

Intentional avoidance of physical activity in women with migraine

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Abstract

Given the benefits of habitual physical activity for migraine management and overall health, it is important to understand the reasons for low physical activity levels in those with migraine. Beliefs that physical activity can trigger and/or worsen migraine pain may contribute to low physical activity levels via intentional avoidance of physical activity, particularly of higher intensities. This study evaluated intentional avoidance of physical activity at varying intensity levels and its association with (a) leisure-time physical activity levels, (b) beliefs that physical activity will trigger and/or worsen migraine, and (c) migraine characteristics. Participants were women ($n = 100$) who screened positive for migraine on the ID Migraine and completed an online survey on physical activity and migraine. The majority of the sample (78%) reported avoiding physical activity to manage migraine attacks at least once in the past month, and most reported avoidance of both moderate- and vigorous-intensity activity. Among those who reported avoidance, moderate- and vigorous-intensity physical activity was avoided on an average of 4.0 ± 2.0 and 4.1 ± 2.2 days/week, respectively. More frequent avoidance of vigorous-intensity physical activity (but not moderate-intensity) was significantly correlated with lower vigorous-intensity physical activity indicated by fewer days/week ($r = -0.28, p = 0.016$) and fewer minutes/day ($r = -0.29, p = 0.011$). The frequency of physical activity avoidance was significantly correlated with stronger expected likelihood that physical activity, at both intensity levels, will both trigger ($r = 0.39-0.43, p < 0.01$) and worsen ($r = 0.24-0.25, p < 0.05$) migraine attacks. Individuals who avoided physical activity reported a significantly higher number of migraine attacks in the past month and were more likely to have chronic migraine, compared to those who did not report avoidance. Intentional avoidance of moderate- and vigorous-intensity physical activity is a common migraine management strategy that is associated with lower levels of vigorous-intensity physical activity, stronger beliefs that physical activity will trigger or worsen migraine, and more frequent migraine attacks. Individuals with migraine who avoid physical activity may benefit from targeted intervention to address beliefs about physical activity and migraine, which has the strong potential to improve both migraine and health outcomes.

Keywords

avoidance, exercise, pain worsening, trigger

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Engagement in regular physical activity (PA) and aerobic exercise is recommended for the management of migraine.^{1–4} Moderate-intensity aerobic exercise produces reductions in migraine frequency and intensity, increases migraine-related quality of life and fitness level,^{5–7} and is an efficacious augmentation to pharmacotherapy.⁸ While mechanisms are not yet fully understood, regular PA might reduce migraine attack frequency and pain intensity via effects on biological factors (e.g. inflammatory, neuromodulatory, etc.) and related affective, cognitive, and motivational aspects of the pain experience.⁴

However, individuals with migraine have lower daily PA levels and lower fitness levels compared to those without.^{9–11} Indeed, a recent study, and the only one to date to use objective assessments of free-living PA in patients with migraine, found that women with comorbid migraine and overweight/obesity spend an average of nearly 1.5 fewer hours of total PA per day compared to women who had overweight/obesity without migraine.⁹ Given the benefits of regular PA engagement for reducing headache and improving overall health in patients with migraine, there is a clear need to identify reasons for low PA levels in this population.

One potential reason for low PA levels in patients with migraine is that PA (i.e. exercise, exertion and/or straining) is perceived as a trigger for migraine attacks in approximately 25% of patients with migraine.^{12,13} However, experimental studies in patients who cite PA as a trigger for migraine show that only 33–57% actually experience acute migraine onset following strenuous or vigorous exercise,^{14,15} and only 20% experience this phenomenon reliably.¹⁵ Thus, PA does not consistently produce acute migraine onset even among those who report PA as a triggering factor for migraine. A second reason for low PA might be that PA exacerbates pain during a migraine attack, a clinical feature of migraine¹⁶ reported by two-third of patients.¹⁷ Yet, less than 10% of individuals with migraine consistently experience pain worsening with PA during migraine attacks.¹⁷ However, the extent to which individuals believe or expect PA will trigger and/or worsen migraine could contribute to low PA levels via intentional avoidance of PA, particularly of higher intensities. This avoidance, in turn, could have the unintentional effect of undermining effective migraine management (i.e. regular PA engagement) and, as a result, may maintain migraine severity and disability.

