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Original article

Positive Attributes Protect Adolescents From Risk for the Metabolic Syndrome

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A B S T R A C T

Purpose: Risk for cardiovascular disease develops as early as adolescence. The primary objective of the present study was to identify whether low levels of positive and high levels of negative emotions and attitudes are associated with the combination of cardiovascular risk factors known as the metabolic syndrome.
Methods: Participants were 239 healthy adolescents (57% black; 53% female; mean age, 15.7 years) from a low-to-middle class community. They completed measures of negative and positive emotions and attitudes, which were factor analyzed and yielded two factors. Positive attributes included general positive affect, optimistic attitudes, subjective social status, and self-esteem. Negative emotions included cynical attitudes, depressive symptoms, trait anger, and general negative affect. Components of the metabolic syndrome (waist circumference, glucose, blood pressure, triglycerides, and high-density lipoprotein cholesterol) were standardized and averaged to create a metabolic syndrome composite risk score.
Results: Linear regression analyses showed that the positive attributes factor was inversely associated with metabolic syndrome composite risk score, $p < .01$. The relationship remained significant after adjusting for age, sex, race, socioeconomic status, physical activity, smoking, and body mass index percentile. The negative emotion factor was unrelated to metabolic risk score.
Conclusions: Adolescents with more positive attributes had lower metabolic syndrome risk scores. This study emphasizes the importance of the development of psychosocial resources during the adolescent transition for potentially reducing future cardiovascular risk.

IMPLICATIONS AND CONTRIBUTION

Similar to studies demonstrating a link between psychosocial variables and the metabolic syndrome in adulthood, this relationship appears to be present even during adolescence. Positive attributes, particularly positive affect and high social status compared to peers, are associated with lower metabolic syndrome risk.

Risk factors for cardiometabolic diseases are not uncommon in adolescence and predict subclinical cardiovascular disease in adulthood. In the National Health Administration Examination Survey (NHANES) study, for example, 6% of female adolescents and 20% of male adolescents had high fasting blood glucose (≥100 mg/dL) [1]. Combining blood pressure (BP) data from 11 studies and a total of 58,698 children and adolescents, up to 9.8% of children and adolescents had systolic hypertension and up to 7.1% had diastolic hypertension [2]. BP at the age of 13 years predicted adulthood BP at age 24 years, in addition to elevated lipids and glucose [3]. Autopsy studies of young adults who died from traumas reported a linear relationship between number of cardiometabolic risk factors and intima surface covered with fatty streaks in the aorta: 0, 1, 2, and 3 or 4 risk factors had, respectively, 19.1%, 30.3%, 37.9%, and 35.0% of the intimal surface covered [4]. Similarly, greater number of risk factors (cigarette smoking, elevated lipids, BP, and body mass index [BMI]) in adolescence was linked with greater carotid intima medial thickness in both men and women in adulthood [5]. A cluster of risk factors in adolescents was associated with reduced carotid

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artery elasticity and increased stiffness [6,7]. The metabolic syndrome, a combination of elevated BP, triglycerides, waist circumference, glucose, and low high-density lipoprotein cholesterol (HDL-C) levels, in childhood and adolescence predicted cardiovascular disease in adulthood [8].

Few investigations have examined the psychosocial correlates of clustering of cardiovascular risk factors in adolescence, in contrast to the burgeoning literature in adulthood on the metabolic syndrome [9]. One study of 37 boys found that trait anxiety, but not perceived stress or depressive symptoms, was related to higher metabolic risk scores, defined as standardizing and summing waist circumference, mean arterial BP, hemoglobin A1c, and HDL-C [10]. This study is limited because of its small sample size of boys only (no race reported) and simple correlation analyses. Räikkönen et al. [11] reported that high hostility predicted participants who were classified with the metabolic syndrome 3 years later, compared to individuals who did not have the metabolic syndrome at either visit. Metabolic syndrome was defined as having two or more cardiometabolic risk factors above the 75th percentile distributions based on age, sex, and race. The sample comprised 134 children and adolescents, and the psychosocial variables were limited to components of hostility. Another study of 122 adolescent females at risk for depression found that more negative social interactions throughout the day predicted increasing metabolic risk across 2 years, although they were unrelated to baseline metabolic risk. Metabolic risk was defined by standardizing and averaging the risk factors that constitute the metabolic syndrome [12]. The Dunedin Study reported that children who were socially isolated and rejected were at elevated cardiovascular risk as young adults, defined as having at least three of six cardiovascular risk factors (overweight, low HDL-C, high BP, high cholesterol, high glycosolated hemoglobin, and low maximum oxygen consumption) [13]. In the Cardiovascular Risk in Young Finns Study, depressive symptoms at age 12 years predicted the metabolic syndrome defined by standard National Cholesterol Education Program guidelines among women, but not men, 20 years later [14]. In the aggregate, these studies suggest that negative psychosocial characteristics in youth are associated with a clustering of cardiovascular risk factors, but the studies did not test the same negative characteristics so there was no opportunity for replication. Furthermore, metabolic risk was defined in various ways across studies.

