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Peculiarities of the physical growth of school children and teenagers with chronic diseases of the gastroduodenal area

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Abstract

The objective of this research was to study the physical development of schoolchildren and teenagers with chronic gastroduodenal pathology (CGDP). The basis of the work was a multifactor analysis of 1547 schoolchildren from 6 to 15 years old. We carried out a study of physical growth indicators, including body height for age and weight for age and body mass index (BMI). To maintain the reliability of the study, we selected only children with CGDP, excluding children with functional impairments not associated with damage to these organs. CGDP included chronic gastritis, gastroduodenitis, duodenitis, gastric ulcers, and duodenal ulcers. The results indicated weight loss in children with CGDP against a background of increased growth compared to the control group (63.64%). These were mainly children with various forms of chronic gastritis and gastroduodenitis. Analysis of BMI evinced that 35.66% of children showed a decrease in the index (BMI<18.5), while 55.24% had BMI=20-25, and 7.69% BMI=25-29.9. We observed in children and teenagers with CGDP physical growth disorders, such as a reduction or increase in body weight compared with healthy coevals. The differences observed were dependent on the gastroduodenal area pathology type. Registered with ClinicalTrials.gov PRS ID: NCT04702542 (https://clinicaltrials.gov/ct2/show/NCT04702542).

Keywords: chronic diseases, schoolchildren, teenagers, gastroduodenal area

1. Introduction

The health state of the population is one of the important indices of the welfare of society, reflecting the characteristics of the economic and social tendencies in the country (1, 2). Thus, the problem of maintaining the normal physical growth of schoolchildren and teenagers has great significance in modern paediatrics (3). In the practice of paediatrics, gastrointestinal tract (GIT) organ pathology is often observed in association with predominantly chronic inflammatory diseases, including gastroduodenitis and ulcers with a long relapsing course, which lead to a considerable reduction in the quality of life for children and to the development of different complications (anaemia, obesity, insufficient body weight, bleeding, perforation and so on) (4,5).

According to some authors, studying the physical development of these patients remains controversial due to the small number of studies (6, 7). However, relatively little attention is given to the factors related to the daily activities of schoolchildren and their feeding (1, 8). In recent years, the study factors leading to disorders in the physical development of growing children has been an actual direction in medicine.

The impact of environmental and social factors on the development of chronic gastroduodenal pathology (CGDP) in children and teenagers remains a question.

2. Patients and methods

2.1. Study design

The clinical observation of patients was based on a randomized controlled scientific study. The test reports are in accordance with the CONSORT 2010 recommendations and presented with their protocols on the website: https://clinicaltrials.gov/ct2/show/NCT04702542. We conducted this study in three stages: Stage 1 – We conducted a screening survey based on a comprehensive questionnaire. The children in middle and high schools completed their own questionnaires, while the children in primary schools did so with the help of medical professionals through a "question-and-answer" method. Medical workers completed the questionnaires for children of younger age groups. Teens self-administered the questionnaires.

Stage 2 – We performed a common outpatient examination of children, including a comprehensive survey with other specialists (neurologists, endocrinologists, ophthalmologists, otolaryngologists, paediatric surgeons, etc.). We also evaluated the physical development of children (body length/height, weight, body mass index, BMI).

Stage 3 – We conducted clinical laboratory and instrumental studies, and performed EF om 6 to 15 years old

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living in Tashkent City and the Tashkent area (Uzbekistan). The median GDS.

2.2. Patients

The basis of this work was a multifactor analysis of 1547 schoolchildren fr age was 11.8 ±2.5 years. We examined the children after taking permission from their parents. We carried out examinations based on the regular medical examination schedule of schoolchildren. We divided the examined children into age groups according to WHO recommendations.

The first group included children from 6 to 8 years old, who made up 39.49% (n=611) of the total number of examined children, while the second group included children from 9 to 11 years old with 32.84% (n=508), and teenagers (12-15 years old) composed the third group with 27.67% (n=428). The ratio of girls to boys was 1.2:1.

2.3. Research methods

Research methods included the following:

• General clinical research: complete blood count, complete stool analysis.

• Instrumental research: fibrogastroduodenoscopy (FGDS) of the upper digestive system.

• Study of the physical development of patients.

We evaluated the physical growth of schoolchildren (body height for age, weight for age, index of body weight - BMI), performed GDS (gastroduodenoscopy), and determined the level of somatotrophin (STH). Subsequently, we treated all patients.

2.4. Ethical review

We conducted the described study in accordance with the Code of Ethics of the World Medical Association (Declaration of Helsinki) for experiments involving humans. To conduct clinical and laboratory studies on children in an outpatient setting, we obtained a certificate from the Ethics Committee under the Ministry of Health of the Republic of Uzbekistan (protocol no. 3 of 20.04.2017). We registered the study on the ClinicalTrials.gov PRS site (https://clinicaltrials.gov/ct2/show/NCT04702542). Before the clinical trials, we also obtained written permission from the parents or guardians to examine their children and adolescents. Furthermore, we recorded all the study results in the patients' outpatient documentation.

