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Comparison between genders for trunk mobility in normal adults: A cross sectional study

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***Abstract*---**Introduction: There are multiple factors which can affect spinal range of motion such as medical conditions, pelvic asymmetry age, sex, race and geographical distribution etc. Aim: The present study aims to assess the differences between genders for trunk mobility in normal adults. Material & methods: In this cross sectional study, 137 subjects (71 females and 66 males) were included for 6 months from various institutes of Sumandeep Vidyapeeth and assessed using Tape method and goniometry for trunk mobility in all planes (sagittal, frontal and transverse) for forward flexion with and without stabilization, extension, lateral flexion and rotation to both the sides and their gender specific differences were calculated using students t test. Result: The mean values by tape method and goniometry for all movements (flexion with and without stabilization, extension, lateral flexion to both the sides and rotation to both the sides) have been given in form of descriptive statistics in the table. There was no statistically significant difference for all spinal movements among the genders, except in lateral flexion (p value 0.009 & 0.008) and rotation (p value 0.023 & 0.004) where females had greater mobility than males. Conclusion: The study concluded that females are more mobile compare to males especially in lateral flexion and rotation of the trunk. For other movements, males are comparable to females.

***Keywords*---**Trunk mobility, gender mobility, spine range of motion, goniometry, tape method.

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Introduction

Bending and twisting motion of spine is essential for activities of daily living.[1] Trunk kinematics is important in sustaining body equilibrium..[2]The core of physical therapy is to assess and evaluate the range of motion. The measurement of motion has the advantage of being more objective and quantifiable than the assessment of subjective measures such as pain and its correct interpretation can have a significant role in the scientific basis of therapeutic interventions.[3,4]

The normative values of spinal range of motion are essential for apt diagnosis of spinal disabilities as well as for evaluation of interventional outcome. [5] Most of the studies listed [6,7,8] evaluate the movement in the sagittal plane, some in the coronal plane, while very few have considered horizontal plane movement. It is also necessary to investigate motion in the coronal plane where regularity, symmetry and restraint parameters together constitute individual intervertebral motion phenotypes.[9,10]

As The nature of flexibility is complex, involving not only the range of motion of a joint or series of joints but it is affected by internal influences such as the type of joint, the elasticity of muscle tissues, tendon, ligaments, and the skin and also by external influences such as age, gender, the stage in the recovery process of a joint, time of the day. Egwu et al summarized factors such as medical conditions; pelvic asymmetry age, sex, race and geographical distribution are determinants of joint ROM. Thus, there should be age and gender specific Spinal ROM values for every population.[5,11]

Stanislav Peharec et al. used goniometer to measure spine flexion and extension analyzing mobility according to gender and age. They found no significant differences between men and women. They also analyzed spine measurements by using modified Schober method and compared lumbar spine flexion and extension values in healthy subjects according to gender. Results of this study showed higher flexion in men using Tape method and significan. [12]

Studies have shown some validity and reliability for extremity ROM measurements [13,14,15,16], whereas measurement for trunk motion has proven to be more difficult. These include the use of visual estimation, radiographs, inclinometers, spondylometers, fingertip-to-floor methods, goniometers, plumb lines, and tape measures. Due to existence of a multitude of techniques for measurement of back motion, not one method has been developed fully (i.e., its reliability and validity demonstrated) for clinical use.[17,18,19] Fitzgerald et al found high reliability for tape measure technique.[20] The goniometric method of measuring spinal mobility, though not most accurate, seems to be clinically accessible, objective and easy to use.[20] so, present study has taken tape method as well as goniometry measurement for measuring spine range of motion.

As discussed, few studies show more trunk mobility in females than males especially for rotations where as number of studies do not show any difference. [7,8,21,22] Therefore, gender roles in trunk mobility are still a topic of research. So in the present study an attempt has been made to compare between genders for trunk mobility in normal adults.

Materials and Methods

This cross sectional study was approved by Sumandeep Vidyapeeth Institutional Ethical Committee (SVIEC) for Ethical approval. The individual between 18 to 26 years of age and self declared healthy was approached from April 2013 to October 2013 to participate in the study. The subject was explained about the study procedure and if the subject is willing to participate in the study, informed consent was then obtained. A total 137 subjects (66 males & 71 females) for the study were recruited from three colleges- department of Pharmacy, College of Nursing and college of Physiotherapy of Sumandeep Vidyapeeth campus using a convenient sampling. Subjects who were having history of trauma, thoracic pain, past medical history of a malignanttumour, structural deformity, prolonged use of corticosteroids, drug abuse, immunosuppressant, HIV, any systemic disease, unexplained weight loss, any neurological diseases, fever were excluded. Demographic details were taken in form of age, gender, name, height, weight and brief history in all the subjects. All movements of the trunk were measured three times and an average of three was taken. For ROM measurement with tape[19,23], the following procedure was used (table/fig 1).

