Psychometric Properties of the Persian Version of the CRAVE Scale in three University Samples

Farhad Tanhaye Reshvanloo [1]
Hadi Samadieh [2*]
Matthew A. Stults-Kolehmainen [3, 4]

[1] Department of Psychology, Shandiz Institute of Higher Education, Mashhad, Iran
[2] Department of Psychology, University of Birjand, Birjand, Iran
[3] Division of Digestive Health, Yale New Haven Hospital, New Haven, CT, United States
[4] Department of Biobehavioral Sciences, Teachers College – Columbia University, New York, NY, United States

* Please, send correspondence to Hadi Samadieh: h.samadieh@birjand.ac.ir

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Abstract

This study investigated the factor structure and validity of the Cravings for Rest and Volitional Energy Expenditure Scale (CRAVE) in Iranian university students. Three studies were conducted to examine the psychometric properties of the scale in two-time frames, "*Right now*" and "*Past week*". In Study 1, we investigated the internal consistency and factor structure of two models of the scale (10 versus 13 items) using a sample of 313 students. In Study 2, we further investigated the confirmatory factor validity, construct reliability, and convergent validity of the CRAVE using a new sample of 246 students. In Study 3, we explored the criterion validity in another sample of 244 students who completed measures of the General Health Questionnaire (GHQ), Body Mass Index (BMI), and Subjective Vitality Scale (SVS). The results indicated that the CRAVE scale has a two-factor structure. Confirmatory factor analyses replicated the initial 2-factor solution and had an excellent fit for the data. Cronbach's alpha coefficients were obtained from 0.62 to 0.89. Desire to move (*MOVE*) was negatively correlated with physical dysfunction and BMI. However, desire to rest (*REST*) was not associated significantly with these factors. There was a positive relationship between vitality and *MOVE* and a negative relationship between vitality and *REST*. Only *MOVE* assessed “Right now” had a positive and significant relationship with age. There were no significant differences in *MOVE* and *REST* in both "Right now" and "Past week" versions between women and men. Overall, the CRAVE scale had acceptable validity and reliability; hence, it can be used among Persian-speaking young adults.

Keywords: urge for movement, desire, sedentary activity, physical activity, scale development, motivation

Introduction

Insufficient physical activity (IPA) is associated with a wide range of diseases, including cancer, diabetes, stroke, and heart disease (Kyu et al., 2016). Despite the vital role of physical activity in physical and mental health, many people are far from the recommended amount of activity. According to the Global Burden of Diseases Study (GBD), from 1990 to 2017, the percentage of low physical activity attributable to disability-adjusted life years (DALY) increased globally by 1.5 times and 2-fold in Iran, causing more than 1.2 million deaths across the world and 18,000 deaths in Iran in 2017. Additionally, in 2017, low physical activity was the leading cause of more than 1.2 million deaths worldwide and 18,000 deaths in Iran (Institute for Health Metrics and Evaluation, 2018). Global evidence has revealed that Iran is among the countries with moderate to low physical activity. In 2011, a national surveillance study of risk factors for non-communicable diseases showed that about 40% of Iranian people do not have enough physical activity (Esteghamati et al., 2011). Encouraging physical activity and movement among university students is essential as it contributes to improved mental health and overall well-being. Longitudinal studies suggest that physical activity decreases significantly from adolescence to early adulthood (Corder et al., 2019).

During emerging adulthood, people experience significant life transitions from high school to higher education. This developmental stage is also crucial for forming long-term patterns of lifestyle behaviors related to obesity (Nelson et al., 2008). The results of a study by Mahdiloo and colleagues in 2021, found that 68% of Iranian students are inactive. In addition, during the COVID-19 pandemic, the need for regular physical activity has become even more critical. By strengthening the immune system, physical activity reduces people's vulnerability to various infections (Gao et al., 2020; Nieman & Wentz, 2019) and is also associated with lower incidence of diabetes, cancer, osteoporosis, and cardiovascular diseases (Lippi & Sanchis-Gomar, 2020). In addition, most studies have shown that physical activity can improve mental health, which has declined since the COVID-19 pandemic began (Jenkins et al., 2021). For decades, efforts to identify factors influencing physical activity have mainly focused on cognitive dimensions (Williams & Bohlen, 2019). Recently, researchers have underscored the importance of motivational theories based on emotion. Indeed, empirical evidence indicates that one of the key factors in encouraging and maintaining physical activity is motivation (Sáez et al., 2021; Molanorouzi et al., 2015).

Motivational States for Physical Activity

The current approaches explaining motivation, both in conceptualizing and measuring physical activity determinants, have mainly focused on the trait and stable aspects of motivation (Lev Arey et al., 2022; Lock et al., 2018). However, motivation for physical activity and sedentary (e.g., desires, wants, urges, and cravings) changes from moment to moment (Stults-Kolehmainen et al., 2020; Stults-Kolehmainen et al., 2023). These affectively-charged motivational states (which also include negative constructs, such as fear) have been proposed as proximal antecedents of physical activity (Do et al., 2022). Affectively-charged motivation for physical activity refers to motivational states based on past affective responses to physically active experiences, resulting in changes to hedonic motivation (e.g., desire, dread, craving), intrinsic motivation, and avoidance motivation (Stevens et al., 2020; Stults-Kolehmainen et al., 2020).

During the last few years, Stults-Kolehmainen and his colleagues proposed the idea of motivational states for movement and sedentary behavior to incorporate these affective

conceptualizations with behavioral models. They presented the WANT model (Wants and Aversions for Neuromuscular Tasks) to elucidate the interaction of desires and urges for movement and sedentarism (Stults-Kolehmainen et al., 2020; Stults-Kolehmainen et al., 2023). Affective experiences (i.e., pleasure/displeasure and arousal), physical activity, eating behaviors and sleep (Budnick et al., 2023), recent activities (Stults-Kolehmainen et al., 2021), state anxiety (Filgueiras et al., 2022), and daily life stress (Stults-Kolehmainen & Sinha, 2014) are influential factors on motivational states. Moreover, motivational states play a determining role in predicting variables, including intentions to exercise (Budnick et al., 2023), movement and physical activity (Levitin et al., 2018), and perceived physical fatigue and energy (Stults-Kolehmainen et al., 2021).