2.5. Statistical analysis

In the course of the study, we entered all the mathematical data obtained into the primary patient database using MS Excel 2013 spreadsheets (based on Microsoft Office 2013), followed by data processing using Statistical 10 application packages. We determined the statistical significance of differences in trait values in the study groups using the nonparametric Mann–Whitney and Kruskal–Wallis tests. We used the Spearman correlation coefficient to identify the relationships between the variables, and the nonparametric Wilcoxon test to compare the changes in indicators. Data are presented as the mean (M) and standard deviation (M±S). The obtained statistical results were considered significant at $P \leq 0.05$.

3. Results

The results showed that as age increased, the number of schoolchildren with functional disorders of the gastrointestinal tract increased. Intending to obtain “clear” results, we chose only children with chronic diseases of the gastroduodenal area (CGDP), excluding children with functional disorders that were not associated with damage to these organs. We diagnosed the following CGDP: chronic gastritis, gastroduodenitis, enterocolitis, and gastroduodenal ulcers. After all stages of the study, we diagnosed 437 (28.25%) schoolchildren from a total of 1547 with different clinical variants of functional disorder of organs in the gastroduodenal area. Among them, 12.81% (n=56) were 6 to 9 years old, 32.72% (n=143) were 10 to 13 years old and 54.46% (n=238) were teenagers (14-15 years old). For comparison, we chose 225 children and teenagers without chronic somatic diseases as the control group.

The study evinced that the physical development of schoolchildren from the first group with CDGDA did not practically differ from that of their healthy coevals. The differences in the weight and height indices in comparison to the control group were not significant.

We observed a trend of a reduced weight index for age on the background of an increased height index among the schoolchildren with CGDP from the second age group compared to the control group. We identified obesity only in 2 (1.40%) children (BMI>30) and diagnosed them with duodenal ulcers. Moreover, we observed an increase in the height index in 63.64% (n=91) of the children in this group in comparison to that in the control group. The difference was approximately 18.6%. These were mainly children with different forms of chronic gastritis and gastroduodenitis. The others accounted for 36.36% (n=48), and the height index was in accordance with that of the children from the control group, except for the retardation of height compared to the control group. During the analysis of the body weight index, we observed a reduction in the index (BMI < 18.5) in 51 (35.66%) children. The BMI was 20-25 in 79 (55.24%) schoolchildren with CGDP and 25-29.9 in 11 children (7.69%).

Among the teenagers, we marked the obvious trend towards differences in physical growth. An analysis of the weight index in relation to the height showed a marked reduction in comparison with the control group, at approximately 38%. The height index for age in 126 (52.94%) teenagers was also in accordance with that of the control group. The other 32 (13.45%) teenagers showed marked growth retardation, and 80 (33.61%) had increased

height compared to the control group. The analysis of the index body weight in 109 (45.8%) patients evinced a reduction in the index (BMI<18.5). We marked obesity in 6 (2.52%) teenagers (BMI>30), and in 19 children and teenagers (7.98%), the BMI was 25-29.9.

We found the BMI as 20-25 in only 104 (43.69%) teenagers with CDGDA.

4. Discussion

Early diagnosis and treatment of chronic diseases in children and adolescents are one of the most urgent problems in modern paediatrics. Digestive diseases occupy a leading position in the overall incidence of childhood diseases and thus represent a serious medical and social problem. Over the past 10 years, the frequency of diseases of the gastrointestinal tract in children under 14 years of age increased by 30%, and 15-17 years of age by 44% (9,10).

There is a large amount of information on the mechanisms underlying the development of digestive system pathology, and the resulting impact of pathological factors in various origins is a decrease in the barrier properties of the gastroduodenal mucosa, forming a cascade of adaptive reactions that affect the homeostasis of nearly the entire body (11,12).

Studies have shown that gastroduodenal area pathology influenced physical growth. In particular, obesity and elevated BMI were observed in children with ulcerous diseases of the duodenum.

According to Abuquteish D and Putra J. (2019), the prevalence of duodenitis in children with diseases of the upper digestive tract ranged from 33% to 48% (1). According to Styne DM et al. (2017), obesity or underweight in these diseases led to long-term complications; therefore, screening for concomitant obesity in patients with these diseases should be applied in a hierarchical, logical way for early identification before more serious complications arise (13). We noted in this study that chronic gastritis and ulcerous damage to the stomach in children resulted in a reduction in body weight and a corresponding reduction in the BMI, which was evidently displayed in the teenage period.

It should be noted that the teenage period sharply differed from all other stages of development owing to the pace and uniqueness of activities in this period of life.

As the endocrine system is in constant connection with the digestive system, disorders or deviations in one system are reflected in changes in the functional activity of the other system.

It should also be noted that the main factor in the pathogenesis of CGDP is nutrition disorders. The predominance or reduction of specific food ingredients promotes changes in specific fermentation products and hormones in organisms, which is especially observed in children and teenagers.

