BACKPAIN RISK DIGNOSIS IN CHILDREN FROM CABORCA, MEXICO CAUSED BY OVERLOAD OF SCHOOL SUPPLIES AND POOR DESIGN AND MANUFACTURING SCHOOL DESKS, WHICH DON´T FIT THEIR ANTHROPOMETRY

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ABSTRACT

The incidence of back pain in adults is a recognized health problem worldwide and it is accepted that this disease has its origins in childhood associated primarily with the characteristics of the person along with factors in the environment school. Some authors point out that back pain in children increases with the increase in the burden of school bags and it is accepted that children, educational purposes, remain seated for long periods in furniture that does not comply with the student's anthropometry may produce neck and back pain. The aim of this study was to perform a diagnosis of the situation that public school kids basic level of the city of Caborca, Mexico have, in the two factors mentioned. The work was a transversal investigation made in the 2009-2010 school year, without register the day of the week or the year station in it was made, data were collected on weight and type of backpack without register how the back pack was loads, if in the back or shoulder or hand. Regarding the type of furniture were recorded the dimensions of the largest piece of furniture in every classroom and grade. The sample was of 319 students (160 women and 159 men) and recorded data were: age, sex, grade and school group, floor level of the classroom, the backpack weight and type, after that, they were asked as they had gotten to school if walking, car or public transport and, finally were measured 14 anthropometric characteristics. With this information we have analyzed data with the following results: Estimated at 95% confidence that between 14.4% and 23.2% of students carry a backpack weighing more than 15% of body weight (upper limit recommended), if the limit is taken 10% of body weight, the 95% confidential interval grow between 47.9% and 59.1% of children that carry loads in excess of the low limit. For both limits are observed, for ages 6, 7 and 8 years, a large number of cases of overload with higher values. Moreover, it was noted that the proportion of

men carrying overweight backpacks is lower that the women because their body weight is significantly higher that women weight, P (α <0.057). Moreover, in the sample it was found 30.8% of obese school children (Cole et al. 2000), it cause that in some cases it does not reflect the transported overhead of this portion of children. On the correspondence between the dimensions of the school desk and the user's anthropometric measures, the literature suggests that the keys relationships to review are: 1) the chair height with popliteal height 2) level work surface with set elbow height 90^0. Regarding the first, the literature suggests that a mismatch occurs when the chair seat height is less than 88% or greater than 95% of the user's popliteal height, under this criterion was found that 99.05% of the elements of the sample have a strong mismatch. The seat height is well above the popliteal height and, to be seated, your feet do not touch the floor, producing that the back of the thighs support the lower leg weight, causing pressure on it, producing discomfort and restriction in the flow of blood. With regard to second relationship, level work surface with elbow height 900 was found that 97.7% (CI 95%, 96.2%, 99.4%) of all students in the sample have a big mismatch, the height of the table exceeds, by far, the upper limit recommended which causes that the children to develop activities with arm abduction, producing strong stress in the shoulders and neck. In conclusion we can say that significant proportion of children, in public schools Caborca Mexico, are at high risk of take back pain by excessive load on their backpack and, primarily, by the use of furniture school with mismatch to their anthropometry. All which may become a precursor of back pain in adulthood, so it is recommended to recognize this as a public health problem and establish government policies to minimize these risks.

Keywords: anthropometry, school furniture, back pain, back pack

1. INTRODUCTION

It is globally recognized high incidence of back pain in adults (Sato et al. 2008), quoting Balague F et.al, Kelsey JK and Nachemson AL, says that between 70 and 80% of world population has suffered at some point in their life, a history of low back pain. Also emphasizes that this problem is for children, as great as in adults and indicates that the lifetime prevalence in children and adolescents reaches a level of 28.8%. Similarly, (Bejia et al. 2005) points to a 28.4% of cumulative lifetime prevalence in children and adolescents in school. (Trevelyan and Legg 2010) indicate a 35% prevalence of low back pain. (Kovacs et al. 2003) tells than in school children between 13 and 15 years there is a prevalence of LBP of 50.9% for males and 69.3% for female. On the other hand (Hestbaek et al. 2006) mentioned that high prevalence rates of back pain among children and adolescents has been demonstrated in several studies, and has been theorized that low back pain in childhood can have significant consequences for back pain in adulthood. Also notes that teens 12 to 22 years of age with persistent LBP during the previous year have an odds ratio of 3.5 persistent back pain eight years later. In another sense (Heuscher et al. 2010) evaluated the association between annual self-reported low back pain with the weight of the backpack use among college students, and the results of this study suggest that increased weight reported

