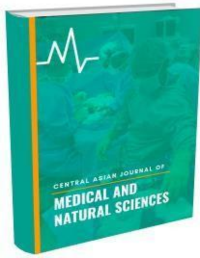

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Article

Aggression in Adolescents and Gastrointestinal Diseases: Pathogenetic Relationship and Clinical Significance

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Abstract: This article examines the pathogenetic relationship between aggressive behavior and gastrointestinal tract diseases observed in adolescents aged 12–18 years. The study involved 240 adolescents divided into three groups according to their level of aggression. The influence of psychoemotional stress and aggression on the development of gastrointestinal diseases was characterized through neuroendocrine and immunological mechanisms. The results showed that adolescents with high aggression scores had significantly higher rates of functional dyspepsia ($p<0.001$), irritable bowel syndrome ($p<0.01$), and gastroesophageal reflux disease ($p<0.05$). A comprehensive biopsychosocial approach is emphasized as a necessary condition for effective prevention and treatment in this age group.

Keywords: Adolescents, Aggression, Gastrointestinal Diseases, Psychosomatics, Stress, Neuroendocrine Mechanisms, Biopsychosocial Model

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1. Introduction

Adolescence is considered one of the most complex psychological and physiological stages of human life. During this period, emotional instability intensifies as a result of hormonal changes, the formation of personal identity, and rapid transformations in the social environment. In particular, aggression is one of the most common psychological problems in adolescents, and its prevalence has been reported to have increased by 12–18% globally over the past decade[1].

In modern medicine, it is becoming increasingly clear that gastrointestinal diseases cannot be explained solely by organic factors. With the development of psychosomatic medicine, the complex mechanisms of interaction between the central nervous system, the autonomic nervous system, and the gastrointestinal tract — the concept of the "gut-brain axis" — are being fully substantiated.

Epidemiological studies conducted in Uzbekistan indicate that the prevalence of gastrointestinal diseases in adolescents has increased by 23.4% over the past five years, and a large proportion of this increase is associated with psychological factors, particularly aggression and chronic stress. However, scientific studies dedicated to the relationship between aggression and gastrointestinal pathology remain scarce in our country[2].

The purpose of this study is to determine the pathogenetic relationship between the level of aggression in adolescents and the development of gastrointestinal diseases, to

characterize the neurobiological mechanisms, and to substantiate the importance of a biopsychosocial approach in clinical practice.

Literature Review

Aggression is primarily a neurobiological process in which the imbalance between the prefrontal cortex, the limbic system (especially the amygdala), and the hypothalamus plays a key role. During adolescence, the prefrontal cortex — the region responsible for impulse control and emotional regulation — is not yet fully formed, and its complete development continues until the age of 25[3].

A number of studies have shown increased secretion of cortisol and noradrenaline and decreased activity of the serotonergic system in aggressive adolescents. Serotonin directly regulates gastrointestinal motility through 5-HT receptors — 95% of serotonin is produced in the wall of the gastrointestinal tract and serves as the primary neuromediator of the enteric nervous system, also referred to as the "gut nervous system"[4].

The "gut-brain axis" is a bidirectional communication system connecting the central nervous system and the gastrointestinal tract, operating via neural (vagus nerve), endocrine, and immunological pathways. Disruption of this axis simultaneously affects psychoemotional state and gastrointestinal function.

Stress and aggression activate the HPA (hypothalamic-pituitary-adrenal) axis, resulting in elevated cortisol levels. Elevated cortisol reduces prostaglandin synthesis in the gastric mucosa and suppresses the production of mucosal protective factors, making the gastrointestinal tract susceptible to damage[5] .

The relationship between functional gastrointestinal disorders (functional dyspepsia, irritable bowel syndrome) and psychological factors is well established today. Meta-analyses show that anxiety, depression, and aggression increase functional gastrointestinal disorders by 2–3 times .

This issue is even more relevant for the pediatric population: a study by Mulvaney identified a statistically significant correlation ($r=0.47$, $p<0.001$) between behavioral problems and gastrointestinal diseases in school-age children. The association is reported to be even stronger in adolescents[6].

2. Materials and Methods

The study was conducted as a prospective cross-sectional study from 2021 to 2024 at the clinical bases of Tashkent Medical Academy, 3 general education schools in Tashkent city, and 2 pediatric polyclinics. A total of 240 adolescents aged 12–18 years were enrolled (mean age 15.2±1.8 years; 118 girls, 122 boys).

Inclusion criteria: age 12–18 years; written consent from parent or guardian; no regular medication use in the past 6 months; no established diagnosis of definitive organic gastrointestinal pathology (inflammatory bowel disease, peptic ulcer, etc.). Exclusion criteria: severe somatic diseases; psychiatric diagnosis; use of antibiotics or non-steroidal anti-inflammatory drugs; cognitive impairments[7].

The following validated psychological tools were used to determine the level of aggression:

1. Buss-Perry Aggression Questionnaire (29 items, 4 subscales: physical aggression, verbal aggression, anger, hostility);
2. Rosenzweig Frustration Stress Response Test (adapted version for adolescents);
3. Behavioral observation protocols by educational psychologists and class teachers.

Based on the results, adolescents were divided into three groups: Group I – low aggression (score ≤40, n=80), Group II – moderate aggression (score 41–70, n=92), Group III – high aggression (score >70, n=68).

