

Differences in Psychological Characteristics Between People With Knee Osteoarthritis From Japan and Australia

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Research article

Keywords: Osteoarthritis, knee, pain, pain catastrophizing, fear of movement, depression, culture

Posted Date: September 8th, 2020

DOI: <https://doi.org/10.21203/rs.3.rs-63571/v1>

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Abstract

Background

The aim of this study was to investigate differences in psychological characteristics between people with knee osteoarthritis (OA) from Japan and Australia.

Methods

A total of 62 adults from Japan and 168 adults from Australia aged over 50 years with knee pain were included. Japanese data were collected from patients with knee OA diagnosed by medical doctors. Australian data were baseline data from a randomized controlled trial. Psychological characteristics evaluated were depressive symptoms (depression subscale of the 21-item short-form of Depression Anxiety Stress Scale), fear of movement (Brief Fear of Movement Scale for Osteoarthritis), and pain catastrophizing (Pain Catastrophizing Scale). Psychological characteristics were compared between the Japanese and Australian cohorts by calculating 95% confidence intervals (CIs) for difference of the mean. To test for equivalence of the average values of characteristics, the equivalence margin was set at 0.5 standard deviations (SD) of the mean, where these SDs were based on the Australian data. When the 95%CI for the difference of the mean value lay entirely within the range of equivalence margin (i.e. between -0.5 and 0.5 times the Australian SD), the outcome was considered equivalent.

Results

There were no significant differences between the groups from Japan and Australia for depressive symptoms (mean \pm SD; Japan 4.9 ± 5.4 , Australia 4.2 ± 4.7) and fear of movement (11.7 ± 3.8 , 12.5 ± 3.2 , respectively). Mean (95%CI) between group differences were 0.75 (-0.79 to 2.28) for depressive symptoms and -0.77 (-1.77 to 0.22) for fear of movement. Based on the equivalence test, 95%CIs of mean difference between groups for depressive symptoms was within the range of equivalence margin (± 2.35). However, the lower limit of the 95% CI of difference in mean for fear of movement (-1.77) was just outside the lower equivalence margin (-1.60). People from Japan with knee OA showed significantly higher pain catastrophizing (20.7 ± 11.0) than those from Australia (14.8 ± 9.6).

Conclusions

People from Japan with knee OA showed higher pain catastrophizing than people from Australia. The level of depressive symptoms and fear of movement appeared to be equivalent between people from the two countries.

Background

Knee osteoarthritis (OA) is a highly prevalent, chronic health condition leading to significant pain and disability among adults globally [1, 2]. In Japan, more than 60% of adults aged 60 years or over have radiographic knee OA and more than 26% have symptomatic knee OA [3]. However, in addition to the

physical impairments, psychological impairments are common in people with knee OA, including depressive symptoms [4], fear of movement [5], and pain catastrophizing [5]. Psychological impairments in knee OA patients are associated with higher pain [4], worse physical functioning [6] and reduced physical activity levels [7, 8].

Psychological characteristics may be dissimilar among people from different countries due to environmental, societal (e.g. healthcare) and cultural differences. For example, studies show self-efficacy, illness beliefs and the emotional and behavioral response to pain may be influenced by race, ethnicity and/or culture [9-11]. In people with OA, racial and ethnic background appear to be associated with severity of pain and disability [12, 13]. However, these studies were performed within a single (Western) population. Further, recent systematic reviews reporting differences in pain-related beliefs and pain catastrophizing between countries included data mostly from Western populations, with the exception of one Asian population (Singapore) [14, 15]. Little is known about the differences in psychological characteristics among people with knee OA living in different countries, in particular between those living in Western countries (e.g. Australia) compared with those living in Asia (e.g. Japan).

