Original Article

Physical Activity among a Sample of Iranians Aged Over 60 Years: An Application of the Transtheoretical Model

Leili Salehi PhD[1], Hassan Eftekhar MD MPH•[1,2], Kazem Mohammad PhD[3], Mohammad Hossain Taghdisi PhD[4], Davoud Shojaeizadeh PhD[1]

Abstract

Background: Physical inactivity is one of the leading causes of major chronic disease, which contributes substantially to the global burden of disease, death and disability. This study examined physical activity in a randomly selected sample of elderly people in Tehran, Iran.

Methods: A random sample of 400 elderly people aged 60 years and over was selected through multistage sampling. A multi-sectional questionnaire that contained demographic characteristics, physical activity knowledge, benefits, barriers, self-efficacy, and readiness stage was used. Physical activity was measured by questions retrieved from the Physical Activity Scale for the Elderly.

Results: This study showed knowledge, perceived benefits, and self-efficacy could predict physical activity stage of change (*P*<0.001). Sixty-two percent of participants reported laziness as the most important barrier for not engaging in physical activity. Meeting new people (74%), having fun (71.8%), and contacting friends (67.73%) were the most prevalent reasons for participating in physical activity.

Conclusion: According to this study, individuals with higher knowledge, perceived benefits and self-efficacy were more likely to engage in physical activity. Furthermore, those who perceived lower barriers towards this behavior were more physically active.

Keywords: transtheoretical model, elderly, physical activity, self-efficacy

Introduction

Physical inactivity is one of the most important public health problems of the 21st century that leads to most chronic diseases.[1] Physical inactivity is associated with increased risk for all-cause mortality.[2] Since the 1950s, numerous population studies have shown that people who are sedentary experienced higher risk of incident or fatal cardiovascular events, up to twice compared with those who are physically active.[3] In spite of these proven advantages, there evidence shows that more than 80% of the Iranian population is physically inactive.[4]

Factors associated with participation in physical activity by older adults have been identified in many studies.[5,6] Demographic and health variables known to be associated with participation in physical activity include sex, age, and level of educational attainment, income, weight, and exercise-related self-efficacy. Support from family members, friends or exercise program staff is also a significant factor in physical activity participation. Environmental factors such as safe footpaths, safe neighborhoods and weather can affect physical activity. There are, however, few stud-

Authors' affiliations: [1]Department of Health Education and Promotion, School of Public Health, Iran University of Medical Sciences, Tehran, [2]Health Center for Community based Participatory Research, Tehran University of Medical Sciences, Tehran, [3]Department of Epidemiology and Biostatistics, School of Public Health, Tehran University of Medical Sciences, Tehran, [4]Department of Health Education and Promotion, School of Public Health, Iran University of Medical Sciences, Tehran, Iran.

•**Corresponding author and reprints:** Hassan Eftekhar MD, Department of Health Education, School of Public Health, Tehran University of Medical Sciences, Tehran, Iran. P.O. Box: 13214-14489. Tel: +98-218-898-9128, E-mail: eftkhara@tums.ac.ir.

Accepted for publication: 2 June 2010

ies that have examined factors associated with physical activity in older people from Iran.

One of the most popular models for studying behavioral determinants is the Trans Theoretical Model (TTM).[7,8] According to this model, individuals move through a series of stages as they adopt and maintain new behaviors.[7] Specifically, the stages include pre-contemplation, contemplation, preparation, action, and maintenance. Pre-contemplation includes those not participating in regular physical activity and not intending to change in the next six months. Contemplation includes those not participating in regular physical activity but intending to do so in the next six months. Preparation includes those not participating in regular physical activity but actively making small changes to do so. Action includes those who have actively engaged in regular physical activity for less than six months. Maintenance includes those who have actively engaged in regular physical activity for six months or more. According to the TTM model, individuals use various processes of change as they progress through these stages. Marcus and colleagues have identified five behavioral processes and five cognitive processes used throughout the stages of changes.[9] Decisional balance and self-efficacy are other important constructs of this model. Self-efficacy is defined as a person's perceived confidence in his or her ability to overcome barriers to initiating and maintaining behavioral change.[10] The decision balance is related to an individual's weighing of the pros (benefits) and cons (barriers) of changing behavior.[11] This model has been applied successfully for determining the stage of physical activity behavior in a wide variety of populations,[12,13] however, most of these studies have been conducted among adults from western countries whereas there is evidence that cultural variation could influence adopting and finding behaviors.[14] To the best of our knowledge there is no study to assess the stages of this behavior among Iranian elderly people. Since it is reasonable to assume that effective interventions should focus on those factors that mediate behavior and there is little empirical evidence to identify, describe, and explain the variables associated with the individual's participation in health-promotion behavior, such as physical activity, understanding of how these factors influence the adoption of this behavior at the individual level is needed.[15] Therefore this study was designed to examine the TTM in a sample of Iranian elderly.

