Correlation of Knee Pain with Ratings of Perceived Exertion and Dyspnoea during Morning Walks in Persons with Osteoarthritis

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ABSTRACT

Exercise prescription in persons with osteoarthritis commonly includes morning walks. The exercise tolerance is taken into account when prescribing exercises. It is imperative to study the correlation of pain on the general exercise tolerance of persons affected by osteoarthritis. Thus, Correlating VAS with the perceived exertion and breathlessness will be useful. Borg's scale and its modified form are useful to rate the perceived exertion and Dyspnoea. It is also interesting to study the correlation of pain and thereby VAS if any with the ratings on the Borg's scale. The main objectives of this study are 1) To find the correlation between VAS and the Borg's scale and 2) To analyse the correlation between BMI with pain and Borg's scale. The results showed that correlation of age with pain scores was noted to be insignificant (p=0.989). Age showed no effect on the pain and with perceived breathlessness (p=0.732) and RPE (p=0.298).There was no significant differences between males and females in terms of pain scores, breathlessness and perceived exertion, (p>0.05). Pain scores and rating of perceived breathlessness. The pain scores showed significant positive correlation with the rating of perceived breathlessness (p=0.000). The pain scores showed significant positive correlation with the rating of perceived exertion (p=0.002). BMI showed positive correlation with pain scores, breathlessness and RPE (p=0.000).

Key words: Osteoarthritis, pain, exercise tolerance

INTRODUCTION

In today's life, physical exercises are emphasized to combat obesity, conditions such as diabetes, stress and other problems. Morning walks are most preferred form of exercises for adults in urban life. The habit, though not new is popularly adopted when a person comes across a warning sign in any of the health issues. It is considered a powerful weapon to maintain good health in adults until any inhibition sets into the person's life. Knee pain is one such disastrous ailment. Bookwala et al (2003) stated that knee injury threatens an individual's ability to perform daily tasks as well as regular aerobic exercise.

Osteoarthritis is a common cause of knee pain and discomfort in older adults. It is one of the most disabling conditions affecting a person's lifestyle and independence. World Health Organization as reported by Vad et al (2002) inferred that knee osteoarthritis is the fourth most common cause of disability in all women and the eighth in men. Knee pain restricts mobility thereby placing concern on general health issues and physical fitness. It influences the prognosis

of systemic health conditions. Pain is evaluated with Visual Analog Scale for all practical purposes.

Osteoarthritis is a preferred topic of study for many clinicians. Modes of conservative management mainly include drugs and physiotherapy. Surgery is advised in advanced cases with marked degeneration and pain. In both conservative and postoperative cases, physiotherapy targets at pain relief, restoration of joint functions and optimisation of mobility.

Apart from the clinical management, persons affected with knee osteoarthritis commonly continue their existing habit of morning walk. Some adopt it upon the clinician's advice for weight management and for maintaining general health. According to the American College of Sports Medicine (ACSM's Guidelines, 2000), a physically active lifestyle combined with moderate cardiorespiratory fitness has been shown to lower the risk of developing chronic diseases such as coronary artery disease, hypertension, obesity, osteoporosis, type II diabetes, and some forms of cancer.

In case of osteoarthritis, pain induces stress, discomfort and affects general endurance inducing early fatigue. In addition, hips, ankle and the trunk take up additional load to compensate deficiencies at the knee joints, thereby leading to abnormal muscle action and early fatigue. This inhibitory effect of pain on exercise tolerance lowers the intensity and frequency of the exercise program especially in case of home aerobic exercise schedules. In other words, it can be understood that pain limits exercise, therefore inhibiting sufficient activity vital for good health and prevention of life threatening ailments. In such circumstances, it is highly imperative to study the correlation of pain on the general exercise tolerance of affected persons by correlating VAS with the perceived exertion and breathlessness. Borg's scale and its modified form are useful to rate the perceived exertion and Dyspnoea. It is also interesting to study the correlation of pain and thereby VAS if any with the ratings on the Borg's scale.

The main objectives of this study are 1) To find the correlation between VAS and the Borg's scale and 2) To analyse the correlation between BMI with pain and Borg's scale. The null hypothesis of the study is that VAS does not have any correlation with the Borg's scale and BMI does not have correlation with pain and Borg's scale.

