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Validation and Invariance Analysis of the Arabic Versions of The Transtheoretical model Scales for Exercise

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Abstract

This study develops, evaluates the reliability and factorial invariance of the Arabic versions of the Decisional Balance and Self Efficacy measures for exercise, and tests their predicted relationships with Stages of Change. In a sample of Saudi adults *(N* = 685*)*, three levels of invariance were tested: Configural, Pattern Identity, and Strong Factorial Invariance**.** *Decisional Balance*: the two-factor uncorrelated model was the most parsimonious good-fitting model (χ^2 (35) = 97.803, $p < .001$; CFI = .922; RMSEA = .076 [90% CI = .058, .093]). Coefficient Alpha and factor rho reliability were .86 for Pros and .53 for Cons. Strong Factorial Invariance was a good fit for the model across seven grouping variables: gender, age, health status, educational level, employment status, BMI, and stage of change for exercise. *Self Efficacy*: the one-factor model revealed an excellent fit ($\chi 2$ (8) = 16.732, p = .033; CFI = .991; RMSEA = .056 [90% CI = .015, .094]). Coefficient alpha was .86 and factor rho reliability was .89. Strong Factorial Invariance was a good fit for the model across all seven grouping variables. Multivariate analysis by stage of change replicated expected patterns: Pros (ω^2= .08), Cons (ω^2= .02), and Self Efficacy (ω^2= .21)**.** The results demonstrate the internal and external validity and measurement invariance of these measures, supporting their use in research and interventions to increase exercise among Saudi population.

Keywords: Decisional Balance; Self-Efficacy; Exercise; Transtheoretical model; Factorial invariance; Arabic version.

Introduction

There is a substantial literature indicating that physical activity can improve both physical and psychological health. People who are physically active tend to live longer and have lower risk for heart disease, stroke, type 2 diabetes, and some cancers. It can also help with weight control and may improve academic achievement in students (CDC, 2014). Physical activity also offers positive psychological improvements by decreasing levels of anxiety, depression, and enhancing self-esteem (U.S DHHS, 1996).

Despite of the known health benefits of physical activity, physical inactivity is a global public health problem (Kohl et al., 2012). The prevalence of physical activity varies widely by country, the highest being reported in Sweden and Denmark, and the lowest in Brazil, Thailand and Kingdom of Saudi Arabia (Sisson & Katzmarzyk, 2008).

The high prevalence of physical inactivity in Saudi Arabia (AlNoza et al., 2007; AlZalabani, AlHamdan, & Saeed, 2015; Amin et al., 2012; Assiri et al., 2015; Awadalla et al., 2014; El Bcheraoui et al., 2016) is a major public health problem that contributed to the increasing lifestyle-related diseases (e.g. coronary heart disease, diabetes, hypertension, obesity, etc.). Without serious actions to reduce physical inactivity in Saudi population, these diseases may keep increasing to epidemic proportions, and the cost to public health will be substantial (Al-Hazzaa, 2004a, 2004b; AlNoza et al., 2007; El Bcheraoui et al., 2016).

Because of the extremely high prevalence of physical inactivity in Saudi Arabia, effective interventions to promote and increase physical activities are necessary in Saudi Arabia. The Transtheoretical model of behavior change (TTM) is a major theoretical framework that helps researchers to better understand how people adopt and maintain regular exercise. Worldwide, interventions to promote regular exercise based on the TTM have been developed and implemented and have demonstrated significant impacts in numerous applications (Grande, Cieslak & Silva, 2016; Greaney et al, 2008; Johnson et al 2008; Marcus et al., 1996,1998; Sarkin et al, 2001; Steptoe et al., 1999; Woods et al., 2002; Zhu et al, 2014). In tailored computerized interventions based on the TTM, different response patterns to the TTM measures (e.g., Decisional Balance and Self Efficacy) result in different individualized feedback for participants. TTM- tailored interventions therefore require valid and reliable measures particularly when data from these measures are used for empirical decision making and intervention recommendations (Redding et al., 1999,2008; Velicer et al., 1993,1994). The TTM measures for exercise were initially developed and validated in white populations primarily in the United States (Marcus et al., 1992a, 1992b). These measures have since been validated in several English-speaking populations (e.g. multiethnic sample, African American) (Blaney et al., 2012; Geller et al., 2012; Musser, 2003; Paxton et al., 2008; Plotnikoff et al., 2001).

The aims of this study are: first, to translate the Stages of Change, Decisional Balance, and Self Efficacy scales for exercise into Arabic language. Second, to assess the psychometric properties, and confirm the factorial invariance of these measures across population subgroups varying in gender, age, health status, educational level, employment status, Body Mass Index (BMI), and stage of change. Finally, to examine the expected patterns of relationships between Decisional Balance and Self Efficacy and the stage of change groups in this population.

Method

Participants

Participants were population-based Saudi adults (*N = 685*), who were recruited online via emails and social media from across the Kingdom of Saudi Arabia. More than half of participants were females (55.91%). Mean age was 33.11, ranging from 18 to 70 years. Most participants were educated and indicated that they were in excellent health. Table 1 gives a complete listing of the demographic variables of the sample.

