Effects of Physical Activity on Psychological Variables in Adolescents

Karen J. Calfas and Wendell C. Taylor

To identify the most consistent relationships among psychological variables and physical activity in youth (ages 11–21 years), 20 articles on depression, anxiety, stress, self-esteem, self-concept, hostility, anger, intellectual functioning, and psychiatric disorders were reviewed. Physical activity was consistently related to improvements in self-esteem, self-concept, depressive symptoms, and anxiety/stress. The effect sizes were +.12, −.15, and −.38 for self-esteem/self-concept, stress/anxiety, and depression, respectively. The evidence for hostility/anger and academic achievement was inconclusive. No negative effects of physical activity were reported. The literature suggests that physical activity in youth is psychologically beneficial. More research is needed to confirm previous findings. Adolescents should engage in moderate or vigorous aerobic activity approximately three times per week for a total of at least 60 minutes per week.

In historical times, a healthy mind in a healthy body was a valued concept of Greek tradition. In contemporary times, the mind–body unity is evident in concepts such as high-level wellness, optimal health, and holistic medicine. Both the historical and contemporary perspectives emphasize the importance of psychological and mental health, as well as physical health. Therefore, in addition to the physical effects of activity, it is important to review the research on the psychological effects of physical activity in adolescents. No comprehensive reviews on the psychological effects of physical activity in adolescents (ages 11–21) were found.

Psychological and mental health can be defined in a variety of ways. For the purpose of this review, the psychological variables of primary interest are depression, anxiety, stress, self-esteem, self-concept, hostility, anger, intellectual functioning, and psychiatric disorders defined by the Diagnostic and Statistical Manual of Mental Disorders (DSM-III-R, 1).

These variables were selected for several reasons. First, the literature on the psychological effects of physical activity on adults suggests that these variables are important (2, 3, 4). Significant relationships with these variables have been documented in studies with adults. Second, the selected variables cover a
range of effects from maintaining psychological and mental health to ameliorating and managing psychiatric disorders. The range of variables permits the review of nonclinical and clinical adolescent populations and of preventive and therapeutic measures. Third, the selected variables are appropriate for the developmental level of our age group (ages 11–21). Self-esteem and academic performance (intellectual functioning) are salient concerns for this age group. Moreover, depression, suicide, and psychiatric disorders are prevalent in this age group (5). Fourth, several variables can show either positive or negative psychological effects from participation in physical activity (e.g., stress, self-esteem, anxiety). In summary, the selected psychological variables provide a range and balance to review the positive and negative psychological effects of physical activity in both nonclinical and clinical populations.

Method of Review

Index Medicus and social science data bases were searched over the last 10 years for studies or review articles regarding physical activity or exercise and psychological variables including depression, anxiety, stress, self-esteem, self-concept, hostility, anger, intellectual functioning, and psychiatric disorders. Also, we conducted personal retrieval searches. Studies included in this review were identified by these search techniques and relevant references before 1983 were included.

We used several criteria to select and classify studies. Studies that included subjects in the 11- to 21-year-old age range were included in the review. Studies that had a significant proportion of subjects in the age range of interest were also included if they had good scientific merit. Studies including apparently healthy adolescents were of particular interest. Studies examining adolescents with psychological problems or diagnosed with psychological illnesses were included in the High-Risk Populations section of this review. This review focuses on studies that used a randomized controlled, a prospective observational, or a cross-sectional observational design. We excluded conclusions drawn from case reports and expert opinion. Data from unpublished studies and dissertations were not included.

Results and Discussion

Characteristics of the studies included in this review are described in Table 1. Subjects are classified by age, gender, socioeconomic status, and ethnicity when reported. Study design is classified by level of evidence collected, including (a) Level I, a randomized controlled trial or quasi-experimental design; (b) Level IIA, a prospective observational study, or (c) Level IIB, cross-sectional observational study. Physical activity measures and interventions are described, including the frequency, intensity, type, and time (FITT) where possible. Characteristics of intervention and control groups are specified. Dependent variables of psychological function are identified. Particular attention was given to possible dose–response relationships.

