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THE ROLE OF PROPER NUTRITIONAL HYGIENE IN THE PREVENTION OF OBESITY AND ANEMIA IN SCHOOL-AGE CHILDREN: AN INTEGRATED EPIDEMIOLOGICAL APPROACH

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Abstract: The dual burden of malnutrition, characterized by the paradoxical coexistence of childhood obesity and iron-deficiency anemia, poses a severe threat to public health. This article presents a cross-sectional study conducted at the Department of Hygiene and Ecology of Andijan State Medical Institute. Using the IMRAD framework, the research investigates the impact of nutritional hygiene and dietary habits on the anthropometric and hematological profiles of 150 school-age children in the Fergana Valley. The study reveals a significant correlation between the consumption of highly processed, energy-dense but nutrient-poor foods and the simultaneous development of excessive body weight and anemia. Children with poor nutritional hygiene scores exhibited a threefold higher risk of developing this dual burden. The authors conclude that educational interventions focusing on the hygiene of nutrition, promoting whole foods, and regulating school meals are imperative to prevent early metabolic and cardiovascular derangements.

Keywords: nutritional hygiene, childhood obesity, iron-deficiency anemia, school-age children, public health, metabolic syndrome.

РОЛЬ ПРАВИЛЬНОЙ ГИГИЕНЫ ПИТАНИЯ В ПРОФИЛАКТИКЕ ОЖИРЕНИЯ И АНЕМИИ У ДЕТЕЙ ШКОЛЬНОГО ВОЗРАСТА: ИНТЕГРИРОВАННЫЙ ЭПИДЕМИОЛОГИЧЕСКИЙ ПОДХОД

Аннотация: Двойное бремя неполноценного питания, характеризующееся парадоксальным сосуществованием детского ожирения и железодефицитной анемии, представляет серьезную угрозу для общественного здравоохранения. В данной статье представлено перекрестное исследование, проведенное на кафедре гигиены и экологии Андijanского государственного медицинского института. Используя структуру IMRAD, исследование изучает влияние гигиены питания и пищевых привычек на антропометрические и гематологические профили 150 детей школьного возраста в Ферганской долине. Исследование выявляет значительную корреляцию между потреблением высокопереработанных, энергоемких, но бедных питательными веществами продуктов и одновременным развитием избыточной массы тела и анемии. Дети с низкими показателями гигиены питания имели в три раза более высокий риск развития этого двойного бремени. Авторы делают вывод, что образовательные вмешательства, ориентированные на гигиену питания, пропаганду цельных продуктов и регулирование школьного питания, крайне важны для предотвращения ранних метаболических и сердечно-сосудистых нарушений.

Ключевые слова: гигиена питания, детское ожирение, железодефицитная анемия, дети школьного возраста, общественное здравоохранение, метаболический синдром.



**MAKTAB YOSHDAGI BOLALARDA SEMIRISH VA KAMQONLIKNING
PROFILAKTIKASIDA TO'G'RI OVQATLANISH GIGIYENASINING O'RNI:
INTEGRATSIYALASHGAN EPIDEMIOLOGIK YONDASHUV**

Annotatsiya: Bolalar semirishi va temir tanqisligi anemiyasining paradoksal ravishda birga kechishi bilan tavsiflanuvchi noto'g'ri ovqatlanishning ikki tomonlama yuki jamoat salomatligi uchun jiddiy xavf tug'diradi. Ushbu maqolada Andijon davlat tibbiyot institutining Gigiyena va ekologiya kafedrasida o'tkazilgan kesim (cross-sectional) tadqiqot natijalari keltirilgan. IMRAD tuzilmasiga asoslangan ushbu ish Farg'ona vodiysidagi 150 nafar maktab yoshidagi bolalarning antropometrik va gematologik profililariga ovqatlanish gigiyenasi va ovqatlanish odatlarining ta'sirini o'rganadi. Tadqiqot yuqori darajada qayta ishlangan, quvvatga boy, ammo oziq moddalari kam bo'lgan mahsulotlarni iste'mol qilish hamda ortiqcha tana vazni va kamqonlikning bir vaqtda rivojlanishi o'rtasida sezilarli bog'liqlikni aniqlaydi. Ovqatlanish gigiyenasi ko'rsatkichlari past bo'lgan bolalarda ushbu ikki tomonlama yukning rivojlanish xavfi uch baravar yuqori bo'lgan. Mualliflar erta metabolik va yurak-qon tomir kasalliklarining oldini olish uchun ovqatlanish gigiyenasiga qaratilgan ta'limiy aralashuvlar, tabiiy mahsulotlarni targ'ib qilish va maktab ovqatlanishini tartibga solish o'ta muhim degan xulosaga keladilar.

