

Exercise involvement and trait-anxiety are determinants of physical self-concept: exercisers exhibit superior profiles compared with non-exercisers

LÁSZLÓ TÓTH¹, DÁNIEL LÓKÖS², KORNÉL SIPOS³, FERENC KÖTELES⁴, ATTILA SZABO⁵
^{1,3}Department of Psychology and Sport Psychology, University of Physical Education, Budapest, HUNGARY

²Department of Physical Education, Budapest Business School, University of Applied Sciences, Budapest, HUNGARY

^{4,5}Institute of Health Promotion and Sport Sciences, ELTE Eötvös Loránd University, Budapest, HUNGARY

Published online: March 31, 2019

(Accepted for publication February 22, 2019)

DOI:10.7752/jpes.2019.01085

Abstract:

Physical self-concept represents an important determinant of healthy psychological functioning. It is influenced by several factors, including physical activity, body competence, and chronic anxiety. In this study 391 women and men were subjected to aerobic (Cooper test) and anaerobic (sit-ups) performance tests and completed questionnaires assessing their physical self-concept, trait anxiety, and exercise status (i.e. exercising regularly or not). A hierarchical multiple regression analysis revealed that gender, exercise status, fitness, and trait-anxiety accounted for 41% of the variance in the physical self-concept ($p < .001$). Further, exercisers differed in both aerobic and anaerobic performance measures, and physical self-concept ($p < .001$) from the non-exercisers. Mediation analysis indicated that the performance indices had negligible impact on the relationship between exercise status and physical self-concept. Our results imply that mere involvement in regular exercise has positive effect on physical self-concept that is virtually unaffected by one's physical performance.

Key words: anxiety, Cooper test, exercise, fitness, self-esteem.

Introduction

As self-esteem represents the evaluative aspect of self-concept, it is heavily influenced by emotional biases (Lorr & Wunderlich, 1988; Rosenberg, 1962). The most important trait-like factors are negative affect (a term used for describing a predisposition to experiencing aversive mood states (Watson & Clark, 1984), and, more specifically, anxiety (Lorr & Wunderlich, 1988; Rosenberg, 1962; Sowislo & Orth, 2013; Watson & Clark, 1984). Based on a literature review, the results of cross-sectional studies yielded a weak link between regular physical activity and anxiety indices, while the quasi-experimental studies showed a strong association between these variables (Strong et al., 2005). Further, cross-sectional research results also revealed a moderately positive correlation between physical activity and physical self-concept (Strong et al., 2005). Therefore, purposeful physical activity, or habitual exercise appears to be associated with both reduced anxiety and elevated physical self-concept. This triadic relationship, through which the doubly positive effects of exercise could be demonstrated was not tested to date.

Physical activity performance and competence represent an important source of self-esteem (Fox, Biddle, & Boutcher, 2000; Lox, Martin Ginis, & Petruzello, 2010; Scully, Kremer, Meade, Graham, & Dudgeon, 1998; Sonstroem, 1997). The latter is mediated primarily by one's body image and body competence (Haugen, Säfvenbom, & Ommundsen, 2011; Scully et al., 1998). According to Sonstroem and Morgan's (1989) model, the major components behind the latter association are physical competence, self-efficacy, and *acceptance* of one's physical competence. As all three components are *perceived*, they have an objective (actual physical performance) and a subjective (i.e. evaluative) component (Köteles, Kollsete, & Kollsete, 2016; Lox et al., 2010). An unanswered question is that which objective domains of the physical performance (e.g. strength, endurance, or both) have an impact on subjective physical self-concept (i.e., body-related self-esteem)?