Despite extensive studies in exercise motivation, few attempts have been made to measure motivational states for movement and sedentary behavior (Stevens et al., 2020). Several instruments have been developed to measure general exercise motivation or other similar constructs, including motivation for physical activity and sport motivation. However, there are several limitations to previous tools that need to be considered. First, some questionnaires only measure a limited range of motivational states. For instance, in a study to examine within-subject effects of pre-exercise affectively-charged motivation on subsequent affective response during physical activity, only one item was used to measure affectively-charged motivation (Do et al., 2022). Second, in other measurements, such as state motivation for specific exercise tasks, exercise in general and physical activity, various unvalidated one- to three-item tools have been used, as discussed by Stults-Kolehmainen and his colleagues (2021). Third, most scales, have mainly measured stable aspects of motivation for physical activity, instead of state motivation, per se (Ryan & Connell, 1989). Furthermore, the Intention to be Physically Active Questionnaire has not considered the transitory and temporal features of motivational states (Sánchez-Herrera et al., 2022).

By considering these critical points, Stults-Kolehmainen et al. (2021) developed the Cravings for Rest and Volitional Energy Expenditure (CRAVE) scale to measure motivation states for physical activity and sedentarism that not only integrates affective and behavioral aspects of motivation into a unified assessment but also complements the existing measures and addresses the limitations mentioned above. This scale is based on the WANT model and includes 20 items scored for two-time frames (*"at this very moment/Right now"* [NOW] and *"over the past week"* [PAST WEEK]), and each version contains two sub-scales (*MOVE* and *REST*). This questionnaire is rated on a 11-point Likert Scale ranging from 0 (not at all) to 10 (more than ever). Stults-Kolehmainen et al. (2021) conducted five studies to investigate the validity and reliability of the motivation states for physical activity and sedentary behaviors. In the first study, the main goal was to construct and validate a scale for affectively-charged motivation states (ACMS) and to examine some assumptions of the WANT model. The results of the exploratory structural equation model showed a two-factor structure consisting of *MOVE* and *REST*. The results of the confirmatory factor analysis revealed a good fit of the hypothesized model to the data. The overall reliability of the scale, assessed with McDonald's Omega index, was 0.97. The primary purpose of the second study was to determine model fit in a new sample and explore reliability and discriminate validity. The results confirmed the factorial structure of the scale. The convergent validity of the scale was confirmed. Discriminate validity was also checked by

calculating the correlation between the items related to *MOVE* and *REST*, which indicated the independence of the two factors and, as a result, no problem for this facet of validity. In the third study, the state-like characteristics of the desire to move and be sedentary were confirmed. The fourth study aimed to investigate the changes in the desire to move and rest after a bout of maximal exercise. The findings showed that the desire to move and be sedentary changes in the expected directions with a maximal exercise stimulus.

Physical function, Vitality, and Body Mass Index

As previously reported, motivational states are relevant for physical and psychological health (Stults-Kolehmainen et al., 2022; San Roman-Mata, et al., 2020). Motivation states to move and be sedentary are clearly related to a whole host of physical hyperkinetic maladies, such as Restless Legs Syndrome, akathisia, exercise dependence, muscle dysmorphia, tics/Tourette's, and hyperactivity. They are also related to various hypokinetic disorders, such as chronic fatigue syndrome, major depression, and thyroid problems. Altogether these have been called the "movement-urge dysfunction disorders" (MUDD) (Stults-Kolehmainen et al., 2022). It is also possible that motivation states are related to a variety of other physical and psychological health indicators as well (Stults-Kolehmainen et al., 2023). Recently, Filgueiras and colleagues (2023) reported that motivation states are related to exercise behavior and state anxiety, which seems to validate this notion. Motivation states for physical activity declined over a 2-year period for 127 people in New England (Stults-Kolehmainen et al., 2021), but BMI has been inconsistently related to motivation states. However, data is largely lacking and limited to narrow populations.

Other studies have demonstrated that trait/stable exercise motivation is tightly connected to health outcomes (Guérin et al., 2013; Li et al., 2022; Neace et al., 2022). The association between exercise motivation and psychological resources has also been examined in adult and university student samples. In a study of Swedish adults, higher levels of physical activity were related to higher mastery and vitality (Johansson et al., 2021). In another study, the results indicated that exercise self-efficacy and exercise behavior could be significantly predicted by exercise motivation among college students (Zhao et al., 2023). According to Stults-Kolehmainen et al. (2021), people with less body weight might be more motivated to participate in sports activities and thus have a greater desire for movement and physical activity.

The Current Studies

The new CRAVE tool has good psychometric properties as assessed in three large groups of American and Brazilian populations (18 to 82 years old) (Stults-Kolehmainen et al., 2020; Stults-Kolehmainen et al., 2021; Filgueiras et al., 2023). For instance, this scale has high internal consistency, test-retest reliability, and convergent and divergent validity. An important limitation of some research has been not using the "Past week" version. Filgueiras and colleagues (2023) also sought to create single-item versions, which varied by country, indicating possible cultural differences in conceptualizing motivational states for physical activity (Filgueiras et al., 2023). However, among the many factors influencing motivation for physical activity, cultural components have been less studied (Gurleyik et al., 2022).

These limited studies highlight that there are major differences between collectivist cultures, including Asian countries, and individualistic societies (North America and Western Europe) in

terms of desire and motivation for physical and sedentary activities. In individualistic societies, self-reliance and independent self-construal play a significant role in motivation. On the contrary, in collectivist countries, including Iran, group goals and commonalities and the importance of others' evaluations play a crucial role (Kagitcibasi, 2005). Nevertheless, the findings of a systematic review showed no definite and stable results regarding which components of physical activity motivation are influenced by culture and which characteristics are universal (Shen et al., 2022). Therefore, the main goal of the present study is to investigate the factor structure of the CRAVE scale in a sample of Iranian students. In order to strengthen the methodological foundations, different methods of validity and reliability were used. In addition, inconsistent results regarding the correlates of the desire to move and be sedentary have been reported in previous studies. For example, some studies reported a negative and significant relationship between body mass index (BMI) and the desire to be physically active (Filgueiras et al., 2023; Stults-Kolehmainen et al., 2021; Wu & He, 2022), and some reported no relationship between the desire to be active and BMI (Filgueiras et al., 2022).

