

Frequency of neuromusculoskeletal disorders in adolescents of Veracruz

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Introduction

The relationship between health and posture on neuromusculoskeletal disorders has shown that the presence of these disorders can generate low performance, alter the quality of life and generate significant disabilities (1), this because the locomotive system is subjected to various pressures, tractions and deformatant forces activating structures such as muscles, bones and joints (2) in countries such as Mexico today almost 80% of adolescents do not meet the minimum physical activity requirements and almost 60% of them spend more time in front of a screen (3). This implies a problem to be addressed since these musculoskeletal disorders in adult life are associated with the main causes of absenteeism or medical consultations (4) exposure to ergonomic risk factors that may be highly related to pathologies such as osteoarthritis and other musculoskeletal diseases (5). In Mexico, recent studies found that problems affecting the health of adolescents are directly related to lack of physical activity, sex life without responsibility, exposure

to violence and consumption of tobacco, alcohol and drugs (6); These and other sociodemographic factors coupled with postural problems guarantee pain states in adolescents, with cervical, lumbar and shoulder pain being the most frequently documented (7). There are reports in which, since before adolescence and in lower grades, the presence of neck pain associated with furniture, vision problems and excessive work is identified (8). In countries such as the United States of America from 2007 to 2016, visits to chiropractic by adolescents increased, the cause of visits being lumbar pain, neck and shoulders (9). It should be stressed that musculoskeletal health problems have several causes and it is not always possible to specify which of them is the main one, also after the pandemic recently experienced it is necessary to pay attention to the mental health of adolescents (10); emphasizing sociodemographic characteristics as it has been shown that these directly influence the opportunity of access to care alternatives for neuromusculoskeletal conditions (11), for example, in countries such as Brazil, studies have been reported in which more

than 60% of the population studied suffers from lumbar pain (12), again being factors related to lifestyle and inherited customs, which directly influence the presence of pain (13). In addition to that, today there is no specific panorama in the state of Veracruz about habits, customs and the relationship that these could have with health, as well as the ergonomics of people.

Material and Method

The purpose of the research was to describe the neuromusculoskeletal alterations in adolescents aged 15 to 18, with the aim of identifying these alterations in a timely manner. The technique to use the data collection was a personal survey applied as an interview and a clinical history was integrated. A digital application was used for imaging, this application has 95% reliability. The research carried out is quantitative, cross-sectional, observational, for the collection and analysis of data the information was processed by

the software IBM SPSS Statistics. The present study was conducted in a public school where the universe were all enrolled, in such a way that it is considered a non-probabilistic sample since it was worked with all students who wanted to participate upon invitation by the educational institution, due to the interest in identifying the postural alterations that may present young students. A schedule of intervention activities was agreed without affecting school activities and prior information to parents and guardians for signing informed consent.

Results

In the present research 386 students, belonging to various specialties of their training, participated in gender 46% female and 54% male, in an age range of 14 to 19 years, Observing a higher frequency in the age of 15 years, 31%; 30% aged 16 and 26% aged 17. Table 1 and 2.

Table 1. Percentage of participating population by gender

Category	f	%	Valid percentage	Cumulative percentage
Masculino	208	53.6	53.6	53.6
Feminine	178	46.1	46.1	99.7
Other	1	0.3	0.3	100
Total	386	100	100	

Source: Own database

Table 2. Percentage of participating population by age

Years old	f	%	Valid percentage	Cumulative percentage
14	23	5.9	5.9	5.9
15	118	30.7	30.7	36.5
16	116	30.1	30.1	66.7
17	102	26.4	26.4	93.1
18	26	6.7	6.7	99.7
19	1	0.3	0.3	100
Total	386	100	100	

Source: Own database

Based on medical history and orthopedic tests, the following findings are made: When evaluating the tilt angle of the head, 45% present an ideal angle of inclination, 35% are within the acceptable range, and 20% fail to reach the minimum

acceptance range of head tilt. Observing that 80% present an angle of inclination within the acceptable range for its correct biomechanical functionality. Table No 3.

Table No. 3 Head Tilt Angle Ranges

Rank	f	%	Valid percentage	Cumulative percentage
0	1	0.3	0.3	0.3
Ideal 45°	172	44.6	44.6	44.8
1/4 "Within range" 40°	137	35.5	35.5	80.3
1/2 "Out of range" 35°	72	18.7	18.7	99
>1/2 "Insufficient" -30°	4	1	1	100
Total	386	100	100	

Source: Own database

In relation to shoulder displacement, 46% present a displacement with superiority in the right shoulder, 47% present a superiority of the left shoulder and 7% present a normal alignment. Therefore, it is found that 93% of the population studied presents a shoulder displacement that

impacts biomechanical functionality. Situation that infers that the majority of the population finds a biomechanical disease of the spine due to incorrect postures that compromise the state of health of the neuromusculoskeletal system Table 4.