backpack is associated with increased annual prevalence of low back pain. (Korovessis, Kouros and Papazisis 2004) points out that back pain in children and adolescents increased with increasing backpack load. (Negrini and Carabalona 2002) state that the backpack for daily transport is a common cause of discomfort for schoolchildren. 79.1% of the children felt the excessive load, fatigue 67.5% and 46.1 lumbar pain which indicates that there is an association between this load and back pain, although the relationship is not direct. (Pau, Corona and Leban 2010) states: Although the scientific community widely recognizes that the transport bag in primary school children is a serious problem, its consequences in terms of postural disturbances and possible occurrence of musculoskeletal disorders is not understood and the results suggest that heavy loads, in the case of significant exposure times may increase the risk of discomfort of the foot and acting as a cofactor in the development of abnormal foot structure or pathology. Also the observed changes suggest that the transport bag balance causes deterioration and therefore may increase the risk of unintentional falls in children.

In another sense (Schröder 1997) states that inadequate school furniture used by children is often seen as the cause of severe postural problems in adulthood (Trevelyan and Legg 2006) states that back pain is now recognized that occurs in early childhood and is associated with high prevalence rates in children 11-14 years and the most important risk factors associated with back pain are in principle the characteristics of the person then the factors in the school environment. On an average day in school, a child in Caborca, Mexico, according to grade level, must go, because there is no system to prevent, a variety of school supplies, plus some have lunch and / or a sports article. Almost always for the child it´s very difficult to define what material can stay in the house and what should stay the school and vice versa, and the children almost always choose bring and carry all the tools and materials every day. These tools, in some cases must be transported in bags, most type back, walking considerable distances for their age, to reach school. Once the child reaches school will probably have to carry all this set up the second floor to reach the classroom; once class starts the child should remain about 5.5 hr., doing academic work and most of the time sitting at inadequate school desks for their anthropometrics. All this may become a high risk of back and neck pain which may be a precursor of similar pains in adulthood. In the absence of information in our environment, it is necessary diagnose this back pain risk. The aim of this paper is present a descriptive study of the situation of two aspects that may influence the onset of back pain in school children. Specifically the objectives are:

Estimate the statistical distribution of the percentage ratio between the weight of the burden of carrying school supplies with their body weight and compare with the recommendations made in the scientific literature.

Analyze the concordance of anthropometric measures of students with the banks used in their school activities.

The hypothesis that arises is that: There is a high risk that school children are affected by load backpacks with a weight that exceeds the recommended weight and used furniture does not comply with their anthropometry. Research is carried out cross the 2009-2010 school year, excluding the day of the week or during the month. Data were collected on weight and type of backpack without taking into account the load as if in the back or shoulder or hand. Also not quantified the distances and the times when children carry the bag from home to school and vice versa. For furniture was observed that in the classrooms there are different types of school desks and it was taken the dimensions of the more numerous type of each grade.

2. FRAMEWORK

2.1 Load weight backpacks

There are some recommendations regarding the maximum burden that children should be carried in backpack, someone accept like limit 15% of the body weight other accept 10% limit of body weight, and others more recommend between 10% and 15% of body weight. (Brackley and Stevenson 2004) states: epidemiological, physiological and biomechanical suggest that the recommended weight limit for the backpacks of children is 10% to 15% of body weight. (Hong, Li and Fong 2008) suggests that the burden on the backpacks of children should be limited to no more than 15% for transportation for a period of up to 20 minutes to avoid muscle fatigue. (Wong, Lee and Yeung 2009) published that the results of their studies suggest that the raise reported in backpack weight is associated with increased annual prevalence of low back pain. However, these results provide no evidence to support the recommendation that the weight of the backpack should be necessary less than 10% of body weight. (Moore, White and Moore 2007) indicates that the data obtained in their work suggest the use of 10% body weight limit for the safe use of backpacks more some variety of practical methods to help students. It also states that the younger students and women are at greater risk due to relatively lower body weight while females also carry heavier backpacks than males.

