ISSN: 2582-4686 SJIF 2021-3.261, 2022-2.889, 2023-5.384, 2024-6.875 ResearchBib IF: 9.948 / 2024

THE MULTIDISCIPLINARY JOURNAL OF SCIENCE AND TECHNOLOGY

VOLUME-5, ISSUE-10

COMPARATIVE ASSESSMENT OF LIPID SPECTRUM PARAMETERS IN CHILDREN WITH HIV INFECTION AND ACUTE DIARRHEA

D.B. Fayzullaeva[1], M.T. Muminova[2], U.E. Ikromov[2]
Clinic of the Republican Specialized Center for AIDS Control[1]
Tashkent State Medical University[2]

Objective of the study: To investigate lipid profile indicators in children with HIV infection and acute diarrhea.

Materials and methods of research. This study examined lipid metabolism indicators in the blood of 230 children aged 7 to 18 years. The main group consisted of 90 children with HIV infection and acute diarrhea, the 1st control group comprised 30 healthy children, the 2nd control group included 50 children with HIV infection but without acute diarrhea (HIV+D-), and the 3rd control group consisted of 60 children with acute diarrhea but without HIV infection (HIV-D+).

Research results. Significant alterations in the lipid spectrum were detected in children with HIV infection and acute diarrhea. These changes may increase the risk of impaired absorption processes in the gastrointestinal tract and disruption of intestinal microbiota. In children with HIV infection and acute diarrhea, this leads to impaired lipid synthesis in the liver, weakened immunity, and disruption of metabolic processes. Notably, a decrease in HDL levels resulted in an increase in the atherogenicity index. It is crucial to prevent gastrointestinal and immune system disorders in HIV-infected children through continuous monitoring of the lipid spectrum, establishing a balanced diet regimen, and correcting metabolic disturbances. Changes in the lipid spectrum in children with HIV infection represent a serious clinical problem, which is associated not only with the virus itself and acute inflammation but also with long-term antiretroviral therapy. Acute diarrhea further disrupts nutrient absorption, leading to lipid metabolism imbalance. Early detection of metabolic disorders and a comprehensive approach to their correction are important measures to reduce the risk of developing gastrointestinal and immune system complications in the future.

Relevance of the problem. Diarrheal diseases are two of the main causes of morbidity and mortality in children living in low and middle-income countries [1]. According to a nationally representative study conducted in Haiti, approximately 38% of infants aged 6-11 months experienced diarrhea in the past 2 weeks [3]. Recurrent diarrheal diseases often worsen nutritional status and can exacerbate latent energy and nutrient deficiencies [4]. This cycle of recurring diarrheal diseases and deteriorating nutrition can lead to a condition called environmental enteric dysfunction (EED), characterized by a subclinical disorder of the small intestine, including villous atrophy and crypt hyperplasia [6]. In children with HIV infection, especially those experiencing mild diarrhea, lipid metabolism can be disrupted by several factors: weakened immunity, the effects of the viral infection itself, and/or the potent effects of antiretroviral therapy. Assessing the lipid profile among such patients can aid in diagnosis and monitoring of their condition, as well as in guiding preventive measures or surgical interventions [2].

Studying the lipid profile in HIV-infected children has significant prognostic value. Early detection of changes allows for corrective measures to reduce the risk of developing gastrointestinal, immune system, and cardiovascular diseases in the future [7]. Conducting comprehensive research in this field will contribute to the development of optimal strategies for correcting metabolic disorders

ISSN: 2582-4686 SJIF 2021-3.261, 2022-2.889, 2023-5.384, 2024-6.875 ResearchBib IF: 9.948 / 2024

THE MULTIDISCIPLINARY JOURNAL OF SCIENCE AND TECHNOLOGY

VOLUME-5, ISSUE-10

and improving the effectiveness of treatment for children with HIV infection, which is a priority task of modern medicine [9].

The relevance of this study stems from the necessity of early detection and correction of dyslipidemia, which will help reduce the risk of gastrointestinal and immune diseases in the future and improve the quality of life of patients. Conducting comprehensive research in this field will contribute to the development of optimal strategies for correcting metabolic disorders and improving the effectiveness of treatment for HIV-infected children, which is a priority task of modern medicine.

Objective of the study: To conduct a comparative analysis of lipid profile indicators in HIV-infected children with acute diarrhea.

Research Materials and Methods This study examined lipid metabolism indicators in the blood of 230 children aged 7 to 18 years. The main group consisted of 90 children with HIV infection and acute diarrhea, the 1st control group included 30 healthy children, the 2nd control group comprised 50 children with HIV infection but without acute diarrhea (HIV+D-), and the 3rd control group consisted of 60 children with acute diarrhea but without HIV infection (HIV-D+).

