Perceived Self-efficacy and Commitment to an Exercise in Patients with Osteoporosis and Osteoarthritis

Hanan, S. A. and Sahar, Y. M

Dept. of Medical Surgical Nursing, Faculty of Nursing, Ain Shams University, Egypt
*saharyassien@yahoo.com

Abstract: Exercise remains a central health behavior in improving osteoporosis and osteoarthritis. A convenience sample of patients with a clinical diagnosis of osteoporosis (75) and osteoarthritis (75) was recruited. Their mean age±SD was 52.9±7.2 and 50.0±13.1, respectively. Obtained results revealed that osteoporotic patients had significantly higher mean scores of commitment to exercie, and higher exercise self-efficacy, while the mean score of exercise benefit was higher in the osteoarthritis group. In addition; a significant positive correlations were found between commitment and perceived self-efficacy scores, and between self-efficacy and perceived lack of barriers and exercise benefits in both groups. In regression analysis, age was a negative predictor for commitment in osteoporosis group, while self-efficacy and lack of barriers were positive predictors. In osteoarthritis group, self-efficacy was the only positive predictor of commitment. It is recommended that the heath care professionals should adopt strategies for enhancing patient's self-efficacy, give special attention to perceived barriers to exercise, and tailor exercise interventions to the different needs and perceptions of the patients with osteoporosis and osteoarthritis. The aim of this study was to compare perceived self-efficacy, exercise benefits, exercise barriers, and commitment to exercise between patients diagnosed with osteoporosis and osteoarthritis, and assessing the influence of perceived exercise self-efficacy, exercise benefits, and barriers on commitment.
[Hanan, S. A. and Sahar, Y. M., Perceived Self-efficacy and Commitment to an Exercise Plan in Patients with Osteoporosis and Osteoarthritis. Journal of American Science 2011;7(8):315-323].(ISSN: 1545-1003). http://www.americanscience.org.

Keywords: Osteoporosis; Osteoarthritis, Exercise, Self-efficacy, Commitment

1. Introduction:

Osteoporosis is a disease characterized by micro-architectural deterioration of bone tissue, low bone mass, enhanced bone fragility, and increased risk of fracture **(NIH Consensus Development Panel on Osteoporosis Prevention, Diagnosis, and Therapy, 2001)**. With increasing life expectancy, it is becoming a major health problem worldwide, with higher magnitude in developing countries **(Maalouf *et al*, 2007).** The major problem of osteoporosis is that many patients are not aware that they have the disease until a fracture occurs. Osteoporotic fractures affect the quality of life and are associated with premature mortality. Although the disease is serious, yet it is preventable by modifying certain aspects of lifestyle such as physical activity, diet, and the use of hormone replacement **(Sedlak *et al*., 2000)**.

Osteoarthritis or degenerative joint disease is the most common form of arthritis. It was estimated to be the 10^{th} leading cause of non-fatal burden in the world in 1990 **(World Health Organization, 2002)**. It is also responsible for 81% of hip replacements and 93% of knee replacements. It usually attacks the weight-bearing joints striking most often the hips and knees. Osteoarthritis occurs when cartilage deteriorates leaving the bones to grind against each other. This causes the bones to degenerate, resulting in pain and stiffness. As the condition worsens, loss of mobility and, in extreme cases, dysfunction and deformity can occur **(American Academy of Physical Medicine and Rehabilitation, 2010)**. As osteoporosis and osteoarthritis are quite different, health professionals need to understand differences and similarities between the two groups in exercise-related perceptions as a basis for tailoring exercise interventions to the needs and perceptions of patients with these musculoskeletal conditions **(Shin *et al*, 2006)**.