Limited clinical research to date has directly examined intentional avoidance of PA in patients with migraine. One large study found that approximately 30% of patients reported avoidance of exercise for migraine prophylaxis and 74% reported avoidance of exercise for acute migraine management.¹⁸ To our knowledge, no studies to date have directly considered the use of intentional PA avoidance for migraine management in individuals with migraine and its relation to PA levels, if such avoidance is specific to vigorous-intensity PA (which is associated with greater

physical exertion and potential physical discomfort relative to lighter intensities) and whether avoidance is associated with beliefs that PA will trigger and/or exacerbate attacks. Thus, the current study aimed to evaluate the presence and frequency of intentional avoidance of PA at both moderate- and vigorous-intensity levels. Additionally, we aimed to evaluate the presence and frequency of intentional PA avoidance and its association with (a) leisure-time PA levels, (b) beliefs that PA will trigger and/or worsen migraine, and (c) migraine characteristics. It was hypothesized that more frequent PA avoidance would be associated with lower leisure-time PA levels, stronger beliefs about PA as a triggering and worsening factor for migraine, and more severe migraine. We also hypothesized that these associations would be stronger for vigorous-intensity PA compared to moderate-intensity PA. We evaluated these associations among women with migraine, given the roughly 3:1 female-to-male prevalence of migraine.¹⁹

Method

Participants and procedures

Participants were adult women with a self-reported migraine who completed an anonymous online survey on migraine and physical activity. Participants were recruited between November 2017 and January 2018. A link to the survey programmed in REDCap, an electronic data capture tool, was posted on various social media outlets through the Association of Migraine Disorders. Individuals were first provided an informational overview about the study, including the voluntary nature of the survey. Those who agreed to participate completed the ID Migraine,²⁰ a validated screener for probable migraine diagnosis. Individuals who endorsed two of the three items on the ID Migraine were deemed eligible and were subsequently routed to the study survey, which required approximately 20 min to complete. Of the 137 women who initiated the survey, 9 were ineligible based on incomplete or negative ID Migraine screen and 28 were excluded due to non-completion (early termination) of the survey. The final sample included 100 participants.

Measures

Migraine diagnosis. The ID Migraine²⁰ is a brief, self-administered three-item screener used to diagnose migraine. Items assess photophobia, nausea, and disability. A positive screen for migraine is indicated by endorsement of at least two of the three items on the ID Migraine. This questionnaire is widely used and well-validated for this purpose.²⁰ Meta-analytic findings of the diagnostic accuracy of the ID Migraine indicate that the sensitivity (i.e. correctly classifying true positives) is 84% (CI₉₅ = 75–90%) and the

specificity (i.e. correctly classifying true negatives) is 76% ($CI_{95} = 69\text{--}83\%$).²¹

Migraine characteristics. Four items were used to assess migraine characteristics, including age of first migraine, frequency of migraine attacks in the past 30 days, average duration of attacks (in hours), and average maximum pain intensity during attacks rated from 0 (*no pain*) to 100 (*maximum pain*). Chronic migraine was indicated based on the presence of ≥ 15 migraine days in the past month, which was a crude index of chronic migraine. This full diagnostic criterion for chronic migraine¹⁶ was not assessed.

Physical activity behavior. The *Global Physical Activity Questionnaire (GPAQ)* is a 16-item self-report assessment developed by the World Health Organization for surveillance of PA.²² The GPAQ items estimate an individual's level of PA in three domains—work, transportation, and leisure-time. The leisure-time PA domain (“sports, fitness or recreational activities”) was utilized in the current study. The GPAQ provides data on the presence of PA in the past month (yes/no), the frequency of PA in a typical week in the past month (days/week), and average quantity of PA on a typical day (min/day). The validity and reliability of the GPAQ have been widely documented,²³ including its criterion validity with accelerometer-determined estimates of PA.²⁴

Physical activity intensity. The GPAQ items assess moderate-intensity and vigorous-intensity PA. Moderate-intensity activity is defined as *activities that cause a small increase in breathing or heart rate* and vigorous-intensity defined as *activities that cause large increases in breathing or heart rate*. These definitions were used in the current study in order to characterize and examine differences by PA intensity level.

Intentional PA avoidance. Four items were used to assess intentional avoidance of PA *to manage migraine headaches*. Items were formatted based on the GPAQ to include assessment of the presence of intentional PA avoidance for migraine management in the past month (yes/no), and the frequency of PA avoidance in a typical week in the past month (days/week). Intentional avoidance of moderate-intensity and vigorous-intensity PA were assessed.