It appears that regardless of the type and intensity of exercise, mere participation in physical activity improves physical self-concept. For example, in a 60-minute once a week mixed-exercise intervention study that lasted for six-month, Alfermann and Stoll (2000) found increased physical self-concept, but no change in trait-anxiety scores in 24 middle aged male and female participants. The authors repeated the same study with the inclusion of a relaxation and a back-strengthening control groups while the frequency of exercise was increased from one session to two 60-minute sessions per week. Further, an aerobic exercise group was also formed in addition to the mixed exercise in their first study. To the surprise of the authors, all groups exhibited improvements in physical self-concept. Considering, the wide-range in exercise intensities used in the

intervention and control groups, these findings suggest that mere *participation* in exercise improves self-concept giving rise to the hypothesis that exercisers (regardless of type, frequency and intensity) may possess higher physical self-concept than non-exercisers. A later study delivered a shorter (10-week) exercise intervention programme, consisting of one aerobics class and two step-dance classes every week, to 20 female university students with the inclusion of a matched *inactive* control group in which the participants were told not to undertake any structured physical activity (Aşçi, 2003). The physically active group exhibited increased scores on measures of physical self-concept and showed decreased trait-anxiety, in contrast to the control group, after the intervention. Thus, the results of this work suggest that some sort of exercise activity, even if that only requires minimal effort like in Alfermann and Stoll's (2000) control groups, may be necessary to see changes in physical self-concept. As such, the actual difference between *doing* or *not doing* the activity could make a difference in one's perceived physical self-concept.

This theorem was tested in a large sample of 12th grade girls with depressive symptoms (Dishman et al., 2006). The results indicated that physical activity and sport participation were positively associated with physical self-concept that was independent of participants' cardiovascular (aerobic) fitness level. Accordingly, the link between participation and physical self-concept may be relatively independent of both, type of exercise activity and fitness level. However, perhaps independent of sport or exercise participation, gender differences in physical self-concept also exists between men and women in the favour of the former (Aşçi, 2002; Klomsten, Skaalvik, & Espnes, 2004). Further, anxiety, which is reversely linked to regular exercise in both cross-sectional and quasi-experimental research (Strong et al., 2005), is usually higher in women than in men (McLean & Anderson, 2009; Nakazato & Shimonaka, 1989). Therefore, since exercise participation is associated with lower trait-anxiety (Aşçi, 2003; Fox, 1999) and higher physical self-concept (Alfermann & Stoll, 2000; Aşçi, 2003), the relationship between these variables in the context of one's exercise status merits scholastic attention. Trait-anxiety may be reversely linked to physical self-concept, but *objective* fitness measures, or the actual physical competence as based on Sonstroem and Morgan's (1989) model, may mediate this relationship. The aims of the current work, therefore, were to test this relationship while controlling for the effects of objective performance indices and to see whether mere participation is associated with lower trait-anxiety and higher physical self-esteem in exercisers versus non-exercisers.

Hypotheses

The hypotheses of the current study were as follows: We expected that individuals who exercise regularly would show higher levels of (1) aerobic and (2) anaerobic performance, and (3) self-concept, and (4) lower levels of trait anxiety. We also presumed that self-concept will be related to both (5) aerobic and (6) anaerobic performance, and (7) trait anxiety (in a reverse relationship). Finally, (8) we hypothesized that the association between physical self-concept and exercise status, at least in part, will be mediated by the objective measures of aerobic and anaerobic performance.

Method

Participants

Individuals taking physical education courses at a large urban university were solicited to take part in the study. Whether they exercised or not before the course did not matter, but based on their responses to a demographic question, participants were grouped into exercising and non-exercising categories. Elite athletes and those with some medical conditions (being not healthy) were excluded from the study. A total of 391 participants (men: $n = 149$, $M_{age} = 21.38$, $SD = 1.85$ and women: $n = 242$, $M_{age} = 21.00$, $SD = 1.46$) have consented in writing to take part in the study. The sample size was determined *a priori* using the G* Power v. 3.1.9.2 software (Faul, Erdfelder, Lang, & Buchner, 2007) to ascertain that the number of participants met the minimum required sample size for all pre-planned statistical analyses (i.e., > 130). The research was conducted in accord with the Helsinki Declaration (World Medical Association, 2008).

Materials

The 20-item Spielberger Trait-anxiety Inventory (STAI-T FX-2; Spielberger, Gorsuch, & Lushene, 1970) was employed to assess the general/trait level of anxiety on a 4-point Likert scale. Higher scores reflect higher levels of trait anxiety. The internal consistency of the questionnaire (Cronbach α) in the present research was .88.