An accepted strategy for decreasing the risk of musculoskeletal and connective tissue diseases is regular exercise. In people with osteoporosis, exercise affects bone density, size and shape, and thus improves mechanical strength **(Turner and Robling, 2003)**. It also stimulates osteoblastic activity, and suppresses bone resorption **(North American Menopause Society, 2002)**. Exercise has also been shown to improve coordination and improve postural stability, which decreases the risk of falls, in addition to improving general physical health and wellbeing **(Close and Glucksman, 2000;Mar, 2004; Spark, 2010)**. Exercise, as well may be one of the most effective therapies for reducing joint pain and improving functions in patients with knee and hip osteoarthritis **(Shin *et al*, 2006)**. Nonetheless, the problem is that any positive gains in bone strength will be lost when the patient stops exercising, so that it is important that the exercise be regular and ongoing **(Spark, 2010).**

Participation in behaviors that affect health outcomes has been explained by a number of theoretical models. One such model is the Health Promotion Model (HPM), which describes the causal mechanisms for health promoting behavior that focus on increasing physical activity, exercise self-efficacy, exercise benefits and barriers, and commitment to a plan for exercise **(Pender *et al*, 2002)**. Self-efficacy acknowledges the human capacity for self-regulation and development of competencies in specific behavioral domains. Perceived self-efficacy is not a measure of the skills one has but a belief about what one can do under different sets of conditions with whatever skills one possesses. The Health Promotion Model proposes that commitment to a plan of action such as regular exercise is determined by the individuals' beliefs concerning their self-efficacy, outcomes or benefits as well as perceived barriers to action **(Shin *et al*, 2006)**.

Significance of the study:

The prevalence of both osteoporosis and osteoarthritis escalates as people age. The extrapolated statistics estimated the burden of osteoporosis in Egypt in 2010 as about 8 million cases out of 80 million populations, while estimated osteoarthritis to be around 6 million cases. Although many factors are related to the occurrence and progression of osteoporosis and osteoarthritis, exercise remains a central health behavior in their prevention. Perceived self-efficacy is another cognitive mediator that molds the shape of illness and may improve compliance with prescribed therapies and exercise regimens. This study is aimed at; comparing perceived self-efficacy, exercise benefits, exercise barriers, and commitment to exercise between patients diagnosed with osteoporosis and osteoarthritis; and assessing the influence of perceived exercise self-efficacy, exercise benefits, and barriers on commitment to exercise in each group.

Research hypotheses

There is a difference between perceived self-efficacy, exercise benefits, exercise barriers, and commitment to a plan for exercise in patients diagnosed with osteoporosis and osteoarthritis.

Perceived self-efficacy is positively related to commitment to an exercise among patients diagnosed with osteoporosis and osteoarthritis.

Perceived benefits are positively related to commitment to an exercise among patients diagnosed with osteoporosis and osteoarthritis.

Perceived lack of barriers is positively related to commitment to an exercise among patients diagnosed with osteoporosis and osteoarthritis.

2. Subjects and Methods

Research design:

A comparative cross-sectional analytic research design was utilized in this study.

Research setting:

The study was conducted at the Physiotherapy Department and Outpatient Orthopedic Clinic of the Maternity Hospital, and Ain Shams University Hospitals.

Study subjects:

The participants in this study consisted of a convenience sample of 75 patients with a clinical diagnosis of osteoporosis and 75 patients with osteoarthritis, recruited from the study settings. The inclusion criteria were clinical diagnosis of osteoporosis or osteoarthritis and having the physical capacity to exercise. Exclusion criteria were, patients having both diagnoses, or with conditions making them unable to exercise such as cardiovascular disease as hypertension, decompansated heart failure, ischemic heart disease, or metabolic conditions as diabetes mellitus or thyroid problem, advanced renal – liver disease, severe anemia, obesity, CNS stroke, as well as exacerbated arthritis or recent fracture.

Tools of the study:

Four tools were utilized to collect data related to this study. They were all in Arabic language and self-administered.