LITERATURE REVIEW

The study by Felson et al (1987) investigated the prevalence of osteoarthritis (OA) of the knee in elderly subjects. Radiographic evidence of OA increased with age, from 27% in subjects younger than age 70, to 44% in subjects age 80 or older. There was a slightly higher prevalence of radiographic changes of OA in women than in men (34% versus 31.This study extends current knowledge about OA of the knee to include elderly subjects, and shows that the prevalence of knee OA increases with age throughout the elderly years. Badley (1995) stated that Osteoarthritis (OA) is the primary cause of long-term disability and is ranked second among all pathologies that result in reduced physical activity. The epidemiology of knee osteoarthritis in India was studied by Bhan (2002). Common stage of presentation of osteoarthritis of major joints of hip

and knee was reported to be more than 40-50 years. Knee osteoarthritis is common in women than in men.

Symmons et al (2000) described osteoarthritis as a condition characterized by joint pain, tenderness, limitation of movement, crepitus, occasional effusion, and variable degrees of local inflammation. The pathological condition is characterised by erosion of articular cartilage within synovial joints, associated with hypertrophy of bone. Histologically, the disease is characterized early by fragmentation of the cartilage surface, cloning of chondrocytes, vertical clefts in the cartilage, variable crystal deposition, remodeling, and eventual violation of the tidemark by blood vessels.

Altman et al (1986) provided the classification of OA of the knee. The factors, viz, knee pain for most days of prior month, crepitus on active joint motion, morning stiffness # 30 min in duration, age more than 38 years and bony enlargement of the knee on examination were taken as criteria to classify and report osteoarthritis.

The American Thoracic Society as referred by Enright(2003) has issued guidelines for the 6-minute walk test (6MWT). The 6MWT is safer, easier to administer, better tolerated, and better reflects activities of daily living than other walk tests (such as the shuttle walk test). The primary measurement is 6-min walk distance (6MWD), but during the 6MWT data can also be collected about the patient's blood oxygen saturation and perception of dyspnoea during exertion.

Thomas et al (2003) compared physical activity levels in men and women with end-stage knee osteoarthritis to those of a comparison group and to examine the relationship between physical activity level and physical performance. Performance measures included fast self-paced walk test, timed up-and-go test, and a timed stair performance measure

Hulens et al (2003) assessed the presence of medical conditions that might interfere with walking; the differences in walking capacity, perceived exertion and physical complaints between lean, obese and morbidly obese women; anthropometric, physical fitness and physical activity variables that contribute to the variability in the distance achieved during a 6-minute walk test in lean and obese women. A 6-minute walk test was performed and heart rate, walking distance, Borg rating scale of perceived exertion (RPE) and physical complaints at the end of the test were recorded. Morbidly obese women (BMI > 35 kg m(-2)N = 133) walked significantly slower than obese and lean women, were more exerted (RPE 13.3, 12.8 and 12.4, respectively, $P < 0.05$) and complained more frequently of dyspnea (9.1%, 4.7% and 0% resp., $P < 0.05$) and musculoskeletal pain (34.9%, 17.7% and 11.4% resp., $P < 0.05$) at the end of the walk. Advice or programs aimed at increasing walking for exercise also need to address the conditions that interfere with walking, as well as perceived symptoms and walking difficulties in order to improve participation and compliance.

Marks (2007) identified the prevalence of overweight among community-dwelling adults diagnosed as having knee osteoarthritis (OA) and the relationship between the weight status of these individuals, selected disease-related outcomes, and disease progression. At least 80% of all present cohorts were overweight or obese. Those with higher BMIs reported more pain than

those with lower BMIs ($p < 0.05$) and pain was related to perceived physical exertion ($p < 0.05$). It was concluded that a high body mass is present in most adults with knee OA. Moreover, being overweight may affect knee joint impact rates and pain incrementally. Having high body weights may heighten the risk for bilateral knee joint, as well as hip joint, OA.

