Journal of Sport and Health Research 2016, 8(1):75-92

Barrantes-Brais, K.; Sánchez-Ureña, B.; Ureña-Bonilla, P. (2016). The effect of psychological and exercise interventions on college students' well-being and ill-being: a meta-analysis of randomized controlled trials. *Journal of Sport and Health Research.* 8(1):75-92.

Review

EL EFECTO DE INTERVENCIONES PSICOLÓGICAS Y DE EJERCICIO EN EL BIENESTAR Y MALESTAR DE ESTUDIANTES UNIVERSITARIOS: UN META ANÁLISIS DE ESTUDIOS CONTROLADOS ALEATORIZADOS

THE EFFECT OF PSYCHOLOGICAL AND EXERCISE INTERVENTIONS ON COLLEGE STUDENTS' WELL-BEING AND ILL-BEING: A META-ANALYSIS OF RANDOMIZED CONTROLLED TRIALS

Barrantes-Brais, Kristy[1] ; Sánchez-Ureña, Braulio [1]; Ureña-Bonilla, Pedro [1].

[1]*Universidad Nacional, Costa Rica*

Correspondence to:
Barrantes-Brais. Kristy
Universidad Nacional de Costa Rica
P.O. Box 83-3000 Heredia, Costa Rica
kristy.barrantes.brais@una.cr

Edited by: D.A.A. Scientific Section Martos (Spain)

editor@journalshr.com

Received: 15-3-2015
Accepted: 9-7-2015

Journal of Sport and Health Research 2016, 8(1):75-92

RESUMEN

Propósito: Examinar el efecto de intervenciones experimentales (psicológicas y de ejercicio) en el bienestar y malestar de estudiantes universitarios.

Método: Se revisó la literatura pertinente encontrada mediante los motores de búsqueda PubMed, Ebsco Academic Search Complete, SportDiscus y Science Direct, incluyendo únicamente ensayos controlados y aleatorizados. Dieciséis estudios publicados entre 1987 y 2012 (con un total de 1342 participantes) cumplieron con los criterios de selección.

Resultados: Las intervenciones psicológicas y de ejercicio mostraron efectos positivos globales, sin diferencias significativas entre sí. Los tamaños de efecto respectivamente fueron 0.48; CI al 95% [0.39, 0.56] y 0.57; CI al 95% [0.42, 0.72], con intervalos de confianza que confirman efectos significativos. Los resultados mostraron heterogeneidad, el análisis de variables moderadoras no explicó la variabilidad.

Conclusiones: Las intervenciones psicológicas y de ejercicio impactan de manera similar el bienestar de estudiantes universitarios, encontrándose disminuciones en los indicadores de ansiedad y depresión. Solo las intervenciones psicológicas modifican el afecto negativo. **Implicaciones**: Se recomienda realizar estudios confirmatorios y de rentabilidad, así como investigaciones sobre el efecto combinado de intervenciones psicológicas y de ejercicio.

Palabras clave: (educación superior, salud mental, ansiedad, depresión, afecto negativo, movimiento humano).

ABSTRACT

Objective: To examine the effect of experimental interventions (psychological and exercise-based) on well-being and ill-being related variables in college students.

Methods: A systematic literature search was conducted using PubMed, Ebsco Academic Search Complete, SportDiscus and Science Direct, including only randomized controlled trials (RCT). Sixteen studies published between 1987 and 2012 (totaling 1342 individuals) met the selection criteria.

Results: Both psychological, effect size= 0.48; 95% CI [0.39, 0.56], and exercise interventions, effect size= 0.57; 95% CI [0.42, 0.72] yielded overall positive effects. No differences were found between types of intervention. Results are heterogeneous; moderator analyses did not explain the variability.

Conclusion: Psychological and exercise interventions are similarly effective in impacting higher education students' well-being and ill-being. Decreases in anxiety and depression were found after both types of interventions. Only psychological strategies effectively change negative affect. Confirmatory trials and cost-effectiveness studies in college settings are recommended. Future research on strategies combining exercise and psychological approaches is needed.

Keywords: (higher education, mental health, anxiety, depression, negative affect, human movement).

Journal of Sport and Health Research 2016, 8(1):75-92

INTRODUCTION

The promotion of well-being in college settings has increased over the past few decades, focusing on the potential benefits of different types of interventions such as exercise-based and psychological approaches (Conley, Durlak, & Dickson, 2013; Parks, 2011). Well-being in students is a strong predictor for good physical health (Pettit, Kline, Gencoz, Gencoz, & Joiner Jr, 2001), is positively associated with better adjustment to educational settings (Shoshani & Slone, 2013) and is inversely related to illicit drug use and sexual risk behavior (Schwartz et al., 2011). In general, experiences related with well-being have shown positive associations with overall health measured through functional and physiological markers (Howell, Kern, & Lyubomirsky, 2007; Ryff, Singer, & Dienberg Love, 2004; Steptoe, Dockray, & Wardle, 2009).

Well-being is a complex construct that concerns optimal experience and functioning (Ryan & Deci, 2001), includes a balance of satisfaction with life and positive/negative affect (subjective well-being) (Diener, Suh, Lucas, & Smith, 1999) and notions of meaning, self-actualization, growth and optimal functioning (psychological well-being) (Ryff, 1995). This concept provides a more comprehensive approach to mental health issues, compared to the focus on addressing illness and disorders (M. E. Seligman & Csikszentmihalyi, 2000).

On the other hand, ill-being related conditions such as depression and anxiety would potentially jeopardize students' well-being by limiting their abilities to enjoy positive experiences, to thrive and grow. Numbers of college students diagnosed with depression and anxiety show a steady increase in the last few years (ACHA, 2014). Prevention and treatment of these conditions in college settings become relevant when considering that onset ages tend to coincide with the first years of college life for most students (Cukrowicz & Joiner Jr, 2007).

Even though there are reports on results of specific interventions in college student population, aiming to reduce symptoms of illness or increase well-being indicators (S. Brown & Schiraldi, 2004; Deckro et al., 2002; Hurley & Kwon, 2012; Kanji, White, & Ernst, 2006; Mailey et al., 2010; Sheldon & Lyubomirsky, 2006), there are no meta-analyses that determine and compare the effect of different types of interventions in this particular population.

