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Socio-economic position and cardiovascular risk in rural indian adolescents

Medical Science

KEYWORDS : Socio-economic position, Cardiovascular risk

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ABSTRACT

Objectives

This study examined association between socio-economic position and cardiovascular risk factors in adolescents to investigate whether childhood socio-economic position is a risk factor for future cardiovascular disease, independently of adult behaviours.

Study design and methods

Cross-sectional associations between socio-economic position and cardiovascular risk factors were examined using linear regression models.

Results

The mean BMI was 16.7 kg/m2 for boys and 17.8 kg/m2 for girls. Socio-economic position was positively associated with fat mass index (0.15 kg/m2; 95% CI: 0.05–0.25) and inversely associated with central-peripheral skinfold ratio (−0.04; 95% CI: −0.06 to −0.01) and, in boys, fasting triglycerides (−0.05; 95% CI: −0.09 to −0.01).

Conclusions

The study thus showed that lower socio-economic position may be associated with greater central adiposity and higher triglyceride levels in these settings.

Introduction

Under-nutrition associated with low socio-economic position has been associated with adverse cardiovascular risk.(1) On the other hand, no independent association was observed between socio-economic position and blood pressure in Jamaican children.(2)

Assessment of the association between socio-economic position and cardiovascular risk would help focus the interventions to a vulnerable group and could inform the policy for the mitigation of cardiovascular risk. The authors therefore examined the association between socio-economic position and cardiovascular risk in a cohort of rural adolescents from South India.

Methods

The association between socio-economic position and cardiovascular risk was examined in a rural birth cohort, established to assess the long-term impact of a nutrition supplementation trial. Cohort profile and details of the initial trial have been reported earlier.(3,4).In intervention villages (n = 15) only, a nutritional supplement (a freshly cooked preparation made of corn–soya blend and soybean oil) was available daily to all pregnant and lactating women and children < 6 years, providing on average 2.09 MJ and 20–25 g protein to women and 1.25 MJ and 8–10 g protein to children. All births taking place in 29 villages (15 intervention, 14 control) over this time period were eligible for inclusion in the cohort. Children born in this cohort were traced in 2003–05 and invited to undergo clinical examination. This report is based on cross-sectional analyses of data collected during this follow-up.

Sample size calculations for the main study were carried out for the primary outcomes of cardiovascular risk. The study was adequately powered (80% power at 5% significance level and 0.01 ICC for village-level clustering) to detect mean differences of 1.8–2.9 mmHg for systolic BP, 1.5% for Aix and 1.7–3.2 mU/ml for fasting insulin.

Results

Table 1 indicates participant characteristics in the three SLI groups of girls and boys. The proportion of individuals in the three SLI groups was different among the boys and girls with a smaller proportion (<10%) of girls belonging to the low SLI group. More than 50% of girls were postpubertal as expected due to an earlier onset of puberty in girls, whereas none of the boys were postpubertal. As expected, boys and girls from the higher SLI groups were taller than their counterparts in the lower SLI groups. In the case of boys, but not the girls, higher socio-economic position was associated with higher BMI and fat mass index. Central-peripheral skin fold ratio, however, was lower in the high SLI group, in boys and girls. In the case of boys, blood pressure and serum insulin were higher, and AIx and serum triglycerides were lower in the high SLI group, but these differences were not observed in girls.

Table 2 presents the adjusted differences in cardiovascular risk factors across the SLI groups. All models were adjusted for sex except triglycerides, for which there was statistical evidence of an interaction between socio-economic position and sex (P = 0.008); hence, the models for triglycerides are presented separately for boys and girls. Socio-economic position was positively associated with fat mass index (0.15 kg/m2; 95% CI: 0.05–0.25) and inversely associated with central-peripheral skinfold ratio (−0.04; 95% CI: −0.06 to −0.01) and, in boys only, fasting triglycerides (−0.05; 95% CI: −0.09 to −0.01). Associations with other risk factors (blood pressure, arterial stiffness, fasting glucose, insulin and cholesterol) were weak and inconsistent, and did not persist after adjustment for potential confounders, including age, sex, pubertal stage, height, adiposity and nutrition supplementation.

