

THE ANOMALOUSLY DESIGNED CHILDREN'S FURNITURE AS A REASON FOR CURVATURE OF THE SPINE COLUMN

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ABSTRACT

The increased number of spine column curvatures in preschool children using anomalously designed desks and chairs imposes the need to collect data that will help design furniture suited to their age, as one of the conditions for a proper physical development. For this purpose, anthropometric analyses of preschoolers have been conducted, and through comparison of the existing chairs and desks in preschool institutions, preliminary findings of a proper design have been acquired.

Key words: preschool children, furniture design, spine column, anthropometry, children's desks and chairs.

INTRODUCTION

In order to provide a proper growth and development of preschool children, apart from adjusting the environment in which they are staying, it is necessary to utilize ergonomic furniture that will follow the anatomy and size of the human body, thus achieving comfort in using it as well.

RESEARCH PURPOSE

The furniture used by children in preschool institutions presents a very important element in their development. Conducting anthropometric analyses in preschool premises leads to findings that can further serve to help design the furniture. The research of children's anthropometry allows, using the received results, making comparison with the existing furniture and designing and constructing such furniture that will be fully compatible with the needs and measurements of the children.

MATERIAL AND METHODS

During this research the method of direct measurement has been used, which yields certain data on the dimensions of the existing chairs and desks in preschool institutions, as well as the method of specific measurements of the human body (anthropometry). Moreover, the analytic-synthetic method describes the problem while at the same time offering solutions to resolve it.

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RESULTS AND DISCUSSION

The conducted analyses have yielded the following specific measurements according to which chairs and tables can be designed.

- For children aged 2-3, chairs need to be of 24cm seat height, 27cm seat length and 36cm seat width.
 - For children aged 3-4, chairs need to be of 26cm seat height, 30cm seat length and 36cm seat width.
 - For children aged 4-5, the existing chairs fully satisfy the dimensions, namely 27,5cm seat height, 30cm length and 36cm width.
 - For children aged 5-6, chairs need to be of 32cm seat height and height and length of 30,5x30cm.
- The desks for the first and second younger group need to be 45cm, for the middle one 48cm, and for the older one 56cm.

Problems arising from using anomalously designed chairs and desks

A very careful approach is essential in designing furniture for preschool children, taking into consideration two aspects. The first aspect is the child's anatomy. During the earliest years of childhood the spine column, much like the rest of the bones, is not fully formed, hence the proper utilization of furniture is of great importance. If the seating element is designed according to the needs of the children, i.e., it follows the body line, this will lead to proper development of the body. The second aspect is the size of the furniture elements. Items of furniture that are too big or too small also lead to an anomalous physical development.

One of the most common curvatures of the spinal column is the scoliosis, which is a curvature in the "coronal" (frontal) plane, and kyphosis, which is a spinal curvature of the thoracic vertebrae in the form of a hump.

Besides the spinal curvatures, which are the most common ones, deformities occur with the legs as well. This phenomenon is a result of the too small dimensions of the chairs which forces the legs in an improper posture.

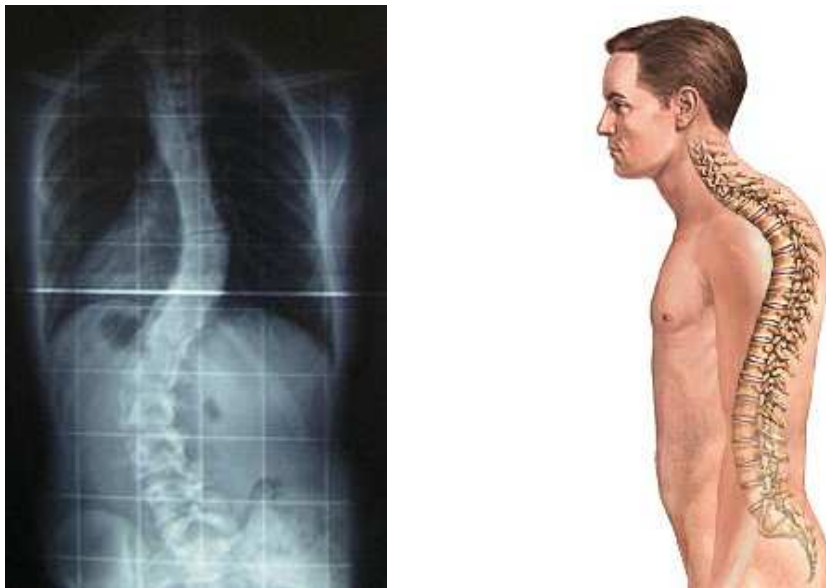


Fig. 1: Scoliosis

A research conducted by the specialist psychiatrists Prim. Dr. Velika Labachevska and Prim. Dr. Lidija Ivanovska regarding spinal column curvatures of 4,609 children, has yielded the following results:

- 1,168 children or 25,3% have spinal curvatures in the form of scoliosis,
- 339 or 7,4% have curvatures in some form of kyphosis.

