Age and sex-specific differences of mindfulness traits with measurement invariance controlled in Chinese adult population: A pilot study

Ruochen Gan [a], Yanping Wei [a], Limin Sun [a], Liuyi Zhang [a], Jiayu Wang [a], Tingfei Zhu [a], Shulin Chen [a,**], Jiang Xue [a,b,*]

[a] Department of Psychology and Behavioral Science, Zhejiang University, Hangzhou, China
[b] School of Humanities and Management, Guangdong Medical University, Dongguan, China

ARTICLE INFO

ABSTRACT

Objectives: To examine the relationships of age and sex with mindfulness traits among Chinese adults with controlling for measurement invariance.
Methods: A total of 1777 participants completing the Five-Facet Mindfulness Questionnaire were included for analysis. Their age and sex information were also collected. Descriptive analysis, Pearson's Chi-Square test and analysis of variance were performed to test the age- and sex-specific differences, measurement invariance was examined by confirmatory factor analysis.
Results: Excellent data fit to the model indicated configural, metric, and scalar invariance across age and sex. Participants aged 60 or above scored significantly higher in dimensions of acting with awareness, nonjudging of inner experience, nonreactivity to inner experience, and the total scores than younger individuals, who had higher scores in the observing domain. In addition, females scored higher in describing and observing than males, while the latter had higher score in nonreactivity to inner experience.
Conclusions: The Five-Facet Mindfulness Questionnaire Mindfulness showed acceptable measurement invariance across age and sex in Chinese adult population. The old and the young differs in the traits of awareness, observing, nonjudging of inner experience, nonreactivity to inner experience and the total mindfulness level, while males and females varied in describing, observing and nonreactivity to inner experience. Individual differences should be considered and well addressed in future studies on mindfulness.

1. Introduction

The topic of mindfulness is popular in recent years as it has demonstrated promising results across various samples in coping with clinical and non-clinical problems [1–4]. Mindfulness refers to "the awareness that emerges through paying attention on purpose, in the present moment, and nonjudgmentally to the unfolding of experience moment by moment" [5]. Over the past decades, some research has demonstrated that mindfulness can be instrumental in promoting well-being as higher mindfulness level has been found to

---

* Corresponding author. Department of Psychology and Behavioral Science, Zhejiang University, Hangzhou, China.
** Corresponding author.
E-mail addresses: chenshulin@zju.edu.cn (S. Chen), xuejiangpsy@zju.edu.cn (J. Xue).

link to higher level of positive emotions [6,7], self-esteem [8], self-compassion [9], life satisfaction [10,11], and quality of life [12–14]; and associated with lower levels of depression [15,16] and anxiety [15,17].

Though numerous studies have been conducted on mindfulness in the context of different cultures, most of the findings [18–22] were established based on variable-centered analyses assuming that all participants have been sampled from a single population (i.e., population homogeneity assumption), with neglecting the aspect of individual differences. In the study conducted by Pearson and his colleagues [23], they found that even within the same context, individuals could be divided into four subgroups based on their mindfulness profiles, with each subgroup demonstrating different outcomes. Their study indicated that the importance of person-centered analyses to explore distinct facets of mindfulness.

Some studies have reported the relationships between demographic characteristics like age, sex and the mindfulness level. Mahlo and Windsor [24] suggested that with advancing age, people were more likely to focus on the present-moment and adopt a nonjudgmental orientation. This viewpoint has been recognized in several studies [25–27]. In addition, Fountain-Zaragoza and colleagues' study conducted among a sample of 75 older adults and 50 young adults showed that older adults reported significantly higher levels of trait mindfulness than young adults [26], while a study conducted by Mahoney and colleagues among 426 younger adult students and 85 community-dwelling older adults also showed similar results [27].

Findings on the sex-specific differences of mindfulness were inconsistent across studies. Some studies found no significant association of mindfulness with sex at all [28–30], while others reported significant differences [31–34]. For example, Theofanous and colleagues [33] compared mindfulness levels among 1034 Greek-speaking adults and young adults and found that females had lower mindfulness levels compared with males. A study conducted in 152 athletes [32] and another study in 319 undergraduate students [31] also showed similar results. The questionnaire administered to 200 nurses by Vitale [34] indicated significant lower mindfulness total scores in females than males, though females reported significant higher levels in dimensions "Observe" and "Act with awareness", while males scored higher in dimension "Accept without judgement".

