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Examining a Stage-Based Intervention and Predictors of Exercise Behavior among Iranian Sedentary Adolescents

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Abstract

This study evaluated the effect of an intervention based on Transtheoretical Model on exercise behavior and examined TTM constructs as predictors of stages of change among Iranian adolescents. Fifty-six sedentary adolescents completed an assessment at baseline, 2 months, and 4 months. Repeated measures ANOVA and logistic regression were used to analyze the data. The analysis showed a statistically significant difference in the mean scores on stages of change for the experimental group. Thus, students in the experiment group significantly improved their stages compared to the baseline. Furthermore, stages of change were found to correlate with TTM constructs, and self-efficacy was shown to be a strong predictor of stages of change. This study indicated that a stage-based intervention using TTM constructs could effectively improve adolescents' intention to engage in physical activity. Moreover, the level of physical activity in adolescent can be improved by increasing their self-efficacy to exercise.

Keywords: Physical Activity; Stage of Change; Processes of Change; Decisional Balance; Self-efficacy; Transtheoretical Model

1. Introduction

In recent years, health programs have paid increased attention to enhancing the engagement of individuals in physical activity (PA). Insufficient physical activity may have negative effects on health, such as increasing the risk of coronary heart diseases, diabetes, and obesity as well as hypertension, osteoporosis, lipid disorders, depression, and anxiety (American College of Sports Medicine, 2013; U.S. Department of Health and Human Services, 2008). Physical inactivity is also prevalent among children and adolescents worldwide, as it contributes to the higher levels of obesity as well as other serious medical problems among youths (Livingstone, 2001; Speiser et al., 2005). Based on this evidence, the 2008 Physical Activity Guidelines for Americans developed by USDHHS recommend that individuals regularly engage in moderate-intensity (at least 150 min a week) or vigorous-intensity (75 min a week) exercise. In spite of extensive attempts to increase exercise behavior among people, more than 60% of the world's population are not physically active (World Health Organization [WHO], 2005). Furthermore, studies on the changes in physical activity patterns in terms of age and gender demonstrated a large portion of inactivity among adolescents. The data from the 2001 National Youth Risk Behavior Surveillance (Eaton et al., 2012) showed that female adolescents were less active compared to males; 38% of high school girls and 24% of high school boys did not participate in recommended moderate or vigorous physical exercise. In addition, a sharp decline in physical activity rates has been noted during adolescence and early adulthood, which continues well into adulthood (Caspersen, Pereira, & Curran, 2000).

Cross-sectional studies of Iranian adolescent girls showed some similarity to the rest of the world, as a major proportion of Iranian adolescents are insufficiently active (Kelishadi et al., 2006; Pirasteh, Hidarnia, Asghari, Faghihzadeh, & Ghofranipour, 2011; Taymoori & Lubans, 2008). A recent study on sedentary behavior among Iranian adolescents reported that 64% of girls were not regularly active (Taymoori, Rhodes, & Berry, 2010). In the same line, a research demonstrated the prevalence of sedentary behavior, with 81.5 percent of Iranian adolescents being inactive, as reported by Sanaeinasab, Saffari, Nazeri, Karimi Zarchi, and Cardinal (2013).

Considering numerous benefits of PA on health, decreasing levels of PA among adolescents is a worrying public health issue. In order to resolve this issue, there is a need to clarify the underlying mechanisms of behavior change and apply them to applicable interventions. Transtheoretical model by Prochaska and DiClemente (2005) ; an eclectic of hundreds of theories of psychotherapy relating to behavior change, has been recognised as a powerful behavior change model since as opposed to other models for the exercise intervention, it does not focus only on individuals prepared for action (Marcus & Forsyth, 2009). Other models tend to focus on those individuals ready for a change, while only a small proportion of people actually are ready for action. Identifying the needs of the participants leads to more effective interventions that are designed to meet the needs of the individuals rather than expecting them to comply with an action-oriented program.

The prevention of the sedentary behavior among female adolescents demands identifying factors that influence intention towards physical activity, which can be changed and addressed through interventions. A comprehensive review of previous research by Sallis, Prochaska, and Taylor (2000) on factors related to adolescents' exercise behavior indicated that further studies are needed due to inconsistent results across studies. They assumed it as a result of differences in samples, since the reviewed studies focused mostly on population-based samples of young individuals rather than on populations of adolescents with inactive lifestyles. Developing interventions for these at-risk adolescents is essential to identify the factors that contribute to change in physical activity.