Previous reviews and meta-analyses have reported effects of psychological and exercise-based treatments on outcomes like anxiety, depression and psychological/subjective well-being. Psychological interventions on anxiety showed low (Duijts, Faber, Oldenburg, van Beurden, & Aaronson, 2011; Goyal et al., 2014), moderate (Hofmann, Sawyer, Witt, & Oh, 2010) and high effects (Cape, Whittington, Buszewicz, Wallace, & Underwood, 2010; Noordik, van der Klink, Klingen, Nieuwenhuijsen, & van Dijk, 2010). Depression symptoms improved after psychological treatments in a variety of settings (Bolier et al., 2013; Cape et al., 2010; Cuijpers, van Straten, & Smit, 2006; Duijts et al., 2011; Goyal et al., 2014; Jakobsen, Hansen, Storebo, Simonsen, & Gluud, 2011; Sin & Lyubomirsky, 2009). Using well-being as the main outcome, a recent meta-analysis found small effect sizes for subjective and psychological well-being (Bolier et al., 2013). Some mechanisms associated with the effectiveness of psychological interventions include de-activation of hypervalent dysfunctional schemas and more reflective mode of thought and behavior, as well as reduced activation of the amygdalohippocampal subcortical regions implicated in the generation of negative emotion and increased activation of higher-order frontal regions involved in cognitive control of negative emotion (Clark & Beck, 2010).

Interventions using different modes of exercise regarded this approach as an effective way to reduce anxiety. Meta-analytic reviews reported low or moderate effects (Conn, 2010; Wegner et al., 2014; Wipfli, Rethorst, & Landers, 2008). Exercise interventions on depression also seem to be effective, meta-analyses indicate small (J. C. Brown et al., 2012; Duijts et al., 2011; Rimer et al., 2012), moderate (Cooney et al., 2013; Wegner et al., 2014) and high effects (Lawlor & Hopker, 2001; Rethorst, Wipfli, & Landers, 2009; Robertson, Robertson, Jepson, & Maxwell, 2012). One meta-analysis reported significant changes in positive affect after exercise interventions (Reed & Buck, 2009). Several hypotheses linking neurobiological, psychological, social and developmental factors to the antidepressive and anxiolytic effects of exercise have been outlined (Daley, 2008; Strohle, 2009).

Journal of Sport and Health Research 2016, 8(1):75-92

Table 1. *Selection criteria*

Component	Criteria
Interventions	Psychological or exercise-based
Outcomes	Psychological well-being or its components Subjective well-being or its components Mental Health Anxiety Depression
Target population	College students
Design/reports	Presence of a control group Randomization (subjects, not groups) Reporting statistics to calculate effect sizes Reporting measures pre and post intervention Published in a peer reviewed journal

Evaluation of different intervention approaches in college students is regarded imperative (Miller & Chung, 2009) in order to broaden current understanding of interventions and provide higher education institutions with valuable information to enhance campus services to optimize student success in psychosocial and academic domains (Conley et al., 2013). Considering the two main approaches used to increase well-being and narrowing down the target population to college students, the purpose of this study was to examine the effect of experimental (psychological and exercise-based) interventions well-being and ill-being related variables in college students.

METHODS

Search strategy

A systematic literature search was carried out in Academic Search Complete, SportDiscus, Science Direct and PubMed. Combination of the following terms (both in English and Spanish) were used to conduct the search: "college students", "intervention", "exercise", "psychological", "therapy", "cognitive", "behavioral", "well-being", "mental health", "positive affect", "negative affect", "mood", "anxiety" and "depression". Searches in reference lists from previous meta-analysis and in Medicine & Science in Sport & Exercise were also conducted. If an article was not available from databases an email was sent to the corresponding author requesting for the full-text.

Selection of Studies

The inclusion criteria are described in Table 1 and the process of selection is outlined in Figure 1. Exercise interventions were included if fulfilled the definition of the American College of Sport Medicine: planned, structured and repetitive bodily movement done to improve or maintain one or more components of physical fitness (ACSM, 2013). Psychological interventions included cognitive, behavioral and psychoeducational strategies.

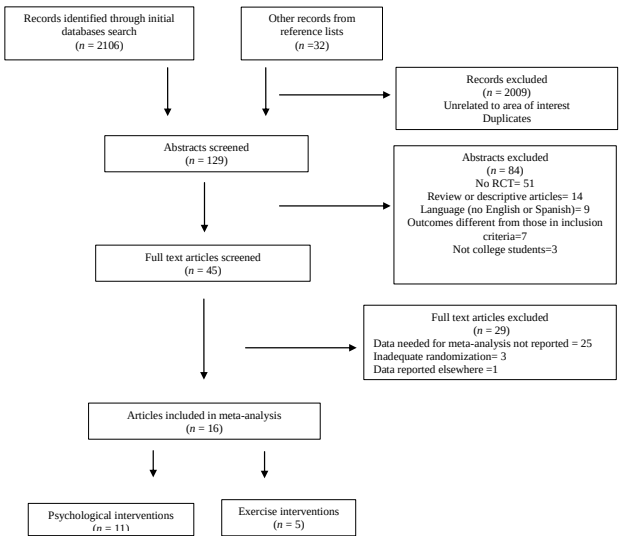

Figure 1. Flow diagram. Selection of studies

Data extraction and coding

Data were extracted for: type of intervention (psychological, exercise or control), outcomes reported and their scores (pre and post intervention), length of intervention (weeks), total number of sessions, length of sessions (minutes per session), frequency (times/week), mode (group or individual), time of post measurement (endpoint or follow-up), mean age of subjects. Two reviewers coded the data independently; disagreements between the reviewers were resolved by consensus. The inter-rater reliability was 0.90.

