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Table 1. Characteristics of included studies

Outcome assessed	Reference	Country	Setting	Study design (groups)	Participants	Findings [effect size]	PA/E groups	Non PA/E groups	Tool used	Assessment time point	Intention to treat analysis used
Affect	Daley, 2006 (50)	UK	Community	RCT (3)	Adolescents with obesity (n=81) (M age=13.1yrs)	No effect [not reported]	AE-mod (n=28); CE-low (n=23)	WL (n=30)	PANAS	PP, FU (6wks, 20wks)	Yes
	Noggle 2012(43)	USA	Secondary school	C-RCT (2)	Adolescents (n=51) (M age=17.2yrs)	Yoga decreased negative affect [0.66] (BG)	Yoga (n=36); PE (n=15)	None	PANAS-C	PP	Yes
Anger	Noggle 2012(43)	USA	Secondary school	C-RCT (2)	Adolescents (n=51) (M age=17.2yrs)	No effect [not reported]	Yoga (n=36); PE (n=15)	None	STAXI-2	PP	Yes
Anxiety Sensitivity	Sabourin 2016(45)	Canada	University	RCT (4)	Female university students with high (n=81) or low (n=73) anxiety sensitivity (M age=18.8yrs)	CBT+AE-running and HE reduced AS in women with high AS [not reported] (PP), no BG differences	CBT+AE-running (high AS) (n=44); CBT+AE-running (low AS) (n=39)	HE (high AS) (n=37); HE (low AS) (n=34)	ASI	PP	No
Anxiety Symptoms	Aras 2016(51)	Turkey	University	non-random CT (2)	Sedentary university students (n=19) (M age=21.5yrs)	Rock climbing reduced anxiety [not reported] (PP), no BG analysis presented	Rock climbing (n=9)	No intervention (n=10)	CASAI-2	PP	NS
	Baghurst 2014(52)	USA	University	RCT (4)	University students (n=531) (M age=21.4yrs)	SM and PA decreased test anxiety [not reported] (BG)	PA (n=144); CE (n=131)	SM (n=124); No intervention (n=132)	TAS	PP	NS
	Bonhauser 2005(40)	Chile	Secondary school	C-RCT (2)*	Adolescents (n=198) (M age=15.5yrs)	Enhanced PE decreased anxiety [not reported] (BG)	Enhanced PE (n=98); Standard PE (n=100)	None	HADS	PP	Yes
	Gallego 2015(53)	Spain	University	RCT (3)	University students (n=125) (M age=20.1yrs)	MBCT reduced anxiety [not reported] (BG) (PP for MBCT $d=0.32$)	PE (n=42); MBCT (incl. yoga) (n=41)	No intervention (n=42)	DASS-21	PP	No
	Hilyer 1982(54)	USA	State industrial school	RCT (2)	Incarcerated male adolescents (n=60) (M age=16.9yrs)	CE + counselling + Rehabilitation program reduced anxiety [not reported] (BG)	CE + counselling + Rehabilitation program (n=30)	Rehabilitation program (n=30)	STAI-C	PP	No

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	Khorvash 2012(47)	Iran	University	RCT (4)	Male university students with elevated anxiety/depression symptoms (n=120) (M age=25.1yrs)	Combined RE and AE reduced anxiety. Did not report results for groups individually [not reported]	RE (n=30); AE (n=30)	No intervention (n=30 & n=30)	Kettle questionnaire	PP	NS
	Melnyk 2009(41)	USA	Secondary school	C-RCT (2)	Adolescents (n=19) (M age=15.5yrs)	COPE reduced anxiety [0.56] (PP)	COPE Program (n=12)	HE (n=7)	BYI-II	PP	No
	Melnyk 2013(42)	USA	Secondary school	C-RCT (2)	Adolescents (n=807) (M age=14.7yrs)	No effect [not reported]	COPE Program (incl. PA) (n=374)	Healthy Teens program (n=433)	BYI-II	PP, FU (6mo)	Unclear
	Roth 1987(55)	USA	University	RCT (3)	University students with a high number of negative life events (n=55) (M age=18.9yrs)	No effect [not reported]	AE-walking/running (n=23)	PMR (n=21); No intervention (n=21)	STAI	PP, FU (2mo)	NS
