Development of the General Self-regulation Scale for a Healthy Lifestyle (GSRSHL) among Japanese University Students

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Abstract

Background: A healthy lifestyle of students is an important contributor to both quality of life and longevity. The objective of this study was to develop a new measurement scale, the General Self-regulation Scale for a Healthy Lifestyle (GSRSHL), for university students.

Methods: A total of 434 university students (281 male, 153 female) participated in this study. To confirm the validity of the new scale, we examined the relationship among the GSRSHL, the Japanese version of the Brief Self-control Scale, perceived stress, and life satisfaction.

Results: The exploratory factor analysis of 15 items yielded two correlated factors: “planning achievement” and “emotional control.” The new scale showed good internal consistency. Confirmatory factor analysis with covariate analysis demonstrated that “planning achievement” and “emotional control” were positively associated with self-regulation and life satisfaction. “Emotional control” related negatively to perceived stress. “Planning achievement” increased the odds of adequate sleep, balanced diet, and physical exercise. “Emotional control” increased the odds of consuming breakfast, having adequate sleep, following a balanced diet, and having less stress.

Conclusions: Our study provided evidence of the validity and the applicability of the GSRSHL in Japanese students.

Background

Recently, chronic somatic diseases (e.g., diabetes, cardiovascular disease, respiratory disease, and cancer) have become the most common causes of death worldwide, and nearly all such diseases emerge following years of undesirable, unhealthy lifestyles. (e.g., Matsui, 2019; Miller et al., 2018).

With the continued aging of Japanese society, the annual mortality rate is over 60% from chronic somatic diseases, and now, Japanese health organizations and jurisdictions have increasingly implemented health-promotion programs aimed at the prevention, diagnosis, and treatment of lifestyle-related diseases. (Ministry of Health, Labour and Welfare, 2016; 2019). However, their effectiveness has recently aroused widespread doubt (World Health Organization, 2010), because participants do not appear able to maintain long-term behavioral changes that support more healthful lifestyles despite having received health education from an early age. These ineffective efforts toward long-term change can result from any number of factors such as bad influences in one’s environment or a loss of interest in one’s health care over time (Darviri et al., 2014; Yamamoto et al., 2018).

In Japan as elsewhere, young people who graduate from high school and leave for university gain newfound independence from their parents and establish drastically different lifestyles. Young people on their own must construct their new lives according to their priorities and values, including regarding how they maintain their health. Yet young adulthood is the time when many undesirable lifestyle habits form such as smoking, drinking, skipping meals, overeating, and ceasing or failing to exercise. Indeed, many

previous researchers reported that increasingly unhealthy lifestyles in adolescence were associated with lifestyle-related diseases in adulthood (Matsui, 2019; Miller et al., 2018). The implication of these various findings is that, for people to enjoy healthy lives and prevent lifestyle-related diseases, they must be made aware of the importance of “self-regulation” from an early age, and efforts are needed to improve this ability, especially among university students. Future research can be expected to provide individualized health education tailored to clients’ individual levels of self-regulation ability.

So what is self-regulation? In the early stages of research on self-regulation, the definition focused mainly on “impulse control/emotional control” (e.g., Mischel et al., 1989; Thoresen & Mahoney, 1974). Impulse behavior control has long been a concern in fields of research related to the self-regulation of eating behaviors, alcohol abuse, and other dangerous behaviors (e.g., Atalayer, 2018; Stephan et al., 2017). In addition, it is reported that emotional control and adjustment are related to psychosomatic symptoms in children (Sato et al., 2016). Recently, research has focused on other aspects of self-regulation, such as “achieving the goals/solving problems/adapting to social life” (e.g., Miyazaki et al., 2007; Sugiwaka, 1995; Takahashi & Miura, 2016). Self-regulation, composed of achieving goals and solving problems, can help people curb relatively undesirable goals and, at the same time, pursue more desirable goals over the long term by realizing one’s own social value (Ozaki et al., 2016).

Precisely individual differences in lifestyle self-regulation are associated with a variety of healthy habits. Therefore, self-regulation in daily life, if capable of being measured, will play a prominent role in improving unhealthy lifestyles and preventing lifestyle-related diseases.