As Table 1 indicates, there is a general lack of experimental research on the psychological effects of physical activity among adolescents. Regarding
Table 1  Study Characteristics and Results on the Relation of Physical Activity (PA) and Psychological Variables in Adolescents

<table>
<thead>
<tr>
<th>Citation</th>
<th>Subjects</th>
<th>Design</th>
<th>Intervention</th>
<th>Control</th>
<th>Measure</th>
<th>Effect outcomes</th>
<th>Dose</th>
<th>Comments</th>
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<tbody>
<tr>
<td>Apparently healthy population</td>
<td></td>
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<td>Fr = one exercise session; I = monitored; Ty = walk/run; Ti = 15 min.</td>
<td>Read for 15 min; busy work for 15 min</td>
<td>HR measured before, after PA, 10 min after PA</td>
<td>Anxiety (STAI children) less anx from end of activity to FU; no diff betw. groups</td>
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<tr>
<td>Bahrke &amp; Smith (34)</td>
<td>N = 65 (54% F); age M = 10.6 (SD = .8); white, middle class</td>
<td>I</td>
<td>Fr = one exercise session; I = monitored; Ty = walk/run; Ti = 15 min.</td>
<td>Read for 15 min; busy work for 15 min</td>
<td>HR measured before, after PA, 10 min after PA</td>
<td>Anxiety (STAI children) less anx from end of activity to FU; no diff betw. groups</td>
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<tr>
<td>Berger et al. (17)</td>
<td>N = 305 (65% F); age M = 20.0</td>
<td>I</td>
<td>Fr = 3x/wk; I = 65-80%; Ty = jogging; Ti = 20 min.</td>
<td>Relaxation resp. 20 min 5 d/wk; control: no treatment</td>
<td>Exercise pulse rates, pulse rate duration, self-monitor PA frequency</td>
<td>Stress (profile of mood states)</td>
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<tr>
<td>Holloway et al. (26)</td>
<td>N = 59 F; age M = 16</td>
<td>I</td>
<td>Fr = 3x/wk, 12 wk; I = nonaerobic; Ty = wt training; Ti = 1 hr/class</td>
<td>Measured best single rep max in free wt squat, bench press, &amp; arm curl (measured in Tx group only)</td>
<td>Self-efficacy (physical self-efficacy, physical strength, and self-efficacy test); effectiveness (Eating Disorder Inventory)</td>
<td>Self-efficacy &amp; effectiveness</td>
<td>Can’t determine</td>
<td>Pretest group diff on some efficacy variables</td>
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<tr>
<td>Study</td>
<td>N</td>
<td>Gender</td>
<td>Age</td>
<td>Activity</td>
<td>Control</td>
<td>Exercise</td>
<td>Self-esteem</td>
<td>Results</td>
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<td>Koocher (35)</td>
<td>N = 65 M;</td>
<td>I</td>
<td>M, I</td>
<td>10.3</td>
<td>control</td>
<td>Learn to swim: Fr = daily; I = vigorous; Ty = swimming; Ti = 12 d</td>
<td>Passed swimming test previously failed</td>
<td>Exercise reduced gap between ideal self &amp; self-concept and control group</td>
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<td>age M = 10.3 (range = 7-15)</td>
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<td>McGowan et al. (36)</td>
<td>N = 37 M;</td>
<td>I</td>
<td></td>
<td></td>
<td></td>
<td>Endurance training program: Fr = 3-4 x/wk; I = vigorous; Ty = sports; Ti = 18 wk</td>
<td>No participation in PE classes</td>
<td>Self-concept; peer approval and improvements in cardiovascular fitness</td>
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<td></td>
<td>7th-graders</td>
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<tr>
<td>Norris et al. (18) Study 2</td>
<td>N = 80 (50% F); age M = 16.5; working class to affluent</td>
<td>I</td>
<td></td>
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<td>Matched: 1—Fr = 2x/wk, 10 wk; I = 70-75% MHR; Ty = aerobics; Ti = 25-30 min</td>
<td>Self-report of general exercise habits; step test (2 min, HR taken rest, post, 2 min FU)</td>
<td>Stress (life events survey [NS], perceived stress); illness (NS); mood (multiple affect adjective checklist); improvement seen for high-intensity group only</td>
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<tr>
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<th>Signif. mental health outcomes</th>
<th>Dose</th>
<th>Comments</th>
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</thead>
<tbody>
<tr>
<td>Rape (37)</td>
<td>$N = 42$ M; age = 18-25; European Americans</td>
<td>I matched controls, cross-sectional observational</td>
<td>Fr = NR; I = NR; Ty = running; Ti = 15 mi/wk</td>
<td>No activity</td>
<td>Self-report frequency distance of running</td>
<td>Depression (Beck Depression Inventory); runners less depressed than nonexercisers</td>
<td>Depression</td>
<td></td>
<td>Self-selection potential confound</td>
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<tr>
<td>Brown &amp; Siegel (38)</td>