Thoracic and Lumbar Flexion and Extension

The subject was asked to stand erect with no lateral flexion and rotation at cervical, thoracic and lumbar spine. Marking of C7 and S1 spinous processes was done using skin marker. By aligning the tape, Distance between two marks was measured and recorded. The tape was held in place and the subject was asked to perform flexion and then extension (allowing the tape to accommodate the motion.). Hip and knee flexion was avoided. The distance was recorded once patient completes the motion. Discrepancy among the measurements indicated the amount of thoracic and lumbar flexion and extension.

Flexion with Stabilization

The subject was asked to stand erect with no lateral flexion and rotation at cervical, thoracic and lumbar spine. Subject's pelvis was stabilized by a belt which was attached with a wooden chair to prevent pelvic motion. Rest all Procedure was same as measuring flexion.

Thoracic and Lumbar Lateral Flexion

The subject was placed in standing position with the arms resting by the side and the distance between the tip of middle finger and the floor at the leg level was measured using tape.With both feet lying flat to the ground and knees in full extension, the subject was asked to arch sideways as much as possible. The distance was measured again and discrepancy was recorded.The same procedure was performed for the opposite side.

Thoracic and Lumbar Rotation

The subject was asked to be in sitting position keeping knees together and hip 90^0 flexed, arms placed across chest. For right rotation, Left posterior clavicular

Prominence to right greater trochanter was marked and measuring tape was placed. The subject was asked to sit erect and then turn to right side as much as he can. Initial and final distances were recorded. The same procedure was performed for the left side.
For ROM measurement with goniometer[20], the following procedure was used (table/fig 2).

Spinal Flexion and Extension

The subject was asked to be in erect standing position keeping feet shoulder width apart. The goniometer was aligned keeping the fulcrum at superior aspect of iliac crest while stationary arm and movable arm were placed perpendicular to the floor and parallel to midaxillary line respectively. The subject was then asked to bend forward and backward as far as possible for flexion and extension respectively keeping the knees extended. At the end of the maximum spinal motion attained by subject, the degrees of motion were recorded.

Flexion with Stabilization

The subject was standing erect with feet approximately shoulder-width apart. Subject's pelvis was stabilized by a belt which was attached with a wooden chair to prevent pelvic motion. Rest all procedure was same as measuring spinal flexion.

Lateral Flexion

Subject was positioned in erect standing keeping the feet shoulder-width apart, the fulcrum of goniometer was placed at the level of lumbosacral junction. The position of stationary arm was perpendicular to the floor while movable arm was positioned parallel to spine taking reference point of C7 spinous process. To keep the goniometer at eye level, the observer was sitting behind the subject. Then subject was asked to bend sideward as far as possible. The degrees of motion were recorded for both right and left side.

Thoracic and Lumbar Rotation

The subject was placed in sitting without back support, keeping the feet flat on the floor to stabilize the pelvis. The goniometer was aligned keeping the fulcrum over the center of cranial aspect of patient's head and the stationary arm was kept parallel to imaginary line joining both prominent tubercles of iliac crests. The movable arm was aligned parallel to line joining two acromion processes. Now the subject was asked to perform the motion. At the end of the rotation, the degrees of motion were recorded for both right and left side.

Statistical analysis

The data were analyzed using SPSS software (version 14). The difference between genders was assessed using students t test. The level of significance was kept at <0.05.

Result

Total participants were 137 out of which 66 were males (48%) and 71 were females (52%). The mean age of total participants was 20.42±2.32 (male-19.56, female-21.22) years and mean BMI of total participant was 20.94±4.03 (male-20.71, female-21.16) kg/m^2. The difference between genders was not statistically significant for BMI in the present study (P value 0.510). Table/fig 3 shows descriptive data of the study. It includes mean and standard deviation of all the movements taken with Tape measurement as well as Goniometer. Gender comparison shows statistical difference in lateral flexion for Tape method (p value 0.009 and 0.008) and rotation to both the sides for Goniometer (p value 0.023 and 0.004). For rest all movements, there wasn't any statistical difference. (Table/fig 4)

Tables & Figures

[Table/Fig 1] Measuring trunk movements by tape method

[Table/Fig 2] Measuring trunk movements by goniometry

[Table/Fig 3]
Mean, Standard deviation for different movements using both methods