In Japan, previous studies on self-regulation have focused on learning psychology, neurology, sociology, and criminology (e.g., Arai & Hishiki, 2019; Harada & Tsuchiya, 2019; Kiuchi et al., 2017; Umeno et al., 2017), and scales were developed to measure these aspects (learning, interpersonal, etc.) of self-regulation (e.g., Ozaki et al., 2016), but few studies have been conducted on self-regulation relating to lifestyle changes. Some sporadic studies on health-related self-regulation ability have been conducted among patients, but not the general public (Fukada et al., 2012; Ogasa, 2018). Additionally, the only measurement available for health-related self-regulation targets the elderly, focusing more on the health behaviors of the elderly, with questions regarding dental checkups, regular meal intake, exercises, and whether they have physical examinations (Fukada et al., 2012).

To focus on the Japanese population, the Self-control Scale Japanese Version (Miyazaki et al., 2007) was created based on the Self-control Scale (Tangney et al., 2004). This scale was developed to measure self-control behaviors for various situations of daily life. It also focused on “control” and “regulation”, and the items covered control over thoughts, emotional control, impulse control, performance regulation, and habit breaking. Even though this scale uses items to measure habits like “keeping the time” and “eating healthy food,” there are only a few of them, because this scale is not only for maintaining lifestyle habits, which is related to health. Additionally, in the results of an exploratory factor analysis (EFA) for the Japanese version, the items that measure interpersonal control, emotional control, and impulse control were mixed in one subscale. The Brief Self-control Scale Japanese Version (BSCS-J) (Ozaki et al., 2016)

was created based on the short version of the Self-control Scale. It is a good scale to assess individual differences in self-control in several different aspects, but there are only two items to measure healthy habits.

In order to address the above problems, it is necessary to design a new measurement scale to evaluate the degree of control exerted by an individual only on daily life habits, especially for university students. Thus, in this study, based on the two important aspects of definition of self-regulation “control” and “achievement,” we created a new general self-regulation scale for a healthy lifestyle (GSRSHL). This scale records several specific health behaviors in relation to daily life, not a vague measure for several aspects. In addition, in further studies, this measurement may be used to investigate lifestyles and behavior characteristics shown by individuals with high self-regulation ability, allowing us to focus on strengthening self-regulation ability in terms of lifestyle habits in further studies.

Thus, the objective of this study was to create and assess a new GSRSHL. Concurrent validation of the scale was based primarily on a similar self-control scale, perceived stress, and healthy lifestyle questionnaires.

Methods

Design and procedure

A total of 434 Japanese university students (281 male, 153 female, aged 17 to 25 years old, $M = 20.0$, $SD = 1.7$) were asked to participate in this study. Excluding the missing value, the object of analysis was 411 (265 male, 146 female, aged 18 to 25 years old, $M = 20.0$, $SD = 1.7$), and the effective answer rate was 89.3%. Participants completed the questionnaire either before or after classes with the permission of teachers. Participants were given an outline of this research before answering the questions. The research protocol was approved by the Human Ethics Committee of the Faculty of Human Development of K University of Japan.

Measurements

Development of item pool for self-regulation for the lifestyle scale

To collect items assessing self-regulation ability in daily life, 20 open questions like “What are you doing to protect your healthy lifestyle?” and “What kinds of behaviors do you think will damage your daily routine?” were designed. Twenty-two university students (12 male, 10 female) were asked to complete the questionnaire. Finally, 15 items were gathered based on the qualitative data obtained from the participants’ answers in order to measure general self-regulation for a healthy lifestyle (GSRSHL), with a five-point Likert scale (1 = not at all; 5 = very much) used in the questionnaire.

Self-control

Self-control was assessed with the BSCS-J (Ozaki et al., 2016), which, more specifically, was used to assess individual differences in self-control. This scale was translated based on the Brief Self-control Scale English version (Tangney et al., 2004). This one-dimensional scale measures control over thoughts, emotional control, impulse control, performance regulation, and habit breaking with 13 items. Participants were instructed to indicate how they saw themselves on a five-point Likert scale. Cronbach's alpha was .72.

