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DEVELOPMENT AND VALIDATION OF THE ARABIC VERSIONS OF THE TRANSTHEORETICAL MODEL SCALES FOR EXERCISE

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DEVELOPMENT AND VALIDATION OF THE ARABIC VERSIONS OF THE
TRANSTHEORETICAL MODEL SCALES FOR EXERCISE

BY

IMAN ALY ALMOHAMMADI

A DISSERTATION SUBMITTED IN PARTIAL FULFILLMENT OF THE
REQUIREMENTS FOR THE DEGREE OF

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OF
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ABSTRACT

High prevalence of physical inactivity in Saudi Arabia is a major public health problem that contributed to the increasing lifestyle-related diseases. Thus, interventions to promote and increase exercise are necessary. The Transtheoretical model demonstrated significant impacts in this area, however, effective interventions require psychometrically sound measures. The goal of this study is to develop, assess the psychometric properties, and confirming the factorial invariance of the Arabic versions of the Decisional Balance and Self Efficacy measures for exercise, as well as test their predicted theoretical relationships with Stages of Change with a population-based sample of Saudi adults ($N=685$). Three levels of invariance were tested: Configural Invariance (nonzero factor loadings unconstrained), Pattern Identity Invariance (equal factor loadings), and Strong Factorial Invariance (equal factor loadings and measurement errors). For Decisional Balance, the two-factor uncorrelated model was the most parsimonious good-fitting model ($\chi^2(35) = 97.803$, $p < .001$; CFI = .922; RMSEA = .076 [90% CI = .058, .093]). Internal consistency 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. The one-factor model of Self Efficacy Scale revealed an excellent fit ($\chi^2(8) = 16.732$, $p = .033$; CFI = .991; RMSEA = .056 [90% CI = .015, .094]). Internal consistency 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 for Pros ($\omega^2 =$

.08), Cons ($\omega^2 = .02$), and Self Efficacy ($\omega^2 = .21$). The results demonstrate the internal and external validity and measurement invariance of the Arabic versions of TTM measures for exercise, supporting their use in research and tailored interventions to increase exercise among Saudi population, as well as supporting the applicability of the Transtheoretical model to exercise behavior in Saudi Arabia.

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CHAPTER 1

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).

According to the *2008 Physical Activity Guidelines for Americans*, adults need at least 150 minutes of moderate-intensity aerobic activity or 75 minutes of vigorous-intensity aerobic every week, and muscle-strengthening activities on 2 or more days a week that work all major muscle groups: legs, hips, back, abdomen, chest, shoulders, and arms (U.S DHHS, 2008).

Despite of the known health benefits of physical activity, only 21% of adults meet the 2008 Physical Activity Guidelines (CDC, 2014), and less than 5% of adults participate in 30 minutes of physical activity each day (PCFSN, 2017).

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).

Several studies showed that the prevalence of physical inactivity is high in Saudi Arabia. Alnoza et al (2007) examined data was collected between 1995 and 2000 using the National Epidemiological Health Survey. 17395 Saudi adults aged 30-70 years participated in the study. Leisure-type and sport-related physical activities including walking were examined. They found that inactivity prevalence was very high, 98.1% for females and 93.9% for males. Also, inactivity prevalence increases with increasing age, especially in males, and decreases with increasing education levels. Amin et al (2012) conducted a study with 2176 Saudi adults aged 18-65 years to determine the prevalence and pattern of the leisure time physical activity (LTPA). Participants were interviewed using the Global Physical Activity Questionnaire (GPAQ). Physical activity (PA) was expressed in metabolic equivalents (METs). The results revealed that the median total METs minutes/week for LTPA for both genders was (256 METs minutes/week) compare to the cut off (600 METs-minutes/day) or 150 minutes of moderate intensity 5 or more days/week. Only 19.8% of the total PA was LTPA, 50.0% of participants reported no leisure activity, and only 21.0% were considered sufficiently active. Overall, nearly 80% of participants did not achieve the recommended LTPA level with beneficial health effects. A cross sectional study (Awadalla et al, 2014) evaluated the pattern of physical activity among students of the Health College at King Khalid University (N =1257). The Arabic short form of the International Physical Activity Questionnaire was administrated. Overall, 58.0% of the students were physically inactive, 13.4% of the students perform vigorous physical activity, 14.8% perform moderate-intensity physical activity, and 29.9% practice walking. Another study (AlZalabani, AlHamdan, & Saeed, 2015) investigated data

that was part of a cross-sectional nationally representative household survey of 4758 participants conducted in 2005 in Saudi Arabia. The Global Physical Activity Questionnaire (GPAQ) was used to measure physical activity in three domains: work, transportation and leisure. Participants were asked about the number of days in a typical week and the number of minutes/hours in a typical day that were spent in physical activity. They reported that 66.6% of adult males, and 72.9% of adult females are physically inactive. A relatively recent study (Assiri et al, 2015) was aimed to explore the risk factors of physical inactivity among 400 Saudi adults. The International Physical Activity Questionnaire (IPAQ) was used to assess physical activities. Results found that 65% of participants perform light physical activities, 25% perform moderate physical activities, and 10% participate in high intensity physical activities. Finally, El Bcheraoui et al (2016) conducted a large household survey in 2013 to determine current rates of physical activity in Saudi Arabia. The Saudi Health Interview Survey for individuals 15 years and older was administrated. From a total of 12,000 households contacted, 10,735 (89.4%) participants completed the survey. An estimated 4.5 million (34.5%) Saudis aged 15 years or older reported no weekly physical activity at all, and 3.4 million (25.8%) practice low levels of physical activity, while only 1.7 million (12.9%) meet the recommended levels of moderate physical activity.

