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資　料

Development of the Revised Japanese Athletic Hardiness Scale for University Athletes[1)]

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Although the original Athletic Hardiness Scale (AHS) has been used to measure hardiness among university athletes in Japan, some psychometric problems have been identified with this scale. Thus, the purpose of this study was to revise the AHS for Japanese university athletes and to examine differences in hardiness according to gender and competitive role. The participants were 511 Japanese university athletes (305 men; 206 women; mean age 19.9 years, *SD* = 1.21). The measures consisted of sociodemographic questions, the revised AHS questionnaire for Japanese university athletes (RAHS), and the Self-rating Depression Scale. An exploratory factor analysis of the RAHS revealed a 12-item, three-factor model. We labeled the factors as "commitment," "challenge," and "control." Cronbach's α coefficients ranged from .75 to .84. A confirmatory factor analysis indicated acceptable structural validity of the RAHS. Men reported higher hardiness scores than women, and a negative correlation between hardiness and depressive symptoms was confirmed. The RAHS showed satisfactory reliability and validity, and it may be useful for understanding hardiness among university athletes.

key words: athletes, hardiness, scale development, stress

Introduction

Superior sport performance has been attributed to a variety of factors including mental toughness, mental skills, and hardiness (Gould et al., 2002). Hardiness acts as a buffer for major life stressors (Maddi et al., 2006). Hardiness is a concept advocated by Kobasa (1979) and consists of "commitment", "control", and "challenge". and Nakajima et al. (2015) defined hardiness as the attitudes and skills used to support stress coping methods. Commitment refers to the tendency to involve oneself in whatever one is doing or encountering, rather than to alienate oneself from the situation. Control refers to the tendency to feel and act as if one is influential (as opposed to helpless) in the face of the various contingencies of life. Finally, challenge refers to the belief that change rather than stability is typical in life, and that the anticipation of changes is an incentive to grow rather than a threat to security (Kobasa, 1979).

In research on hardiness, the Dispositional Resilience Scale (DRS), has been used to measure hardiness in the general population (Bartone, 2007). Resil-

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ience is explains as “how some individuals maintain healthy lifestyles and become even more capable in spite of facing similar adversities, stressors, or life changes that result in maladaptation to life event among non-resilient people” (Richardson et al., 1990), which is a different concept to hardiness, but may be used as a measure of hardiness. The reason why a scale of resilience is used to assess hardiness, is that a scale measuring hardiness itself has not been developed. In addition, hardiness research using the DRS has often focused on mental health and performance. For example, one study of undergraduate students with low levels of hardiness demonstrated that they were more likely to report suicidal ideation than were students with high levels of hardiness and established a negative correlation between hardiness and depression or suicidal thoughts (Abdollahi et al., 2015). Moreover, high levels of hardiness can buffer against high levels of stress. Not only do athletes with higher levels of hardiness better manage their anxiety and cope more effectively than those with lower levels of hardiness, but they also perform better and compete at the highest levels (Salim et al., 2016). Other scales that are used to assess hardiness are the 18-item Personal Views Survey 3（PVS3）(Maddi and Khoshaba, 2001) and the revised Norwegian Dispositional Resilience Scale (NDRS-R) (Hystad et al., 2010). The item content of these scales focuses on work activities and levels of interest in daily life. However, there is no mention of competition, which is an important component when measuring hardiness in athletes. Additionally, the aforementioned scales are not specific to athletes, but are measures widely used with general university students.

Schaufeli et al. (2002) advocated that measurement indices should be tailored to the characteristics of the target population (e.g., occupation and gender) and based on accurate psychological assessment. Therefore, the scales mentioned above are not strictly indicators of hardiness. However, no scale has been created to measure hardiness. As mentioned above, the DRS and PVS have been used to measure hardiness, but it is unclear if the results obtained by them reflect hardiness or resilience. In order to solve the above problems, Yamaguchi et al. (2016) created the first scale for assessing the hardiness of athletes: The Athletic Hardiness Scale (AHS).

