Prevalence of Thoracic Kyphosis in Girls after Puberty in Cairo Governate

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ABSTRACT

This study was conducted to determine the prevalence of thoracic kyphosis in girls after puberty in Cairo Governate. 1800 girls after puberty participated in this study. They were selected randomly from the preparatory and secondary schools in Cairo on the following criteria: 900 girls from preparatory schools and 900 girls from secondary schools. Their ages ranged from 12 to 17 years old. Their thoracic kyphosis angle and thoracic inclination angle were measured by spinal goniometer. Duration of the study was 6 months from September 2010 to March 2011. The obtained results showed that the percentage of girls who had kyphotic angle <40° was 67.56 % and the percentage of girls who had kyphotic angle >40° was 32.44%. Accordingly, it can be concluded that the prevalence of thoracic kyphosis in girls after puberty in Cairo Governate is 32.44%.
Key words: Thoracic kyphosis, Puberty, Spinal Goniometer.

INTRODUCTION

Kyphosis is a curving of the spine that causes a bowing of the back, which leads to a hunchback or slouching posture[21]. Normal values for the thoracic kyphosis are between 20° and 40° of angulations When the curve of the thoracic spine exceeds this, it is described as either a postural kyphosis or Scheuermann's kyphosis[20].

There are several kinds of kyphosis: Postural kyphosis, the most common type, normally attributed to slouching can occur in both the old and the young. In the young, it can be called 'slouching' and is reversible by correcting muscular imbalances. In the old, it may be called 'hyperkyphosis' or 'dowager's hump'. About one third of the most severe hyperkyphosis cases have vertebral fractures. Otherwise, the aging body tends towards a loss of musculoskeletal integrity, and kyphosis can develop due to aging alone[13].

Scheuermann's kyphosis is significantly worse cosmetically and can cause pain. It is considered a form of juvenile osteochondrosis of the spine, and is more commonly called Scheuermann's disease. It is found mostly in teenagers and presents a significantly worse deformity than postural kyphosis[14].

In the early teens, during the period of rapid growth, posture and sitting habits often deteriorate making parents and gym teachers worry that the faulty posture may lead to back problems later in life. Posture was previously generally believed to be important in the pathogenesis of back pain, and in many countries routine school examinations of spinal configuration were based on this assumption. However, there are no studies showing that physiotherapeutic intervention improves the posture and reduces related problems, and screening is justified only if some type of intervention will reduce the risk of future back problems[7].

Adolescents who have a slouched posture that is corrected by "standing straight" usually have postural round back. Often seen in early adolescents, especially girls who are growing rapidly and developing secondary sexual characteristics, round back may reflect some degree of self-consciousness. However, with counseling and completion of physical and emotional maturation, postural round back often subsides. There is no bony problem[15].

Computer use was associated with changes in adolescent habitual postures and it is possible that these changes were due to a carry-over effect from temporary changes in posture during computer use. These changes varied between males and females, although reasons for this relationship are yet to be determined. The postural changes also tended to be consistent across sitting and standing, which may imply a greater impact on health. Therefore, computer use in adolescence may

alter developing neuromusculoskeletal systems[22].

Congenital kyphosis can result in infants whose spinal column has not developed correctly in the womb. Vertebrae may be malformed or fused together and can cause further progressive kyphosis as the child develops. Surgical treatment may be necessary at a very early stage and can help maintain a normal curve in coordination with consistent follow ups to monitor changes[19].

Nutritional kyphosis can result from nutritional deficiencies, especially during childhood, such as vitamin D deficiency (producing rickets) which softens bones and results in curving of the spine and limbs under the child's body weight[24].

Thoracic kyphosis represented by the traditional Cobb angle. Traditional Cobb perpendiculars were extended from lines drawn through superior landmark markings of T1 and inferior markings of T12. The resulting angle was measured from the intersection of the two perpendiculars[10].

The gold standard method for measuring the thoracic kyphosis is a standing radiograph. Using this method the Cobb, modified Cobb, computer assisted method for deriving radius of thoracic spine curvature, and thoracic vertebral centroid angles may be measured and calculated[3].