Materials and Methods

This population-based cross-sectional survey was conducted between September, 2007 and April, 2008 to investigate physical activity and its' determinants in a randomly selected sample of elderly people who were members of elderly centers in Tehran. From all listed members of 23 elderly centers, a sample of 454 eligible people aged 60 years and over was selected through multistage random sampling. The sample size was estimated on the basis that we could obtain the highest rate of sample size. For this, it was assumed that 50% of the elderly people would be physically active, considering an 80% power of study and confidence interval of 95%, thus the actual sample size obtained for the study included 454 individuals. Individuals who were not interested in participating, those who were hospitalized or who suffered from serious illnesses, or underwent surgery (up to three months prior to the date of data collection) were excluded from the study. This study was approved by the Ethics Committee of Tehran University of Medical Sciences. Before conducting any procedure, the aim, method, and confidentiality of the study were explained completely to potential participants and informed, written consent was obtained from all participants. Data were collected through face to face interviews by trained interviewers in the elderly centers.

Data collection

A multi-section questionnaire was developed to assess physical activity among the Iranian elderly. This questionnaire consisted of three sections which included self-reported demographic and anthropometric data, including variables such as age, sex, education, employment status, and BMI. Weight was measured by a digital scale with subjects minimally clothed and not wearing shoes, whereas a tape measure was used to measure height while the subjects were standing, without shoes, and the shoulders were in a normal position.

The second section of the questionnaire consisted of information on physical activity levels among the elderly. A modified version of the Physical Activity Scale for Elderly (PASE)[16] questionnaire was used to measure self-reported physical activity. The third part of this questionnaire consisted of different determinants that might influence physical activity, including knowledge, perceived benefits and barriers

regarding physical activity. Furthermore there were three other determinants that included the physical activity stages of change, general self-efficacy and support rating. Prior to collecting data through these instruments, all questions were translated into Persian using a forward-backward translation process. Minor translation adjustments were carried out until the two versions of the English format were identical. To establish content validity of the questions, they were reviewed by ten specialists who were experienced in elderly care. Their considerations were then applied to the questionnaire. To test reliability, internal consistency was assessed using Cronbach's alpha coefficient. An alpha equal to or greater than 0.7 was considered satisfactory.[17]

For initial data collection, potential interviewers were educated regarding the questionnaires and how they could effectively communicate with elderly people to achieve the best results. Each interview lasted up to 45 minutes.

PASE (Physical Activity Scale for Elderly) questionnaire

PASE is a brief (5 minute) and easily scored survey designed specifically to assess physical activity over a week's time frame in epidemiologic studies of the elderly.[16] Participation in leisure activities, including walking outside the home; light, moderate, and strenuous sports, recreation and muscle strengthening were recorded as: never, seldom (1 – 2 days/week), sometimes (3 – 4 days/week), and often (5 – 7 days/week). Duration was categorized as less than one hour, 2 – 4 hours or more than 4 hours. Paid or unpaid work, other than work that involved mostly sitting activities, was recorded in total hours per week. Housework (light and heavy), lawn work, home repair, outdoor gardening, and caring for others were recorded as yes/no. The frequency and duration of household activities were not reported. The total PASE score was computed by multiplying the amount of time spent in each activity (hours/week) or participation (yes/no) in an activity by the empirically derived item weights that were originally derived by regressing a component score developed from a three day physical activity on responses to the PASE in a community-dwelling sample of 277 older adults whose mean age was 74 years.