This high prevalence of physical inactivity in Saudi Arabia is a major public health problem that contributed to the increasing lifestyle-related diseases (e.g. coronary heart disease, diabetes, hypertension, obesity, etc.). Unless concrete steps are taken to reduce physical inactivity in the Saudi population, these diseases may keep

escalating to epidemic proportions, and the public health cost will be heavily burdened (Al-Hazzaa, 2004a; Al-Hazzaa, 2004b; AlNoza et al, 2007; El Bcheraoui et al, 2016).

Given this extremely high prevalence of physical inactivity in Saudi Arabia, which may be considered among the highest in the world, effective interventions to increase exercise are necessary in Saudi Arabia. One popular theoretical framework that helps researchers to better understand how people adopt and maintain regular exercise is the Transtheoretical model of behavior change (TTM). 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 require valid and reliable measures particularly when data from these measures are used for empirical decision making and intervention recommendations. However, TTM measures for exercise were developed and validated in white populations primarily in the United States.

Therefore, the aims of this study are: first, to translate the Stages of change, the Decisional Balance, and the 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 the Decisional Balance, the Self Efficacy and the stage of change groups in this population.

CHAPTER 2

REVIEW OF LITERATURE

Factorial invariance is a crucial psychometric requirement for any measure. A measurement model is called *factorially invariant* when the model is the same across different groups or across different time points. This methodological approach determines whether the set of items purported to assess theoretical constructs across different subgroups are empirically valid (Meredith, 1993; Cheung & Rensvold, 2002). If invariance does not hold, comparing means between different populations are meaningless because the measurement scales are fundamentally different across the two populations (Steenkamp and Baumgartner, 1998).

The Transtheoretical Model measures for exercise have been validated in several populations. One study (Plotnikoff et al., 2001) examined the validity and reliability of Decisional Balance scales for exercise in a large longitudinal population-based randomized sample of Canadian adults ages 18 to 65 years. Content, factorial, concurrent, and construct validity along with internal consistency and test-retest reliability were established for the Decisional Balance scales in this population. Another study (Musser, 2003) investigated the TTM measures for exercise in a sample of individuals with mobility impairments. The results only partially confirmed the measurement models. Paxton et al. (2008) assessed the factorial validity of the TTM measures for exercise to determine if the underlying structure was invariant between genders and among age groups and ethnicities. Measurement models of Self Efficacy

and revised models of temptations and processes of change demonstrated sufficient evidence for measurement invariance among all subgroups. A revised model of Decisional Balance demonstrated sufficient evidence for measurement invariance between genders and among ethnicities, but not among age groups. In addition, Geller et al. (2012) tested the measurement properties of the Transtheoretical Model constructs for physical activity with participants from an ethnically diverse sample in Hawaii ($N = 700$). Factorial validity was confirmed for each construct using confirmatory factor analysis, and longitudinal invariance was also evidenced across a shorter (3-month) and longer (6-month) time period via nested model comparisons. Blaney et al. (2012) validated TTM measures for exercise in an African-American adults sample. They found that the structures of these measures replicated with good internal and external validity, except for the cons scale, which requires additional development. Their results support the use of these measures in tailored interventions to increase exercise among African-Americans. Finally, Almohammadi et al. (under review manuscript) validated the Decisional Balance and the Self Efficacy scales for Exercise, in a sample of parents ($N = 347$) who were at risk for insufficient exercise. Factorial invariance across subgroups varying in gender, age, health status, educational level, income, Body Mass Index (BMI), and stage of change, along with internal consistency were established for these scales in this population.

Based on existing literature cited earlier (e.g., Blaney et al., 2012; Geller et al., 2012; Almohammadi et al., under review manuscript), it was hypothesized that the structure or the relationships between TTM constructs for exercise would be the same for this population. That is, in a Saudi sample: (1) the TTM exercise constructs would

reveal adequate fit to the theorized measurement models for Decisional Balance (two uncorrelated factor model for the pros and cons) and Self Efficacy (one-factor model of Self Efficacy); (2) the TTM exercise constructs would demonstrate adequate levels of invariance across subgroups varying by gender, age, health status, educational level, employment status, BMI, and stage of change; (3) a characteristic crossover pattern of pros and cons would be found, with an increase in pros and a decrease in cons across the stages from the precontemplation to action stages; and (4) the relationship between Self Efficacy and stage of change would show an increase in Self Efficacy across the stages.