Belief that PA will trigger/worsen migraine. Given the relevance of PA as a trigger for migraine, participants were asked to rate their perceived likelihood that PA will *trigger migraine* (i.e. *cause a headache*). Response options ranged from 0% to 100% likelihood scale. In addition, given the relevance of PA in pain worsening during an attack, participants were asked to rate their perceived likelihood that PA will *worsen migraine* (i.e. *increase the intensity of your pain during a headache*). The likelihood that PA will trigger/worsen migraine was assessed for moderate-intensity and vigorous-intensity PA. These items were also rated on a 0% to 100% likelihood scale.

Statistical analysis

Distribution of continuous variables was examined for normality. Frequency of PA avoidance and frequency/quantity of leisure-time PA followed a zero-inflated distribution (i.e. abundance of zeros in tail of distribution). For this reason, these variables were square root transformed for inferential analyses that included the full sample. This transformation corrected the non-normal distribution. Descriptive statistics (mean and SD) were calculated for all continuous variables. Categorical variables were represented using counts and proportions (%). Initial paired *t* tests were conducted to examine differences between PA variables of interest at moderate- and vigorous-intensity PA levels. Next, independent samples *t* test and χ^2 analyses were used to compare demographic, PA, and migraine characteristics by the presence/absence of any intentional PA avoidance (coded 0 = *No*; 1 = *Yes*). Effect sizes were computed using Cohen's *d*, where 0.2, 0.5, and 0.8 can be used to reflect small, medium, and large effects between group means. Cramer's *V* was computed to index effect size for χ^2 , where 0.1, 0.3, and 0.5 can be used to reflect small, medium, and large effects. Subsequent subgroup analyses were conducted by examining the bivariate correlations between frequency of PA avoidance with other PA and migraine characteristics, among only those individuals who reported PA avoidance. Finally, analysis of covariance was used to examine whether there were significant differences between those who do and do not avoid PA in terms of beliefs about the triggering/worsening effect of PA, after adjusting for relevant migraine characteristics. The sample size of 100 was determined a priori to provide 80% power for detecting small to medium sized effects ($\alpha = 0.05$).

Results

Table 1 shows demographic, migraine, and PA characteristics of the sample. Women were on average low active. Compared to vigorous-intensity PA, moderate-intensity PA occurred on significantly more days per week ($r = 0.36$, $p < 0.001$; $t[99] = 3.98$, $p < 0.001$, $d = 0.41$) and was performed for more minutes per day ($r = 0.30$, $p = 0.003$; $t[99] = 2.94$, $p = 0.004$, $d = 0.30$). Beliefs that moderate-intensity PA will trigger migraine were significantly correlated with beliefs that vigorous-intensity will trigger migraine ($r = 0.83$, $p < 0.001$), although participants reported the likelihood to be significantly higher for vigorous-intensity PA compared to moderate-intensity PA ($t[99] = 6.35$, $p < 0.001$, $d = 0.64$). Similarly, beliefs that moderate-intensity PA will worsen migraine were significantly correlated with beliefs that vigorous intensity will worsen migraine ($r = 0.83$, $p < 0.001$), although participants reported the likelihood to be significantly higher for vigorous-intensity PA compared to moderate-intensity PA ($t[99] = 6.29$, $p < 0.001$, $d = 0.66$).

Table 1. Sample characteristics ($n = 100$).