Uncontrolled measurement invariance is a possible contributor to the mixed findings. Measurement invariance refers to the same attributes that measurements measure under different conditions of underlying phenomena [35]. It provides a solid foundation in evaluating observed variables' measurement properties in regard to their reliability as well as validity [35], and presents important considerations for researchers in drawing conclusions across populations. However, many existing publications, including those relating to mindfulness, usually conduct the analyses and draw the conclusion without controlling for the measurement invariance. On the other hand, cultural context disparities may also bias the study findings. As one of the oldest countries where the mindfulness originated and with the largest population in the world, however, rare studies have investigated the mindfulness profiles in China. Thus, the purpose of this study was to examine the measurement invariance of a commonly-used assessment tool for mindfulness, the Five Facet Mindfulness Questionnaire, across age and sex, and to determine the age- and sex-specific differences on the mindfulness profiles in the Chinese adult population.

2. Methods

2.1. Participants and procedures

Participants were adults aged 18 or over recruited either from online social platforms or offline communities. Initially, an online survey package was delivered through the Wechat Moments and online forums (e.g., cc98.org). Even if there's not any restriction imposed on age, no people aged 60 or over was recruited online. To expand the age range of participants, trained research assistants conducted the study interview to older adults aged 60 or over from eight randomly selected communities in the community senior centers. Data collected both in the online survey and the interview included age, sex and the Chinses version of Five Facet Mindfulness Questionnaire - Short Form (FFMQ-SF).

Inclusion criteria for the study included: 1) aged 18 or over, 2) a resident in China, and 3) willing and able to complete the survey or interview. All participants provided informed consent for participation. After participation, each participant was rewarded with 5 Chinese yuan (RMB).

Finally, a total of 1806 participants were recruited and completed the survey or the interview, with 234 aged 60 or above and 1572 aged less than 60. Of these participants, 29 (1.61%) were subsequently excluded due to missing values on demographic information, leaving the analyzed sample of 1777.

2.2. Measures

Participants' age and sex information were collected. Their mindfulness profiles were evaluated by the Chinses version of Five Facet Mindfulness Questionnaire - Short Form (FFMQ-SF). The Five Facet Mindfulness Questionnaire (FFMQ) was initially derived through examining the facet structure of mindfulness by extracting common factors from a package of items from various mindfulness scales, including the Mindful Attention Awareness Scale (MAAS), the Kentucky Inventory of Mindfulness Skills (KIMS), the Freiburg Mindfulness Inventory (FMI), the Cognitive and Affective Mindfulness Scale (CAMS) and the Southampton Mindfulness Questionnaire (SMQ).

The FFMQ consists of five facets: observing, describing, acting with awareness, non-judging of inner experience and non-reactivity to inner experience. The psychometric properties of the FFMQ have been verified in different samples [36], and it is the most widely used scale of mindfulness.

The short form of the Chinses version of Five Facet Mindfulness Questionnaire was conducted in the current study, as it was more

simple and time-saving but has acceptable psychometric properties compared to the full scale [37]. It consisted of 15 items measuring individual differences in five dimensions: observe (items 15, 20, 31, for example "*I pay attention to sensations, such as the wind in my hair or sun on my face*"), describing (items 2, 32, 37, for example "*I'm good at finding words to describe my feelings*"), acting with awareness (items 5,13, 38, for example "*When I do things, my mind wanders off and I'm easily distracted*"), nonjudging of inner experience (items 25, 30, 39, for example "*I tell myself that I shouldn't be thinking the way I'm thinking*"), nonreactivity to inner experience (items 19, 21, 24, for example "*When I have distressing thoughts or images, I 'step back' and am aware of the thought or image without getting taken over by it*"). All items were rated on a 5-point Likert scale, ranging from 1 (never or very rarely true) to 5 (very often or always true). Cronbach's alphas values were 0.826, 0.800, 0.891, 0.735, 0.743 for subscales respectively, and 0.782 for the whole scale.

2.3. Statistical analysis

Descriptive statistics including means, standard deviations, maximum and minimum, frequency and percentage were derived for descriptive analyses. Pearson's correlation coefficients were calculated to determine the correlations between age and the facets of mindfulness. As the constructs of the FFMQ-SF measure a common general aspect related to mindfulness and these constructs are conceptually related, Multivariate Analysis of Variance (MANOVA) was performed to test the difference of mindfulness traits across different age and sex groups. All the above statistical analyses were performed using SPSS 26.0 software, and a two-sided p value less than 0.05 were considered statistically significant.