Journal of Sport and Health Research 2016, 8(1):75-92

Data analysis

Effect sizes (ES) were calculated using Cohen's *d*, corrected with Hedges' *g* (Thomas & French, 1986) and adjusted for total variance with a fixed effects model (Cooper, Hedges, & Valentine, 2009). Significance of ES was determined by calculation of *Z* and 95% confidence intervals (Cooper et al., 2009; Thomas & French, 1986). Heterogeneity was assessed using Cochran's *Q* and I^2 (Borenstein, Hedges, Higgins, & Rothstein, 2009). Moderator analyses were run with Student's *t* (for categorical variables) and Pearson's *r* (for numeric variables) in SPSS 21.

RESULTS

Description of the studies

Sixteen studies (including 1342 individuals) published between 1987 and 2012 met the selection criteria, 11 used psychological interventions ((Calvo, Betancort, & D. Díaz, 2009; Church, De Asis, & Brooks, 2012; Deckro et al., 2002; Fresco, Moore, Walt, & Craighead, 2009; Hurley & Kwon, 2012; Kanji et al., 2006; McMakin, Siegle, & Shirk, 2011; Pace & Dixon, 1993; Sheldon & Lyubomirsky, 2006; Steinhardt & Dolbier, 2008; Yazdani, Rezaei, & Pahlavanzadeh, 2010)) and five focused on exercise ((Hopkins, Davis, Vantieghem, Whalen, & Bucci, 2012; Kubitz & Landers, 1993; Roth, 1989; Roth & Holmes, 1987; Russell & Newton, 2008)). Outcomes from these studies are: anxiety, depression, positive affect and negative affect. 96 effect sizes were calculated (51 experimental and 45 in control groups). See Table 6 for details on the characteristics of the studies.

Effect of interventions on well-being and ill-being related variables

Both psychological and exercise interventions yielded overall positive effects in the analyzed variables (pooled effect for anxiety, depression, positive and negative affect). ES were 0.48; 95% CI [0.39, 0.56] and 0.57; 95% CI [0.42, 0.72] for psychological and exercise approaches respectively. Control groups also showed effect, but it is much lower than the interventions and might be considered trivial: 0.13; 95% CI [0.06, 0.21] according to Cohen's classification, ES< 0.20= no effect .

Effect of interventions by outcome

Psychological interventions show positive effects on anxiety, depression and negative affect (Figure 2); whereas effect of exercise interventions is only significant on anxiety and depression (Figure 3). There was not sufficient data available to calculate ES for positive affect.

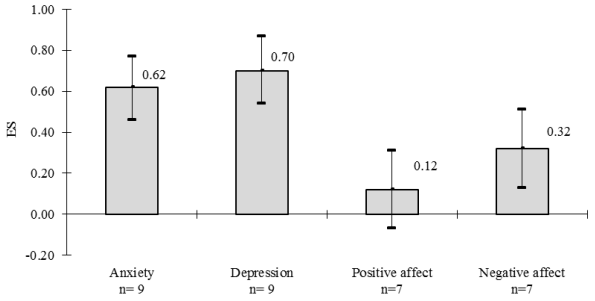

Figure 2. Effect sizes of psychological interventions, by outcome

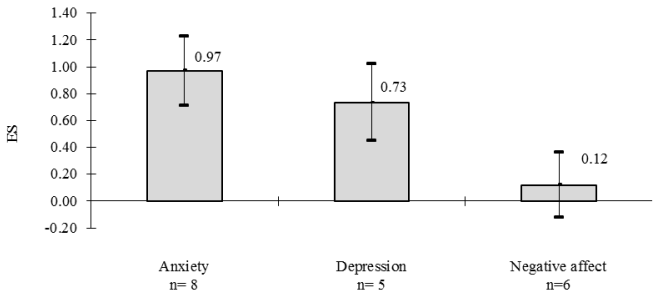

Figure 3. Effect sizes of exercise interventions, by outcome

Further information on effect sizes, significance and heterogeneity is outlined in Tables 2 (psychological interventions) and 3 (exercise interventions). High heterogeneity was found for anxiety and depression results in both types of interventions.

Journal of Sport and Health Research 2016, 8(1):75-92

Table 2. Effect of psychological interventions. Overall and by outcome measure

	n studies	*n ES*	*ES*	*95% CI*	*Z*	*Q*	I^2
Overall effect	11	32	0.48	[0.39, 0.56]	10.97*	184.74**	95.13
Outcome measure							
Anxiety	4	9	0.62	[0.46, 0.77]	7.96*	41.05**	92.69
Depression	7	9	0.70	[0.54, 0.87]	8.46*	68.36**	91.22
Positive affect	4	7	0.12	[-0.07, 0.31]	1.27		
Negative affect	4	7	0.32	[0.13, 0.51]	3.36*	6.24	51.91

Note. CI= confidence interval. * = p<.05. ** = p<.01. I^2 > 75%= high heterogeneity.

Table 3. Effect of exercise interventions. Overall and by outcome measure

	n studies	*n ES*	*ES*	*95% CI*	*Z*	*Q*	I^2
Overall effect	5	19	0.57	[0.42, 0.72]	7.37*	124.67**	96.79
Outcome measure							
Anxiety	4	8	0.97	[0.71, 1.23]	7.20*	76.25**	96.07
Depression	3	5	0.73	[0.45, 1.02]	5.01*	9.35**	78.62
Negative affect	2	6	0.12	[-0.12, 0.36]	0.98		

Note. Insufficient data to calculate ES for Positive affect. CI= confidence interval. * = p<.05. ** = p<.01. I^2 > 75%= high heterogeneity.

Moderator analyses

Moderator analyses were conducted when heterogeneity was found. The analyses provide no plausible explanation for the high variation in the results. Tables 4 and 5 show the results after statistical analyses.

COMMENT

Using meta-analytic techniques, this study analyzed the effect of psychological and exercise interventions on well-being and ill-being outcomes in college student population. Sixteen randomized controlled studies (11 for psychological and five for exercise interventions) met the inclusion criteria. Both types of interventions show moderate to high effects on anxiety and depression; no differences between exercise and psychological interventions were found for those variables. Only psychological interventions have a small effect on negative affect.