The present study extends the existing research by investigating factors that influence physical activity among adolescents, particularly high-school girls at risk of sedentary lifestyles. The selected variables as potential predictors were based on transtheoretical Model (Prochaska, Redding, & Evers, 1997). They included personal, behavioral, and cognitive variables. Considering that physical education classes in school have the potential to affect students exercise behavior, this stage-based intervention research has been design for the context of school. The findings of this study can provide a guideline for developing interventions intended to improve exercise behavior in female adolescents at risk for a sedentary lifestyle. The present study aimed to evaluate the effect of a stage-based intervention on exercise behavior and examine constructs of TTM as predictors of stages of change among Iranian adolescents.

2. Method

2.1 Participants

The research population for the current study was sedentary students from a high school in Iran. To determine their eligibility, students completed a questionnaire to determine their stage of exercise behavior. Study participants (n = 56) were randomly selected from 247 students in grades 9 or 10 who were in the contemplation and precontemplation stages of exercise behavior. The participants completed a baseline survey assessing their demographic and medical background, stage of change, and transtheoretical constructs. Then participants were randomly assigned into an experimental and a control group with 28 students in each group. Only students who had no illness, such as orthopedic injuries, chronic disease, or any impairment that would prevent them from attending a regular physical activity program were eligible to participate in this study.

2.2 Instruments

The subjects' stages of change, identified based on their responses to four questions, measured on a dichotomous scale with *No* = 0 and *Yes* = 1 (Marcus & Forsyth, 2009). Three questionnaires were employed to assess the participants' psychological factors associated with exercise behavior change. The processes of change questionnaire by Marcus, Rossi, Selby, Niaura, and Abrams (1992b), which included 40 items measuring 10 processes of change, was translated into Persian. In this questionnaire, individuals were asked to rate the frequency of the use of each process of change item on a 5-point Likert-type scale (ranging from 1, "*never*" to 5, "*repeatedly*"). The decisional balance scale by Marcus, Rakowski, and Rossi (1992a) comprised16 items measuring the two subscales (pros and cons). It asked participants to indicate the importance of statements regarding their decision to exercise on a 5-point Likert-type scale ranging from 1 = "*not at all important*" to 5 = "*extremely important*". The exercise self-efficacy scale Marcus, Selby, Niaura, and Rossi (1992c) consists of 5 item measured on a 5-piont scale ranging from 1 "*cannot do*" to 5 "*certain can do*". Individuals indicated their level of confidence in their ability to perform regular exercise under different circumstance. Cronbach's alpha was calculated to measure the internal consistency for the scales, and the coefficients ranged from 0.85 to 0.92. The results obtained from the pilot participants were also used to revise the instrument, and they provided content validity for the instrument.

2.3 Procedures

The designed intervention program comprised 30-minute sessions offered once a week. The sessions focused on consciousness-raising by posing awareness-raising questions, engaging in discussions and speeches about the benefits of being physically active, watching film segments, and discussing the importance of physical activity and modeling activities to increase learners' awareness of the factors affecting intention to physical activity and the strategies and processes used to improve their willingness to be physically active. Additionally, pros and cons of exercise were included to help them evaluate the advantages and disadvantages of exercise. At the outset of the study, the stages of change questionnaire was given as pre-test to all participants in order to determine their stages of physical activity and also the possible differences between the participants in the groups in terms of their stages of change before starting the treatment phase of the study. POC, SE, and DB questionnaires were also given to participants at pre-test to determine their psychological differences prior to the treatment phase of the study. Upon the completion of the treatment phase,

two post-tests, (2-month and 4-month) were administered to the learners in both groups in order to determine their stages of physical activity and related psychological factors at the end of the TTM intervention. The results obtained from the pre-tests, post-test 1, and post-test 2 were analyzed using repeated measures ANOVA in order to determine the effectiveness of the intervention on sedentary students' progression through the stages of change for exercise during the study. Additionally, logistic regression was conducted to determine the predictors of stages of change in exercise behavior.

3. Results

To achieve the first objective of the study, repeated measures ANOVA was conducted to test the differences between the mean scores of students' stages of change measured at 3-time points during the intervention. As summarized in Table 1, the results show a statistically significant difference among the mean pre-test, post-test 1, and post-test 2 scores for participants' stages of change in the experimental group, F (2, 54) = 309, $p < .05$; Wilk's $\Lambda = 0.40$, partial $\eta 2 = .96$. Therefore, TTM intervention improved students' stages of change significantly regarding their exercise behavior in the future.