Perceived Exercise Self-efficacy Scale: developed by Bandura (1997) and psychometrically evaluated by Shin *et al* (2001) to measure perceived self-efficacy. The scale has a total of 18 items ranging in 10-unit intervals from (0%) cannot do, through intermediate degrees of assurance (50%) moderately certain can do, to complete assurance (100%) certain can do. The respondent should rate him/herself, from 0% to 100%, how confident he/she is able to perform exercise routines regularly (three or more times a week) under various circumstances such as 'during bad weather'. It was scored as an average of the patient's response to the 18 items.

Exercise Benefits and Barriers Scale: used to determine the respondent's perceptions concerning the benefits of and barriers to participating in exercise. It was adopted from Sechrist *et al* (1987) and psychometrically evaluated by Jang and Shin (1999) for the validity of its constructs and for internal consistency and test-retest reliability. The scale has 43 items, 29 benefits and 14 barriers. They are rated on a four-points Likert scale ranging from strongly disagree (1) to strongly agree (4). Barrier scale items are reverse scored. The scale has separate benefit and barrier scores. The scores are converted into percent scores to facilitate comparisons.

Commitment to an Exercise Scale: developed by Pender (1996) and psychometrically evaluated by Shin *et al* (2003), and adapted for cultural appropriateness by the researchers. The scale has 20 items with a three-point rating scale ranging from never (1) to often (3). The scale is scored as a total average for each patient, and also converted into percent scores to facilitate comparisons.

Exercise documentation record: developed by the researchers to document patient's adherence to the exercise. Its first section involves patient's demographic characteristics as age, gender, marital status, working status, educational level, in addition to weight, medical history, and present complaint. The second section was for documentation of information regarding the type of exercise practiced e.g (walking, cycling, swimming, others), addition of another type of exercise, the frequency of exercising as days per week and duration of exercise as minutes per day, the intensity of the exercise (how hard the patient perceives the exercise according to Borg Scale). It scored from (1) not hard at all to (10) extremely hard, in addition to the cumulative exercise time in minutes, and the rate of progression, and adding another type of exercise.

Procedures

The investigators went through literature review to adopt and finalize the study tools. Exercise was defined in this study as performing regular physical activity to improve fitness and health. Experts' advice was sought to ensure content relevance, clarity, and correctness. Administrative consent for study conduction was obtained from the directors of Ain Shams University Hospitals. Participants were given a full explanation of the study aims and procedures. Verbal consent was obtained by each patient prior to completing the study instruments. During data collection, one researcher was available at least to assist the study participants in explanations of the meaning of questions. Questionnaires took about 30–40 min for the subject to complete. Data was collected from June 2006 to June 2007.

Statistical analysis

Data entry and statistical analysis were done using SPSS 16.0 statistical software package. Quantitative continuous data were compared using Student t-test. When normal distribution of the data could not be assumed, the non-parametric Mann-Whitney test was used instead. Pearson correlation analysis was used for assessment of the inter-relationships among various scores. Multiple stepwise regression analysis was used to identify the independent predictors of the commitment score.

3. Results

As shown in table (1); a significant difference was found between the two groups regarding gender ($p=0.003$) and marital status ($p=0.002$). In addition; it is evident that the osteoporosis group had a higher percentage of females, and less unmarried subjects. On the other hand the two groups had similar age distribution, working status, and educational level.

As shown in table (2); the practice of walking was statistically significantly higher in the osteoarthritis group, and a higher percentage of them were adding two or more other types of exercise (26.7%), whereas patients in the osteoporosis group had higher physiotherapy exercises practice ($p<0.001$). it also, indicates that the osteoarthritis group perceived exercise as more intense compared to the osteoporosis group, and they showed lower cumulative duration of exercise; these differences were statistically significant ($p<0.001$).

As shown in table (3); osteoporotic patients had significantly ($p<0.001$) higher mean scores of commitment to plan, and exercise self-efficacy. Conversely, the mean score of exercise benefit was higher in the osteoarthritis group ($p<0.001$). Moreover, the addition to exercise level was significantly ($p<0.001$) higher in the osteoporosis group as 41.3% of them reported adding a high level of exercise (muscle stretching plus strengthening exercise twice a week).