<td>$N = 364$ F; age $M = 14$ (7th-11th grade); mostly white upper &amp; upper-middle class</td>
<td>IIA pre/posttest</td>
<td>N/A</td>
<td>N/A</td>
<td>Self-rep. of time spent in 14 activities (aerobic &amp; nonaerobic)</td>
<td>Stress (life events); health (seriousness of illness rating scale); PA not cor. with stress or illness at pre- or posttest</td>
<td></td>
<td></td>
<td>Can’t determine</td>
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<tr>
<td>Folkins et al. (39)</td>
<td>$N = 137$ (50% F); jr. college students</td>
<td>IIA controls not randomized, post scores NR</td>
<td>Fr = 2x/wk, 15 wk; I = NR; Ty = walk/jog; Ti = 25-35 min (goal) jogging course</td>
<td>Fr = 2x/wk, 15 wk; I = NR; Ty = golf or archery; Ti = NR</td>
<td>Timed 1.75 mi run, resting HR</td>
<td>Self-confidence/personal adjustment (adjective checklist); anxiety, depression (multiple affect adjective checklist); work efficiency, sleep (self-report over last week)</td>
<td>Depression (F only), anxiety (F only), self-confidence (F only), sleep</td>
<td></td>
<td>PreTx diff betw. groups; gender diff may be mediated by baseline levels; posttest scores for control goup NR</td>
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<tr>
<td>Study</td>
<td>Sample Size</td>
<td>Age</td>
<td>Methodology</td>
<td>Outcome Measures</td>
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<td>Hawkins &amp; Gruber (40)</td>
<td>N = 98 M; age M = 10.7 (range 9-12)</td>
<td>IIA</td>
<td>Observed little league baseball program for an entire season; weekly games and practice on other days</td>
<td>Participation in little league baseball (improved after one season) Hostility Can't determine</td>
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<tr>
<td>Scanlan &amp; Passer (29)</td>
<td>N = 205 M; age = 11-12</td>
<td>IIA</td>
<td>Observed 16 teams of soccer players</td>
<td>Outcome of game (score); self-report of fun during game; perception of importance of win to coach Anxiety (sport competition anx test, STAI for children); self-concept (Piers-Harris self concept scale); losing players had anx after game; baseline anx, level of fun &amp; importance of win to coach predicted</td>
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<tr>
<td>Sharp &amp; Reilley (41)</td>
<td>N = 65 M; age = 18-23</td>
<td>IIA</td>
<td>Fr = 2x/wk; I = NR; Ty = aerobic conditioning; Ti = 45 min</td>
<td>12 min run VO$_2$max Personality, depression (Minnesota Multi-Phasic Personality Inventory); fitness (-) corr w/depr.; change in fitness corr w/change on MMPI</td>
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<td>Depression; some components of personality Can't determine</td>
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<tr>
<td>Brown &amp; Lawton</td>
<td>$N = 220$ F; age $M = 14$ (range = 11-17); white, upper-middle class</td>
<td>IIB</td>
<td>N/A</td>
<td>N/A</td>
<td>Self-report type, intensity, duration</td>
<td>Stress (schedule of recent life events); health (seriousness of illness rating scale); depression (Multiple Affect Adjective Checklist); vigorous PA corr. w/less depr; infrequent PA corr w/more vulnerability to stress &amp; illness</td>
<td>Depression, anxiety</td>
<td></td>
<td>Can’t determine</td>
</tr>
<tr>
<td>Dyer &amp; Crouch</td>
<td>$N = 59$ (46% F); age = 18-24</td>
<td>IIB corr</td>
<td>N/A</td>
<td>N/A</td>
<td>Self-report running</td>
<td>Mood: depression, anger, confusion, fatigue, tension; runners more (+) mood than nonrunners; no diff for frequent/advanced vs. novice runners</td>
<td>Depression, anxiety</td>
<td></td>
<td>No. mi/wk did not differentiate mood outcome</td>
</tr>
<tr>
<td>Study</td>
<td>Sample Size</td>
<td>Gender</td>
<td>Age (Mean, Range)</td>
<td>Occupation</td>
<td>Self-report of Stress</td>
<td>Illness rating (mean, SD)</td>
<td>Depression, predicted stress</td>
<td>Dropouts</td>
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<tr>
<td>Norris et al. (18)</td>
<td>147</td>
<td>52% F</td>
<td>14 (13-17)</td>
<td>Working class to affluent</td>
<td>Self-report of ex. habits in organized sports &amp; others (mean, SD N/A)</td>
<td>Stress (life events); illness (seriousness of illness rating scale); mood (Multiple Affect Adjective Check List); neg low corr betw stress &amp; PA (-.23)</td>
<td>Can’t determine</td>
<td></td>
<td></td>
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<tr>
<td>Brown et al. (27)</td>
<td>27</td>
<td>41% F</td>
<td>16.5</td>
<td>Working class to affluent</td>
<td>Depression (Beck Depression Inventory), mood (Profile of Mood States); self-efficacy (self-efficacy questionnaire); no diff at post or 4 wk FU; some changes noted at midpoint</td>
<td>Can’t determine</td>
<td></td>
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</table>