Within a clinical setting, a radiological investigation of the kyphosis would not generally be indicated and therefore, a reliable, simple and time efficient method of assessing the thoracic kyphosis would be beneficial in a given patient population. Spinal goniometers have been used in reliability investigations of range of movement and angular postures and potentially represent a method of measuring the thoracic kyphosis[17].

In females the onset of puberty comes with an increase in the hormone relaxin which affects the ligaments and muscles. As a result females have more ligamentous laxity than males, which associated with biomechanical changes seen during growth in the adolescent female, increasing the risk of ligamentous injury[4].

Kyphosis as a disease can be prevented by early detection of kyphosis as condition. Non operative management is usually successful when its main aim is the prevention of progression. By the time the condition has reached the point where correction is necessary to produce an acceptable end result, non operative methods often fail. Kyphosis is frequently missed on routine school physical examinations because it is not specifically looked for or because the examiners are not aware of the early physical findings. The most efficient and effective way for early detection is through school screening clinics in the 10 to 13 year age group[12].

SUBJECTS, MATERIAL AND METHODS

1800 girls after puberty participated in this study. They were selected randomly from the preparatory and secondary schools in Cairo on the following criteria: 900 girls from preparatory schools and 900 girls from secondary schools. Girls were using backpack either with or without complain. Girls with missing menstruation or primary amenorrhea, with structural problems and with spinal operation are excluded from this study. Duration of the study was 6 months from September 2010 to March 2011. Weight-Height Scale was used for measuring the body weight and height of each girl participating in the study to calculate the subject's body mass index. Spinal goniometer was used for measuring thoracic kyphosis angle (angle between T1 & T12) and for measuring kyphotic inclination angle fig. (1).
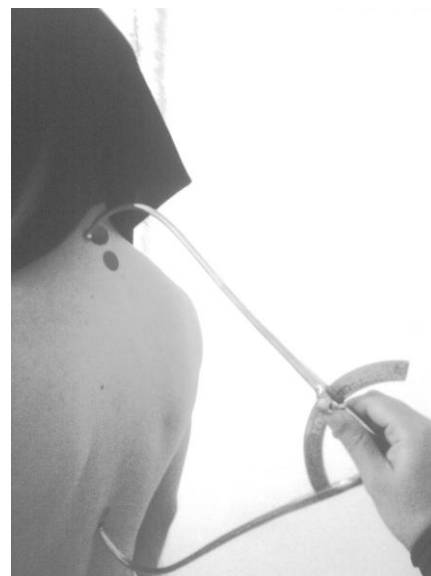

Fig. (1): Measurement of kyphotic angle.

Thoracic inclination is defined as angle between the vertical line and a plane across C7 to the level of the greatest thoracic prominence[5]. Measurement of thoracic inclination were taken in relaxed standing with girls adopting a natural posture after measurement of kyphotic angle using spinal goniometer on the level of the most prominent part f thoracic vertebrae.

The data had been collected and statistically analyzed by using descriptive statistics (mean, standard deviation and percentage).

RESULTS

A- Physical characteristics of the girls:

Their ages ranged from 12 - 17 yrs, with a mean value of 14.52 ± 1.686 yrs; their weight ranged from 41- 90 Kg, with a mean value of 58.99 ± 9.259 Kg; their height ranged from 140-189 cm, with a mean value of 157.21 ± 33.809 cm and their BMI ranged from 28.9- 40.742 Kg/m^2, with a mean value of 24.099 ± 3.478 Kg/m^2.

Table (1): Physical characteristics of the girls.

Variables	Minimum	Maximum	Mean	Std. Deviation
Age (yrs)	12	17	14.52	1.686
Weight (Kg)	41	90	58.99	9.259
Height (cm)	140	190	157.21	33.809
BMI (Kg/m^2)	28.9	40.742	24.099	3.478

B- Prevalence of kyphosis of girls after puberty in Cairo Governate:

Table (2) shows the prevalence of kyphosis of girls after puberty in Cairo Governate. The percentage of girls who had kyphotic angle <40° was 67.56 % and the percentage of girls who had kyphotic angle >40° was 32.44% fig (1).

Table (2): The prevalence of kyphosis in girls after puberty in Cairo Governate.