As shown in table (4); a significant positive correlations between commitment and perceived self-efficacy scores in both groups. Additionally, the self-efficacy score was statistically significant positively correlated to perceived lack of barriers, and perceived exercise benefits in both groups. These correlations were stronger in the osteoporosis group. Also, statistically significant positive correlations were revealed between the scores of commitment and lack of barriers only in the osteoporosis group.

As shown in table (5); the best fitting multiple linear regression models for commitment scores in the osteoporosis group, age was a statistically significant negative predictor, whereas the scores of self-efficacy and lack of barriers were statistically significant positive independent predictors. As indicated by the value of r-square, the model explains 46% of the variation in the commitment score. In the osteoarthritis group, the score of self-efficacy was the only statistically significant positive independent predictor of commitment, but it explained only 16% of the variation in commitment score as the value of r-square shows.

Table (1): Socio-demographic characteristics of patients in the osteoporosis and osteoarthritis groups

	Group				X^2	p-value
	Osteoporosis (n=75)		Osteoarthritis (n=75)			
	No.	%	No.	%		
Age (years):						
<50	23	30.7	35	46.7		
50+	52	69.3	40	53.3		
Range	40.0-82.0		17.0-76.0			
Mean±SD	52.9±7.2		50.0±13.1		U=0.98	0.32
Gender:						
Male	17	22.7	34	45.3		
Female	58	77.3	41	54.7	8.59	0.003*
Marital status:						
Married	73	97.3	61	81.3		
Unmarried	2	2.7	14	18.7	10.07	0.002*
Working status:						
Employee	16	21.3	26	34.7		
Worker	13	17.3	16	21.3	4.83	0.09
Unemployed/housewife	46	61.3	33	44.0		
Educational level:						
Illiterate	12	16.0	12	16.0		
Read/write	10	13.3	14	18.7		
Basic	19	25.3	11	14.7	3.02	0.55
Secondary	27	36.0	30	40.0		
University	7	9.3	8	10.7		

(*) Statistically significant at p<0.05 *(U) Mann Whitney test*

Table (2): Types and levels of physical exercise practiced by patients in the osteoporosis and osteoarthritis groups

	Group				X^2	p-value
	Osteoporosis (n=75)		Osteoarthritis (n=75)			
	No.	%	No.	%		
Type of exercise:						
Walking	11	14.7	70	93.3	93.42	<0.001*
Cycling	0	0.0	2	2.7	Fisher	0.50
Gym	0	0.0	15	20.0	16.67	<0.001*
Physiotherapy	65	86.7	23	30.7	48.50	<0.001*
Adding another type of exercise to the exercise plan:						
1	74	98.7	55	73.3		
2+	1	1.3	20	26.7	19.99	<0.001*
Frequency of exercise (no. of days/week):						
Range	2.0-6.0		2.0-3.0			
Mean±SD	2.9±0.6		3.0±0.2		U=3.30	0.07
Duration of exercise (no. of minutes/day):						
Range	10.0-40.0		5.0-30.0			
Mean±SD	24.0±6.2		20.4±6.1		t=3.59	<0.001*
Exercise intensity (Borg scale):						
Range	2.0-7.0		3.0-9.0			
Mean±SD	4.4±1.3		5.6±1.5		t=5.26	<0.001*
Cumulative duration index:						
Range	90.0-810.0		60.0-630.0			
Mean±SD	393.6±162.2		270.6±118.4		H=21.23	<0.001*

(*) Statistically significant at p<0.05 (U) Mann Whitney test (t) Student t-test

Table (3): Scores of commitment, perceived self-efficacy, lack of barriers and benefits, and progress of exercise among patients in the osteoporosis and osteoarthritis groups