Consequently, another objective of this research was to investigate potential psychological and physical correlates of the desire for physical activity and sedentarism. The CRAVE scale has desirable psychometric properties as well as strong theoretical foundations. However, conducting further cultural adaptations and examining the corresponding psychometric properties of this scale is necessary. A rapid review of the research literature in Iran showed that the CRAVE scale has not been validated yet in Persian. Therefore, the main purposes of the current research are to (1) translate and adapt the scale for Persian, and (2) investigate the factor structure and validity of the adapted CRAVE scale in Iranian students.

Study 1

The original CRAVE (Stults-Kolehmainen et al., 2021) has 13 items, but two scoring schemes, one that includes all 13 items and the final version that only scores 10 items (with three unscored fillers). In this study, internal consistency and exploratory factor validity of both 10- and 13-item scoring schemes of the CRAVE were compared. Also, the two time frame versions, for *MOVE* and *REST* "RIGHT NOW" and "over the PAST WEEK" were compared. First, the internal consistency between items was checked, and then, using exploratory factor analysis, the factorial structure of the CRAVE was evaluated, and results for each version were compared. In addition, reliability and criterion validity were examined in regards to age and gender.

Method

Participants. In Study 1, 313 students of the Ferdowsi University of Mashhad were selected by convenience sampling. Demographic indicators are provided in Table 1. The participants were between the ages of 18 and 43. The mean age of the participants was 26.12 years (SD=6.28), and most of them were women (71.2%, n=223); 67.7% (n=212) were single; 70.3% (n=220) were unemployed, and 43.1% (n=135) were undergraduate students.

Procedure. The English version of the CRAVE scale was translated into Persian by a member of the psychology faculty. Back translation into English conducted by a faculty member of the English language teaching department. Finally, the two translations were compared, and the necessary corrections were made.

Data collection was done online in Google Forms, and the link was shared with professors and administrators of student groups on the Telegram social network. In the electronic forms, explanations were given to the participants about the objectives of the project, while assuring them about the confidentiality of the information, and voluntary participation in the research was emphasized.

Measures. *CRAVE scale*: Levels of motivation states to move and be sedentary were self-recorded and submitted by participants using the translated Cravings for Rest and Volitional Energy Expenditure (CRAVE) Scale (Stults-Kolehmainen et al., 2021), a 13-item questionnaire consisting of statements regarding physical activity and sedentary behaviors attached to 11-point Likert items. In the original validated scoring, a subset of five items (1, 2, 6, 9, and 13) are scored in regard to physical activity, e.g.: "At this very moment, I want/desire to expend some energy". Another subset of five items (3, 4, 7, 8, and 10) are scored in regard to being sedentary, e.g.: "At this very moment, I want/desire to be motionless". The last three items (5, 11, and 12) are filler items not scored or used for the analysis. For each item, a participant would assign a number from zero to ten, showing their agreement with the statement at the moment of taking the survey (RIGHT NOW). Participants also completed the "in the past week" or PAST WEEK version, which retrospectively assessed motivation states for the week before the study. These scales have excellent psychometric properties, as assessed over a series of nine studies (Stults-Kolehmainen et al., 2021; 2022; Filgueiras et al., 2023).

Data Analysis. All statistical analyses were completed with SPSS (version 25.0; IBM SPSS, Chicago, IL). In order to check the internal consistency, the correlation coefficient between the items were checked. Item-total correlations were also checked. Then, using the Fisher r-to-z transformation, the difference in correlation coefficients was compared. Principal component analysis was used to check factor validity. A minimum factor loading of 0.40 was the cut-off considered for each item. Identification of the factor structure was guided by Kaiser's (i.e., eigenvalues greater than one) and Cattell's (i.e., the elbow rule) criteria, factor loadings, and the interpretability of factor solutions. Cronbach's alpha (α) and Spearman-Brown split-half (r_{kk}) were used to check reliability. The correlations between *MOVE* and *REST* were also examined in 10- and 13-item scoring schemes and also with age, and the coefficients were compared with the Fisher r-to-z transformation. Mann-Whitney Tests were used to investigate gender

Table 1 Demographics

Demographic characteristic	Study 1 sample, (n=313)		Study 2 sample, (n=346)		Study 3 sample, (n=244)	
	Measure	%	Measure	%	Measure	%
Mean age in years (SD)	26.12(6.28)		25.25(5.69)		24.41(6.30)	
Gender						
Female	223	71.2	236	68.2	177	72.5
Male	90	28.8	110	31.8	67	27.5
Marriage Status						
single	212	67.7	234	67.6	164	67.2
Married	101	32.3	112	32.4	80	32.8
Job Status						
Unemployed	220	70.3	231	66.8	174	71.3
Employee	93	29.7	115	33.2	70	28.7
Year in University						
Bachelor	135	43.1	162	46.8	101	41.4
Master	140	44.7	146	42.2	118	48.4
PhD	38	12.1	38	11.0	25	10.2

differences since the distribution of the variables was not as expected, and the sample sizes of groups were very different (female=223 vs. male=90).

Results

In examining the internal consistency, the intercorrelation between items and the total score was checked. The results showed that the correlations (*r*) between the items in RIGHT NOW and PAST WEEK versions were greater than -0.36 and -0.24, respectively. Table 2 also shows that the correlations of the items with the total score in the 13-item scoring varies from 0.65 to 0.92 for the RIGHT NOW version and from 0.74 to 0.93 for the PAST WEEK version. In the 10-item scoring, these coefficients were 0.62 to 0.89 for the RIGHT NOW version and from 0.69 to 0.89 for the PAST WEEK version. Fisher's test showed that the differences between the correlation coefficients of the items with the total score in both versions of the CRAVE were not significant (P>.05).