Perceived stress

The degree to which an individual's life is considered stressful was assessed with the Perceived Stress Scale (PSS) Japanese Version (Sumi, 2006). This scale was translated based on the PSS English version (Cohen et al., 1983). This is a two-factor model scale that measures positive (7 items) and negative (7 items) aspects of stress control using a five-point Likert scale (0–4) for 14 items. Higher scores indicate a higher level of perceived stress. Cronbach showed a good internal consistency ($\alpha = .83$).

Lifestyle

A lifestyle scale (Morimoto, 2000) was used to evaluate the lifestyle, which related with chronic diseases quantitatively. It assesses "whether to eat breakfast (breakfast)", "sleeping about 7~8 hours (sleep duration)", "balanced diet (nutritional)", "non-smoking", "exercise habits", "not overdrinking", "learning/working less than 9 hours (learning/working hours)", and "less perceived stress" with 8 items. Items can be answered as yes (=1) or no (=0). "Yes" means a healthy habit, and "no" means an unhealthy habit. A higher total score means a healthier daily routine. Based on the total score, the sample can be divided into three groups: unhealthy group (0~4 scores), moderate group (5~6 scores), and healthy group (7~8 scores). The Cronbach's alpha was .74.

Data analysis

EFA was used to identify the factor structure for the 15 GSRSHL items. Loadings of each item were maximized using the principal factor method promax rotation. Items with a factor loading below .3 would be deleted (Oshio, 2018) and the EFA repeated. Cronbach's alpha of each subscale was calculated to assess the internal consistency of the identified factors, along with the calculation of t-tests to describe gender differences.

Confirmatory factor analysis was performed to express the significant determinants of subscales of the GSRSHL for healthy lifestyles. Thus, the convergent and discriminant validity of the GSRSHL can be inferred using several different validating variables.

Then, we applied a binary logistic regression analysis to predict healthy behaviors of the lifestyle scale in each subscale of the GSRSHL. In addition, based on scoring rules of the lifestyle scale, we also grouped lifestyle in three groups: healthy group, moderate group, and unhealthy group. Analysis of variance (ANOVA) of the GSRSHL was conducted on these groups.

The Statistical Package for the Social Sciences (SPSS) version 22 and Amos version 21 were used for all analyses.

Results

First, we verified the ceiling and floor effect of the 15 items, and there was no ceiling and floor effect in these items.

Table1 EFA Result for GSRSHL and Cronbach's Alpha for Each Subscale

	I	II
I Plan Achievement $\alpha=.85$		
47 I tend to plan everything.	.85	.09
53 I live my daily life in a planned way.	.82	.02
24 I proceed little by little in a planned manner.	.80	.07
41 I always decide the timetable before doing things.	.71	.06
19 I always try to keep time in order to make things moving in a planned manner.	.57	.07
7 Even when there is something that I like, I try not to lose track of time and overdo it.	.47	.00
60 I always set new goals and challenges.	.45	.01
II Emotional Control $\alpha=.86$		
40 Even when I feel worried, I try to live my life as usual.	.01	.84
57 Even when I feel restless, I try to live my life as usual.	.02	.83
34 Even when an unfortunate thing happens, I try not to let it affect my normal life rhythm.	.10	.72
48 Even when there is a fun thing happening, I try to live my life as usual.	.03	.69
13 Even when there are things that make me happy, I try to live my life as usual.	.20	.62
26 Even when I feel lonely, I like to live as usual.	.05	.56
1 Even when there are things that disappoint me, I try not to let them affect my life.	.12	.54
Deleted Items		
20 Even when things are not working well, I try not to let them affect my normal life rhythm.		
Factors relationship		.503***

*** $p < .001$

Table 1 shows the results of EFA of the GSRSHL, using the principal factor method with promax rotation. We deleted one item because the factor loading was below .30 and performed the analysis again. As a result, two factors were found based on the scree-plot and interpretability of the factors. "Emotional control (7 items)" assessed a general capacity for emotional self-discipline, and "planning achievement (7 items)" assessed a range of the performance of plan achievement. Factor loadings of these two factors were above .45, and Cronbach's alphas were .86 and .85. This shows that these two factors associated with each other positively ($r = .503, p < .001$).