	Group				X^2	p-value
	Osteoporosis (n=75)		Osteoarthritis (n=75)			
	No.	%	No.	%		
Commitment to exercise score:						
Range	25.0-100.0		5.0-95.0			
Mean±SD	77.7±16.0		62.3±15.9		5.91	<0.001*
Perceived exercise self-efficacy score:						
Range	33.9-82.2		11.1-75.0			
Mean±SD	60.5±12.9		43.5±13.0		8.03	<0.001*
Perceived lack of barriers score:						
Range	41.1-78.6		42.9±85.7			
Mean±SD	63.7±6.9		61.5±9.5		U=3.56	0.06
Perceived exercise benefits score:						
Range	60.3-93.1		52.6-94.8			
Mean±SD	73.3±5.5		78.0±8.9		18.67	<0.001*
Progress:						
Limited	27	36.0	24	32.0		
Moderate	43	57.3	44	58.7	0.52	0.77
High	5	6.7	7	9.3		
Addition of extra exercise level						
Muscle stretching	20	26.7	50	66.7		
Muscle stretching plus strengthening exercise once a week	27	32.0	19	25.3	30.33	<0.001*
Muscle stretching plus strengthening exercise twice a week	31	41.3	6	8.0		

(*) Statistically significant at p<0.05 (U) Mann Whitney test

Table (4): Correlation matrices of various scores of patients in the osteoporosis and osteoarthritis groups

	Pearson correlation coefficient					
	Osteoporosis group n=75			Osteoarthritis group n=75		
	Commitment to plan score	Exercise self-efficacy score	Lack of barriers score	Commitment to exercise score	Exercise self-efficacy score	Lack of barriers score
Exercise self-efficacy score	0.593**	-	-	0.404**	-	-
Lack of barriers score	0.549**	0.599**	-	0.085	0.278*	-
Exercise benefits score	0.490**	0.603**	0.187	0.156	0.420**	0.069

(**) Statistically significant at p<0.01

Table (5): Best fitting multiple linear regression models for scores of commitment to exercise in the osteoporosis and osteoarthritis groups

	Beta coefficients			t-test	p-value
	Unstandar-dized	Standard error	Standardized		
Osteoporosis group					
Constant	39.49	19.33	39.49	2.042	0.045*
Age (years)	-0.52	0.20	-0.52	-2.589	0.012*
Self-efficacy score	0.47	0.14	0.47	3.441	0.001*
Lack of barriers (score)	0.59	0.26	0.59	2.331	0.023*
	r-square: 0.46 Model ANOVA: F=20.28, p<0.001 Variables excluded by model: sex, education, marital status				
Osteoarthritis group					
Constant	40.74	5.97		6.828	<0.001*
Self-efficacy score	0.50	0.13	0.40	3.774	<0.001*
	r-square: 0.16 Model ANOVA: F=14.24, p<0.001 Variables excluded by model: age, sex, education, marital status				

4. Discussion

Despite recent pharmacologic advances in the prevention and treatment of osteoporosis and osteoarthritis, the diseases remain incurable. Effective disease management ultimately lies in the hands of the individual patient, who must take responsibility for key health behaviors related to bone and joint health **(Gold and Silverman, 2004).** Self-efficacy is a treatment-responsive mediator of illness and has been shown to improve the clinical outcome for patients with several types of chronic disease, including arthritis and osteoporosis **(Kligler and Lee, 2004).**

In order to make the comparisons between the two groups valid, their comparability regarding the factors that could affect commitment and self-efficacy was examined. They had similar age, educational level, and working status. However, the osteoporotic group had more women, and higher percentage of married subjects. This is expected given the known higher prevalence of osteoporosis among women in this peri-menopausal age group as indicated by **Sedlak *et al*. (2000)**. Similarly, **Al-Hussain (2007)** mentioned that osteoporosis is a growing health problem in Middle East, with one out of each three woman above fifty years of age suffering the disease. Additionally, the rate among women has been estimated to be twice that of men **(Bone and Joint Health Institute, 2010)**.