Furthermore, gastrointestinal hormones play a huge role in the humoral regulation of digestive functions (14). These substances are produced by the endocrine cells of the gastric mucosa, duodenum, and pancreas. Gastrointestinal hormones are involved in the regulation of secretions, motility, absorption, trophism, and the release of other regulatory peptides, and the disruption of their production affects metabolism. A representative gastrointestinal hormone is somatostatin (GHIF-growth hormone inhibiting factor, SRIF-somatotropin-release inhibiting factor).

It is worth mentioning that the concentration of somatostatin in the islets of Langerhans of the pancreas is higher than in the tissues of the hypothalamic zone of the brain. There are also high levels of somatostatin in the antral mucous membrane of the stomach and much less somatostatin in the intestinal mucosa. In general, 3/4 of all immunoreactive somatostatin is produced by D-cells located in the digestive organs, and the rest is produced in the brain (15,16).

In addition, the relationship between somatostatin and somatotropin (growth hormone, GH) is indisputable. GH increases the synthesis of cartilage tissue in the epiphyseal parts of the bones, stimulates the growth of the body in length and increases the thickness and width of bones in childhood (17).

Additionally, somatotropin has powerful anabolic and anticatabolic effects; that is, it accelerates protein synthesis and inhibits protein breakdown, providing nitrogen and phosphorus homeostasis and lowering urea levels, as well as helping to reduce the deposition of subcutaneous fat, increasing fat burning and the muscle mass-to-fat ratio (15).

In our previous study (4), we found a clear association between the hormonal background and the physical development of schoolchildren. Somatotropin is called the hormone of height because in children, teenagers, and young people, it causes an acceleration of linear (in length) height, mainly due to its effects on the long cylindrical bones of the extremities. Somatotrophin increases the synthesis of cartilaginous tissue in the epiphyses of bones, leading to an increase in the length of the epiphyses of bones, which then leads to changes in body height; and by increasing the periosteal height somatotropin also increases the width and thickness of bones. An increase in the mass of muscular and connective tissue occurs, and the mass of the inner organs also increases.

However, many physiological factors influence the balance of these hormones and the secretion of the growth hormone. The secretion of the growth hormone is stimulated by sleeping, physical exercise, increased consumption of high-protein foods, and hypoglycaemia. Under hypoglycaemic conditions, the level of GH sharply increases in the blood, which is one of the natural physiological

mechanisms for the fast correction of hypoglycaemia, and the secretion of GH is suppressed under hyperglycaemic conditions and with high blood plasma levels of free lipoic acids and glucocorticoids.

Therefore, there is a direct connection between the physical development of children and chronic gastroduodenal pathology.

We associated physical growth disorders in children and teenagers with CGDP with reduced (to 45% of the level of the observed patients) or increased body weight (to 8% of the lnevel of observed patients) compared to the healthy coevals. In a given category of schoolchildre, we observed an increase in the height index (to 64% of the level of the examined patients). Accordingly, we observed deviations in the body weight index in either direction. The differences observed were dependent on the gastroduodenal area pathology type. In children and teenagers with CGDP, the average increase in STH in relation to the control group was 24.35%, but in terms of normative indices. Given the controversial nature of the problem and the results of this research, clinical research in this area is ongoing, and the results will be communicated in the near future.

Conflict of interest

The authors declare that they have no competing or financial interests. Funding for clinical research was carried out at the expense of the authors' personal contributions and with the support of the administration of the medical institute.

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Authors' contributions

We, Turdieva ShT and Ganieva DK, the authors of this scientific article, guarantee the provision of the Author Agreement after the acceptance of the article for publication. We are the only authors who claim that there is no one on the list of authors except us.

Authors jointly participated in conducting a clinical study and writing an article. Contribution of each author: Turdieva Sh.T. - contributed to study conception and design; contributed to data acquisition, analysis, or interpretation; drafted the manuscript; critically revised the manuscript, gave final approval; and agrees to be accountable for all aspects of the work, ensuring its integrity and accuracy. Ganieva DK - contributed to data acquisition and interpretation and drafted the manuscript and agrees to be accountable for all aspects of the work, ensuring its integrity and accuracy.

Both authors contributed to the writing of the manuscript and approved its final version.

Ethics approval

The manuscript does not contain the data of any person in any form (including any individual data, images, or videos); consent for publication obtained from parents or legal guardians - not applicable.

The work described has been carried out in accordance with the Code of Ethics of the World Medical Association (Declaration of Helsinki) for experiments involving humans. To conduct clinical and laboratory studies of children on an outpatient basis, a certificate was issued by the Ethics Committee under the Ministry of Health of the Republic of Uzbekistan (protocol no. 3 of 20.04.2017).

We registered this study on the ClinicalTrials.gov PRS site (ID: NCT04702542). In addition, before clinical trial participation, we obtained written permission from the parents and guardians to examine their children and adolescents. We recorded all study results simultaneously in the patients' outpatient documentation.

Consent for publication

The manuscript does not contain information requiring consent for the publication of any individual person’s data in any form (including any individual details, images or videos). Consent for publication must be obtained from that person, or in the case of children, their parents or legal guardians.

Availability of data and materials

This published article includes all data generated or analysed during this study.

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