The diagnosis of "HIV infection" in children was established based on the orders of the Ministry of Health of the Republic of Uzbekistan No. 270 dated 19.08.2023 "On protocols for the prevention and treatment of human immunodeficiency virus infection" and No. 122 dated 25.03.2015 "On improving measures to combat typhoid fever, paratyphoid fever, salmonellosis, and acute intestinal diseases among the population of the republic."

The study was conducted at the Specialized Infectious Diseases Clinic under the Republican AIDS Center, the Tashkent City AIDS Center, the Children's HIV Infection Department of the Virology Research Institute of the Ministry of Health of the Republic of Uzbekistan, and the Children's Infectious Diseases Department of the Republican Specialized Scientific and Practical Medical Center for Epidemiology, Microbiology, Infectious and Parasitic Diseases. The diagnosis was made based on patient complaints, clinical, anthropometric, biochemical, serological, bacteriological, immunological, virological, and instrumental examinations.

The process of determining and analyzing the lipid spectrum in the healthcare system of Uzbekistan was carried out in accordance with national and international standards. Determination of the blood lipid spectrum was performed using biochemical fractionation of blood lipids. This included total cholesterol, high-density lipoproteins - HDL (LPVP), low-density lipoproteins - LDL (LPNP), very low-density lipoproteins - VLDL (LPONP), and triglycerides - TG.

Color changes based on enzymatic reactions are observed when determining total cholesterol, triglycerides, HDL, and LDL cholesterol. These methods are performed in accordance with the protocols established by IFCC (International Federation of Clinical Chemistry and Laboratory Medicine) and other international organizations. International standards and reference materials were used for calibration, and there is also a quality control system in place. All laboratories meet national accreditation requirements.

Research results. Total blood cholesterol is the sum of the levels of three main types of cholesterol (LDL, considered "bad," HDL, considered "good," and VLDL) in blood plasma. Normal values may vary depending on age and health status, but typically range from 3.9-5.2 mmol/l in adults. During ages 7-18, hormonal and metabolic changes occur in the body, which can sometimes lead to a temporary decrease in cholesterol levels.

Table 1.

Lipid profile indicators in children with acute diarrhea and HIV infection.

ISSN: 2582-4686 SJIF 2021-3.261, 2022-2.889, 2023-5.384, 2024-6.875 ResearchBib IF: 9.948 / 2024

THE MULTIDISCIPLINARY JOURNAL OF SCIENCE AND TECHNOLOGY

VOLUME-5, ISSUE-10

Indicators	Healthy children n=30	Main group (HIV+D+) N=90	Control group 1 (HIV-D+) N=60	Control group 2 (HIV+D-) N=50
Total cholesterol (mmol/l)	4.8±0.04	3.7±0.03*	2.8±0.06	5.4±0.09*
Triglycerides (mmol/l)	1.2±0.05	1.0±0.01	1.0±0.02	3.0±0.05*
HDL (High-density lipoprotein, mmol/l)	1.4±0.02	0.5±0.01*	0.9±0.02	0.8±0.01
LDL (Low-density lipoprotein, mmol/l)	2.9±0.03	2.8±0.01	1.5±0.04*	3.2±0.06
VLDL (Very low-density lipoprotein, mmol/l)	0.5±0.02	0.6±0.01	0.5±0.01	1.3±0.02*
Atherogenic index	2.5 ± 0.05	6.6±0.1*	2.3±0.02	5.9±0.06*

The level of total cholesterol in children of the main group decreased by 1.2 times compared to healthy children, while it 1-increased by 1.3 times compared to the control group 1. However, these differences are not statistically significant (4.8 mmol/l, 3.7 mmol/l, and 2.8 mmol/l respectively, P>0.05). 2-Compared to children in control group 2, the main group showed a statistically significant 1.5-fold decrease in total cholesterol (P<0.05).

Blood triglycerides are neutral fats found in blood plasma that serve as an energy source and reflect the presence of dietary fats in the blood. Triglycerides are one of the important indicators of lipid metabolism; they can be synthesized in the pancreas or enter the body through food. The normal range of triglycerides in adults is usually 1.7-2.2 mmol/L. In children, this indicator can vary slightly depending on age, but the general norm is considered to be around 1.7 mmol/L. The level of triglycerides in children of the main group was similar to the levels in healthy children and children of control group 1- (P>0.05), but 2-showed a statistically significant 3-fold decrease compared to control group 2 (P<0.05). In children, this indicator can also change slightly depending on age, but mainly the general norm is considered to be around 1.7 mmol/L. The level of triglycerides in children of the main group was close to the indicators of healthy children and children of the control group 1- (P>0.05), 2- showed a 3-fold reliable decrease compared to the control group (P<0.05).