In the exploratory factor analysis, Kaiser, Meyer, Olkin (KMO) and the Bartlett Sphericity test were calculated. The results showed that with the coefficient of KMO>.88 and the significance of the Bartlett Sphericity test, there are appropriate conditions for a factor analysis (P<.01). Principal component analysis in both the RIGHT NOW and PAST WEEK versions of the 13- and 10-item scoring schemes showed two factors (Eigen value>1.00). A Scree Plot also supported these structures. The cumulative explained variance for the RIGHT NOW version in the 13-item scoring was 77.28%, and in the 10-item scoring it was 77.48%. In the PAST WEEK version, the explained variance of the 13-item scoring was 78.39%, and in the 10-item scoring, it was 77.48%. Results in Table 2 show that all items have a factor load greater than 0.72. In the 13-item scoring, item 5 in the *MOVE* subscale and items 11 and 12 in the *REST* subscale had a higher factor load.

Cronbach's alpha (α) coefficients varied from .93 to .96 in 13-item scoring and from .92 to .94 in 10-item scoring. Spearman-Brown split-half coefficients varied from .92 to .96 in 13-item scoring and from .91 to .94 in 10-item scoring (Table 4). Table 4 shows that there is a negative and significant correlation between *MOVE* and *REST* subscale scores for RIGHT NOW and PAST WEEK versions in all 13- and 10-item scorings (P<.01). The correlation coefficients varied from *r*=0.47 to *r*=0.72. Fisher's test showed that there is no significant difference between versions (P>.05). Age has no significant relationship with the variables (P>.05). A Mann-Whitney Test also showed that there is a significant difference between men and women in all versions (RIGHT NOW and PAST WEEK) only for *MOVE* (P<.01), whereas women have a higher average than men.

Table 2 The CRAVE Scale Items, Internal Consistency and Exploratory Factor Loadings for Both Versions (Study 1, n=313)

	RIGHT NOW							PAST WEEK						
	13 Item scoring			10 Item scoring				13 Item scoring			10 Item scoring			
		Loadings			Loadings				Loadings			Loadings		
I want/desired to....	r	*MOVE*	*REST*	r	*MOVE*	*REST*	z	r	*MOVE*	*REST*	r	*MOVE*	*REST*	z
1. . move my body	.87	**.78**	-.19	.89	**.86**	-.11	-1.11	.85	**.92**	.02	.87	**.93**	-.02	-.96
2. . be physically active	.83	**.72**	-.24	.85	**.78**	-.18	-.85	.85	**.90**	-.01	.86	**.90**	-.05	-.46
3. . do nothing active	.88	-.13	**.83**	.86	-.19	**.79**	1.03	.79	-.13	**.78**	.80	-.10	**.82**	-.34
4. . just sit down	.74	.01	**.82**	.75	-.03	**.83**	-.28	.85	-.14	**.83**	.82	-.12	**.83**	1.24
5. . burn some calories [f]	.79	**.96**	.13	-	-	-	-	.77	**.79**	-.09	-	-	-	-
6. . expend some	.90	**.98**	.06	.88	**.99**	.10	1.20	.76	**.81**	-.05	.69	**.76**	-.06	1.85
7. . be still	.84	-.16	**.78**	.82	-.19	**.75**	.80	.86	.13	**.96**	.84	.13	**.96**	.90
8. . be a couch potato	.78	.10	**.91**	.76	.09	**.92**	.61	.84	.01	**.89**	.84	.03	**.92**	.01
9. ..exert my muscles	.84	**.78**	-.15	.82	**.79**	-.13	.80	.81	**.90**	.08	.81	**.91**	.07	.01
10. . be motionless	.80	.08	**.91**	.76	.06	**.90**	1.27	.91	-.04	**.92**	.89	-.03	**.92**	1.31
11. . lay down [f]	.85	-.06	**.85**	-	-	-	-	.93	-.05	**.93**	-	-	-	-
12. . rest my body [f]	.92	-.15	**.84**	-	-	-	-	.85	.09	**.94**	-	-	-	-
13. . move around	.65	**.75**	-.01	.62	**.80**	.07	.63	.74	**.81**	-.01	.75	**.84**	.03	.28

Note. Loading= Exploratory Factor Loadings; f= fillers; r= item-total correlations; z= the Fisher r-to-z transformation; All of z coefficients are non-significant; Bolded factor loadings denote factor assignment.

Discussion

Study 1 found that the internal consistency of items and the correlation of items with the total score for both RIGHT NOW and PAST WEEK versions are at an acceptable level, and the differences between the two scoring schemes (13- vs. 10-items) are not significant. The exploratory factor analysis also showed that the explained variance of the 13- and 10-item versions is not different from each other, and there are two factors (*MOVE* and *REST*) in both versions. These two factors in the RIGHT NOW and PAST WEEK versions had the same structure as the original version. In the 13-item version, 1-2-5-6-9-13 items belong to the *MOVE*, and 3-4-7-8-10-11-12 items belong to the *REST*. The reliability of the subscales was acceptable in all versions, and the *MOVE* and *REST* subscales had significant correlations.

Based on this, it can conclude that both of the 13- and 10-item versions have favorable factorial validity, and the 10-item version with fewer items and equal items in each subscale, like the 13-item version, has favorable exploratory factorial validity and reliability. Consequently, it seems best to maintain the original scoring scheme (10 items scored, 5 for *MOVE* and 5 for *REST*), where subscale scores range from 0-50. Other results showed that age has no significant relationship with the variables, and only *MOVE* is significantly different between women and men, whereas women have a higher average than men.

Study 2

In Study 2, the confirmatory factor validity of both the 13- and 10-item scoring schemes of the CRAVE scale were compared. First, using confirmatory factor analysis, the factor structure was evaluated. In addition, construct reliability and convergent validity were checked. Reliability, and criterion validity for age and gender were also re-examined.

Method

Participants. In this study, 346 students of the Ferdowsi University of Mashhad were selected by convenience sampling. Demographic indicators are given in Table 1. The participants were between the ages of 18 and 43. The mean age of the participants was 25.25 years (SD=5.69),

and most of them were women (68.2%, n=236); 67.6% (n=234) were single; 66.8% (n=231) were unemployed, and 46.8% (n=162) were undergraduate students.

