Assessment of Physical Development in Children with IgE-Dependent Allergy to Cow's Milk Proteins with Different Therapeutic Approaches

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Abstract

Specific oral tolerance induction and elimination diet are two radically different therapeutic approaches in the treatment of cow's milk protein allergy. Practice shows that the removal of dairy products from the diet leads to the depletion of nutrients in the body, including calcium. This situation leads to frequent physical developmental delays. Specific oral tolerance induction is a modern technique of treating allergies, which enables to provide important nutrients and achieve harmonious physical development.

The aim of the study was to assess the physical development of children with IgE-dependent allergy to cow's milk proteins in various therapeutic approaches – specific oral tolerance induction or elimination diet.

Materials and methods. The study involved 120 young children, of whom 60 had a confirmed cow's milk protein allergy and 60 were healthy. Children with cow’s milk protein allergy were randomized into two groups, where group 1 (n=30) received specific oral tolerance induction and group 2 (n=30) kept to an elimination diet. The comparison group consisted of healthy children, of which group 3 (n=36) – without a positive family history of allergies, group 4 (n=24) – with a positive family history of allergies. Assessment of physical development (weight, height) was performed at the start of the study and three years later.

Results. Children from the group of specific oral tolerance induction had the greatest absolute difference in weight (5.67±0.83), and the group of elimination
therapy had the smallest (4.69±0.67). Healthy children without a positive family history of allergies had the greatest absolute difference in growth (15.14±1.91), and the group of elimination therapy had the smallest (11.43±6.47). Not only belonging to the group affected the dynamics of growth and weight, but also the baseline growth and weight rates, which are significantly different in the compared groups. This effect was particularly pronounced for weight and had the greatest effect on the rates in groups with cow’s milk protein allergy.

Conclusions.

1. Specific oral tolerance induction allowed children with cow's milk protein allergy to achieve harmonious physical development as healthy peers.
2. An elimination diet leads to depleted nutrition and physical developmental delays.
3. Assessment of the dynamics of physical development should be carried out comprehensively, taking into account age, diet, and baseline growth and weight rates.

Keywords: cow’s milk protein allergy, physical development, height, weight, young children

Introduction

Our present is characterized by an extremely alarming situation regarding the increasing incidence of allergic pathologies. According to the WHO, various manifestations of allergic reactions and diseases are registered in 7-20% of the population, and in recent years, there has been a constantly increasing tendency [6]. Reactions to foods not involving immunocompetent cells are diagnosed in 10% of children [1, 3].

Cow's milk protein allergy (CMPA) is one of the most common manifestations of food allergy. The vast majority of cases of cow's milk protein allergy is manifested in the first year of life and a large proportion of children before school age develop tolerance to this product [2, 5]. There is a great need for timely oral immunotherapy, which makes it possible to rebuild the immune response and prevent the development of atopic march [4].

There are two therapeutic approaches in the treatment of CMPA – specific oral tolerance induction (SOTI) or elimination diet. Practice shows that the removal of dairy products from the diet leads to the depletion of nutrients in the body, including calcium [7]. This situation leads to frequent physical developmental delays. Specific oral tolerance induction is a modern method of allergy treatment, which not only prevents the development of atopic march, i.e. the progression of the disease from skin manifestations (food allergy, atopic dermatitis) to respiratory ones (bronchial asthma, allergic rhinitis) but also provides the body with important nutrients [8].

The aim of the study was to assess the physical development of children with IgE-dependent allergy to cow's milk proteins in various therapeutic approaches – specific oral tolerance induction or elimination diet.
Assessment of physical development in children with IgE-dependent allergy ...

Materials and methods.
The study involved 120 young children, of whom 60 had a confirmed cow's milk protein allergy and 60 were healthy. Children with cow’s milk protein allergy were randomized into two groups, where group 1 (n=30) received specific oral tolerance induction and group 2 (n=30) kept to an elimination diet. The comparison group consisted of healthy children, of which group 3 (n=36) – without a positive family history of allergies, group 4 (n=24) – with a positive family history of allergies. Assessment of physical development (weight, height) was performed at the start of the study and three years later.