The Physical Self-concept sub-scale of the Tennessee Self-concept Scale (TSCS; Fitts, 1965) was adopted to measure body-related aspects of self-esteem (i.e. satisfaction with the appearance of the body, perceived strength and vitality, etc.). This instrument contains 18 items which are rated on a 5-point Likert-scale. Higher total scores reflect a more positive self-evaluation. The internal consistency of the scale was $\alpha = .90$ in the current study.

Procedure

After giving written consent for taking part in the study, participants answered three demographic questions (age, gender, exercise status) and then completed the STAI and the TSCS. Subsequently, they performed the 12-minute Cooper test (Cooper, 1968) to determine their aerobic performance. In this test the

participants should try to cover as much distance as they can in 12 minutes. The Cooper test results can be employed for estimating aerobic fitness (Cooper, 1968). On another occasion, participants completed the Army sit-ups test (Department of the Army, 1992) for determining their anaerobic abdominal muscle strength and endurance. This test consists of sit-ups the number of which are recorded at exhaustive fatigue or maximum time of three minutes.

Statistical analysis

Statistical calculations were performed with the Statistical Package for Social Sciences (SPSS v. 25). Correlation analyses were followed by a hierarchical multiple regression (fully described in the Results section). Multivariate analysis of variance (MANOVA) was used to determine the possible differences between exercisers and non-exercisers on physical and psychological measures. Descriptive statistics are presented in context of this analysis in Table 2. The mediating effects of aerobic (Cooper) and anaerobic (sit-ups) performances were estimated with the INDIRECT method (an SPSS extension; Preacher & Hayes, 2008).

Results

Initial correlation analyses indicated that physical self-concept correlated significantly with the exercise status (Hypothesis 3 [H3]; $r = .293$, $r^2 = 0.086$, $p < .01$), trait-anxiety (H7; $r = -.555$, $r^2 = 0.308$, $p < .01$), Cooper test (H5; $r = .311$, $r^2 = 0.097$, $p < .01$), and number of sit-ups (H6; $r = .201$, $r^2 = 0.040$, $p < .01$). Next, a hierarchical linear multiple regression, using the enter method, was calculated to examine whether exercise status, gender, Cooper test results, number of sit-ups, and trait-anxiety could predict the physical self-concept. The test yielded a statistically significant regression equation ($F [5, 390] = 55.59$, $p < .001$, $R = .65$, $R^2 = .419$, $R^2_{adjusted} = .412$). The test of the standardized residuals confirmed that the data contained no outliers (i.e., Std. Residual Min = -2.87, and Std. Residual Max = 2.48). Further tests were performed to determine if the data met the assumption of collinearity. The results of these tests demonstrated that multicollinearity was not a concern in the data (exercise status, $tolerance = .91$, Variance Inflation Factor (VIF) = 1.11; trait-anxiety, $tolerance = .96$, $VIF = 1.05$; Cooper test, $tolerance = .85$, $VIF = 1.18$; sit-ups, $tolerance = .96$, $VIF = 1.05$; gender, $tolerance = .89$, $VIF = 1.13$). The data also met the assumption of independent errors (Durbin-Watson = 2.01) and the assumption of non-zero variances ($s^2 > 0.00$). In predicting physical self-concept scores, all the five predictors (H3, H5-7) contributed statistically significantly to the model (Table 1).

Table 1. Model Coefficients

Model	Unstandardized Coefficients		Standardized Coefficients		Significance (p)	95% Confidence interval for β	
	β	Standard error	Beta	t		Lower bound	Upper bound
Constant	70.981	3.198		22.198	<.001	64.69	77.27
Exercise status	4.163	.832	.204	5.005	<.001	2.528	5.798
Trait anxiety	-.580	.045	-.508	-12.797	<.001	-.669	-.491
Cooper test results	.192	.039	.205	4.876	<.001	.114	.269
Number of sit-ups	.021	.009	.092	2.325	=.021	.003	.040
Gender	2.617	.859	.126	3.048	=.002	.929	4.305