Demographic characteristics	Mean \pm SD/%
Age	37.8 \pm 9.6
Race	
White	94.0%
Black/African American	1.0%
Other/more than one race	5.0%
Marital status	
Single, never married	34.0%
Married or domestic partnership	52.0%
Divorced/separated	14.0%
Educational attainment	
High school degree or equivalent	4.0%
Trade/technical/vocational training	6.0%
Some college credit, no degree	17.0%
College/university degree	46.0%
Graduate/professional degree	27.0%
Migraine characteristics	
Age of migraine onset	15.8 \pm 7.5
Past-month migraine frequency	10.3 \pm 8.8
Average attack duration (h)	24.5 \pm 24.9
Average max pain severity	78.7 \pm 15.2
Chronic migraine	34.0%
Anthropometric characteristics	
BMI	28.1 \pm 8.3
Intentional PA avoidance for migraine management	
Proportion avoiding moderate-intensity PA	73.0%
Days/week avoidance	2.9 \pm 2.5
Proportion avoiding vigorous-intensity PA	74.0%
Days/week avoidance	3.1 \pm 2.6
PA engagement in the past month	
Proportion engaging in moderate-intensity PA	50.0%
Days/week	1.4 \pm 1.9
Time/day (min)	26.5 \pm 39.1
Days/week (in pts with past-month PA)	3.0 \pm 1.6
Time/day (min, in pts with past-month PA)	53.9 \pm 40.7
Past-month vigorous-intensity PA	24.0%
Days/week	0.7 \pm 1.5
Time/day (min)	14.3 \pm 29.6
Days/week (in pts with past-month PA)	3.0 \pm 1.4
Time/day (min, in pts with past-month PA)	59.6 \pm 30.9
PA as a trigger/worsening factor for migraine	
PA as a triggering factor	
Moderate-intensity PA	50.2 \pm 30.2
Vigorous-intensity PA	61.8 \pm 32.2
PA as a worsening factor	
Moderate-intensity PA	75.6 \pm 24.4
Vigorous-intensity PA	84.2 \pm 19.9

PA: physical activity; BMI: body mass index; Pts: participants.

Intentional PA avoidance

Overall, the majority of the sample (78%) reported avoiding PA to manage migraine attacks in the past month. Of those who reported any intentional PA avoidance, 88.5% ($n = 69$) reported avoidance of both moderate- and vigorous-intensity PA, whereas 6.5% ($n = 5$) reported avoidance of vigorous-intensity PA only and 5.1% ($n = 4$) reported avoidance of moderate-intensity PA only. The frequency of PA avoidance is reported in Table 1. The

frequency of avoiding moderate-intensity PA was significantly correlated with the frequency of avoiding vigorous-intensity PA ($r = 0.78$, $p < 0.001$) and the mean difference was nonsignificant ($t[99] = -1.53$, $p = 0.130$, $d = 0.15$). Among only those participants who avoided PA, moderate-intensity PA was avoided on an average of 4.0 \pm 2.0 days in a typical week and vigorous-intensity PA was avoided on an average of 4.1 \pm 2.2 days. There were no differences in demographic factors or body mass index in women who reported PA avoidance compared to those who did not.

The associations between PA avoidance with migraine and PA characteristics are presented in Table 2.

Migraine characteristics

Women who avoided moderate-intensity PA compared to those who did not reported significantly more migraine attacks in the past month and were more likely to have chronic migraine. In addition, women who avoided vigorous-intensity PA reported significantly more migraine attacks in the past month and were significantly more likely to have chronic migraine, compared to those who did not avoid vigorous-intensity PA. There were no significant differences in average attack duration or maximum pain intensity by PA avoidance status. The frequency of moderate-intensity PA avoidance was significantly positively correlated with frequency of past-month migraine attacks ($r = 0.24$, $p = 0.041$) and average attack duration ($r = 0.27$, $p = 0.023$), but not pain intensity ($r = 0.04$, $p = 0.716$). A similar pattern of results was observed for vigorous-intensity PA avoidance, although the correlations were smaller in size and nonsignificant for frequency of past-month migraine attacks ($r = 0.20$, $p = 0.081$) and average attack duration ($r = 0.20$, $p = 0.084$) but not associated with pain intensity ($r = -0.01$, $p = 0.978$).

Leisure-time PA

There were no significant differences in leisure-time PA participation, days/week, or minutes/day in women who reported PA avoidance compared to those who did not. Among those who avoided moderate-intensity PA, the frequency of moderate-intensity PA avoidance was not significantly related to leisure-time PA. However, among those who avoided vigorous-intensity PA, the frequency of vigorous-intensity PA avoidance was significantly correlated with fewer days/week of vigorous-intensity PA ($r = -0.28$, $p = 0.016$) and lower minutes/day doing vigorous-intensity PA ($r = -0.29$, $p = 0.011$).

Belief that PA will trigger migraine

Women who avoided moderate-intensity PA, compared to those who did not, reported a significantly higher likelihood that moderate-intensity PA would trigger the onset

Table 2. Differences in PA and migraine characteristics by PA avoidance status.