In the development of the AHS, items were selected in an exploratory manner using an interview survey. The interview to prepare the AHS was conducted with seven Japanese university students (7 men, M_{age} = 20.85 years, SD = 1.12) belonging to an athletic club. Based on Kobasa’s (1979) definition of hardiness, participants were asked what kind of hardiness during sport they experienced, and in which kinds of situations. Subsequently, 308 university students were surveyed (men = 248, women = 60; M_{age} = 19.6, SD = 1.21). Participants were asked to complete a questionnaire that included sociodemographic questions (e.g., gender, age, sport) and questions related to hardiness obtained from an interview. Using factor analysis, 15 items were extracted that represented the three factors of “commitment,” “control,” and “challenge,” The reliability of the AHS was established based on Cronbach’s alpha coefficients ranging from .72 to .80 for each subscale.

However, the AHS have some issues in terms of its psychometric properties, and its content validity in particular, which make it a somewhat problematic measure for accurately assessing the hardiness of athletes. All items of the “commitment” subscale are reverse scored, which can lead to confusion when attempting to understand the question content. That is, because the content of “commitment” consists entirely of reversed items, it may result in the incorrect interpretation that the participant did “not commit” when they did, in fact, commit. Additionally, the item content can be problematic when considering team versus individual sports, particularly for items such as, “If I can, I want to practice alone,” and “I do not want to engage with teammates in practice and games.” While some items may be appropriate for team sports, they will likely

not be relevant to individuals who must practice on their own regularly. Similarly, the item "I'm unfazed by a dangerous play from the opponent" may be difficult to imagine in the case of individual athletics such as track and field, swimming, and archery. Moreover, the AHS by Yamaguchi et al. (2016) aimed to measure the hardiness of general university students who belonged to sports clubs or circle activities, rather than university athletes.

Purpose

We re-examined the scale created in the preliminary study (Yamaguchi et al., 2016), to establish a hardiness scale for athletes and to investigate the characteristics of Japanese university athletes' hardiness.

Methods

In this study, 9 new items were added to the original 15 items of the AHS. We confirmed the definition of "commitment" by Nakajima et al. (2015) and referred to the content of the item in the Sports Commitment Scale developed by Hagiwara & Isogai (2014) to examin whether the revised scale represented "commitment" more accurately. Specifically, a health psychologist, a sports psychologist, a psychiatrist, and two graduate students specializing in sports psychology and pedagogy reached a consensus on item selection. After discussion, consensus was obtained on the 9 items. Content validity was ensured by the consensus established between these 5 specialists. The nine items were "I feel pain in adapting to the team," "I am not aware of how to become involved with teammates," "I am able to adapt myself to the team," "It is important to be involved with teammates," "I try to communicate with teammates," "It is difficult to devote myself to my team," "When there are difficult developments in the game, I will actively play the role that is required," "I am able to carry out my own role in the team," and "Even in difficult situations in a game, I can respond dispassionately."

Participants

Between September and October 2016, 511 university athletes participated (305 men, 206 women; mean age = 19.9 years, *SD* = 1.21).

Procedures

This was a cross-sectional study conducted at one time point using a questionnaire, which was distributed via postal mail or completed as a group survey. We mailed a request for participation to several universities in Japan to which the target university athletes belonged. The group surveys were completed in university conference rooms, while the individual questionnaires were sent to university athletes. We obtained written informed consent from all participants, and they were made aware of their right to decline their participation at any time without any repercussions, even after consenting to participate. After giving their consent, participants responded to the questionnaire. The researchers stored the questionnaires in locked cabinets. In addition, data were analyzed only after ensuring anonymization. The study was approved by the Research Ethics Committee of the Faculty of Health and Sports Science, Juntendo University (Number: 28-54, June 30, 2016).

Measures

2.2.1 Socio-demographic information

Participants were asked to report their gender, age, grade, and sports.

2.2.2. Revised Athletic Hardiness Scale (RAHS)

The initial AHS-J included 24 items. The participants responded to all the questionnaire items on a Likert scale ranging from 1 ("*I do not agree at all*") to 4 ("*I agree very much*"). The scale score was calculated as the average of the item scores for each factor. A high score indicates a high level of hardiness.

2.2.3 Self-Rating Depression Scale (SDS)

This 20-item scale is designed to assess an individual's level of depressive symptoms (Zung, 1965). The participants responded to all the questionnaire items on a Likert scale ranging from 1 ("*not at all*") to 4 ("*much more than usual*"). Higher scores indicate a more serious state of depression, with a total score ranging from 20 to 80. The Cronbach's α coefficient was .73, indicating relatively high reliability

(Fukuda and Kobayashi, 1983). A high score indicates a high level of depressive condition.

