ISSN NO: 2770-2936
November 2025

Assessment Of Metabolic Status Indicators In Children In Relation To Feeding

Sultanova Nafisa Sabirovna, - Associate Professor of the Department of Propaedeutics of Pediatric Diseases, PhD, Tashkent State Medical University,
Xo'janiyozova Maftuna Yusupboy qizi Assistant of the Department of Propaedeutics of Pediatric Diseases, PhD, Tashkent State Medical University,
Khudaybergenova Nasiba Pulat qizi,
Khudaybergenova Luiza Pulatovna,
Students Tashkent State Medical University, Tashkent, Uzbekistan

Abstract
The type of infant feeding plays a crucial role in metabolic adaptation and long-term health outcomes. This study aimed to evaluate metabolic status indicators in children depending on the type of feeding during infancy. A total of 124 children were followed longitudinally for 14 years. Clinical and laboratory assessments included complete blood count, biochemical tests, and lipid profile analyses (LDL, HDL, triglycerides, and total cholesterol).
Children who were exclusively breastfed demonstrated optimal lipid and carbohydrate metabolism parameters. In contrast, those who received mixed or artificial feeding showed signs of dyslipidemia, characterized by significantly higher triglyceride (1.2 ± 0.08 mmol/L vs. 0.74 ± 0.08 mmol/L, $p < 0.05$) and LDL levels (3.4 ± 0.11 mmol/L vs. 2.0 ± 0.01 mmol/L, $p < 0.05$). Early rapid weight gain was more frequent among artificially fed infants and was associated with later metabolic imbalance. These findings suggest that exclusive breastfeeding contributes to stable lipid and carbohydrate metabolism and helps prevent early metabolic disturbances. The type of feeding and early child care practices are key determinants of metabolic adaptation and prevention of obesity-related disorders in adolescence.
Keywords: breastfeeding, artificial feeding, metabolism, lipid profile, child health, metabolic syndrome

Introduction. Recent shifts in infant feeding practices have highlighted the need for biomedical justification of their appropriateness and long-term safety [1]. Rational nutrition and proper care during infancy are fundamental for realizing the child's genetic potential for physical, functional, and neurodevelopmental growth [2,7]. Exclusive breastfeeding remains the gold standard for infant nutrition, providing a unique composition of bioactive compounds that support optimal physical, psychomotor, cognitive, and immunological development [3,4]. In contrast, artificial feeding has been associated with higher rates of allergic, gastrointestinal, and metabolic disorders, as well as iron deficiency anemia and obesity [5,6]. Moreover, artificial feeding has been linked to increased risks of metabolic syndrome, hypertension, and cardiovascular diseases in later life.

Aim of the Study. To investigate the characteristics of metabolic disturbances in children and adolescents depending on the type of feeding during infancy.

Materials and Methods. A longitudinal observational study was conducted involving 124 children**,** who were monitored prospectively from infancy until 14 years of age**.** Participants were allocated into four groups based on their predominant type of feeding during the first 6 months of life:

- Exclusive breastfeeding (EBF) – infants receiving only breast milk
- Partial breastfeeding (PBF) – breast milk combined with occasional formula feeding
- Supplemented feeding (SF) – breast milk combined with regular complementary feeding introduced early
- Artificial feeding (AF) – infants exclusively fed with formula

Clinical and Laboratory Assessments

At each annual visit, a standardized set of clinical evaluations and laboratory investigations was performed:

- **Complete blood count (CBC)** to assess hematologic status and detect early inflammatory changes
- **Biochemical profile**, including:
  – fasting glucose

ISSN NO: 2770-2936
November 2025

– lipid profile (LDL, HDL, triglycerides, total cholesterol)
– markers of carbohydrate and lipid metabolism

• **Anthropometric measurements**, recorded using calibrated equipment:
– weight
– height
– BMI and age-specific percentiles
– waist and hip circumference

• **Growth monitoring**, including assessment of growth velocity and nutritional status according to WHO reference standards

Additional Data Collection. During follow-up, information on dietary habits, feeding practices in the first year of life, physical activity, sleep duration, and family history of metabolic disorders was collected through structured questionnaires completed by parents.

Dynamic Follow-Up. Participants were evaluated **once per year**, following the same protocol across all age points. All measurements were conducted by a trained pediatric endocrinology team to minimize measurement variability.
Efforts were made to maintain continuous follow-up; missed appointments were rescheduled within 3 months. Overall follow-up completeness was **92%**.

Statistical Analysis. Statistical analyses were carried out using Student's t-test for comparison of continuous variables and a significance threshold of $p < 0.05$ was applied. Additional analyses (ANOVA, χ^2 test, correlation assessment) were used where appropriate in extended evaluation.

Results. Metabolic profiles differed significantly across feeding types. Children on exclusive breastfeeding maintained normal metabolic parameters, while those with mixed or artificial feeding showed a progressive tendency toward metabolic imbalance.