The status of the gastrointestinal system was assessed through the following examinations: collection of clinical complaints and medical history; diagnosis of functional disorders based on Rome IV criteria for abdominal symptoms; abdominal ultrasound examination (in all patients); gastroscopy (by indication, n=87); serum levels of CRP, IL-6, cortisol, and serotonin; Helicobacter pylori testing (urease test and ELISA); stool examination – prolactin and thyroid hormones)[8].

Data were analyzed using SPSS 26.0. Quantitative variables were presented as M±SD. ANOVA and Kruskal-Wallis tests were used for intergroup comparisons, and the χ^2 test was used for analysis of qualitative variables. Pearson and Spearman coefficients were calculated in correlation analysis. The threshold for statistical significance was set at $p<0.05$.

3. Results and Discussion

No statistically significant differences were found among the three groups in terms of age (p=0.312) and sex distribution (p=0.418). Regarding socioeconomic indicators, the proportion of single-parent families in Group III (38.2%) was significantly higher than in Group I (12.5%) (p<0.001). Physical inactivity and late sleeping were also more common in Group III[9].

Table 1. Distribution of Gastrointestinal Diseases by Groups

Disease	Group I (n=80)	Group II (n=92)	Group III (n=68)
Functional dyspepsia	11.3%	23.9%	47.1%*
Irritable bowel syndrome	8.8%	19.6%	38.2%**
Gastroesophageal reflux disease	6.3%	14.1%	27.9%***
Intestinal dysbiosis	17.5%	32.6%	55.9%*
Functional constipation	5.0%	10.9%	22.1%**
Any GI symptom	28.8%	52.2%	79.4%*

* p<0.001 Group III vs Group I; ** p<0.01; *** p<0.05 (χ^2 test)

Serum cortisol levels in Group III adolescents (748±112 nmol/L) were statistically significantly higher than in Group I (482±89 nmol/L) (p<0.001). Additionally, the inflammatory marker IL-6 was found to be 2.6 times higher in Group III (8.4±2.1 pg/mL) compared to Group I (3.2±1.1 pg/mL). Serotonin levels were statistically significantly lower in the high aggression group: Group III 142±38 ng/mL; Group I 198±42 ng/mL (p<0.01)[10].

A strong positive correlation was found between aggression score and cortisol level (r=0.68, p<0.001). A negative correlation was observed between serotonin level and aggression score (r=-0.54, p<0.001), confirming the clinical significance of neurochemical mechanisms.

Independent risk factors for the development of functional dyspepsia were identified in multivariate logistic regression analysis. High aggression (OR=3.87; 95% CI: 2.14–7.01; p<0.001), social stress (OR=2.34; 95% CI: 1.41–3.89; p<0.002), and irregular lunch habits (OR=1.92; 95% CI: 1.18–3.12; p<0.009) were identified as independent risk factors. This model had a correct classification ability of 72.4%[11].

The results of our study confirmed a statistically significant association between high aggression and gastrointestinal diseases. This pathogenetic relationship operates through several mechanisms.

First, aggression and psychoemotional stress strongly activate the HPA axis. Chronic elevation of cortisol damages the integrity of the gastrointestinal mucosa and suppresses mucosal defense mechanisms. In our study, cortisol levels in Group III adolescents being 55% higher than in Group I clinically confirms this mechanism[12].

Second, hypofunction of the serotonergic system was found in aggressive adolescents. Serotonin is not only a mood regulator but also an important controller of gastrointestinal motility, secretion, and visceral sensitivity. Decreased serotonin levels play a central role in the pathogenesis of irritable bowel syndrome and functional dyspepsia[13].

Third, elevated levels of inflammatory markers (IL-6, CRP) indicate the significance of neuroimmunological mechanisms. Peripheral inflammation increases the permeability of the gastrointestinal mucosa (leaky gut), leads to disruption of the microbiome, and enhances visceral hypersensitivity. The results of our study are consistent with data from other authors. Xiang et al. studied 1,250 adolescents in China and found an OR=2.9 between aggression and irritable bowel syndrome. Our study showing OR=3.87 for functional dyspepsia indicates an even stronger association, which may be explained by the specific biological and sociocultural characteristics of the Central Asian population[14-16].

4. Conclusion

The results of this study confirmed the following important conclusions:

1. Adolescents with high aggression levels have a statistically significantly higher risk of developing functional dyspepsia (OR=3.87), irritable bowel syndrome (OR=2.94), and gastroesophageal reflux disease (OR=2.11).
2. The pathogenetic relationship operates through neuroendocrine (cortisol ↑, serotonin ↓) and neuroimmunological (IL-6 ↑) mechanisms.
3. Psychosocial factors, particularly aggression, must be mandatorily assessed in the prevention and treatment of gastrointestinal diseases in adolescents.
4. A biopsychosocial approach — the collaborative work of a pediatrician, gastroenterologist, and clinical psychologist — is considered the most effective strategy in this age group. The practical significance of this study lies in the fact that pediatricians and school physicians can monitor aggressive adolescents as a risk group for gastrointestinal diseases and take timely preventive measures. Psychological correction — cognitive behavioral therapy and emotional regulation exercises — was found to help reduce gastrointestinal symptoms ($p<0.05$).

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