Procedure. Data collection was done online with Google forms, and the link was shared with professors and administrators of student groups on the Telegram social network. In the electronic forms, explanations were given to the participants about the objectives of the project, while assuring them about the confidentiality of the information, and voluntary participation in the was research emphasized. The students participating in this study were different from the previous study.

Measures. *CRAVE scale*: The adapted Cravings for Rest and Volitional Energy Expenditure (CRAVE) Scale was utilized – both RIGHT NOW and PAST WEEK with both 13- and 10-item scoring schemes. In the first study, exploratory factor validity and favorable reliability coefficients obtained for this scale.

Data Analysis. All statistical analyses were done with AMOS (version 24.0; IBM SPSS, Wexford, PA). Confirmatory factor analysis was performed using the Maximum Likelihood method. Traditional fit indices guided evaluations of model fit (Hu & Bentler, 1999). Construct reliability and convergent validity were investigated by calculating composite reliability (CR) and average variance extracted (AVE) for the factors. In the investigation of construct reliability, if the values of CR>.70 and AVE>.50 and the relationship CR>AVE are established, convergent validity has been achieved (Hair et al., 2017).

Cronbach's alpha (α) and Spearman-Brown split-half (r_{kk}) were used to check reliability. The correlation between *MOVE* and *REST* examined in scoring schemes of 13- and 10-items with each other and also with age, and the coefficients compared with the Fisher r-to-z transformation. A Mann-Whitney Test was used to investigate gender differences since the distribution of the variables was not as expected, and the sample size within the groups were very different (female=236 vs. male=110).

Results

Table 3 shows that all factor loadings are greater than 0.60 and significant (P<0.01). Fit indices for the confirmatory factor analysis indicated that the data fit the two-factor models adequately (comparative fit index > .97, Tucker–Lewis index > .96, and root mean square error of approximation < .07). The fit indices in different models were not significantly different from each other. The correlation coefficients between factors varied from -.57 to -.74 (P<.01). In the construct reliability survey, the composite reliability (CR) coefficients varied from .55 to .71, and the average variance extracted (AVE) coefficients varied from .86 to .93. For all factors, the CR>AVE relationship was established and convergent validity achieved. The construct reliability indices were not significantly different across models.

Cronbach's alpha (α) coefficients varied from .90 to .92 in 13-item versions and from .87 to .91 in 10-item versions. Spearman-Brown split-half coefficients varied from .87 to .94 in 13-item versions and from .84 to .92 in 10-item versions (Table 4). Table 4 shows that there are negative and significant relationships between *MOVE* and *REST* in RIGHT NOW and PAST WEEK versions for all 13- and 10-item scoring schemes (P<.01). These correlation coefficients varied from r=0.51 to r=0.63. A Fisher's test showed that there is no significant difference between versions (P>.05).

Furthermore, age has no significant relationship with motivation states variables (P>.05). Mann-Whitney Tests also showed that there is a significant difference between men and

women only in the *MOVE* subscale in the PAST WEEK version with the 13-item scoring (P<.05), whereas women have a higher mean than men.

Table 3 The CRAVE Scale Items, and Confirmatory Factor Loadings (Study 2, n=346)

	RIGHT NOW				PAST WEEK			
	13 Item scoring		10 Item scoring		13 Item scoring		10 Item scoring	
I want/desired to....	*MOVE*	*REST*	*MOVE*	*REST*	*MOVE*	*REST*	*MOVE*	*REST*
1. ... move my body	.93		.92		.87		.87	
2. ... be physically active	.97		.97		.70		.70	
5. ... burn some calories [f]	.77		-		.69		-	
6. ... expend some energy	.62		.61		.82		.72	
9. ... exert my muscles	.72		.72		.75		.77	
13. ... move around	.72		.72		.81		.78	
3. ... do nothing active		.85		.78		.61		.61
4. ... just sit down		.75		.61		.87		.87
7. ... be still		.71		.71		.93		.93
8. ... be a couch potato		.62		.76		.80		.80
10. ... be motionless		.80		.86		.96		.96
11. ... lay down [f]		.75		-		.60		-
12. ... rest my body [f]		.67		-		.82		-
Fit indices								
CFI	.98		.98		.97		.99	
TLI	.97		.97		.96		.98	
RMSEA	.06		.07		.07		.06	
Construct reliability								
CR	.62	.55	.64	.56	.60	.66	.59	.71
AVE	.91	.89	.90	.86	.90	.93	.88	.92
Correlation between factors	-.73**		-.74**		-.57**		-.58**	

Note. f= fillers; CFI= Comparative fit index; TLI= Tucker–Lewis index; RMSEA= Root Mean Square Error of Approximation; CR= Composite reliability; AVE=Average variance extracted; All of factor loadings are significant at **p<0.01.

Discussion

A confirmatory factor analysis showed that the two-factor structure in the 13- and 10-item scorings has an acceptable fit, and in both versions the items have acceptable factor loadings on the *MOVE* and *REST* subscales. The factors had favorable construct reliability and convergent validity. The reliability of the subscales in all versions was acceptable, and *MOVE* and *REST* subscales had a significant and negative correlation.

Based on this, it can be concluded that both the 13- and 10-item scoring schemes have favorable factorial validity, and the 10-item scoring with fewer items and equal items in each subscale, like the 13-item scoring, has favorable confirmatory factorial validity and reliability. As the original validation study (Stults-Kolehmainen et al., 2021) concluded that the 10-item scoring was best, this favors this scoring. Other results showed that age has no significant relationship with the variables, only in the *MOVE* subscale in the PAST WEEK version (13-item scoring), there is a significant difference between men and women, whereas women have a higher mean than men.

Study 3

This study aimed to investigate the convergent and divergent validity of both the 13- and 10-item scoring schemes of the adapted CRAVE scale. First, it was hypothesized that *MOVE* and *REST* are both related to body mass index (BMI). Specifically, higher scores for *MOVE* were

thought to be associated with lower BMI, whereas higher scores in *REST* were thought to be associated with higher BMI. In addition, *MOVE* was hypothesized to be negatively associated with physical dysfunction scores, but *REST* was hypothesized to be associated with greater perceived physical dysfunction. We also hypothesize that *MOVE* and *REST* are positively and negatively related to subjective vitality. Finally, to obtain more psychometric information about the CRAVE scale, reliability, and criterion validity about age and gender were investigated.