Anthropometric analysis

The analysis of the anthropometry of children is very important as it is a period of accelerated growth and physical measurements change with each coming year.

This paper includes anthropometric research conducted in one of the preschool institutions of the Municipality Centre – “13th November”, in order for relevant data of the measurements of preschool children to be acquired and for the existing furniture to be compared with that of the other preschool institutions.

The research included measuring of 80 children, in four different groups of 20 children of each age group. The first group was comprised of children from the first younger group of children aged 2-3, the second included the children of the second younger group aged 3-4, the third those of the middle group aged 4-5, and the fourth group included the children of the older group aged 5-6.

The anthropometric analysis by groups is presented in the following charts:

Tab. 1: 1st younger group aged 2-3

1 st younger group aged 2-3	
Height	96
Eye height	86
Body height in seated position	52, 2
Height of max, reach	115, 5
Buttocks-knee length	29
Knuckle height	30, 5
Shinbone height	25
Buttocks-shin length	28
Shoulder height in seated position	34
Shoulder width	29
Elbow-to-elbow width	38
Hips width	25
Height of elbow prop	17, 5

Tab. 2: 2nd younger group aged 3-4

2 nd younger group aged 3-4	
Height	108
Eye height	96
Body height in seated position	57, 5
Height of max, reach	129
Buttocks-knee length	32
Knuckle height	32, 5
Shinbone height	26, 5
Buttocks-shin length	34
Shoulder height in seated position	35
Shoulder width	30
Elbow-to-elbow width	38
Hips width	26
Height of elbow prop	18, 5

Tab.3: Middle group aged 4-5

Middle group aged 4-5	
Height	110
Eye height	100
Body height in seated position	60
Height of max, reach	131
Buttocks-knee length	34
Knuckle height	33, 5
Shinbone height	28, 5
Buttocks-shin length	38
Shoulder height in seated position	37
Shoulder width	30
Elbow-to-elbow width	38
Hips width	27
Height of elbow prop	19

Tab.4: Older group aged 5-6

Older group aged 5-6	
Height	125
Eye height	112
Body height in seated position	66
Height of max, reach	148
Buttocks-knee length	36
Knuckle height	37
Shinbone height	33
Buttocks-shin length	39
Shoulder height in seated position	42
Shoulder width	31
Elbow-to-elbow width	39
Hips width	30
Height of elbow prop	23

CONCLUSION

While recording the preschool institutions of the Municipality Centre, measurements of the furniture used by children have been conducted. There are two types of chairs with different dimensions. One is of smaller dimensions, with seat height of 28cm, length of the front side of the seat of 36,5 cm, length of the back side of 29cm and seat width of 30cm. The other type of chair is of bigger dimensions. The seat height is 35cm, the length is 30,5cm, and the width 30cm.