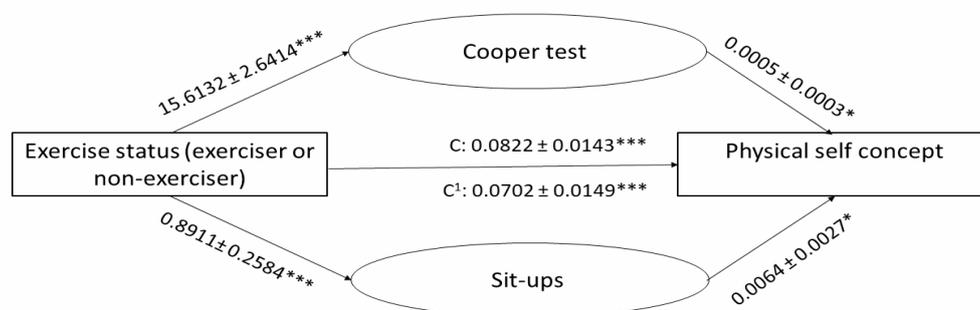


Figure 1. Results of the mediation analysis (regression coefficients \pm standard errors). The analysis was controlled for gender and trait anxiety. C: Direct association; C': Association after the inclusion of the two mediating variables.

Mediation

For the INDIRECT test, a normal distribution is not necessary and binary variables can be included (Preacher & Hayes, 2008). The present mediation analysis was controlled for gender and trait anxiety. Its results indicated a very weak, almost negligible, partial mediation effect (i.e., 95% bias corrected confidence intervals were - 0.0001 and 0.0195 for aerobic performance and 0.0008 and 0.0147 for anaerobic performance). In other words, the inclusion of aerobic (Cooper test) and anaerobic (sit-ups) performance did not substantially weaken the association between exercise status and the physical self-concept (H8) (Figure 1).

Between Groups Differences

A 2 (group: exercisers, non-exercisers) by 2 (gender) MANOVA with four dependent measures (trait-anxiety, Coopers test results, sit-ups, and physical self-concept) resulted in a statistically significant multivariate main effect for exercise status (Pillai's trace = .119, $F[4, 384] = 12.954$, $p < .001$, partial ETA squared [η^2] = .119) and for gender (Pillai's trace = .105, $F[4, 384] = 11.295$, $p < .001$, $\eta^2 = .105$), but no exercise status by gender interaction has emerged. The univariate tests revealed that exercisers scored significantly higher on both aerobic (H1) and anaerobic (H2) tests, as well as on physical self-concept (H3) ($p < .001$), while no significant differences in trait anxiety (H4) were found. Moreover, women scored higher on trait-anxiety ($p = .029$) and lower on the Cooper test ($p < .001$) than men, although no a priori hypothesis was formulated for gender differences. The means and standard deviations, along with the summary of the univariate results, are illustrated in Table 2.

Table 2. Means and standard deviations of four dependent measures in exercises and non-exercisers as well as in men and women. Under the descriptive statistics F , p values, and effect sizes (partial ETA squared; η^2) are also shown for group differences. NS = Not Significant.

Groups	Physical self-concept	Cooper test (km)	Sit-ups (total)	Trait-anxiety
Exercisers (n = 171)	67.83 (9.46)	2.12 (0.56)	75.51 (39.30)	41.42 (8.65)
Non-exercisers (n = 220)	61.85 (9.85)	1.89 (0.38)	59.46 (45.62)	43.01 (8.99)
F	33.43	13.20	19.7	0.92
p	< .001	< .001	< .001	NS
Effect size η^2	.080	.033	.032	-
Men (n = 149)	65.02 (10.30)	2.19 (0.50)	68.25 (38.78)	40.87 (8.85)
Women (n = 242)	64.13 (10.01)	1.87 (0.43)	65.39 (46.44)	43.20 (8.78)
F	0.46	32.91	0.00	4.83
p	NS	< .001	NS	= .029
Effect size η^2	-	.078	-	.012