Overview of The Transtheoretical Model

The Transtheoretical Model is a model of behavior change with a focus on dynamic variables rather than static variables. The TTM can be conceptualized as involving three dimensions: the temporal dimension, the independent variable dimension, and the intermediate variable dimension (Velicer et al., 2000).

The temporal dimension is represented by five stages of change (SOC) describing different levels of readiness to change (e.g. engage in regular exercise). People are classified by their readiness to change into one of five stages: Precontemplation (PC), Contemplation (C), Preparation (PR), Action (A), and Maintenance (M). The independent dimension is composed of the Processes of Change (POC) that act as strategies to bring about change (Prochaska et al., 1988; Marcus & Simkin, 1993). The 10 Processes of Change represent two broad dimensions, experiential and behavioral. Experiential processes consist of Consciousness Raising, Dramatic Relief, Environmental Reevaluation, Self-

reevaluation, and Social Liberation. Behavioral processes consist of Stimulus Control, Counter Conditioning, Reinforcement Management, Self-Liberation, and Helping Relationships (Marcus et al., 1992). The intermediate/outcome variable dimension (Velicer et al., 1996) includes a series of intermediate outcome measures, including *Decisional Balance and Self-Efficacy*. The *Decisional Balance* are Cognitive and motivational aspects of decision-making measured by the Decisional Balance Inventory (Prochaska et al., 1994; Velicer et al., 1985), which contains two constructs the Pros and Cons of engaging in a behavior (e.g. adopting and/or increasing exercise). The *Self Efficacy* is a person's confidence that they can prevent or cope with the temptation to fall back into unhealthy or high-risk behavior (e.g. confidence a person has that she or he can exercise regularly), is measured using measures of confidence and situational temptations inventory (DiClemente, 1986; Velicer et al., 1990; Marcus et al., 1994).

CHAPTER 3

METHODOLOGY

Design

Cross-sectional measure development study.

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 indicated that they were in excellent health (61.17%), and no one indicated poor health. A majority of participants were educated (14.3% have a graduate degree, 37.96% have a college degree, and 27% have some college education). 42.04% of participants were employed, (25.84%) were college students, and (15.33%) were homemakers. Assessing the Body Mass Index (BMI) of participants based on self-reported height and weight revealed that (5.26%) of participants were underweight, (34.01%) had a healthy BMI, (31.97%) were overweight, and (28.76%) were obese. Distribution of individuals across Stages revealed that (10.36%) of participants were in PC, (17.52%) in C, (31.97%) in PR, (17.66%) in A, and (22.48%) in M. Descriptive variables were examined to create subgroups. Table 1 gives a complete listing of the demographic variables of the sample. Table 2 gives a summary of the demographic characteristics of Saudi

population in the year of 2017. Categories used to create the sub-groups for invariance analyses are listed in Tables 3 and 4.

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 et 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 ($\alpha = .90$), and five items assessing the Cons of exercising ($\alpha = .67$) was 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 ($\alpha = .82$) is 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).

1. Initial translation. Forward 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 (T1, T2). 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 exercised regularly” since Arabs are not accustomed to hear words like “comfortable” used to describe their feeling about their bodies, unlike words like “satisfied” or “confident” which are more popular in this subject. 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”.

2. Synthesis of the translations. 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 (T-12).
3. Back translation. Two native English-speaking translators fluent in Arabic, without prior knowledge of the original version or the concepts examined, independently translated the Arabic version (T-12) back to English (BT1, BT2). 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).
4. Expert committee. The 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.

5. Test of the prefinal version. 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. It is worth mentioning that 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 item does 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 (Appendix A).

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.

1. *Confirmatory factor analyses (CFA)*. CFA were conducted to assess the structure for the Decisional Balance and Self Efficacy scales for exercise. For Decisional Balance scale two measurement models, a correlated and uncorrelated, were compared to establish the best-fitting measurement model

for the two factors scale. For Situational Self Efficacy scale, the 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).

2. 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 (Δ CFI) 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 Δ CFI as the final determinant of measurement invariance due to the susceptibility of Chi-squared 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)

3. *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).
4. *Known Groups Validation.* A MANOVA, with follow up 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.

CHAPTER 4

FINDINGS

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 a poor fit to the data, $\chi^2(35) = 332.236, p < .001$; CFI = .765; RMSEA = .111 [90% CI: .101, .122]. An alternative model with correlated latent Pros and Cons factors was assessed, and also provided a poor fit for the data, $\chi^2(34) = 321.268, p < .001$; CFI = .773; RMSEA = .111 [90% CI: .100, .122].

Step II: Exploratory Analysis. To investigate the measurement structure of the Arabic version of the Decisional Balance scale for exercise, the sample was randomly split in two sections. 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 & 5 additional items) from the Decisional Balance scale were analyzed using principal component analysis with orthogonal varimax rotation ($N=324$). As expected, there were two factors with mostly simple structure. These two factors explained 44% of variance in these 15 items (Table 5 gives means and Standard deviation of 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 variance in these 13 items (8 items for Pros & 5 items for Cons). Finally, to obtain symmetry between Pros and Cons, three items with lower loadings were deleted from the final principal component 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 variance in the final 10 items, which were used in the confirmatory factor analysis and invariance analysis (Table 6). Cronbach’s coefficient alphas were calculated for each factor with values of .88 for the first factor (Pros) and .56 for the second factor (Cons).