Lipid metabolism:

- Triglycerides: 0.74 ± 0.08 mmol/L (EBF), 0.78 ± 0.08 mmol/L (PBF), 0.89 ± 0.09 mmol/L (SF), 1.2 ± 0.08 mmol/L (AF; $p < 0.05$)
- LDL: 2.0 ± 0.01 mmol/L (EBF) vs. 3.4 ± 0.11 mmol/L (AF; $p < 0.05$)
- Total cholesterol: 3.6 ± 0.08 mmol/L (EBF) vs. 5.7 ± 0.33 mmol/L (AF; $p < 0.05$)
- HDL remained within normal limits across all groups

Weight gain: During the first year, infants on AF had significantly higher weight gain in the second quarter (2665 ± 109.5 g vs. 1585 ± 17.7 g in EBF; $p < 0.01$) and continued excessive gains in later quarters (1555 ± 60.3 g vs. 1004 ± 27.4 g; $p < 0.01$). Early accelerated weight gain correlated with higher risk of obesity during school age.

Age dynamics: At ages 4–6 years, metabolic parameters (glucose, triglycerides, HDL, LDL) were within normal ranges for most children, although LDL showed a mild upward trend ($p < 0.01$). By ages 7–14, dyslipidemia and hyperglycemia became more frequent, especially in the control group. The main group (n = 54) that received optimized care demonstrated better metabolic outcomes compared to the control group (n = 70). The frequency of abnormal laboratory findings — including elevated cholesterol, triglycerides, and glucose — was 20–30% lower in the main group.

Discussion. The study confirms that infant feeding type is a critical determinant of metabolic programming. Exclusive breastfeeding promotes optimal lipid and carbohydrate metabolism through several mechanisms, including regulation of gut microbiota, hormonal balance (leptin, adiponectin), and insulin sensitivity.
Artificial feeding, in contrast, may lead to overnutrition, altered gut microbiota, and early adiposity rebound — all recognized as predictors of metabolic syndrome in later life. These findings are consistent with global research showing that breastfed children have lower risks of obesity, type 2 diabetes, and cardiovascular disorders [8–10]. Early preventive measures — including breastfeeding promotion, balanced complementary feeding, and appropriate child care — are therefore essential components of long-term metabolic health.

Conclusions

1. The type of infant feeding significantly influences the formation of metabolic homeostasis.
2. Exclusive breastfeeding ensures stable lipid and carbohydrate metabolism and prevents early dyslipidemia.

ISSN NO: 2770-2936
November 2025

3. Artificial feeding is associated with elevated triglycerides, LDL, and total cholesterol, as well as excessive weight gain during infancy.
4. Early nutritional and caregiving interventions are critical for preventing obesity and metabolic syndrome in adolescence.

References

1. Takhiriva R.N., Masharibova N.I. Influence of feeding type on the development of preschool children. Pediatrics (Tashkent), 2016; 1:28–31.
2. Fateeva E.M., Leshkevich I.A. Infant nutrition: new data and modern approaches. International Symposium, Moscow, 2018; 23–27.
3. Shenderov B.A. Functional Nutrition and Its Role in the Prevention of Metabolic Syndrome. Moscow: DeLi-Print; 2012.
4. Sultanova N. S. Some peculiarities of physical development of children depending on applied care methodology. Eur. Sci. Rev. 2015;7-8:102-105.
5. Kon I.Ya., Shilina N.M., Gmoshinskaya M.V. Breastfeeding and obesity: new aspects of the problem. Pediatrics (Speransky Journal), 2016; 95(4):92–98.
6. Sultanova N. S. Features of the psycho-neurological status of children after cerebral ischemia depending on the type of feeding and care principles. Pediatriya. 2016;2:33-35.
7. World Health Organization. Complementary feeding of young children in developing countries: A review of current scientific knowledge. Geneva: WHO; 2000.
8. Department of Health, United Kingdom. UK Review of Welfare Food Scheme. London: Stationery Office; 2000.
9. Sultanova N. S. The role of obesity in the development of psycho-emotional disorders in children with different types of feeding. Sharing the Results of Research Towards Closer Global Convergence of Scientists. Montreal. 2016:66-68.
10. Engle P.L. et al. The Care Initiative: Assessment, Analysis and Action to Improve Care for Nutrition. New York: UNICEF; 1997.
11. Victora C.G. et al. Breastfeeding in the 21st century: Epidemiology, mechanisms, and lifelong effect. The Lancet. 2016; 387(10017):475–490.
12. Oddy W.H. Breastfeeding, childhood asthma, and allergic disease. Ann Nutr Metab. 2017; 70(2):26–36.
13. Sultanova N. S., Kamalov Z. S. Frequency of allergic diseases in children depending on types of feeding and principles of care// Russian allergological journal. - Kazan, 2016. - No. 3. - P. 38-39.
14. Rollins N.C. et al. Why invest, and what it will take to improve breastfeeding practices The Lancet. 2016; 387:491–504.