DESIGN

A sample of 50 persons with the age of 45-60 years suffering from knee osteoarthritis engaged in morning walks at least thrice a week were selected randomly after they fitted into the mild to moderate variety of osteoarthritis in accordance to the American academy of rheumatology criteria for osteoarthritis. Persons with any major trauma or surgeries at knee or lower limbs were excluded from the study. Persons with known heart ailments, hypertension, knee deformities and respiratory conditions were excluded from the study. Subjects who took analgesics for past 1 day were excluded from the study. After excluding the above, the remaining number for the study was 38.The number of males and females was 20 and 18 respectively. Informed written consent was obtained from all the subjects. The study involved single sample and single test.

Method: The entire subjects ready for morning walk were given a questionnaire to fill in before starting the test. The questionnaire was used to collect 1) general information of the subjects including name, age, sex, height and body weight 2) Measurement of pain by Visual analog scale (10 cms) marked with 0 cms as no pain and 10cms as intolerable pain 3) Borg's scale to be marked by the subject after the 6 minute walk test for the rating of perceived exertion 4) modified Borg's scale to be marked by the subject after the 6 minute walk test for the rating of perceived breathlessness The subjects were explained instructions on the six minute walk test to be performed. After the 6 minute walk test was performed, the subjects were allowed to enter the ratings related to the perceived exertion and breathlessness on their own form.

DATA ANALYSIS

Pearson's correlation was used to correlate the ratings of visual analog scale with the rating of perceived exertion and the rating of dyspnoea (breathlessness). Summary of data relating to the descriptive of age, pain scores, exertion and dyspnoea was analysed. Correlation was individually analysed between the BMI, age and VAS, ratings of perceived exertion and perceived breathlessness. Individual descriptive of males and females was analysed. Comparison between males and females in respect to the ratings on the Borg's and modified Borg's scale was done by independent T test.

RESULTS

The descriptive data showed that the range of age of subjects was 47 years to 60 years with a mean 53.65 and standard deviation 3.82 (Table 1). The subjects were generally in the age where the condition is in the initial phase not requiring surgical management. This is a group where physical therapy is recommended to prevent deterioration and to maintain fitness. Physical

activity is emphasized and weight reduction is advised at this stage to prevent early degeneration and reduce load upon the joints. Morning walks form an important constituent of conventional management at this stage. The mean of BMI of the subjects was found to be 29.84, representing the overweight category. Pain on VAS ranged from 3 to 7 with mean 4.97 inferring that the sample suffered from moderate pain in general. The mean of perceived breathlessness was 4.86. The mean of rating of perceived exertion was 13.76

Variable 1=Age, Variable 2=Sex, Variable 3=Pain, Variable 4=Breathlessness, Variable 5=Rating of perceived exertion, Variable 6=BMI

Descriptive Statistics (Table 1)

	N	Minimum	Maximum	Mean	Std. Deviation
VAR00001	38	47.00	60.00	53.6579	3.82931
VAR00003	38	3.00	7.00	4.9737	.99964
VAR00004	38	3.00	8.00	4.8684	1.01798
VAR00005	38	10.00	18.00	13.7632	2.36454
VAR00006	38	22.00	41.00	29.8421	5.10181
Valid N (listwise)	38				

Correlations

		VAR00003	VAR00004	VAR00005	VAR00006
VAR00003	Pearson Correlation	1	.660**	.478**	.630**
	Sig. (2-tailed)		.000	.002	.000
	N	38	38	38	38
VAR00004	Pearson Correlation	.660**	1	.627**	.698**
	Sig. (2-tailed)	.000		.000	.000
	N	38	38	38	38
VAR00005	Pearson Correlation	.478**	.627**	1	.844**
	Sig. (2-tailed)	.002	.000		.000
	N	38	38	38	38
VAR00006	Pearson Correlation	.630**	.698**	.844**	1
	Sig. (2-tailed)	.000	.000	.000	
	N	38	38	38	38

Correlations

		VAR00003	VAR00004	VAR00005	VAR00006
VAR00003	Pearson Correlation	1	.660**	.478**	.630**
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VAR00004	Pearson Correlation	.660**	1	.627**	.698**
	Sig. (2-tailed)	.000		.000	.000
	N	38	38	38	38
VAR00005	Pearson Correlation	.478**	.627**	1	.844**
	Sig. (2-tailed)	.002	.000		.000
	N	38	38	38	38
VAR00006	Pearson Correlation	.630**	.698**	.844**	1
	Sig. (2-tailed)	.000	.000	.000	
	N	38	38	38	38