When compared to previous meta-analytic data, psychological interventions showed similar (Duijts et al., 2011; Goyal et al., 2014; Hofmann et al., 2010; Noordik et al., 2010) and lower (Cape et al., 2010) ES, anxiety being the outcome measure and considering confidence intervals. Anxiety/depression comorbidity is rather common and it has been reported that treatments designed to impact one of the conditions could potentially affect the other (Hofmann & Smits, 2008). In this meta-analysis, ES from psychological and exercise interventions were similar for anxiety and depression; no differences between exercise and psychological (cognitive) treatments have been reported elsewhere (Lawlor & Hopker, 2001). However, compared to prior meta-analytic published results (Bartley, Hay, & Bloch, 2013; Petruzzello, Landers, Hatfield, Kubitz, & Salazar, 1991; Wegner et al., 2014; Wipfli et al., 2008), anxiolytic effects of exercise appeared higher in the present study.

Results for depression ES in this meta-analysis are higher than those previously reported from some psychological (Bolier et al., 2013; Sin & Lyubomirsky, 2009) and exercise interventions (J. C. Brown et al., 2012; Duijts et al., 2011). Only one study presented higher ES (Jakobsen et al., 2011); this effect might be influenced by the fact that all interventions included were delivered to patients diagnosed with major depressive disorder. Results from other meta-analysis were similar to the present study (Cape et al., 2010; Hofmann et al., 2010; Lawlor & Hopker, 2001; Rethorst et al., 2009; Wegner et al., 2014). Quality of studies, number of studies included and diversity in target populations might explain the differences. ES produced by this meta-analysis are obtained exclusively from college students, who seem to benefit from the analyzed interventions, regardless of the type, and, in most cases, report higher effects than other groups of target subjects (e.g. inpatients, older adults, cancer survivors, mixed population).

Mechanisms underlying the beneficial effects of psychological interventions include changes in explanatory style, hopelessness, self-esteem, and dysfunctional attitudes (M. E. P. Seligman, Schulman, DeRubeis, & Hollon, 1999) and brain

Journal of Sport and Health Research 2016, 8(1):75-92

structural changes in areas involved in negative emotion control (Clark & Beck, 2010).

Regarding exercise and its antidepressive and anxiolytic effect, some of the physiological hypothesis refer to the monoamine and opioid systems, hypothalamic-pituitary-adrenal axis, neurotrophic factors and neuroimmune effects (Anderson & Shivakumar, 2013; Eyre, Papps, & Baune, 2013; Peluso & Guerra de Andrade, 2005; Wipfli et al., 2008). Psychosocial hypothesis point to anxiety sensitivity and exposure factors, the distraction hypothesis, self-esteem, self-efficacy and social support (Anderson & Shivakumar, 2013; Pickett, Yardley, & Kendrick, 2012; Rethorst et al., 2009).

Publications that appropriately measure and report effect on other measures of well-being are scarce. Positive and negative affect, as components of subjective well-being (Diener et al., 1999), were included as outcomes; negative affect was the only variable with significant results (positively impacted by psychological interventions), with an ES similar to one reported by Bolier et al. (2013) for subjective well-being. The fact that positive affect is not influenced by interventions might indicate that this variable is less susceptible to change (subjects might be more sensitive to improvements in negative mood); meaning that some mechanisms, such as cognitive restructuring and reappraisal (Clark & Beck, 2010) act more effectively in regulating negative affect than in increasing positive feelings.

Moderator analyses did not provide sufficient information to account for high heterogeneity in the ES nor for anxiety or depression. Some trend was observed in variables related to intervention (length of the intervention, total number of sessions, length of sessions and frequency), in most cases, they showed some inclination to be inversely correlated to ES. This tendency was previously noted by Reed and Buck (2009) with regards to program duration, where the effects appear to diminish for programs > 13 weeks; habituation was thought to play a role in this phenomenon.

The evidence of psychological and exercise interventions' efficacy for improving well-being and ill-being related outcomes in college population is relevant in the context of increasing attention to promotion and prevention programs for higher education (Conley et al., 2013; Oades, Robinson, Green, & Spence, 2011). These interventions are feasible to deliver to a large number of students through classroom settings or open group modalities, which would represent an alternative to the less cost-effective one-to-one type of intervention and may become a strong strategy for primary prevention (Albee & Gullotta, 1986; S. Brown & Schiraldi, 2004).

Post meta-analytical confirmatory studies to integrate and compare the effects of well-designed psychological and exercise-based interventions are recommended. Follow-up measures should be considered. Measuring, targeting and reporting a wide range of well-being measures (mental health, satisfaction with life, positive affect, negative affect, psychological well-being) would provide a much better understanding of the actual contribution of treatments, currently limited by some bias to studying illness-related outcomes.

Journal of Sport and Health Research 2016, 8(1):75-92

Table 4. *Moderator analyses for psychological interventions*

	Anxiety						***Depression***					
	n studies	*n ES*	*t*	*p*	*r*	*p*	*n studies*	*n ES*	*t*	*p*	*r*	*p*
	4	9					7	9				
Related to intervention												
Length (weeks)	3	8			-0.30	0.46	7	9			0.02	0.96
Total number of sessions	3	8			-0.40	0.32	6	8			-0.03	0.93
Length of sessions (min.)	4	9			-0.45	0.21	6	8			-0.07	0.86
Frequency (times/week)	4	9			-0.12	0.76	3	5			-0.67	0.22
Mode	*na*	*na*							-0.41	0.70		
Individual							4	5				
Group							3	4				
Time of measurement			1.62	.15					0.07	0.94		
Endpoint	4	6					5	7				
Follow-up	2	3					2	2				
Related to subjects												
Age	3	5			-0.18	0.76	5	7			-0.42	0.35

Note. *p*= significance. *t*= Student's *t*. *r*= Pearson's *r*. na= not applicable due to insufficient data

Table 5. *Moderator analyses for exercise interventions*

	Anxiety				***Depression***			
	n studies	*n ES*	*r*	*p*	*n studies*	*n ES*	*r*	*p*
	4	8			3	5		
Related to intervention								
Length (weeks)	4	8	-0.5	0.2	3	5	-0.21	0.73
Total number of sessions	2	5	-0.45	0.44	2	3	0.78	0.42
Length of sessions (min.)	4	8	-0.48	0.22	3	5	0.59	0.28
Frequency (times/week)	3	7	-0.52	0.22	3	5	0.86	0.06

Note. Insufficient data for variables: mode, time of measurement and age. *p*= significance. *r*= Pearson's' *r*.