**High-risk population**

- Aerobics & regular PE: Fr = 3x/wk, 9 wk; I = NR; Ty = running/aerobics; Ti = NR
- One mile run time, resting HR, recovery HR, BMI
- Psychological Variables — 413

(continued)
Table 1 (continued)

<table>
<thead>
<tr>
<th>Citation</th>
<th>Subjects</th>
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</thead>
<tbody>
<tr>
<td>Hilyer et al. (8)</td>
<td>N = 60 M</td>
<td>I</td>
<td>Fr = 3x/wk, 20 wk; I = NR; Ty = flexibility, static flexibility, wt training, running; Ti = 1.5 hr (last 15 min spent w/ counselor to set goals and increase motivation)</td>
<td>Regular physical education programs (team sports)</td>
<td>Skinfold, wt bench press, sit &amp; reach, no. sit-ups, chinups, resting HR, run time</td>
<td>Self-esteem (self-est inventory form A); mood (Profile of Mood States); anx (State-Trait Anx Inventory for Children); depr (Beck Depr Inventory); sig (+) changes in almost all measures of 4 (f) compared to control</td>
<td>Depression (BDI only), anxiety, self-esteem (multi-component measure)</td>
<td>Can't determine</td>
<td>Effects of activity without 15 min counseling session at end of each bout unknown</td>
</tr>
<tr>
<td>MacMahon &amp; Gross (28)</td>
<td>N = 98 M; age M = 16.3 (range = 14-18); 6% African-American; 42% Latino, 1% Asian, 51% white; juvenile delinquent incarcerated</td>
<td>I</td>
<td>Fr = 3x/wk, 12 wk; I = 160 HR; Ty = running, vig basketball; Ti = 40 min</td>
<td>Less vigorous PE program: Fr = 3x/wk, 12 wk; I = 120 HR; Ty = foul shot contest, volleyball, wrestling; Ti = 40 min</td>
<td>Submaximal cycle ergometer (workload of 170)</td>
<td>Self-concept (Piers-Harris Children’s Self-Concept Scale); depr. (BDI); no diff betw completers &amp; those who dropped; greater increase in mood &amp; fitness by aerobic</td>
<td>Depression, self-concept</td>
<td>Can’t determine</td>
<td>30% dropped out</td>
</tr>
</tbody>
</table>
MacMahon & Gross (19)