		VAR00001	VAR00004	VAR00005	VAR00003
VAR00001	Pearson Correlation	1	.057	-.173	-.002
	Sig. (2-tailed)		.732	.298	.989
	N	38	38	38	38

**. Correlation is significant at the 0.01 level (2-tailed).

Descriptives (Table 3)

	VAR00002			Statistic	Std. Error
VAR00003	F	Mean		4.9444	.23532
		95% Confidence Interval for Mean	Lower Bound	4.4480	
			Upper Bound	5.4409	
		5% Trimmed Mean		4.9383	
		Median		5.0000	
		Variance		.997	
		Std. Deviation		.99836	
		Minimum		3.00	
		Maximum		7.00	

		Range		4.00	
		Interquartile Range		2.00	
		Skewness		.122	.536
		Kurtosis		-.145	1.038
	M	Mean		5.0000	.22942
		95% Confidence Interval for Mean	Lower Bound	4.5198	
			Upper Bound	5.4802	
		5% Trimmed Mean		5.0000	
		Median		5.0000	
		Variance		1.053	
		Std. Deviation		1.02598	
		Minimum		3.00	
		Maximum		7.00	
		Range		4.00	
		Interquartile Range		2.00	
		Skewness		.000	.512
		Kurtosis		-.671	.992
VAR00004	F	Mean		4.7222	.19479
		95% Confidence Interval for Mean	Lower Bound	4.3112	
			Upper Bound	5.1332	
		5% Trimmed Mean		4.7469	
		Median		5.0000	
		Variance		.683	
		Std. Deviation		.82644	
		Minimum		3.00	
		Maximum		6.00	
		Range		3.00	
		Interquartile Range		1.00	
		Skewness		-.110	.536
		Kurtosis		-.293	1.038
	M	Mean		5.0000	.26157
		95% Confidence Interval for Mean	Lower Bound	4.4525	
			Upper Bound	5.5475	
		5% Trimmed Mean		4.9444	
		Median		5.0000	
		Variance		1.368	
		Std. Deviation		1.16980	
		Minimum		3.00	
		Maximum		8.00	
		Range		5.00	
		Interquartile Range		1.75	
		Skewness		.877	.512
		Kurtosis		1.167	.992

VAR00005	F	Mean		14.0556	.59118
		95% Confidence Interval for Mean	Lower Bound	12.8083	
			Upper Bound	15.3028	
		5% Trimmed Mean		14.0617	
		Median		14.0000	
		Variance		6.291	
		Std. Deviation		2.50816	
		Minimum		10.00	
		Maximum		18.00	
		Range		8.00	
		Interquartile Range		4.25	
		Skewness		.106	.536
		Kurtosis		-1.140	1.038
	M	Mean		13.5000	.50524
		95% Confidence Interval for Mean	Lower Bound	12.4425	
			Upper Bound	14.5575	
		5% Trimmed Mean		13.5000	
		Median		14.0000	
		Variance		5.105	
		Std. Deviation		2.25948	
		Minimum		10.00	
		Maximum		17.00	
		Range		7.00	
		Interquartile Range		3.75	
		Skewness		.061	.512
		Kurtosis		-.969	.992
VAR00006	F	Mean		29.8889	1.29577
		95% Confidence Interval for Mean	Lower Bound	27.1551	
			Upper Bound	32.6227	
		5% Trimmed Mean		29.7654	
		Median		30.0000	
		Variance		30.222	
		Std. Deviation		5.49747	
		Minimum		22.00	
		Maximum		40.00	
		Range		18.00	
		Interquartile Range		8.50	
		Skewness		.170	.536
		Kurtosis		-.768	1.038
	M	Mean		29.8000	1.08725
		95% Confidence Interval for Mean	Lower Bound	27.5244	
			Upper Bound	32.0756	
		5% Trimmed Mean		29.5556	
		Median		28.0000	

	Variance	23.642	
	Std. Deviation	4.86231	
	Minimum	23.00	
	Maximum	41.00	
	Range	18.00	
	Interquartile Range	8.25	
	Skewness	.831	.512
	Kurtosis	-.116	.992

Chart 2

Age

Correlation of age with pain scores was noted to be insignificant (p=0.989). Age showed no effect on the pain scores. In addition, it was also noted that age no significant correlation with perceived breathlessness (p=0.732) and RPE (p=0.298). The range of exertion levels perceived by persons of similar age groups was wide and no trend was observed.