Discussion

As predicted, physical self-concept was positively associated with exercise status and both aerobic and anaerobic exercise performance, while being inversely related to trait anxiety. Despite the statistically significant results, the positive correlations, based on the coefficients of determination (r^2), showed that separately the variables shared less than 10% of the variance with physical self-concept, the exception being trait-anxiety that shared slightly over 30% of the variance with this variable. However, jointly, with gender added as another predictor, these variables accounted for a large proportion of the variance (41%) in physical self-concept. Nevertheless, while indicators of objective physical performance (both aerobic and anaerobic) were associated with physical self-concept, their contribution was almost negligible in the mediation of the relationship between exercise status and physical self-concept.

These findings match those reported by Dishman and colleagues (2006) who found that physical activity and sport participation was positively related to physical self-concept but it was independent of participants' fitness level. One explanation for these findings is that the subjective (evaluative) component has a dominant impact on physical self-concept as compared to objective (actual) performance. For example, it may be the result of a linear expectancy effect through subjective association between doing something for which a reward, or a positive outcome, may be anticipated (Szabo, 2013). In that case, the mode and characteristics of the action become unimportant, so just *by doing it* a subjective result may be experienced (Szabo, 2013). Another explanation is that the subjective evaluation of actual performance changes over time; higher levels of performance increase the person's standards thus subjective evaluation remains relatively constant (Köteles et al., 2016). There is at least one intervention study that found that increase in physical self-concept was linked to an increase in physical fitness (Schneider, Dunton, & Cooper, 2008). While physical self-concept improved in other intervention studies too (i.e., Alfermann & Stoll, 2000; Aşçı, 2003), the mediatory role of fitness was not demonstrated in previous works.

The results of the current work also agree with the intervention studies, showing that short (i.e., 10-weeks) or longer duration (i.e. six month) exercise intervention, *of different modalities*, alter physical self-

concept (Alfermann & Stoll, 2000; Aşçı, 2003). Although 10 weeks is not a long period, instant situational (or acute) changes in self-concept were reported more than half a century ago (Morse & Gergen, 1970). While, speculative, it may not be impossible that directed attentional focus (generated by the demographic question) to self-reported exercise status contaminates the responses to questionnaire items measuring physical self-concept via the Pygmalion, or Rosenthal effect (Rosenthal, 2002). This phenomenon is more plausible in cross-sectional studies, while action and invested effort may generate expectancy that mediates the outcome in intervention studies (Szabo, 2013). In both cases inflated ratings of the physical self-concept may be caused by information-based anticipation or actual action (exercise-based) expectation. Such an effect, however, is no longer observable when no-action is present, as noted in the control group examined by Aşçı (2003). To control for possible Pygmalion effects, in cross sectional studies the non-contextual testing of physical self-concept is advised *before* linking it to exercise behaviour, to avoid participants making a cognitive connection between the two. The mediating role of aerobic and anaerobic performance could be estimated more precisely in such a design.

Exercisers scored higher than non-exercisers on physical performance tests, which was expected, or else the data would be unreliable. They also scored higher on physical self-concept, but not on trait-anxiety. Therefore, the expected relationship, through which the doubly positive effects of exercise could be demonstrated separately for exercisers and non-exercisers via lower trait-anxiety and higher physical self-concept could not be demonstrated in the current work. This finding is in contrast with the results of Aşçı (2003), but agrees with those reported by Alfermann and Stoll (2000). However, both investigations employed an intervention and one tested young women only while the other tested an older middle-aged sample. Therefore, the results cannot be compared. The noted gender differences in trait-anxiety are not novel finding as they were already reported in the literature (McLean & Anderson, 2009; Nakazato & Shimonaka, 1989). They simply re-confirm the extant knowledge. It should be added, however, the although statistically significant differences emerged between women and men, the effect size was small (refer to Table 2), suggesting that these findings have little theoretical or practical implications and do not warrant a special discussion. In contrast to past research (Aşçı, 2002; Klomsten, Skaalvik, & Espnes, 2004), physical self-concept did not differ between men and women. A high inter-individual variability may be one explanation for these findings. Another explanation may be related to a superior emotional stability and/or high self-esteem of women in the current sample, but this explanation is highly speculative in lack of relevant measures.