	Sabourin 2016(45)	Canada	University	RCT (4)	Female university students with high (n=81) or low (n=73) anxiety sensitivity (M age=18.8yrs)	HE reduced anxiety symptoms in women with high AS [not reported] (PP), no BG differences	CBT+AE-running (high AS) (n=44); CBT+AE-running (low AS) (n=39)	HE (high AS) (n=37); HE (low AS) (n=34)	BAI	PP	No
	Smith 2011(38)	USA	University	non-random CT (3)	University students with elevated DASS scores (n=81) (M age=21.2yrs)	Integrated Yoga decreased anxiety [not reported] (BG)	Integrated Yoga (n=34); Yoga as exercise (n=15)	No intervention (n=32)	DASS	PP	No
	Wipfli 2011(56)	USA	University	RCT (2)	University students (n=72) (M age=20.7yrs)	No effect [0.14] (BG). AE-cycling and Stretching/yoga decreased anxiety [not reported] (PP)	AE-cycling (n=35); Stretching/yoga (n=37)	None	STAI	PP	No
Body Image	Taspinar 2014(57)	Turkey	University	RCT (3)	Sedentary university students & staff (n=80) (M age=25.6yrs)	Yoga and RE-weight training improved body image (PP). RE-weight training improved more than yoga [not reported] (BG)	Hatha Yoga (n=27); RE-weight training (n=25)	No intervention (n=28)	BCS	PP	No

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Burnout	Baghurst 2014(52)	USA	University	RCT (4)	University students (n=531) (M age=21.4yrs)	SM and PA decreased burnout [not reported] (PP)	PA (n=144); CE (n=131)	SM (n=124); No intervention (n=132)	PBS	PP	NS
Depression Symptoms	Balkin 2007(36)	USA	University	non-random CT (3)	Female university students (n=110) (M age=21.4yrs)	AE decreased depression [0.55] (PP; not BG)	RE-weight lifting (n=21); AE (n=46)	No intervention (n=14)	BDI-II	PP	No
	Bonhauser 2005(40)	Chile	Secondary school	C-RCT (2)*	Adolescents (n=198) (M age=15.5yrs)	No effect [not reported]	Enhanced PE (n=98); Standard PE (n=100)	None	HADS	PP	Yes
	Cecchini-Estrada 2015(46)	Spain	University	RCT (4)	University students scoring 29-34 on the adapted self-report depression scale (n=106) (M age=19.6yrs)	PA-1, PA-2 and PA-3 decreased depression [unclear, unable to be extracted] (PP). PA-1 decreased depression at post intervention and 6mo FU [unclear, unable to be extracted] (BG)	PA-1 (Epstein's TARGET w/ PE teacher) (n=27); PA-2 (usual PA program w/ PE teacher) (n=27); PA-3 (usual PA program w/o PE teacher) (n=26)	Stretching/flexibility (n=26)	Adapted self-report depression scale	PP, FU (6mo)	NS
	Daley, 2006 (50)	UK	Community	RCT (3)	Adolescents with obesity (n=81) (M age=13.1yrs)	No effect [not reported]	AE-mod (n=28); CE-low (n=23)	WL (n=30)	CDI	PP, FU (6wks, 20wks)	Yes
	Gallego 2015(53)	Spain	University	RCT (3)	University students (n=125) (M age=20.1yrs)	MBCT reduced depression [not reported] (BG) (PP for MBCT $d=0.60$)	PE (n=42); MBCT (incl. yoga) (n=41)	No intervention (n=42)	DASS-21	PP	No
	Hemat-Far 2012(37)	Iran	University	non-random CT (2)	Moderately depressed female university students (n=20) (M age=ns, range 18-25)	AE-jogging/running reduced depression [not reported] (PP)	AE-jogging/running (n=10)	No intervention (n=10)	BDI	PP	NS