Sex

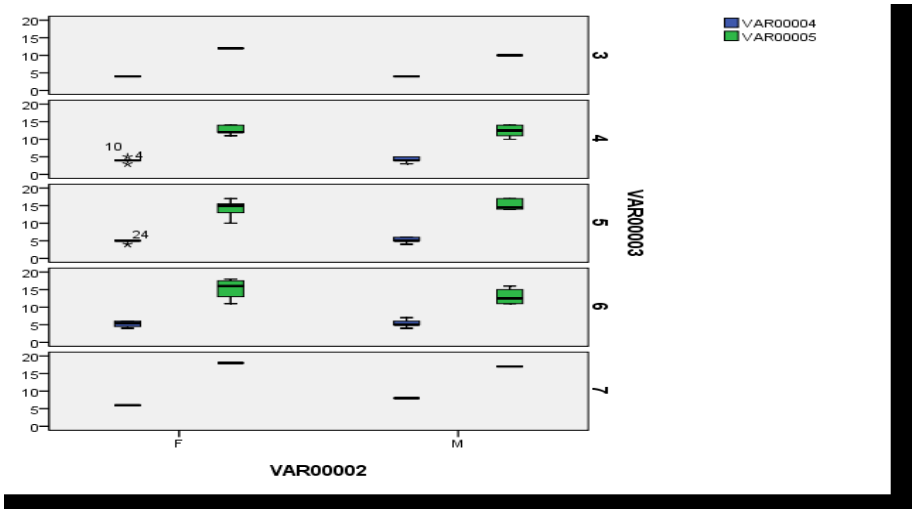
There was no significant differences between males and females in terms of pain scores, age and BMI (p>0.05) as shown in table 3. When rating on breathlessness and perceived exertion was compared, the sex did not show significant effect. Chart 4 shows perceived exertion and dyspnoea in the two sexes, the sexes exhibited only minor differences

Table 3- Independent T test for analysis of differences between the values of males and females

Variable	p value	Remarks
Age	0.245	Not significant

Pain	0.866	Not significant
Dyspnoea	0.408	Not significant
Exertion	0.477	Not significant
BMI	0.777	Not significant

Observations of perceived exertion and breathlessness in males and females - Chart 4



Pain scores and rating of perceived breathlessness (dyspnoea) and the rating of perceived exertion (RPE).

The mean of pain score was observed to be 4.97.The mean of perceived breathlessness was noted to be 4.86. The pain scores showed significant positive correlation with the rating of perceived breathlessness (p=0.000). The mean of ratings of perceived breathlessness was noted to be 13.76. The pain scores showed significant positive correlation with the rating of perceived exertion (p=0.002). Chart 1 shows the exertion range perceived at individual pain scores by the subjects. Number of subjects experiencing the pain scores and related exertion levels is also shown in the chart. It gives an impression of a correlation. Chart 2 shows the age groups with the ranges of exertion levels. The chart depicts no correlation. Chart 3 shows the ratings of perceived dyspnoea with various pain scores. The chart depicts relation of exertion and dyspnoea with pain scores. Chart 5 shows the pattern of the 3 variables in the subjects. The graph exhibits similarity in patterns of pain, exertion and dyspnoea.