Journal of Sport and Health Research 2016, 8(1):75-92

Table 6. *Description of studies*

Authors (year of publication)	*Type of intervention (P=Psychological, E=Exercise)*	*n exp*	*n control*	*Age (mean)*	*Mode G=Group, I= Indiv.*	*Length (weeks)*	*Total number of sessions*	*Length of sessions (minutes)*	*Freq. (times/week)*	*Outcome (measure)*	*ES*
Calvo, Betancort, and D. Díaz (2009)	Automated Suggestive Brief Relaxation Technique (P)	65	73	21.29	G	1	1	15	1	Anxiety (STAI)	1.74
Church, De Asis, and Brooks (2012)	Emotional Freedom Techniques (P)	9	9	16.7	G	3	4	90	nr	Depression (BDI)	5.59
Deckro et al. (2002)	Mind/Body Intervention (Relaxation-response-based skills & Cognitive behavioral interventions) (P)	46	44	24	G	6	6	90	1	Anxiety (STAI) State Trait	0.74 0.46
Fresco, Moore, Walt, and Craighead (2009)	Self-Administered Optimism Training (P)	43	55	19.23	I	4	nr	nr	nr	Depression (BDI)	0.22
Hopkins, Davis, Vantieghem, Whalen, and Bucci (2012)	Treadmill (walking or jogging) (E)- 1	12	13	nr	I	4	nr	30 (min.)	4 (min.)	Anxiety (STAI-Y1) Depression (BDI) Negative Affect (PANAS)	-0.32 1.58 -0.51
	Treadmill (walking or jogging) (E)- 2	14	15	nr	I	4	nr	30 (min.)	4 (min.)	Anxiety (STAI-Y1) Depression (BDI) Negative Affect	0.63 1.40 -1.06

Journal of Sport and Health Research 2016, 8(1):75-92

										(PANAS)	
Hurley and Kwon (2012)	Savoring the moment intervention (P)	94	99	19.48	I	2	1	20	nr	Depression (BDI) Positive Affect (PANAS-X) Negative Affect (PANAS-X)	0.33 0.14 0.40
Kanji et al. (2006)	Autogenic training (P)	32	31	nr	G	8	8	60	1	Anxiety (STAI) State, endpoint Trait, endpoint State, follow-up Trait, follow-up	0.55 0.56 -0.22 0.31
Kubitz and Landers (1993)	Cyclo-ergometer (E)	13	11	nr	I	8	24	40	3	Anxiety (STAI) At baseline After stressor task After recovery	0.38 1.47 0.81
McMakin, Siegle, and Shirk (2011)	Positive Affect Stimulation and Sustainment (PASS) (P)	13	14	nr	I	2	3	20	nr	Depression (BDI-II) Positive Affect (PANAS) Negative Affect (PANAS)	1.31 0.20 0.36

Journal of Sport and Health Research 2016, 8(1):75-92

Pace and Dixon (1993)	Cognitive Therapy (P)	31	43	22.54	I	5	7	45	1	Depression (BDI) Endpoint Follow-up	2.32 2.27
Roth (1989)	Cyclo-ergometer (E)	40	40	20.8	I	1	1	20	1	Anxiety (POMS) Depression (POMS)	3.59 0.39
	Interactive video game exercise (cycling) (E) Group 1 – Male	18	32	20.44	G	1	1	30	1	Negative Affect (PANAS)	0.43
	Interactive video game exercise (cycling) (E) Group 2 - Female	38	24	21.32	G	1	1	30	1	Negative Affect (PANAS)	0.34
Russell and Newton (2008)	Cyclo-ergometer (E) Group 1 - Male	28	32	23.39	G	1	1	30	1	Negative Affect (PANAS)	0.15
	Cyclo-ergometer (E) Group 2 - Female	28	24	22.04	G	1	1	30	1	Negative Affect (PANAS)	0.39
	Gratitude exercise (P)	21	23	nr	I	4	nr	nr	nr	Positive Affect (PANAS) Endpoint Follow-up	0.09 - 0.29
Sheldon and Lyubomirsky (2006)										Negative Affect (PANAS) Endpoint Follow-up	0.36 0.23

Journal of Sport and Health Research 2016, 8(1):75-92

	Best possible selves exercise (P)	23	23	nr	I	4	nr	20	nr	Positive Affect (PANAS) Endpoint Follow-up Negative Affect (PANAS) Endpoint Follow-up	0.33 - 0.45 0.40 - 0.33
Steinhardt and Dolbier (2008)	Resilience psychoeducational Intervention (P)	30	27	nr	G	4	4	120	1	Depression (CESD) Positive Affect (PANAS) Negative Affect (PANAS)	0.52 0.62 0.51
Yazdani, Rezaei, and Pahlavanzadeh (2010)	Stress management training program (P)	38	38	20.9	G	4	8	120	2	Anxiety (DASS-42) Endpoint Follow-up Depression (DASS-42) Endpoint Follow-up	 0.40 0.51 0.45 0.58

Note. BAI= Beck Anxiety Inventory, BDI=Beck's Depression Inventory, BDI-II= Beck's Depression Inventory (second version), CESD= Center for Epidemiologic Studies Depression Index, DASS-42=Depression, Anxiety and Stress Scale, PANAS-X= Positive and Negative Affect Schedule-Expanded Form, POMS= Profile of Mood States, SIAS= Social Interaction Anxiety Scale, STAI = State-Trait Anxiety Inventory, STAI-Y1 = State-Trait Anxiety Inventory (Form Y), nr= not reported, min= minimum.

Journal of Sport and Health Research 2016, 8(1):75-92

LIMITATIONS

Most studies included in this meta-analysis did not report data on possible moderators like delivery mode of interventions, time of measurements, intensity of exercise and age of participants. This lack of information impairs the ability to explain variability of the results. Another limitation concerns the final number of studies included in the meta-analysis; inclusion criteria were intended to dismiss studies with limited quality, but this also resulted in a small number of ES.

