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Original Article

Predictors of Physical Activity Based on Self Determination Theory Using Path Analysis in Women of Reproductive Age

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ABSTRACT

Background: Identification of psychological processes associated with increased physical activity (PA) i.e., sustainable motivation, is limited. Over recent years, self-determination theory (SDT) has been widely used to study long term PA motivation. Using path analysis in women in the reproductive age, the current study was conducted with the aim to investigate predictive factors of PA based on SDT.
Methods: This cross sectional study was carried out on 412 women aged 15-49 years in Tonekabon, Mazandaran in the north of Iran in 2015. Path analysis was used to investigate the relationship between psychological need satisfaction, PA motivation, healthcare climate, various motivation types and PA. Additionally, path analysis was used to investigate the appropriateness of SDT for PA.
Results: Perception of autonomy, enjoyment, health, appearance and social motives indirectly correlated with PA through Relative Autonomy Index (RAI). Moreover, RAI, perception of autonomy and social motive directly correlated with PA. These variables accounted for 56% of the variance in PA.
Conclusion: Findings from this study can be used to design SDT-based interventions. In order to promote PA among women in the reproductive age, the autonomous behavioral regulation, perception of autonomy, and social motive should be strengthened.
Keywords: Physical activity, Self-determination theory, Women
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Introduction

There is strong evidence that the proposed PA is effective in the primary prevention of cardiovascular diseases, colon and breast cancers, type 2 diabetes, obesity, and osteoporosis (1) and physical inactivity makes people vulnerable to adverse health conditions (2). However, the warning rates of physical inactivity have been determined in developed and developing counties (3-5). The World Health Organization (WHO) recommends doing at least 150 minutes of moderate to vigorous-intensity PA or 75 minutes of vigorous-intensity

PA throughout the week to get health benefits (6). Previous studies have reported inactivity level in Iran to be about 48.6-91% (7-9). Actually, the failure of a lot of people to adhere to healthy behaviors is a public health problem (10). The psychological processes related to the increased PA have been identified limitedly (11), especially with regard to stable motivation (10). Though there are other determinants, one should focus in particular on the perception of motivational factors of the exercise initiating and maintaining (12). Motivation is the person's performance stimulus (13).

SDT has been widely used to study PA motivation (14-16). SDT constructs are personal motivation, psychological needs, exercise motives, and socio-environmental backgrounds to motivation (14). SDT provides an insight into reasons why people adopt and insist on specific health behaviors (13-17). Motivation for PA can be in the form of amotivation, extrinsic motivation and intrinsic motivation. Amotivation is the absence of motivation to perform PA (18). Extrinsic motivation refers to behaviors that performed to attain consequences which are separated from the behavior itself. In the extrinsic motivation there is a continuum of behavioral regulations reflecting the degree of autonomy including; External regulation i.e. the person is active to attain performance-based rewards, obey requests. expectations, or avoid punishments, Introjected regulation i.e. the person participates in PA based on internal pressures to avoid feelings of guilt and shame and to strengthen or protect one's ego, and Identified regulation i.e., personally valuing the benefits of being active (13, 19). Intrinsic motivation is the most self-determined type of motivation and refers to performing activity for the sake of the activity itself (13, 17). Using SDT to investigate PA motivation is useful, because it has determined the psychological conditions which are the basis of motivation quality. Such conditions which can be affected by social environments (e.g., by teacher, instructor, or child parents) can provide goals for behavioral interventions (16).

There are three basic psychological needs which are considered as the required factors for autonomous motives and mental well-being (13, 16): Autonomy i.e. one's responsibility for his behaviors, relatedness i.e. to feel being respected by others, being connected to them, and being worthy (13), and competence i.e. the individuals feeling of efficiency toward behavior (20). Exercise motives is a new issue concerning the problem of PA that is related to the role of the person's reasons to exercise in explaining the long-term adherence to regular PA (21).