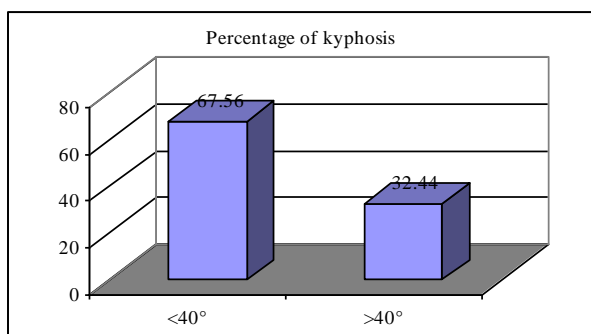| Kyphosis angle	No. of girls	Percentage
< 40°	1216	67.56 %
> 40°	584	32.44 %

Fig. (2): The prevalence of kyphosis in girls after puberty in Cairo Governate.

C- Percentage of kyphosis in Cairo preparatory and secondary schools:

In preparatory schools the percentage of girls who had kyphotic angle <40° was 72.89%

and the percentage of girls who had kyphotic angle >40° was 27.11%. In secondary schools the percentage of girls who had kyphotic angle <40° was 62.23% and the percentage of girls who had kyphotic angle >40° was 37.77%, table (3), fig (2 and 3).

Table (3): The percentage of kyphosis in Cairo preparatory and secondary schools.

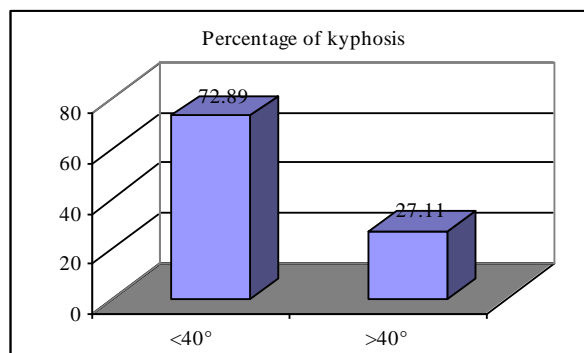| School	Kyphosis angle	No. of girls	Percentage
Preparatory	< 40°	656	72.89%
Preparatory	> 40°	244	27.11%
Secondary	< 40°	560	62.23%
Secondary	> 40°	340	37.77%

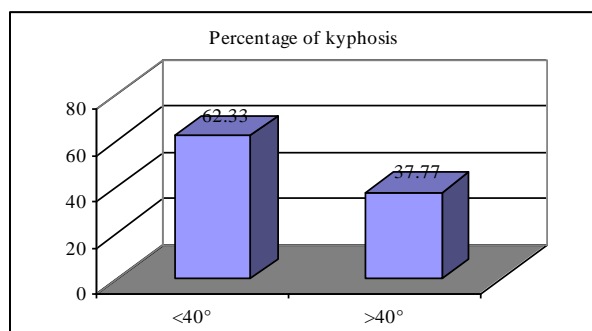*Fig. (3): The percentage of kyphosis in preparatory schools.*

Fig. (4): The percentage of kyphosis in secondary schools.

DISCUSSION

Postural kyphosis may be caused by poor posture during adolescence; tall teen hunches forward around peers, or female teen hunches forward to conceal breast development. Chronic spasticity of pectoralis major and minor and serratus anterior muscles or weak rhomboid major and minor muscles can cause postural kyphosis[23].

The analysis of the human back shape, especially in children and adolescents is very demanding because of the complex interaction between anatomical, muscular and psychological factors. To prevent spine deformities and posture asymmetries an early and objective diagnosis of posture changes is essential[2].

This was the first study in Egypt conducted to determine the prevalence of kyphosis in girls after puberty.

Normal values for thoracic kyphosis are between 20° to 40° of angulations, when the curve of the spine exceeds this; it is described as either postural kyphosis or Scheuermann's thoracic kyphosis[1].

The result of this study found that, the percentage of girls who had kyphotic angle <40° was 67.56 % and the percentage of girls who had kyphotic angle >40° was 32.44 %. So, the prevalence of thoracic kyphosis in girls after puberty in Cairo Governate was 32.44%.