$N = 54$ M; age $M = 9.7$ (range = 7.1-12.75); middle class; ave. or above ave., intelligence, learning disabled

I randomized controlled pre, posttest

Fr = 5 d/wk, 20 wk; I = HR > 160 bpm; Ty = distance running, aerobic dance, soccer; Ti = 25 min

Fr = 5 d/wk, 20 wk; I = HR < 150 bpm without sustained elevation in HR; Ty = slow relay races, dodge ball, volleyball; Ti = 25 min

Random sample were monitored for HR to verify intensity level; fitness: submaximal testing using cycle ergometer (load raised HR to 170)

Self-concept (Piers-Harris Children's Self-Concept Scale) validated this sample, read aloud (74->80 percentile vs. 67->68); acad. achieve (Wide Range Achieve Test); motor prof. (Buininks-Oseretsky Test of motor prof.); body comp

Watters & Watters (43)

$N = 5$ autistic M; age = 9-11

I counter-balanced conditions; subject as own control

Fr = 11 tot. sessions; I = NR; Ty = jogging; Ti = 8-10 min

TV watching; homework academic condition

Observation

Self-stimulatory behaviors (e.g., rocking, hand flapping, mouthing) were reduced ($M = 32.7\%$) after the physical exercise condition vs. the academic and TV conditions

Self-stimulatory behavior

Can't determine

Unwanted behaviors reduced

Note. NR = not reported. F = female; M = male. Fr = frequency; I = intensity; Ty = type; Ti = time. Tx = treatment. For design, I = controlled trial; IIA = prospective observational study; IIB = cross-sectional observational study.
apparently healthy adolescents, we identified seven studies that used an experimental or quasi-experimental design, five that used a prospective observational design, and three that used a cross-sectional observational design. Studies of adolescents at risk included two of incarcerated youths, one study of psychiatric inpatients, one of learning disabled individuals, and one of autistic participants. All studies of populations at risk used a Level I research design.

We have the most confidence drawing conclusions from experimental studies, which represent over half of the studies reviewed. Most of these studies compared a fitness training program to a no-activity or low-activity group. The Level II studies generally measured change in a psychological variable of interest before and after acute or programmatic activity, or they correlated psychological and activity variables cross-sectionally.

We calculated effect sizes for all Level I studies where experimental and control group means and standard deviations were provided. Effect size was calculated by subtracting the control group mean from the experimental group mean and dividing the difference by the pooled estimate of the standard deviation (6, 7). Effect sizes were calculated separately for outcome variables of interest. Of the seven Level I studies of apparently healthy adolescents, effect sizes were calculated for two studies. Of the five Level I studies of at-risk adolescents, effect sizes were calculated for three studies. The effect sizes for each type of outcome variable are shown in Figure 1. While these effect sizes are calculated using a small number of studies and should be interpreted with caution, they demonstrate a moderate and positive relationship between physical activity and various psychological outcomes. For each example, participation in physical activity is associated with increases in self-esteem and decreases in stress/anxiety and depression.