Most of the studies (22, 23) in the area of PA investigated some of the constructs of SDT in order to explain PA in women. Moreover, the Scale of Psychological Needs Satisfaction for doing exercise is not obvious in some studies (12). Therefore, considering the above mentioned cases, the current research was aimed to study all constructs of behavioral regulation i, Psychological Needs Satisfaction, Motives for PA, and the health care climate in prediction of PA using path analysis in women of reproductive age in Iran.

Methods

Study design and participants

This cross sectional study was conducted on women in the reproductive age in Tonekabon, Iran. Women in the reproductive age group between 15-49 years' old, those who were married, and had electronic health record were included in the study. non-pregnant, those who had no major diseases and orthopedic disorders were included in the study. Those women who were pregnant, had disabling chronic diseases or orthopedic disorders, and filled out the questionnaire incompletely were excluded from the study. According to the rule of 5 observations per measurement variable, a total of 365 samples size was calculated. Sample were selected from urban health care centers using systematic random sample. There were four urban healthcare centers in Tonekabon, so in in each urban healthcare center 103 women in the reproductive age were selected based on household health record number. The required permission was obtained from the healthcare center authorities. Subjects were invited to participate in the study through phone call and a meeting session at the health care center was scheduled for them. Subjects' participation in the study was completely voluntary.

Research Instruments

All scales used in the present study were adopted from the previous studies and translated into Persian using the forward backward translation method. The face validity of the questionnaire was evaluated by 15 women in the reproductive age, who were not included in the final sample. The content validity of the questionnaire was assessed through calculating Content validity index (CVI) based on the judgment of a panel of ten experts in health education, two experts in physical education and sports science, and one expert in biostatistics. Items reliability was measured using test-retest method and correlation coefficient of two performances was calculated as the reliability index. The questionnaire was filled out by 30 women who were not in the final sample, in two steps two weeks apart. The questionnaire consisted of several parts. The demographic information questionnaire included age, education level, occupation, spouse's job.

The next section was the motivation for PA scale adopted from previous studies (24). This 19-item scale measures people reasons to perform PA. It includes the sub-scales to assess intrinsic motivation, identified regulation, introjected regulation, external regulation and amotivation. The subjects responded to each item on a 5-point Likert scale ranged from zero (not true at all for me) to 4 (completely true for me). The sub-scales CVI index was 0.83-0.95. The reliability index of subscales was between 0.74-0.83. The mean scores of the five subscales in a 5-degree scale indicating the scope of each type of motivation were added and put on SDT continuum. RAI (known as the self-determination index (SDI)) was estimated by adding the weighted score for each sub-scale. The chance of relative autonomy was estimated by adding the weighted scores for each sub-scale: (intrinsic motivation × +3) + (identified regulation × +2) + (introjected regulation × -1) + (external regulation × -2) + (amotivation × -3) (25). The scores were rated from -21 to 20.

The third part was related to psychological needs satisfaction. This 18-item scale (26), measures the perception of autonomy, competence, and relatedness needs

in performing PA. Each sub-scale consists of 6 items, with a 6-point Likert scale ranging from 1 (not at all true) to 6 (completely true). The scores were between 18 and 108 points. The validity and reliability of the sub-scales were calculated to be 0.81-0.83 and 0.84-0.89, respectively. The fourth part of the scale was dedicated to the motives for PA, which was adopted from a scale developed by Ryan et al. (27). This scale measures five general motives to participate in PA, including enjoyment, competition, appearance, readiness.health, and social motives. Each area was estimated on a 7-point Likert scale (1 = low, 7 = high). In this study, 24 items in different areas were examined. Scores were between 24 and 168.

The next questionnaire was the health care climate. This 15-item scale developed by Williams et al. (28) assesses participants' perceived need support. It assesses the subjects' perceptions about the extent to which health care providers support their autonomy needs. Responses on a 7-point Likert vary from 1 = Strongly Disagree to 7 = Strongly Agree. The scores were between 15 and 105 points. The Cronbach's alpha coefficient, validity, and reliability for this scale were calculated to be 0.95, 0.82, and 91.8, respectively.