Table 1. Demographic Characteristics (*N*=685)

		N	%
Gender (*N* =685)			
	Male	302	44.09
	Female	383	55.91
Educational level (*N* = 685)			
	Less than high school	29	4.23
	High school	113	16.50
	College student	131	19.12
	Associate degree	54	7.88
	Bachelor's degree	260	37.96
	Master's degree	76	11.09
	Doctorate degree	22	3.21
Employment status (*N* = 685)			
	Employed for wages	288	42.04
	Not employed	51	7.45
	Student	177	25.84
	Self employed	38	5.55
	Homemaker	105	15.33
	Retired	26	3.80
Health status (*N* = 685)			
	Poor	0	0.00
	Fair	18	2.63
	Good	248	36.20
	Excellent	419	61.17
Body Mass Index (*N* = 685)			
	Under weight (BMI< 18.5)	36	5.26
	Healthy weight (BMI= 18.5–24.9)	233	34.01
	Overweight (BMI = 25–29.9)	219	31.97
	Obesity (BMI > 30)	197	28.76
Stage of change for Exercise (*N* = 685)			
	Precontemplation	71	10.36
	Contemplation	120	17.52
	Preparation	219	31.97
	Action	121	17.66
	Maintenance	154	22.48
		Mean	SD
Age (*N* = 685) ranges (18-70)		33.11	9.97
Height (inches) (*N* = 685)		64.57	0.04
Weight (lb) (*N* = 685)		161.20	43.72
BMI (*N*= 685)		27.07	6.24

Measures

A demographic questionnaire, Stages of Change, Decisional Balance, and Situational Self Efficacy for Exercise were included.

Demographic Questionnaire. Questions about participant's age, gender, education level, employment, health status, height, and weight.

Stages of Change. The Stages of Change algorithm assesses the readiness of individuals to engage in regular exercise. Regular exercise is described as any planned physical activity (i.e., brisk walking, aerobics, jogging, bicycling, swimming, rowing, etc.) intended to increase physical fitness, and performed 3 to 5 times per week for 20-60 minutes per session. Exercise does not have to be painful to be effective but should be done at a level that increases breathing rate and causes sweating. Precontemplation is defined as not exercising at that level and having no intention to do so in the next 6 months. Contemplation is defined as not currently engaging in regular exercise but intending to begin regular exercise within next 6 months. Preparation is defined as not currently engaging in regular exercise but having intention to begin regular exercise within 30 days. Action is defined as currently engaging in regular exercise for less than 6 months. Maintenance is defined as engaging in regular exercise for more than 6 months. These definitions are consistent with staging algorithm recommendations (Reed et al., 1997; Schumann et al., 2002; Hellsten el al., 2008).

Decisional Balance. This scale assesses the advantages (the Pros) and disadvantages (the Cons) of engaging in regular exercise. Five items assessing the Pros of exercising (α = .90), and five items assessing the Cons of exercising (α = .67) were administered. Individuals responded on a five-point scale (1 = Not at all Important - 5 = Extremely Important). Higher scores on the Pros and lower scores on the Cons items indicate that an individual perceived exercise as advantageous, while lower scores on the Pros and higher scores on the Cons would indicate that an individual perceived exercise as disadvantageous (Nigg et al., 1998; Blaney et al.,2012).

Situational Self Efficacy. A six-item Situational Self Efficacy scale (α = .82) was used to assess the confidence of individuals to engage in regular exercise across a variety of challenging circumstances. Participants rated their confidence levels for each item from 1 to 5 (1 = Not at all Confident - 5 = Completely Confident). Higher scores indicated higher levels of confidence to exercise even across challenging circumstances (Benisovich et al., 1998; Blaney et al, 2012).

Translation and Cross-Cultural Adaptation procedures.

The methodology used for translation and adaptation followed the published guidelines for the cross-cultural adaptation of self-reported measures by Beaton et al. (2000). *First*, initial translation of Stages of change, Decisional Balance, and Self Efficacy scales for exercise from English into Arabic by two native Arabic-speaking translators fluent in English. One of these translators was familiar with the subject and the constructs that are being assessed, while the second translator was unaware of the concepts addressed. To ensure a greater cultural fit, both translators avoided literal translation of items. For example, in the Decisional Balance scale "I would feel more comfortable with my body if exercised regularly" was translated to "I would feel more satisfied with my body if I exercised regularly" since Arabs are not accustomed to use words like "comfortable" to describe their feeling about their bodies, unlike words like "satisfied" or "confident" which are more popular in this context. Also "Exercise puts an extra burden on my significant other" was translated to "Exercise puts an extra burden on the most important person in my life; e.g. spouse or any beloved one" to fit Saudi culture. As with the Self Efficacy scale "when it's raining or snowing" was translated to "when it's hot or humid". *Second*, the two translators and a recording observer sat down to synthesize the results of the translations and resolve any discrepancies. This procedure led to the first Arabic consensus version. *Third*, two native English-speaking translators fluent in Arabic, without prior knowledge of the original version or the concepts examined, independently translated the Arabic version back to English. The goal was to evaluate the extent to which the translated version reflects the item content of the original version. It is important to note that back translation does not imply that an item must remain literally identical to the original but rather it must maintain a conceptual equivalence (Borsa et al., 2012). *Fourth*, an expert committee comprising a methodologist, the principal investigator, language professional, and four translators, reviewed all versions and components of the original scales and the translations. They reached consensus on the final wording to be used in the Arabic versions of the Stages of change, Decisional Balance, and Self Efficacy scales for exercise. The goal was to achieve the maximum semantic, idiomatic, experiential, and conceptual equivalence between the English and Arabic versions. *Finally*, the prefinal version was tested in undergraduate students from King AbdulAziz University, Jeddah, Saudi Arabia (N =40). Subjects who completed the scales were interviewed about their understanding of each item, the wording, the response alternatives, and if they had any suggestions for revision. Accordingly, slight modifications were made. In addition, several new items were added to the final Arabic versions of the Decisional Balance and Self Efficacy scales to serve as substitutes in case any original items did not fit well in this population. These additional items were created based on the interviews with undergraduate students from King AbdulAziz University. This step produced the final Arabic versions of the scales that were used in this study.