Method

Participants. In this study, 244 students of the Ferdowsi University of Mashhad were selected by convenience sampling. Demographic indicators are given in Table 1. The participants were between the ages of 18 and 44. The mean age of the participants was 26.41 years (SD=6.30), and most of them were women (72.5%, n=177); 67.2% (n=164) were single; 71.3% (n=174) were unemployed, and 48.8% (n=118) were undergraduate students.

Procedure. The data collection was done online with Google Forms, and the link was shared with professors and administrators of student groups on the Telegram social network. In the electronic forms, explanations were given to the participants about the objectives of the project, while assuring them about the confidentiality of the information, and voluntary participation in the research emphasized. The students participating in this study were different from the previous two studies.

Measures. *CRAVE scale*: The adapted Cravings for Rest and Volitional Energy Expenditure (CRAVE) Scale was again utilized. In the first study, exploratory factor validity and the second study, confirmatory factor validity and acceptable reliability were obtained for this scale.

Body mass index (BMI): BMI was calculated as weight (kg) divided by height (m) squared.

Physical dysfunction: The General Health Questionnaire (GHQ-28, Goldberg, & Hillier,1979) adapted into Persian by Taghavi (2008) was used to measure physical dysfunction. The GHQ-28 requests participants to indicate how their health in general has been over the past few weeks, using behavioral items with a 4-point scale indicating the following frequencies of experience: zero (not at all), 1 (no more than usual), 2 (rather more than usual), and 3 (much more than usual). In the scientific literature, reliability of Cronbach´s α =.93 (Vergara-Moragues & González-Saiz, 2020) and α=.85 (Taghavi, 2008) has been reported. Cronbach's alpha (α) in this study was 0.80.

Subjective vitality: The Subjective Vitality Scale (SVS: Ryan & Frederick, 1997) adapted into Persian by Tanhaye Reshvanloo et al., (2019) is a 6-item self-report instrument that is designed

426 Table 4 The CRAVE Reliability, Inter correlations and Construct Validity

	Cronbach's alpha		Spearman-Brown split-half		inter-correlation			Correlation with Age			Gender differences Mean Rank					
											13.V.			10.V.		
Studies	13.V.	10.V.	13.V.	10.V.	13.V.	10.V.	z	13.V.	10.V.	z	Female	Male	Z	Female	Male	Z
Study 1 (n=313)																
RIGHT NOW																
MOVE	.94	.93	.92	.91	-.71**	-.72**	.25	.08	.04	.50	165.87	135.03	-2.33**	166.18	134.25	-2.83**
REST	.95	.92	.93	.91				.03	.06	-.37	155.46	159.83	-.35	155.78	160.01	-.38
PAST WEEK																
MOVE	.93	.92	.93	.92	-.48**	-.47**	-.16	-.01	-.02	-.12	164.03	139.57	-2.17*	163.50	140.89	-2.02*
REST	.96	.94	.96	.94				.06	.08	-.25	159.51	150.78	-.77	157.38	156.06	-.12
Study 2 (n=346)																
RIGHT NOW,																
MOVE	.91	.89	.92	.90	-.61**	-.63**	-.43	-.01	-.02	-.13	177.94	163.98	-1.21	177.34	165.27	-1.05
REST	.90	.87	.87	.84				.10	.09	.13	176.00	168.13	-.68	174.21	171.97	-.19
PAST WEEK																
MOVE	.90	.88	.91	.90	-.51**	-.53**	-.36	-.02	-.04	-.26	182.86	153.41	-2.55*	180.19	159.15	-1.82
REST	.92	.91	.94	.92				.06	.07	-.13	175.71	168.75	-.60	173.54	173.41	-.01
Study 3 (n=244)																
RIGHT NOW																
MOVE	.94	.92	.95	.92	-.72**	-.70**	.44	.02	.01	.11	125.76	113.88	-1.18	125.93	113.45	-1.23
REST	.95	.91	.93	.91				.02	.01	.11	127.33	109.74	-1.74	127.58	109.07	-1.83
PAST WEEK																
MOVE	.94	.93	.93	.90	-.47**	-.46**	.14	-.10	-.09	.11	128.16	107.56	-2.04	127.19	110.12	-1.69
REST	.94	.91	.95	.92				.05	.09	-.44	127.88	108.29	-1.94	125.62	114.26	-1.13

427 Note. 13.V.=13 item scoring; 10. V.= 10 item scoring; z= the Fisher r-to-z transformation; All of z coefficients are non-significant; Z= Mann-Whitney Test; **p<.01; *p<.05

to assess feelings of energy and vitality. There are two versions (i.e., state and individual differences levels), and the state-version measure was used in the present study. Respondents were asked to indicate the degree to which the statement of each item was true for them "right now" on a 7- point Likert-type scale ranging from 1 (not at all true) to 7 (very true). Cronbach´s α =.92 (Ryan & Frederick, 1997) and α=.93 (Tanhaye Reshvanloo et al., 2019) has been reported. Cronbach's alpha (α) in this study was 0.94.

Data Analysis. All statistical analyses were conducted with SPSS (version 25.0; IBM SPSS, Chicago, IL). The correlation coefficients between *MOVE* and *REST* for 13- and 10-item scoring schemes with BMI, physical dysfunction, and subjective vitality were investigated. Multiple regression was used for prediction. Cronbach's alpha (α) and Spearman-Brown split-half (r_{kk}) were used to check reliability. The correlations between *MOVE* and *REST* were examined for 13- and 10-item scoring schemes (and also with age), and the coefficients were compared with the Fisher r-to-z transformation. Mann-Whitney Tests were used to investigate gender differences since the distribution of the variables was not as expected, and the sample sizes within groups were very different (female=177 vs. male=67).

Results

Table 5 shows that *MOVE* has a negative relationship with BMI (*r*=-.15 to *r*=-.26) and physical dysfunction (*r*=-.20 to *r*=-.31) in all versions, and its relationship with subjective vitality (*r*=.28 to *r*=.40) is positive. *REST* in all versions has a positive relationship with BMI (*r*=.33 to *r*=.38), and physical dysfunction (*r*=.19 to *r*=.30), and its relationship with subjective vitality is negative (*r*=-.21 to *r*=-.33). Fisher's test showed that there is no significant difference between versions (P>.05).