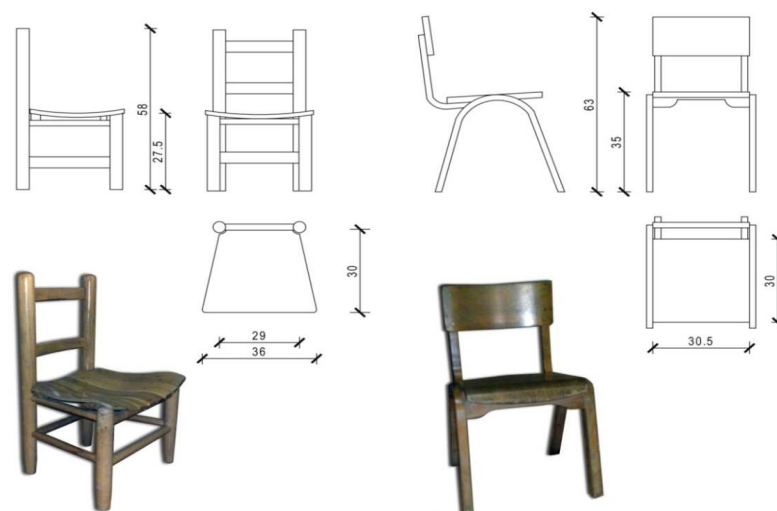


Fig. 2: Dimension of chairs

For a proper seating posture, the dimensions of the seat need to be compatible with the dimensions of the human body. At the same time, the seat height should not exceed that of the shin. This allows the legs to freely touch the floor and avoid the pressure to the shin. Moreover, the seat width must not exceed the buttocks-shin length. The width of the seat must always be lower than the measurement of the buttocks-shin length. This prevents the strain of the thigh muscles and the tingle in the lumbar part. The seat length should fully encompass the dimensions of the buttocks, i.e., not to break the dimension prescribed for the seat.

From the analysis of the anthropometric data acquired via the measuring of the children, the conclusion is that the children of the first younger group can use the small chairs, but they are not fully compatible with the children's measurements. The average shin height of the children aged 2-3 is 25 cm, while the seat height is 27,5 cm, which causes their little legs to hang loose. This is not a major deficiency as they can still touch the floor with the tip of their foot. This applies to all the children whose shin length is below 27,5 cm. The seat length of 36,5 cm in the front side and 29 cm in the back side satisfies the measurements of 25 cm hips width. The seat width of 30 cm does not correspond to the dimension of 28cm buttocks-shin length. According to the measurements of the children, the ideal seat dimension of the chair would be 27cm wide, 24cm high, while the length should remain as it is.

The children of the second younger group can also use the smaller-dimension chairs, provided the seat height is lowered to 26 cm, as the shin height is 26,5 cm, the buttocks-shin length is 34 cm, and the hips width 26 cm.

The children from the middle group aged 4-5 should use the smaller chairs. The height of the chair is 27,5 cm, which is compatible with the 28,5 cm shin height. The seat length is 36,5 cm, while the hips width is 27 cm. The seat width is 30 cm, while the buttocks-shin length is 38 cm. this type of chair is suitable for the dimensions of the children from this age group.

The chair with bigger dimensions fulfills the conditions to be used by children of the older group. The seat height is 35 cm, while that of the shin is 33 cm. This measurement for certain types of children does not meet the conditions for seat height. The 30,5 x 30 cm length and width of the seat fit the buttocks-shin length of 39,5 cm and hips width of 30 cm.

From the analysis described above, it can be deduced that the existing chairs in the preschool institutions in the Municipality Centre, with some small alterations, will be fully compatible with the dimensions of the children. The first younger group can use the chairs with smaller dimensions, but if the seat height and width are changed, then the new dimensions would be fully compatible with this age group. The height of the seat needs to be 24 cm, while the seat width 27 cm. The second younger group and the middle group can use the smaller chairs without making any significant alterations in the dimensions, while the older group can use the chairs with bigger dimensions, provided that some changes are made to the seat height, i.e., the height needs to be 32 cm. The first younger group has a shin height of 25 cm, so when the height of the elbow prop of 17,5 cm is added, we get the dimension of 42,5 cm. Hence, the height of the desk should be 43 cm. The second younger group has a shin height of 26,5 cm, so by adding the height of the elbow prop of 18,5, we arrive at the desk height of 45 cm. As for the children of the middle group, the desk height needs to be 48 cm, as the shin height is 28,5 cm and the elbow prop height is 19 cm. The height of the desk for the children of the older group needs to be 56 cm, which corresponds to the existing desk height in the institutions.

The desk are of the same type for each group. The dimensions used in all the institutions in the Municipality Centre are of 56,5 cm height and hob width and length of 79 cm x 79 cm. According to Mate Bayen in the book „ Shkolske zgrade 1”, the height of the desk should be in line with the height of the elbow hanging freely in a seated position. Hence, to properly set the dimensions of the desks, the measurement of the height of the elbow prop should be taken

as reference. This height will be obtained when the height of the elbow prop is added to the shin height.

Based on the conducted analyses, we can conclude that the desk height should be designed according to the stated measurements, where different dimensions are prescribed for each group. To simplify matters during manufacturing, the height for the first and the second younger groups should be with the dimension of 45 cm. This height will be somewhat higher for the younger group, but that presents no problem as the difference is only 2 cm. The height of the desks for each group could be managed using the principle of setting a mechanism to adjust the height.

The width and length of the desks should not only be suited to the measurements of the children, but also to be adjusted to their daily activities. Hence, this hob size is acceptable as it is a space where children eat, perform leisure activities, and activities related to the educational process.

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