	PA avoidance for migraine management							
	Moderate intensity				Vigorous intensity			
	No (n = 27)	Yes (n = 73)	χ^2 or t	ES ^a	No (n = 26)	Yes (n = 74)	χ^2 or t	ES ^a
Migraine characteristics								
Past-month attack frequency	6.1 ± 6.0	11.8 ± 9.2	3.61**	0.67	5.2 ± 5.7	12.1 ± 9.0	4.46**	0.83
Chronic migraine	5 (18.5%)	29 (39.7%)	3.95*	0.20	4 (15.4%)	30 (40.5%)	5.43*	0.23
Average attack duration (h)	22.3 ± 24.6	25.2 ± 25.0	0.52	0.12	21.7 ± 24.6	25.4 ± 24.9	0.66	0.15
Average max pain intensity (0–100)	76.8 ± 14.5	79.4 ± 15.2	0.78	0.18	76.6 ± 14.3	79.4 ± 15.2	0.84	0.19
PA characteristics (past month)								
Number (%) engaging in any leisure PA	10 (37.0%)	40 (54.8%)	2.49	0.16	4 (15.4%)	20 (27.0%)	1.43	0.12
Days/week leisure PA	1.1 ± 1.9	1.6 ± 1.8	1.49	0.27	0.5 ± 1.1	0.8 ± 1.6	1.20	0.24
Time/day leisure PA (min)	17.4 ± 31.0	29.0 ± 23.1	1.50	0.32	8.0 ± 20.8	16.5 ± 32.0	1.49	0.29
Belief PA trigger/worsen migraine								
Percent likelihood PA trigger	29.0 ± 23.1	58.0 ± 28.8	4.71**	1.06	40.2 ± 26.7	69.4 ± 30.6	4.33**	0.99
Percent likelihood PA worsen	63.7 ± 29.9	80.0 ± 20.6	2.61**	0.70	71.1 ± 26.5	88.8 ± 14.6	3.24**	0.96

ES: effect size; PA: physical activity.

^aEffect size is Cohen's *d* for continuous variables (0.2, 0.5, and 0.8 reflect small, medium, and large effects between group means) and Cramer's *V* for categorical variables (0.1, 0.3, and 0.5 reflect small, medium, and large effects).

**p* < 0.05.

***p* < 0.01.

of a migraine attack. In addition, women who avoided vigorous-intensity PA, compared to those who did not, reported a significantly higher likelihood that vigorous-intensity PA would trigger the onset of a migraine attack. Among those who avoided PA, the frequency of moderate-intensity PA avoidance was significantly correlated with a higher reported likelihood that moderate-intensity PA will trigger migraine ($r = 0.39$, $p = 0.001$), and frequency of vigorous-intensity PA avoidance was significantly correlated with a higher reported likelihood that vigorous-intensity PA will trigger migraine ($r = 0.43$, $p < 0.001$). See Figure 1 for visual depiction of group differences. After adjusting for migraine frequency, medium–large differences emerged between women who avoided PA versus those who did not in terms of perceived likelihood that migraine would be triggered by moderate-intensity PA ($d = 0.89$) and vigorous-intensity PA ($d = 0.72$).

Belief that PA will worsen migraine

Women who avoided moderate-intensity PA, compared to those who did not, reported a significantly higher likelihood that moderate-intensity PA would worsen an existing attack. Women who avoided vigorous-intensity PA, compared to those who did not, reported a significantly higher likelihood that vigorous-intensity PA would worsen an existing attack. Among those who avoided PA, the frequency of moderate-intensity PA avoidance was significantly correlated with a higher reported likelihood that moderate-intensity PA will worsen migraine ($r = 0.25$, $p = 0.030$), and frequency of vigorous-intensity PA avoidance was significantly correlated with a higher reported likelihood that vigorous-intensity PA will worsen migraine

($r = 0.24$, $p = 0.039$). See Figure 1 for visual depiction of group differences. After adjusting for migraine frequency, medium–large differences emerged between women who avoided PA versus those who did not in terms of perceived likelihood that migraine worsening would result from moderate-intensity PA ($d = 0.68$) and vigorous-intensity PA ($d = 0.89$).

Discussion

Despite the evidence supporting moderate-to-vigorous intensity PA as an efficacious non-pharmacological migraine management strategy, most patients with migraine are insufficiently active, and reasons for these low PA levels are relatively unknown. One potential contributor might be that patients with migraine intentionally avoid PA because they believe it will trigger and/or worsen PA, although this has not been previously examined. The current study sought to fill this gap by evaluating the rate of intentional PA avoidance in women with migraine and associations with leisure-time PA levels, beliefs that PA will trigger and/or worsen migraine and migraine characteristics. We found that not only did the majority (78%) of participants report intentionally avoiding PA, but those who reported PA avoidance did so frequently (i.e. an average of 4 days during a typical week). These findings suggest that PA avoidance is commonly used as a migraine management strategy.

