1,240)	Headache on the day with exercise (<i>n</i> = 251)	<i>p</i> value
Pain intensity, VAS	4.4 (2.2)	4.0 (2.0)	0.017
Duration of headache attack, h	8.1 (5.8)	7.3 (5.4)	0.027
Usage of abortive treatment, %	59.9	45.8	<0.0001
Disability associated with headache, %	47.5	32.3	<0.0001

Values are mean (SD).
VAS, Visual Analogue Scales.

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Statement of Ethics

The protocol of this study was reviewed and approved by the Institutional Review Board/Ethic Committee of Dongtan Sacred Heart Hospital (Institutional Review Board approval number: 2014-132) and Uijeongbu St. Mary's Hospital, the Catholic University of Korea College of Medicine (Institutional Review Board approval number: UC14OIM10085). The participants received a detailed explanation of the aim and procedure of the study and provided written informed consent.

Disclosure Statement

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BMS, and Eisai Korea, and received research support from Hallym University Research Fund 2016 and lecture honoraria from Yuyu Pharmaceutical Company. M.-K.C. was involved as a site investigator for a multicenter trial sponsored by Eli Lilly and company, worked an advisory member for Teva, and received lecture honoraria from Allergan Korea and Yuyu Pharmaceutical Company in the past 24 months. J.-W.P. reports no conflict of interest. S.-G.P. reports no conflict of interest.

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Author Contributions

J.-W.P., M.-K.C., S.-J.C., and S.-K.P.: contributed to the conception and design, or analysis and interpretation of data. J.-W.P., M.-K.C., S.-J.C., and S.-K.P.: were involved in drafting the manuscript or re-

vising it critically for important intellectual content. J.-W.P., M.-K.C., S.-J.C., and S.-K.P.: have given final approval of the version to be published. J.-W.P. agrees to be accountable for all aspects of the work and ensures that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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