Table 2 presents the mean scores of each subscale of the GSRSHL. It also shows the meaningful associations between the subscales of the GSRSHL and other study variables. As a result of the t-test of the GSRSHL, we did not find a significant difference between men and women. The significant associations with the subscale scores of the GSRSHL can be summarized that all subscales were significantly positively correlated with the BSCS-J and lifestyle scale. "Emotional control" was negatively associated with the PSS.

Table 3 shows the results of logistic regression analysis. Older age was significantly associated with sleep duration ($p < .001$), and compared with men, women have healthier eating behaviors (breakfast and nutritional, $p < .001$ and $p < .01$). The higher planning achievement group made healthy choices in sleep duration, nutritional, and exercise habits ($p < .01$, $p < .001$, and $p < .001$, respectively). The higher emotional control group was significantly associated with breakfast, sleep duration, nutritional, and less perceived stress ($p < .01$, $p < .05$, $p < .05$, and $p < .01$, respectively). Age, gender, planning achievement, and emotional control were noncontributory to non-smoking, not overdrinking, and learning hours.

Table 2 Results of CFA with covariate analysis, the relationship between the GSRSHL subscales and other study measurements, and t-test results by gender

	Gender	Age	BSCS-J	PSS	LS	R^2	Mean(SD)			t	Cohen's d
							Total	Male ($n=265$)	Female ($n=146$)		
GSRSHL											
Emotional Control	.00	-.14	.26***	-.16*	.11***	.52	3.0(0.8)	3.0(0.8)	2.9(0.8)	1.5	0.16
Plan Achievement	.01	.06	.66***	-.07	.10***	.37	2.7(0.8)	2.6(0.7)	2.8(0.8)	1.4	0.14

* $p < .05$, *** $p < .001$

GSRSHL: General Self-regulation for a Healthy life Scale; BSCS-J: Brief Self-Control Scale Japanese version;
LS: Lifestyle; PSS: Perceived Stress Scale

$\chi^2(df)=3.710(6)$, GFI=.997, AGFI=.988, CFI=1.000, RMSEA (90% CI)=.000(.000 - .048)

Table 3 Results of binary logistic regression analysis predicting lifestyle by GSRSHL, age and gender

	Age	Gender	GSRSHL	
			Plan Achievement	Emotional Control
breakfast				
OR	0.86	2.77	1.26	1.67
Sig.	0.13	< 0.001	0.17	< .01
CI 95%	0.76-0.97	1.71-4.51	0.91-1.75	1.21-2.31
sleep duration				
OR	1.35	1.07	1.55	1.45
Sig.	< 0.001	0.75	< .01	0.02
CI 95%	1.16-1.57	0.69-1.67	1.14-2.12	1.07-1.96
nutritional				
OR	1.07	1.84	1.53	2.91
Sig.	0.35	< .01	< 0.001	0.02
CI 95%	0.93-1.23	1.18-2.86	1.53-2.91	1.06-1.95
non-smoking				
OR	0.98	1.76	1.44	0.73
Sig.	0.88	0.21	0.20	0.24
CI 95%	0.78-1.23	0.73-4.23	0.82-2.53	0.43-1.24
exercise habits				
OR	1.08	0.70	1.70	1.21
Sig.	0.24	0.11	< 0.001	0.20
CI 95%	0.95-1.24	0.46-1.08	1.26-2.30	0.90-1.62
non-overdrinking				
OR	1.07	1.72	1.33	1.02
Sig.	0.57	0.14	0.24	0.94
CI 95%	0.85-1.34	0.83-3.53	0.83-2.15	0.65-1.60
learning hours				
OR	0.97	0.85	0.90	0.99
Sig.	0.66	0.48	0.51	0.93
CI 95%	0.86-1.10	0.54-1.34	0.65-1.24	0.72-1.35
less perceived stress				
OR	0.91	0.70	1.29	1.59
Sig.	0.12	0.10	0.10	< .01
CI 95%	0.81-1.03	0.46-1.07	0.96-1.75	1.18-2.14

Table 4 shows the “planning achievement” and “emotional control” average scores of the unhealthy, moderate, and healthy groups of the lifestyle scale. It also shows the results of ANOVA among the three groups. We found that in both subscales of the GSRSHL, there were significant differences among the three groups ($F=10.9$, $p< .001$, $df= 409$; $F=30.1$, $p< .001$, $df= 409$).