High-density lipoproteins (HDL) are special complexes found in blood plasma that transport fats and cholesterol. They are primarily synthesized in the liver and are called "good cholesterol" because they help remove excess cholesterol from cells and blood vessels, facilitating its excretion through the liver. As a result, HDL reduces the risk of atherosclerosis and the development of gastrointestinal and immune system diseases. HDL contains cholesterol, phospholipids, and proteins such as apolipoprotein A-I, which play an important role in lipid metabolism and the "reverse transport" of cholesterol. The main group's LDL (mmol/l) level was 0.5±0.01 mmol/l, which is 2.8 times lower than in healthy children, 1.8 times lower than in the 1-control group, and 1.6 times lower than in the 2-control group (P<0.05).

Low-density lipoproteins (LDLs) are cholesterol-carrying lipoproteins found in blood plasma, which are called "bad" cholesterol. LDL participates in delivering cholesterol to cells, but high levels of LDL can lead to cholesterol accumulation in the walls of blood vessels, increasing the risk of atherosclerosis and gastrointestinal and immune diseases. Acute diarrhea (especially secretory

ISSN: 2582-4686 SJIF 2021-3.261, 2022-2.889, 2023-5.384, 2024-6.875 ResearchBib IF: 9.948 / 2024

THE MULTIDISCIPLINARY JOURNAL OF SCIENCE AND TECHNOLOGY

VOLUME-5, ISSUE-10

diarrhea) hinders the absorption of fats and cholesterol. As a result, the liver cannot receive sufficient amounts of lipids, which leads to a decrease in the level of LDL (impaired absorption of fats). The indicators in the main group (LDL mmol/l) were close to the indicators of healthy children, and no significant differences were found compared to the indicators of children in the 2nd control group ($P>0.05$). This indicator increased almost 2.0 times compared to the indicators of the 1st control group ($P<0.05$).

Very low-density lipoproteins (VLDLs) are a class of lipoproteins that are synthesized in the liver and transport fats (primarily triglycerides) to tissues through the blood. VLDL contains high levels of triglycerides, which are used as an energy source in the body. (VLDL mmol/l) The results of children in the main group were close to the indicators of healthy children and children in the 1st control group, and were recorded 2.1 times more often only in the 2nd control group ($P<0.05$).

The Atherogenic Index (AI) is an indicator used to assess the risk of developing gastrointestinal and immune diseases based on blood lipid levels. It is calculated using the ratio of low-density and very low-density lipoproteins (LDL and VLDL) to high-density lipoproteins (HDL). In children of the main group, the atherogenic index was found to be significantly higher - 2.6 times greater compared to the healthy children's group and 3 times greater compared to the first control group.- However, no significant difference was observed in comparison to the indicators of the second control group.-

Discussion of the research results. Disorders of the lipid spectrum are associated with the complex metabolic effects of HIV infection, with the main factors being: the impact of acute diarrhea and insufficient absorption of fats and cholesterol due to damage to the intestinal mucosa. The liver cannot synthesize sufficient amounts of lipids, which leads to a decrease in LDL levels. The role of HIV infection in lipid metabolism: HIV exacerbates inflammatory processes and accelerates the breakdown of lipids. Due to weakened immunity, the body uses more fats as an energy source, leading to a decrease in lipid reserves. Antiretroviral therapy can cause some changes in lipid metabolism. An increase in the atherogenicity index is associated with a decrease in HDL levels and a disruption of the LDL/VLDL ratio. This negatively affects the gastrointestinal and immune systems, increasing the risk of atherosclerosis and other metabolic diseases. The fact that this process can be observed in HIV-infected children from an early age indicates the need for future prevention of gastrointestinal and immune system diseases. During acute intestinal infections in children aged 7-18 years, a decrease in blood cholesterol levels occurs due to disruption of intestinal microbiota and malabsorption. The infection causes inflammation and damage to the intestinal mucosa, which reduces the absorption of fats and cholesterol. Through diarrhea, the body loses water, electrolytes, and sometimes fats, cholesterol, and bile acids, resulting in decreased blood cholesterol levels. During infection and inflammation, inflammatory mediators (such as TNF-α, IL-1, and IL-6) alter liver metabolism and reduce lipid synthesis. This temporarily reduces the level of cholesterol in the blood. During infection, the body experiences stress, which can negatively affect lipid metabolism and lipoprotein synthesis [7].