Discussion

In this study in a rural adolescent cohort, lower socio-economic position was associated with central adiposity and higher serum triglyceride levels. However, no clear associations were observed between socio-economic position and other cardiovascular risk factors.

Studies in adults from high-income countries have generally found an inverse association between socio-economic position and cardiovascular risk.32,33 On the other hand, contrary to a more consistent pattern noted in adults, studies in children and adolescents in these settings have found inconsistent associations between socio-economic position and cardiovascular risk assessed using different indicators of cardiovascular risk such as adiposity, blood pressure, lipid profile, C-reactive protein and homocysteine levels.34–37 Studies from low-income countries such as India have also shown inconsistent results in the case of adults as well as adolescents, finding both direct and inverse associations between measures of socio-economic position and cardiovascular risk.38,39 Findings from this study corroborate the inverse association between socio-economic position and cardiovascular risk as central adiposity and higher triglyceride levels could be considered as early indicators of enhanced cardiovascular risk in this population.

A number of prospective studies have shown that adiposity, especially central adiposity in childhood and adolescence is linked to adverse cardio-metabolic risk profile in later life.40,41 Data from the Avon Longitudinal Study of Parents and Children (ALSPAC) indicated that adiposity in childhood was associated with increased cardiovascular risk in later life.42 A study from Denmark also showed that high plasma triglyceride and high BMI in childhood were associated with low insulin-sensitivity index values in young adulthood.43 It may be speculated that the inverse relationship between socio-economic status and cardiovascular risk factors may become more pronounced at a later stage in the participants of the present study.

Low socio-economic position increases cardiovascular disease risk through a number of unfavourable environmental exposures including early under nutrition leading to developmental programming of adult health. In addition, chronic inflammation associated with higher rates of infections in low income group populations as well as psychological stress have been implicated as reasons for the inverse association of cardiovascular risk with socio-economic position. Cereal based high carbohydrate diets commonly consumed by low income group populations in India are also known to be associated with higher triglyceride levels.44

With lifestyle changes consequent to future urbanization of these settings, association between socio-economic position and cardiovascular risk may strengthen at a later stage.

Conclusions

The present study suggests an inverse relationship between socio-economic position and cardiovascular disease risk in this cohort of rural Indian adolescents. Cardiovascular risk mitigation strategy should therefore focus on the youth belonging to the low socio-economic stratum.

Table 1
Participant characteristics by Standard of Living Index (SLI), of boys.