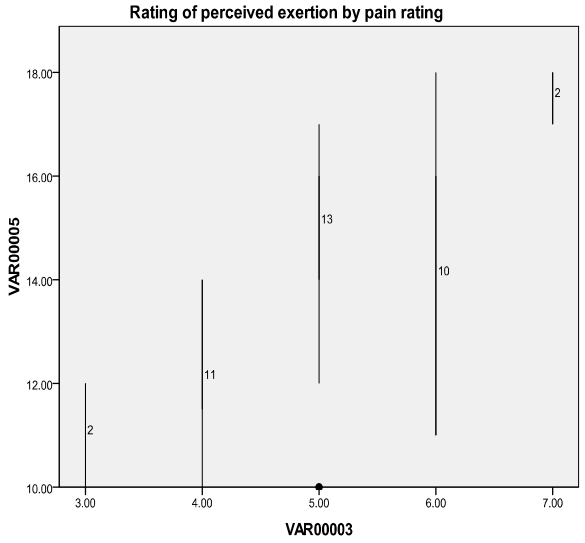


Chart 1

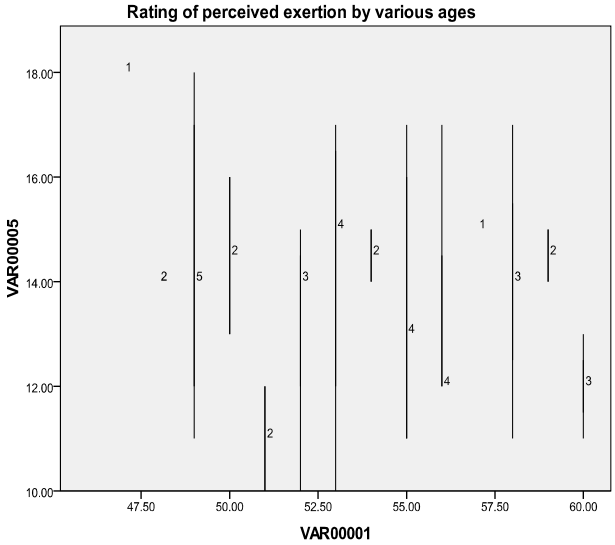


Chart 2

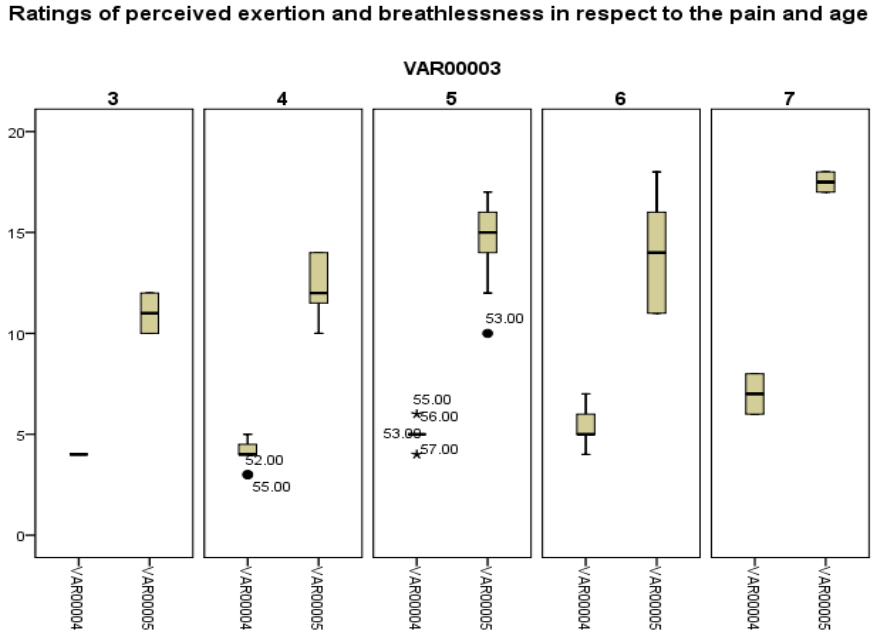


Chart 3

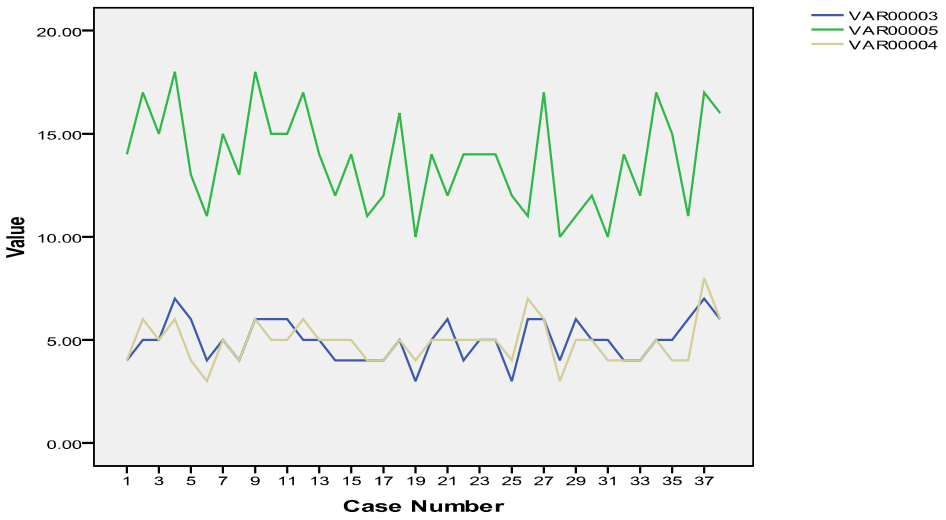


Chart 5 (Individual ages in relation to pain, breathlessness and RPE-Chart 5)

BMI

The mean of body mass index of subjects was found to be 29.84. BMI showed positive correlation with pain scores, breathlessness and RPE (p=0.000). Body mass index however did not have significant correlation with age and sex.

DISCUSSION

It was understood from the observations that age did not have significant correlation with pain, exertion and dyspnoea. The age group of 45-60 years showed variation in exertion scores perceived by them. It was also noted that even sex did not show any correlation with any of the other variables. The range of other variables was also wide among both the sexes. It was observed that pain showed a significant correlation with perceived breathlessness and exertion in both the sexes. Also, BMI showed correlation with the perceived rate of exertion.

It is well known that Borg's scale is used to determine the amount of exertion perceived based on which exercise limits are explained. This is much so in the cases where home exercise programmes are explained with an alert of perceived exertion used to set exercise limits. With the above observations, it is understood that apart from the BMI which is correlated with exertion perceived, the pain perception is a crucial factor to be considered. Apart from the additional efforts and work done by muscles of other joints as a compensatory mechanism, pain may erroneously morph lower exercise tolerance or cardiovascular endurance as the pain shadows on a person's overall tolerance to stress, physical exercise not being an exception. It may influence the exercise performance; restrict exercise schedules in terms of intensity and time of exercise therefore affecting the entire health of a person. Borg's score may have an apparent difference in presence of pain as compared to the absence of pain. Keen et al (1999) studied how

