VIGOROUS PHYSICAL ACTIVITY AS STRESS BUFFER IN ADOLESCENTS AND YOUNG ADULTS FROM THE GENERAL POPULATION

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Abstract

The adverse effects of stress and the positive effects of physical activity on health are well established but their interaction is less clear. The present study investigated whether vigorous physical activity may buffer the negative effects of stress on depressive symptoms in adolescents and young adults from the general population. A random community sample of 14 to 21 year-olds was drawn from the population registry of Dresden (Germany) in 2015 and reported, among others, about perceived stress (Perceived Stress Scale, PSS-4), the weekly number of days with vigorous physical activity, and depressive symptoms (Patient Health Questionnaire, PHQ-9) cross-sectionally at baseline (n = 1,053) and longitudinally at one-year follow-up (n = 651). Linear regression analyses with interaction terms were applied both cross-sectionally and longitudinally with PHQ-9 sum score as outcome variable and stress and activity as interacting predictor variables, adjusting for baseline age, sex, body mass index and – in prospective analyses – also for baseline depressive symptomatology. In cross-sectional analysis, no significant interaction emerged between baseline stress and physical activity on baseline depressive symptoms; there was only a main effect of perceived stress. However, prospective-longitudinal analyses supported the stress-buffering-hypothesis. There was a significant interaction between baseline perceived stress and physical activity on follow-up depression symptomatology (p < .05). Decomposing the interaction showed that among those with high perceived stress at baseline, a higher number of days with vigorous physical activity at baseline was linked to lower depression levels at follow-up. These findings suggest that vigorous physical activity exhibits prospectively an antidepressogenic effect under high perceived stress conditions and may be a useful target for prevention or early intervention efforts during the crucial developmental period of adolescence and young adulthood.

Keywords: *Epidemiology, mental health, adolescence, young adulthood, cohort study.*

1. Introduction

The adverse effects of stress and the positive effects of physical activity on health are well established but their interaction is less clear (e.g., Neumann et al. 2022). The present study investigated whether vigorous physical activity may buffer the negative effects of stress on depressive symptoms in adolescents and young adults from the general population.

2. Methods

2.1. Sample and assessments

A random community sample of 14 to 21 year-olds was drawn from the population registry of the city of Dresden (Germany) in 2015 and N = 1,180 (21.7%) were assessed at the baseline wave (11/2015-12/2016) of the epidemiological Behavior and Mind Health (BeMIND) study (Beesdo-Baum et al., 2020). Among the comprehensive assessments, perceived stress during the past month (4-item Perceived Stress Scale, PSS-4; Cohen & Williamson (1988)), the weekly number of days with vigorous physical activity in the past three months (single item: "How many days a week are you intensively physically active, so that your breathing and pulse rate increase sharply and you break a sweat?; Scheidt-Nave et al., 2012), and depressive symptoms during the past two weeks (Patient Health Questionnaire, PHQ-9; Kroenke et al., 2001) were assessed. Complete data in these questionnaires were available for n = 1,053 subjects, forming the baseline analysis sample. Of these n = 651 participants completed the PHQ-9 again during the one-year follow-up wave, forming the prospective-longitudinal analysis sample.

2.2. Statistical analyses

Linear regression analyses with interaction terms were applied both cross-sectionally and longitudinally with depressive symptoms (PHQ-9 sum score) as outcome variable and perceived stress (PSS-4) and physical activity as interacting predictor variables, adjusting for baseline age, sex, body mass index and – in prospective analyses – also for baseline depressive symptomatology. Baseline sample weights were applied (weighted percent, means, regression coefficients), ensuring that the overall BeMIND sample is representative for the population of the 14–21-year-old residents of Dresden with regard to sex and age. N are reported unweighted. STATA 15.1 was used for analysis (STATA Corp, 2018).

3. Results

3.1. Sample characteristics

The baseline analysis sample (n = 1,053) consisted of n = 431 males (weighted percent [%w]: 50.7) and n = 622 females (49.3%w). Weighted mean age was 17.9 years (standard error [SE]: 0.08). Baseline weighted means for perceived stress, physical activity, and depressive symptoms were 5.6 (SE: 0.10), 2.5 (SE: 0.06), and 4.3 (SE: 0.11), respectively. Higher baseline perceived stress scores were related to lower odds of participation at follow-up (Odds Ratio: 0.94, 95% Confidence Interval [95% CI]: 0.90 - 0.99, $p = 0.011$).