Table 4 The average values and the ANOVA results of each LS group

	LS Group	N	M(SD)	F	Group Comparison (a,b,c)
Emotional Control	Unhealthy ^a	149	2.8(0.7)	19.0 ^{***}	a < b < c
	Moderate ^b	177	3.0(0.8)		
	Healthy ^c	85	3.4(0.7)		
Plan Achievement	Unhealthy ^a	149	2.4(0.7)	30.1 ^{***}	a < b < c
	Moderate ^b	177	2.7(0.7)		
	Healthy ^c	85	3.2(0.7)		

*** $p < .001$

Discussion

The objective of this study was to develop a new questionnaire to examine the self-regulation ability involved in daily lifestyle (General Self-regulation Scale for a Healthy Life, GSRSHL), and to test the factorial and construct validity. Fifteen items of this new measurement were derived from a descriptive questionnaire, and EFA was used to clarify the factor structure of these items. After deleting one item (factor loadings < .3), two factors were obtained from the analysis – “planning achievement” and “emotional control” – which demonstrated two aspects of the self-regulation definition: “achievement” and “control” (e.g., Baumeister et al., 1998; Miyazaki et al., 2007; Sugawaka, 1995; Thoresen & Mahoney, 1974). “Emotional control (7 items)” assessed a general capacity for emotional self-restraint, while “planning achievement (7 items)” assessed a range of the various performances of regulation. Both factors described the principal regular behavior that is crucial for maintaining a routine and can contribute to keeping an efficient and healthy life. As the Cronbach’s alphas were above 0.70 (Oshio, 2018), both factors showed satisfactory internal consistency, and the scores showed adequate variances relative to the theoretical ranges. The result of Pearson correlation indicated that the two factors were significantly positively related to each other, which implies that these two factors represent the degree of people’s self-regulation ability collectively.

To test validation, a similar questionnaire (BSCS-J) was used, which measured individual differences in self-control. The results showed a positive association between the subscales “planning achievement” and “emotional control” of the GSRSHL with the BSCS-J. Therefore, as presented in the results section, a high GSRSHL score reflects a self-efficacious lifestyle pattern. Further, the new measurement was developed as a broad-based questionnaire of self-regulation. According to previous studies, the scale for the general public needs to ensure that there is no gender difference between men and women. And the result of comparison of gender proves it very well (Ozaki et al., 2016; Tangney et al., 2004).

Comparing with Fukada et al.’s (2012) health-related self-regulation scale, the GSRSHL targeted younger people (university students). The items not only measured regular daily activities (like whether eating on time every day), but also recorded specific healthy habits (planned and targeted lifestyle, negative emotional control) that relate to one’s daily routine. In comparison with the Self-control Scale and the

BSCS-J Japanese Version (Miyazaki et al., 2007; Ozaki et al., 2016), the GSRSHL measured “planning achievement” in daily life in more detail, as well as the control of emotions that have negative effects on daily life. As the results presented in Table 2 show, both subscales of the GSRSHL related to the BSCS-J positively. However, “planning achievement” was more strongly associated with the BSCS-J than “emotional control.” It is conceivable that the BSCS-J is more focused on achievement and planning.

As this new measurement scale assesses the self-regulation ability that can help to keep one’s life healthy, we proposed that the GSRSHL will be positively correlated with a healthy daily routine. The positive association between the GSRSHL and the lifestyle scale confirmed that (Table 2). Moreover, the results of ANOVA showed that the higher the scores of “planning achievement” and “emotional control” people had, the healthier the choices they made (Table 4). Previous studies have shown the association between emotion regulation and promotion of mental health (e.g., Sakakibara, 2017). Therefore, in support of the concurrent validity of our new measurement scale, the PSS was negatively associated with the “emotional control” of GSRSHL (Table 2) and less perceived stress of the lifestyle scale was positively associated with the “emotional control” of GSRSHL (Table 3).