Table No. 4 Shoulder displacement

Displacement	f	%	Valid percentage	Cumulative percentage
Superior Right	177	45.9	45.9	45.9
Upper Left	182	47.2	47.2	93
Normal	27	7	7	100
Total	386	100	100	

Source: Own database

As for the displacement of the rib cage 88% (341) present a displacement to the left or right. The impact of this displacement is reflected in

possible complications with respiratory system and of course neuromusculoskeletal. Table 5.

Table 5. Displacement of the rib cage

Displacement	f	%	Valid percentage	Cumulative percentage
Normal	45	11.7	11.7	11.7
Offset to the right	179	46.4	46.4	58
Shifted to the left	162	42	42	100
Total	386	100	100	

Source: Own database

When analyzing the images of hip displacement, it is found that 96% (369) present displacement to the left or right side, which impacts their gait,

situation that in the short or long term will generate wear on your lower limb joints and at the level of your hip. Table 6.

Table 6. Hip displacement

Displacement	f	%	Valid percentage	Cumulative percentage
Superior Right	166	43	43	43
Upper Left	203	52.6	52.6	95.6
Normal	17	4.4	4.4	100
Total	386	100	100	

Source: Own database

When checking reflexes in the spine, it is observed that 12.5% (45) present a notable loss of reflexes at the level of C5 on the right side and 10% (36) present an hyporeflex in C5 left side. Approximately 86% (312) are normal in their reflexes in both left and right side C5. Hyporeflexia at the level of right side C5 is identified in 1.4% (5) in left side C5 in 1.7% (6). In 5 of the participants in the intervention an exaggerated increase in the level of reflexes in the vertebra in question is identified, both on the right and left side. At the level of C6 on the right side, 7.2% (26) present hyporeflexia, 91.1% (329) are within the normal response range and 0.8% (3) present hyperreflexia, only 0.8% (3) manifest an exaggerated reflex at the level of C6 on the right side. For C6 left side 0.6% (2) present arreflexia, that is, a notable decrease in reflexes and 5.8% (21) present hyporreflexia. On average, 91% (329) present normal reflexes for the analyzed vertebra and hyperreflexia is found in C6 left side in 1.7% (6) and in 0.8% (3) right side. Only 0.6% (2) have exaggerated reflex at C6 left side and 0.8% (3) right side. As far as C7 of right and left side is not found arreflexia, only 3.9% (14) has hyporreflexia on the right side and 2.2% (8) on

the left side. Approximately 95% (343) are normal in their reflexes at the C7 level on both the left and right sides. 0.3% (1) have exaggerated reflexes of both right and left side at C7 level. When analyzing the reflexes at the level of L4 we found arreflexia in L4 right side in 0.8% (3) and in left side in 1.1% (4). Hyporeflexia is present on both the right and left sides in 9.4% (36). On average, 86% (320) have normal reflexes in the lumbar plexus region. Hyperreflexia of right side is observed in 2.8% (10) and left side in 3.9% (14). And an exaggerated reflex on the right side is identified in 0.6% (2) and on the left side in 0.3% (1). In this region S1, right-sided remodeling is identified in 0.6% (2) and hyporeflex in 4.4% (16) right-sided and 5.3% (19) left-sided, 93% (336) present normal reflexes in this region. Hyperreflexia is found in 0.8% (3) of both left and right sides. In 1.1% (4) exaggerated reaction is identified on the right side and in 0.8% (3) on the left side. This allows us to identify if the nerve related to the tendon reflex responds to the stimulus performed by the chiropractor, in order to identify if there is any alteration that inhibits or over stimulates the tendon response. Table 7.

Table 7. Nerveplexus reflexes

Reflex	Ar reflexia		Hipor reflexia		Normal		Hyper reflexia		Clonus	
	f	%	f	%	f	%	f	%	f	%
C5 Right Reflex	2	0.6	43	11.9	308	85.3	5	1.4	3	0.8
C5 Left Reflex	0	0	36	10	317	87.8	6	1.7	2	0.6
C6 Right Reflex	0	0	26	7.2	329	91.1	3	0.8	3	0.8
C6 Left Reflex	2	0.6	21	5.8	330	91.4	6	1.7	2	0.6
C7Right Rflex	0	0	14	3.9	340	94.2	6	1.7	1	0.3
C7 Left Reflex	0	0	8	2.2	343	95	9	2.5	1	0.3
L4 Right Reflex	3	0.8	35	9.7	311	86.1	10	2.8	2	0.6
L4 Left Reflex	4	1.1	33	9.1	309	85.6	14	3.9	1	0.3
S1 Right Reflex	2	0.6	16	4.4	336	93.1	3	0.8	4	1.1
S1 Left Reflex			19	5.3	336	93.1	3	0.8	3	0.8

