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Childhood socioeconomic status and lifetime health behaviors: The Young Finns Study

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ABSTRACT

Background: Differences in health behaviors partly explain the socioeconomic gap in cardiovascular health. We prospectively examined the association between childhood socioeconomic status (SES) and lifestyle factors in adulthood, and the difference of lifestyle factors according to childhood SES in multiple time points from childhood to adulthood.

Methods and results: The sample comprised 3453 participants aged 3–18 years at baseline (1980) from the longitudinal Young Finns Study. The participants were followed up for 31 years (N = 1675–1930). SES in childhood was characterized as reported annual family income and classified on an 8-point scale. Diet, smoking, alcohol intake and physical activity were used as adult and life course lifestyle factors. Higher childhood SES predicted a healthier diet in adulthood in terms of lower consumption of meat ($\beta \pm SE$ -3.6 ± 0.99, $p < 0.001$), higher consumption of fish (1.1 ± 0.5, $p = 0.04$) and higher diet score (0.14 ± 0.044, $p = 0.01$). Childhood SES was also directly associated with physical activity index (0.059 ± 0.023, $p = 0.009$) and inversely with the risk of being a smoker (RR 0.90 95%CI 0.85–0.95, $p < 0.001$) and the amount of pack years (-0.47 ± 0.18, $p = 0.01$). Life course level of smoking was significantly higher and physical activity index lower among those below the median childhood SES when compared with those above the median SES.

Conclusions: These results show that childhood SES associates with several lifestyle factors 31 years later in adulthood. Therefore, attention could be paid to lifestyle behaviors of children of low SES families to promote cardiovascular health.

1. Introduction

Direct association between socioeconomic status (SES) and cardiovascular health has repeatedly been shown and one of the contributors is suggested to be health behaviors [1,2,3]. SES has been consistently shown to be related to multiple lifestyle factors such as diet choices,

Abbreviations: FFQ, food frequency questionnaire; PAI, physical activity index; SES, socioeconomic status.

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smoking and physical activity [4,5], that, in turn, associate with the risk of numerous morbidity and mortality outcomes, both as single factors and combined [6,7,8,9]. The results of the studies showing the association between health behaviors and socioeconomic differences in mortality vary, but they typically explain 30–50% of the differences [10,11,12,13]. Despite knowledge of the socioeconomic divide in risk factors, and trends toward healthier lifestyles over time across SES groups, the socioeconomic gap in various risk factors has still widened [14,15].

Lifestyle factors are modifiable and thus suitable target for health promotion and disease prevention [16]. Interventions that begin in childhood, as health behaviors are being established, may be more beneficial than those that target adults. Therefore, it is important to find out whether SES differences in health behaviors start already in childhood and whether they persist all the way into the adulthood. The reports from the Cardiovascular Risk in Young Finns Study have previously examined the association between childhood SES and health behaviors among other conventional cardiovascular risk factors in youth, but not in adulthood [17,18,19]. The association of childhood SES with smoking and physical activity in adulthood has been shown in few other cohorts [20,21,22]. However, prospective data on the association between childhood SES and a wide variety of health behaviors in adulthood are missing.

Using data from the longitudinal Cardiovascular Risk in Young Finns Study cohort, we examined the independent association of childhood family SES with diet, smoking, alcohol consumption and physical activity in adulthood after 31 years of follow-up. Additionally, we investigated the differences in health behaviors between children with low or high family SES in multiple time points from childhood to adulthood.

2. Methods

2.1. Participants

The Cardiovascular Risk in Young Finns Study cohort and methods have been previously described in detail [23]. The cohort comprised 3596 participants aged 3–18 years at baseline in 1980. Thereafter, the cohort has been followed up in 1983, 1986, 2007 and 2011, with 2991, 2779, 2204 and 2060 participants from the original cohort, respectively. The present study sample comprised 3453 participants aged 3–18 years at baseline (1980), who provided data on their SES and lifestyle risk factors. In the follow-ups, sample sizes varied 1604–3432, depending on the outcome variable. All participants provided written informed consent, and the study was approved by local ethics committees.

2.2. Classification of socioeconomic status

Annual income was considered as an indicator of SES both in childhood (family income) and adulthood (participant's own income) [24,25]. Values of annual family income in childhood were corrected for time. Annual income strata were determined on an 8-point scale: in childhood from 1 (<2500 euros) to 8 (>16,800 euros) and in adulthood from 1 (<10,000 euros) to 8 (>70,000 euros). In addition, we made sensitivity analyses, where childhood SES was defined according to the parental educational years [26].