	Boys (N = 607)					Girls (N = 521)				
	N	Low SLI (N = 164)	Middle SLI (N = 281)	High SLI (N = 162)	P-value*	N	Low SLI (N = 48)	Middle SLI (N = 249)	High SLI (N = 224)	P-value*
Sociodemographics										
Age (years)	607	15.9 (0.9)	15.9 (0.9)	15.9 (0.8)	0.967	521	15.7 (0.9)	15.8 (0.9)	15.8 (1.0)	0.855
Pubertal stage (n, %)	604				0.508	517				0.880
Early puberty	171	38 (23.5)	87 (31.0)	46 (28.6)		0	0 (0.0)	0 (0.0)	0 (0.0)	
Middle puberty	322	94 (58.0)	145 (51.6)	83 (51.6)		43	4 (8.3)	22 (8.9)	17 (7.7)	
Late puberty	111	30 (18.5)	49 (17.4)	32 (19.9)		204	17 (35.4)	94 (38.1)	93 (41.9)	
Postpuberty	0	0 (0.0)	0 (0.0)	0 (0.0)		270	27 (56.3)	131 (53.0)	112 (50.5)	
Anthropometry										
Height (mm)	604	1580.5 (81.5)	1579.3 (86.7)	1613.1 (82.7)	<0.001	516	1495.0 (58.8)	1516.4 (55.4)	1517.3 (58.1)	0.040
Body mass index (kg/m2)	604	16.5 (1.8)	16.5 (1.8)	17.2 (2.6)	<0.001**	516	17.8 (2.2)	17.7 (1.8)	18.0 (2.6)	0.254**
Fat mass index (kg/m2)	604	1.5 (0.5)	1.6 (0.6)	1.8 (1.0)	<0.001**	516	3.7 (1.0)	3.7 (0.9)	3.8 (1.3)	0.226**
Central-peripheral skinfold ratio	604	1.6 (0.2)	1.5 (0.2)	1.5 (0.2)	0.002	516	1.5 (0.3)	1.4 (0.2)	1.4 (0.2)	0.033
Cardio-metabolic risk										
Systolic blood pressure (mmHg)	603	109.7 (11.1)	110.2 (10.7)	112.2 (10.9)	0.080	515	107.5 (8.3)	107.5 (9.3)	107.2 (9.2)	0.917
Diastolic blood pressure (mmHg)	603	61.4 (6.8)	61.7 (6.5)	63.8 (6.4)	0.001	515	63.0 (5.7)	62.6 (7.0)	62.7 (6.0)	0.924
Augmentation index (%)	486	5.1 (10.4)	3.8 (9.8)	1.8 (10.9)	0.035	376	6.8 (12.3)	3.9 (11.1)	4.8 (9.9)	0.365
Total cholesterol (mmol/l)	567	3.2 (0.6)	3.3 (0.7)	3.3 (0.6)	0.769	483	3.5 (0.7)	3.6 (0.7)	3.7 (0.7)	0.040
LDL cholesterol (mmol/l)	567	1.9 (0.5)	1.9 (0.6)	2.0 (0.5)	0.577	483	2.1 (0.7)	2.2 (0.6)	2.2 (0.6)	0.247
HDL cholesterol (mmol/l)	567	1.0 (0.2)	1.0 (0.2)	1.0 (0.2)	0.146	483	0.9 (0.3)	1.0 (0.2)	1.0 (0.2)	0.093
Triglyceridesa (mmol/l)	567	0.8 (1.4)	0.8 (1.4)	0.7 (1.4)	0.036	483	0.9 (1.5)	0.9 (1.4)	0.9 (1.5)	0.305
Glucose (mmol/l)	543	4.7 (0.7)	4.7 (0.6)	4.7 (0.6)	0.828	465	4.7 (0.6)	4.8 (0.8)	4.6 (0.6)	0.027**
Insulina (mU/l)	543	16.4 (1.7)	15.2 (1.8)	17.9 (1.8)	0.020	465	16.6 (1.8)	16.7 (1.8)	18.1 (1.7)	0.275
HOMA scorea	541	3.4 (1.7)	3.1 (1.8)	3.7 (1.8)	0.022	462	3.4 (1.8)	3.4 (1.9)	3.7 (1.7)	0.474

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Participant characteristics by Standard of Living Index (SLI), of girls.