Kalit so'zlar: ovqatlanish gigiyenasi, bolalar semirishi, temir tanqisligi anemiyasi, maktab yoshidagi bolalar, jamoat salomatligi, metabolik sindrom.

INTRODUCTION

The health and physical development of school-age children are fundamentally determined by their environment and lifestyle, with nutrition serving as the most critical exogenous factor. In recent years, global public health has encountered a complex phenomenon known as the "dual burden of malnutrition." This paradox is characterized by the simultaneous manifestation of overnutrition, leading to overweight and obesity, and undernutrition, specifically micronutrient deficiencies such as iron-deficiency anemia. The Fergana Valley region is currently experiencing a rapid nutritional transition. Traditional dietary patterns, which were historically balanced and rich in local produce, are increasingly being replaced by diets dominated by highly processed, energy-dense, and nutrient-poor foods. This shift has profound implications for the pediatric population, whose growing bodies require a dense supply of essential vitamins and minerals alongside adequate caloric intake.

Nutritional hygiene in the context of school-age children extends beyond mere food safety and the prevention of foodborne illnesses. It encompasses the entire culture of eating, including the regularity of meals, the balance of macronutrients, the avoidance of "empty calories" from fast food and sugary beverages, and the physiological appropriateness of the diet. Poor nutritional hygiene inevitably disrupts the metabolic homeostasis of a developing child. The accumulation of adipose tissue in childhood is not a benign condition; it initiates a cascade of inflammatory and neurohumoral changes that lay the groundwork for severe chronic diseases in adulthood. Concurrently, an iron-deficient diet impairs cognitive development, reduces physical endurance, and weakens immune competence.

The Department of Hygiene and Ecology at Andijan State Medical Institute recognized the urgent need to evaluate these dietary shifts and their clinical consequences within the local context. The primary objective of this research is to investigate the role of proper nutritional hygiene in the prevention of both obesity and anemia among school children. The study hypothesizes that a significant proportion of childhood anemia in our region is not due to a sheer



lack of food, but rather due to the consumption of calorically dense but micronutrient-devoid diets, leading to the simultaneous presentation of high body mass and low hemoglobin levels.

LITERATURE REVIEW

The intersection of excessive caloric intake and specific nutrient deficiencies has garnered significant attention in contemporary medical literature. The mechanisms by which childhood obesity predisposes individuals to future cardiovascular and metabolic pathologies are complex and deeply rooted in cellular metabolism.

Recent regional studies have provided profound insights into the long-term consequences of metabolic dysregulation. Tashtemirova [1] investigated the state of functional activity of the sympathetic-adrenal system and free radical processes in women of fertile age with metabolic syndrome. The foundational elements of this metabolic syndrome, including insulin resistance and central adiposity, almost invariably trace their origins back to poor dietary habits established during school age. The chronic oxidative stress and autonomic overactivity described in adults with metabolic syndrome begin as a subclinical process in obese children.

Furthermore, the quality of dietary fats and the overall balance of lipid metabolism play a crucial role in vascular health. Juraboyev and Tashtemirova [2] assessed lipid peroxidation processes and lipid metabolism disorders in patients with ischemic heart disease. The hyperlipidemia and excessive lipid peroxidation that characterize adult ischemic disease are the direct evolutionary results of sustained poor nutritional hygiene and obesity from youth. Diets high in trans fats and refined sugars, typical of poor school-age nutrition, initiate this pathological lipid profile early on.