2.2 Nonconformity of school furniture

(Molenbroek, Kroon-Ramaekers and Snijders 2003) quoting Faassen (1978), Liebisch (1990), Snijders et al (1995), states that the headache, neck pain, back pain and impairment in concentration in students, are the result of prolonged sedentary positions for educational purposes, so attention must be paid to the design of school furniture. (Parcells, Stommel and Hubbard 1999) quoting Zacharkow D. (1988) states that, the adverse effects of inappropriate classroom furniture have been known for a long time. In the analysis of furniture suitable for students exist many interesting relations like: chair high to popliteal high, seat depth with the length from buttock to back of the knee, wide hips with seat width, height of table with elbow height 90^0, etc. (Saarni et al. 2007) mentions that the main measures are the differences

between seat height and popliteal height and desk height and elbow-floor height. Therefore this study only analyzes these two relations.

Relationship between Popliteal height and Seat height
(Chaffin DB 1999) states that, when the seat height is too low, the knee bending angle becomes sharp, and the weight of the trunk should be transferred to the seat through the back of the thigh, is through a small area in the ischial tuberosity on the pelvis. When the seat height is very high so that the feet do not touch the ground, pressure on the back of the thigh is very not comfortable and the person tends to be forward of the seat of the chair, allowing feet are flat on the floor, but the back support is not used properly resulting in low back pain if the posture is long. Feet should rest firmly on the floor or foot support for the weight the lower leg is not supported by the back of the thighs on the seat. (STANDARS 1998, ISO 9241-5 1998) indicates: it is not acceptable to assume that people stay with the vertical legs, it is desirable, therefore, that the bottom of the leg to reach the ground in front of the knee joint to provide a greater than 90 º.

3.3 Work surface ratio elbow height
(Chaffin DB 1999) notes that the height of the table in relation to the person sitting is very important, not only for the low back it will affect the shoulders and torso height, depending on the position and arm support. A work surface located above elbow level, results in shoulder abduction, causing increased stress on shoulders, arms and neck. For prolonged tasks is recommended shoulder abduction angle between 15^0 and 20^0. It also mentions that Bendix (1987) recommended that the height of the desk, for adults, should be between 3 and 4 cm above the elbow of the person in a position sedative.

3. MATERIALS AND METHODS

For this investigation it was considered a target population of 7429 students from primary schools, public, urban, municipality of Caborca, Mexico, grouped in 28 clusters. The sample size was calculated for the variable of greatest interest is the proportion of students who exceed 15% of the ratio of backpack weight to body weight of children, to an accuracy of ± 5%, 95% confidence and was a hit ratio of 30%, obtaining a sample size of 337 students. To take the random sampling was considered a probabilistic design, the school like cluster and school grade and sex of students like stratums. From each student were took the data on age, sex, grade and school group, preferred hand and floor level of the classroom location, were recorded the weight and type of backpack, they were asked how they got to school if walking, by car or public transport in addition were take body weight and 13 anthropometric measurements. Finally we visited each classroom and were taken the style banks and were measured all their heights.

4. ANALYSIS OF RESULTS

This procedure was conducted in two stages

• Analysis of field data from the percentage ratio between the weight of the backpack and body weight of each child with a analysis of backpack type and transportation mode.
• Correspondence between school banks with anthropometric measurements of children.

4.1 Ratio between weight of the backpack and body weight In total it is estimated that 18.8% (CI 95%, 14.4% and 23.2%) of primary school children carry a backpack over the upper limit accepted of 15%. In Figure 1 presents the data dispersion of percent of weight of load in relation to body weight by age of the participants and can be seen that for ages 6, 7 and 8 years there is a lot of data showing relations higher than the accepted upper limit (15%) and also show an increasing trend. For ages 10, 11 and 12 years there are a lesser amount data above the upper limit and this is because with age and increased body weight reflects a lower value of the relationship between weights. Figure 2 shows the dispersion of data for girls and there is a 22.53% (95%, 15.8% -29.26%) of them in the sample, exceeding the high limit accepted. In Figure 3 shows the dispersion of data from kids and found that 15.6% (95%, 9.8% - 21.4%) loaded a backpack that weighs above the upper limit accepted. The proportion of girls is higher than that presented the men because the body weight of them is significantly higher than women´s weight, P (α <0.057). If we use the lowest acceptable limit of 10% of body weight the proportion of students who carry loads above this lower limit, it increase considerably, as seen in the graphs. Moreover, it was found that 54.53% of the students moved on foot to school and 25.6% of them (95%, 20.9% - 30.8%) carry a backpack weighing more than 10%, which increases the stress load. In another sense, the analysis of data revealed, according to international standards (Cole et al. 2000), 30.8% (95%, 25.7% - 35.9%) of participating