Measurement invariance was tested by Multigroup Confirmatory Factor Analysis (MGCFA) using Lavaan package in R 4.1.1 [38]. By imposing cross-group constraints on a measurement model and examining the change in the goodness-of-fit indexes, measurement invariance could be demonstrated [39]. The following indexes were used to check the model fit: comparative fit index (CFI), Tucker-Lewis index (TLI), root-mean square error of approximation (RMSEA), Bayesian information criterion (BIC). If the CFI and TLI values are >0.90, RMSEA<0.08, the model is considered adequate [40]. When ΔCFI≤0.01 and ΔTLI≤0.01, we considered the measurement invariance was hold [39].

3. Results

3.1. Demographic characteristics

The sample was composed of 1777 adults covering the age from 18 to 80 years old ($M = 29.59$, $SD = 16.92$), with majority of participants aged below 60 years old (86.83%), and females account for 69.16% of the population. The demographic characteristics were shown in Table 1.

3.2. Measurement invariance of the FFMQ across age and sex

The present five-facet of FFMQ model yielded a good fit to data based on the CFI, TLI, and RMSEA. The figure with the MGCFA model and its respective standardized factor loadings can be found in the supplementary materials. As shown in Table 2, the results supported measurement invariance in relation to age. The age category configural model has an acceptable fit. The metric invariance model for the age categories also yield good fit indices ($\triangle$CFI = 0, $\triangle$TLI = 0, $\triangle$RMSEA = 0). Also, a scalar model also demonstrated adequate fit indices ($\triangle$CFI = −0.006, $\triangle$TLI = 0, $\triangle$RMSEA = 0.002). Table 2 also indicated that this model exhibited satisfactory fit indices across sex. The sex configural model for the five-facet of FFMQ model has an excellent fit. A metric model in terms of sex also yielded excellent fit indexes ($\triangle$CFI = 0, $\triangle$TLI = 0.003, $\triangle$RMSEA = −0.002). In addition, a scalar model showed excellent fit indexes ($\triangle$CFI = −0.001, $\triangle$TLI = 0.003, $\triangle$RMSEA = −0.001). These results supported the configural, metric, and scalar invariance as tenable assumptions when taking age and sex into consideration.

3.3. Mindfulness profiles in the participants

The five facets and total scores of mindfulness was illustrated in Table 3. Each facet of mindfulness scores covered the range of minimum score of 3 to maximum score of 15, and the total mindfulness scores ranged from 17 to 73, with the mean score of 44.74 and standard deviation of 7.60.

As shown in Fig. 1, participants aged above 60 scored higher in four facets of mindfulness, namely, describing, acting with

Table 1
Demographic characteristics of participants.

Age	Sex	N (%)	Mean (SD)	Min	Max
Below 60	Total	1543(86.83)	23.29(5.03)	18	53
	Male	481(27.07)	23.08(4.36)	18	53
	Female	1062(59.76)	23.39(5.31)	18	53
Above 60	Total	234(13.17)	71.16(4.16)	62	80
	Male	67(3.77)	72.48(4.22)	63	80
	Female	167(9.40)	70.63(4.03)	62	79
Total		1777(100)	29.59(16.92)	18	80

Table 2
Measurement invariance model it indicts across age and sex.

		χ [2]	*df*	CFI	TLI	RMSEA	△CFI	△TLI	△RMSEA
Age	Below 60	341.695	80	0.818	0.761	0.046			
	Above 60	358.236	80	0.976	0.968	0.122			
	Configural	1353.235	440	0.926	0.912	0.073			
	Metric	1353.235	440	0.926	0.912	0.073	0	0	0
	Scalar	1473.695	480	0.920	0.912	0.075	−0.006	0	0.002
Sex	Males	252.771	80	0.948	0.932	0.063			
	Females	377.404	80	0.961	0.949	0.055			
	Configural	630.176	160	0.957	0.944	0.058			
	Metric	646.53	170	0.956	0.946	0.056	0	0.003	−0.002
	Scalar	660.742	180	0.956	0.949	0.055	−0.001	0.003	−0.001

Note. χ^2, Chi square; *df*, degrees of freedom; CFI, comparative fit index; TLI, Tucker-Lewis index; RMSEA, root mean square error of approximation.

Table 3
Scores of FFMQ in age and sex groups.