Method	Variables	Mean (std. Deviation)
Tape measurement	Flexion Stabilization (cm)	6.95 (0.64)
	Flexion (cm)	9.59 (0.73)
	Extension (cm)	4.71 (0.51)
	Rt Lateral Flexion (cm)	17.28 (2.59)
	Lt Lateral Flexion (cm)	17.06(2.54)
	Rt. Rotation (cm)	5.49 (0.55)
	Lt. Rotation (cm)	5.38(0.55)
Goniometry	Flexion Stabilization (degrees)	74.68 (5.67)
	Flexion (degrees)	99.33 (5.53)
	Extension (degrees)	26.03 (3.29)
	Rt Lateral Flexion (degrees)	32.95 (3.38)
	Lt Lateral Flexion (degrees)	32.60 (3.44)
	Rt. Rotation (degrees)	41.93 (3.35)
	Lt. Rotation (degrees)	41.65 (3.39)

[Table/Fig 4]
Comparison of mean values between the genders using tape method & goniometry by student's t-test

Variables	Gender	Mean (SD)	P value	Mean (SD)	P value
		Tape method		Goniometry	
Flexion with stabilization	Males	6.89±0.62	0.310	74.90±5.59	0.670
	Females	7.01±0.67		74.48±5.78	
Flexion	Males	9.69±0.69	0.155	100.05±5.42	0.143
	Females	9.51±0.75		98.66±5.59	
Extension	Males	4.79±0.46	0.097	26.44±2.85	0.166
	Females	4.65±0.57		25.66±3.65	
Rt. Lateral flexion	Males	16.73±2.28	0.009*	33.11±2.96	0.613
	Females	17.87±2.79		32.82±3.75	
Lt. lateral flexion	Males	16.51±2.29	0.008*	32.76±2.98	0.621
	Females	17.65±2.68		32.46±3.85	
Rt. Rotation	Males	5.47±0.53	0.754	41.26±3.06	0.023*
	Females	5.51±0.59		42.55±3.51	
Lt. Rotation	Males	5.33±0.53	0.28	40.80±3.21	0.004*
	Females	5.43±0.59		42.44±3.37	

*Statistically significant difference at 0.05

Discussion

The purpose of present study was to compare gender differences for trunk mobility in normal healthy individuals. Total 137 participants were recruited for the study, which included 66 males & 71 females.

The mean BMI for the total population in the present study was 20.94 kg/m^2 which falls under normal range. Luca Vismara Et alfound that thoracic ROM was reduced in obese people during forward flexion and reasoned that obesity affects normal posture and due to that stiffness can occur.[24] As the mean value of the present study falls under normal range, the effect of BMI is possibly eliminated.

Sagittal plane movements

Flexion was measured with and without pelvic stabilization to observe the changes that occur due to movement of pelvis as it helps to increase the consistency of measurements.[25] The difference was not statistically significant between genders for flexion movement. This matches with the results of Egwu et al.[5]

In a study by J. M. H. Moll, the average spinal extension values were also similar.[26] He found extension to be more in males than females but the study consisted of participants in 15-24 years of age group with predominantly males. One more similar study who found that males are having more mobility than females took fewer females in their population. [21] In the present study, the difference was not statistically significant between males and females. However,

the ranges were lesser when compared to the normative values given by Kapandji and Batch.[20] Their age range was greater than this study.

Frontal plane movements

The mean value of lateral flexion in a study which was done only on females was higher than the present study.[25] Several studies [7,25,26] have shown that lateral flexion is more in females compared to males. In the current study, the difference was statistically significant in lateral flexion between males and females by tape method which could be due to, an artefactual effect arising from morphological differences, like a narrower waist and broader pelvis in the female.[26] One more study who investigated gender differences for spinal ROM showed more reduction in lumbar ROM in females than males. The possibility of reduction could be because of more lumbar curvature and high chances of low back pain in females compared to males.[7]

Transverse plane movements

Average rotation of 5.35 can occur at trunk which has been given by Margaret Frost et al which matches with present study.[19]Their method of measuring trunk rotation in sitting was similar to this study to measure rotation. However, Veronica et al assessed spinal rotation in three different positions and suggested that position can not affect the rotation.[25,27] A study done to compare genders for spine mobility concluded similar results. They justified it stating young females have more arch in back than males leading to more spinning of vertebrae which gives more rotation than males.[8]

This study has measured all the ranges of spine and compared between genders. No or little evidences are available which measures all the ranges in a single study. [7,8] This study has few limitations. The age range of subjects was very narrow. Also the study included only healthy individuals so possibility of generalizing it in all population becomes limited. The study can be done in future on larger population with different age groups to make it more generalized.

Conclusion

This study established a set of normal values for trunk mobility in healthy individuals. The difference between genders was not statistically significant for all movements except lateral flexion and rotation where females were found to have a significantly higher lateral flexion and rotation range of motion than males.

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Conflict of interest
Authors declare no conflict of interest

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NIL
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Purvi Patel: concept, data collection, manuscript writing
Lata Parmar: analysis and interpretation of data

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