Statistical analysis

Several sets of analyses were conducted on the Arabic versions the Decisional Balance and Self Efficacy scales for exercise using EQS 6.1 and SAS 9.2 software packages.

Confirmatory factor analyses (CFA). CFA were conducted to assess the structure for the Decisional Balance and Self Efficacy scales for exercise. For Decisional Balance, two measurement models, a correlated and an uncorrelated model, were compared to establish the best-fitting model. These models were based on previous studies, which have consistently shown that a two-factor model best describes Decisional Balance (Hall &

Rossi, 2008). For Situational Self Efficacy, a one factor model was examined. Model fit was assessed based on several indices, including the χ^2 significance test, the comparative fit index (CFI), and the root mean square error of approximation (RMSEA). For the χ^2 test, a non-significant χ^2 indicates that the model can reasonably reproduce the population covariance matrix (Harlow, 2014). For CFI, values closer to 1.0 indicate good fit, with values of at least .90 indicate an adequate fit, and values above .95 indicate an excellent fit. For RMSEA, values closer to zero indicate good fit, with values less than .08 considered acceptable and values below .05 indicating a very good fit (Kline, 2011).

Factorial Invariance. Three levels of invariance were examined in sequential order with each level requiring more constraints: (1) configural invariance (unconstrained nonzero factor loadings); (2) pattern identity invariance (equal factor loadings); (3) strong factorial invariance (equal factor loadings and measurement errors) (Meredith & Teresi, 2006, Meredith, 1993). In addition to the model fit indices (CFI and RMSEA) described, the difference in CFI (ΔCFI) values between the higher-level model and the lower level of invariance was calculated. A difference of .01 or smaller indicates that the null hypothesis of invariance should not be rejected and that the model demonstrates invariance (Cheung & Rensvold, 2002). The present study emphasized ΔCFI as the final determinant of measurement invariance due to the susceptibility of the chi-square statistic to sample size and model complexity that may reject null hypotheses when only trivial model differences exist (Bentler & Bonett, 1980; Cheung and Rensvold, 2002; Hu & Bentler, 1999; Kline, 2011; Wu, Li, & Zumbo, 2007). Each invariance procedure was evaluated across specific subgroups varying by gender (male/female), age (18-35/36-70), health status (excellent/good), educational level (Less than college degree/ College degree and higher), employment status (Employed/students /homemakers), BMI (healthy BMI, overweight, obese), and stage of change (C/PR/A/M). To avoid convergence issues (Velicer & Fava, 1998) any subgroup size less than 100 was eliminated from invariance analysis (e.g. Precontemplation = 71, Underweight BMI = 36, and Not employed = 51)

Scale Reliabilities. The internal consistency reliabilities of Decisional Balance and Self Efficacy scales were assessed with Cronbach's coefficient Alpha (Cronbach, 1951). In addition, factor rho reliability coefficients were calculated by using unstandardized model estimates (Kline, 2011).

Known Groups Validation. A multivariate analysis of variance (MANOVA), with follow up univariate analyses of variance (ANOVAs) and Tukey tests, were conducted for each scale (Pros, Cons, and Self Efficacy) to examine functional relationships between these scales (means in standardized *T*-score) and the stage of change groups. Also, effect sizes (ω^2) were calculated.

Results

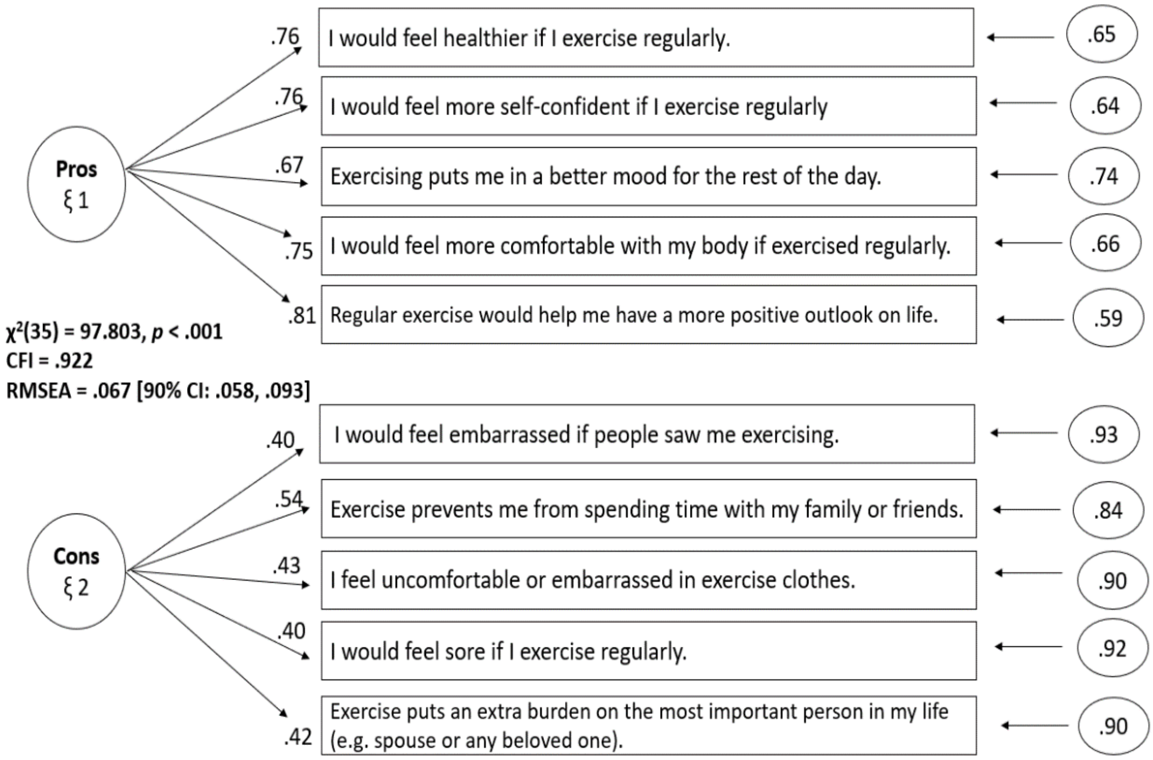
I. Decisional Balance scale for Exercise