The final part of the instruments was Global Physical Act Questionnaire (GPAQ), includes questions about performing PA and sedentary behavior. The level of PA was measured using standardized GPAQ (29). This questionnaire shows a moderate to strong positive correlation with international PA questionnaire (30), which is a valid and acceptable scale of PA (31). PA in the work, travel to and from places and during leisure time as well as sedentary behavior were evaluated. Participants were asked about time they spent as hard to moderate work per day and how many days they walk or ride on a bike for at least 10 minutes continuously. The collected data were processed in accordance with the analysis guideline of this questionnaire (32) and the value of MET – minute per week was estimated. METs (metabolic equivalents) were used to express the intensity of physical activities. One MET is defined as the context energy consumption, and is equivalent to 1kal per kg per hour. Low level of activity or sedentary behaviors were classified according to the number of minutes while sitting in a chair, sitting with friends**,** watching TV, ttraveling by car, etc., per day, except for the time spent sleeping (32, 33).

Statistical analysis

All Statistical Analyses were performed using IBM SPSS Statistics for Windows, Version 22.0 (IBM Corp., Armonk, NY, USA). Data were analyzed using descriptive statistics, Kolmogorov Smirnov tests. In order to measure the relationship between SDT constructs and the level of PA, Spearman correlation test was used. Path analysis and assessing fitness of SDT model for PA behavior was performed using LISREL version 8.80 (Scientific Software International, Inc., Lincolnwood, IL, USA).

In order to determine the relationship between PA motivation, psychological needs satisfaction and exercise motives, and PA path analysis was used as an instrument for structural equivalent modeling (SEM). The theoretical model was considered based on assumptions of figure 1. The following indices and criteria were used for assessing model goodness of fit; goodness of fit index (GFI) and adjusted goodness of fit index (AGFI), and Normed Fit Index (NFI) $\geq$ 0.90, chi-square to degree of freedom ratio less than 3 (34, 35), Root Mean Square Error of Approximation (RMSEA) $\leq$ 0.08 and Root Mean Square Residual (RMSR) < 0.05 (36, 37). The p-value less than 0.05 was considered to be statistically significant.

Results

A total of 412 women participated in this study. The mean age of participants was 30.7 (SD = 7.28). Background characteristics of study participants is illustrated in table 1. The majority of women were housekeeper (72.8%) and had academic education (47%). Mean score of physical activity was 905.67 (SD = 881.72) MET. Mean duration of sitting behaviors was 281 (SD = 135.7) minute. Table 2 shows the correlation between motivational regulations and other constructs of SDT and PA.