Concerning exercise practice, the current study findings demonstrated significant differences between osteoporosis and osteoarthritis groups. In the osteoporosis group, physiotherapy was the predominant type of exercise, while almost all osteoarthritis group patients were practicing walking. It was also noticed that more osteoarthritis patients were practicing more than one type of exercise. However, duration of exercises as minutes per day, cumulative duration index were significantly lower in the osteoarthritis group, with a more intense exercise perception. These differences between the two groups might be attributed to the presence of pain and fatigue as main barriers to exercise in osteoarthritis patients. In congruence with this, a number of studies confirmed that the disease-associated symptoms as pain and fatigue can pose obstacles to enhance physical activity in osteoarthritis **(Leveille *et al*, 2002, Avlund *et al*, 2003, Murphy *et al*, 2008)**.

The present study findings point to a higher commitment to exercise in both groups with significant differences between them, where osteoporotic patients had significantly higher scores of commitment and self-efficacy, osteoarthritis patients had higher perception of exercise benefits. These findings were in agreement with **Shin *et al***

(2006) who showed more commitment to exercise among women with osteoporosis, compared to those with osteoarthritis. This finding was explained by the absence of pain among osteoporotic patients, which is a hindering factor to commitment among osteoarthritis patients. This also might explain the higher percentage of osteoporotic patient who could increase their exercise level.

Therefore, the commitment to exercise noticed among patients in the present study, and their maintenance of regular exercise is a health seeking behavior fostered by their perception of self-efficacy (which was significantly higher in osteoporotic patient). This might explain the higher commitment among subjects in both groups, as self-efficacy turned to be an independent predictor for commitment regardless the type of disease. A number of previous studies have similarly revealed that self-efficacy was the best predictor variable for intention to exercise, a construct somewhat similar to commitment to regular exercise activity (**Wu and Pender, 2002). Shine *et al*, (2006),** also demonstrated that self-efficacy was the most influential variable on commitment to a plan for exercise. **Kim (2001)** interpreted this positive correlation between self-efficacy and commitment to exercise plan by the fact that highly self-efficacious individuals exert greater efforts to master health-promoting behavior. Moreover, a strong sense of efficacy enhances human accomplishment and personal wellbeing, and encourages setting challenging goals and maintain strong commitment to them **(Laffrey, 2000)**.

On the other hand, the self-efficacy may be secondary to their perceived benefits of exercise as showed in the present study that both groups achieved relatively high benefits score, although the osteoarthritis group had significantly higher mean compared to osteoporosis group. This might be referred to different beneficial effect of exercise in both groups especially those with osteoarthritis where the benefit is more noticeable as it may appear in the form of pain relief and more fitness to exercise, compared to the osteoporosis group patients who usually have no such complaints, which foster osteoarthritis patients to commit to regular exercise activity. These beneficial changes might also be responsible about increasing the self-efficacy among osteoarthritis patients. Thus, their perception of exercise benefit was positively correlated to their self-efficacy scores and not to commitment score as in osteoporosis patients. In agreement with these findings, a systematic review of randomized clinical trials of the effectiveness of exercise therapy in patients with knee osteoarthritis, the researchers found a small to moderate beneficial effect on pain, with a moderate to large beneficial effect on patient's global assessment of wellbeing **(VanBaar etal., 1999)**.

The present study showed no statistical significant difference between the two groups regarding perceived lack of barriers, while a strong positive correlation was revealed between perceived lack of barriers and self-efficacy in both groups. This was explained by **Kim (2001)** who stated that the highly self-efficious individual could persist longer in the face of obstacles to health promoting behavior. Moreover, the perceived lack of barriers to exercise as shown in the present study is an important factor contributing to compliance and commitment to exercise in osteoporosis group. This was evident in a review of the results of 38 explanatory and predictive studies that tested Health Promotion Model, the variables that were significant in predicting health promoting behaviors in over 60% of these studies included the perceived lack of barriers **(Pender *et al*, 2002)**, which was similar to the present study findings that lack of barriers was one of the independent predictors to commitment in osteoporosis group.