There is growing evidence to support the delivery of psychological interventions to help people with musculoskeletal pain and dysfunction including for people with knee OA [16, 17]. However, psychological interventions developed in Western countries may not be equally effective for people living in Japan. One reason for this may be differences in prevalence or severity of psychological impairments, such as depressive symptoms [4] and pain catastrophizing [18, 19]. Thus, the purpose of this study was to compare psychological characteristics, specifically depressive symptoms, fear of movement and pain catastrophizing, between people with knee OA living in Japan and Australia. Based on findings regarding depressive symptoms from a previous study comparing Japanese and Australians [20], we hypothesized that people with knee OA living in Japan would have greater levels of psychological impairments than people living in Australia.

Methods

Participants

A total of 62 people from Japan and 168 people from Australia, aged over 50 years with knee pain rated as four or greater on an 11-point numeric rating scale (NRS, range 0-10, higher = worse pain) were included. For the people from Japan, knee OA was diagnosed by orthopedic doctors based on radiographic images using Kellgren-Lawrence grading system (KL grade) [21]. Japanese people with KL grade ≥ 2 were included in this study. The data for people from Australia were the baseline data from a randomized controlled trial that evaluated the effectiveness of adding telephone coaching to a physiotherapist-delivered physical activity intervention [22]. Participants in the Australian trial were diagnosed with knee OA using American College of Rheumatology clinical criteria [23]. They were also classified as 'sedentary' or 'insufficiently physically active' according to the Active Australia Survey [24]. Exclusion criteria were similar for both groups: an inability to safely participate in moderate intensity

exercise, undertaking regular lower extremity strengthening exercise and/or receiving non-pharmacological treatment for knee pain from a health professional more than once within the past six months, knee surgery or intraarticular corticosteroid injection within the past six months, history of joint replacement on study knee or on a surgical waiting list, systemic arthritic condition, current or past (within four weeks) oral corticosteroid use, having another condition affecting lower extremity function more than knee pain, and/or if they scored more than 21 on the depression subscale of the 21-item short-form of Depression Anxiety Stress Scale (DASS-21) [25, 26]. People in the Australian study were also excluded if unable to use/access a telephone.

Outcome measures

Demographic details, pain, psychological characteristics (depressive symptoms, fear of movement and pain catastrophizing), and functional status were evaluated using self-report questionnaires. Participants from Japan completed questionnaires in an outpatient setting. Participants from Australia completed questionnaires at home via post/email [22].

Pain intensity

Average level of knee pain in the past week was assessed using 11-point NRS [27] with possible responses ranging from zero (no pain) to ten (worst pain possible).

Depressive symptoms

Depressive symptoms were measured via the depression subscale of the DASS-21 [25, 28]. The DASS-21 [26] consists of seven items for each of the three subscales (depression, anxiety and stress). Responses range from zero (did not apply to me) to three (apply to me very much, or most of the time). Scores from each subscale are summed and multiplied by two to give a subscale score ranging from 0-42 (higher scores indicate greater level of depressive symptoms). The English version has high internal consistency and construct validity [25, 26]. A Japanese version of the DASS [25] was used for participants in Japan, however, reliability and validity of the translated version have not yet been reported.

Fear of movement

Fear of movement was assessed using the Brief Fear of Movement Scale for Osteoarthritis (BFOMS0) [29]. It consists of six items extracted from the Tampa Scale for Kinesiophobia (TSK) [30] using a four-point scale from “strongly agree” to “strongly disagree” to assess fear of injury or re-injury due to movement. It ranges from six to 24 (higher scores indicate greater fear of movement). For participants in Japan, the same six questions of the BFOMS0 [29] were extracted from the Japanese version of Tampa Scale for Kinesiophobia (TSK-J) [31]. The original version of TSK was translated into Japanese and

linguistically validated [31]. The TSK-J is psychometrically reliable and valid for detecting fear of movement in the Japanese population suffering from neck to back pain [32]

Pain catastrophizing

Pain catastrophizing was assessed using the Pain Catastrophizing Scale (PCS) [33]. It consists of 13 items, which measure tendencies to ruminate about pain, magnify pain and feel helplessness about pain, on scales from zero to four. The total score ranges from 0-52 (subscale of rumination: 0-16, magnification: 0-12, helplessness: 0-24), with higher scores indicating greater level of catastrophizing. It has high internal consistency and is associated with heightened pain, psychological distress, and physical disability among adults [34]. The Japanese version of the PCS [35] was used for the participants in Japan. The reliability and validity of the Japanese version of the PCS has been confirmed as acceptable [35]. The PCS was only collected from a total of 130 out of 168 participants in the cohort from Australia [22].