Variable	Group	*n*	Observing	Describing	Acting with awareness	Nonjudging of inner experience	Nonreactivity to inner experience	Total
Age	Below 60	234	9.45 (2.77)	9.11 (2.60)	8.91 (2.93)	8.13 (2.46)	8.97 (2.22)	44.56 (7.88)
	Above 60	1543	8.76 (3.15)	9.28 (2.02)	9.65 (2.34)	8.68 (2.43)	9.56 (2.49)	45.92 (5.28)
Sex	Male	548	9.05 (2.79)	8.87 (2.56)	9.13 (2.90)	8.07 (2.41)	9.43 (2.24)	44.56 (7.63)
	Female	1229	9.49 (2.84)	9.25 (2.51)	8.95 (2.86)	8.26 (2.49)	8.87 (2.25)	44.82 (7.59)
Total		1777	9.36 (2.83)	9.13 (2.53)	9.01 (2.87)	8.20 (2.47)	9.05 (2.26)	44.74 (7.60)

Note. each column represents *Mean* (*SD*). FFMQ, Five-Facet Mindfulness Questionnaire.

awareness, nonjudging of inner experience, nonreactivity to inner experience, and total scores of mindfulness, while those aged below 60 had higher scores in observing. Moreover, female participants had slightly higher scores in the dimensions of observing, describing, nonjudging of inner experience, and the whole scale than their male participants, while males scored higher in acting with awareness and nonreactivity to inner experience.

3.4. Correlations between age, the five facets and total score of mindfulness

The correlations between age and five facets of mindfulness were shown in Table 4. All facets of mindfulness were significantly
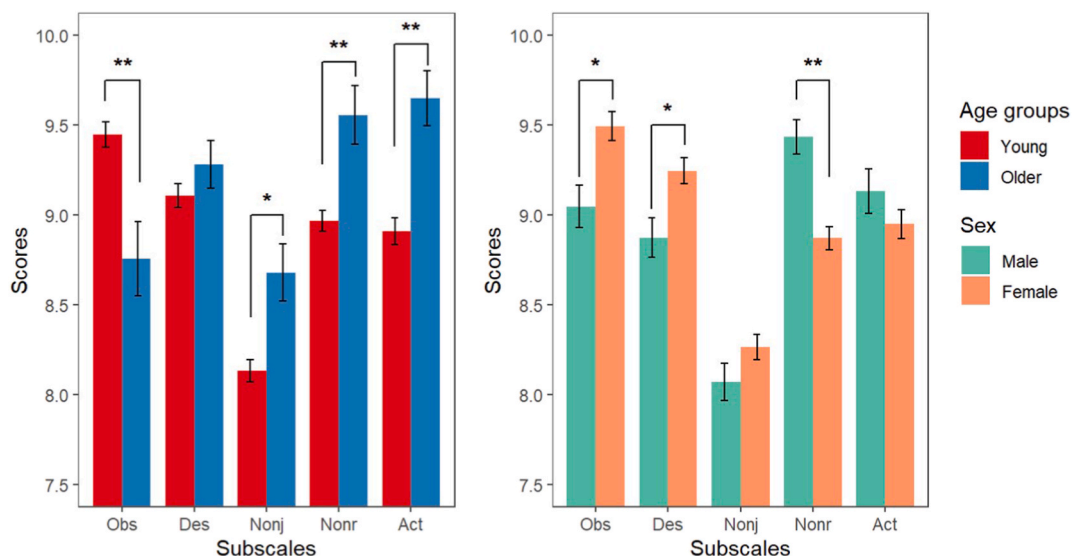

Fig. 1. Scores of mindfulness subscales according to age and sex groups.

correlated except the link of nonjudging of inner experience with describing and nonreactivity to inner experience with acting with awareness. Age was positively correlated with the total mindfulness scores. To be specific, age was negatively associated with observing, and positively associated with nonjudging of inner experience, nonreactivity to inner experience, and acting with awareness. No significant relationship was found between age and describing.

3.5. Age- and sex-specific differences on mindfulness

There was significant difference ($t = 6.52$, $p = .011$) in the total mindfulness scores between the two age groups (See Table 5), as participants aged above 60 scored significantly higher than those aged below 60. Significant differences were found in four of mindfulness dimensions: observing ($t = 12.17$, $p < .001$), nonjudging of inner experience ($t = 13.65$, $p < .001$), nonreactivity to inner experience ($t = 10.04$, $p < .001$), and acting with awareness ($t = 13.28$, $p < .001$). People who were 60 years and older demonstrated more qualities or capacities in acting with awareness, nonjudging of inner experience and nonreactivity to inner experience, while observing was more likely to shown on individuals aged below 60. No significant difference was shown in the describing facet ($t = 0.96$, $p = .327$).

Though non-significance ($t = 0.48$, $p = .449$) was shown in the total level of mindfulness between different sex, three facets of mindfulness demonstrated valuable results: observing ($t = 9.47$, $p = .002$), describing ($t = 8.22$, $p = .004$) and nonreactivity to inner experience ($t = 23.77$, $p < .001$) were all significantly different between males and females. To be specific, females had distinguishing higher level in observing and describing, while nonreactivity to inner experience had more possibility to shown on males. There was no significant difference in nonjudging of inner experience ($t = 1.57$, $p = .211$) and acting with awareness ($t = 2.33$, $p = .127$) dimensions.