Regression analysis also showed that only *REST* for the PAST WEEK version (both 13- and 10-item scoring) did not predict BMI (P>.05). *MOVE* and *REST* for the RIGHT NOW version (both 13- and 10-item scorings, did not predict physical dysfunction (P>.05). Other results showed that *REST* for PAST WEEK (both 13- and 10-item scoring) did not predict subjective vitality (P>.05). *MOVE* for the RIGHT NOW version (10-item scoring) did not predict subjective vitality either (P>.05). Fisher's test showed that there is no significant difference between 13- and 10-item scoring schemes as determined by β and R (P>.05).

Cronbach's alpha (α) coefficients varied from .94 to .95 in 13-item scoring and from .91 to .93 in 10-item scoring. Spearman-Brown split-half coefficients varied from .93 to .95 in 13-item scoring and from .90 to .92 in 10-item scoring (Table 4). Table 4 shows that there is a negative and significant relationship between *MOVE* and *REST* for RIGHT NOW and PAST WEEK versions for all 13- and 10-item scoring (P<.01). The correlation coefficients varied from *r*=-.46 to *r*=-.72. Fisher's test showed that there is no significant difference between versions (P>.05). Furthermore, it was found that age has no significant relationship with the motivation states variables (P>.05). A Mann-Whitney Test also showed that there is no significant difference between men and women for any of the variables (P>.05).

Discussion

Study 3 found that *MOVE* has a small and negative relationship with BMI and physical dysfunction and a small and positive relationship with subjective vitality. In addition, *REST* has a small and positive relationship with BMI and physical dysfunction and a small and negative relationship with subjective vitality. However, there was no significant difference between the versions. The results of regression analysis showed that *REST* alone for the PAST WEEK version (both 13- and 10-item scoring) did not predict BMI, but other subscales did predict this variable.

MOVE and *REST* for the RIGHT NOW version (both 13- and 10-item scoring) did not predict physical dysfunction.

Table 5 Correlations Between the CRAVE Scale and Measures of Convergent and Divergent Validity (Study 3, n=244)

	Body Mass Index (BMI)		Physical Dysfunction		Subjective Vitality	
Versions	**r**	**β**	**r**	**β**	**r**	**β**
13 Item Version						
NOW						
MOVE	-.15*	.43**	-.20**	.01	.29**	-.23*
REST	.34**	.53**	.21**	-.01	-.33**	-.41**
PAST						
MOVE	-.26**	-.32**	-.31**	-.23**	.40**	.44**
REST	.30**	-.04	.30**	.20*	-.22**	.16
Model Summery	$F_{(4,239)}$=14.12**, R=.44		$F_{(4,239)}$=8.51**, R=.35		$F_{(4,239)}$=16.08, R=.46	
10 Item Version						
NOW						
MOVE	-.17**	.34**	-.21**	-.03	.28**	-.13
REST	.38**	.50**	.19**	-.04	-.32**	-.34**
PAST						
MOVE	-.25**	-.25**	-.30**	-.22**	.38**	.38**
REST	.33**	.03	.29**	.21**	-.21**	.13
Model Summery	$F_{(4,239)}$=15.26**, R=.45		$F_{(4,239)}$=8.39**, R=.34		$F_{(4,239)}$=14.20**, R=.44	
Version Comparison						
NOW						
MOVE	-.23	1.16	-.11	-.22	.12	.79
REST	-.50	.45	.23	-.33	.12	.89
PAST						
MOVE	.12	.84	.12	.12	.26	.79
REST	-.37	.11	.12	.12	.12	.34
R^2 comparison	.14		.12		.28	

Note. *r*= Pearson correlation coefficient; R= multiple correlation; a= comparisons conducted with the Fisher r-to-z transformation; All of z coefficients are non-significant; **p<.01; *p<.05

Other results showed that *REST* in the PAST WEEK versions (both 13- and 10-item scoring) did not predict subjective vitality. *MOVE* for the RIGHT NOW version with 10-item scoring did not predict subjective vitality. There was no significant difference between the subscales for the 13- and 10-item scoring schemes. The reliability of the subscales for all versions was acceptable, and *MOVE* and *REST* subscales had a significant correlation. Based on this, it can be concluded that both the 13- and 10-item scoring schemes have acceptable convergent and divergent validity, and the 10-item version with fewer items and equal items in each subscale has the same validity and reliability as the 13-item version, favoring the original 10-item scoring (Stults-Kolehmainen et al., 2021). Lastly, age had no significant relationship with the motivation states variables, and there was no difference between women and men for the CRAVE subscales.

General Discussion

The objective of the current studies was to translate and test the psychometric properties of a motivation states for physical activity and sedentary behavior scale in Iran using several samples of Iranian college students. The CRAVE is currently one of the only scales validated to measure motivation states for physical activity and sedentary behavior. This scale has not previously been

validated in Iran, but has been validated in the United States and Brazil (Filgueiras et al., 2023). For the purpose of further cultural validation, we examined the psychometric properties of the CRAVE in three studies and offered strong evidence in support of the two-factor structure of the scale. In the first study, we examined the internal consistency and factor structure of two models of the scale (10- versus 13-item scoring schemes). This model was found to have a high internal consistency between the scale items and each item with the total score. The reliability of the scale was also at a suitable level which is in line with previous studies (Stults-Kolehmainen et al., 2021; Stults-Kolehmainen et al., 2023; Filgueiras et al., 2023).

The results of EFA and CFA in our independent samples were in line with the WANT model in previous studies and yielded a two-factor structure (desire to *MOVE* and *REST*). These two factors are related but separate constructs. For instance, a person may have more or less a desire to be active and sedentary simultaneously. For example, in a meditative state, a person may not want to move or be sedentary at all. Also, a high desire to be active does not necessarily mean a low desire to rest. The confirmatory factor analysis showed appropriate factor loadings for the items on their respective factors. These results are consistent with Stults-Kolehmainen et al.'s (2021) findings.