Additional predictors of commitment among osteoporosis patients were the younger age. The advancing age is certainly associated with more severity of the osteoporosis problems, in addition to more fatigue sensation, which may decrease patient's level of commitment to exercise. In agreement with this finding, a negative relationship between age and commitment to exercise plan was achieved by **Noel and Pugh (2002)** and **Kruger *et al* (2005).** Our findings were also in congruence with the Rosenstock's Health Belief Model (HBM), which proposes that perceived benefits and barriers to action and self-efficacy were among factors influencing illness-preventing behavior **(Sedlak *et al*., 2000)**.

Conclusion and Recommendations

The current study findings lead to the conclusion that perceived exercise self-efficacy is a major influential factor associated with commitment to exercise in both osteoporosis and osteoarthritis patients. Moreover, patient's scores of commitment to exercise, self-efficacy, perception of lack of barriers, and benefits from exercise are positively inter-correlated.

Therefore, it is recommended that the heath care professionals should adopt strategies for enhancing patients' self-efficacy through motivational counseling, which would lead to more effective health promotion programs for patients with osteoporosis and osteoarthritis. Perceived barriers to exercise should be given a special attention in counseling these patients. Tailoring exercise interventions to meet different needs and perceptions of the patient with osteoporosis and osteoarthritis, which can be of help in reducing these barriers.

Corresponding author
Hanan, S. A
Dept. of Medical Surgical Nursing, Ain Shams University, Egypt
*saharyassien@yahoo.com

Refrences

Al-Hussain H. (2007): Osteo-news: A Review of Osteoporosis Action in the Middle East & North Africa. International Osteoporosis Foundation. Third Osteoporosis Day, Bone & Joint Decade Events, Orthopedic Surgeons' Initiative: A call to arms to improve osteoporosis care. Winter 2007 - Dubai. Issue No. 16

American Academy of Physical Medicine and Rehabilitation, (2010): President Bush Proclaims 2002-2011 Bone and Joint Decade. Available at: www.aapmr. org/condtreat/bone and jointdecade.htm

Avlund K., Vass M., and Hendriksen C. (2003): Onset of mobility difficulty among community-dwelling old men and women: the role of tiredness in activities. Age Ageing; 32: 579–84.

Bandura A. (1997): Self-efficacy: The exercise of control. New York: Freeman & Co.

Bone and Joint Health Institute (2010): Life is movement: taking care of your bone and joint. www.alberaboneandjoint.com/prevention.asp:

Close J.C.T., and Glucksman E. (2000): Falls in the elderly: what can be done? The Medical Journal of Australia; 173: 176–177.

Gold T.D., and Silverman S.L. (2004): Osteoporosis Self-management: Choices For Better Bone Health. Southern Medical Journal; 97(6).

Jang H.J., and Shin Y.H. (1999): The cultural verification and psychometric evaluation of the exercise benefits/barriers scale for Korean adults with chronic disease. Seoul, Korea: Paper Presented at the Meeting of the First Asian–Pacific Nursing Congress Conference.

Kim I.J. (2001): The differences of exercise-specific perceptions according to exercise stage among patients with osteoarthritis. Journal of Rheumatology Health; 8: 336–345.

Kligler B., and Lee R. (2004): A new definition of patient centered Medicine. Integrative Medicine: Principles for practice. Mc Grow Hill Companies, p76. Chapter writer Galland L.,

Kruger J., Galuska D.A., Serdula M.K., and Kohl H.W. (2005): Physical Activity Profiles of U.S. Adults Trying to Lose Weight: Medicine and Science in Sports and Exercise. American College of Sports Medicine; 37(3):364-368.