	Hilyer 1982(54)	USA	State industrial school	RCT (2)	Incarcerated male adolescents (n=60) (M age=16.9yrs)	CE + counselling + Rehabilitation program reduced depression [not reported] (BG)	CE + counselling + Rehabilitation program (n=30)	Rehabilitation program (n=30)	BDI	PP	No

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Khorvash 2012(47)	Iran	University	RCT (4)	Male university students with elevated anxiety/depression symptoms (n=120) (M age=25.1yrs)	RE reduced depression compared to AE. Did not report results compared to no intervention [not reported]	RE (n=30); AE (n=30)	No intervention (n=30 & n=30)	Beacke questionnaire	PP	NS
MacMahon 1988(35)	USA	Juvenile detention facility	non-random CT (2)	Incarcerated male adolescents (n=98) (M age=16.3yrs)	AE decreased depression [not reported] (BG)	AE (n=45); standard PE (n=53)	None	BDI	PP	No
Melnyk 2009(41)	USA	Secondary school	C-RCT (2)	Adolescents (n=19) (M age=15.5yrs)	No effect [BG not reported, COPE PP $d=0.32$]	COPE Program (n=12)	HE (n=7)	BYI-II	PP	No
Melnyk 2013(42)	USA	Secondary school	C-RCT (2)	Adolescents (n=807) (M age=14.7yrs)	No between group differences. COPE reduced depression in subset of teens with extremely elevated baseline depression scores [not reported] (BG)	COPE Program (incl. PA) (n=374)	Healthy Teens program (n=433)	BYI-II	PP, FU (6mo)	Unclear
Nabkasom 2006(39)	Thailand	University	RCT crossover (2)	University students scoring >16 on the CED-D (n=59) (M age=18.8yrs)	AE-Jogging decreased depression [not reported] (BG)	AE-jogging (n=28)	WL (n=31)	CES-D	PP	No
O'Dougherty 2012(58)	USA	Community	RCT (2)	Sedentary young women (n=372) (M age=25.2yrs)	AE buffered against depression in relation to life events [not reported] (BG)	AE (n=203)	No intervention (n=169)	CES-D	PP	NS
Robledo-Colonia 2012(59)	Columbia	Community	RCT (2)	Pregnant women (n=80) (M age=21yrs)	AE reduced depression [not reported] (BG)	AE (n=40)	No intervention (n=40)	CES-D	PP	Yes
Roth 1987(55)	USA	University	RCT (3)	University students with a high number of negative life events (n=55) (M age=18.9yrs)	No effect at PI. AE decreased depression but only at mid-intervention [not reported] (BG)	AE-walking/running (n=23)	PMR (n=21); No intervention (n=21)	BDI	PP, FU (2mo)	NS
Rotheram-Borus 2016(60)	South Africa	Community	C-RCT (2)	Unemployed men (n=142) (M age=21.9yrs)	No effect [not reported]	Soccer program (n=72)	WL (n=70)	CES-D	PP	NS

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	Sabourin 2016(45)	Canada	University	RCT (4)	Female university students with high (n=81) or low (n=73) anxiety sensitivity (M age=18.8yrs)	CBT+AE-running and HE reduced depression in women with high AS [not reported] (PP), no BG differences	CBT+AE-running (high AS) (n=44); CBT+AE-running (low AS) (n=39)	HE (high AS) (n=37); HE (low AS) (n=34)	DASS-21	PP	No
	Smith 2011(38)	USA	University	non-random CT (3)	University students with elevated DASS scores (n=81) (M age=21.2yrs)	Integrated Yoga and Yoga as exercise decreased depression [not reported] (BG)	Integrated Yoga (n=34); Yoga as exercise (n=15)	No intervention (n=32)	DASS	PP	No
	Taspinar 2014(57)	Turkey	University	RCT (3)	Sedentary university students & staff (n=80) (M age=25.6yrs)	Yoga and RE-weight training decreased depression [not reported] (PP)	Hatha Yoga (n=27); RE-weight training (n=25)	No intervention (n=28)	BDI	PP	No