CONCLUSIONS

Psychological and exercise interventions are similarly effective in impacting higher education students' well-being and ill-being. Decreases in anxiety and depression measures are reported after both types of interventions. Exercise does not impact negative affect results, but psychological strategies do. Since mechanisms underlying the effect of the two types of interventions do not seem to interfere with each other (might actually complement), it is plausible that initiatives that combine exercise and psychological approaches result in increased enhancement of well-being. Confirmatory trials and cost-effectiveness studies in college settings are recommended.

REFERENCES

1. ACHA. (2014). American College Health Association-National College Health Assessment II: Spring 2014 Reference Group Executive Summary. Hanover, MD: American College Health Association.

2. ACSM. (2013). *ACSM's Resource Manual for Guidelines for Exercise Testing and Prescription.* (Seventh ed.). Lippincott: Williams and Wilkins.

3. Albee, G., & Gullotta, T. (1986). Facts and fallacies about primary prevention. *Journal of Primary Prevention, 6*(4), 207-218. doi: 10.1007/bf01330262

4. Anderson, E., & Shivakumar, G. (2013). Effects of exercise and physical activity on anxiety. *Front Psychiatry, 4*, 27. doi: 10.3389/fpsyt.2013.00027

5. Bartley, C. A., Hay, M., & Bloch, M. H. (2013). Meta-analysis: Aerobic exercise for the treatment of anxiety disorders. *Progress in Neuro-Psychopharmacology and Biological Psychiatry, 45*(0), 34-39. doi: http://dx.doi.org/10.1016/j.pnpbp.2013.04.016

6. Bolier, L., Haverman, M., Westerhof, G. J., Riper, H., Smit, F., & Bohlmeijer, E. (2013). Positive psychology interventions: a meta-analysis of randomized controlled studies. *BMC Public Health, 13*, 119. doi: 10.1186/1471-2458-13-119

7. Borenstein, M., Hedges, L. V., Higgins, J. P. T., & Rothstein, H. R. (2009). *Introduction to Meta-Analysis*. Wiltshire: Wiley.

8. Brown, J. C., Huedo-Medina, T. B., Pescatello, L. S., Ryan, S. M., Pescatello, S. M., Moker, E., . . . Johnson, B. T. (2012). The efficacy of exercise in reducing depressive symptoms among cancer survivors: a meta-analysis. *PloS One, 7*(1), e30955. doi: 10.1371/journal.pone.0030955

9. Brown, S., & Schiraldi, G. R. (2004). Reducing Subclinical Symptoms of Anxiety and Depression: A Comparison of Two College Courses. *American Journal of Health Education, 35*(3), 158-164. doi: 10.1080/19325037.2004.10603632

10. Calvo, F., Betancort, E., & D. Díaz, M. (2009). La técnica de relajación sugestiva breve automatizada: ampliación del estudio de su eficacia a una muestra de univesrsitarios. (Spanish). [Article]. *Ansiedad y Estres, 15*(2/3), 119-130.

11. Cape, J., Whittington, C., Buszewicz, M., Wallace, P., & Underwood, L. (2010). Brief psychological therapies for anxiety and depression in primary care: meta-analysis and meta-regression. *BMC Medicine, 8*, 38. doi: 10.1186/1741-7015-8-38

12. Church, D., De Asis, M. A., & Brooks, A. J. (2012). Brief group intervention using emotional freedom techniques for depression in college students: a randomized controlled trial. *Depress*

Res Treat, 2012, 257172. doi: 10.1155/2012/257172

13. Clark, D. A., & Beck, A. T. (2010). Cognitive theory and therapy of anxiety and depression: convergence with neurobiological findings. *Trends Cogn Sci, 14*(9), 418-424. doi: 10.1016/j.tics.2010.06.007

14. Conley, C. S., Durlak, J. A., & Dickson, D. A. (2013). An evaluative review of outcome research on universal mental health promotion and prevention programs for higher education students. *Journal of American College Health, 61*(5), 286-301. doi: 10.1080/07448481.2013.802237

15. Conn, V. S. (2010). Anxiety outcomes after physical activity interventions: meta-analysis findings. *Nursing Research, 59*(3), 224-231. doi: 10.1097/NNR.0b013e3181dbb2f8

16. Cooney, G. M., Dwan, K., Greig, C. A., Lawlor, D. A., Rimer, J., Waugh, F. R., . . . Mead, G. E. (2013). Exercise for depression. *The Cochrane Database Of Systematic Reviews, 9*, CD004366.

17. Cooper, H., Hedges, L. V., & Valentine, J. C. (Eds.). (2009). *The Handbook of Research Synthesis and Meta-Analysis* (2nd ed.). New York: Russell Sage Foundation.

18. Cuijpers, P., van Straten, A., & Smit, F. (2006). Psychological treatment of late-life depression: a meta-analysis of randomized controlled trials. *International Journal of Geriatric Psychiatry, 21*(12), 1139-1149. doi: 10.1002/gps.1620

19. Cukrowicz, K. C., & Joiner Jr, T. E. (2007). Computer-Based Intervention for Anxious and Depressive Symptoms in a Non-Clinical Population. [Article]. *Cognitive Therapy & Research, 31*(5), 677-693. doi: 10.1007/s10608-006-9094-x

20. Daley, A. (2008). Exercise and Depression: A Review of Reviews. [Article]. *Journal of Clinical Psychology in Medical Settings, 15*(2), 140-147. doi: 10.1007/s10880-008-9105-z

21. Deckro, G. R., Ballinger, K. M., Hoyt, M., Wilcher, M., Dusek, J., Myers, P., . . . Benson, H. (2002). The evaluation of a mind/body intervention to reduce psychological distress and perceived stress in college students. *J Am Coll Health, 50*(6), 281-287. doi: 10.1080/07448480209603446

22. Diener, E., Suh, E. M., Lucas, R. E., & Smith, H. L. (1999). Subjective well-being: Three decades of progress. *Psychological Bulletin, 125*(2), 276-302. doi: 10.1037/0033-2909.125.2.276