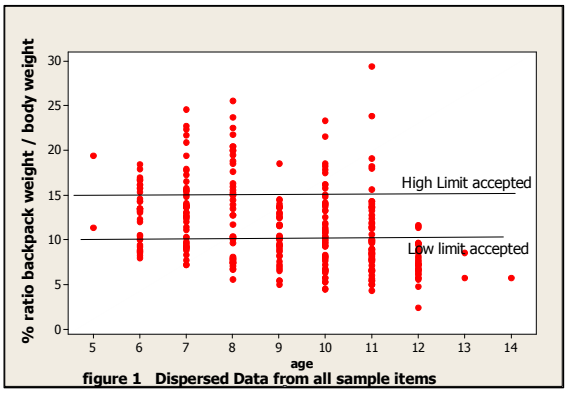

figure 1 Dispersed Data from all sample items

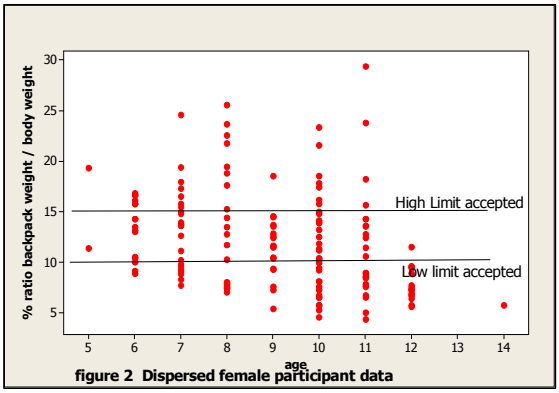

figure 2 Dispersed female participant data

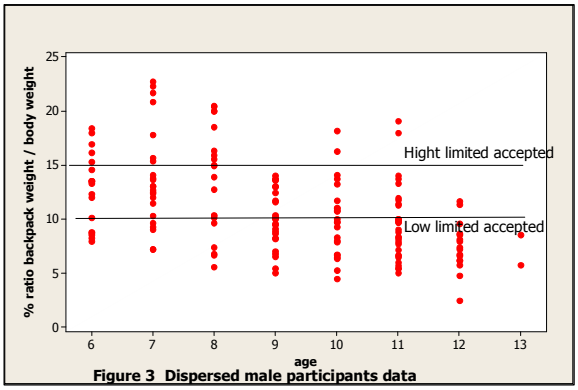

Figure 3 Dispersed male participants data

children are obese, which causes in some cases, a relationship does not reflect percentage body-weight load, above the accepted limit.

4.2 Matching desks with anthropometric measurements

4.2.1 Analysis of the relationship popliteal height and seat height

(Parcells et al. 1999) defined on the basis of existing research, a mismatch of popliteal height and seat height is presented for any seat height that is less than 88% or greater than 95% of popliteal height user. This allows there is a clear knee between 5% and 12% of popliteal height. Under this criterion it was found that 99.05% of the components of the sample give a strong mismatch. The seat height is well above the popliteal height of children causing their feet off the floor, causing the weight of the lower leg is supported by the back of the thigh causing pressure and discomfort in the same and decrease in blood circulation.

4.2.2 Analysis of relationship elbow height to 90^0 height to work surface

For the analysis of this relationship was applicable to children literature. (Chaffin DB,1999) notes that the height of the table should be based on the user's elbow height so he recommended that the height of the desk, writing activity, must be between 3 and 4 cm above the elbow of every person in a position sedative for adults, this allows for shoulder abduction between 15^0 and 20^0 obviously this recommendation does not apply to children. To enable this same shoulder abduction in children we estimate that this range should be between 0.5 and 1.5 cm in height of the surface of work above elbow height. The research found that 97.7% (CI 95%, 96.2%, 99.4%) of all students in the sample show a strong mismatch, the height of the table exceeds by far that recommended limit which causes the children develop activities with arm abduction greater than recommended, it produce strongly stress in shoulder and neck.

5. CONCLUTION AND RECOMMENDATIONS

In conclusion we can say that a significant proportion of children in public schools of Caborca Mexico are at high risk for suffer back pain by excessive load on their back pack and, in particular, the risk is higher for ages 6, 7 and 8 years and for females, the same way, the risk increases significantly by the use of school furniture with dimensions not conforming to their anthropometry. All this can be a precursor of back pain in adulthood but, especially in children can cause headache, neck pain, back pain and poor concentration. Therefore it is recommended to recognize this as a public health problem and establish government policies to minimize these risks.

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