**Psychological Impact of Physical Activity**

Generally, the studies report moderate evidence that physical activity is psychologically beneficial for youth. The most consistent effect was for self-esteem/

![Figure 1](image-url)  
**Figure 1** — Average effect size in reviewed studies of psychological variables.
self-concept and anxiety/stress variables. Eight of the 11 studies addressing anxiety/stress variables found a positive relationship or experimental effect of activity such that physical activity was associated with reductions in anxiety and stress. For example, flexibility training reduced anxiety in an ethnically diverse group of adolescent boys (8). Similarly, runners were found to have low anxiety (9). Perceived stress was lower among participants of a vigorous activity program compared to those of a moderate activity program. In a recent review of primarily adult data, Petruzzello et al. (10) found that only aerobic physical activity produced reductions in anxiety and that the effects were generally independent of subject characteristics.

Nine of the 10 studies addressing self-esteem, self-concept, or self-efficacy also found a positive relationship or experimental effect. Self-esteem and self-concept have been studied as important predictors of many types of human behavior, ranging from academic performance to antisocial activities, and these variables may mediate other psychological states. Physical activity can contribute to improvements in self-concept and self-esteem (11, 12, 13). In fact, self-concept has been described as the variable with the “highest payoff” in physical activity and personality research (14).

Two important reviews (12, 13) describe and evaluate the literature related to self-esteem and physical activity. In studies with children typically younger than the age range for this review, Gruber (12) evaluated the relationship between physical activity and self-esteem in 84 articles. Using meta-analytic techniques, Gruber concluded that handicapped children (e.g., emotionally disturbed, trainable mentally retarded, economically disadvantaged, educable mentally retarded) experience large improvements in their self-concepts as a result of physical activity. Typically, handicapped children begin enrichment programs with lower self-concepts than do nonhandicapped children. While nonhandicapped children show improvements in self-concept as a result of physical activity, handicapped children show the greatest improvement in self-concept. Additionally, Gruber concluded that participants in physical fitness and aerobic activities show greater improvements in self-esteem than do participants in programs of creative movement (e.g., dance, mime) or sports skills (e.g., gymnastics, soccer).

Sonstroem (13) documented the scientific limitations in 16 studies of exercise and self-esteem, including adolescent and adult participants. Because the results were consistently positive, in spite of experimental shortcomings, Sonstroem concluded that participants in exercise programs report significant increases in self-esteem scores.

In the 11–21 age group, physical activity can play a unique role in self-esteem enhancement. Mastery experiences and successes with physical activity can be meaningful in improving self-esteem, particularly during the developmental stage of adolescence. Moreover, the duration and type (e.g., aerobic vs. nonaerobic) of physical activity may be an important factor in enhancing self-esteem. More research is needed in this area.

Of studies addressing depressed mood, 9 of 11 studies found a positive relationship or experimental effect. Exercise has an antidepressant effect for mild to moderate forms of depression in adults (15). In a meta-analysis of adults and children, North et al. (16) found exercise to be a better antidepressant than relaxation and other enjoyable activities, and exercise was most effective when combined with psychotherapy. North et al. (16) also found that subjects requiring
medical or psychological care demonstrated the largest decreases in depression. This finding is consistent with Gruber's (12) assertion that those with lower levels of initial functioning benefit more from physical activity and may reflect regression to the mean.

Very little evidence was available for hostility/anger and physical activity. The available evidence was inconsistent. One study found a significant decrease in hostility/anger (17), and another study found no significant difference between experimental and control groups (18). A cross-sectional study found no relationship (14). Evidence regarding academic achievement was also sparse. One study found no significant effects on academic performance (19), while another study found that a one-hour increase in physical activity per day improved math performance of grade-school children (20). In a review, Kirkendall (21) asserted that there is no conclusive evidence regarding the effects of exercise on intellectual development or performance especially in our age group.