Physical function

Physical function was assessed using the English and Japanese versions of the physical function subscale of the Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC) Likert version [36, 37]. The physical function subscale of WOMAC has 17 questions with five response options from zero (indicating no physical dysfunction) to four (indicating extreme physical dysfunction). The Japanese version of WOMAC was found to be reliable, valid, and responsive for assessing the effectiveness of total knee arthroplasty in the Japanese context despite the cultural differences from Western countries [37].

Statistical analysis

Difference and 95% confidence intervals (CIs) between means was calculated for demographic data and outcomes including PCS subscales (rumination, magnification, and helplessness subscale). If differences in demographic data (age and Body Mass Index (BMI)) and pain between the two groups were found at a significance level of ≤ 0.05 , we examined the linear relationship between those variables and psychological outcomes using Pearson's correlation coefficient to confirm whether those variables were potential covariates. If the linear correlation was $r \geq 0.2$, the lines of best fit for the two cohorts would have been examined and analysis of variance used to determine if there was an interaction by group for the association. Then if there was no interaction (no difference in the slopes), analysis of covariance controlling for the demographic variable would have been performed rather than a t-test.

To test for equivalence between means for psychological outcomes, an equivalence margin was set at 0.5 standard deviations (SD) of the mean, where these SDs were based on the Australian data. When the 95% CI of the difference of the mean value lay entirely within the range of equivalence margin (i.e.

between -0.5 and 0.5 times the SD of the Australian data), we determined the outcome was equivalent. The sample size of participants from Japan required to establish equivalence of measures, with an equivalence margin of 0.5 SDs and power of 0.9, was determined to be 57. Statistical analyses were performed using SPSS software (version 26.0, SPSS Inc., Chicago, IL).

Results

The demographic data for the two groups and main results are shown in Table 1. The groups were very similar in terms of gender, but there were significant differences between the means for age and BMI, with the participants from Japan being about 8 years older and having about 6 points lower BMI.

Table 1. Descriptive characteristics and results.

	Japan (n=62), mean ± SD	Australia (n=168), mean ± SD	Difference of the mean value [95%CI], (Equivalence margin minimum, maximum)
Men, n (%)	23 (37.1%)	62 (36.9%)	
Age, years	70.2 ± 6.7	62.2 ± 7.4	7.97 [5.85, 10.09]
Height, cm	159.1 ± 8.4	167.4 ± 9.4	-8.25 [-10.99, -5.52]
Weight, kg	65.0 ± 12.5	88.3 ± 20.8	-23.31 [-27.81, -18.81]
BMI, kg/m ²	25.5 ± 3.9	31.5 ± 7.1	-5.98 [-7.45, -4.51]
Pain, NRS (0-10)	6.1 ± 1.7	5.7 ± 1.4	0.40 [-0.04, 0.84]
Physical function, WOMAC (0-68)	14.6 ± 10.7	28.8 ± 10.7	-14.19 [-17.32, -11.06]
Depression, DASS (0-42)	4.9 ± 5.4	4.2 ± 4.7	0.75 [-0.79, 2.28] (-2.35, 2.35)
Fear of movement, BFOMSO (6-24)	11.7 ± 3.8	12.5 ± 3.2	-0.77 [-1.77, 0.22] (-1.60, 1.60)
Pain catastrophizing, PCS (0-52)	20.7 ± 11.0	14.8 ± 9.6 ^a	5.85 [2.79, 8.92] (-4.80, 4.80)
Rumination (0-16)	8.4 ± 4.1	5.4 ± 3.7 ^a	3.00 [1.83, 4.17] (-1.85, 1.85)
Magnification (0-12)	3.9 ± 2.9	3.2 ± 2.4 ^a	0.63 [-0.22, 1.48] (-1.20, 1.20)
Helplessness (0-24)	8.4 ± 5.1	6.2 ± 4.2 ^a	2.23 [0.85, 3.60] (-2.10, 2.10)