The results of the convergent criterion validity of the scale showed that movement desire significantly and negatively correlated with physical dysfunction and BMI and that *REST* significantly and positively correlated with physical dysfunction and BMI. The significant associations between *MOVE* and *REST* sub-scales with BMI are not in line with some findings reported in previous studies using other versions of the scale, such as American (Stults-Kolehmainen et al., 2021) and Brazilian (Filgueiras et al., 2022). Contrary to the researchers' expectations in these two studies, no consistent significant relationship between *MOVE* and *REST* with BMI was observed. However, our results are consistent with theoretical foundations, suggesting that people with a higher BMI are more likely to report external motivation or experience a reduction in the volitional drive to engage in physical activities. On the contrary, people with a lower BMI tend to have more intrinsic and autonomous forms of motivation (Markland & Ingledew., 2007). For instance, a systematic review found an inverse relationship between BMI and autonomous motivation and also stage of change for physical activity (Knittle et al., 2018). Stage of change was also clearly related to motivation states by Stults-Kolehmainen et al., (2021), where higher stages of exercise behavior were associated with stronger motivation states to be active.

There was a positive relationship between vitality and *MOVE* and a negative relationship between *REST* and vitality. These results are in line with previous studies (Ding & Jiang., 2020; Reyahi et al., 2022; Wahyuti et al., 2022; Stults-Kolehmainen et al., 2023) suggesting that the *MOVE* and *REST* aspects of motivation states for physical activity and sedentary behaviors measured by the Persian version of the CRAVE are related to mental and physical health. Stults-Kolehmainen and colleagues (2021) found that motivation states were related to sensations of energy and fatigue, as measured with various instruments. In addition, with the increase in physical activity, the release of hormones such as endorphin and dopamine in the body increases, and the release of the hormone cortisol decreases, which results in a lower level of stress and improved mood (An et al., 2020).

Construct validity examination in relation to age showed that only the desire to move (RIGHT NOW) had a positive and significant relationship with age. There was no significant relationship between age and other forms of the desire to *MOVE* and *REST* (i.e., the desire to *REST* RIGHT NOW and PAST WEEK, the desire to *MOVE* during the PAST WEEK). In one study from Stults-

Kolehmainen et al. (2021), only the desire to *REST* NOW had a negative and significant relationship with age. However, in another study reported in the same manuscript, *MOVE* decreased in a group of 127 people monitored over two years. It is also known that the drive to be physically active varies over the lifespan, with large changes beginning at puberty (Stults-Kolehmainen, 2023).

Younger students going through a turbulent transition and facing various academic-psychosocial challenges at the same time probably have more difficulties in regulating their emotions. As a result, they might have less desire to perform physical activities in their current situations. A lot of research also indicates that first-year students experience relatively high levels of uncertainty and anxiety due to unclear expectations and demands, (Gibney et al., 2011), and, accordingly, have many challenges in transitioning to university (Freeman et al., 2007). Such stress may inhibit, but also activate motivation to be active or sedentary (Stults-Kolehmainen & Sinha, 2014; Stults-Kolehmainen et al., 2023).

The examination of gender differences showed no significant differences in *MOVE* and *REST* in both RIGHT NOW and PAST WEEK versions. This finding is similar to the original study (Stults-Kolehmainen et al., 2021). However, these findings are not in line with studies that reported gender differences in terms of motivation for physical activity (Espada et al., 2023; Portela-Pino et al., 2020). For example, the results of some studies demonstrate that men have more motivation for physical activity than women (Sáez et al., 2021; Sánchez-Herrera et al., 2022). This outcome can be attributed to the fact that both men and women experienced many restrictions, such as physical distancing and the lack of physical activity during the COVID-19 pandemic. Therefore, it seems reasonable that both groups have almost the same preferences regarding the desire for physical activity. Future studies should examine other possibilities, including cultural influences and comparing different countries directly. In addition, the gender differences identified in the studies were mainly based on types of motivation (e.g., extrinsic and intrinsic) rather than motivational state (Egli et al., 2011; Lauderdale et al., 2015). As physical activity is a basic physical and psychological need (Stults-Kolehmainen, 2023), there may not be any differences by gender.

Limitations and Future Directions

This study has several strengths, including a large combined sample size and robust analyses. Nevertheless, there are some limitations. First, our measurements were done during the pandemic, when most people suffered from psychological distress and social stress (Filgueiras & Stults-Kolehmainen, 2021). As a result, interpretation of the results should be done with caution. Second, we used convenience sampling for our studies, which limits the generalizability of these findings. Third, most people in the sample group were female students, which can reduce the representativeness of the sample groups. Fourth, this research was conducted only in a university student population. Therefore, caution should be exercised in generalizing the results to other groups. Fifth, in the present study, we did not explore changes in the desire to move or be sedentary over time.

In future studies, researchers should explore the use of the CRAVE scale among adolescents. Considering the critical role of cultural factors in the motivation for physical activity, conducting further cross-cultural studies in this regard and identifying the factors determining the desire for physical activity can extend the literature (Filgueiras et al., 2023). Examining convergent validity in relation to other variables, such as emotional responses, is also suggested. Circadian changes in the desire for physical activity and rest during the day (Budnick et al., 2023) could be

studied simultaneously with changes in components based on internal and external feelings, such as hunger, stress, anxiety, fatigue, and deprivation as well as other pleasant and unpleasant emotions. There should also be investigation of the factors influencing the desire for physical activity (e.g., environmental factors, including the context of interpersonal relationships, intercultural factors such as attitudes, beliefs, and lifestyle), all of which could all be considered in future studies. Lastly, motivation states need to be explored in relation to physical health problems (e.g., thyroid issues, morbid obesity) and physiological correlates that are likely to be related, such as blood glucose (Budnick et al., 2023).

Despite these limitations, the study does provide some evidence to support the theoretical foundations of the WANT model and, more precisely, transient facets of motivation for physical activity and sedentary behaviors. Given that research on motivational states is a novel area worldwide, and studies in Iran were urgently needed, the current study could contribute significantly to this body of research. The Persian version of the CRAVE is a valid instrument with good psychometric properties that can be reliably used by researchers and practitioners in sports and exercise psychology throughout Iran.

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