**Negative Effects of Physical Activity**

Notably, no studies reported negative effects of activity. In fact, all changes that were not statistically significant were in the direction expected (i.e., improvements). Still, potential negative outcomes of physical activity may include exercise abuse, eating disorders, overtraining, and staleness (i.e., competitive athletes who overtrain suffer mood disturbances such as depression) (22, 23). In adolescents, extreme levels of physical activity can be related to other problems. During primary care visits, it is appropriate to question adolescents who are extremely physically active about possible eating disorders and stress induced by excessive competitive drives. However, a causal relationship between activity and eating disorders is not well documented (24, 25). The potential for negative effects of physical activity merits further study. The available literature suggests that physical activity creates no psychological harm in adolescents.

**Type/Dose of Activity**

Little is known about the amount of activity most likely to produce psychological benefits. Few studies experimentally controlled for intensity or dose of activity. One study examined the effect of moderate- versus high-intensity activity, and demonstrated that anxiety and stress were lower for the high-intensity group compared to that of the moderate-intensity group at posttesting (18). Other studies compared high- versus moderate-intensity activity groups or aerobic versus flexibility activity groups and found greater improvement on psychological variables for the more aerobic or active conditions. Regarding duration and frequency of activity, Dyer and Crouch (9) found that moderate levels of running (7 miles per week for 5 months) were associated with positive mood to the same extent as more advanced levels of running (56 miles per week for > 5 years). The average duration in studies that found significant effects was 106 min per week (60–125 min per week). The average duration of intervention in studies which found significant effects was 12.8 weeks (1–20 weeks).

Only one study examined the effects of a strength-training program (26). While this study has methodological flaws, there was a general trend for participants in the strength-training program to show greater improvements in total self-efficacy, perceived physical ability, self-presentation, and perceived effectiveness
than either the mild cardiovascular training condition or no-activity condition. Since there are very little data that assess dose–response relationships in intensity of training, duration, or frequency, it is inappropriate to draw firm conclusions about dose, given the current state of the literature.

**High-Risk Populations**

The adult literature supports the use of physical activity as an adjunctive treatment for clinical and subclinical psychological disorders, including depression (16) and anxiety (10). The available data for adolescent populations is insufficient to draw the same conclusions. One study of male and female psychiatric inpatients showed moderate changes in mood as a result of physical activity (27). However, the researchers did not report other psychological interventions that may have been taking place during their hospitalization. Also, the gender effects reported in this study (i.e., girls showed more improvement in depression than boys) may have been mediated by psychiatric diagnosis, in which more girls than boys were diagnosed as dysthymic at baseline.

The two other high-risk studies examined the effect of activity on institutionalized youth offenders (8, 28) and showed a general positive effect on mood and self-esteem. Clearly, these three studies are not representative of the most frequent types of psychological dysfunction seen in the adolescent population. Risk for suicide, substance abuse, and eating disorders are also appropriate targets for potential intervention at either the clinical or subclinical level. The efficacy of physical activity may depend on the psychological condition. More research is needed on physical activity as an adjunct treatment for specific disorders in adolescence.

**Limitations**

There are several methodological problems with the data reviewed. First, the number of controlled trials in this area is limited. Second, many of the conclusions in the studies were based on a small number of subjects. Attrition was very high in some studies, potentially skewing the results. Third, these studies targeted different psychological variables measured in different ways. It is particularly important for studies to use age-appropriate measures that have been developed and validated for an adolescent population. Fourth, assessing physical activity has unique challenges. Observation is the preferred and most reliable method, but is unrealistic for large groups. Self-report is more easily administered, but may not be accurate. Mechanical devices provide better data than self-report, but may not accurately measure all types of activity. It is important that the measurement of physical activity be well documented and validated.

