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Prevalence of hamstring tightness in school children in the United Arab Emirates

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Abstract
Introduction: Back pain amongst children is on the rise exponentially. Hamstring tightness is known to have cause/effect relationship with low back pain. Presence of hamstring tightness is also associated with increase in risk of muscular strains. The purpose of this study was to assess the prevalence of hamstring tightness in school going children in the United Arab Emirates. To our knowledge, this is the first such reported study in the Middle East.
Material and Methods: All children of a school based in Dubai, UAE from grade 2 to grade 10 aged 7-15 years were assessed by a team of 5 physiotherapists. Hamstring tightness was evaluated by standard active knee extension [AKE] test in the school medical department. A total of 317 children were assessed [634 limbs] by two observers and any inability to actively extend the knee completely while the hip being at 90-degree flexion was considered as hamstring tightness.
Results: Out of 317 subjects, 287 [90.53%] were found to have hamstring tightness. There was a statistically significant difference between genders: boys showing more prevalence. All age groups across the school showed similar pattern. This may be the highest ever recorded prevalence of hamstring tightness in school children in any reported study in English literature.
Conclusion: An alarming proportion of children in a Dubai based school have hamstring tightness. More wider studies with larger numbers should be undertaken so as to ascertain if this is in some way related to lack of active lifestyle in the UAE where gadget-dependency of younger generation as well as prolonged sitting might be a causative factor. Whether such high prevalence is pathological or physiological also needs to be addressed. School authorities and parents in UAE should engage the children in regular stretching programs.

Keywords: hamstring tightness, school children, pediatric back pain, active knee extension test

Introduction
The musculoskeletal health of the pediatric age group doesn't get enough attention and recognition worldwide [1]. Various conditions and disorders (e.g., musculoskeletal deformities, congenital/developmental syndromes, mental health, obesity) that begin during childhood may have a lot of implications to a child's daily function, quality of life, family relations and psychological wellness [1, 2]. The effects of these health issues may stay and be seen in adulthood [3]. However, back pain, which has not been seen frequently in children before, has been increasingly reported recently [4]. The stated percentage has risen from 2-11% to 27-51% in recent studies [5-8]. Other reports have noted a lifetime prevalence of 70-80% in patients up to 20 years of age [9]. Now, various reasons are being considered as to being the cause of childhood low back pain. Some of them are, to heavy school bag use, reduced physical activity, too much video-game playing and/or television viewing, improper sleep, and obesity [8, 10, 11-13]. Hamstring tightness has been reported to be the cause of posterior pelvic tilting, reduced lumbar lordosis and exacerbation of existing pain in patients with low back pain [14]. A number of studies have shown that there lies a strong link between hamstring flexibility and low back pain [15].
Hamstring muscles play an important role in managing the stride length during running; if the stride length is longer, then fewer contractions cycles are needed to cover the same distance. This equates to a conservation of energy, allowing for greater all longer performance prior to fatigue and a reduction in chance of injury [16, 17].
Inability to extend the knee completely when the hip is flexed, accompanied by discomfort or pain along the posterior thigh and/or knee is considered as hamstring tightness [18]. Tight hamstring muscles increase the patellofemoral compressive force because of the increased passive resistance during the swing phase of ambulation and running [19].
This study aims to find the prevalence of hamstring tightness amongst school children in United Arab Emirates where such statistics are not available as yet.

Material and Methods
All grade 2 to grade 10 students of a school based in Dubai were included in this study. Permission from the relevant authorities was obtained prior to the assessment. The subjects as well as their parents were briefed about the Active Knee Extension (AKE) test [16] and the outcome. AKE test remains the gold-standard for hamstring flexibility assessment and has high intra-rater and inter-rater reliability. A total of 317 subjects between the age of 7 to 15 of grades 2 to 10th were assessed. The average age was 9.2 years. The subjects included 181 boys and 136 girls. The AKE test was conducted by five licensed physiotherapists practicing in

the UAE. The team comprised 2 male and 3 female physiotherapists. Each student was assessed by at least 2 examiners to confirm the findings. There was an administrative staff included to record the details of the participants. The subjects were called to the setup by the increasing order of the class grades. Each student was explained about the standard AKE test and the test was conducted as per described positioning of hips and knees bilaterally. Children of all grades had their data recorded as positive and negative and compared at the end of the study. Any inability to actively extend the knee completely while the hip being flexed at 90 degree flexion was considered as hamstring tightness. Results were compared between sexes by Chi Square test and any statistically significant differences were identified.