Statistical analysis

The goodness of fit index (GFI), adjusted GFI (AGFI), comparative fit index (CFI), and root mean square error of approximation (RMSEA) were used as fitness indices. The maximum likelihood estimation method was used, and the variance of each latent variable was set to a value of 1. The paths from the errors to the observed variables were all limited to one within this model.

To establish the reliability of the RAHS, internal consistency (Cronbach's α) coefficients were calculated for the total score and each subscale. To further assess the concurrent validity of the hardiness scale, we assessed its correlation with the depression scale. Finally, differences related to gender was examined to explore the characteristics of Japanese university athletes' hardiness. The analysis generated both p-values and indicators of effect size (Cohen's d). Regarding Cohen's d, a small effect is defined as .20, a medium effect as .50, and a large effect as .80; thus, there were clear criteria for assessing the magnitude of effects (Cohen, 1988). The software SPSS Statistics 21 and AMOS 21 were used for the analysis. Statistical significance was set at $p < .05$.

Results

Exploratory factor analysis

Factors with an eigenvalue of 1.0 or greater were extracted, and the factor load amount was rounded down to .45 or less. The results, 12 out of 24 items were extracted from the revised scale. These 12 items of the RAHS and their mean and standard deviation are shown in Table 1. The first factor was "Control," the second "Challenge," and the third "Commitment." All items of "Commitment" that posed problems in the original version were replaced with new items.

Reliability

Cronbach's α coefficients were .75, .80, and .77, for the commitment, control, and challenge factors, respectively, indicating adequate internal consistency.

Confirmatory factor analysis

The results of the CFA showed that the factor model fit the data well (CFI = .91, GFI = .93, AGFI = .90, and RMSEA = .08). The hypothesized latent variables, observed variables, and path coefficients among the latent variables were all significant at $p < .001$.

Concurrent validity

The results evaluating the concurrent validity are presented in Table 2. A significant negative relationship between the total score of the RAHS and SDS was identified ($r = -.45$, $p < .01$). For the subscales, a significant negative correlation was found between depression and the three factors of commitment, control, and challenge ($r = -.29$ to $-.40$, all ps $< .01$).

Gender differences

Table 3 shows the differences in RAHS scores between men and women. There was a significant difference between men and women in the RAHS total scale score. A significant difference between men and women was also found for the control subscale, but not for the commitment or challenge subscales.

Discussion

The purpose of this study was to revise the AHS for Japanese university athletes and to confirm differences in hardiness between gender and among competitive roles. The original AHS consisted of 15 Japanese written items relating to three factors. The original version had problems with inappropriate content and reversed items. Therefore, we reexamined the questions of the original version and created new items. In this study, when preparing the question items, we made the items applicable to both individual and team athletes in order to reinforce content validity. As the results, all items that were inappropriate for individual competition were removed from the AHS. The RAHS contains three factors and 12 Japanese written items and can be used for athletes who participate in either individ-

Table 1 Results of the exploratory factor analysis.

Subscale	Factor loading			Communality	Mean (*SD*)
	F1	F2	F3		
F1: Control (α = .80)					
Even with a difficult situation in the game, I can respond dispassionately	.904	− .095	− .115	.667	2.8 (0.74)
I am able to carry out my own role in the team	.692	.101	.019	.579	2.9 (0.72)
When there are difficult developments in the game, I will actively play the role that is required	.635	.041	.154	.543	2.9 (0.76)
I can correct myself when I make a mistake	.593	.022	− .055	.341	2.8 (0.79)
F2: Challenge (α = .77)					
Even when practice is difficult, I will try my best	− .082	.781	− .014	.539	3.3 (0.73)
Even when there is no practice, I try to engage in self-practice	.080	.657	− .090	.447	2.8 (0.90)
I like to practice	− .043	.643	− .050	.362	3.0 (0.86)
Even when I cannot play as I want to, I will try not to give up making an effort	.174	.617	.074	.582	3.2 (0.67)
F3: Commitment (α = .75)					
I feel pain in adapting to the team (R)	− .149	− .035	.789	.530	3.1 (0.87)
I find it difficult to devote myself to my team (R)	− .126	.176	.692	.531	2.9 (0.92)
I am not aware of how to become involved with teammates (R)	.104	− .214	.618	.356	3.3 (0.84)
I am able to adapt myself to the team	.259	.023	.551	.507	2.8 (0.75)
Cumulative variance explained (%)	32.1	42.1	49.9		
Factor correlations	1	2	3		
1	—				
2	.55	—			
3	.42	.42	—		

Note. (R) Denotes reverse-scored items. Goodness-of-fit indices: GFI = .93, AGFI = .90, CFI = .91, and RMSEA = .08
All twelve items shown here were translated from Japanese to English

Table 2 Relationship between hardiness and depression.