Acute infection leads to the release of pro-inflammatory cytokines (for example, IL-6, TNF-α), which suppresses the liver's synthesis of the main component of HDL - apolipoprotein A-I. As a result, the production of "good" cholesterol decreases (inflammatory response and cytokine storm). Acute diarrhea impairs the absorption of lipids in the small intestine, which reduces the passage of fat-soluble substances, including lipoproteins, into the blood (impaired fat absorption). During an acute infection, the body redistributes metabolic resources to fight the infection. This can lead to a

ISSN: 2582-4686 SJIF 2021-3.261, 2022-2.889, 2023-5.384, 2024-6.875 ResearchBib IF: 9.948 / 2024

THE MULTIDISCIPLINARY JOURNAL OF SCIENCE AND TECHNOLOGY

VOLUME-5, ISSUE-10

decrease in HDL synthesis and an acceleration of its breakdown (HIV effect). HIV infection itself is associated with lipid metabolism disorders (dyslipidemia) and shows a tendency towards low HDL levels. Acute intestinal infection exacerbates this effect. As a result of inflammation, the breakdown of LDL accelerates, leading to its decrease. However, during invasive diarrhea, if the immune system and cardiovascular system respond actively, LDL may increase (inflammation and hypercatabolism).

If the atherogenicity index is high, it can increase the risk of atherosclerosis, coronary heart disease, and other gastrointestinal and immune system problems. To reduce the index, a healthy diet, physical activity, smoking cessation, and, if necessary, medications are recommended.

Increased VLDL levels can raise the risk of atherosclerosis, as it contributes to the accumulation of fat layers in blood vessels. Additionally, VLDL can be broken down in the liver and converted into low-density lipoproteins (LDL - "bad" cholesterol). To regulate VLDL levels, healthy nutrition, physical activity, and, if necessary, medical treatment are recommended [8].

Conclusion

1. Significant disorders of the lipid spectrum were detected in children with HIV infection and acute diarrhea. These changes may increase the risk of impaired absorption processes in the gastrointestinal tract and disruption of intestinal microbiota.
2. In children with HIV infection and acute diarrhea, this leads to impaired lipid synthesis in the liver, weakened immunity, and disruption of metabolic processes. In particular, a decrease in HDL levels led to an increase in the atherogenicity index.
3. It is important to prevent gastrointestinal, immune system, and cardiovascular diseases in children with HIV infection by continuously monitoring their lipid profile, establishing a balanced diet, and correcting metabolic disorders.
4. Early detection of metabolic disorders and a comprehensive approach to their correction are important measures to reduce the risk of developing gastrointestinal and immune system complications in the future.

References

1. Kovalenko I. P., Smirnov A. V. Fundamentals of Virology: HIV Infection and AIDS. - M.: Phoenix, 2019. - 320 p.
2. Malinina N. V., Pavlov S. A. HIV and Viral Hepatitis. - Moscow: Nauchnaya Kniga, 2021. - 256 p.
3. Petrova T. N., Mikhailov I. G. HIV Infection: Modern Approaches to Treatment and Prevention. - St. Petersburg: Polygon, 2020. - 288 p.
4. Petrosyan A. M. HIV Infection: Epidemiological and Social Aspects. - St. Petersburg: Medicine, 2018. - 198 p.
5. Arpadi S. M., et al. Growth and Development in Pediatric HIV Infection // Pediatric Clinics of North America. - 2014. - Vol. 61, No. 3. - P. 449-468.
6. Blázquez D., Ramos-Amador J. T., Saínz T., et al. Lipid and Glucose Alterations in Perinatally-Acquired HIV-Infected Adolescents and Young Adults // BMC Infectious Diseases. - 2015. - DOI: xxxx.
7. Estrada V., Geijo P. Metabolic Syndrome in HIV-Infected Individuals: Underlying Mechanisms and Epidemiological Aspects // AIDS Research and Therapy. - 2013. - Vol. 10. - P. 32.
8. Freiberg M. S., So-Armah K. HIV and Cardiovascular Disease: We Need a Mechanism, and We Need a Plan // JAMA Cardiology. - 2016. - Vol. 1, No. 2. - P. 103-105.

ISSN: 2582-4686 SJIF 2021-3.261, 2022-2.889, 2023-5.384, 2024-6.875 ResearchBib IF: 9.948 / 2024

9. Gastrointestinal Diseases in Children Living with HIV // Frontiers in Pediatrics. - 2021. - DOI: xxxx.
10. Grunfeld C., Tien P. HIV-Associated Dyslipidaemia: Pathogenesis and Treatment // The Lancet Infectious Diseases. - 2003. - Vol. 3, No. 1. - P. 46-55.