23. Duijts, S. F., Faber, M. M., Oldenburg, H. S., van Beurden, M., & Aaronson, N. K. (2011). Effectiveness of behavioral techniques and physical exercise on psychosocial functioning and health-related quality of life in breast cancer patients and survivors--a meta-analysis. *Psycho-Oncology, 20*(2), 115-126. doi: 10.1002/pon.1728

24. Eyre, H. A., Papps, E., & Baune, B. T. (2013). Treating depression and depression-like behavior with physical activity: an immune perspective. *Front Psychiatry, 4*, 3. doi: 10.3389/fpsyt.2013.00003

25. Fresco, D. M., Moore, M. T., Walt, L., & Craighead, L. W. (2009). Self-Administered Optimism Training: Mechanisms of Change in a Minimally Supervised Psychoeducational Intervention. [Article]. *Journal of Cognitive Psychotherapy, 23*(4), 350-367. doi: 10.1891/0889-8391.23.4.350

26. Goyal, M., Singh, S., Sibinga, E. M., Gould, N. F., Rowland-Seymour, A., Sharma, R., . . . Haythornthwaite, J. A. (2014). Meditation programs for psychological stress and well-being: a systematic review and meta-analysis. *JAMA Intern Med, 174*(3), 357-368. doi: 10.1001/jamainternmed.2013.13018

27. Hofmann, S. G., Sawyer, A. T., Witt, A. A., & Oh, D. (2010). The effect of mindfulness-based therapy on anxiety and depression: A meta-analytic review. *Journal of Consulting and Clinical Psychology, 78*(2), 169-183. doi: 10.1037/a0018555

28. Hofmann, S. G., & Smits, J. A. (2008). Cognitive-behavioral therapy for adult anxiety disorders: a meta-analysis of randomized placebo-controlled trials. *Journal of Clinical Psychiatry, 69*(4), 621-632.

29. Hopkins, M. E., Davis, F. C., Vantieghem, M. R., Whalen, P. J., & Bucci, D. J. (2012). Differential effects of acute and regular physical exercise on cognition and affect. *Neuroscience, 215*, 59-68. doi: 10.1016/j.neuroscience.2012.04.056

30. Howell, R. T., Kern, M. L., & Lyubomirsky, S. (2007). Health benefits: Meta-analytically determining the impact of well-being on objective health outcomes. *Health Psychology Review, 1*(1), 83-136. doi: 10.1080/17437190701492486

31. Hurley, D., & Kwon, P. (2012). Results of a Study to Increase Savoring the Moment: Differential Impact on Positive and Negative Outcomes. [Article]. *Journal of Happiness Studies, 13*(4), 579-588. doi: 10.1007/s10902-011-9280-8

32. Jakobsen, J. C., Hansen, J. L., Storebo, O. J., Simonsen, E., & Gluud, C. (2011). The effects of cognitive therapy versus 'no intervention' for major depressive disorder. *PloS One, 6*(12), e28299. doi: 10.1371/journal.pone.0028299

33. Kanji, N., White, A., & Ernst, E. (2006). Autogenic training to reduce anxiety in nursing students: randomized controlled trial. [Article]. *Journal of Advanced Nursing, 53*(6), 729-735. doi: 10.1111/j.1365-2648.2006.03779.x

34. Kubitz, K. A., & Landers, D. M. (1993). The effects of aerobic training on cardiovascular responses to mental stress: an examination of underlying mechanisms. / Les effets d'un entrainement aerobie sur les responses cardiovasculaires au stress mental, un examen des mecanismes sous-jacents. *Journal of Sport & Exercise Psychology, 15*(3), 326-337.

35. Lawlor, D. A., & Hopker, S. W. (2001). The effectiveness of exercise as an intervention in the management of depression: systematic review and meta-regression analysis of randomised controlled trials. *BMJ, 322*(7289), 763-767.

36. Mailey, E. L., Wojcicki, T. R., Motl, R. W., Hu, L., Strauser, D. R., Collins, K. D., & McAuley, E. (2010). Internet-delivered physical activity intervention for college students with mental health disorders: a randomized pilot trial. *Psychol Health Med, 15*(6), 646-659. doi: 10.1080/13548506.2010.498894

37. McMakin, D. L., Siegle, G. J., & Shirk, S. R. (2011). Positive Affect Stimulation and Sustainment (PASS) Module for Depressed Mood: A preliminary investigation of treatment-related effects. *Cognit Ther Res, 35*(3), 217-226. doi: 10.1007/s10608-010-9311-5

38. Miller, E. J., & Chung, H. (2009). A literature review of studies of depression and treatment outcomes among U.S. College students since 1990. *Psychiatric Services, 60*(9), 1257-1260. doi: 10.1176/appi.ps.60.9.1257

39. Noordik, E., van der Klink, J. J., Klingen, E. F., Nieuwenhuijsen, K., & van Dijk, F. J. (2010). Exposure-in-vivo containing interventions to improve work functioning of workers with anxiety disorder: a systematic review. *BMC Public Health, 10*, 598. doi: 10.1186/1471-2458-10-598

40. Oades, L. G., Robinson, P., Green, S., & Spence, G. B. (2011). Towards a positive university. *Journal of Positive Psychology, 6*(6), 432-439. doi: 10.1080/17439760.2011.634828

41. Pace, T. M., & Dixon, D. N. (1993). Changes in depressive self-schemata and depressive symptoms following cognitive therapy. *Journal of Counseling Psychology, 40*(3), 288-294. doi: 10.1037/0022-0167.40.3.288

42. Parks, A. C. (2011). The state of positive psychology in higher education: Introduction to the special issue. *J Posit Psychol, 6*(6), 429-431. doi: 10.1080/17439760.2011.637729

43. Peluso, M. A. M., & Guerra de Andrade, L. H. S. (2005). Physical activity and mental health:

the association between exercise and mood. *Clinics, 60*(1), 61-70.

44. Petruzzello, S. J., Landers, D. M., Hatfield, B. D., Kubitz, K. A., & Salazar, W. (1991). A meta-analysis on the anxiety-reducing effects of acute and chronic exercise. Outcomes and mechanisms. *Sports Medicine, 11*(3), 143-182.