4. Discussion

With the growing interest in the differences of mindfulness associated with age and sex, several investigations have been conducted in the Western cultural context on test this topic. Nonetheless, debate is still going on regards the existing findings, along with the lack of evidences from eastern countries where the mindfulness originated. The aims of the present study was to evaluate the age- and sex-specific differences of mindfulness and its facets among Chinese adult population, with controlling for the measurement invariance which was seriously ignored in research previously published.

The primary finding of the study is that the mindfulness assessment tool, the FFMQ-SF, demonstrated acceptable measurement invariance across age and sex, which allowed further analyses on their relationships with mindfulness. As expected, significant differences of mindfulness on age were detected, as the total score of mindfulness increased with age, and the facet describing was negatively linked to age, while the associations for acting with awareness, nonjudging of inner experience and nonreactivity to inner experience were positive. Also, adults aged over 60 reported higher levels of acting with awareness, nonjudging of inner experience, nonreactivity to inner experience and the total score of mindfulness compared to the younger.

These findings provided some evidence on the existing theories about the development of mindfulness across an individual's lifespan [24,41]. The model of strength and vulnerability integration (SAVI) proposed by Charles [42] claimed that, increased strengths were demonstrated in the frequency and success of adopting emotion regulation strategies to regulate emotional experiences during developmental period. These cultivated skills were the results of perspective changes regarding time lived and time left. With age, the accumulated experience enable adulthood to appreciate the engagement in the present-moment, the adopt a non-evaluative stance to events and experiences [24].

Another important implication of the study is that, though there's no significant differences on the total score of mindfulness across sex, males and females exhibited significant differences in three facets of mindfulness. Actually, multiple previous studies in primarily non-meditating samples have found some negative correlations among mindfulness facets, especially between observing and nonjudging of inner experience [43,44]. These negative intercorrelations of FFMQ facets were believed to prevent the meaningful creation of a total composite score. Thus, further research was recommended to focus more on the specific facets of mindfulness rather than simply taking the total score for consideration.

Specifically, female participants in the sample scored higher in the domains of describing and observing, while male participants had higher scores in nonreactivity to inner experience. Emotional regulation strategies were suspected to contribute to the disparity. Theoretically, compared with males, females are more likely to seek social support in situations associated with negative emotions, which leads them more sensitive to the surrounding environments and more willing to describe their feelings and thoughts [45]. In

Table 4
Correlation between age and five facets of mindfulness.

	1	2	3	4	5	6	7
1. Age	1						
2. Observing	−0.105***	1					
3. Describing	0.032	0.383***	1				
4. Acting with awareness	0.098***	0.106***	0.205***	1			
5. Nonjudging of inner experience	0.119***	−0.16***	0.037	0.284***	1		
6. Nonreactivity to inner experience	0.085***	0.308***	0.31***	0.012	0.299***		
7. Total	0.072**	0.58***	0.657***	0.388***	0.632***	0.667***	1

Note. **$p < .01$, ***$p < .001$.

Table 5
MANOVA on age, sex and the five facets of mindfulness.

	Observing	Describing	Acting with awareness	Nonjudging of inner experience	Nonreactivity to inner experience	[a]Effect size [95% CI]
Age	12.17 (<0.001)	0.96 (0.327)	13.65(<.001)	10.04(0.002)	13.83(<0.001)	0.03 [0.01, 1.00]
Sex	9.47(0.002)	8.22 (0.004)	1.56(0.211)	2.33(0.127)	23.77(<0.001)	0.04 [0.02, 1.00]

Note. each column represents F-value (p-value).
[a] The effect sizes were estimated using the η^2(partial).

contrast, males are more likely to use avoidance and suppression, hiding their inner voice and coping with their feelings in an nonreactive way [45].

5. Conclusion

A major strength of the study was that all the findings were concluded with controlling for the measurement invariance. Identification of measurement invariance cannot be underestimated due to the fact that it is the premise of comparison between groups [46]. Only a questionnaire measuring identical constructs with the same structure across different groups can make the comparison reliable and valid [47]. If measurement invariance is neglected, it is hard to make a comparison as groups or subjects may respond differently to the items based on their understandings. Therefore, further research should put measurement invariance into consideration when establishing a comparison across groups.