	Wipfli 2011(56)	USA	University	RCT (2)	University students (n=72) (M age=20.7yrs)	AE-cycling decreased depression [0.66] (BG)	AE-cycling (n=35); Stretching/yoga (n=37)	None	BDI	PP	No
Fatigue	Taspinar 2014(57)	Turkey	University	RCT (3)	Sedentary university students & staff (n=80) (M age=25.6yrs)	Yoga and RE-weight training decreased fatigue (PP). Yoga improved more than RE-weight training [not reported] (BG)	Hatha Yoga (n=27); RE-weight training (n=25)	No intervention (n=28)	VAS	PP	No
Functioning	Khalsa 2012(44)	USA	Secondary school	C-RCT (2)	Adolescents (n=121) (M age=16.8yrs)	Yoga preserved anger control [0.48] (BG)	PE (n=47); Yoga (n=74)	None	BASC-2-SRP	PP	No
Hopefulness	Smith 2011(38)	USA	University	non-random CT (3)	University students with elevated DASS scores (n=81) (M age=21.2yrs)	Integrated Yoga and Yoga as exercise increased hopefulness [not reported] (BG)	Integrated Yoga (n=34); Yoga as exercise (n=15)	No intervention (n=32)	HHS	PP	No
Life Purpose & Satisfaction	Khalsa 2012(44)	USA	Secondary school	C-RCT (2)	Adolescents (n=121) (M age=16.8yrs)	No effect [0.04 BG]	PE (n=47); Yoga (n=74)	None	IPPA	PP	No
Mindfulness	Noggle 2012(43)	USA	Secondary school	C-RCT (2)	Adolescents (n=51) (M age=17.2yrs)	No effect [not reported]	Yoga (n=36); PE (n=15)	None	CAMM	PP	Yes

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Mood States	Berger 1988(61)	USA	University	RCT (4)	University students (n=387) (M age=20.0yrs)	AE-Jogging, PMR & discussion reduced stress (compared to no intervention). AE-Jogging & PMR reduced stress compared to discussion [not reported] (BG)	AE-jogging (n=84)	PMR (n=96); Discussion (n=100); No intervention (n=107)	POMS	PP	No
	Hilyer 1982(54)	USA	State industrial school	RCT (2)	Incarcerated male adolescents (n=60) (M age=16.9yrs)	CE + counselling + Rehabilitation program improved mood states [not reported] (BG)	CE + counselling + Rehabilitation program (n=30)	Rehabilitation program (n=30)	POMS	PP	No
	Khalsa 2012(44)	USA	Secondary school	C-RCT (2)	Adolescents (n=121) (M age=16.8yrs)	Yoga improved Fatigue-Inertia [0.48] (BG)	PE (n=47); Yoga (n=74)	None	POMS-SF	PP	No
	Noggle 2012(43)	USA	Secondary school	C-RCT (2)	Adolescents (n=51) (M age=17.2yrs)	Yoga improved total mood disturbance [0.69] and Tension-Anxiety [0.87] (BG)	Yoga (n=36); PE (n=15)	None	POMS-SF	PP	Yes
	Norris 1992(62)	UK	Secondary school	RCT (3)+ non-random control group	Adolescents (n=80) (M age=16.7yrs)	AE-high decreased anxiety only [not reported] (BG)	AE-high (n=22); AE-mod (n=19)	Stretching (n=19); No intervention (n=20)	MAACL	PP	NS
Self-Perception	Daley 2006 (50)	UK	Community	RCT (3)	Adolescents with obesity (n=81) (M age=13.1yrs)	AE-mod improved PSW at PI and FU, and increased PA at FU (BG). CE-low improved PSW at PI. (BG) AE-mod and CE-low improved GSW at FU [not reported] (BG)	AE-mod (n=28); CE-low (n=23)	WL (n=30)	SPP	PP, FU (6wks, 20wks)	Yes
Psychological Symptoms & Distress	Roth 1987(55)	USA	University	RCT (3)	University students with a high number of negative life events (n=55) (M age=18.9yrs)	No effect [not reported]	AE-walking/running (n=23)	PMR (n=21); No intervention (n=21)	SCL-90	PP, FU (2mo)	NS