3.2. Cross-sectional analyses

As shown in Table 1, no significant interaction emerged between baseline perceived stress and physical activity on baseline depressive symptoms ($p = .091$). The main effect of perceived stress ($p < .001$), but not the main effect of physical activity ($p = .146$) was significant.

Table 1. Association between baseline perceived stress and physical activity with baseline depressive symptoms: Results of linear regression analysis with interaction term (adjusted for age and sex).

Baseline Depressive Symptoms	B	SE	95% CI	p
Baseline Perceived Stress	0.63	0.07	0.49 - 0.77	<.001
Baseline Physical Activity	0.18	0.12	-0.06 - 0.42	0.146
Baseline Percieved Stress * Physical Activity	-0.04	0.02	-0.09 - 0.01	0.091
Baseline Age	0.07	0.04	-0.02 - 0.15	0.120
Sex	0.72	0.19	0.34 - 1.10	<.001
Baseline Body Mass Index	0.09	0.03	0.03 - 0.15	0.006
Constant	-2.71	0.98	-4.64 - -0.78	0.006

B: unstandardized regression coefficient, SE: standard error, 95% CI: 95% confidence interval, p: p-value

3.3. Prospective-longitudinal analyses

Prospective-longitudinal analyses supported the stress-buffering-hypothesis. As shown in Table 2, there was a significant interaction between baseline perceived stress and physical activity on 1-year follow-up depression symptomatology ($p = .006$). Decomposing the interaction showed that among those with high perceived stress at baseline, a high number of days with vigorous physical activity at baseline was linked to lower depression levels at follow-up (see Figure 1).

Table 2. Association between baseline perceived stress and physical activity with follow-up depressive symptoms: Results of linear regression analysis with interaction term (adjusted for baseline depressive symptoms, age, and sex).

Follow-up Depressive Symptoms	B	SE	95% CI	p
Baseline Perceived Stress	0.38	0.08	0.23 - 0.53	<.001
Baseline Physical Activity	0.26	0.11	0.04 - 0.48	0.022
Baseline Percieved Stress * Physical Activity	-0.06	0.02	-0.10 - -0.02	0.006
Baseline Depressive Symptoms	0.27	0.04	0.19 - 0.35	<.001
Baseline Age	-0.01	0.04	-0.09 - 0.08	0.888
Sex	0.05	0.21	-0.37 - 0.47	0.820
Baseline Body Mass Index	0.00	0.03	-0.05 - 0.06	0.922
Constant	0.31	0.96	-1.57 - 2.19	0.749

B: unstandardized regression coefficient, SE: standard error, 95% CI: 95% confidence interval, p: p-value

Figure 1. Display of interaction between baseline perceived stress and physical activity (low:<= 25th percentile, middle >25th percentile & <= 75th percentile, high: >75th percentile) on depressive symptoms at 1-year follow-up.
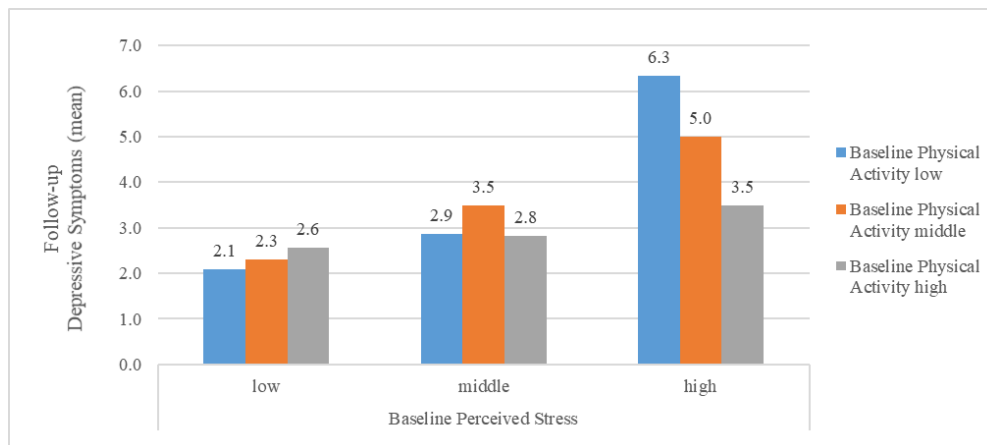
4. Discussion

These findings in this general population sample of adolescents and young adults indicate that vigorous physical activity exhibits prospectively an antidepressogenic effect under high perceived stress conditions. This suggests that higher physical activity may strengthen resilience and thus pose a useful target for prevention or early intervention efforts in highly stressed individuals during the crucial developmental period of adolescence and young adulthood.

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