The study has limitations. First, as it is a pilot and exploratory study, the sample recruited from just one city is small and not representative of the Chinese population, so caution needs to be exercised in generalizing the findings to the population in other regions. Also, the study was conducted during the COVID-19 pandemic, which situation may affect the results of the research. Moreover, older participants were recruited and participated offline while younger participants completed the procedure online, which might expand the differences observed in the study. Other limitations include the relatively low proportion of those aged above 60 in the sample, and the sex distribution is slightly unbalanced. Finally, data on other characteristics probably related to mindfulness like educational attainment and religion were not collected, which may overstate the differences reported in the study. In successive investigations it is recommended to increase the sample in number and geographical location, and also incorporate all the variables that may affect the results.

In conclusion, the present study contributed to the literature on the relationships of mindfulness with age and sex. Evaluated by the FFMQ-SF with acceptable measurement invariance, mindfulness and its five facets varied across age and sex, with people aged above 60 demonstrated higher levels of acting with awareness, nonjudging of inner experience, nonreactivity to inner experience compared to the younger, while the latter had higher observing capacity. Additionally, females were more likely to observing and describing, while males would tend to take a non-active way to inner experience. The findings will help to guide the future design and application of personalized mindfulness training programs.

Ethical statement

The study was reviewed and approved by the Academic Review Board of Zhejiang University Department of Psychology (register number: 1806).

Funding

Author contribution statement

Ruochen Gan; Yanping Wei: Performed the experiments; Analyzed and interpreted the data; Wrote the paper.
Limin Sun; Liuyi Zhang; Tingfei Zhu: Performed the experiments.
Jiayu Wang: Performed the experiments; Analyzed and interpreted the data.
Jiang Xue; Shulin Chen: Conceived and designed the experiments; Contributed reagents, materials, analysis tools or data; Wrote the paper.

Data availability statement

Data will be made available on request.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Acknowledgment

We thank all the participants in the study, and we are also grateful to research assistants who participated in the study for their assistance in research coordination and data collection.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.heliyon.2023.e19608.

References

[1] S.B. Goldberg, et al., Mindfulness-based interventions for psychiatric disorders: a systematic review and meta-analysis, Clin. Psychol. Rev. 59 (2018) 52–60, https://doi.org/10.1016/j.cpr.2017.10.011.

[2] J. Wielgosz, S.B. Goldberg, T.R.A. Kral, J.D. Dunne, R.J. Davidson, in: T. Widiger, T.D. Cannon (Eds.), Annual Review of Clinical Psychology, Vol 15 Vol. 15 Annual Review of Clinical Psychology, 2019, pp. 285–316.

[3] L. Bartlett, et al., A systematic review and meta-analysis of workplace mindfulness training randomized controlled trials, J. Occup. Health Psychol. 24 (2019) 108–126, https://doi.org/10.1037/ocp0000146.

[4] M. Janssen, Y. Heerkens, W. Kuijer, B. van der Heijden, J. Engels, Effects of Mindfulness-Based Stress Reduction on employees' mental health: a systematic review, PLoS One 13 (2018), https://doi.org/10.1371/journal.pone.0191332.

[5] J. Kabat-Zinn, Mindfulness-based interventions in context: past, present, and future, Clin. Psychol. Sci. Pract. 10 (2003) 144–156, https://doi.org/10.1093/clipsy/bpg016.

[6] J. Du, Y. An, X. Ding, Q. Zhang, W. Xu, State mindfulness and positive emotions in daily life: an upward spiral process, Pers. Individ. Differ. 141 (2019) 57–61, https://doi.org/10.1016/j.paid.2018.11.037.

[7] E.K. Lindsay, et al., How mindfulness training promotes positive emotions: dismantling acceptance skills training in two randomized controlled trials, J. Pers. Soc. Psychol. 115 (2018) 944–973, https://doi.org/10.1037/pspa0000134.

[8] C. Randal, D. Pratt, S. Bucci, Mindfulness and self-esteem: a systematic review, Mindfulness 6 (2015) 1366–1378, https://doi.org/10.1007/s12671-015-0407-6.

[9] K. Raab, Mindfulness, self-compassion, and empathy among health care professionals: a review of the literature, J. Health Care Chaplain. 20 (2014) 95–108, https://doi.org/10.1080/08854726.2014.913876.

[10] B. Bajaj, N. Pande, Mediating role of resilience in the impact of mindfulness on life satisfaction and affect as indices of subjective well-being, Pers. Individ. Differ. 93 (2016) 63–67, https://doi.org/10.1016/j.paid.2015.09.005.

[11] F. Kong, X. Wang, J. Zhao, Dispositional mindfulness and life satisfaction: the role of core self-evaluations, Pers. Individ. Differ. 56 (2014) 165–169, https://doi.org/10.1016/j.paid.2013.09.002.