	1	2	3	4	5	Mean	*SD*
1. Hardiness	—					3.0	0.47
2. Commitment	.73**	—				3.0	0.64
3. Control	.78**	.35**	—			2.8	0.59
4. Challenge	.77**	.30**	.47**	—		3.1	0.61
5. Depression (SDS)	− .45**	− .40**	− .35**	− .29**	—	6.6	5.17

Note. SD = standard deviation; $^{**}p < .01$

ual or group sports. In addition, as the RAHS has fewer items compared to the original measure, the response time to complete it is somewhat shorter, and it may be easier to use. The original AHS (Yamaguchi et al., 2016) had issues related to the reversal of items and item content. All commitment factor

Table 3 Gender differences in hardiness and subscales score (*t*-tests).

	Men ($n = 305$)		Women ($n = 206$)		*t*	Cohen's *d*	95% CI
	M	*SD*	*M*	*SD*			
Hardiness	3.0	(0.47)	2.9	(0.46)	2.27*	.21	[0.01, 0.18]
Commitment	3.0	(0.65)	3.0	(0.63)	1.23	.11	[−0.04, 0.19]
Control	2.9	(0.60)	2.8	(0.58)	2.44*	.22	[0.03, 0.24]
Challenge	3.1	(0.61)	3.0	(0.61)	1.54	.14	[−0.02, 0.19]

Note. Cohen's *d*: small effect = .20, medium effect = .50, large effect = .80 (Cohen, 1988); $*p < .05$, $**p < .01$, $***p < .001$

items in the AHS must be reverse scored. In the RAHS, three of the four commitment factor items are reverse scored, thereby resolving the problem of misinterpretation by providing an internal fail-safe in the form of the one non-reverse-scored item. Regarding issues related to item content in the AHS, some items were perceived as lacking relevance to individual athletes. In this study, when preparing the question items, we made the items applicable to both individual and team athletes in order to reinforce content validity. There seemed little difficulty in understanding the items by participants.

The first factor, control, determines whether an athlete understands his/her position and role as a member of the team, and whether he/she can perform that role properly. Control is consisted of four items (e.g., "Even with a difficult situation in the game, I can respond dispassionately" and "I can correct myself when I make a mistake"). Originally, this factor contained five items, but as a result of factor analysis, four items remained and the contents were renewed. For example, it was difficult for individual athletes to understand the item "I am not affected by dangerous play from the opponent team." There were also similar issues with "I can understand what I am ask me" and "I understand my role." Therefore, in the revised scale, the above items were not included, and the problem was resolved. According to Kaizoji et al. (2004), when individuals with high control experience external pressure and stress, they can typically control the situation and use effective coping behaviors. Therefore, athletes with high control scores may be able to use external stress to achieve better outcomes.

The second factor, challenge, measures the extent to which individuals, in the face of stressors during competitions, can change their behavior by considering these stressors as sources of growth. Challenge is comprised four items (e.g., "Even when practice is difficult, I will try my best" and "Even when there is no practice, I try to engage in self-practice"). The item "I am proud to be a member of the team" in the original scale was problematic, as its content overlapped with the commitment factor. However, as a result of factor analysis, the items was excluded, and only items that properly reflected the concept of challenge remained. This factor measures the extent to which individuals, in the face of stressors during competitions, can change their behavior by considering these stressors as sources of growth. Individuals with high challenge scores believe that they can grow though learning rather than through comfort and security (Maddi et al., 2006). Therefore, when athlete high on the challenge domain faces a problem or stumbles, they show a proactive attitude to solve the problem and engage.