Active Knee Extension Test [16]

Subjects were instructed to assume a supine position on the examination table and both the hip and knee flexed 90º of one lower limb, the other limb being fixed to table in full extension (Fig.1). The subject then grasped behind the examining knee with both hands to stabilize the hips at 90 degree of flexion. Marking was done to identify lateral malleolus and lateral femoral condyle. The subject actively extended the knee in turn as much as possible. Then based on that, the subject's hamstring flexibility was assessed. A subject who could completely extend the knee was considered not to have any hamstring tightness. Any shortfall in making the knee extend to 180° was considered tightness. Each child was examined by two therapists and concurrence of hamstring being tight was established.

AKE Test Starting Position AKE Test Final Position

Fig 1

Exclusion criteria

Only those subjects who had no previous history of congenital or developmental disorders including scoliosis or trauma were included.

Results

Out of the 317 subjects, 287 had hamstring tightness while 30 did not (Fig 3). Among those who presented with tightness 171 subjects were males and 116 females. Among those who did not have tightness, 10 were male and 20 female. Amongst all grades, the maximum number of children (104) belonged to grade 2 where 89.4% showed hamstring tightness. All [100%] children of grade 5 and grade 9 showed positive results for hamstring tightness although the number of students were only 18 and 7 respectively. On the other hand, out of 23 children of grade 8, only 78.2% showed hamstring tightness. Grade wise comparison in illustrated in Fig 2.

The outcome showed an average of 90.53% having some degree of hamstring tightness. Hamstring tightness was more among the males being 95% and lesser in females with average 85.2% which is statistically significant p<.05 by chi square test.

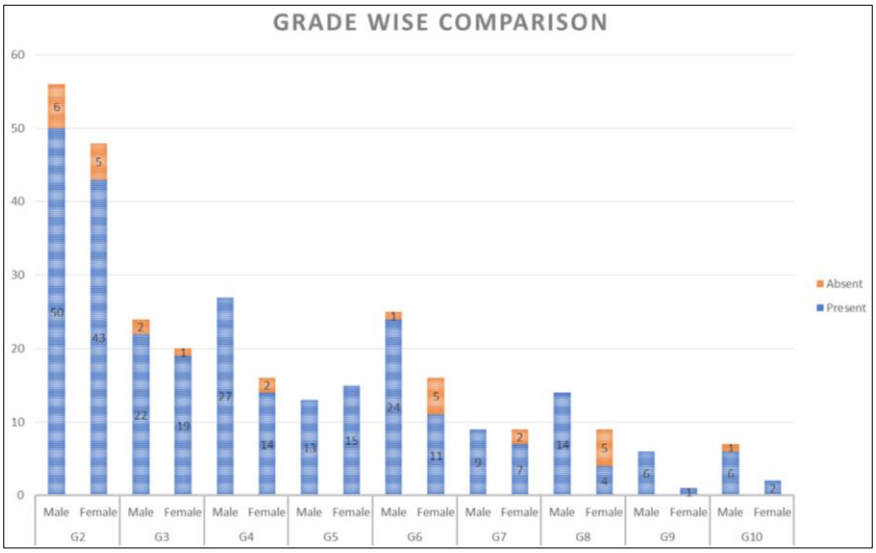

Fig 2: Grade of school wise comparison of presence or absence of hamstring tightness.

