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Dietary quality indices in relation to cardiometabolic risk among Finnish children aged 6–8 years – The PANIC study

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Abstract *Background and aims:* There are no studies on the relationships of dietary quality indices to the clustering of cardiometabolic risk factors in children. We therefore investigated the associations of four dietary quality indices with cardiometabolic risk score and cardiometabolic risk factors in Finnish children.
Methods and results: Subjects were a population sample of 204 boys and 198 girls aged 6–8 years. We assessed diet by 4-day food records and calculated Dietary Approaches to Stop Hypertension (DASH) Score, Baltic Sea Diet Score (BSDS), Mediterranean Diet Score (MDS), and Finnish Children Healthy Eating Index (FCHEI). We calculated the age- and sex-adjusted cardiometabolic risk score summing up Z-scores for waist circumference, mean of systolic and diastolic blood pressure and concentrations of fasting serum insulin and fasting plasma glucose, triglycerides and HDL cholesterol, the last multiplying by −1. Higher FCHEI was associated with lower cardiometabolic risk score among boys (standardised regression coefficient $\beta = -0.14$, $P = 0.044$) adjusted for age, physical activity, electronic media time and household income. Higher DASH Score was related to a lower serum insulin in boys ($\beta = -0.15$, $P = 0.028$). Higher DASH Score ($\beta = -0.16$, $P = 0.023$) and FCHEI ($\beta = -0.17$, $P = 0.014$) were related to lower triglyceride concentration in boys. Higher FCHEI was associated with lower triglyceride concentration in girls ($\beta = -0.16$, $P = 0.033$). Higher DASH Score ($\beta = -0.19$, $P = 0.011$) and BSDS ($\beta = -0.23$, $P = 0.001$) were associated with lower plasma HDL cholesterol concentration in girls.
Conclusion: Higher FCHEI was associated with lower cardiometabolic risk among boys, whereas DASH Score, BSDS or MDS were not associated with cardiometabolic risk in children.

Abbreviations: BMI-SDS, Body mass index standard deviation score; BSDS, Baltic Sea Diet Score; DASH, Dietary Approaches to Stop Hypertension; FCHEI, Finnish Children Healthy Eating Index; HDL, High-density lipoprotein; LDL, Low-density lipoprotein; MDS, Mediterranean Diet Score; MUFA, Monounsaturated fat; PANIC, Physical Activity and Nutrition in Children; PUFA, Polyunsaturated fat; SFA, Saturated fat.

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Introduction

Cardiometabolic risk factors, such as excess body fat, impaired insulin sensitivity, dyslipidaemia and elevated blood pressure, cluster to same individuals similarly throughout childhood and adulthood [1]. The clustering of cardiometabolic risk factors has been related to an increased risk of metabolic syndrome, type 2 diabetes and atherosclerotic cardiovascular diseases in adulthood [2,3]. Therefore, the early detection and management of the clustering of cardiometabolic risk factors are essential to prevent major chronic diseases later in life.

Some dietary factors, such as a higher consumption of sugar-sweetened beverages [4,5] and a higher intake of saturated fat [6,7], have been associated with a higher cardiometabolic risk among children and adolescents. However, the effects of single foods and nutrients on cardiometabolic health may not be separable in real life, because various diets consist of combinations of foods with complex compositions of nutrients that have synergistic effects and interactions.

Various dietary quality indices have been developed to assess adherence to desirable diets comprehensively and to investigate the health effects of these diets among adults [8]. Low Mediterranean Diet Score (MDS) and Dietary Approaches to Stop Hypertension (DASH) Score have been associated with an increased risk of type 2 diabetes, cardiovascular diseases and premature cardiovascular and all-cause death among adults [9–13]. Moreover, a lower Baltic Sea Diet Score (BSDS) has been associated with a higher abdominal fat content in adults [14].

A healthy diet assessed by the DASH Score, BSDS, or MDS is based on food choices that are recommended not only for adults but also for children [15]. Moreover, all three indices use scorings based on population-specific distribution of food consumption that takes into account the amount of foods consumed in the studied population. Therefore, we suggest that these indices could be applicable for children, as well. However, there are only a few studies on the associations of dietary quality indices with cardiometabolic risk factors among children. In these studies, a low MDS has been related to increased body fat content in children [16,17], but dietary quality indices have not been associated with plasma lipids or lipoproteins in children [18,19]. The associations of dietary quality indices with blood pressure, serum insulin or plasma glucose in children are not known. A lower Finnish Children Healthy Eating Index (FCHEI) was recently associated with a worse dietary quality among Finnish children [20]. However, the association of FCHEI with cardiometabolic risk factors has not been studied.

There are few studies on the relationships of various dietary quality indices with cardiometabolic risk factors and no studies on the clustering of these risk factors in children. We therefore investigated the associations of DASH Score, BSDS, MDS, and FCHEI with cardiometabolic risk factors and the clustering of these risk factors in a population sample of Finnish children.

Methods

Study design and study population

The present analyses are based on the baseline data of the Physical Activity and Nutrition in Children (PANIC) study, which is an ongoing physical activity and dietary intervention study in a population sample of primary school children from the city of Kuopio, Finland (ClinicalTrials.gov registration number NCT01803776). We invited 736 children 6–8 years of age who were registered for the 1st grade in 16 primary schools of Kuopio in 2007–2009. Altogether 512 children (70%) of those invited, participated in the baseline study in 2007–2009. The participants did not differ in sex distribution, age, or BMI-SDS from all children who started the 1st grade in the primary schools of Kuopio in 2007–2009 based on the comprehensive data obtained from the school health examinations. The final study sample of this study included 402 children (204 boys, 198 girls) who had complete data on variables needed in the analyses. The children who had complete data did not differ in sex distribution, age or BMI-SDS from the children who had incomplete data (data not shown). This study was conducted according to the guidelines laid down in the Declaration of Helsinki and all procedures were approved by the Research Ethics Committee of the Hospital District of Northern Savo. Written informed consent was obtained from all participating children and their parents.

Assessment of dietary factors

Nutrient intake and food consumption were assessed by food records administered by the parents on four predefined consecutive days, including two weekdays and two weekend days (99.5% of participants) or three weekdays and one weekend day (0.5% of participants), as described previously [21]. A clinical nutritionist instructed the parents to record all food and drinks consumed by their children at home, at school, in afternoon care, and elsewhere outside home using household or other measures, such as tablespoons, decilitres, and centimetres, at the 1st study visit. A clinical nutritionist reviewed the food records with the parents at the 2nd study visit and completed the records using a picture booklet of portion sizes, if needed. A clinical nutritionist asked the catering company providing food for all schools about the details of food and drinks, such as menus, cooking fat, and spread on bread, served at schools and in afternoon care and explored the recipes and ingredients of prepared foods and dishes to complete the information about food consumption and nutrient intake. Food records that included less than four days, included other than consecutive days, did not include any weekend days or had severe missing information were excluded from the analyses. The food records were analysed using The Micro Nutrica® dietary analysis software, Version 2.5 (The Social Insurance Institution of Finland). Data on nutrient intake obtained are