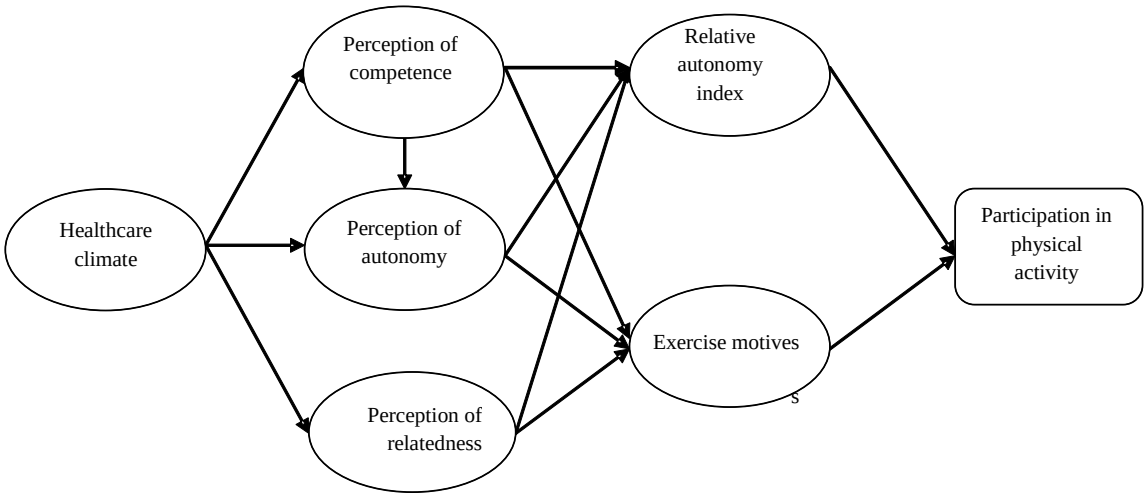

Figure 1. Theoretical Model Predicting the Level of Physical Activity Behavior in Women in the Reproductive Age Under Study Based on SDT

Table 1. Descriptive Characteristics of Women of Reproductive Age

Characteristics	Mean (SD)	Frequency (%)
Age	28.7 (7.30)	
Education level		
Less than diploma		18
Diploma		34.7
Higher education		47
Occupation		
Housekeeper		72.8
Employee		16.75
Freelancer		5.33
Student		5.12
level of physical activity		
Vigorous intensity		3.9
Moderate intensity		34
Low intensity		62.1
Sitting behaviors (Minutes per day)	281 ± 135.7	

Abbreviation: SD, Standard deviation

There was a direct correlation between psychological needs satisfaction and intrinsic motivation, identified regulation, introjected regulation, and external regulation. In contrast, amotivation was inversely correlated with needs satisfaction. There was a direct correlation between RAI as an index for SDT and a lot of constructs, while amotivation was inversely correlated with autonomy index. No significant relationship was observed between autonomy index and external regulation.

There was a direct correlation between four motivational forms of RAI (i.e., intrinsic motivation, identified regulation, introjected regulation, and external regulation), and PA (r = 0.7, 0.64, 0.42, and 0.37, respectively, and P-value < 0.01), and inverse correlation between PA and amotivation that is the weakest form of motivation. Additionally, there was a direct correlation between psychological needs satisfaction and PA (r = 0.52-0.53, P-value < 0.01), and between exercise motives (i.e., enjoyment, competition, appearance, fitness. health, and social motives) and PA (r = 0.22-0.29, P-value < 0.01). Only healthcare climate was not correlated with PA (r = 0.05).

As shown in table 2, many SDT constructs are correlated with PA. Therefore, path analysis was used in order to determine the most obvious relationship between SDT constructs and the strongest predictors of PA and to fit the most appropriate model for prediction. The theoretical used for path analysis of SDT constructs is shown in figure 1.

In the current research, the proposed predictive model was selected after investigating fitness indices and considering the goodness of fit statistics. The indices are presented in table 3. The most appropriate model for predicting PA behavior is illustrated in Figure 2. As shown in figure 2, perception of autonomy (B = 0.56), motives of enjoyment (B = 0.23), readiness, health (B = 0.11), appearance (B = -0.12), and social (B = -0.10) indirectly affect participation in PA through RAI. Perception of autonomy has the strongest effect (B = 0.56) on RAI. RAI (B = 0.49), perception of autonomy (B = 0.21), and social motives (B = 0.11) directly affect participation in PA.

Table 4 shows direct, indirect and total effect of significant predictors on PA. As shown in table 4, RAI (B = 0.49), perception of autonomy (B = 0.48), and enjoyment motive (B = 0.11) have the strongest effect on PA, respectively.

Overall, perceived autonomy and exercise motives except for competition accounted for 56% of the variance in RAI. Finally, the selected model predicted 56% of the variance in participation in PA through RAI, perception of autonomy, and exercise motives.

Discussion

Results from path analysis showed that RAI, perception of autonomy, and motives had direct positive effect on PA. These variables predicted 56% of the variance in PA, and RAI had the greatest effect.

In a similar study (38), behavioral regulations (identified regulation positively and external regulation negatively) explained 88% of variance in exercise. Exercise participation motives indirectly affected exercise by influencing behavioral regulations, and appearance motive negatively affected participation in exercise.

