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Abstract

Objective: To determine the presence of hypermobility and differences between females and males in a Dutch population. Study design: Joint mobility was measured in a primary and a secondary school population. Beighton and Biro measurements were used. The data were evaluated statistically. Results: Using the Beighton score, 15.5% of group I (n=252; 4–13 years) and 13.4% of group II (n=658; 12–17 years) were hypermobile. Hypermobility was found more in females than in males, the difference being significant in the older group. Overall, hypermobility did not significantly diminish with ageing, although the individual joints did show a significant decrease in mobility with ageing. Hypermobility was significantly more pronounced at the non-dominant body side in both groups. The Quetelet-index did not show a significant relation to hypermobility.

Conclusion: Hypermobility was found more in females than in males, with a trend of decrease of hypermobility with ageing. The non-dominant body side proved to be more hypermobile and the Quetelet-index did not show a relation to hypermobility. Beighton's measurements proved best, since Biro considers the two body sides being equal. © 1997 Elsevier Science Ireland Ltd.

Keywords: Hypermobility; Beighton Score; Biro Score; Females; Non-dominancy

1. Introduction

Interest in a possible relationship between hypermobility in pregnant women and the 'peripartum pelvic pain syndrome' [1] triggered us to study the incidence of hypermobility in a non-pregnant Dutch population, because no such figures are available.

Hypermobility was best described by Kirk et al. [2]: 'the joints are unduly lax and the range of motion is in excess of the accepted normal in most of the joints examined'. The name 'Hypermobility Syndrome', however, is reserved for the situation in which this joint laxity is associated with musculoskeletal complaints [2–4]. In literature hypermobility is found 1.5 to 3 times more in women than in men [3,5–15]. Grahame [16] states that joint laxity decreases with age [6–11,15–17]. Beighton et al. [13] describe the non-dominant (mostly left) body side being significantly more mobile than the dominant (mostly right) body side [5,9]. Length and body weight do not seem to influence the joint mobility [9,13]. In musicians, athletes and dancers hypermobility is more pronounced, probably because hypermobility is an asset to these professions [11,17–19]. This is thought to be true, because joints that do not participate in the specific training also tend to be more lax than in other populations.

Ethnical differences are also described: Beighton et al. [13] found hypermobility in a South African population to be 20% in females and 6% in males. Among students in Iraq, Al-Rawi et al. [9], using the Beighton score, found 38.5% of the females and 25.4% of the males being hypermobile. In adult Iraqi women this percentage was 18% [20]. In Caukasian ballet-dancers 10.6% of the females and 2.2% of the males were hypermobile [11]: this study was also based on the Beighton score. A physiological form of hypermobility develops during pregnancy. There is a temporary hormonal laxity due to the hormone relaxin which relaxes the symphysis facilitating a vaginal...
Table 1
Criteria for hypermobility according to Beighton [13]

<table>
<thead>
<tr>
<th>Criterion</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hyperextension knee &gt;10°</td>
<td>2</td>
</tr>
<tr>
<td>Hyperextension elbow &gt;10°</td>
<td>2</td>
</tr>
<tr>
<td>Passive apposition of the thumb to the flexor aspect of the forearm</td>
<td>2</td>
</tr>
<tr>
<td>Passive hyperextension of the 5th metacarpophalangeal joint ≥ 90°</td>
<td>2</td>
</tr>
<tr>
<td>Forward flexion of the trunk, with knees straight, so that the palms of the hands rest easily on the floor</td>
<td>1</td>
</tr>
</tbody>
</table>

Maximum possible score 9

Hypermobile if score ≥ 4.

delivery [21,22]. Other joints are also influenced by relaxin [23–26]. This may cause back pain in 50% of all pregnant women [27–31].

2. Materials and methods

We have chosen a primary and a secondary school in Nijmegen to start our study with. Girls at that age are most likely not pregnant or have not been pregnant. Therefore, relaxin is a negligible factor in existing hypermobility among these girls.

Measurements were taken during gymnastics, since the students would already be in shorts. Students with parents of a different race, with joint disabilities or who were or had been pregnant were excluded.

Joint laxity was measured by standardized tests. The methods used were Beighton’s and Biro’s scores. The Beighton score (Table 1, [13]) is a modification of a technique which was initially developed by Carter and Wilkinson [32]. Each hypermobile joint gives 1 point, the maximum score being 9 points. With four or more points assigned, the individual is considered to be hypermobile. For the populations we compared with [9,20,32], the same score of ≥ 4/9 has been used.

Biro (Table 2, [12]) gives each hypermobile joint pair 1 point, the maximum score being 5 points. With three or more points assigned, Biro considers the individual hypermobile.

The tests were all easy to perform. Exact measurements were made of the knees, the elbows and the little fingers, by means of a goniometer (Tables 1 and 2). Date of birth, sex, length and body weight (Quetelet index: weight/height² kg/cm²) and right- or left handedness were also noted.

Measurements in group I were taken in May 1995 and in group II through January and February 1995.

Statistical analysis was done by computer using the Chi-Square test, the Trendtest of Van Eeden, the McNemar test and the Spearman Correlation analysis: p<0.05 was considered to be significant.

3. Results

In group I (primary school) 252 Dutch students in the ages 4 to 13 years were included in the study. Since the children were very young, they were asked to write or draw: 84.5% were right handed and 15.5% were left handed.

In group II (secondary school) 658 Dutch students in the ages 12 to 17 years were included in the study; 85.7% were right handed, 13.8% were left handed and 0.5% showed no preference: they could use both hands for several activities. No significant difference in dominance between the body sides was found between females and males of both groups (Table 3).