Limitations and strength

The current study is not without limitations. Its cross-sectional nature does not permit causal inferences and participants came from a young convenience sample that may not be representative. Not assessing the frequency, intensity, and history of regular exercise is another limitation of the study, because these features of the exercise behaviour could also be predictors or mediators of physical self-concept. One strength of the work is that it took an objective measure of both aerobic and anaerobic performance, thus expanding the findings from an earlier research that only tested cardiovascular fitness (Dishman et al., 2006). While supporting this past work, the current study further expands the results obtained by Dishman et al. by replicating the finding in healthy young men and women and demonstrating that anaerobic performance also does not have a significant impact on the exercise status and physical self-concept relationship.

Main contribution of the work

The subjective claim of participation in a regular physical activity regimen is associated with higher physical self-concept than that reported by those who admit non-exercising on a regular basis. Gender, trait-anxiety, aerobic-, anaerobic performance and exercise status jointly predict a large proportion of the variance (41%) in the reported scores of physical self-concept.

References

- Alfermann, D., & Stoll, O. (2000). Effects of physical exercise on self-concept and well-being. *International Journal of Sport Psychology*, 31(1), 47-65.
- Aşçı, F. H. (2003). The effects of physical fitness training on trait-anxiety and physical self-concept of female university students. *Psychology of Sport and Exercise*, 4(3), 255-264. doi:10.1016/s1469-0292(02)00009-2
- Asci, F. H. (2002). An investigation of age and gender differences in physical self-concept among Turkish late adolescents. *Adolescence*, 37(146), 365-371.
- Cooper, K. H. (1968). A Means of Assessing Maximal Oxygen Intake: correlation between field and treadmill testing. *JAMA*, 203(3), 201-204. doi:10.1001/jama.1968.03140030033008
- Department of the Army (1992). *FM 21-20*. Washington, DC, The Army
- Dishman, R. K., Hales, D. P., Pfeiffer, K. A., Felton, G. A., Saunders, R., Ward, D. S., ... Pate, R. R. (2006). Physical self-concept and self-esteem mediate cross-sectional relations of physical activity and sport participation with depression symptoms among adolescent girls. *Health Psychology*, 25(3), 396-407. doi:10.1037/0278-6133.25.3.396