Source: Own database

In relation to the perception of skin stimuli, 0.6% (2) of C4, C5, C6 and C7 were absent in 0.3% (1) respectively. At L4 level, 0.6% (2) of the stimulus is absent and at L5 level, 0.3% (1) likewise, no stimulus response is identified. There was an alteration in the response to stimulus at dermatomo C2 level in 0.3% (1), 0.8% (3) in C3, in C4 in 0.6% (2), in C5 0.8% (3), in C6 in 1.4% (5), in C7 in 1.1% (4). In dermatomo L1 alteration

in response to the stimulus is observed in 1.4% (5), in L2 alteration is identified in 1.1% (4), in dermatomo L3 in 0.6% (2), in L4 0.8% (3) and in dermatomo L5 in 0.6% (2). It was not possible to evaluate it in one patient (0.3%). It should be noted that on average 99% (358) of the participants responded normally to the stimulus performed during the diagnostic evaluation. Table 8.

Table 8. Dermatomo

Dermatomo	Normal		Absent		Alterado		Unassessed	
	f	%	f	%	f	%	f	%
Dermatome C2	360	99.7	0	0	1	0.3		
DermatomeC3	355	98.3	2	0.6	3	0.8	1	0.3
Dermatome C4	358	99.2	1	0.3	2	0.6		
Dermatome C5	357	98.9	1	0.3	3	0.8		
Dermatome C6	355	98.3	1	0.3	5	1.4		
Dermatome C7	356	98.6	1	0.3	4	1.1		
Dermatome L1	356	98.6	0	0	5	1.4		
Dermatome L2	357	98.9	0	0	4	1.1		
Dermatome L3	359	99.4	0	0	2	0.6		
Dermatome L4	356	98.6	2	0.6	3	0.8		
Dermatome L5	358	99.2	1	0.3	2	0.6		

Source: Own database

Prevalence of neck, shoulder, upper and lower back pain has been investigated, in which the presence of significant neck and shoulder pain is evidenced, as well as low back pain in children more than in women, associated with a musculoskeletal disorder (14)

Studies show that chiropractic care is increasing, in recent years the number of visits increased in countries where the chiropractic profession is more strengthened, men from 14 to 17 years old those who go more to receive chiropractic care (9)

It is important to give importance to the identification of mental problems of adolescents, since in 2019 globally they accounted for 16% of diseases in the population aged 10 to 19 (15)

It is important to recognize the scarce publication on NME alterations, as well as public health policy that specifically addresses this pathology, and consider that the frequency of neuromusculoskeletal alterations in adolescents may vary according to the population studied and the geographical region. It is necessary to make general estimates based on the literature such as: back pain that is common in adolescents and that can affect about 20 to 30% of them at some point. (Balagué, F. et al.2012); Scoliosis in adolescents varies according to studies and criteria used, but it is estimated that it affects about 2% to 3% of this population. Weinstein, 2013. Neuromusculoskeletal lesions are relatively common in active adolescents, the frequency may vary according to sport and activity, but some studies such as that of Stracciolini,A. et al. 2013 report injury rates of 20% to 40% in adolescents who play high-risk sports. Rathleff, M. S et al. 2013 points out that patellofemoral pain syndrome is a condition that can affect about 7% to 15% of adolescents and is related to knee pain.

Overuse injuries such as lateral epicondylitis (tennis elbow) or medial epicondylitis (golfer's elbow) can also be common in active teens, with rates varying depending on the sport and activity they perform. In the present research, we found that 88% have back pain, a situation reflected in

Table No.5 and that causes us to infer possible scoliosis to be discarded by imaging studies.

Conclusion

This study not only allows us to identify the frequency of neuromusculoskeletal disorders in adolescents from the state of Veracruz, Mexico. The findings highlight the significant impact of poor posture, lifestyle factors and lack of physical activity on adolescent musculoskeletal health. The high prevalence of shoulder displacement, rib cage misalignment, and hip displacement among participants highlights the pressing need for interventions and preventive measures. The results also indicate a worrying trend, the majority of adolescents present biomechanical problems that can cause health complications in the short, medium and long term, a situation that allows us to visualize the impact on the productive age.

Attention to the possible correlation between musculoskeletal disorders and neurological reflexes is important, so the integration of a comprehensive intervention program to address both aspects of health should be considered. Identification of notable loss or hyporeflexia at certain levels of the spine warrants holistic investigation and development of specific interventions. On the other hand, the study highlights the scarcity of public health literature and policies that address neuromusculoskeletal disorders in adolescents. The need for more research, awareness, and specific public health strategies tailored to this population is evident. The study calls for a broader understanding of the factors that influence adolescent musculoskeletal health, considering not only physical aspects but also mental well-being. It is crucial to develop specific interventions, promote healthy lifestyles and implement educational programs to safeguard the musculoskeletal health of adolescents in the state of Veracruz and beyond.

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