Results
The mean age of children with CMPA was 14.6±3.86 months, and the comparison groups 14.5±3.18 months (p=0.88).
The weight and height rates are presented in tables 1 and 2.

Table 1. Weight rates in the studied groups

<table>
<thead>
<tr>
<th>Groups</th>
<th>Baseline weight</th>
<th>Weight after 36 months</th>
<th>Absolute difference</th>
<th>Difference %</th>
<th>n</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>12.22±2.13</td>
<td>17.89±1.84</td>
<td>5.67±0.83</td>
<td>48.43</td>
<td>30</td>
</tr>
<tr>
<td>2</td>
<td>12.51±1.68</td>
<td>17.21±1.46</td>
<td>4.69±0.67*</td>
<td>38.46*</td>
<td>30</td>
</tr>
<tr>
<td>3</td>
<td>14.06±1.63*#</td>
<td>19.42±1.52*#</td>
<td>5.36±0.52#</td>
<td>38.76*</td>
<td>36</td>
</tr>
<tr>
<td>4</td>
<td>14.89±1.41*#</td>
<td>20.34±1.45*#</td>
<td>5.45±0.50#</td>
<td>36.97*</td>
<td>24</td>
</tr>
</tbody>
</table>

* - the difference when compared with the 1st group;  
# - the difference in comparison with the 2nd group.

The data in Table 1 show that children from the SOTI group had the greatest absolute difference in weight (5.67±0.83), and the elimination therapy group had the smallest (4.69±0.67).

Table 2. Growth rates in the studied groups

<table>
<thead>
<tr>
<th>Groups</th>
<th>Baseline growth</th>
<th>Growth after 36 months</th>
<th>Absolute difference</th>
<th>Difference %</th>
<th>n</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>86.53±8.32</td>
<td>101.17±6.94</td>
<td>14.63±2.46</td>
<td>17.25</td>
<td>30</td>
</tr>
<tr>
<td>2</td>
<td>88.40±7.62</td>
<td>99.83±8.53</td>
<td>11.43±6.47*</td>
<td>13.20*</td>
<td>30</td>
</tr>
<tr>
<td>3</td>
<td>93.67±6.97*#</td>
<td>108.81±6.89*#</td>
<td>15.14±1.91#</td>
<td>16.29</td>
<td>36</td>
</tr>
<tr>
<td>4</td>
<td>94.83±6.18*#</td>
<td>108.83±6.17*#</td>
<td>14.00±1.96</td>
<td>14.85</td>
<td>24</td>
</tr>
</tbody>
</table>

* - the difference when compared with the 1st group;  
# - the difference in comparison with the 2nd group.
The data in Table 2 show that healthy children without a positive family history of allergies had the largest absolute growth difference (15.14±1.91), and the elimination therapy group had the smallest (11.43±6.47).

From the obtained results, it is obvious that the baseline growth and weight rates are different in groups, so it may affect the final results. For this purpose, we further study the effect of baseline weight and height on the dynamics of the difference using ANCOVA. The p ANCOVA values taking into account the baseline growth rate were the following: "Group" factor (p=0.000040), baseline growth (p=0.001637). The p ANCOVA values taking into account the baseline weight rate were the following: "Group" factor (p=0.000000), baseline weight (p=0.000001).

The dynamics of weight and height, depending on the baseline rates, are shown in Figures 1-2.

**Figure 1.** Dynamics of weight in groups, depending on the baseline rates
As we can see, in both cases, not only belonging to the group affected the dynamics of growth and weight, but also the baseline growth and weight rates, which are significantly different in the compared groups. This effect was particularly pronounced for weight and had the greatest effect on the rates in groups with cow's milk protein allergy.

**Conclusions**

1. Specific oral tolerance induction allowed children with cow's milk protein allergy to achieve harmonious physical development as healthy peers.
2. An elimination diet leads to depleted nutrition and physical developmental delays.
3. Assessment of the dynamics of physical development should be carried out comprehensively, taking into account age, diet, and baseline growth and weight rates.

**Conflict of interest.** The authors do not report any financial or personal connections with other persons or organizations that might negatively affect the content of this publication and/or claim authorship rights thereto.
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References


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