^an=130

BFOMSO: Brief Fear of Movement Scale for Osteoarthritis, BMI: Body Mass Index, DASS: Depression, Anxiety and Stress Scale, NRS: Numeric Rating Scale; PCS: Pain Catastrophizing Scale, WOMAC: Western Ontario and McMaster Universities Osteoarthritis Index

While the Japanese group was significantly older than Australian group, there was no significant linear relationship between age and any of the psychological outcomes except for the PCS subscale of rumination (correlation $r = 0.14$) (Table 2). BMI was significantly correlated with the depression subscale of the DASS ($r = 0.15$) and the BFOMSO ($r = 0.16$) (Table 2). Because these correlations did not reach our threshold ($r \geq 0.2$), all psychological outcomes were compared between the two groups using t-tests.

Table 2. Correlation between age and BMI, and psychological outcomes

	Age	BMI
Depression, DASS	0.10	0.15*
Fear of movement, BFOMSO	-0.11	0.16*
Pain catastrophizing, PCS	0.04	0.01
Rumination	0.14*	-0.10
Magnification	-0.10	0.10
Helplessness	0.03	0.05

* $p < 0.05$; BFOMSO: Brief Fear of Movement Scale for Osteoarthritis, BMI: Body Mass Index, DASS: Depression, Anxiety and Stress Scale, PCS: Pain Catastrophizing Scale

There were no significant differences between participants from Japan and Australia for pain severity, depressive symptoms and fear of movement (Table 1). The difference in the means between Japanese and Australian cohorts for the depression subscale of the DASS and BFOMSO were within the range of the equivalence margins, however, the lower limit of the 95% CIs of differences in mean for BFOMSO (-1.77 points) was just outside the lower equivalence margin (-1.60 points), indicating some uncertainty about whether people in Japan do not have less fear of movement than people in Australia.

Participants from Japan with knee OA scored significantly higher pain catastrophizing levels than those from Australia and the difference in the means (5.85 points) was outside the margin of equivalence (-4.80 to +4.80). Looking closer at the PCS, the 'rumination' and 'helplessness' subscale scores for the participants from Japan with knee OA were significantly higher than the scores from the participants from Australia, while the subscale of 'magnification' was not different. However, the upper limit of the 95% CIs of differences in mean for PCS subscale of magnification (1.48 points) was just outside the upper equivalence margin (1.20 points), indicating some uncertainty that people in Japan do not have more tendencies to magnify about pain than people in Australia.

Regarding physical function, there was a significant difference between two groups, with the participants from Japan being scored about 15 points less on the WOMAC physical function subscale (Table 1).

Discussion

This study investigated the differences in psychological characteristics between people with knee OA living in Japan and Australia. Pain catastrophizing was higher in the participants from Japan and the difference was accounted for by higher 'rumination' and 'helplessness' rather than by 'magnification'. On the other hand, depressive symptoms and fear of movement did not appear to be different. Our hypothesis that people from Japan would have greater levels of psychological impairments was partially supported by the findings in this study. Of note, the two cohorts reported similar levels of pain but differed in terms of age, BMI and physical function.