Stages of change questionnaire regarding physi-

cal activity

Stage of change for regular exercise was measured using a standard questionnaire.[18] Regular exercise was defined as any planned physical activity (e.g., walking and swimming) performed to increase physical fitness. Such activity should be performed three or more times per week for 20 min per session at a level that increases breathing and heart rate.

Self-efficacy rating scale

Self efficacy was measured through the use of Marcus, Selby, Niaura, and Rossi's[9] scale. The scale is designed to measure confidence in one's ability to persist with exercising in various situations. The present study asked participants to rate their self-efficacy related to moderate, leisure time physical activity for 30 min on most days of the week. The Cronbach's alpha for this scale was 0.95.

Perceived benefits and barriers regarding physical activity

The advantage and disadvantages of physical activity were assessed through a questionnaire that was based on a questionnaire by Marcus et al.[19] A pool item for the decision balance was obtained from the 16 item decision balance scale that had been developed by Marcus et al. (1992) and literature review. In the first step, we used forward-backward translation. In the second step, ten focus groups were conducted with 60 elderly Iranians aged 60 – 78 (10 groups, each group of six persons). The elderly were asked about their beliefs concerning the negative and positive aspects of physical activity and factors important for such activity. The Benefits of Physical Activity Subscale consists of 10 items with 5 point Likert-type responses ranging from "not at all important" to "extremely important." An additive summary score was constructed to provide an overall estimate of the perceived benefits of physical activity, with possible scores ranging from 10 to 50 points.

The Barriers of Physical Activity Subscale consists of six items with 5 point Likert-type responses ranging from "not at all important" to "extremely important." with possible scores ranging from 6 to 30 points. For content analysis, four specialists (two elderly health educators and elderly health workers) were asked to review the items for relevancy. Then, this questionnaire was examined with five health educators who were members of an elderly association

and who were asked to rank items from not meaningful to very meaningful. According to the educator, all items were meaningful. The Cronbach's alpha for the Scale of Benefits of Physical Activity was 0.88 and for the Scale of Barrier towards Physical Activity was 0.89.

Exercise knowledge

In order to assess participants' knowledge regarding the recommendation of physical activity, six multiple choice questions were obtained from the interview questions used by Morrow and College.[20] The first two items were: "What is the minimum number of days per week you believe a person must be physically active in order to receive any health benefits?" ['0-1', '2-3,' 3-5 'not sure' (correct response was 3-5)]. "What is the minimum length of time (in minutes) one needs to be physically active throughout a typical day in order to achieve health benefits?" [30, 15, 20, not sure (correct response was 30)]. The next four items used a true/false/not sure response format. These items were: "Vigorous level of physical activity is necessary to provide any health benefits" (correct response was "false"). "Moderate levels of physical activity do not provide my health benefits" (correct response was "false"). "Ten minutes of physical activity for three times per day is equal to a single session of 30 minutes for good health" (correct response was true). "Everyone should get 30 minutes of at least moderate physical activity most days of the week" (correct response was "true"). Correct responses were summed to create a total knowledge score (0-6).

This scale was found to be valid (approved by ten exercise specialists) and reliable (alpha Cronbach Coefficient Equaled 0.8).

Perceived social support

In order to assess social support regarding physical activity we used modified social support and eating habit scales that were applied in a previous study.[21] These questionnaires were 5 point scales scored from (1) none to (5) very often. Each scale consisted of six items with total scores that ranged from 6 to 30.

The total scores for all six items of each part ranged between 6 – 30. Sallies et al. provided evidence of construct validity, test-retest reliability and concurrent criterion validity of the original questionnaire in 1987.[21] The Cronbach's alpha of this section of the questionnaire in the current study was calculated as 0.85.

Data analysis

Descriptive and analytic analyses such as frequency, mean and standard deviation, ANOVA, Chi-square, *t*-test, and multiple linear regression analysis were used. Multiple linear regression analysis was used to identify independent predictors for physical activity stages of change. The independent variables entered into the models were: perceived benefits, perceived barriers, self efficacy and knowledge, and social support. A stepwise procedure was followed to identify only those characteristics that were significantly ($P<0.05$) associated with physical activity stage of change after adjustment for all independent variables. The dependant variable in the study was the stage of change of physical activity. One-way analysis of variance and *t*-test were used to compare the mean score of physical activity across subgroups. ANOVA were used to test differences in TTM variables and physical activity between stages. Post *hoc* comparisons were performed using the LSD test.