45. Pettit, J. W., Kline, J. P., Gencoz, T., Gencoz, F., & Joiner Jr, T. E. (2001). Are Happy People Healthier? The Specific Role of Positive Affect in Predicting Self-Reported Health Symptoms. *Journal of Research in Personality, 35*(4), 521-536. doi: 10.1006/jrpe.2001.2327

46. Pickett, K., Yardley, L., & Kendrick, T. (2012). Physical activity and depression: A multiple mediation analysis. *Mental Health and Physical Activity, 5*(2), 125-134. doi: 10.1016/j.mhpa.2012.10.001

47. Reed, J., & Buck, S. (2009). The effect of regular aerobic exercise on positive-activated affect: A meta-analysis. *Psychology of Sport and Exercise, 10*(6), 581-594. doi: 10.1016/j.psychsport.2009.05.009

48. Rethorst, C. D., Wipfli, B. M., & Landers, D. M. (2009). The antidepressive effects of exercise: a meta-analysis of randomized trials. *Sports Medicine, 39*(6), 491-511. doi: 10.2165/00007256-200939060-00004

49. Rimer, J., Dwan, K., Lawlor, D. A., Greig, C. A., McMurdo, M., Morley, W., & Mead, G. E. (2012). Exercise for depression. *The Cochrane Database of Systematic Reviews, 7*, CD004366. doi: 10.1002/14651858.CD004366.pub5

50. Robertson, R., Robertson, A., Jepson, R., & Maxwell, M. (2012). Walking for depression or depressive symptoms: A systematic review and meta-analysis. *Mental Health and Physical Activity, 5*(1), 66-75. doi: 10.1016/j.mhpa.2012.03.002

51. Roth, D. L. (1989). Acute emotional and psychophysiological effects of aerobic exercise. *Psychophysiology, 26*(5), 593-602.

52. Roth, D. L., & Holmes, D. S. (1987). Influence of aerobic exercise training and relaxation training on physical and psychologic health following stressful life events. *Psychosom Med, 49*(4), 355-365.

53. Russell, W., & Newton, M. (2008). Short-term psychological effects of interactive video game technology exercise on mood and attention. *Journal of Educational Technology & Society, 11*(2), 294-308.

54. Ryan, R. M., & Deci, E. L. (2001). On happiness and human potentials: a review of research on hedonic and eudaimonic well-being. *Annual Review of Psychology, 52*, 141-166. doi: 10.1146/annurev.psych.52.1.141

55. Ryff, C. D. (1995). Psychological Well-Being in Adult Life. *Current Directions in Psychological Science, 4*(4), 99-104. doi: 10.1111/1467-8721.ep10772395

56. Ryff, C. D., Singer, B. H., & Dienberg Love, G. (2004). Positive health: connecting well-being with biology. *Philosophical Transactions of the Royal Society of London. Series B: Biological Sciences, 359*(1449), 1383-1394. doi: 10.1098/rstb.2004.1521

57. Schwartz, S. J., Waterman, A. S., Vazsonyi, A. T., Zamboanga, B. L., Whitbourne, S. K., Weisskirch, R. S., . . . Ham, L. S. (2011). The Association of Well-Being with Health Risk Behaviors in College-Attending Young Adults. *Applied Developmental Science, 15*(1), 20-36. doi: 10.1080/10888691.2011.538617

58. Seligman, M. E., & Csikszentmihalyi, M. (2000). Positive psychology. An introduction. *American Psychologist, 55*(1), 5-14.

59. Seligman, M. E. P., Schulman, P., DeRubeis, R. J., & Hollon, S. D. (1999). The prevention of depression and anxiety. *Prevention & Treatment, 2*(1), 8a. doi: 10.1037/1522-3736.2.1.28a

60. Sheldon, K. M., & Lyubomirsky, S. (2006). How to increase and sustain positive emotion: The effects of expressing gratitude and

Journal of Sport and Health Research 2016, 8(1):75-92

visualizing best possible selves. *Journal of Positive Psychology, 1*(2), 73-82. doi: 10.1080/17439760500510676

61. Shoshani, A., & Slone, M. (2013). Middle School Transition from the Strengths Perspective: Young Adolescents' Character Strengths, Subjective Well-Being, and School Adjustment. *Journal of Happiness Studies, 14*(4), 1163-1181. doi: 10.1007/s10902-012-9374-y

62. Sin, N. L., & Lyubomirsky, S. (2009). Enhancing well-being and alleviating depressive symptoms with positive psychology interventions: a practice-friendly meta-analysis. *Journal of Clinical Psychology, 65*(5), 467-487. doi: 10.1002/jclp.20593

63. Steinhardt, M., & Dolbier, C. (2008). Evaluation of a resilience intervention to enhance coping strategies and protective factors and decrease symptomatology. *J Am Coll Health, 56*(4), 445-453. doi: 10.3200/jach.56.44.445-454

64. Steptoe, A., Dockray, S., & Wardle, J. (2009). Positive affect and psychobiological processes relevant to health. *J Pers, 77*(6), 1747-1776. doi: 10.1111/j.1467-6494.2009.00599.x

65. Strohle, A. (2009). Physical activity, exercise, depression and anxiety disorders. *Journal of Neural Transmission, 116*(6), 777-784. doi: 10.1007/s00702-008-0092-x

66. Thomas, J. R., & French, K. E. (1986). The use of meta-analysis in exercise and sport: a tutorial. *Research Quarterly for Exercise and Sport, 57*(3), 196-204.

67. Wegner, M., Helmich, I., Machado, S., Nardi, A. E., Arias-Carrion, O., & Budde, H. (2014). Effects of exercise on anxiety and depression disorders: review of meta- analyses and neurobiological mechanisms. *CNS & Neurological Disorders Drug Targets, 13*(6), 1002-1014.

68. Wipfli, B. M., Rethorst, C. D., & Landers, D. M. (2008). The anxiolytic effects of exercise: a meta-analysis of randomized trials and dose-response analysis. *Journal of Sport & Exercise Psychology, 30*(4), 392-410.

69. Yazdani, M., Rezaei, S., & Pahlavanzadeh, S. (2010). The effectiveness of stress management training program on depression, anxiety and stress of the nursing students. *Iranian Journal Of Nursing And Midwifery Research, 15*(4), 208-215.