Hiperlaxity ligamentous (Beighton test) in the 8 to 12 years of age school population in the province of Granada

Félix Zurita Ortega, a, b Luis Ruiz Rodríguez, b Asunción Martínez Martínez, a, b Manuel Fernández Sánchez, a Concepción Rodríguez Paiz, a, b and Remedios López Liria a, b

a Escuela Universitaria de Ciencias de la Salud, Universidad de Almería, Spain
b Departamento de Didáctica de la Expresión Musical, Plástica y Corporal (Área de Corporal), Universidad de Granada, Spain

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Introduction

Since ancient times it is common for circuses to incorporate contortionists among its star attractions, where the artists (often women and / or young subjects) are able to make movements and adopt body postures impossible for the vast majority of the population. Undoubtedly, the development of such skills requires hard training and learning specific skills, but could hardly reach the spectacular levels cited if the subject does not have some unique features that promoted an exaggerated anatomo-physiological increase in joint range of motion or joint hypermobility.

Although Kirk1 in 1967 described the hypermobility syndrome, it is not until the early 1990s when Grahame2 coined the term ‘benign joint hypermobility syndrome’ (BJHS), characterized by the presence
of hypermobility of joints, associated with musculoskeletal discomfort in the absence of demonstrable systemic rheumatic disease.

Bravo\(^3\) states that joint hypermobility is the result of a hereditary disorder of the collagen fibers that is transmitted as an autosomal dominant disorder that causes a lower resistance of the soft tissues of the joint (ligaments, tendons and capsules), that consequently leads to instability, dislocations and subluxations.

Scott\(^,4\) Gedaliah\(^,5\) Mikkelsens\(^,6\) among others, have found a relationship between joint hypermobility and musculoskeletal pain. Also, Graham\(^e\) and Gedaliah\(^f\) suggested that BJHS is a common cause of joint pain and transient arthritis in childhood, which often coincides with more severe rheumatic processes.

Other studies (Al-Rawi\(^,7\), Binns\(^,8\), Al Graf\(^,9\) Quindrsland\(^,10\) Aracena\(^,11\) and Menéndez\(^12\)) have also associated joint hypermobility joint pain with sprains, flat feet, Raynaud’s phenomenon, fragile skin, high palate and varicose veins. Table 1 shows the main clinical conditions associated with hypermobility.

As for the prevalence of this disease, Graham\(^13\) considers that this condition can be found to a greater or lesser extent in all population groups. In Europe the proportion of affected individuals stands at 10% of the population, which would be consistent with the values associated with hypermobility.

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the corresponding custom resolution reports to schools and parents of schoolchildren in relation to detections. Data was collected between February and March 2007.

The selection of the final sample of schools was conducted by sampling, reflecting the natural composition of the groups’ requested centers, with no other criterion of inclusion or exclusion in the conformity with the participation in the study, recruiting 100% of groups. The final sample used in the study was of 2956 subjects, aged from 8 to 12 years, in the province of Granada, of both genders, with the sample reflecting the natural composition of the groups, with a ratio of 50.1% of boys and 49.9% of girls (Figure 2).

The distribution of children between 8-12 years was fairly homogeneous, whereas the sample was taken in the second and third cycle of the primary level; however, children under 12 years were the least representative (repeaters, students who have lost a year of schooling or had been enrolled after the required minimum age), but were taken into account and included in our study to establish the groups at 100% (Table 2).

Variable

As already mentioned, the technique used for the assessment of joint hypermobility was the Beighton test. The test proposed by Carter in 1964 and modified by Beighton in 1973, it has been used by a multitude of scientists (Gedaliah, Larsson, Beighton, Grahame, Balagué, Balagué, and De Cunto) and is based on presenting a “positive Beighton score” which requires having 4 or more points out of nine. Subjects are rated on a scale of 9 points, considering 1 point for each hypermobile site, performing the test in both halves of the body and measuring the following:

- Hyperextension of the elbows (+10°), with the subject seated on a stool and extension by the examiner of the explored arm.
- Touching in a passive manner the forearm with the thumb, with the wrist in flexion, and the individual in the same position.
- Passive extension of the index finger over 90°, with the subject seated and with the palm of the hand fully extended on the table.
- Hyperextension of the knees (10° or more) with the subject supine. The examiner explores the joint, determining its strength.
- Bending the trunk forward touching the floor with the palms of the hands without bending the knees.

Figure 3 shows the embodiment of each of the tests. Getting four or more of these maneuvers positive (Table 3) will establish, in a generalized manner, the presence of ligamentous laxity (positive Beighton).