Step III: Final Confirmatory Factor Analysis was conducted on the final 10 items from the Arabic version of the Decisional Balance scale ($N=314$). 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, $\chi^2(35) = 97.803, p < .001$; CFI = .922; RMSEA = .076 [90% CI: .058, .093]. Factors 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 was assessed, and also provided a good fit for the data, $\chi^2(34) = 96.712, p < .001$; 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 Δ CFI comparing the nested correlated and uncorrelated models indicated that estimating the extra parameter in the correlated model did not improve model fit, $\Delta\chi^2(1) = 1.091, p = .296$; Δ CFI = .000. Therefore, the

uncorrelated model was retained for parsimony and theoretical consistency and used for subsequent invariance testing.

Factorial Invariance. Multiple-sample CFA was used to test hierarchical factorial invariance for the two Pros and Cons subscales. The fit indices for the invariance models are summarized in Table 7.

Gender. Sample size was adequate for both subgroups: male ($n=292$) and female ($n=373$). Strong factorial invariance held across these subgroups (CFI =.957; RMSEA = .051 [90% CI: .039, .063]).

Age. Sample size was adequate for both age subgroups: 18 to 35 years old ($n=421$) and 36 to 70 years old ($n=254$). Strong factorial invariance fit well across these subgroups (CFI =.921; RMSEA = .072 [90% CI: .061, .083]).

Health status. Sample size was adequate for both health subgroups: good health ($n=228$) and excellent health ($n=399$). Strong factorial invariance held across these subgroups (CFI =.947; RMSEA = .055 [90% CI: .042, .067]).

Educational level. Sample size was adequate for both education subgroups: Less than college degree ($n=307$) and College degree and higher ($n=338$). Strong factorial invariance held across these subgroups (CFI =.948; RMSEA = .052 [90% CI: .040, .064]).

Employment status. Sample size was adequate for three subgroups: Employed for wages ($n=288$), students ($n=177$), and homemaker ($n=105$). Strong factorial invariance held across these subgroups (CFI =.926; RMSEA = .068 [90% CI: .055, .080]).

Body Mass Index. Sample size was adequate for three subgroups: Healthy weight (BMI= 18.5–24.9) ($n=228$), Overweight (BMI = 25–29.9) ($n=214$), and Obesity (BMI

> 30) ($n=192$). Strong factorial invariance held across these subgroups (CFI =.950; RMSEA = .051 [90% CI: .037, .064]).

Stages of change. There were four stage subgroups with adequate sample sizes: C ($n=120$), PR ($n=219$), A ($n=121$), and M ($n=154$). Strong factorial invariance held across these subgroups (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.

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 an insufficient fit for the data, $\chi^2(8) = 54.993$, $p < .001$; CFI = .976; RMSEA = .093 [90% CI = .070, .116].

Step II: Exploratory Analysis. To investigate the measurement structure of the Arabic version of the Self Efficacy scale for exercise, the sample was randomly split in two sections. 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 & 5 additional items) from the Self Efficacy scale were analyzed using principal component analysis with orthogonal varimax rotation ($N=330$). As expected, there was one factor that explained 59% of variance in these 11 items (Table 8 gives means and Standard deviation of 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 component analysis was conducted. There was one factor that explained 64% of variance in these final 6 items, which were then used in the confirmatory factor analysis and invariance analysis (Table 9). Cronbach's coefficient alpha was .88.

Step III: Final Confirmatory Factor Analysis was conducted on the final 6 items from the Arabic version of the Self Efficacy scale ($N=346$). The one-factor model (Figure 2) provided an excellent fit for the data, $\chi^2(8) = 16.732$, $p = .033$; CFI = .991; RMSEA = .056 [90% CI = .015, .094]. Factor loadings for individual items were excellent ranging from .73 to .89.

Factorial Invariance. Multiple-sample CFA was used to test hierarchical factorial invariance for Self Efficacy scales. The fit indices for the invariance models are summarized in Table 10.

Gender. Sample size was adequate for both subgroups: male ($n=302$) and female ($n=383$). Strong factorial invariance held across these subgroups (CFI = .986; RMSEA = .055 [90% CI: .034, .075]).

Age. Sample size was adequate for both age subgroups: 18 to 35 years old ($n=426$) and 36 to 70 years old ($n=259$). Strong factorial invariance fit well across these subgroups (CFI = .971; RMSEA = .079 [90% CI: .060, .098]).

Health status. Sample size was adequate for both health subgroups: good health ($n=248$) and excellent health ($n=419$). Strong factorial invariance held across these subgroups (CFI = .965; RMSEA = .085 [90% CI: .067, .104]).