Depressive symptoms

No significant difference was found in depressive symptoms between the two groups. In addition, 95% CI of mean difference between Japanese and Australian groups in depression subscale of the DASS was within the range of the equivalence margin. This result indicates that depressive symptoms among people from Japan and Australia with similar levels of pain from knee OA are equivalent. This is in contrast to a previous study that demonstrated significantly higher depressive symptoms using the Geriatric Depression Scale in community-dwelling older Japanese than Australians, even after controlling for lifestyle and health factors associated with depressive symptoms [20]. Mean scores were notably low in both cohorts (4.9 and 4.2 out of 42 for participants from Japan and Australia respectively). Both Japanese and Australian cohort excluded people who scored more than 21 points on the depression subscale of the DASS-21 [26]. This meant that participants' levels of depressive symptoms were limited to the normal to moderate range [38], which may have influenced the findings. The lower BMI and better physical functioning among the participants from Japan may explain lower than expected levels of depressive symptoms relative to the comparison group, and the contrast between our findings and the previous comparison [20].

Fear of movement

Fear of movement did not present as being different between people with knee OA from Japan and Australia, although the lower limit of 95% CIs of mean differences in BFOMSO is slightly lower than lower equivalence margin of BFOMSO indicating uncertainty of equivalence. Given the association between pain and fear-avoidance in people with chronic pain [39], equivalence in fear of movement may be expected given the equivalence in pain levels between our two groups. Passive practitioner-dependent treatment approaches such as acupuncture, acupressure, and massage are commonly used in the treatment of musculoskeletal pain in Japan. We therefore hypothesized that people from Japan with knee OA would present higher fear of movement. Health professionals in many countries, including Japan, tend to advise people to rest in response to pain, rather than continue activity [15]. Advice to rest in response to pain may foster avoidance beliefs relating to pain [40], yet runs counter to evidence for effective knee OA management [41]. In recent years, the importance of exercise for musculoskeletal pain

has become more widely known, including in Japan, and may be reflected in lower than expected fear of movement among the cohort from Japan. Further, the cohort from Australia were included on the basis of being inactive or insufficiently inactive, which may have selectively biased that cohort to have higher levels of fear of movement.

Pain catastrophizing

Pain catastrophizing levels were significantly higher in the people from Japan, despite similar pain intensity. Pain catastrophizing is well known to be associated with the intensity of pain [42]. In a previous study comparing pain catastrophizing in ethnic Asian people with ethnic Westerners, Chinese-Canadians similarly reported higher pain catastrophizing scores than European-Canadians despite no difference in pain intensity from an induced painful stimulus [43]. The experience of pain is multifaceted. Sensory-discriminative aspects are those related to the location, intensity, and duration of painful stimuli, while affective-motivational aspects relate to how pain is qualitatively experienced [43, 44]. Several studies indicate that ethnic differences in pain experiences may be most apparent for the affective-motivational aspects as these are more influenced by psychosocial factors than the sensory-discriminative aspects such as pain intensity [45-47]. Thus, there appears to be psychosocial differences related to geographical location, culture and/or ethnicity that may explain these findings of different levels of reported catastrophizing.

One theory of catastrophizing is that it is a manifestation of a broader dimension of a 'communal' approach to coping, whereby a person in pain catastrophizes in order to garner interpersonal or social help as part of their coping strategy [42]. Catastrophizing may serve a social communicative function aimed toward maximizing the probability that distress will be managed within a social or interpersonal context rather than an individualistic context [48, 49]. Thus, greater catastrophizing may be associated with 'interdependence orientation' rather than 'independence orientation'. Japanese culture emphasizes interdependence rather than independence compared to Western culture [50]. This cultural difference is one possible explanation for the difference in PCS identified in our study.

On the other hand, Japanese people consider pain behaviors such as crying or showing pain, to be less acceptable than do Western people [51]. Japanese traditionally place emphasis on stoicism and the concealing pain and emotions, while Western culture places greater emphasis on the expression of personal feelings. This could imply that people from Japan would score lower on pain catastrophizing. We can only speculate that people from Japan may tend to conceal pain behaviours while at the same time experiencing catastrophic cognitions.