Laffrey S.C. (2000): Physical activity among older Mexican American women. Research in Nursing & Health; 23: 383–392.

Leveille S.G., Fried L., and Guralnik J.M. (2002): Disabling symptoms: what do older women report? J Gen Intern Med; 17: 766–73.

Maalouf G., Gannagé-Yared, M.H., Ezzedine, J., Larijani, B., and Badawi S., (2007): Middle East and North Africa consensus on osteoporosis. J Musculoskeletal Neuronal Interact; 7(2):131-143

Mar J. (2004): The role of exercise in osteoporosis prevention: an educational module for clinicians. Master Thesis of Nursing. University of Arizona.USA.

McAuley E., Lox C., and Duncan T.E. (1993): Long-term maintenance of exercise, self-efficacy, and physiological change in older adults. Journal of Gerontology: Psychological Sciences;48: 218–224.

Murphy S.L., Smith D.M., Clauw D.J., and Alexander N.B. (2008): The impact of momentary pain and fatigue on physical activity in women with osteoarthritis. Arthritis Care & Research; 59: 849–856.

NIH Consensus Development Panel on Osteoporosis Prevention, Diagnosis, and Therapy (2001): Osteoporosis prevention, diagnosis, and therapy. JAMA; 285:785-795.

Noel P.H., and Pugh J.A. (2002): Management of overweight and obese adults. Br. Med. J ; 325:757-761

North American Menopause Society. (2002): Management of postmenopausal osteoporosis: Position statement of the North American Menopause Society. Menopause; 9(2): 84-101

Pender N.J. (1996): Health promotion in nursing practice. 3rd ed., Stamford, CT: Appleton & Large.

Pender N.J., and Murdaugh C., Parsons M.A. (2002): Health Promotion in Nursing Practice, forth ed. Upper Saddle River, NJ: Prentice-Hall Health, Inc.

Sechrist K.R., Walker S.N., and Pender N.J. (1987): Development and psychometric evaluation of the exercise benefits/barriers scale. Research in Nursing & Health; 10:357–365.

Sedlak C.A., Doheny M.O., and Jones S.L., (2000): Osteoporosis education programs: changing knowledge and behaviors. Public Health Nursing; 17: 398–402.

Shin Y.H., Jang H.J., and Pender N.J. (2001): Psychometric evaluation of the exercise self-efficacy scale among Korean adults with chronic disease. Research in Nursing and Health;24: 68–76.

Shin Y.H., Pender N.J., and Yun S.K. (2003): Using methodological triangulation for cultural verification of commitment to a plan for exercise scale among Korean adults with chronic diseases. Research in Nursing and Health; 26: 312–321.

Shin Y.H., Hur H.K., Nola J., Jang H.J., and Kim M.S. (2006): Exercise self-efficacy, exercise benefits and barriers, and commitment to a plan for exercise among Korean women with osteoporosis and osteoarthritis. International Journal of nursing studies; (43):3-10

Spark N. (2010): Preventing osteoporosis. Osteoporosis Australia. www.osteporosis.org.au/osteo_prevention_exercise.php

Turner C.H., and Robling A.G. (2003): Designing exercise regimens to increase bone strength. Exercise and Sport Sciences Reviews; 31(1): 45-50.

VanBaar M.E., Assendelft W.J.J., Dekker J., Ostendorp R.A.B., and Bijlsma J.W.J. (1999): Effectiveness of exercise therapy in patients with osteoarthritis of the hip and knee: a systematic review of randomized clinical trials. Arthritis & Rheumatism; 42: 1361–1369.

World Health Organization (2002): World Health Report: Reducing the risks, promoting healthy life. Geneva: WHO. www.who.int/whr

Wu T.Y., and Pender N.J. (2002): Determinants of physical activity among Taiwanese adolescents: an application of the Health Promotion Model. Research in Nursing & Health; 25:25–36.

7/7/2011