Addressing these issues requires precise clinical attention to prevent progression into complex conditions. As emphasized by Tashtemirova [3] regarding the diagnostic criteria and attentive reviews in the treatment of Cardiac Syndrome X, identifying microvascular and metabolic dysfunction requires a meticulous approach. Preventing such severe cardiovascular syndromes must start with recognizing and correcting the early "hidden hunger" and metabolic imbalances in children, highlighting the absolute necessity of enforcing rigorous nutritional hygiene protocols in schools and homes.

METHODS

This cross-sectional epidemiological and clinical study was conducted by the Department of Hygiene and Ecology at Andijan State Medical Institute between September 2023 and May 2024. The research involved a comprehensive assessment of a representative sample of school-age children to evaluate the correlation between their dietary practices and their anthropometric and hematological status.

The study population consisted of one hundred and fifty school children aged between seven and fourteen years, randomly selected from three different public schools in the Andijan region. Informed consent was obtained from the parents or legal guardians of all participating children prior to the commencement of data collection. Children with known congenital metabolic disorders, chronic gastrointestinal diseases affecting absorption, or those currently receiving pharmacological treatment for anemia or obesity were excluded from the analysis to ensure that the findings reflected lifestyle and dietary factors rather than underlying organic pathologies.

Data collection was executed through a multi-tiered approach. The first phase involved a detailed nutritional hygiene survey completed by the children with the assistance of their parents. This validated questionnaire assessed the frequency of daily meals, the inclusion of breakfast, the consumption rate of fresh fruits and vegetables, the intake of iron-rich foods such as lean meats



and legumes, and the frequency of consuming fast food, sweet pastries, and carbonated sugary drinks. Based on these responses, each child was assigned a "Nutritional Hygiene Score," categorizing their diet as either optimal, sub-optimal, or poor.

The second phase involved anthropometric measurements conducted by trained medical personnel. The height and weight of each child were recorded using standardized scales and stadiometers. The Body Mass Index was calculated and plotted on the World Health Organization growth charts for age and gender to classify the children into normal weight, overweight, or obese categories.

The final phase consisted of non-invasive hematological screening. Capillary blood samples were drawn to measure hemoglobin concentration using a portable, calibrated hemoglobinometer. Anemia was defined according to the World Health Organization criteria, adjusting for the specific age groups of the children involved. The collected data encompassing dietary scores, BMI percentiles, and hemoglobin levels were subsequently aggregated and subjected to multivariate statistical analysis using SPSS software to identify significant correlations and determine the predictive value of nutritional hygiene on the development of the dual burden of malnutrition.

RESULTS

The analysis of the collected data revealed significant deficits in the dietary habits of the studied population, correlating strongly with adverse physical health markers.

The baseline evaluation of the one hundred and fifty children showed an average age of ten and a half years, with an equal distribution of boys and girls. The assessment of the Nutritional Hygiene Scores categorized only thirty percent of the children as having an optimal diet. Forty-five percent exhibited a sub-optimal diet, and twenty-five percent were classified as having poor nutritional hygiene. The most common dietary infractions identified were the frequent skipping of a nutritious breakfast, a heavy reliance on carbohydrate-dense snacks during school breaks, and a critically low intake of dietary fiber and bioavailable iron from animal sources.

Table 1: Prevalence of Overweight, Obesity, and Anemia Based on Nutritional Hygiene Scores

Nutritional Hygiene Category	Number of Children (n)	Normal Weight (%)	Overweight / Obese (%)	Anemia Prevalence (%)	Dual Burden (Obesity + Anemia) (%)
Optimal	45	82.2%	17.8%	11.1%	4.4%
Sub-optimal	68	58.8%	41.2%	35.3%	19.1%
Poor	37	24.3%	75.7%	59.5%	48.6%

The anthropometric analysis demonstrated a clear correlation between dietary quality and body mass. As detailed in Table 1, children in the poor nutritional hygiene category had a dramatically higher prevalence of being overweight or obese, reaching over seventy-five percent. These children consistently reported high consumption of energy drinks, chips, and refined bakery products, which provide excessive caloric surplus without satiation.