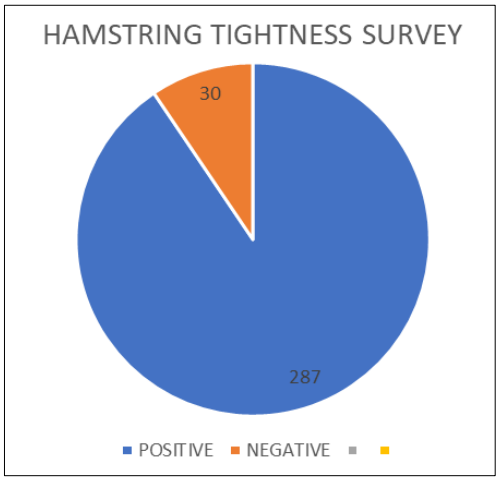

Fig 3: Overview of hamstring tightness in 317 school children

Discussion

Over the years it has become clear that LBP occurs not only in adults but also in the young [20, 21]. Some previously reported studies provide linkage of hamstring tightness with low back pain. Hamstring tightness causes pelvic tilt thereby changing the biomechanics of lumbar region and causing back pain [23]. Stiffness of one muscle group can cause compensatory movement at an adjoining joint that is controlled by muscles or joints with less stiffness [24]. Appropriate and everyday stretching of the hamstring muscles should be taught to all age groups, especially before age 30 as tightness increases more at that time [25].

The above study was conducted on seemingly healthy group of children by AKE test that has an excellent inter-rater and intra-rater reliability [26]. It was alarming to see a significant proportion of school going children having hamstring tightness in this study who showed at least some degree of hamstring tightness. This leads to a concern about its etiology. The reasons for this can be multitudinous, which include growth spurts, prolonged sitting while spending more time on studying, video gaming, digital gadget usage and viewing television rather than going outdoors for play or other activities. The hot climate of the country can be a reason due to which the children avoid spending more time in the outdoors. Even the homework and class assignments and most of the projects are done on computers which only adds to hours in front of the computer and other devices. Increased sitting and inactivity causes a certain fixture in posture due to which the hamstring muscle may develop tightness and recent research points out towards this association [27]. Additionally, sudden growth spurts are also known to cause the stretching of the muscle leading to reduced flexibility [28].

This indeed is an issue which needs immediate attention and also measures to curb or get it in control. If not, this can lead to bigger health issues in early adulthood. It would be interesting for the global community to address if this is physiological or pathological by conducting such studies on a larger scale involving many schools within their countries.

The study involved subjects as young as age 7, and the presence of hamstring tightness in them was indeed a concerning issue. School teachers, especially physical education teachers can help in this condition. Physiotherapists should also include routine screening of hamstring tightness and advice stretching exercises into the treatment program of patients suffering from musculoskeletal disorders of the lower limb and the lower back.

Limitations of this study include the fact that every grade didn't have equal number of students and the senior grades has fewer subjects available thus making this a non-homogenous mix of available subjects. Also, we did not measure and categorize the degree of hamstring tightness as there is no established parameters of grading of hamstring tightness available in the literature. We considered any degree of loss of full extension of knee in the AKE test to represent hamstring tightness whereas some authors consider 20^0 flexion in adults to be normal [29]. Further, this study didn't aim at recording any improvements in degree of hamstring tightness.

Conclusion

As far as the authors are aware, this is the first study conducted in UAE and the Middle East to assess prevalence of hamstring tightness in school children. The result of the above study showed that the hamstring tightness among school going children is highly prevalent in the UAE. The participants of the study were normal healthy children who were not narrowed down through any category, but were selected from all grades available on the day for evaluation. Thus, such a high percentage of positive results in them can only speak for the rest of the pediatric population. Although the sample in this study wasn't equally distributed amongst ages, most of the age groups were found having hamstring tightness and this shows that the problem is not age specific. Females showed statistically significant lesser percentage of hamstring tightness than male participants which is in line with other researchers' findings [30]. Simple methods of hamstring stretching techniques can be applied by school and parents to prevent and treat hamstring tightness. Also, increased outdoor activity whilst reducing time children spend on siting may be helpful. A study involving large number of children would be more beneficial to get an even better understanding of the prevalence of hamstring tightness in children as such data is scarcely available.

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