Step I: Initial Confirmatory Factor Analysis was conducted on the original 10 items from the Decisional Balance scale (N = 685). The measurement model with two uncorrelated factors, consisting of five items each for Pros and Cons, showed an inadequate fit to the data, χ^2 (35) = 332.236, p < .001; CFI = .765; RMSEA = .111 [90% CI: .101, .122]. An alternative model with correlated latent Pros and Cons factors also provided an inadequate fit, χ^2(34) = 321.268, p < .001; CFI = .773; RMSEA = .111 [90% CI: .100, .122].

Step II: Exploratory Analysis. Since the original set of items did not provide a good model, the additional decisional balance items along with the original items were tested in a series of exploratory analyses following the sequential method of scale development (Redding et al., 2006). The sample was randomly split in two sections. The first sample (N = 324) was used for exploratory item analysis using principal components analysis, and the second sample (N = 314) for confirmatory analysis using structural equation modeling. The initial 15 items (10 original items and 5 additional items) from the Decisional Balance scale were analyzed using principal components analysis with varimax rotation. As expected, there were two factors with mostly simple structure. These two factors explained 44% of the variance in these 15 items. The analysis was repeated eliminating items with loadings < .40 or with cross loadings on the non-target factor (e.g., “There is too much I would have to learn to exercise” and “Exercise increases my appetite for food”). Again, there were two factors that explained 47% of the variance in these 13 items (8 items for Pros and 5 items for Cons). Finally, to obtain symmetry between Pros and Cons, three items with lower loadings were deleted from the final principal components analysis (e.g., “I would have more energy for my family and friends if I exercised regularly”, “I would feel less stressed if I exercised regularly”, and “Exercise helps me lose weight or maintain my current weight”). These final two factors explained 53% of the variance in the final 10 items. Cronbach’s coefficient alphas were calculated for each factor with values of .88 for Pros) and .56 for Cons.

Step III: Final Confirmatory Factor Analysis was conducted on the final 10 items selected from the exploratory analyses (N =314). The measurement model with two uncorrelated factors, consisting of five items each for Pros and Cons (Figure 1), showed a good fit to the data, χ^2 (35) = 97.803, p < .001; CFI = .922; RMSEA = .076 [90% CI: .058, .093]. Factor loadings were in the range of .67 to .81 for Pros and .40 to .54 for Cons. An alternative model with correlated latent Pros and Cons factors also provided a good fit for the data, χ^2(34) = 96.712, p < .001; CFI = .922; RMSEA = .077 [90% CI: .059, .095]. The correlation of .085 estimated between the latent Pros and Cons factors was not significant. The χ^2 difference test and ΔCFI comparing the nested correlated and uncorrelated models indicated that estimating the extra parameter in the correlated model did not improve model fit, $\Delta\chi^2(1)$ = 1.091, p = .296; ΔCFI= .000. Therefore, the uncorrelated model was retained for parsimony and theoretical consistency and used for subsequent invariance testing.

Figure 1. Measurement model for uncorrelated Pros and Cons of exercise with standardized parameter estimates (N = 314).



Factorial Invariance. Multiple-sample CFA was used to test hierarchical factorial invariance for the two Pros and Cons subscales. The sub-group categories for invariance analyses and the complete results shown in Table 2. Strong factorial invariance was found with good model fit for gender (CFI =.957; RMSEA = .051 [90% CI: .039, .063]), age (CFI =.921; RMSEA = .072 [90% CI: .061, .083]), health status (CFI =.947; RMSEA = .055 [90% CI: .042, .067]), educational level (CFI =.948; RMSEA = .052 [90% CI: .040, .064]), employment status (CFI =.926; RMSEA = .068 [90% CI: .055, .080]), body mass index (CFI =.950; RMSEA = .051 [90% CI: .037, .064]), and stages of change (CFI =.930; RMSEA = .055 [90% CI: .040, .068]).

Reliability. Cronbach's coefficient alphas were calculated for each subscale (N = 314) with values of .86 for the Pros subscale and .53 for the Cons subscale. Factor rho coefficients were also calculated for each subscale (N = 314) with the same values of .86 for the Pros subscale and .53 for the Cons subscale.

Table 2. Model fit and nested model comparisons for Decisional Balance scale by subgroup.