	N	Low SLI (N = 48)	Middle SLI (N = 249)	High SLI (N = 224)	P-value*
Age (years)	521	15.7 (0.9)	15.8 (0.9)	15.8 (1.0)	0.855
Pubertal stage (n, %)	517				0.880
Early puberty	0	0 (0.0)	0 (0.0)	0 (0.0)	
Middle puberty	43	4 (8.3)	22 (8.9)	17 (7.7)	
Late puberty	204	17 (35.4)	94 (38.1)	93 (41.9)	
Postpuberty	270	27 (56.3)	131 (53.0)	112 (50.5)	
Height (mm)	516	1495.0 (58.8)	1516.4 (55.4)	1517.3 (58.1)	0.040
Body mass index (kg/m2)	516	17.8 (2.2)	17.7 (1.8)	18.0 (2.6)	0.254**
Fat mass index (kg/m2)	516	3.7 (1.0)	3.7 (0.9)	3.8 (1.3)	0.226**
Central-peripheral skinfold ratio	516	1.5 (0.3)	1.4 (0.2)	1.4 (0.2)	0.033
Systolic blood pressure (mmHg)	515	107.5 (8.3)	107.5 (9.3)	107.2 (9.2)	0.917
Diastolic blood pressure (mmHg)	515	63.0 (5.7)	62.6 (7.0)	62.7 (6.0)	0.924
Augmentation index (%)	376	6.8 (12.3)	3.9 (11.1)	4.8 (9.9)	0.365
Total cholesterol (mmol/l)	483	3.5 (0.7)	3.6 (0.7)	3.7 (0.7)	0.040
LDL cholesterol (mmol/l)	483	2.1 (0.7)	2.2 (0.6)	2.2 (0.6)	0.247
HDL cholesterol (mmol/l)	483	0.9 (0.3)	1.0 (0.2)	1.0 (0.2)	0.093
Triglyceridesa (mmol/l)	483	0.9 (1.5)	0.9 (1.4)	0.9 (1.5)	0.305
Glucose (mmol/l)	465	4.7 (0.6)	4.8 (0.8)	4.6 (0.6)	0.027**
Insulina (mU/l)	465	16.6 (1.8)	16.7 (1.8)	18.1 (1.7)	0.275
HOMA scorea	462	3.4 (1.8)	3.4 (1.9)	3.7 (1.7)	0.474

Table 2: Association between Standard of Living Index and cardiovascular risk among participants.

	Model 1			Model 2			Model 3		
	βCoeff	95% CI	P-value	βCoeff	95% CI	P-value	βCoeff	95% CI	P-value
Fat mass index (kg/m2)	0.15	0.05 to 0.25	0.01	0.13	0.04 to 0.23	0.01	0.15	0.05 to 0.25	0.01a
Central-peripheral skinfold ratio	−0.04	−0.06 to −0.01	0.01	−0.05	−0.07 to −0.02	<0.01	−0.05	−0.07 to −0.03	<0.01b
Systolic blood pressure (mmHg)	0.55	−0.23 to 1.33	0.16	0.09	−0.61 to 0.78	0.80	0.15	−0.58 to 0.87	0.68
Diastolic blood pressure (mmHg)	0.54	0.07 to 1.00	0.03	0.40	−0.07 to 0.87	0.09	0.38	−0.08 to 0.84	0.10
Augmentation index (%)	−1.21	−2.36 to −0.06	0.04	−0.72	−1.84 to 0.40	0.20	−0.63	−1.72 to 0.45	0.24
Total cholesterol (mmol/l)	0.06	−0.01 to 0.13	0.06	0.07	0.01 to 0.13	0.04	0.05	−0.01 to 0.11	0.10
LDL cholesterol (mmol/l)	0.05	−0.01 to 0.10	0.09	0.05	−0.01 to 0.11	0.08	0.03	−0.02 to 0.08	0.20
HDL cholesterol (mmol/l)	0.02	−0.01 to 0.04	0.06	0.02	0.01 to 0.04	0.04	0.02	−0.01 to 0.04	0.06
Triglyceridesc (mmol/l) in boysd	−0.05	−0.09 to −0.01	0.02	−0.04	−0.09 to −0.01	0.03	−0.04	−0.08 to −0.01	0.02
Triglyceridesc (mmol/l) in girlsd	−0.04	−0.02 to 0.11	0.17	0.05	−0.02 to 0.11	0.14	−0.05	−0.02 to 0.11	0.17
Glucose (mmol/l)	−0.04	−0.12 to 0.04	0.29	−0.04	−0.12 to 0.04	0.29	−0.03	−0.10 to 0.04	0.35
Insulinc (mU/l)	0.06	0.01 to 0.11	0.05	0.05	−0.01 to 0.10	0.10	0.05	−0.01 to 0.10	0.07
HOMA scorec	0.05	−0.01 to 0.11	0.09	0.04	−0.02 to 0.10	0.16	0.05	−0.01 to 0.11	0.11

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