Results

Of 454 eligible individuals, 32 were excluded from the study, thus a total of 422 individuals consented, entered the study and were interviewed. Of these, 22 individuals did not completely respond to the questions, therefore they were omitted from data analysis. The missing data rate was 5% in this study.

In total, 400 individuals from 23 elderly centers, which included 25.5% (n=102) men and 74.5% (n=298) women participated in the study. The mean age of participants was 64.07 (SD = 4.49), and ranged from 60 to 87 years. The majority of participants were of the age group 60 – 64 (63.8%), married (57.5%) and unemployed (80%) with a BMI between 25 and 29 (48%). The participants self-reported chronic health problems such as: hypertension (7%), arthritis (7%), heart disease (13.5%), and chronic pain (6%). The result of this study showed physical activity at a higher level in the absence of chronic diseases. Also this study revealed that the mean PASE score among study participants was 124.79±24.81. Table 1 shows demographic characteristics of the study population and mean PASE scores.

This study revealed that 74.5% of participants (n=298) knew the minimum days of physical activity per week, and 59% (n=236) were unaware of daily amounts of physical activity. A total of 72.8% of par-

Table 1. Mean PASE scores by demographic characteristics and stage of change among the study sample (*n*=400)

	No (%)	PASE score	P-value*
Age			<0.001
60 – 64	255 (63.8)	128.7±19.17	
65 – 69	87 (21.7)	125.52±19.58	
>70	58 (14.5)	105.09±44.14	
Gender			0.297
Male	102 (25.5)	122.57±22.64	
Female	298 (74.5)	125.54±25.50	
Education			0.698
Illiterate	165 (41.25)	125.36±26.77	
Literate	235 (58.75)	124.38±23.38	
Marital status			0.008
Married	230 (57.5)	127.33±22	
Not married	170 (42.5)	120.98±25.59	
Previous physical activity			<0.001
Yes	203 (50.75)	139.57±14.41	
No	197 (49.25)	109.56±24.14	
BMI			<0.001
<25	64 (16)	152.09±16.74	
25 – 30	165 (41.25)	128.58±9.14	
>30	171 (42.75)	110.91±27.78	
Chronic disease			<0.001
Yes	197 (49.25)	119.73±25.96	
No	203 (50.75)	129.70±22.65	
P<0.05 was considered significant			

ticipants (n=291) expressed awareness that ten min of physical activity three times per day is equal to a 30 min session, 78% (n=312) correctly reported that vigorous levels of physical activity are not necessary to provide benefit, 76% (n=304) understood that exercising at a moderate level provides health benefits and 31% (n=127) were unaware that everyone should get 30 min of at least moderate physical activity most days of the week.

The top three reasons for participation in physical exercise were: to meet new people, to have fun and contact friends. Laziness was the most frequently perceived barrier cited for not participating in physical activity, followed by 'I do not have any one to exercise with' (49%) and depression (Table 2).

As Table 3 shows those who are in the later stages had higher knowledge, more perceived benefits, more self-efficacy, lower perceived barriers, and were more active than those in the early stages of TTM.

Table 5 shows that exercise knowledge, benefits and self-efficacy are significant predictors of physical activity behavior (*P*<0.001).

Table 2. The perceived benefits and barriers stated by most participants

Variable statements	*n*	%
I would feel less stressed if I exercise regularly.	124	31.0
Exercise is fun for me.	287	71.8
Exercising lets me keep in contact with friends.	269	67.73
Exercise helps me to lose weight.	210	52.5
Exercise improves my flexibility.	167	41.8
Exercising helps me sleep better at night.	247	61.8
I will live longer if I exercise.	167	41.8
Exercising is a good way for me to meet new people.	296	74.1
I have a more positive outlook on life with exercise.	169	42.3
I feel as if I am taking care of myself when I exercise.	145	36.3
I am too exhausted to exercise.	95	23.8
Air pollution inhibits me from exercising.	46	11.5
A depressed mood keeps me from exercising.	123	30.75
I do not have any one to exercise with.	197	49.25
I am lazy to exercise.	248	62.0
I cannot exercise with a scarf in front of boys and men.	63	15.75