[12] K.A. Godfrin, C. van Heeringen, The effects of mindfulness-based cognitive therapy on recurrence of depressive episodes, mental health and quality of life: a randomized controlled study, Behav. Res. Ther. 48 (2010) 738–746, https://doi.org/10.1016/j.brat.2010.04.006.

[13] I. Nyklicek, K.F. Kuijpers, Effects of mindfulness-based stress reduction intervention on psychological well-being and quality of life: is increased mindfulness indeed the mechanism? Ann. Behav. Med. 35 (2008) 331–340, https://doi.org/10.1007/s12160-008-9030-2.

[14] D.K. Reibel, J.M. Greeson, G.C. Brainard, S. Rosenzweig, Mindfulness-based stress reduction and health-related quality of life in a heterogeneous patient population, Gen. Hosp. Psychiatr. 23 (2001) 183–192, https://doi.org/10.1016/s0163-8343(01)00149-9.

[15] S.G. Hofmann, A.T. Sawyer, A.A. Witt, D. Oh, The effect of mindfulness-based therapy on anxiety and depression: a meta-analytic review, J. Consult. Clin. Psychol. 78 (2010) 169–183, https://doi.org/10.1037/a0018555.

[16] J.D. Teasdale, et al., Prevention of relapse/recurrence in major depression by mindfulness-based cognitive therapy, J. Consult. Clin. Psychol. 68 (2000) 615–623, https://doi.org/10.1037/0022-006x.68.4.615.

[17] S. Evans, et al., Mindfulness-based cognitive therapy for generalized anxiety disorder, J. Anxiety Disord. 22 (2008) 716–721, https://doi.org/10.1016/j.janxdis.2007.07.005.

[18] T. Asparouhov, B. Muthen, Latent variable centering of predictors and mediators in multilevel and time-series models, Structural Equation Modeling-a Multidisciplinary Journal 26 (2019) 119–142, https://doi.org/10.1080/10705511.2018.1511375.

[19] D.J. Bauer, P.J. Curran, Distributional assumptions of growth mixture models: implications for overextraction of latent trajectory classes, Psychol. Methods 8 (2003) 338–363, https://doi.org/10.1037/1082-989x.8.3.338.

[20] S.A. Brown, et al., A developmental perspective on alcohol and youths 16 to 20 years of age, Pediatrics 121 (2008) S290–S310, https://doi.org/10.1542/peds.2007-2243D.

[21] L. Chassin, D.B. Flora, K.M. King, Trajectories of alcohol and drug use and dependence from adolescence to adulthood: the effects of familial alcoholism and personality, J. Abnorm. Psychol. 113 (2004) 483–498, https://doi.org/10.1037/0021-843x.113.4.483.

[22] M. Windle, E.Y. Mun, R.C. Windle, Adolescent-to-young adulthood heavy drinking trajectories and their prospective predictors, J. Stud. Alcohol 66 (2005) 313–322, https://doi.org/10.15288/jsa.2005.66.313.

[23] M.R. Pearson, A.K. Lawless, D.B. Brown, A.J. Bravo, Mindfulness and emotional outcomes: identifying subgroups of college students using latent profile analysis, Pers. Individ. Differ. 76 (2015) 33–38, https://doi.org/10.1016/j.paid.2014.11.009.

[24] L. Mahlo, T.D. Windsor, Older and more mindful? Age differences in mindfulness components and well-being, Aging Ment. Health 25 (2021) 1320–1331, https://doi.org/10.1080/13607863.2020.1734915.

[25] W. Boekel, S. Hsieh, Cross-sectional white matter microstructure differences in age and trait mindfulness, PLoS One 13 (2018) 17, https://doi.org/10.1371/journal.pone.0205718.

[26] S. Fountain-Zaragoza, N.A. Puccetti, P. Whitmoyer, R.S. Prakash, Aging and attentional control: examining the roles of mind-wandering propensity and dispositional mindfulness, J. Int. Neuropsychol. Soc. 24 (2018) 876–888, https://doi.org/10.1017/s1355617718000553.

[27] C.T. Mahoney, D.L. Segal, F.L. Coolidge, Anxiety sensitivity, experiential avoidance, and mindfulness among younger and older adults: age differences in risk factors for anxiety symptoms, Int. J. Aging Hum. Dev. 81 (2015) 217–240, https://doi.org/10.1177/0091415015621309.

[28] R. Masud, et al., The impact of body mass index, age and gender on dispositional mindfulness amongst medical students, Pak. J. Med. Health Sci. 15 (2021) 1368–1370.