Simultaneously, the hematological screening unveiled the paradoxical nature of this malnutrition. The overall prevalence of anemia in the cohort was approximately thirty-four percent. However, when cross-referenced with the nutritional hygiene scores, it became evident that anemia was heavily concentrated in the groups with poorer diets. Strikingly, nearly sixty percent of the children with poor nutritional hygiene suffered from mild to moderate iron-deficiency anemia.

The most alarming finding was the prevalence of the "dual burden"—children who were simultaneously overweight or obese and anemic. In the optimal diet group, this presentation was



rare. Conversely, nearly half of the children in the poor nutritional hygiene group exhibited this dual pathology. This indicates that their excessive caloric intake was entirely devoid of the essential micronutrients required for healthy hematopoiesis, leading to a state of being overfed yet undernourished.

DISCUSSION

The findings from the Department of Hygiene and Ecology at Andijan State Medical Institute provide a stark illustration of the consequences of the modern nutritional transition affecting school-age children. The high prevalence of the dual burden of obesity and anemia underscores a systemic failure in the maintenance of nutritional hygiene both at home and within the educational environment.

The physiological paradox of an obese child suffering from anemia is primarily driven by the quality of the food consumed. Diets high in refined sugars and unhealthy fats are typically deficient in essential micronutrients like iron, vitamin B12, and folic acid. Furthermore, the chronic low-grade inflammation associated with excess adipose tissue increases the production of hepcidin, a peptide hormone produced by the liver that regulates iron homeostasis. Elevated hepcidin levels inhibit the absorption of dietary iron from the gut and block the release of iron from macrophages, effectively locking iron away and creating a functional deficiency even if some iron is present in the diet. This highlights how obesity itself actively exacerbates the anemic state.

Addressing this crisis requires a profound shift in how nutritional hygiene is conceptualized and taught. It is not sufficient to simply advise children to "eat less" to combat obesity; they must be guided to "eat better." The foundational research by Tashtemirova [1] regarding the sympathetic-adrenal system in metabolic syndrome reminds us that the neuroendocrine damage caused by poor diets is cumulative. The oxidative stress and lipid peroxidation pathways discussed by Juraboyev and Tashtemirova [2] are actively triggered by the very fast foods these children are consuming daily. If these dietary patterns are not corrected during the school-age years, these children are on a direct trajectory toward severe cardiovascular complications and conditions resembling Cardiac Syndrome X, which require complex diagnostic and therapeutic interventions later in life [3].

The role of the school environment is paramount in this preventive strategy. Schools must enforce strict regulations regarding the types of food available in cafeterias and surrounding kiosks, eliminating the availability of ultra-processed snacks. Additionally, practical educational interventions are needed to teach children and their parents about the necessity of a balanced diet, emphasizing the consumption of local, whole foods rich in bioavailable iron and vitamins.

CONCLUSION

The epidemiological study conducted at Andijan State Medical Institute leads to definitive conclusions regarding the critical importance of nutritional hygiene in the pediatric population.

Firstly, the research confirms that poor nutritional hygiene is a primary driver of the dual burden of malnutrition, leading to the simultaneous and paradoxical development of childhood obesity and iron-deficiency anemia. The consumption of calorie-dense, nutrient-poor foods creates a state of severe metabolic imbalance characterized by excessive adiposity and cellular micronutrient starvation.

Secondly, the study highlights that children with sub-optimal and poor dietary habits are at a significantly multiplied risk for developing these interconnected pathologies compared to those



maintaining balanced diets. This early metabolic dysregulation serves as the precursor for adult metabolic syndrome and cardiovascular disease.

Thirdly, purely medical interventions, such as iron supplementation, are insufficient to address this public health issue if the underlying dietary habits remain unchanged.

Therefore, it is strongly recommended that comprehensive nutritional hygiene programs be integrated into the school curriculum. Public health policies must focus on transforming the school food environment and providing targeted education to families to promote diets rich in essential nutrients, thereby safeguarding the long-term health and development of the younger generation.

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