Educational level. Sample size was adequate for both education subgroups: Less than college degree ($n=327$) and College degree and higher ($n=358$). Strong factorial invariance held across these subgroups (CFI =.983; RMSEA = .059 [90% CI: .039, .079]).

Employment status. Sample size was adequate for three subgroups: Employed for wages ($n=288$), students ($n=177$), and homemaker ($n=105$). Strong factorial invariance held across these subgroups (CFI =.981; RMSEA = .059 [90% CI: .034, .081]).

Body Mass Index. Sample size was adequate for three subgroups: Healthy weight (BMI= 18.5–24.9) ($n=233$), Overweight (BMI = 25–29.9) ($n=219$), and Obesity (BMI > 30) ($n=197$). Strong factorial invariance held across these subgroups (CFI =.986; RMSEA = .051 [90% CI: .027, .073]).

Stages of change. There were four stage subgroups with adequate sample sizes: C ($n=120$), PR ($n=219$), A ($n=121$), and M ($n=154$). Strong factorial invariance held across these subgroups (CFI =.954; RMSEA = .082 [90% CI: .062, .101]).

Reliability. Cronbach's coefficient alpha was calculated ($N= 346$) with value of .86. Factor rho coefficient was also calculated ($N= 346$) with value of .89.

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 ($F [4, 680] = 15.27$; $p < .0001$; $\omega^2 = .08$), the Cons ($F [4, 680] = 4.04$; $P = .0030$; $\omega^2 = .02$), and the Self Efficacy ($F [4, 680] = 46.06$; $p < .0001$; $\omega^2 = .21$). 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 (Figure 3). Scale means for the Pros, Cons, and Self Efficacy are shown in Table 11.

CHAPTER 5

CONCLUSION

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 (Almohammadi et al., under review manuscript; 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.

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 $|\Delta\text{CFI}|$ 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 (Almohammadi et al., under review manuscript; 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).

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 $|\Delta\text{CFI}|$ 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 ($\omega^2 = .02$), 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, the Transtheoretical Model of behavior change has proven to be effective across multiple behaviors, including exercise and physical activity. Stages of change, Decisional Balance, and Self Efficacy are key constructs within this strong 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. 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.

APPENDICES

Appendix A: The Arabic versions of Stages of change, Decisional Balance, and Self

Efficacy scales for exercise

مقياس مراحل التغيير للتمارين الرياضية :

التمارين الرياضية المنتظمة هي أي نشاط بدني مُخطط له يؤدي إلى زيادة اللياقة البدنية (مثل المشي السريع، تمارين الأيروبيك، الجري، ركوب الدراجة، السباحة، التجديف، الخ). ينبغي القيام بهذا النشاط من ٣ إلى ٥ مرات أسبوعياً لمدة ٢٠ إلى ٦٠ دقيقة في كل مرة. لا تستلزم أن تكون التمارين الرياضية مؤلمة لتكون فعّالة، ولكن ينبغي أن تتم على مستوى يزيد من معدل تنفسك ويسبب لك التعرق.

سؤال: هل تمارس/ي التمارين الرياضية بانتظام تبعاً للتعريف السابق؟

- نعم، منذ أكثر من ٦ أشهر
- نعم، منذ أقل من ٦ أشهر
- لا، ولكن أنوي ذلك خلال الـ ٣٠ يوما القادمة
- لا، ولكن أنوي ذلك خلال الـ ٦ أشهر القادمة
- لا، ليس لدي نية لذلك خلال الـ ٦ أشهر القادمة

مقياس الكفاءة الذاتية للتمارين الرياضية :

هذا الجزء ينظر إلى مدى ثقتك بأنك ستمارس الرياضة حتى عندما تعترضك أمورٌ أخرى. أرجو الإجابة باستخدام مقياس النقاط الخمسة التالي:

- ١- غير واثق على الإطلاق
- ٢- واثق قليلاً
- ٣- متوسط الثقة
- ٤- واثق إلى حد كبير
- ٥- واثق تماماً

مامدى ثقتك أنك ستمارس الرياضة حتى في الظروف التالية

الإجابة	العبارة	
	سأمارس الرياضة حتى عندما أكون تحت الكثير من الضغط. **	1
	سأمارس الرياضة حتى عندما أشعر بأن ليس لدي وقت. **	2
	سأمارس الرياضة حتى عندما أضطر لممارستها بمفردي. **	3
	سأمارس الرياضة حتى عندما لا يكون لدي إمكانية الوصول إلى مُعدات التمارين الرياضية. **	4
	سأمارس الرياضة حتى عندما أقضي وقتاً مع الأصدقاء أو العائلة الذين لا يمارسون الرياضة. **	5
	سأمارس الرياضة حتى عندما يكون الجو حاراً أو رطباً.	6
	سأمارس الرياضة حتى عندما لا توجد أماكن مخصصة لذلك. **	7
	سأمارس الرياضة حتى عندما يكون لدي التزامات عائلية واجتماعية عديدة.	8
	سأمارس الرياضة حتى عندما أكون مُتعباً.	9
	سأمارس الرياضة حتى عندما لا تكون لدي الرغبة لذلك.	10
	سأمارس الرياضة حتى عندما أكون في مزاج سيئ.	11