The third factor, commitment, consisted of four items (e.g., "I am able to adapt myself to the team" and "I find it difficult to devote myself to my team." All commitment factor items in the AHS were reverse scored (Yamaguchi et al., 2016). In the RAHS, three of the four commitment factor items are reverse scored, thereby resolving the problem of misinterpretation by providing an internal fail-safe in

the form of a non-reverse-scored item. Moreover, among the five items in this factor in the original scale, and it was considered that the content of "commitment" in relation to hardiness was not reflected appropriately. Therefore, in this study, "commitment" in sports was reconstructed with reference to the concept of "sports commitment" in the scale developed by Hagiwara and Isogai (2014). As a result, it is considered that the newly extracted four items can properly reflect the individual involvement and involvement with the team. Regarding commitment in sports, Scanlan et al. (2003) reported that players with high commitment tend to have better results. From this, the content of the commitment domain revised in this study shows whether the athlete himself can be involved in the team or actively.

In this study, gender differences were found in RAHS scores, as men reported higher levels of hardiness than women. In addition, the quantity of effect size suggests that "small" in hardiness and control. In the 95% CI, those with a significant difference did not cross 0. From this, it was suggested that there is a gender difference in hardiness not only from a statistically significant difference but also from the viewpoint of the effect size that is not easily influenced by the sample size. It was also shown that the obtained effect size will be one of the criteria for future research. The present study found similar results, which may be related to the fact that women athletes are more susceptible to the effects of stress than their men counterparts. Men athletes challenged stress to a higher extent than women athletes in both their daily lives and athletic environments, leading to higher hardiness scores. However, this study did not examine differences in hardiness according to other demographic variables besides gender. In other words, we did not consider other factors that could affect hardiness. Therefore, confounding factors could not be eliminated. In the future, in addition to gender, it is necessary to consider other factors that may influence hardiness. In particular, this study focused on athletes, and it is hoped that future studies will examine the role of competitions and the individual competitions.

The results of the concurrent validity analysis showed a negative association between hardiness and depressive symptoms. Hardiness has been shown to negatively correlate with depression and suicidal thoughts (Abdollahi et al., 2015). Furthermore, Boogar and Asgharnejad Farid (2008) reported a significant negative correlation between hardiness and both anxiety and depression. The prevalence of depression among university athletes ranges from 15.6-21% (Proctor and Boan-Lenzo, 2010). Therefore, athletes' mental health issues should be resolved quickly. It has been reported that mental health is improved when hardiness is high (Yamaguchi et al., 2017). Hardiness can also preserve and enhance performance, along with physical and mental health, even in stressful circumstances (Maddi et al., 2006). Given these findings and the results of the present study, it may be possible to lower the rate of depression by increasing hardiness. Since the relationship between hardiness and depression has been clarified, it is necessary to construct an intervention method that increases hardiness.

Conclusion

Revised Athletic Hardiness Scale for university athletes (RAHS) with a three-factor, 12-item was developed. The goodness-of-fit index, which indicates the validity of the scale, was within the acceptable range. Men reported higher hardiness than women, and a negative correlation between hardiness and depressive symptoms was confirmed.

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Appendix 1　Reversed Athletic Hardiness Scale の日本語訳

	英文	和文
1	Even with a difficult situation in the game, I can respond dispassionately	試合で苦しい展開でも，冷静に対応ができる
2	I am able to carry out my own role in the team	チームの中で，自身の役割を遂行できる
3	When there are difficult developments in the game, I will actively play the role that is required	試合で苦しい展開のとき，乗り越えるために自ら活躍する
4	I can correct myself when I make a mistake	自身がミスをしたときに，切り替えることができる
5	Even when practice is difficult, I will try my best	辛い練習でも逃げずに取り組もうと思う
6	Even when there is no practice, I try to engage in self-practice	練習がないときも，自主練習を心がけている
7	I like to practice	練習することは好きだ
8	Even when I cannot play as I want to, I will try not to give up making an effort	思うようにプレーができない時でも諦めずに努力をする
9	I feel pain in adapting to the team（R）	チームに適応させることに苦痛を感じる（R）
10	I find it difficult to devote myself to my team（R）	今の自分にはチームに没頭することが難しい（R）
11	I am not aware of how to become involved with teammates（R）	今の自分には仲間との関わり方が分からない（R）
12	I am able to adapt myself to the team	今の自分はチームに適応できている