The result of this study agreed with Lever, (1995)[16] who stated that the onset of significant spinal conditions generally occurs between 10 and 14 years, so early detection is important not only for students' physical well-being but also to prevent their extended school absence, potential social isolation, and altered self esteem, as well as decreasing fiscal impact for costly school accommodations and health treatment.

The result of this study agreed with Grieve, (1988)[11] who found that there were other variables related to age that were contributory to the thoracic kyphosis in females. They postulated the possibility of female poor posture and hormonal effects on soft tissues with resultant loss of muscle tone lead to increased kyphotic angle in females. It is also reasonable to postulate that the relative physical inactivity in females, probably related to occupation, may decrease the tone on the spinal ligaments and muscles. Also the presence of breasts may further accentuate the kyphotic curve in these females.

Also, Ohenba and Baron, (1996)[18] stated that adolescent girls with poor posture are at a greater risk of postural kyphosis which occurs to compensate the breast development in girls after puberty due to carrying heavy schoolbags, participating in competitive sports and wrong posture. Hence, Kyphosis can lead to serious health problems, such as physical deformity, breathing difficulties or damage to internal organs that are affected by the postural changes. So, it can be cured with early diagnosis.

The result of this study found that, the percentage of thoracic kyphosis in Cairo preparatory schools was 27.11% (kyphotic angle >40°). Also the percentage of thoracic kyphosis in Cairo secondary schools was 37.77% (kyphotic angle >40°).

The result of this study agreed with those of Cutler et al, (1993)[6] and Fon et al., (1980)[8] showed that the ranges of normal thoracic kyphosis and lumber lordosis are dynamic, progressing gradually with growth. During the juvenile and adolescence growth periods, thoracic kyphosis and lumber lordosis become more pronounced and take on more adult appearance.

On the other hand, in a study of 316 healthy subjects with ages ranging from 2 to 27 years done by Gerald and Michael (1980)[9], the upper limit of normal kyphosis was noted to be 45°. It was also noted that the average thoracic kyphosis increases with age from 20° in childhood, to 25° in adolescents, to 40° in adults, So the range of 20° – 40° that has been reported as a normal range for thoracic

kyphosis angle is inadequate because this range would have result in "false normal" in the younger age and "false abnormal" in the older age groups.

Conclusion

On the basis of the data obtained in the present study, we conclude that the prevalence of thoracic kyphosis in girls after puberty in Cairo Governate is 32.44%.

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الملخص العربي

معدل انتشار إنحناء العمود الفقرى فى الفتيات بعد البلوغ على مستوى محافظة القاهرة

أجريت هذه الدراسة لمعرفة معدل انتشار إنحناء العمود الفقرى فى الفتيات بعد البلوغ على مستوى محافظة القاهرة. وقد شارك فى هذه الدراسة ألف وثمانمائة فتاة. تم اختيارهن بشكل عشوائى من المدارس الإعدادية والثانوية فى محافظة القاهرة على النحو التالى: تسعمائة فتاة من طالبات المدارس الإعدادية وتسعمائة فتاة من طالبات المدارس الثانوية. تراوحت أعمارهن بين ١٢- ١٧ سنة . تم قياس زاوية انحناء الفقرات الصدرية وزاوية ميل الفقرات الصدرية بجهاز قياس إنحناء العمود الفقرى لجميع الفتيات. استغرقت هذه الدراسة مدة ستة أشهر: من سبتمبر 2010 الى مارس 2011 . وأوضحت نتائج الدراسة أن نسبة الفتيات التى لديها زاوية إنحناء الفقرات الصدرية أقل من ٤٠° (أربعون درجة) تعادل ٥٦,٦٧% ونسبة الفتيات التى لديها زاوية إنحناء الفقرات الصدرية أكثر من ٤٠° (أربعون درجة) تعادل ٣٢,44% . ومن هذا يمكن أن نستخلص أن معدل انتشار انحناء العمود الفقري بين الفتيات بعد سن البلوغ على مستوى محافظة الجيزة هو٣٢,44% .
الكلمات الدالة : انحناء العمود الفقرى – البلوغ - جهاز قياس إنحناء العمود الفقرى .