Consistent with previous studies by our group and others, women in the current study reported low levels of both moderate- and vigorous-intensity PA. As hypothesized, lower PA levels (both weekly frequency and total time spent in PA) were associated with more frequent PA

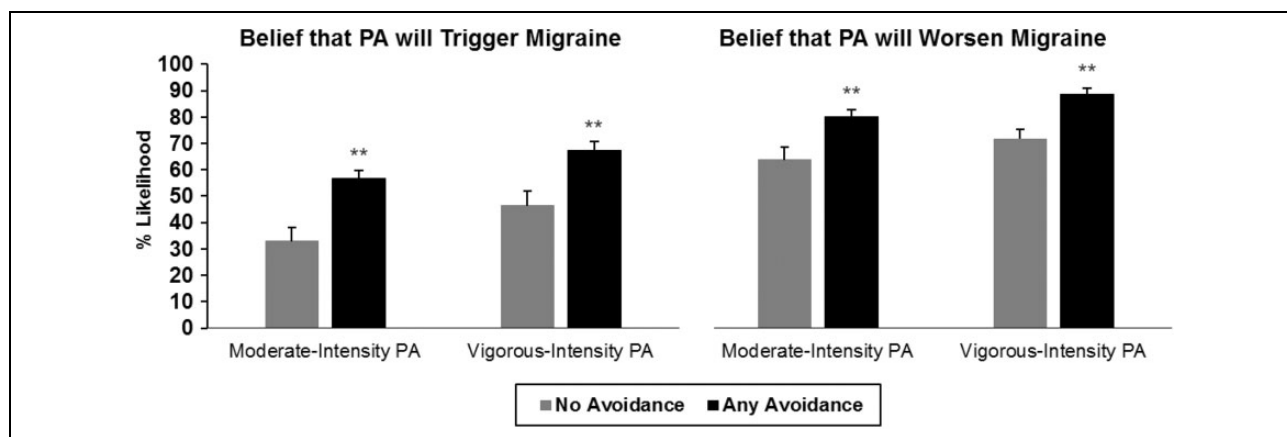


Figure 1. Physical activity avoidance and beliefs about physical activity on migraine.

Note: Means adjusted for past/month migraine attack frequency.

avoidance, although this relationship was specific to vigorous-intensity PA. This finding suggests that potential deleterious effects of PA avoidance on PA participation in individuals with migraine might be greater for those activities performed at higher intensities.

Our findings also provide insight into potential underlying mechanisms of intentional PA avoidance, specifically fear-based beliefs regarding the likelihood that PA, particularly performed at higher intensities, could trigger or worsen a migraine attack. Overall, participants on average reported that engagement in vigorous- and moderate-intensity PA had a 61% and 51% likelihood of triggering a migraine attack. Participants felt even more strongly regarding the potential for PA to exacerbate a migraine attack, reporting a 84% and 75% likelihood that vigorous- and moderate-intensity PA would worsen migraine pain. The experience of migraine onset or pain worsening from PA can contribute to the development of beliefs about PA's negative effect on migraine and promote the use of subsequent strategies for managing the perceived threat,²⁵ like avoidance of PA. Indeed, women who reported PA avoidance held significantly stronger beliefs about PA as a triggering or worsening factor for migraine, compared to women who reported no PA avoidance, and more frequent PA avoidance was associated with stronger beliefs that PA will trigger and/or worsen migraine. Although not examined here due to the cross-sectional nature of the data, it is also likely that over time, repeated PA avoidance serves to negatively reinforce beliefs about PA's negative effect on migraine and the effectiveness of PA avoidance in the management of migraine.