individuals with low back pain perceived physical activity. According to responses, the participants viewed physical activity as "activities of daily living, activities causing breathlessness that they went out of their way to do, and more competitive-type activity." Each participant underwent treatment that successfully reduced their low back pain. However, participation in physical activity following treatment was hindered by fear of pain. As recommended by Ettinger and Afable (1994), further research examining psychosocial factors as modifiers of the relationship between disease and disability in the elderly with OA is worthy. It is worthy to study pain as a psycho- physical barrier for exercise performance and a challenge for exercise prescription. Physical activities to enhance pain reduction is a favourite research till date, now it is time to understand the converse relation, viz, pain reduction to enhance exercise performance. Ettinger recommended better treatment strategies for osteoarthritis and patellofemoral syndrome, as well as other joint pains, to be developed to help assuage patients' fears and encourage them to continue physical activity without worrying about pain or re-injury. National pain coordination committee (2000) has focussed on the status of pain to be considered as the 5^{th} vital sign. It stated that vital signs are taken seriously. If pain were assessed with the same zeal as other vital signs are, it would have a much better chance of being treated properly. This study supports the findings of previously done studies stating the importance of effects of pain on daily exercise programmes and that it should not be neglected in case of persons with osteoarthritis.

Further research is required on this aspect as the present study has a limitation of being a single test study which not followed up by a second test after pain relief.

CONCLUSION

Borg's scale may be affected with the pain scores in persons with osteoarthritis. It is crucial to understand that though the ratings on Borg's scale are very practical to be applied for exercise prescription, the scores may be attributed to pain scores also. It is also imperative to give importance to the management of knee pain if the general cardiovascular health of a person is to be restored.

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