Table 3. Mean scores of knowledge, PASE, self-efficacy, benefits, and barriers in different stages of change

	Pre-contemplation M(SD)	Contemplation M(SD)	Preparation M(SD)	Action M(SD)	Maintenance M(SD)
Knowledge	5.41(2.6)	6.8(2.36)	8.073(1.93)	9.68(1.77)	10.78(1.66)
PASE	118.55(24.06)	115.5(34.94)	127.89±21.60	132.94±25.57	132.101±18.69
SE	5.991(0.71)	6.48(1.48)	12.23(2.19)	13.76(3.31)	15.66(5.57)
Benefits	21.22(7.11)	27.63(6.76)	37.24(5.47)	40.84(2.85)	43.83(3.19)
Barriers	17.45(6.63)	15.69(5.44)	15.35(5.06)	11.72(3.78)	12.41(4.7)
ANOVA showed significant differents between different stages at the level of $P<0.05$. Post *hoc* analysis also revealed significant differences in all variables between stages except for action and maintenance regarding PASE, SE=self-efficacy					

Table 4. Correlation between TTM variables

	PASE	Knowledge	Benefits	Barriers	Self efficacy	Social Support (family)	Social support (friends)
PASE	1						
Knowledge	0.269**	1					
Barriers	0.169**	-0.399**	1				
Benefits	0.214**	0.588**	-0.287**	1			
SE	0.255**	0.546**	-0.273**		1		
SS (family)	0.183**	0.404**	-0.144**	0.264**	0.257**	1	
SS (friends)	0.191**	0.362**	-0.210**	0.288**	0.313**	0.634**	1
**Correlation is significant at the 0.01 level. None of the correlations exceed 0.08 and thus there was no multicolinearity, SE=self-efficacy							

Table 5. Linear regression of different variables to predict physical activity

	Determinants	Mean Score (SD)	*β* (CI %95)	SE	*P*
Knowledge	7.94(2.87)	0.165 (0.106 − 0.224)	0.03	<0.001	
Benefits	32.94(10.68)	0.417 (0.05 − 0.069)	0.005	<0.001	
Barriers	15.11(5.83)	-0.035 (-0.022 − 0.003)	0.006		0.24
SE	9.7(6.05)	0.426(0.091 − 0.123)	0.008	<0.001	
SS (family)	14.26(5.12)	- 0.009(-0.014 − 0.009)	0.006	0.70	
SS (friends)	12.34(5.32)	0.011(-0.009 − 0.015)	0.006	0.64	
F=248.785; Adjusted R2=0.813					

Discussion

This study intended to investigate physical activity and its determinants among Iran's elderly through the TTM as a road-map that provided much information in this high-risk group.

According the results of this study 70% of the participants were sedentary, and engaged in less than one hour per week of exercise; although, approximately all participants believed in the benefits of physical activity. Laziness appeared to be the most important perceived barrier for not engaging in physical activity which was stated by more than half of the participants. In other studies on perceived barriers among older people; the most frequent perceived barrier has been related to time constraints. A study by Booth et al. (2002) on perceived barriers among older Australians have reported that 'having no sufficient time to be physically active' is one of the most frequently cited barriers,[22] while time was not an important factor among Iran's elderly.

Not having an exercise partner was another barrier to exercise among Iran's elderly. Therefore peer motivation should be supported to encourage and motivate the elderly to remain physically active. Air pollution was mentioned as another barrier to exercise among the elderly. Another study cited weather as an exercise barrier.[23] Researchers recommend exercising in the early morning and late day when air pollution is at a minimal level and the situations causing air pollution are minimal.