Subgroup	**Category**	**n**	**Model**	***χ*2**	***df***	**CFI**	**ΔCFI**	**RMSEA**	**[90% CI]**
Gender	Male	292	Configural Invariance	148.572	70	.956	-	.058	[.045,.071]
			Pattern Identity Invariance (λ)	159.762	78	.954	-.002	.056	[.044,.068]
	Female	373	Strong Factorial Invariance (λ, Θδ)	165.359	88	.957	.003	.051	[.039,.063]
Age	18 to 35	421	Configural Invariance	203.852	70	.930	-	.075	[.063,.087]
			Pattern Identity Invariance (λ)	213.858	78	.929	-.001	.072	[.060,.083]
	36 to 70	254	Strong Factorial Invariance (λ, Θδ)	241.732	88	.921	-.008	.072	[.061,.083]
Health Status	Good Health	228	Configural Invariance	139.937	70	.954	-	.057	[.043,.070]
	Excellent Health	399	Pattern Identity Invariance (λ)	152.584	78	.951	-.003	.055	[.042,.068]
			Strong Factorial Invariance (λ, Θδ)	170.849	88	.947	-.004	.055	[.042,.067]
Educational Level	No College degree	307	Configural Invariance	133.822	70	.956	-	.053	[.039,.067]
			Pattern Identity Invariance (λ)	145.024	78	.954	-.002	.052	[.038,.064]
	College degree & higher	338	Strong Factorial Invariance (λ, Θδ)	165.676	88	.948	-.006	.052	[.040,.064]
Employment Status	Employed for wages	288	Configural Invariance	187.825	105	.950	-	.065	[.049,.079]
			Pattern Identity Invariance (λ)	224.274	121	.937	-.013	.067	[.053,.081]
	Students	177	Strong Factorial Invariance (λ, Θδ)	264.209	141	.926	-.011	.068	[.055,.080]
	Homemakers	105							
BMI	Healthy weigh	228	Configural Invariance	151.126	105	.969	-	.046	[.028,.061]
	Overweigh	214	Pattern Identity Invariance (λ)	186.556	121	.956	-.013	.051	[.036,.064]
	Obesity	192	Strong Factorial Invariance (λ, Θδ)	218.536	141	.950	-.006	.051	[.037,.064]
Stages of Change for Exercise	Contemplation	120	Configural Invariance	214.609	140	.940	-	.059	[.043,.074]
	Preparation	219	Pattern Identity Invariance (λ)	242.404	164	.937	-.003	.056	[.040,.070]
	Action	121	Strong Factorial Invariance (λ, Θδ)	283.230	194	.930	-.007	.055	[.040,.068]
	Maintenance	154							

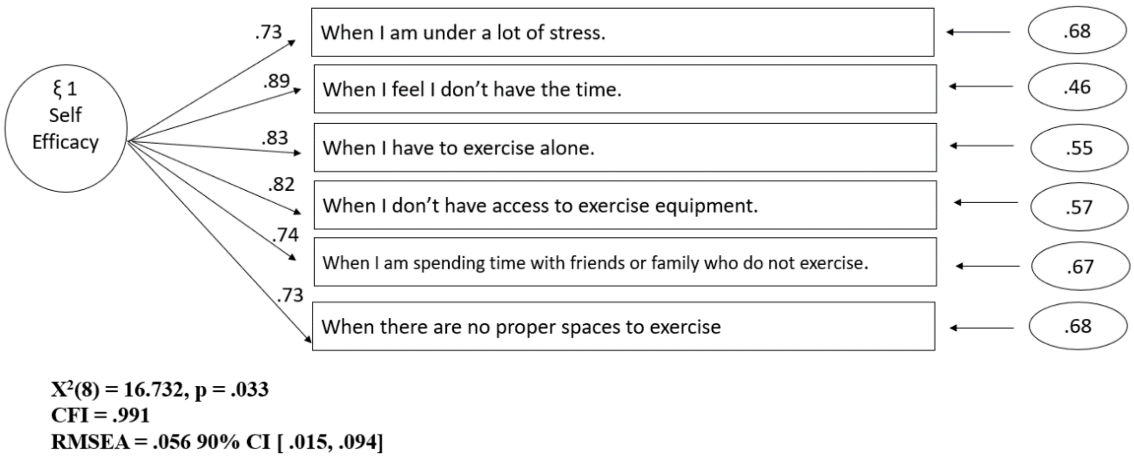
II. Self Efficacy scale for Exercise:

Step I: Initial Confirmatory Factor Analysis was conducted on the original 6 items from the Self Efficacy scale (*N*=685). The one-factor model provided only partially adequate fit for the data, χ^2 (8) = 54.993, *p* < .001; CFI = .976; RMSEA = .093 [90% CI = .070, .116].

Step II: Exploratory Analysis. As with decisional balance, the original set of self efficacy items was combined with the new items and a series of exploratory and confirmatory analyses was conducted to determine the structure of the measure. The sample was randomly split in two sections. The first sample (*N* = 330) was used for exploratory item analysis using principal components analysis, and the second sample (*N* = 346) for confirmatory analysis using structural equation modeling. The initial 11 items (6 original items and 5 additional items) were analyzed using principal components analysis with varimax rotation (*N* = 330). As expected, a one factor solution was obtained, which explained 59% of the variance in these 11 items. The goal was to attain a shorter version (6 items) of the Self Efficacy scale, therefore, five items with lower loadings were deleted and a second principal components analysis was conducted. There was one factor that explained 64% of the variance in these final 6 items, which were then used in the confirmatory factor analysis and invariance analysis. Cronbach's coefficient alpha was .88.