Results

Tables 4-6 detail the results obtained for the Beighton test in the entire study population, by gender and age groups.

It can be seen that a little over a quarter of the students tested were classified as having a positive Beighton test (presence of joint hypermobility), with significantly higher rates in girls than in boys.

Table 5 shows the relations of the Beighton tests and gender on the basis of age, only analyzing those individuals with the presence of hypermobility.

No significant association (P=.19) were seen in hypermobile individuals in terms of gender and age, with a greater prevalence in females (62.1%) (n=466), where age is very similar in the percentages, but laxity in male subjects is less frequent (37.9%) (n=285).
In Figure 4 shows, on the one hand, individuals who had hypermobility (positive Beighton) and compared them by gender, finding that in all ages the percentage of females with hypermobility is much higher than males, as cited for the previous table, showing a high significance \( P = .00 \).

In the above mentioned table and figure (Table 4 and Figure 4) the highest value is for joint hypermobility in girls at 8 years (28.1%) and in boys at age 9 (29.5%), the proportions being very similar during the ages of 8-10 years are, and no statistically significant differences \( P = .18 \), resulting in a decrease in rates from age 10 to age 12 (4.5% in females and 3.9% in males).

The last section determined the relationship between joint hypermobility and designated areas of the province of Granada. The results of the joint hypermobility according to the study areas provide us with significant differences in terms of the geography \( P = .00 \). Zone 4 (Guadix-Baza) with 50.4\% (n=191) was the area with the largest number of cases compared to 11.6\% in Zone 2, with more extreme values concerning positive Beighton, found in areas 5 and 6 with values above 35\% in the presence of ligamentous laxity, while the capital and suburbs (zone 1 and 2) had values below 17\%.

In Figure 5 we highlight the 11.6 and 16.2\% of positive Beighton zones 1 and 2 compared to 50.4\% in Zone 4, which we statistically determined a high coefficient of heterogeneity between areas in terms of the presence of hypermobility \( P = .00 \), as discussed in the next section.

### Table 3

<table>
<thead>
<tr>
<th>Member</th>
<th>Beighton points</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hyperextension of the elbow</td>
<td>*</td>
</tr>
<tr>
<td>Playing with the thumb forearm</td>
<td>*</td>
</tr>
<tr>
<td>Passive extension of the index finger</td>
<td>*</td>
</tr>
<tr>
<td>Hyperextension of the knee</td>
<td>*</td>
</tr>
<tr>
<td>Flexion of the trunk</td>
<td>*</td>
</tr>
</tbody>
</table>

### Table 4

<table>
<thead>
<tr>
<th>Beighton</th>
<th>Frequency</th>
<th>Percent (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Positive</td>
<td>751</td>
<td>25.4</td>
</tr>
<tr>
<td>Negative</td>
<td>2,205</td>
<td>74.6</td>
</tr>
<tr>
<td>Total</td>
<td>2,956</td>
<td>100.0</td>
</tr>
</tbody>
</table>

### Discussion of results

The results of our study show that the prevalence of joint hypermobility among schoolchildren in Granada as a whole (25.4%)
is significantly higher than that obtained for other European populations (Carter, Gedaliah, and El Garf) but without reaching the levels established for the American populations (Arroyo, Knupp, De Cunto, and Torres) (Figure 6).

However, the study also shows significant differences between the different regions of the province, still well above the rates of joint hypermobility obtained in more predominantly rural areas (Baza, Loja, and Alpujarra) than in the capital or metropolitan area. We do not have enough information to attribute this geographical heterogeneity to a specific factor or factors, but if we consider the genetic component studied by Bravo, the association could be due to higher levels of inbreeding, in particular among Roma subjects (area Loja) and/or the education of children of South American immigrants (Baza area).

Moreover, our data is consistent with those of other studies in the Spanish school population (Duro) regarding a greater presence of joint hypermobility in females than males in all age groups and regions studied.

Finally, the comparative analysis of the frequencies of hypermobile subjects according to age shows, as has already been incorporated into various international studies, an inverse association between the two up to 10 years of age, although there are some differences these are not statistically significant ($P = .18$). But after 11 years of age for both boys and girls, there was a significantly reduced prevalence for the group of 12 years, and while maintaining the same trend, in absolute terms, they should be taken with caution, since it is a group with a small number of subjects. Once again we say that our study, because it is eminently descriptive, does not provide sufficient information to establish the causality of that relationship, although it seems logical to think that it is linked to the levels of maturation and consolidation of stabilizing the joint, thereby leading to a progressive reduction of articular hypermobility in older girls and boys, except in the case of persons carrying the gene variant modifying the collagen fibers that would in any case be much lesser. Consequently, we might consider the diagnosis of a ‘real’ hypermobility for such an early age if the criteria are sufficient for it.