Table 1. Repeated measures ANOVA for stages of change

Stages of Change	Wilks Λ	*df*	*F*	*P*	Partial η2
Experimental	0.04	2	308	0.01**	.960
Control	0.06	2	507	0.06	.210

*$p<0.05$, **$p < 0.01$

This finding thus shows that intervention had a significant effect on exercise adherence and physical activity, and throughout the intervention, students improved their intention to engage in physical activity.

To achieve the second objective of the study, logistic regression was conducted to assess whether the three predictor variables, processes of change, decisional balance, and self-efficacy significantly predict and improve their physical activity level. First, the relationship between variables was investigated using Pearson product-moment correlation coefficient.

Table 2. Pearson correlation among variables

	(i)	(ii)	(iii)
(i) Processes of Change	1		
(ii) Decisional Balance	.471**	1	
(iii) Self-efficacy	.443**	.291**	1

*$p < 0.05$, **$p < 0.01$

As summarized in Table 2, the results show a strong, positive correlation between three psychological variables ($p < .05$). When all three predictor variables are considered together, they significantly predict the improvement in physical activity stages of change χ^2 (3, $N = 56$) = 14.36, $p < .05$. The model as a whole explained between 40.1% (Cox & Snell R Square) and 55.1% (Nagelkerke R squared) of the variance in stages of change, and correctly classified 85.7% of cases (Table 3).

Table 3. Logistic Regression predicting who will improve physical activity

	Reliability	B	S.E.	Wald	P	Odds Ratio	95% C.I. for Exp (B)	
							Lower	Upper
POC	0.71	0.13	0.09	2.04	0.11	1.13	0.95	1.36
DB	0.70	0.15	0.14	1.11	0.28	1.16	0.88	1.54
SE	0.77	0.44	0.24	3.34	0.01**	1.54	0.97	2.47
Constant	n/a	-50.24	19.71	6.49	0.01	0.01	n/a	n/a

*$p < 0.05$, **$p < 0.01$

POC= processes of change, DB= decisional balance, SE= self-efficacy

B represents coefficient; S.E. represents standard error; and C.I. represents confidence interval.

-2 log-likelihood statistics = 22.139[a]; Cox & Snell R^2=40.1% Nagelkerke R^2 = 55.

Based on the result in Table 3, only self-efficacy had a unique statistically significant involvement to the model with an odd ratio of 1.54. The results also showed that all TTM variables are correlated with stages of change, while self-efficacy was shown to be the strongest predictor. Thus, designing interventions with the aim to improve physical activity level in female adolescents will be effective through raising adolescent girls' self-efficacy towards engaging in physical activity.

4. Discussion

The First objective of the current study was to evaluate the effect of a TTM stage-based intervention on students' stages of change, as measured by the stages of change inventory at baseline, two months, and four months. The results of the analysis indicated that at post-test, the participants in the experimental group improved their stages of physical activity significantly more compared to those who were in the control group. Moreover, the mean change in stages from the pre-test to the post-test indicates progression through the exercise stages of change in experimental group. The current study indicated that students who have completed the intervention increased their exercise stages of change, and they were expected to maintain physical activity in the future. Possible explanation of the effectiveness of the TTM intervention is that it considers psychological factors (cognitive and behavioral processes of change, decisional balance and self-efficacy) as the important factors to initiate and maintain physical activity. Moreover, strategies used in this research focused completely on improving TTM constructs, providing a clearer picture of their role in improving stages of change and adoption of exercise behavior.

The results of the present study support the findings of the studies by Woods, Mutrie, and Scott (2002) and Kirk, Mutrie, MacIntyre, and Fisher (2004) which showed significant improvement in stages of change among sedentary adult participants at four months and six months, respectively. Analyzing the participant proportion at each stage of exercise behavior change showed that the experimental group significantly outperformed the control group in stages of exercise behavior change at four and six months. In a similar way to the current findings, Blissmer and McAuley (2002) study showed that stage-matched intervention was superior to the mismatched intervention in improving the physical activity behavior of adult personnel in college for four months. In light of the findings of previous studies, it can be concluded that TTM stage-based interventions may facilitate design of a more effective intervention that can blossom into an active lifestyle. According to previous studies, stage-based interventions are more effective in improving stages of change among sedentary individuals (Kim, 2007; Lindgren, Baigi, Apitzsch, & Bergh, 2011). The findings of the current study are in line with the findings of the study by Bock, Marcus, Pinto, and Forsyth (2001) who examined predictors of exercise behavior after completing a 6-month intervention with sedentary adults. The analyses of the proportion of participants in each PA stage of change showed that the experimental group progressed significantly more through the stages of exercise behavior change compared to the control group at 12 months. In their study, experimental group was more likely to be in the action or maintenance stages at post-test (23.5% vs. 45.1%) compared to participants in the control group. Moreover, Boonchuaykuakul (2005) showed that after an eight-week intervention, the experimental group reported they had improved their stage of change from baseline significantly more compared to the control group χ^2 (3, N = 210) = 37.202, $p < .05$), which is consistent with the findings of the current study, which showed a positive effect of intervention on stages of change in experimental group.