Furthermore, this study revealed that a majority of the participants understood the health benefits of phy-

sical activity and there were significant relationships between perceived benefits and stage of change. Social health was the most important benefit of physical activity cited in this study. These findings were consistent with those reported by another study.[24] Other studies have indicated that the most perceived benefits of physical activity which were identified in a nationally representative sample in the European Union (EU) were: 'to maintain good health', 'to release tension' and 'to get fit'. However, the proportions of EU respondents belied that 'to control weight' and 'to have fun' were good reasons for participating in physical activity.[25] Another study demonstrated that middle-aged or older adults cited perceived benefits such as chronic disease management, weight control, stress management, and personal enjoyment as the most important reasons to exercise.[26] 'To have fun' was the second important factor which was cited by 71.8% of the elderly. Fun or enjoyment were one of the most motivating and encouraging reasons cited in the literature for most age groups to be engaged in physical activity.[27]

Although previous studies[28] have shown significant differences between males and females in terms of physical activity, which indicated that men were more active than women,[29] however, the current study showed no significant differences regarding physical activity levels between genders. This difference could be explained by the life styles of Iranian women. Indeed in the context of Iranian living, elderly women have high levels of physical activity due to their daily duties such as household activities, caring for grandchildren and so on.

This study showed no difference between illiterate and literate individuals in terms of physical activity. These results contrast those reported by previous studies.[30] It seems there was no difference between types of physical activity among the two groups. Illiterate woman predominantly wre allocated to a lower social class, and among them vigorous physical activity such as: shopping, caring, and cleaning were common, but physical activity as defined exercise in the literature was uncommon. Among illiterate people, physical activity in the form of exercise such as walking, swimming and playing were more common.

According to Sallis et al. (1999), physical activity is influenced by a variety of psychological, social, cultural, and environmental variables.[15] It is reasonable to assume that effective interventions should alter those variables that appear to mediate behavior. Modifiable variables that have been consistently associated with physical activity are self-efficacy, social support, perceived barriers, perceived benefits, and enjoyment.[15]

According to the results of this study, married participants in comparison with unmarried ones have higher levels of physical activity. Henderson, Ainsworth, and Barbara (2003) indicated that social support which involveed the family members, spouse, and other social networks were means for finding companions for physical activity among African American and American Indian women.[31] The findings of our study also indicated that social support from family and friends increased the level of physical activity among elderly participants. However, the importance of social support may be related to the positive influence of encouragement from friends or family as engaging in physical activity. Encouragement is similar to 'verbal persuasion,' or the coaxing of exercise behavior from family and friends that can positively influence behavior change through informing one's perceived self-efficacy.[10] It is commonly suggested that physical activity in childhood and adolescence is an important prerequisite for physical activity in adulthood.[32] Our study has confirmed these results. In our study it was determined that elderly participants who had previous physical activity were more likely to engage in physical activity. A past or current history of physical activity may act as a facilitator for physical activity, because these persons may have confidence that they are able to be active, or have higher self-efficacy.[10] Our study found that elderly people in the normal BMI range had higher levels of physical activity which may be due to balances of energy among these participants.

Our results showed that self-efficacy and perceived benefits (pros) were significantly higher and perceived barriers (cons) were lower in the later stages as compared to earlier stages which confirmed the results of another study.[33]

Our results were also consistent with other studies,[34,56] which revealed that Self Efficacy and perceived benefits were predictors of physical activity. Therefore, one can deduce that improvement in these individuals' abilities through continued education and training may lead to enhanced levels of physical activity. Our findings showed that participants in more advanced stages of change regarding physical activity were more likely to be physically active. The-

se results imply that the stage of change to physical activity should be considered as an influencing factor while interventions for increasing physical activity are being planned. For example, motiventional strategies for encourageing physical activity may be more effective for those who are in the preaction stage, whereas strategies supporting the maintenance levels of physical activity may be more appropriate for those in the action stages. As previously discussed, participants who were more knowledgeable were more likely to have higher levels of physical activity. Thus, it is important that policy makers and others responsible for peoples' health should be aware of this result of the study. Additionally, more research in different populations is needed to verify these findings. To stimulate more people to be physically active, it is necessary to be aware of the determinants of physical activity behavior. There are a number of models which explain physical activity behavior, but in general these include three sets of determinants: 1) knowledge and attitudes, 2) social influences, and 3) barriers and self-efficacy.[24]

This study revealed that physical activity levels increased as individuals moved to higher stages of change which was confirmed by another study.[36] The stage of participation in exercise was significantly and positively related to an increased participation in leisure and sports activities in addition to habitual activity.