![Figure 4](image-url). Percentages of positive Beighton tests (hypermobility) by age and gender in the study population.

![Figure 5](image-url). Distribution of ligamentous laxity in the study areas.

![Figure 6](image-url). Distribution of ligamentous laxity in the world.

**Table 5**

Distribution of ligamentous laxity in the five age groups by gender

<table>
<thead>
<tr>
<th>Beighton</th>
<th>Gender</th>
<th>Age</th>
<th>Count</th>
<th>% of sex</th>
<th>% age</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Positive Male</td>
<td>Count</td>
<td>75</td>
<td>84</td>
<td>79</td>
<td>36</td>
<td>11</td>
</tr>
<tr>
<td>% of sex</td>
<td>26.3</td>
<td>34.4</td>
<td>12.6</td>
<td>3.9</td>
<td>100.0</td>
<td></td>
</tr>
<tr>
<td>% age</td>
<td>43.5</td>
<td>39.3</td>
<td>30.3</td>
<td>44.4</td>
<td>37.9</td>
<td></td>
</tr>
<tr>
<td>Positive Women</td>
<td>Count</td>
<td>131</td>
<td>109</td>
<td>122</td>
<td>83</td>
<td>21</td>
</tr>
<tr>
<td>% of sex</td>
<td>28.1</td>
<td>23.4</td>
<td>26.2</td>
<td>17.8</td>
<td>4.5</td>
<td>100.0</td>
</tr>
<tr>
<td>% age</td>
<td>63.6</td>
<td>56.5</td>
<td>60.7</td>
<td>69.7</td>
<td>65.6</td>
<td>62.1</td>
</tr>
<tr>
<td>Total</td>
<td>Count</td>
<td>206</td>
<td>193</td>
<td>201</td>
<td>119</td>
<td>32</td>
</tr>
<tr>
<td>% of sex</td>
<td>27.4</td>
<td>25.7</td>
<td>26.8</td>
<td>15.8</td>
<td>4.3</td>
<td>100.0</td>
</tr>
<tr>
<td>% age</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
</tr>
</tbody>
</table>

**Table 6**

Distribution of ligamentous laxity according to the study areas

<table>
<thead>
<tr>
<th>Area</th>
<th>Beighton</th>
<th>Positive</th>
<th>Negative</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No.</td>
<td>%</td>
<td>n</td>
<td>%</td>
</tr>
<tr>
<td>1</td>
<td>126</td>
<td>16.2</td>
<td>652</td>
<td>83.8</td>
</tr>
<tr>
<td>2</td>
<td>78</td>
<td>11.6</td>
<td>597</td>
<td>88.4</td>
</tr>
<tr>
<td>3</td>
<td>93</td>
<td>26.7</td>
<td>255</td>
<td>73.3</td>
</tr>
<tr>
<td>4</td>
<td>191</td>
<td>50.4</td>
<td>188</td>
<td>49.6</td>
</tr>
<tr>
<td>5</td>
<td>69</td>
<td>35.2</td>
<td>127</td>
<td>64.8</td>
</tr>
<tr>
<td>6</td>
<td>138</td>
<td>42.6</td>
<td>186</td>
<td>57.4</td>
</tr>
<tr>
<td>7</td>
<td>56</td>
<td>21.9</td>
<td>200</td>
<td>78.1</td>
</tr>
<tr>
<td>Total</td>
<td>751</td>
<td>25.4</td>
<td>2,205</td>
<td>74.6</td>
</tr>
</tbody>
</table>
Conclusions

1) Approximately one quarter of the school population of 8 to 12 years in the province of Granada has joint hypermobility (Beighton rated as positive), which is higher than in other European populations.

2) The prevalence of hypermobility in the different study areas of the province of Granada has produced a different pattern, therefore in the rural areas, where inbreeding is probably more pronounced and / or immigrant groups are higher (zone 4 and zone 6), the percentages are significantly higher (about 50%) than in urban areas, where values were below 17%.

3) In accordance with what is reflected in most of the studies on the subject, in our population there is a higher prevalence of hypermobility in women than in men, and a decrease in the frequency of hypermobile individuals is seen with age.

References