[29] H.H.-M. Lo, Quality of life among adolescents in Hong Kong: general and gender-specific effects of self-efficacy and mindfulness: a special issue on quality of life in Chinese societies in applied research in quality of life, Applied Research in Quality of Life (2021), https://doi.org/10.1007/s11482-021-09914-w.

[30] H. Abujaradeh, B.A. Colaianne, R.W. Roeser, E. Tsukayama, B.M. Galla, Evaluating a short-form Five Facet Mindfulness Questionnaire in adolescents: evidence for a four-factor structure and invariance by time, age, and gender, IJBD (Int. J. Behav. Dev.) 44 (2020) 20–30, https://doi.org/10.1177/0165025419873039.

[31] J.N. Kingery, J.S. Bodenlos, T.I. Schneider, J.S. Peltz, M.W. Sindoni, Dispositional mindfulness predicting psychological adjustment among college students: the role of rumination and gender, J. Am. Coll. Health 12 (2021), https://doi.org/10.1080/07448481.2021.1943411.

[32] R. Amemiya, Y. Sakairi, The role of self-compassion in athlete mindfulness and burnout: examination of the effects of gender differences, Pers. Individ. Differ. 166 (2020) 6, https://doi.org/10.1016/j.paid.2020.110167.

[33] A. Theofanous, M. Ioannou, M. Zacharia, S.N. Georgiou, M. Karekla, Gender, age, and time invariance of the child and adolescent mindfulness measure (CAMM) and psychometric properties in three Greek-speaking Youth samples, Mindfulness 11 (2020) 1298–1307, https://doi.org/10.1007/s12671-020-01350-5.

[34] E. Vitale, Gender gap in mindfulness assessment among Italian nurses: a pilot descriptive study, J. Evid-Based Psychother. 21 (2021) 81–100.

[35] R.J. Vandenberg, C.E. Lance, A review and synthesis of the measurement invariance literature: suggestions, practices, and recommendations for organizational research, Organ. Res. Methods 3 (2000) 4–70, https://doi.org/10.1177/109442810031002.

[36] R.A. Baer, et al., Construct validity of the five facet mindfulness questionnaire in meditating and nonmeditating samples, Assessment 15 (2008) 329–342, https://doi.org/10.1177/1073191107313003.

[37] T. Zhu, C. Chen, S. Chen, Validation of a Chinese version of the five facet mindfulness questionnaire and development of a short form based on item response theory, Curr. Psychol. (2021), https://doi.org/10.1007/s12144-021-01720-9.

[38] Y. Rosseel, lavaan: an R package for structural equation modeling, J. Stat. Software 48 (2012) 1–36.

[39] G.W. Cheung, R.B. Rensvold, Evaluating goodness-of-fit indexes for testing measurement invariance, Struct. Equ. Model. 9 (2002) 233–255.

[40] L.t. Hu, P.M. Bentler, Cutoff criteria for fit indexes in covariance structure analysis: conventional criteria versus new alternatives, Struct. Equ. Model.: A Multidiscip. J. 6 (1999) 1–55.

[41] Lehto, J., Uusitalo-Malmivaara, L. & Repo, S.

[42] S.T. Charles, Strength and vulnerability integration: a model of emotional well-being across adulthood, Psychol. Bull. 136 (2010) 1068–1091, https://doi.org/10.1037/a0021232.

[43] R.A. Baer, G.T. Smith, J. Hopkins, J. Krietemeyer, L. Toney, Using self-report assessment methods to explore facets of mindfulness, Assessment 13 (2006) 27–45, https://doi.org/10.1177/1073191105283504.

[44] D.B. Brown, A.J. Bravo, C.R. Roos, M.R. Pearson, Five facets of mindfulness and psychological health: evaluating a psychological model of the mechanisms of mindfulness, Mindfulness 6 (2015) 1021–1032, https://doi.org/10.1007/s12671-014-0349-4.

[45] P. Zimmermann, A. Iwanski, Emotion regulation from early adolescence to emerging adulthood and middle adulthood Age differences, gender differences, and emotion-specific developmental variations, IJBD (Int. J. Behav. Dev.) 38 (2014) 182–194, https://doi.org/10.1177/0165025413515405.

[46] X. Bai, Chen, Y. J. A. I. P. S. MEASUREMENT EQUIVALENCE: CONCEPTIOIN and TEST CONDITIONS, 2004.

[47] V. Rens, P. Lugtig, Hox, J. J. E. J. o. D. P. A checklist for testing, measurement invariance 9 (2012) 486–492.