Despite the number of strong points in this study, there are some limitations. Firstly, the generalizability of this study might be decreased because all participants were members of elderly centers, and therefore might differ from the general elderly population living in Tehran. Therefore, additional broader studies that consist of larger samples from different sociodemographic backgrounds are strongly recommended. Secondly, this study used self-reported questionnaires to collect data which may confound the results. Morover, in this study, the construct validities of the questionnaires were not assessed, so this might be another limitation to this study.

Conclusion

As this research demonstrated, the lack of knowledge, low perceived benefits, low self-efficacy, and high perceived barriers towards physical activity could lead to lower levels of physical activity. Fur-

thermore, participants with lower self-efficacy were less likely to participate in regular physical activity. This study concluded that in order to improve physical activity among the Iranian elderly, more attention should be paid to increasing their knowledge, enhancing their perceptions of the barriers and benefits, and self-efficacy regarding physical activity.

Acknowledgements

References

1. Blair SN. Physical inactivity: the biggest public health problem of the 21st century. *Br J Sports Med.* 2009; **43:** 1 – 2.
2. Lee IM, Skerrett PJ. Physical activity and all-cause mortality: what is the dose-response relation? *Med Sci Sports Exerc.* 2001; **33(suppl 6):** S459 – S471.
3. Bauman A, Bellew B, Vita P, Brown W, Owen N. Getting Australia active: Towards better practice for the promotion of physical activity. National Public Health Partnership. Melbourne: 2002. Available from: URL: http://www.health.gov.au/internet/wcms/publishing.nsf/content/health-pubhlth-strateg-active-links.htm-copy3 (Accessed 30 June 2009)
4. Sheikholeslam R, Mohamad A, Mohammad K, Vaseghi S. Non communicable disease risk factors in Iran. *Asia Pac J Clinical Nutrition.* 2004; **13(suppl 2):** S100.
5. King AC. Interventions to promote physical activity by older adults. *J Gerontol A Biol Sci Med Sci.* 2001; **56:** 36 – 46.
6. Booth ML, Owen N, Bauman A, Clavisi O, Leslie E. Social-cognitive and perceived environment influences associated with physical activity in older Australians. *Prev Med.* 2000; **31:** 15 – 22.
7. Prochaska JO, Diclemente CC. Stages and process of self-change in smoking: towards an integrative model of change. *J Consult Clin Psychol.* 1983; **51:** 390 – 395.
8. Prochaska JO, Reddind CA, Ever KE. The transtheoretical model and stage of change. In: Glanz K, Rimer BK, Lewis FM, eds. *Health Behavior and Health Education, Theory, Research and Practice.* 4th ed. San Francisco, CA: Jossey–Bass; 2008.
9. Marcus BH, Selby VC, Niaura RS, Rossi JS. Self-efficacy and the stages of exercise behavior change. *Res Q Exerc Sport.* 1992; **63:** 60 – 66.
10. Bandura A. Self efficacy: toward a unifying theory of behavioral change. *Psychol Rev.* 1977**; 84:** 191

– 215.

11. Marshall SJ, Biddle SJ. The transtheoretical model of behavior change: a meta-analysis of applications to physical activity and exercise. *Ann Behav Med.* 2001; **23:** 229 – 246.

12. Mori K, Suzuki H, Wang DH, Takaki J, Takigawa T, Ogino K. Relationship of psychological factors with physical activity stage of change in prime-and middle-aged Japanese. *Acta Med Okayama.* 2009;**63:** 97 – 104.

13. Faghri PD, Blozie E, Gustavesen S, Kotejoshyer R. The role of tailored consultation following health-risk appraisals in employees' health behavior. *J Occup Environ Med.* 2008; **50:** 1378 – 1385.

14. Nishimura Y, Chikamoto Y. Health promotion in Japan: comparisons with U.S. perspectives. *Am J Health Promot.* 2005; **19(supp l3):** 213 – 215.

15. Sallis JF, Calfas KJ, Nichols JF, Sarkin JA, Johnson MF, Caparosa S, et al. Evaluation of a university course to promote physical activity: project GRAD. *Res Q Exerc Sport.* 1999; **70:** 1 – 10.

16. Washburn RA, Smith KW, Jette AM, Janney CA. The Physical Activity Scale for the Elderly (PASE): Development and evaluation. *J Clin Epidemiol.* 1993; **46:** 153 – 162.