In other studies, intrinsic motivation (39) and identified regulation (40) positively affected PA. In another study, the importance of the perception of autonomy was reported in the explanation of PA (41, 42).

Table 2. Mean, Standard Deviation, and Coefficients of Correlation between SDT Constructs

Variables	RAI	PoC	PoA	PoR	EM	AM	HM	CM	SM	HCC	PA
RAI	-										
PoC	0.54**	-									
PoA	0.56**	0.86**	-								
PoR	0.49**	0.85**	0.85**	-							
EM	0.45**	0.37**	0.33**	0.30**	-						
AM	0.22**	0.33**	0.31**	0.31**	0.48**	-					
HM	0.32**	0.25**	0.26**	0.26**	0.56**	0.58**	-				
CM	0.23**	0.28**	0.21**	0.28	0.52**	0.57**	0.65**	-			
SM	0.12*	0.20**	0.15**	0.27**	0.40**	0.51**	0.45**	0.70**			
HCC	0.11*	0.07	0.07	0.10**	0.23**	0.16**	0.34**	0.19**	0.18**	-	
PA	0.61**	0.52**	0.53**	0.52**	0.29**	0.24**	0.26**	0.26**	0.22**	0.05	-
Mean	27.41	15.08	19.70	17.38	26.26	24.47	23.55	17.74	15.01	78.32	887.40
SD	20.96	9.52	12.22	11.88	7.77	7.81	5.29	6.86	7.11	15.82	783.57

Abbreviation: SDT, Self-determined theory; RAI, Relative autonomy index; PoC, Perception of competence; PoA, Perception of autonomy; PoR, Perception of relatedness; EM, Enjoyment motives; AM, Appearance motive; HM, health motive; CM, competition motive; SM, Social motive; HCC, Health care climate, PA, Physical activity; SD, Standard deviation

Table 3. Fitness Indices of Path Analysis Model

Chi-square	DF	Chi-square DF	GFI	AGFI	NFI	CFI	RMSEA	SRMR
4.84	3	1.61	1	0.97	1	1	0.039	0.018

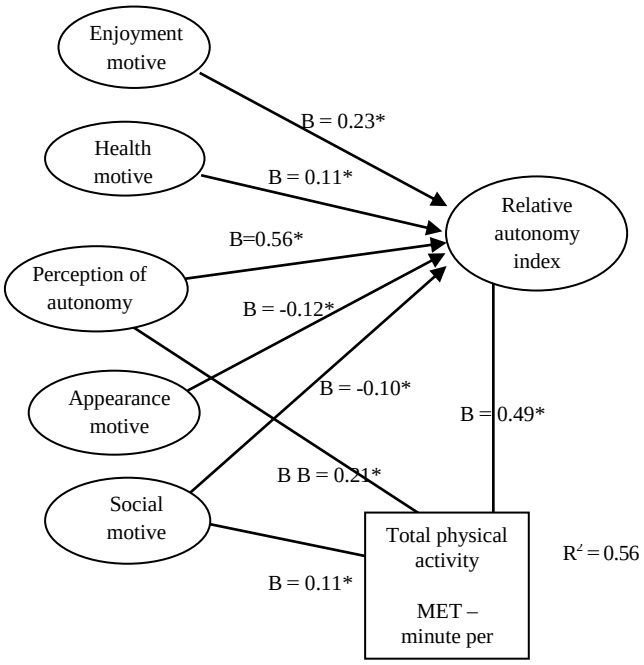

Figure 2. Fitted Model Predicting the Level of Physical Activity in Women of Reproductive Age Based on SDT
* Indicating significant at P-value < 0.05

It is observed that results from this study are in agreement with those obtained by other studies.

By affecting autonomy index, perception of autonomy and PA motives indirectly affected participation in PA. These factors predicted 56% of variance in autonomy index. First, perception of autonomy, and then, enjoyment and health motives, and appearance motive had the greatest positive and negative effect on autonomy index, respectively.