Step III: Final Confirmatory Factor Analysis was conducted on the final 6 items from the second section of the data (*N* = 346). The one-factor model (Figure 2) provided an excellent fit for the data, χ^2 (8) = 16.732, p = .033; CFI = .991; RMSEA = .056 [90% CI = .015, .094]. Factor loadings for individual items ranged from .73 to .89.

Figure 2. Measurement model for Self Efficacy of Exercise with standardized parameter estimates (*N* = 346).



Factorial Invariance. Multiple-sample CFA was used to test hierarchical factorial invariance for the Self Efficacy scale. The categories used to create the sub-groups for the invariance analyses and the fit indices for the invariance models are shown in Table

3. Strong factorial invariance was found with good model fit for gender (CFI =.986; RMSEA = .055 [90% CI: .034, .075]), age (CFI =.971; RMSEA = .079 [90% CI: .060, .098]), health status (CFI =.965; RMSEA = .085 [90% CI: .067, .104]), educational level (CFI =.983; RMSEA = .059 [90% CI: .039, .079]), employment status (CFI =.981; RMSEA = .059 [90% CI: .034, .081]), body mass index (CFI =.986; RMSEA = .051 [90% CI: .027, .073]), and stages of change (CFI =.954; RMSEA = .082 [90% CI: .062, .101]).

Reliability. Cronbach's coefficient alpha was .86. Factor rho coefficient was .89.

Table 3. Model fit and nested model comparisons for Self Efficacy scale by subgroup.

Subgroup	**Category**	**n**	**Model**	$\chi 2$	***df***	**CFI**	**ΔCFI**	**RMSEA**	**[90% CI]**
Gender	Male	302	Configural Invariance	33.500	16	.991	-	.057	[.029,.083]
			Pattern Identity Invariance (λ)	44.727	22	.989	-.002	.055	[.031,.078]
	Female	383	Strong Factorial Invariance (λ, Θδ)	56.551	28	.986	-.003	.055	[.034,.075]
Age	18 to 35	426	Configural Invariance	51.299	16	.983	-	.080	[.056,.105]
			Pattern Identity Invariance (λ)	67.081	22	.978	-.005	.077	[.056,.099]
	36 to 70	259	Strong Factorial Invariance (λ, Θδ)	87.710	28	.971	-.007	.079	[.060,.098]
Health Status	Good Health	248	Configural Invariance	49.301	16	.983	-	.079	[.055,.105]
	Excellent Health	419	Pattern Identity Invariance (λ)	62.331	22	.979	-.004	.074	[.053,.096]
			Strong Factorial Invariance (λ, Θδ)	95.512	28	.965	-.014	.085	[.067,.104]
Educational Level	No College degree	327	Configural Invariance	44.945	16	.985	-	.073	[.048,.098]
			Pattern Identity Invariance (λ)	48.935	22	.986	.001	.060	[.037,.082]
	College degree & higher	358	Strong Factorial Invariance (λ, Θδ)	61.372	28	.983	-.003	.059	[.039,.079]
Employment Status	Employed for wages	288	Configural Invariance	39.698	24	.990	-	.059	[.022,.090]
			Pattern Identity Invariance (λ)	55.642	36	.988	-.002	.054	[.022,.080]
	Students	177	Strong Factorial Invariance (λ, Θδ)	79.162	48	.981	-.007	.059	[.034,.081]
	Homemakers	105							
BMI	Healthy weigh	233	Configural Invariance	49.049	24	.987	-	.070	[.041,.097]
	Overweigh	219	Pattern Identity Invariance (λ)	61.487	36	.987	.000	.057	[.031,.081]
	Obesity	197	Strong Factorial Invariance (λ, Θδ)	75.411	48	.986	-.001	.051	[.027,.073]
Stages of Change for Exercise	Contemplation	120	Configural Invariance	67.865	32	.976	-	.086	[.057,.114]
	Preparation	219	Pattern Identity Invariance (λ)	91.892	50	.972	-.004	.074	[.049,.097]
	Action	121	Strong Factorial Invariance (λ, Θδ)	137.633	68	.954	-.018	.082	[.062,.101]
	Maintenance	154							

Known Groups Validation. A MANOVA was conducted to determine if the Pros, Cons, and Self Efficacy of exercise differed across the five stage of change groups. The results showed that there was a significant main effect for stage of change (Wilks' $\Lambda = .76$; $F[12, 1794.1] = 16.52$; $p < .001$; multivariate $\eta^2 = .24$). Follow-up ANOVAs and Tukey tests revealed that all three variables differed significantly by stage; the Pros ($F[4, 680] = 15.27$; $p < .001$; $\omega^2 = .08$), the Cons ($F[4, 680] = 4.04$; $p = .003$; $\omega^2 = .02$), and the Self Efficacy ($F[4, 680] = 46.06$; $p < .001$; $\omega^2 = .21$). Individuals in precontemplation and contemplation reported significantly lower Pros of regular exercise than those in preparation, action, and maintenance. In addition, participants in contemplation and preparation reported significantly higher Cons of regular exercise than those in maintenance. Moreover, individuals in maintenance reported significantly higher self efficacy of regular exercise then those in precontemplation, contemplation, preparation, and action. Similarly, participants in action reported significantly higher self efficacy of regular exercise then those in precontemplation, contemplation, and preparation. Finally, Individuals in precontemplation reported significantly lower self efficacy of regular exercise then those in contemplation and preparation. Scale means for the Pros, Cons, and Self Efficacy are shown in Table 4, and the profiles of all three scales across the stages of change are shown in Figure 3.