17. Nunnally JC, Bernstein IH. *Psychometric Theory.* 3rd ed. New York: McGraw-Hill; 1994.

18. Dumith SC, Gigante DP, Domingues MR. Stages of change for physical activity in adults from Southern Brazil: a population-based survey. *Int J Behav Nutr Phys Act.* 2007; **4:** 25.

19. Marcus BH, Rakowski W, *Rossi JS.* Assessing motivational readiness and decision making for exercise. *Health Psychol.* 1992; **11:** 257 – 261.

20. Morrow JR Jr, Krzewinski-Malone JA, Jackson AW, Bungum TJ, FitzGerald SJ. American adults' knowledge of exercise recommendations. *Res Q Exerc Sport.* 2004; **75:** 231 – 237.

21. Sallis JF, Grossman RM, Pinski RB, Patterson TL, Nader PR. The development of scales to measure social support for diet and exercise behaviors. *Prev Med.* 1987; **16:** 825 – 836.

22. Booth M. Assessment of physical activity: an international perspective. *Res Q Exerc Sport.* 2000; **71(suppl 2):** S114 – S120.

23. Gobbi S, Nascimento CMC, Brazao MC, Hirayama MS, Gobbi LTB, Emerson S. Physical activity, barriers, and stage of behavior change in older Brazilians living in a medium-size city. LAFE-Department of Physical Activity, Sao Paulo State University, Brazil; 2009. Available from: URL: www.humankinetics.com.

24. Kolt GS, Paterson JE, Cheung VYM. Barriers to physical activity participation in older Tongnon

adults living in New Zealand. *Australian J Age.* 2006; **25:** 119 – 125

25. Zunft HJ, Friebe D, Seppelt B, Widhalm K, Remaut de Winter AM, Vaz de Almeida MD, et al. Perceived benefits and barriers to physical activity in a nationally representative sample in the European Union. *Public Health Nutr.* 1999; **2:** 153 – 160.

26. Grubbs L, Carter J. The relationship of perceived benefits and barriers to reported exercise behaviors in college undergraduates. *Fam Commun Health.* 2002; **25:** 76 – 84.

27. Huddleston S, Mertesdorf J, Araki K. Physical activity behavior and attitudes toward involvement among physical education, health and leisure services pre-professionals. *Coll Stud J.* 2002; **36:** 555 – 573.

28. Ross CE, Bird CE. Sex stratification and health lifestyle: consequences for men's and women's perceived health. *J Health Soc Behav.* 1994: **35:** 161 – 178.

29. Blumenthal JA, Emery CF, Madden DJ, Schniebolk S, Walsh-Riddle M, George LK, et al. Long-term effects of exercise on psychological functioning in older men and women. *J Gerontol.* 1991; **46:** 352 – 361.

30. Pomerleau J, Pederson LL, Ostbye T, Speechley M, Speechley KN. Health behaviours and socio-economic status in Ontario, Canada. *Eur J Epidemiol.* 1997; **13:** 613 – 622.

31. Henderson KA, Ainsworth BE. A synthesis of perceptions about physical activity among older African American and American Indian women. *Am J Public Health.* 2003; **93:** 313 – 317.

32. Yang X, Telama R, Leino M, Viikari J. Factors explaining the physical activity of young adults: the importance of early socialization. *Scand J Med Sci Sports.* 1999; **9:** 120 – 127.

33. Plotnikoff RC, Hotz SB, Birkett NJ, Courneya KS. Exercise and the transtheoretical model: a longitudinal test of a population sample. *Prev Med.* 2001; **33:** 441 – 452.

34. Kosma M, Cardinal BJ, McCubbin JA. Predictors of physical activity stage of change among adults with physical disabilities. *Am J Health Promot.* 2004; **19:** 114 – 117.

35. McAuley E, Morris KS, Motl RW, Hu L, Konopack JF, Elavsky S. Long-term follow-up of physical activity behavior in older adults. *Health Psychol.* 2007; **26:** 375 – 380.

36. Schumann A, Nigg CR, Rossi JS, Jordan PJ, Norman GJ, Garber CE, et al. Construct validity of the stages of change of exercise adoption for different intensities of physical activity in four samples of differing age groups. *Am J Health Promot.* 2002; **16:** 280 – 287.