However, the findings of the current study are in contrast with the results of Lewis et al. (2006)'s study, which revealed no between-group differences in terms of stages of change in sedentary adults from baseline to 3 months (p = .08). This finding is also in contrast with Naylor, Simmonds, Riddoch, Velleman, and Turton (1999), which evaluated the effect of stage-based intervention on exercise behavior on patients. The analysis of their study showed no changes in exercise levels, indicating that stage-based interventions were not more effective compared to other types, e.g., stage mismatched interventions. It seems that further research can address this conflicting issue by including more strategies on psychological factors related to exercise behavior change.

The second objective of the current study was to examine the relationships between stages of change (in the case of action stage) and changes in TTM psychological constructs (processes of change, decisional balance and self-efficacy) to identify determinants that predict the stages of exercise behavior. The result of the analysis indicated that self-efficacy is the most commonly evaluated predictor. It has been found to be a strong predictor of the relationship between TTM constructs and stages of change among adolescents. The findings regarding self-efficacy are consistent with the original TTM framework by Prochaska et al. (1997), showing that exercise self-efficacy increases across the stages of change. The findings of the current study are also in line with the prior literatures, which showed that self-efficacy is one of the strongest determinants of exercise (Sallis, Hovell, & Hofstetter, 1992; Taymoori & Lubans, 2008). Nevertheless, these findings are descriptive, and the hypotheses used related to the temporal relationships between self-efficacy and exercise were unidirectional. McAuley, Courneya, Rudolph, and Lox (1994) for example, used an experimental intervention that was intended and designed particularly to improve exercise behavior by applying the strategies to affect self-efficacy. In this study, self-efficacy was shown to be a predictor of exercise behavior, as treatment group presented greater exercise behavior. The findings of the current study support the findings by Berry, Naylor, and Wharf-Higgins (2005) and Nigg and Courneya (1998) who studied predictors of stages of change and showed that self-efficacy is the strongest stage predictor. Participants had lower self-efficacy in the contemplation stage and their self-efficacy improved through advancing stages of behavior change. They showed that 61.6% of subjects were correctly categorized based on their self-efficacy. In the current study, 88.9% of the participants were classified correctly in the action stage based on their self-efficacy, which shows that self-efficacy is a strong predictor of stages of change. The results of a longitudinal study on adolescents showed that self-efficacy predicted exercise behavior (Nigg et al., 2011). Self-efficacy appears to be a valid construct when studying exercise behavior among adolescents.

The findings of the current study are in contrast with a review of physical activity's determinants in young individuals, which showed indeterminate evidence to support self-efficacy (Sallis et al., 2000); however, a recent review of these factors in female adolescents showed that self-efficacy has a significant correlation with physical activity (Biddle,

Gorely, & Stensel, 2004). The present study's findings also lend support to other findings, which indicated that self-efficacy is an important predictor of behavior and a strong correlate of physical activity (Calfas, Sallis, Oldenburg, & Ffrench, 1997; Dishman & Sallis, 1994). Since exercise self-efficacy is a variable that is able to predict stages of change and time and stress are the biggest hindrance factors, using strategies to encourage students to spend a significant time and coping with their stress should be highlighted to increase their self-efficacy and subsequently the PA behavior of high school students.

5. Conclusion

The present study investigated the effectiveness of a TTM stage-based intervention on the exercise behavior, and determined the psychological variables which may predict stages of change in terms of exercise behavior. The results showed a significant impact of the intervention on the exercise behavior after four month. The findings also revealed that self-efficacy is a strong predictor of stages of change. Although decisional balance and processes of change had strong relationship with stages of change, they did not directly predict them. Evidence from this research suggests that interventions intended to enhance physical activity among sedentary students should emphasize self-efficacy and improve it with employing appropriate strategies.

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