Most of the studies were conducted with white, middle- or upper-middle-class, urban subjects, making generalizations to other ethnic and socioeconomic groups difficult. Additional research is needed using more subjects, a randomized controlled design, and diverse subject populations, particularly with respect to ethnicity, gender, and socioeconomic status. We recognize that physical activity, as well as psychological states, play different roles in different cultural settings. For this reason, it is often difficult to generalize these results across different ethnic and cultural populations.
<table>
<thead>
<tr>
<th>No. studies</th>
<th>Level of quality</th>
<th>Depression</th>
<th>Anxiety/stress</th>
<th>Self-esteem/concept</th>
<th>Hostility/anger</th>
<th>Amount of dose response data</th>
<th>Basis for recommendations</th>
<th>Recommendations</th>
</tr>
</thead>
<tbody>
<tr>
<td>General adolescent population</td>
<td>5-10</td>
<td>I</td>
<td>↑</td>
<td>↑</td>
<td>↑</td>
<td>→</td>
<td>Some</td>
<td>65% adolescent data, Fr = 3x/wk; I = mod/vig 70% MHR;</td>
</tr>
<tr>
<td>&lt; 5</td>
<td>IIA</td>
<td>↑</td>
<td>↑</td>
<td>↑</td>
<td>N/A</td>
<td>→</td>
<td>None</td>
<td>15% adult data, 10% child data, 10% expert opinion</td>
</tr>
<tr>
<td>&lt; 5</td>
<td>IIB</td>
<td>↑</td>
<td>↑</td>
<td>N/A</td>
<td>→</td>
<td>None</td>
<td>Ty = aerobic; Ti = 60 min/wk (total)</td>
<td></td>
</tr>
<tr>
<td>High-risk adolescent population</td>
<td>5-10</td>
<td>I</td>
<td>↑</td>
<td>→</td>
<td>↑</td>
<td>N/A</td>
<td>Some</td>
<td>None</td>
</tr>
</tbody>
</table>

*Note. I = a controlled trial; IIA = a prospective observational study; IIB = cross-sectional observational study. → = no apparent evidence of beneficial trend of PA related to outcome; ↑ = some apparent evidence of beneficial trend of PA related to outcome. Fr = frequency; I = intensity; Ty = type; Ti = time.*
Recommendations

Generally, it is difficult to make specific recommendations regarding physical activity for psychological benefits among adolescents. There are few studies, and the quality of the data are poor in some studies. However, despite the methodological flaws of the research, the overall trend suggests physical activity can be psychologically beneficial for adolescents. Further, there is no evidence that activity causes psychological harm. We recommend that adolescents participate in regular physical activity as specified in Table 2. A good behavioral goal is for adolescents to develop the skills necessary to continue being active throughout their adult years.

Future research should consider the role of the social/psychological context in which the activity occurs. For example, Scanlan and Passer (29) found that soccer players had different psychological responses to presumably the same amount of activity, depending on whether they won or lost a soccer game. Other potential mediating experiences during activity include competition, self-appraisal, expectations about how others appraise one’s performance, individual versus group activities, and social support. According to Sage (30), developmental scientists agree that play (activity) is important for social development. However, the popular notion that participation in sports builds character provides an interesting cultural context for further exploration.

Rowland (31) reports four potential mediating factors for the effect of physical activity on mental health, including (a) "time out" theory, in which attention is diverted away from stressors; (b) self-significance, in which participation in activity fosters feelings of mastery and competence; (c) control, in which activity is experienced as concrete, and improvements can be clearly seen and achieved; and (d) biochemical changes, in which activity causes chemical changes known to improve mood. The reader is referred to other articles for more thorough discussions of potential mediating factors (10, 11, 15, 32).

In conclusion, the data suggest that physical activity is psychologically beneficial for adolescents. More research is needed to better understand this relationship. The World Health Organization defines health as the comprehensive state of physical, psychological, and social well-being, not merely absence of disease (33). Psychological benefits of activity are as important as physical benefits because psychological well-being contributes to overall health. Learning more about the psychological benefits of physical activity will enable us to better understand the concept of a healthy mind in a healthy body.

References