The results of logistic regression analysis showed that age and gender were significantly associated with sleep duration and eating behaviors, because the older a person is, the better his or her sleeping habits, and the more they care about their diet (Kato et al., 2019; Takaizumi et al., 2016). However, this result was not verified on university students, making it essential to consider the specific situation of university students separately in future studies. Additionally, other studies have found that women, rather than men, were more aware of healthy eating habits, similar to what was found in the current study (Nakao et al., 2016; Namiwa et al., 2010).

“Planning achievement” and “emotional control” were significantly associated with better choices in eating habits (breakfast and nutrition) and sleep habit. These results were in line with those obtained in previous studies (e.g., Starcke & Brand, 2012; Tangney et al., 2004). Although several studies have verified the association between emotional control and healthy eating habits, there is no study directly explaining the relationship between emotional control and “not skipping breakfast” (Shibatsuji & Fumiko, 2003; Shimizu, 2013). Additionally, making plans is more important for doing exercises in daily life, and in Japan, several school programs such as “Let’s make a plan” have been carried out to increase the physical strength of students (Ministry of Education, 2008). In this study, the result of logistic regression analysis also revealed the importance of planning.

On the other hand, the result of the binary logistic regression analysis showed that noncontributory was found between the GSRSHL and risk behaviors (smoking habits, drinking habits). The reason might be that the subjects of this study are university students, with an average age of 19.9 years, and they are not allowed to buy/drink alcohol or buy cigarettes in Japan. Therefore, for university students, except for overdrinking and smoking, there are several other common risk behaviors (Internet addiction, traffic-related risk behaviors, etc.) that need to be examined in future studies (Nozu et al., 2006). Moreover, because our new scale focused only on daily lifestyle, not learning regulation, we did not find an

association between the GSRSHL and learning hours. From this result, we can explain the discriminant validity of this new measurement scale.

This study also has a number of limitations. First, the items were selected based on the personal experience of 22 university students of random selection, which does not include all aspects of a daily routine. Moreover, only the self-regulation ability in a general situation is assessed through this new measurement scale. However, self-regulation is not restricted to general situations, but is also reflected in various specific situations we did not look at, such as eating, exercising, and resting. Healthy habits in these specific situations are also related to disease prevention, especially for youth, thus making it essential to focus on these aspects of daily living in future studies. Second, in this study, to confirm the reliability and contractual validity, several analyses were performed. However, to develop a better measurement, we need to carry out more analyses to verify the validity and association factors. Lastly, in the future, it is necessary to expand the scope of the study with more subjects in order to generalize our results.

Conclusions

To summarize, the GSRSHL, which includes two aspects, “planning achievement” and “emotional control,” is a new measurement to assess the degree of one’s self-regulation ability to keep a daily routine for a healthy lifestyle. As the GSRSHL is positively related to a healthy lifestyle and negatively associated with perceived stress, its reliability and validity were determined in this study. It is our hope that this measurement can be used in more studies related to the promotion of healthy behavior in order to reduce the risks of lifestyle-related disease.

Abbreviations

GSRSHL: General Self-regulation Scale for a Healthy Lifestyle

EFA: Exploratory Factor Analysis

BSCS-J: Brief Self-control Scale Japanese Version

PSS: Perceived Stress Scale

LS: Lifestyle Scale

ANOVA: Analysis of variance

SPSS: Statistical Package for the Social Sciences

Declarations

Ethics approval and consent to participate

The research protocol was approved by the Human Ethics Committee of the Faculty of Human Development of Kobe University.

At the cover page of the survey, we wrote the information about contents of the survey, precautions, and how to protect personal information. And at the end of the information, we wrote one sentence “By answering and submitting this survey, it is assumed that you consent to the participation in this survey.”, to get the consent to participants.

We also explained the information verbally before the survey, but did not required a signature for consent form because there is a possibility that we can identify someone by the signature.

The above-mentioned method was approved by the Human Ethics Committee of the Faculty of Human Development of Kobe University

Consent for publication

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

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Authors' contributions

YR and YK conceived of the study and participated in its design and coordination and helped to interpret and draft the manuscript. RU and AR contributed to statistical analyses, writing and interpretation of the results. All authors have read and approved the manuscript

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Not applicable

Licensed scales

All of measurement scales which were used in this study are free, and do not need any licenses.

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