Using the Beighton score, in group I 18.3% of the females and 12.9% of the males proved to be hypermobile, an average of 15.5%. The difference between females and males was not significant. In group II 19.1% of the females and 7.6% of the males proved to be hypermobile, with an average of 13.4%. The difference between females and males proved to be significant (p<0.001), females being 2.5 times more hypermobile than males in this age group (Tables 4 and 5).

Table 2
Criteria for hypermobility according to Biro [12]

<table>
<thead>
<tr>
<th>Criterion</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hyperextension knee &gt;10°</td>
<td>1</td>
</tr>
<tr>
<td>Hyperextension elbow &gt;10°</td>
<td>1</td>
</tr>
<tr>
<td>Passive apposition of the thumb to the flexor aspect of the forearm</td>
<td>1</td>
</tr>
<tr>
<td>Passive hyperextension of the fingers, so that the fingers are parallel to the extension side of the forearm</td>
<td>1</td>
</tr>
<tr>
<td>Forward flexion of the trunk, with knees straight, so that the palms of the hands rest easily on the floor</td>
<td>1</td>
</tr>
</tbody>
</table>

Maximum possible score 5

Hypermobile if score ≥ 3.
Table 3
Body dominance of 910 students (ages 4—17 years)

<table>
<thead>
<tr>
<th></th>
<th>I Primary school</th>
<th>II Secondary school</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>4—13 years</td>
<td>12—17 years</td>
</tr>
<tr>
<td>Females</td>
<td>n</td>
<td>%</td>
</tr>
<tr>
<td>Right dominant</td>
<td>120</td>
<td>86.7</td>
</tr>
<tr>
<td>Left dominant</td>
<td>16</td>
<td>13.3</td>
</tr>
<tr>
<td>No dominance</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Males</td>
<td>132</td>
<td>82.6</td>
</tr>
<tr>
<td>Right dominant</td>
<td>109</td>
<td>82.6</td>
</tr>
<tr>
<td>Left dominant</td>
<td>23</td>
<td>17.4</td>
</tr>
<tr>
<td>No dominance</td>
<td>0</td>
<td>0.3</td>
</tr>
<tr>
<td>Totals</td>
<td>252</td>
<td></td>
</tr>
<tr>
<td>Right dominant</td>
<td>213</td>
<td>84.5</td>
</tr>
<tr>
<td>Left dominant</td>
<td>39</td>
<td>15.5</td>
</tr>
<tr>
<td>No dominance</td>
<td>0</td>
<td>0.5</td>
</tr>
</tbody>
</table>

When we look at the different age groups, overall hypermobility did not decrease significantly with ageing, although there was a trend. When we look at the individual joints there is a significant decrease of hypermobility with ageing nearly in all joints. The joints that contributed most to the hypermobility-score were thumb and little finger in group I and elbow, thumb and knee in group II.

Biro [12] considers joint pairs and therefore seems to consider the left and right body sides being equal. In literature however, many authors consider the non-dominant body side as more mobile. To analyse this we compared the Biro score of the left body side to the Biro score of the right body side in group II: on the right body side 7.6% of the females and 1.8% of the males were hypermobile, a total of 4.7%. Females were significantly more hypermobile than males (p<0.001), females being 4 times more hypermobile than males. On the left body side 12.5% of the females and 2.7% of the males were hypermobile, a total of 7.6%. Again females were significantly 4.5 times more hypermobile than males (p<0.001). This indeed shows a difference between hypermobility on the right (4.7%) and left (7.6%) body side (Table 6). When we specifically consider the right- and left handedness in this group, we see hypermobility on the dominant side in 4.6% (n=30) and on the non-dominant side in 7.8% (n=51): a significant difference (p<0.001).

The same analysis was made in group I: we also found significantly more hypermobility on the non-dominant body side (p<0.05).

In all age groups in both females and males the Quetelet Index did not correlate significantly with hypermobility (Spearman Correlation analysis).

4. Discussion

The incidence of joint hypermobility has not previously been recorded in a Dutch population. Confirming previous studies [3,5—15] joint hypermobility in these studies was more pronounced in females than in males. More females than males remain hypermobile (according to Beighton score) while ageing, as is reflected in Table 5. We can not
explain this phenomenon. In other studies joint laxity seemed to decrease with age [6–10,13–17]. Despite the fact that in our study hypermobility in the individual joints decreased significantly with ageing, the overall hypermobility score according to Beighton did not diminish significantly. Most likely, this is because the most contributing joint to the Beighton score in group I (thumb, 50.2%) was not the same one as in group II (elbow, 28.3%).

We confirmed the finding by other investigators [5,9,13] that the dominant side is less hypermobile than the non-dominant side, probably due to accelerated wear and tear of the dominant side. Our results show that physique, expressed as Quetelet index, has no relation to joint mobility.

Using the Beighton score, in group I the overall percentage of hypermobility was 15.5% and in group II 13.4%. As expected these percentages were lower than in Iraqi students [9]. Our findings seem to be almost the same as in South Africans [13], but that survey was done in adults, while we are talking about children. After correction for age, our findings will probably be lower than those in South Africans. This would confirm the general thought about ethnic differences in hypermobility [9,13].

The Beighton score is used by most authors, being more comparable. Biro has not clearly described the procedure: it is not clear whether one joint or a joint pair needs to be hypermobile in order to get a point. Furthermore, Biro uses the term 'Hypermobility Syndrome', while Hypermobility and Hypermobility Syndrome are two different entities. Last but not least, Biro considers both sides of the body as being equal, while the difference in hypermobility between body sides is obvious. Our advice is to consider both body sides separately in the process of measurements, like in the Beighton score. Therefore, in further studies in pregnant women we will only use the Beighton score.

Acknowledgments

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References