**العبارات الستة المستخدمة في النسخة العربية النهائية لمقياس الكفاءة الذاتية لممارسة التمارين الرياضية.

مقياس موازنة القرار للتمارين الرياضية :

هذا الجزء يتناول الجوانب الإيجابية والسلبية لممارسة التمارين الرياضية. اقرأ التصريحات التالية ثم حدد مدى أهمية كل تصريح في اتخاذ القرار بممارسة الرياضة أو عدم ممارستها في وقت فراغك. ملاحظة: إذا لم تتفق مع أي تصريح أو كنت غير متأكد من كيفية الإجابة عليه، فعلى الأرجح أنه ليس ذات أهمية بالنسبة لك. أرجو الإجابة باستخدام مقياس النقاط الخمسة التالي:

- ٥ = غير مهم
٤ = قليل الأهمية
٣ = مهم إلى حد ما
٢ = مهم إلى حد كبير
١ = شديد الأهمية

ما مدى أهمية العبارات التالية في اتخاذك القرار بممارسة الرياضة أو عدم ممارستها؟

الإجابة	العبارة	
	سيكون لدي المزيد من الطاقة لعائلتي وأصدقائي إذا مارست الرياضة بانتظام.	1
	سأشعر بالإحراج إذا رأني الناس أتمرن. **	2
	سأشعر بضغوط أقل لو مارست الرياضة بانتظام.	3
	سأقضي وقت أقل مع عائلتي وأصدقائي إذا مارست الرياضة بانتظام. **	4
	ممارسة الرياضة تجعلني في مزاج أفضل لبقية اليوم. **	5
	أشعر بعدم الراحة أو الإحراج في ملابس الرياضة. **	6
	سأشعر بالرضا أكثر عن جسدي إذا مارست الرياضة بانتظام. **	7
	هناك الكثير الذي يجب علي تعلمه لممارسة الرياضة.	8
	ممارسة الرياضة بانتظام تجعلني أكثر إيجابية في نظرتي للحياة. **	9
	ممارستي للرياضة تضع عبئاً إضافياً على الشخص المهم لدي (مثال: الزوج/ة أو أي شخص مقرب). **	10
	سأكون أكثر صحة إذا مارست الرياضة بانتظام. **	11
	سأشعر بالألم وعدم راحة إذا مارست الرياضة بانتظام. **	12
	سأشعر بثقة أكثر بنفسني إذا مارست الرياضة بانتظام. **	13
	ممارستي للرياضة تزيد من شهيتي للطعام.	14
	ممارستي للرياضة تساعدني على إنقاص وزني أو المحافظة على وزني الحالي.	15

**العبارات العشرة المستخدمة في النسخة العربية النهائية لمقياس موازنة القرار لممارسة التمارين الرياضية.

الإيجابيات (5,7,9,11,13)، السلبيات (2,4,6,10,12)

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

Table 2. Demographic Characteristics of the population of Saudi Arabia in the year of 2017 ⁽¹⁾

		Population	%
Total population		32552336	
Saudis		20408362	62.69
Non-Saudis		12143974	37.31
Demographic characteristic of Saudi population (20408362)			
		Population	%
Gender	Males	10396914	50.95
	Females	10011448	49.06
Age	15 to 19	1789169	8.77
	20 to 34	5702189	27.94
	35 to 59	5390928	26.42
	60 and older	1333615	6.54
Education (15 years old & older)	Less than high school	3334379	16.34
	High school	4754162	23.30
	Associate degree	854764	4.19
	Bachelor's degree	3181292	15.59
	High Diploma	39253	0.19
	Master's degree	113563	0.56
	Doctorate degree	38678	0.19
	Others	1899810	9.31
Employment	Employed for wages	13018066	63.79
	Unemployed	787895	3.86
	Looking for job	1118801	5.48
Exercise (15 years old & older) ^{(2) (3)}	Practice exercise	3365338	16.49
	Do not practice exercise	17043023	83.51
Health ⁽⁴⁾	Good to very good health	18898143	92.6

(1) All numbers were retrieved from the website of the General Authority for Statistics: Kingdom of Saudi Arabia at <https://www.stats.gov.sa/en>.

(2) is defined as any bodily movement produced by skeletal muscles that causes acceleration of breathing and heartbeats such as running, brisk walking, cycling, swimming, and any sport activities like football, handball, and basketball...etc. Such activity should be performed at least 5 times per week for 30 minutes per session.

(3) Only 25.10% of Saudi males & 7.30% of Saudi females exercise for 150 minutes per week.

(4) Health decreases by increasing age.

Table 3. Sample size by category for each invariance model subgroup: Decisional Balance scale.