2.3. Lifestyle factors

Data on dietary habits, smoking and physical activity were obtained with questionnaires [27]. In 1980, 1983 and 1986, information on dietary habits was obtained with a non-quantitative food frequency questionnaire (FFQ) on the consumption of selected foods relevant to the development of cardiovascular disease (e.g. vegetables, fruits, fish and meat). For participants aged 3 to 9 years, the data were requested from the parents. Older participants answered the questions themselves, assisted by their parents when necessary. Consumption of these foods during last month was assessed on a 6-point scale: from 1 (daily) to 6 (only occasionally or never) [28]. The response categories were converted into times of consumption per week as previously described [29]. In 2007 and 2011, a more detailed quantitative FFQ providing an estimate of food consumption during the last 12 months in grams per day was used [29,30]. In this study, we used data on vegetable, fruit, fish and meat (including meat dish, sausage and cold cuts) consumption that were available both at baseline and the subsequent follow-ups, thus providing longitudinal data from childhood to adulthood. Using the quantitative FFQ in 2007 and in 2011, the total energy intake per day was also calculated.

To complement the longitudinal dietary data, we also used a diet score calculated from the FFQ data obtained in 2007. The score describes the diet as entirety, defined based on the intakes of 9 food groups. In the score, whole grains, fish, fruits, vegetables, and nuts/seeds were designated as favorable, healthy foods, whereas red and processed meats, sweets, sugar-sweetened beverages, and fried potatoes were designated as unfavorable. Intake of each food group was categorized into quartiles and assigned ascending values (0, 1, 2, 3) for favorable foods and descending values (3, 2, 1, 0) for unfavorable foods. These values were summed to generate a diet score (range: 0–27 points), with higher scores representing healthier diets [31].

The FFQ in 2007 and 2011 also provided an estimate on the consumption of beer, wine, spirits and other alcohol beverages (g/day), from which the mean amount of drinks per day was calculated.

Prospective data on cigarette smoking was self-reported by participants beginning of age 12 years or older in 1980, in 1983, in 1986, in 2007 and in 2011. Individuals who had reported daily smoking were defined as smokers. The number of pack years of smoking were also calculated [27].

A physical activity index (PAI) indicating habitual physical activity was calculated at baseline and repeatedly during the follow-ups.Separate questionnaires were used for the younger children (3–6 years of age, a parent-completed questionnaire), older children (9–18 years of age, self-completed questionnaire with the help of parents, if needed) and adults [32]. Due to the different scaling of the PAI during follow-up, the PAI values were age-standardized [32].

2.4. Clinical characteristics

Height, weight, and waist circumference were measured at all examinations [23]. Body mass index (BMI) was calculated as weight in kilograms divided by height in meters squared [27].

2.5. Statistical analyses

To examine differences between baseline characteristics of males and females, we used age-adjusted linear regression for continuous outcomes and logistic regression for binary outcomes. Continuous variables were described by mean ± SD and binary variables as percentages. Associations of family SES in childhood with diet, alcohol consumption, physical activity and pack years of smoking in adulthood (2011) were studied using linear regression ($\beta \pm SE$). To study the association of childhood SES and smoking status (smoker/non-smoker) in adulthood (2011) we examined risk ratios (RR) using logistic regression. The analyses were adjusted for age and sex (Model 1) and additionally for participant's own SES in adulthood (Model 2). We also made additional analyses for diet variables adjusting for daily energy intake. To study the association between childhood SES and life-course levels of consumption of fruit, vegetable, fish, meat, and PAI, the study population was classified into 2 groups according to their SES status in childhood: Group 1; SES below median in childhood and Group 2; SES above median in childhood. We then analyzed the differences of mean values in these groups in 1980, 1983, 1986, 2007 and 2011, using pairwise comparisons adjusted for age and sex. The consumption of fruit, vegetable, fish and meat was defined as mean frequency per week in 1980, 1983 and 1986, and amount per day (g/day) in 2007 and 2011. The prevalences of smoking across the life course in childhood SES groups were examined using cross-tabulation. The differences in prevalence of smoking between SES-groups were analyzed adjusting with age and sex. All statistical tests were performed using SAS version 9.4(SAS institute, Inc., Cary, NC) with statistical significance inferred at a 2-tailed p-value <0.05.

3. Results

3.1. Baseline characteristics

The participants were on average 10.4 years old at baseline and there were slightly more females than males in the study cohort (Supplement Table 1). Females on average consumed more vegetables, had lower PAI and smoked less compared with males.

3.2. Childhood SES and diet

Higher SES in childhood was associated with higher consumption of fish and lower consumption of meat in adulthood in 2011, adjusted for age and sex (Model 1, Table 1). After additional adjustment for own SES in adulthood, the association remained between childhood SES and meat (Model 2, Table 1). Childhood SES was not associated with fruit or vegetable consumption in adulthood after 31 years of follow-up (Table 1).

Childhood SES was also associated with the diet score in adulthood (Model 1, Table 1), higher childhood SES predicting higher diet score indicative of a healthier diet. This association persisted when the analysis was additionally adjusted for participant's own SES in adulthood (Model 2, Table 1).

In additional analyses that further adjusted for daily energy intake (kcal/day), the results concerning associations of childhood SES and adulthood measures of fish, meat, vegetable and fruit consumption in

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