- Faul, F., Erdfelder, E., Lang, A.-G., & Buchner, A. (2007). G*Power 3: A flexible statistical power analysis program for the social, behavioral, and biomedical sciences. *Behavior Research Methods*, 39(2), 175–191. doi:10.3758/bf03193146
- Fitts, W. H. (1965). *Manual for the Tennessee Self-concept Scale*. Nashville, Tennessee: Counsellor Recordings and Tests.
- Fox, K. R. (1999). The influence of physical activity on mental well-being. *Public Health Nutrition*, 2(3a). doi:10.1017/s1368980099000567
- Fox, K. R., Biddle, S., & Boutcher (Eds.). (2000). *Physical activity and psychological well-being*. London: Routledge.
- Haugen, T., Säfvenbom, R., & Ommundsen, Y. (2011). Physical activity and global self-worth: The role of physical self-esteem indices and gender. *Mental Health and Physical Activity*, 4(2), 49–56. https://doi.org/10.1016/j.mhpa.2011.07.001
- Klomsten, A. T., Skaalvik, E. M., & Espnes, G. A. (2004). Physical Self-Concept and Sports: Do Gender Differences Still Exist? *Sex Roles*, 50(1/2), 119–127. doi:10.1023/b:sers.0000011077.10040.9a
- Köteles, F., Kollsete, M., & Kollsete, H. (2016). Psychological concomitants of CrossFit training: Does more exercise really make your everyday psychological functioning better? *Kinesiology*, 48(1), 39–48.
- Lorr, M., & Wunderlich, R. (1988). Self-esteem and negative affect. *Journal of Clinical Psychology*, 44(1), 36–39.
- Lox, C. L., Martin Ginis, K. A., & Petruzello, S. J. (2010). *The Psychology of Exercise. Integrating Theory and Practice* (3rd edition). Scottsdale, Arizona: Holcomb Hathaway.
- McLean, C. P., & Anderson, E. R. (2009). Brave men and timid women? A review of the gender differences in fear and anxiety. *Clinical Psychology Review*, 29(6), 496–505. doi:10.1016/j.cpr.2009.05.003
- Morse, S., & Gergen, K. J. (1970). Social comparison, self-consistency, and the concept of self. *Journal of Personality and Social Psychology*, 16(1), 148–156. doi:10.1037/h0029862
- Nakazato, K., & Shimonaka, Y. (1989). The Japanese State-Trait-anxiety Inventory: Age and Sex Differences. *Perceptual and Motor Skills*, 69(2), 611–617. doi:10.2466/pms.1989.69.2.611
- Preacher, K. J., & Hayes, A. F. (2008). Asymptotic and resampling strategies for assessing and comparing indirect effects in multiple mediator models. *Behavior Research Methods*, 40(3), 879–891. https://doi.org/10.3758/BRM.40.3.879
- Rosenberg, M. (1962). The association between self-esteem and anxiety. *Journal of Psychiatric Research*, 1, 135–152.
- Rosenthal, R. (2002). The Pygmalion Effect and its Mediating Mechanisms. In Aronson J. (Ed.). *Improving Academic Achievement: Impact of Psychological Factors on Education* (pp. 25–36). New York: Academic Press. doi:10.1016/b978-012064455-1/50005-1
- Schneider, M., Dunton, G. F., & Cooper, D. M. (2008). Physical activity and physical self-concept among sedentary adolescent females: An intervention study. *Psychology of Sport and Exercise*, 9(1), 1–14. doi:10.1016/j.psychsport.2007.01.003
- Scully, D., Kremer, J., Meade, M. M., Graham, R., & Dudgeon, K. (1998). Physical exercise and psychological well being: a critical review. *British Journal of Sports Medicine*, 32(2), 111–120.
- Sonstroem. (1997). Physical activity and self-esteem. In W. P. Morgan (Ed.), *Physical activity and mental health* (pp. 127–144). Bristol: Taylor and Francis.
- Sonstroem, R. J., & Morgan, W. P. (1989). Exercise and self-esteem: rationale and model. *Medicine and Science in Sports and Exercise*, 21(3), 329–337.
- Sowislo, J. F., & Orth, U. (2013). Does low self-esteem predict depression and anxiety? A meta-analysis of longitudinal studies. *Psychological Bulletin*, 139(1), 213–240. https://doi.org/10.1037/a0028931
- Spielberger, C.D. (1972). Anxiety: State-trait-process. In C.D. Spielberger & I.G. Sarason, (Eds.): *Stress and anxiety* (Vol. 1), (pp. 115-143). New York: Wiley.
- Spielberger, C. D., Gorsuch, R. L., & Lushene, R. E. (1970). *Manual for the State-Trait-anxiety Inventory*. Palo Alto, CA: Consulting Psychologists Press.
- Strong, W. B., Malina, R. M., Blimkie, C. J., Daniels, S. R., Dishman, R. K., Gutin, B., ... & Rowland, T. (2005). Evidence based physical activity for school-age youth. *The Journal of Pediatrics*, 146(6), 732-737. doi: 10.1016/j.jpeds.2005.01.055
- Szabo, A. (2013). Acute psychological benefits of exercise: Reconsideration of the placebo effect. *Journal of Mental Health*, 22(5), 449–455. doi:10.3109/09638237.2012.734657
- Watson, D., & Clark, L. A. (1984). Negative affectivity: the disposition to experience aversive emotional states. *Psychological Bulletin*, 96(3), 465–490.
- World Medical Association (2008). *World Medical Association Declaration of Helsinki: Ethical Principles for Medical Research Involving Human Subjects*. Retrieved from <http://www.wma.net/en/30publications/10policies/b3/17c.pdf>