Subgroup	Category	N	%
Gender (<i>N</i> = 665)	Male	292	43.91
	Female	373	56.10
Age (<i>N</i> = 675)	18 to 35	421	62.37
	36 to 70	254	37.63
Health status (<i>N</i> = 627)	Good health	228	36.36
	Excellent health	399	63.64
Education level (<i>N</i> = 645)	Less than college degree	307	47.60
	College degree & higher	338	52.40
Employment status (<i>N</i> = 570)	Employed for wages	288	50.53
	Students	177	31.05
	Homemakers	105	18.42
Body Mass Index (<i>N</i> = 634)	Healthy weight (BMI= 18.5–24.9)	228	35.96
	Overweight (BMI = 25–29.9)	214	33.75
	Obesity (BMI > 30)	192	30.28
Stages of change for Exercise (<i>N</i> = 614)	Contemplation	120	19.54
	Preparation	219	35.67
	Action	121	19.71
	Maintenance	154	25.08

Table 4. Sample size by category for each invariance model subgroup: Self Efficacy scale.

Subgroup	Category	N	%
Gender (<i>N</i> = 685)	Male	302	44.09
	Female	383	55.91
Age (<i>N</i> = 685)	18 to 35	426	62.19
	36 to 70	259	37.81
Health status (<i>N</i> = 667)	Good health	248	37.18
	Excellent health	419	62.82
Education level (<i>N</i> = 685)	Less than college degree	327	47.74
	College degree & higher	358	52.26
Employment status (<i>N</i> = 570)	Employed for wages	288	50.53
	Students	177	31.05
	Homemakers	105	18.42
Body Mass Index (<i>N</i> = 649)	Healthy weight (BMI= 18.5–24.9)	233	35.90
	Overweight (BMI = 25–29.9)	219	33.74
	Obesity (BMI > 30)	197	30.35
Stages of change for Exercise (<i>N</i> = 614)	Contemplation	120	19.54
	Preparation	219	35.67
	Action	121	19.71
	Maintenance	154	25.08

Table 5. Items' means and standard deviation: Decisional Balance scale (N=685)

	Item	Mean	Standard deviation
Original Items	1 I would have more energy for my family and friends if I exercised regularly.	3.49	1.10
	2 I would feel embarrassed if people saw me exercising**	1.36	.77
	3 I would feel less stressed if I exercised regularly.	3.54	1.24
	4 Exercise prevents me from spending time with my family and friends**	2.33	1.14
	5 Exercising puts me in a better mood for the rest of the day**	4.11	1.01
	6 I feel uncomfortable/embarrassed in exercise clothes**	1.73	1.13
	7 I would feel more satisfied with my body if exercised regularly**	4.47	.89
	8 There is too much I would have to learn to exercise.	3.68	1.14
	9 Regular exercise would help me have a more positive outlook on life**	4.08	1.02
	10 Exercise puts an extra burden on the most important person in my life; e.g. spouse or any beloved one**	2.23	1.21
Additional Items	11 I would feel healthier if I exercise regularly**	4.51	.76
	12 I would feel sore if I exercise regularly**	1.86	1.01
	13 I would feel more self-confident if I exercise regularly**	4.19	.97
	14 exercise increases my appetite for food	2.82	1.21
	15 exercise helps me lose weight or maintain my current weight	4.26	1.03

** indicates items included in the final Arabic version of the Decisional Balance Scale

Table 6. Principal component loadings for the final retained items: Decisional Balance Scale (N=324)

Item	Pros	Cons
I would feel healthier if I exercise regularly.	.83	-.08
I would feel embarrassed if people saw me exercising-	.04	.58
I would feel more self-confident if I exercise regularly.	.86	-.02
Exercise prevents me from spending time with my family and friends.	.14	.62
Exercising puts me in a better mood for the rest of the day.	.73	-.20
I feel uncomfortable/embarrassed in exercise clothes	.15	.62
I would feel more satisfied with my body if exercised regularly.	.83	.04
I would feel sore if I exercise regularly.	-.02	.62
Regular exercise would help me have a more positive outlook on life.	.85	-.09
Exercise puts an extra burden on the most important person in my life; e.g. spouse or any beloved one	.16	.53

Table 7. Goodness-of-fit statistics for three nested invariance models: Decisional Balance scale.