The PCS subscales of rumination and helplessness appear to be higher in people with knee OA from Japan than from Australia. On the other hand, magnification did not present as being different, although with some degree of uncertainty. The subscales of rumination and helplessness are thought to become more important for longer term pain, while magnification is the predominant catastrophic cognition when pain and injury are more recent [42]. This would support our finding since knee OA is a chronic painful

condition. We might also speculate that Japanese people might report greater feelings of helplessness related to chronic pain from knee OA because of lower personal control and self-efficacy for pain management.

Physical function

Physical function was significantly more impaired in the participants from Australia when compared to those from Japan. This is despite pain, depressive symptoms and fear of movement being equivalent and pain catastrophizing being greater among participants from Japan. This finding was unexpected given previous studies have reported that depressive symptoms and fear-avoidance, along with pain severity, are associated with self-reported physical function [52-54]. The finding may be explained by the difference in BMI which was higher in the Australian cohort and is also negatively associated with self-reported function [55]. In addition, our finding is consistent with a finding that Japanese low back pain patients were significantly less impaired in functioning than American low back pain patients, despite similar pain and physical impairment findings [56].

Limitations

This study has several limitations. First, the participants from Japan were recruited from an outpatient setting at one hospital, while Australian participants were recruited from the community via a variety of sources, such as advertisements and social media. Another important difference in the recruitment was the exclusion of people who were 'sufficiently physically active' (according to Active Australia Survey) from the Australian cohort. Despite this exclusion criteria however, participants from Australia were found to be quite active [8]. Diagnosis was based on radiographic findings for the people in Japan, but from clinical criteria for the people in Australia. The Australian cohort were younger but had higher BMI than the people from Japan. Nevertheless, pain levels were similar for both groups. The second potential limitation is the comparability of the translation of the Japanese version of the depression subscale of DASS-21 used in the study, since validity (including cross-cultural) and reliability have not yet been reported. Differences in validity and reliability between the versions may impact on findings.

Conclusion

People from Japan with knee OA with similar moderate to severe levels of pain had equivalent depressive symptoms and fear of movement as people from Australia, but greater pain catastrophizing. The older age and lower BMI of the Japanese cohort may partly explain these differences, but geographical, cultural and/or ethnic factors may also have a role. The findings highlight a greater need to consider pain catastrophizing when managing Japanese people with knee OA.

Abbreviations

OA: Osteoarthritis; NRS: Numeric rating scale; DASS: Depression Anxiety Stress Scale; BFOMSO: Brief Fear of Movement Scale for Osteoarthritis; TSK: Tampa Scale for Kinesiophobia; PCS: Pain Catastrophizing Scale; WOMAC: Western Ontario and McMaster Universities Osteoarthritis Index; BMI: body mass index;

Declarations

Ethics approval and consent to participate

The University of Melbourne Human Research Ethics Committee and the Kio University Research Ethics Committee approved the study (Ethics IDs 1137237, H29-08, respectively). All participants provided written informed consent to participating in the study, and for their data to be used to answer other research questions related to OA management. This study has been performed in accordance with the Declaration of Helsinki.

Consent to publish

Not applicable

Availability of data and materials

The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request.

Competing interests

The authors declare that they have no competing interests.

Funding

This study was supported by the National Health and Medical Research Council (631717) and the Japanese Physical Therapy Association (H30-A11).

Authors' contributions

TE designed the original randomised controlled trial. BM and PKC collected data. DU, BM, and TE analyzed and interpreted the data. DU and TE wrote and prepared the manuscript. All authors read and approved the final manuscript.

Acknowledgements

We would like to thank Professors Kim Bennell and Rana Hinman for sharing their dataset and assistance with the study methods. We would like to thank Dr Jessica Kasza for calculation of sample

size, and assistance with statistical analysis and interpretation. We would also like to thank PT Takanari Kubo and MD Tadashi Fujii for recruiting Japanese participants and collecting data.

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