Table 4. Direct, Indirect, and Total Effects of SDT Constructs on Participation in Physical Activity

Independent variables	Direct effect	Indirect effect	Total effect
RAI	0.49	-	0.49
Perception of autonomy	0.21	0.27	0.48
Enjoyment motive	-	0.11	0.11
Appearance motive	-	-0.058	0.058
Health motive	-	0.053	0.53
Social motive	0.11	-0.049	0.061

Sebire et al. (39) reported that psychological needs satisfaction predicted 55% and 44% of variance in intrinsic motivation and identified regulation, respectively. This prediction was performed through autonomy need satisfaction. Another study showed that only satisfaction of needs for relatedness and competence were poorly related to a combined score of autonomous motivation (43).

Ingledew et al. (38) reported that the appearance motive increased introjected and external regulations. Additionally, health motive increased identified regulation and introjected, respectively. Therefore, it is observed that results from this study resemble those obtained by other studies.

Evidence (38) classifies the appearance motive in the area of extrinsic motives. Extrinsic motives are temporary and controlled by external factors. As soon as the control imposed by external factors is stopped, the likelihood of weakening and stopping positive behavior raises. Naturally, the amount and maintenance of PA decreases in individuals who follow up extrinsic motives to perform PA. Accordingly, in a study (38), the negative effect of appearance motive on PA through the positive effect on external motivation was reported. This finding supports the current study result.

The results of the current study can be used to design SDT-based interventions in the future. Therefore, in order to promote PA in women in the reproductive age, the autonomous behavioral regulation and perception of autonomy should be increased in particular. In order to enhance autonomous behavioral regulation, perception of autonomy should be improved. Therefore, it is required to present the intervention program in a way that the individuals change their behavior and increase PA on their own will, and advice giving and coercion are avoided. In addition, it is necessary to consider ways to enhance enjoyment and health motives. Accordingly, it is essential to educate individuals that exercise and PA create a sense of happiness and enjoyment as well as improve their physical and health status. After educating the above mentioned cases, the upper motivational levels (intrinsic motivation and identified regulation) are strengthened in individuals and they participate in PA and exercise due to the happiness and satisfaction feeling induced by performing PA as a result of exercise attractiveness as well as the worthy benefits of PA for them.

The results from this cross sectional study showed that all constructs of SDT had appropriate predictive power with regard to variance in PA behavior. This important issue was performed by RAI, perception of autonomy, and social motive, and autonomy index was the strongest predictive factor.

Therefore, future interventions to increase PA should focus on enhancing these variables. Given the results, enhancing perception of autonomy is a very important component in increasing PA in the present population. This can be achieved by giving people authority and enabling them to make choices in deciding to perform PA. The present study had methodological strengths. Sample size was good. Structural equivalent modeling led to conducting accurate tests (38) such that the effects of variables on PA were determined by autonomy index. Additionally, path analysis quantified direct and indirect effects (38).

This study had some limitations which have to be pointed out. Scales were assessed using self-report measures. Given the reviewed existing papers and resources, SDT constructs are very diverse and no specific graphical view has yet been presented for it. It was somewhat difficult to consider a specific theoretical view, on which the present study is based, and given the evidence and documents available in a variety of articles, the theoretical model investigated in the current research was formulated. Moreover, sampling took a

lot of time given the sample size (n = 412) and the large number of items in questionnaire.

Conclusion

This study revealed that some components of SDT including RAI, perception of autonomy, and exercise motives were Signiant predictor of physical activity. Findings from this study can be used to design SDT-based interventions. In order to promote PA among women in the reproductive age, the autonomous behavioral regulation, perception of autonomy, and social motive should be strengthened.

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Ethical consideration

Present research was approved by Institutional Review Board of Shahid Sadoughi University of Medical Sciences, Yazd, Iran.

Conflicts of interests

Authors declared no conflict of interest.

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