However, the above beliefs held by participants regarding potential for PA to trigger or worsen migraine attacks run contrary to recent research indicating only a small subset of patients consistently experience acute onset of migraine from vigorous exercise¹⁵ or pain worsening from routine PA.¹⁷ This apparent discordance between beliefs

and reality ultimately has potential to undermine effective migraine management (i.e. regular engagement in PA). Accordingly, we found that PA avoidance was adversely associated with migraine severity. Participants who reported intentional avoidance of PA had twice as many migraine attacks in the past month compared to women who did not report PA avoidance. Additionally, more frequent PA avoidance was related to a greater number of migraine attacks in the past month and longer average attack duration. This patterning of effects was generally observed for avoidance of both moderate- and vigorous-intensity PA. Although it is unknown whether frequent headache drives avoidance of PA or whether more frequent PA avoidance contributes to migraine exacerbation, the current findings complement prior work that has found an inverse association between migraine frequency and PA levels.¹⁰

There are several notable strengths of this research. This is the first study to evaluate PA avoidance and its association with low levels of leisure-time PA in individuals with migraine. Additionally, we considered not only PA but the intensity at which it is performed, which provides increased specificity in our understanding of PA behavior in migraine. Additionally, this is the first study to examine individuals' *perceptions* about PA's effect on migraine, rather than the presence or absence of PA as a triggering or worsening factor. The latter approach is consistent with a cognitive-behavioral model of pain that considers individual differences in (mis)perceptions about factors that influence pain and subsequent avoidance behaviors.^{26,27}

There are also limitations to this study. First, the data are cross-sectional which prohibits examination of the temporal relationships between PA, avoidance behavior, and pain. Future research should consider collecting daily-level information on migraine and PA behavior in order to evaluate the functional and reciprocal link between migraine and PA avoidance. For example, it would be important to understand whether PA avoidance more commonly occurs

on days in which headache is reported or on headache-free days—the former would support the functional role of PA avoidance in limiting exacerbation of an existing migraine and the latter would suggest attempts to avoid triggering migraine onset. Second, data were collected through an anonymous online survey which relied on self-reported assessment of migraine and PA. Estimates of migraine characteristics may also be biased by retrospective recall and by lack of information about acute treatment, which would influence attack duration and intensity. The low reliability and validity of self-reported PA levels is well-documented,²⁸ although it is notable that the typical over-reporting of self-reported PA levels were not observed in this study. Third, chronic migraine was defined based only on frequency migraine. The ICHD-III¹⁶ defines chronic migraine as ≥ 15 headache days/month for more than 3 months, with features of migraine occurring on at least 8 days/month. Thus, the prevalence of chronic migraine may be underestimated in this sample. Last, although the prevalence of migraine is significantly higher in women than men,¹⁹ the sample was fairly homogenous in that it included only women who were on average white and well-educated. Despite these limitations, this research tracks existing experimental and prospective studies on PA behavior in migraine.^{9,10,15,17}

Conclusion

Findings support the link between migraine and intentional avoidance of PA: (1) women with migraine reported low levels of leisure-time PA, especially vigorous-intensity PA; (2) intentional avoidance of PA was common among 78% of individuals with migraine, occurring within this group on roughly 50% of days in a week, and was equally common across moderate and higher PA intensity levels; (3) more frequent PA avoidance was associated with lower levels of vigorous-intensity PA and stronger beliefs that PA will trigger or worsen migraine; (4) frequency of PA avoidance was positively associated with migraine frequency and attack duration.

The above findings raise concern considering the positive role of PA and aerobic exercise for migraine management.^{4–8} Indeed, these findings illustrate an interesting paradox: on the one hand, PA and aerobic exercise can reduce migraine burden; yet, individuals with migraine commonly report avoidance of PA as a behavioral strategy for migraine management, in part because of the belief that PA will negatively impact migraine. The latter may be reinforced in part by common clinical recommendations to avoid factors that might trigger or worsen migraine.¹⁸ Clinicians may tend overestimate the role that PA has in worsening or triggering migraines and recommend avoidance of PA, especially because pain exacerbation by routine PA is a feature used to support the diagnosis of migraine without aura.¹⁶ However, avoidance is an inadequate strategy for management of migraine given that it can

paradoxically decrease one's tolerance for pain and in turn increase the likelihood that triggering factor (e.g. PA) will actually elicit or exacerbate pain.²⁹ An alternative behavioral management strategy is gradual exposure to triggering and worsening factors.³⁰ For example, patients may initially be encouraged to engage in PA at lower intensities on a non-headache day in order to build tolerance for PA and to challenge beliefs about PA's negative impact on migraine. Indeed, given that patients' (mis)perceptions about the effects of PA on migraine may potentially undermine effective migraine management, cognitive-behavioral interventions aimed at correcting these beliefs have the strong potential to improve both cardiovascular and migraine-specific health outcomes via increased PA levels.

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