Figure 3. Standardized *T* scores for Pros, Cons, and Self Efficacy across the Stages of Change for Exercise.

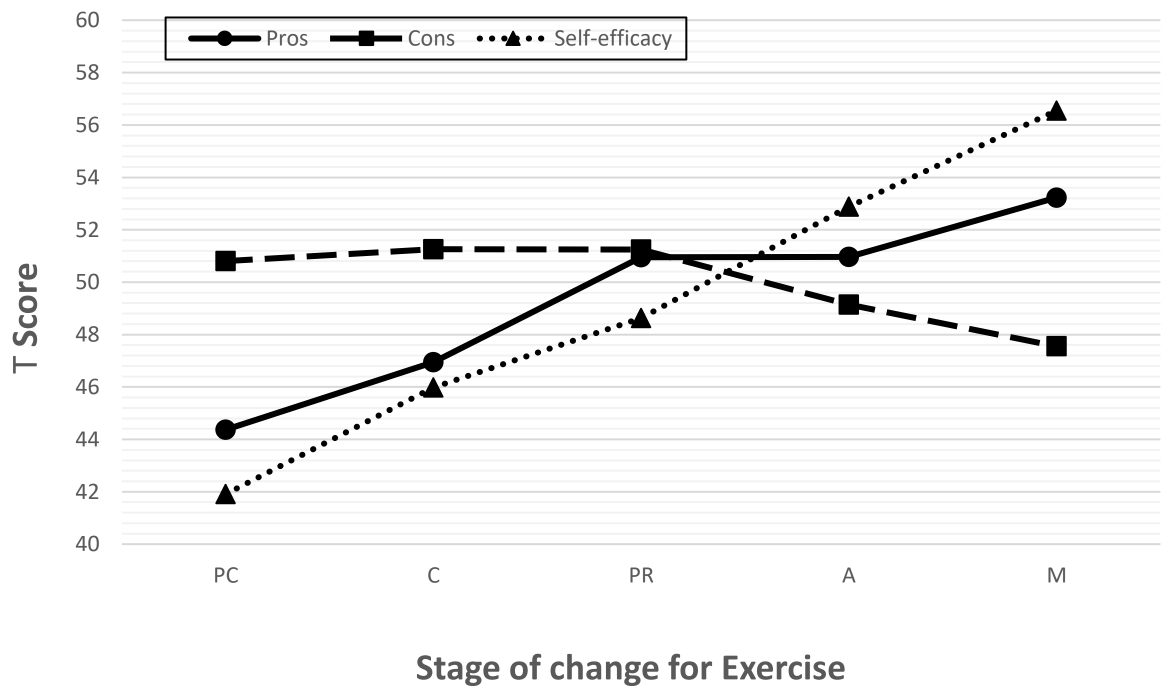


Table 4. Standardized *T*-scores for Pros, Cons, Self Efficacy by stage of change (*N* = 685).

PC indicates precontemplation; C: contemplation; PR: preparation; A: action; M: maintenance.

Factor	Stage	*N*	Mean	SD	*F* (4,680)	ω²	Post hoc Tukey HSD
Pros	Precontemplation	71	44.37	13.44	15.27	.08	PC, C < PR, A, M
	Contemplation	120	46.94	9.88			
	Preparation	219	50.95	9.00			
	Action	121	50.96	9.38			
	Maintenance	154	53.23	8.24			
Cons	Precontemplation	71	50.80	10.45	4.04	.02	M < C, PR
	Contemplation	120	51.26	9.69			
	Preparation	219	51.25	10.55			
	Action	121	49.14	9.10			
	Maintenance	154	47.55	9.52			
Self-efficacy	Precontemplation						
	Precontemplation	71	41.91	8.52	46.06	.21	PC, C, PR, A < M PC, C, PR < A PC < C, PR
	Contemplation	120	45.98	9.36			
	Preparation	219	48.63	8.61			
	Action	121	52.88	8.90			
	Maintenance	154	56.55	9.11			

Discussion

The purpose of this study was three-fold: (a) to translate the Stages of change, the Decisional Balance, and the Self Efficacy scales for exercise into Arabic language, (b) to assess the factorial invariance and the reliability of the Arabic versions of the Decisional Balance and Self Efficacy scales for exercise in Saudi sample, and (c) to examine the expected patterns of relationships between the Decisional Balance, the Self Efficacy and the stage of change groups in this population. The overall psychometric properties of these scales revealed that they were reliable and valid instruments that were invariant across subgroups varying in gender, age, health status, educational level, employment status, BMI, and stage of change. The establishment of factorial invariance indicated that these constructs were being measured similarly across these demographic subgroups.

