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Exploration of metabolic signatures or biomarkers associated with obesity in children and adolescents

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INTRODUCTION

Obesity represents a major health issue globally, impacting both adults and children. Despite its prevalence, the precise mechanisms driving the development of obesity in children remain unclear. Metabolomics, the comprehensive study of metabolites within biological systems, offers a powerful approach to better define the phenotype and understand the complex biochemical alterations associated with obesity.

AIM

The aim of our study was to summarize the current knowledge in the field of metabolomics in childhood obesity, and to identify metabolic signatures or biomarkers associated with obesity in children and adolescents (within the framework of the BIO-STREAMS project (https://www.bio-streams.eu/); a 4-year (2023–2027) Horizon Europe project (No101080718)).

METHOD

We performed a systematic search of Medline and Scopus databases according to PRISMA guidelines. The review was registered in the International Prospective Register of Ongoing Systematic Reviews (PROSPERO 2023 CRD42023494461). We included only longitudinal prospective studies, randomized-controlled trials with ≥12-month follow up, and meta-analyses of the above that assessed the relation between metabolic signatures related to obesity and body mass index (BMI) or other measures of adiposity in children and adolescents with overweight or obesity aged 2-19 years. Initially, 595 records were identified from PubMed and 1565 from Scopus. After removing duplicates and screening for relevance, 157 reports were assessed for eligibility. From the additional search, 75 new records were retrieved, from which none was eligible for our study. Finally, 7 full-text articles were included in our study.

RESULTS

The majority of the included studies stated an association of lipids with changes of BMI, insulin resistance and the risk for metabolic syndrome. More specifically, these include certain lipoproteins, apolipoproteins, cholesterols, fatty acids, glycerides and phospholipids, ketone bodies, lysophosphatidylcholines, as well as acyl–alkyl phosphatidylcholine. Among the overarching class of amino acids, peptides and analogues, included are glycylproline, citrulline, formiminoglutamic acid, 4-hydroxyproline, alanine, phenylalanine, tyrosine, glutamine, methionine, serine and alanine. Furthermore, numerous lipids act as signaling molecules in inflammation pathways or insulin resistance, contributing to obesity-related complications, such as diabetes mellitus type 2 and cardiovascular disease. Acylcarnitines are the by-products of noncomplete fatty acid oxidation.

CONCLUSIONS

Our findings reveal specific biomarkers in the amino acid and lipid pathway that could serve as early indicators of obesity and its related cardiometabolic complications. Continued exploration of metabolomic profiles in childhood obesity is warranted, particularly in pediatrics, to develop targeted interventions and prevent the long-term consequences of this condition.

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MORE INFORMATION

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