	Model	χ^2	df	CFI	ACFI	RMSEA	[90% CI]
Gender	Configural Invariance	148.572	70	.956	-	.058	[.045,.071]
	Pattern Identity Invariance (λ)	159.762	78	.954	-.002	.056	[.044,.068]
	Strong Factorial Invariance (λ , Θ_δ)	165.359	88	.957	.003	.051	[.039,.063]
Age	Configural Invariance	203.852	70	.930	-	.075	[.063,.087]
	Pattern Identity Invariance (λ)	213.858	78	.929	-.001	.072	[.060,.083]
	Strong Factorial Invariance (λ , Θ_δ)	241.732	88	.921	-.008	.072	[.061,.083]
Health status	Configural Invariance	139.937	70	.954	-	.057	[.043,.070]
	Pattern Identity Invariance (λ)	152.584	78	.951	-.003	.055	[.042,.068]
	Strong Factorial Invariance (λ , Θ_δ)	170.849	88	.947	-.004	.055	[.042,.067]
Educational level	Configural Invariance	133.822	70	.956	-	.053	[.039,.067]
	Pattern Identity Invariance (λ)	145.024	78	.954	-.002	.052	[.038,.064]
	Strong Factorial Invariance (λ , Θ_δ)	165.676	88	.948	-.006	.052	[.040,.064]
Employment status	Configural Invariance	187.825	105	.950	-	.065	[.049,.079]
	Pattern Identity Invariance (λ)	224.274	121	.937	-.013	.067	[.053,.081]
	Strong Factorial Invariance (λ , Θ_δ)	264.209	141	.926	-.011	.068	[.055,.080]
BMI	Configural Invariance	151.126	105	.969	-	.046	[.028,.061]
	Pattern Identity Invariance (λ)	186.556	121	.956	-.013	.051	[.036,.064]
	Strong Factorial Invariance (λ , Θ_δ)	218.536	141	.950	-.006	.051	[.037,.064]
Stages of change for Exercise	Configural Invariance	214.609	140	.940	-	.059	[.043,.074]
	Pattern Identity Invariance (λ)	242.404	164	.937	-.003	.056	[.040,.070]
	Strong Factorial Invariance (λ , Θ_δ)	283.230	194	.930	-.007	.055	[.040,.068]

Table 8. Items' means and standard deviation: Self Efficacy scale (N=685)

		Item	Mean	Standard deviation
Original Items	1	When I am under a lot of stress**	2.71	1.23
	2	When I feel I don't have the time**	2.47	1.22
	3	When I have to exercise alone**	3.54	1.31
	4	When I don't have access to exercise equipment**	3.31	1.33
	5	When I am spending time with friends or family who do not exercise**	3.14	1.34
	6	When it's hot or humid	3.03	1.38
Additional Items	7	When there are no proper spaces to exercise**	3.13	1.40
	8	when I have great family and social demands	2.48	1.30
	9	when I feel tired	2.02	1.14
	10	when I don't feel like it.	2.34	1.21
	11	when I am in a bad mood	2.71	1.37

** indicates items included in the final Arabic version of the Self Efficacy Scale

Table 9. Principal component loadings for the final retained items: Self Efficacy Scale (N=330)

Item	Loadings
When I am under a lot of stress.	.79
When I feel I don't have the time.	.79
When I have to exercise alone	.82
When I don't have access to exercise equipment.	.84
When I am spending time with friends or family who do not exercise.	.81
When there are no proper spaces to exercise	.80

Table 10. Goodness-of-fit statistics for three nested invariance model: Self Efficacy scale.

	Model	χ^2	df	CFI	Δ CFI	RMSEA	[90% CI]
Gender	Configural Invariance	33.500	16	.991	-	.057	[.029, .083]
	Pattern Identity Invariance (λ)	44.727	22	.989	-.002	.055	[.031, .078]
	Strong Factorial Invariance (λ , Θ_8)	56.551	28	.986	-.003	.055	[.034, .075]
Age	Configural Invariance	51.299	16	.983	-	.080	[.056, .105]
	Pattern Identity Invariance (λ)	67.081	22	.978	-.005	.077	[.056, .099]
	Strong Factorial Invariance (λ , Θ_8)	87.710	28	.971	-.007	.079	[.060, .098]
Health status	Configural Invariance	49.301	16	.983	-	.079	[.055, .105]
	Pattern Identity Invariance (λ)	62.331	22	.979	-.004	.074	[.053, .096]
	Strong Factorial Invariance (λ , Θ_8)	95.512	28	.965	-.014	.085	[.067, .104]
Educational level	Configural Invariance	44.945	16	.985	-	.073	[.048, .098]
	Pattern Identity Invariance (λ)	48.935	22	.986	.001	.060	[.037, .082]
	Strong Factorial Invariance (λ , Θ_8)	61.372	28	.983	-.003	.059	[.039, .079]
Employment status	Configural Invariance	39.698	24	.990	-	.059	[.022, .090]
	Pattern Identity Invariance (λ)	55.642	36	.988	-.002	.054	[.022, .080]
	Strong Factorial Invariance (λ , Θ_8)	79.162	48	.981	-.007	.059	[.034, .081]
BMI	Configural Invariance	49.049	24	.987	-	.070	[.041, .097]
	Pattern Identity Invariance (λ)	61.487	36	.987	.000	.057	[.031, .081]
	Strong Factorial Invariance (λ , Θ_8)	75.411	48	.986	-.001	.051	[.027, .073]
Stages of change for Exercise	Configural Invariance	67.865	32	.976	-	.086	[.057, .114]
	Pattern Identity Invariance (λ)	91.892	50	.972	-.004	.074	[.049, .097]
	Strong Factorial Invariance (λ , Θ_8)	137.633	68	.954	-.018	.082	[.062, .101]

Table 11. Standardized *T*-scores for Pros, Cons, Self Efficacy by stage of change (*N* = 685).

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

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

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

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

$\chi^2(8) = 16.732, p = .033$

CFI = .991

RMSEA = .056 90% CI [.015, .094]

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

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