Decisional Balance. This study replicated the two-factor (pros and cons) uncorrelated measurement structure for the Decisional Balance scale in this Saudi sample, consistent with prior results (Blaney et al.,2012; Geller et al., 2012; Nigg et al., 1998; Paxton et al., 2008) showing that the pros and cons were orthogonal. Also, the scales showed good internal consistency. The Coefficient Alphas and the factor rho coefficients were .86 for Pros and .53 for Cons. In addition, the factor loadings for individual items were adequate to excellent (.67 to .81 for Pros, and .40 to .54 for Cons). These results suggest that individuals in this sample discriminated between the positive and negative aspects of regular exercise behaviors. Moreover, invariance analyses showed that the ten-item Decisional Balance scale with two uncorrelated Pros and Cons subscales demonstrated the highest level of factorial invariance in population-based sample of Saudi adults. Strong invariance model required that factor loadings and error terms for individual items were constrained to be equal across comparison groups in the model. Strong factorial invariance provided a good fit across gender, age, health status, educational level, employment status, BMI, and stage of change subgroups. The CFI fit indices were around .95 ranging from .921 to .969, and the RMSEA values were below .08 ranging from .046 to .072. The |ΔCFI| values were mostly consistent within the suggested .01 range as each invariance level was assessed hierarchically, demonstrating a high degree of fit for the strong invariance model across the subgroups. For employment status and BMI subgroups, CFI and RMSEA values suggested good fit, but the ΔCFI values were slightly higher than .01. This indicates that there might be some small differences in the factor model within these subgroups. These differences may due to sample fluctuation, but future investigation is needed to determine the source of these differences. However, this violation appears minor since the overall fits of these models were still very good (e.g. CFI and RMSEA). Therefore, strong factorial invariance should not be rejected. The results indicate that there is a consistent relationship between the two subscales (Pros and Cons), and the ten items that measure these factors.

Self Efficacy. This study confirmed the one-factor model for the Self Efficacy scale for exercise in this sample, replicating the underlying structure found in previous studies (Benisovich et al, 1998; Blaney et al.,2012; Geller et al., 2012; Paxton et al., 2008). The Coefficient Alpha was excellent for this relatively short scale with value of .86, as well as factor rho reliability with value of .89. Additionally, the factor loadings for individual items were excellent (.73 to .89). Furthermore, invariance analyses showed that the six-item Self Efficacy scale demonstrated strong factorial invariance across the grouping variables. The CFI fit indices were .95 and above, ranging from .95 to .99, and the RMSEA values were usually below .08 ranging from .05 to .08. In addition, the |ΔCFI| values were mostly consistent within the suggested .01 range as each invariance level was assessed hierarchically, demonstrating a high degree of fit for the strong invariance model across the subgroups. For health status and stages of change subgroups, the CFI and RMSEA values suggested good fit, but the ΔCFI values were slightly higher than .01. This indicates that there might be some small differences in the factor model within these subgroups. These differences may due to sample fluctuation, but future examination is needed to pinpoint the cause of these differences. Again, this violation appears minor since the overall fits of these models were still very good (e.g. CFI and RMSEA). Therefore, strong factorial invariance should not be rejected.

Overall, the results suggest that participants in different subgroups did not respond differently to the Decisional Balance and Self Efficacy scales items. This consistency in the Measurement model is essential to valid research and effective interventions especially with population-based sample where variation is inevitable.

As expected, the results also found that Decisional Balance varied across stage of change groups, and the overall η^2 of .24 could be interpreted as a large multivariate effect size (Cohen, 1992). Participants in the preparation, action, and maintenance stages endorsed the Pros of exercising more highly compared to those in precontemplation and contemplation, with ω^2 of .08 representing a medium effect of stage of change. The Cons of exercising were rated as less important by participants in maintenance compared to those in contemplation and preparation, with ω^2 of .02 representing a small effect of stage of change. Although the magnitude of the Cons stage effect was small (ω^2= .02), it was not surprising since all cons items used in this study had relatively low saturations (.40 to .54), and this pattern was observed in a previous study (e.g. Blaney et al., 2012). Further investigation into the costs of increasing regular exercise in this population is needed to lead to better measure of cons of exercise. The overall patterns for Pros and Cons across the stages of change were consistent with the theoretical predictions of the TTM predictions and previous literature (Hall & Rossi, 2008; Prochaska et al, 1994), supporting the external validity of this exercise Decisional Balance instrument. Similarly, Self Efficacy varied across stage of change. As predicted, self efficacy increased gradually across stages (Rossi & Redding, 2001; Velicer et al., 1990). Participants' confidence to engage in regular exercise was lower in the earlier stages of change and increased as individuals progressed to the later stages. These results are consistent with TTM predictions and replicated previous studies (Benisovich et al., 1998; Blaney et al., 2012; Sarkin et al., 2001), supporting the external validity of this exercise Self Efficacy instrument.

Lastly, the observed findings should be interpreted in light of limitations. One limitation of this study is that this was a cross-sectional sample; future research is needed to examine the stability of these measures in samples over time. Further, a nonclinical, population-based sample was used in this study; scales should undergo additional validation to be utilized with individuals with illnesses related to insufficient physical activity (e.g. heart diseases, pre-diabetes and diabetes, and obesity). Also, the new additional items from the Arabic versions of the Decisional Balance and Self Efficacy scales were only examined within this Saudi sample; future research is needed to examine cross-cultural invariance of these new items. Another limitation was that the majority of participants were from the western region of Saudi Arabia; future research would benefit from a more diverse sample of Saudi adults to help rule out regional differences in exercise behavior. Finally, the generalizability of the measurement properties of Decisional Balance and Self Efficacy instruments is limited to the adult population from which the validation sample was drawn.

To conclude, Stages of change, Decisional Balance, and Self Efficacy are key constructs within the Transtheoretical Model of behavior change framework, and investigators utilize these measures in TTM-based tailored interventions to promote and increase exercise. This study supported the underlying structure, internal consistency reliability, external validity, and measurement invariance of these measures in a population-based Saudi sample.

What Does This Article Add?

Strong support for the applicability of the TTM to Saudi exercise behavior was found. Moreover, these results have important implications by providing empirical and psychometric support for the use of TTM measures in tailored interventions to increase exercise in Saudi population that varies by gender, age, health status, educational level, employment status, BMI, and stage of change.

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