It has become increasingly clear that positive emotions and attitudes can have a strong protective influence on cardiovascular risk in adults, and these effects can be independent of negative emotions and attributes [15,16]. With regard to the influence of positive emotions and attributes on cardiometabolic risk factors in youth, we know of only three relevant studies. In the study by Holmes et al. [10], higher school-related and sport-related self-esteem among boys was related to lower metabolic risk. In the social interaction study of adolescent females at risk for depression, more positive social interactions throughout the day were not associated with metabolic risk [12]. In the Princeton School Study of black and white teenagers, optimistic attitudes were associated with high levels of HDL-C and low levels of insulin and triglycerides (blacks only) [17]. This article did not report the association with the metabolic syndrome or with the total number of elevated risk factors. In sum, high self-esteem and optimism were related to low metabolic risk. However, similar to the studies regarding negative psychosocial characteristics, there was no opportunity for replication as each study measured different positive characteristics.

Adolescence is a unique developmental period not only from the perspective of cardiovascular risk but also because of the psychological and social challenges it presents. Developing a sense of competency, autonomy, and relatedness to others during adolescence is critical to a life of growth, integrity, and well-being [18,19]. Adolescents must meet the demands of school and work, fostering a sense of competency; develop their own sense of values and unique identity to have a sense of autonomy; and form satisfying and enduring relationships within and outside the family in an effort to relate to others. To the extent that adolescents feel positive about themselves, believe they are worthwhile, and are optimistic about their future and generally happy, they may be protected from adverse changes in cardiovascular risk that cooccur with the profound changes associated with maturation.

The aims of the present study were to test whether healthy black and white adolescents who have elevated metabolic syndrome risk profiles have higher negative and lower positive emotions and attitudes. The present study adds to the small adolescent literature in a number of key ways. First, it developed indices of negative and positive characteristics based on factor analysis rather than examining individual characteristics, thereby reducing type I error. The characteristics were selected based on the large literature on the metabolic syndrome in adults. Given the sparse literature on metabolic risk in adolescents, additional characteristics were selected based on theories of successful adolescent development. Finally, the study evaluated whether the relationships were stronger in blacks or whites and males or females.

Methods

Participants

Participants were 250 (47% male and 43% white) healthy students enrolled in a public high school near Pittsburgh, PA. This high school served about 500 students (42% black, 56% white, and 2% other) and 63% were eligible for free or reduced lunch, compared to 26% statewide. In the 3 years of the study, the high school graduated 83%; district performance was ranked as 111 of 123 high schools in western Pennsylvania. This school was selected because it was racially integrated and served a lower-to-middle class community, maximizing the potential for socioeconomic status (SES) to be similar for black and white students. Participants were recruited from health classes for a research study designed to measure stress and risk factors for cardiovascular disease. The University of Pittsburgh Institutional Review Board approved the research protocol. Participants provided written informed consent before any research procedures, and a parent or guardian provided consent for students aged $<$18 years. Parents reported whether their children met inclusion criteria: free of cardiovascular or kidney disease and no medications for emotional problems, diabetes, high BP, or those that affect the cardiovascular system or normal sleep. Sixteen students who were screened were ineligible to participate because of taking medications, and seven students signed consent but did not actively enroll in the study.

Overview of procedure

Protocol was conducted at the high school and lasted for about 1 week. Staff measured height, weight, and waist and hip circumference. Two resting BPs were taken while the participant was seated and had rested for 5 minutes. On a separate