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Quality of Life	Taspinar 2014(57)	Turkey	University	RCT (3)	Sedentary university students & staff (n=80) (M age=25.6yrs)	Yoga and RE-weight training improved QoL (PP). Yoga improved more than RE-weight training [not reported] (BG)	Hatha Yoga (n=27); RE-weight training (n=25)	No intervention (n=28)	NHP	PP	No
Resilience	Khalsa 2012(44)	USA	Secondary school	C-RCT (2)	Adolescents (n=121) (M age=16.8yrs)	Yoga preserved resilience [0.53] (BG)	PE (n=47); Yoga (n=74)	None	RS	PP	No
	Noggle 2012(43)	USA	Secondary school	C-RCT (2)	Adolescents (n=51) (M age=17.2yrs)	No effect [not reported]	Yoga (n=36); PE (n=15)	None	RS	PP	Yes
Self confidence	Aras 2016(51)	Turkey	University	non-random CT (2)	Sedentary university students (n=19) (M age=21.5yrs)	Rock climbing improved self-confidence [not reported] (PP), no BG analysis presented	Rock climbing (n=9)	No intervention (n=10)	CSAI-2	PP	NS
	Khalsa 2012(44)	USA	Secondary school	C-RCT (2)	Adolescents (n=121) (M age=16.8yrs)	No effect [0.26 BG]	PE (n=47); Yoga (n=74)	None	IPPA	PP	No
Self-Concept	Bao 2015(63)	China	Middle School	RCT (2)	7th grade students (n=160) (M age=14.7yrs)	Tai Chi improved overall self-concept [0.50] and aspects of good behaviour [0.54], intellectual and school status [0.45], and popularity [0.51] and anxiety [0.48] (BG)	Tai Chi (n=80); gymnastics (n=80)	None	PHCSCS	PP	No*
	MacMahon 1988(35)	USA	Juvenile detention facility	non-random CT (2)	Incarcerated male adolescents (n=98) (M age=16.3yrs)	AE improved self-concept [not reported] (BG)	AE (n=45); standard PE (n=53)	None	PHCSCS	PP	No
Self-Esteem	Bonhauer 2005(40)	Chile	Secondary school	C-RCT (2)*	Adolescents (n=198) (M age=15.5yrs)	Enhanced PE increased self-esteem [not reported] (BG)	Enhanced PE (n=98); Standard PE (n=100)	None	TSCS	PP	Yes
	Hilyer 1982(54)	USA	State industrial school	RCT (2)	Incarcerated male adolescents (n=60) (M age=16.9yrs)	CE + counselling + Rehabilitation program improved self-esteem [not reported] (BG)	CE + counselling + Rehabilitation program (n=30)	Rehabilitation program (n=30)	CSEI	PP	No

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	Taspinar 2014(57)	Turkey	University	RCT (3)	Sedentary university students & staff (n=80) (M age=25.6yrs)	Yoga and RE-weight training improved self-esteem (PP). Yoga improved more than RE-weight training [not reported] (BG)	Hatha Yoga (n=27); RE-weight training (n=25)	No intervention (n=28)	RSES	PP	No
Situational Motivation	Cecchini-Estrada 2015(46)	Spain	University	RCT (4)	University students scoring 29-34 on the adapted self-report depression scale (n=106) (M age=19.6yrs)	PA-1 increased motivation at PI at 6mo FU (BG) [unclear, unable to be extracted]	PA-1 (Epstein's TARGET w/ PE teacher) (n=27); PA-2 (usual PA program w/ PE teacher) (n=27); PA-3 (usual PA program w/o PE teacher) (n=26)	Stretching/flexibility (n=26)	SIMS	PP, FU (6mo)	NS
Social Skills	Melnyk 2013(42)	USA	Secondary school	C-RCT (2)	Adolescents (n=807) (M age=14.7yrs)	COPE improved social skills [not reported] (BG)	COPE Program (incl. PA) (n=374)	Healthy Teens program (n=433)	SSRS	PP, FU (6mo)	Unclear
Stress	Baghurst 2014(52)	USA	University	RCT (4)	University students (n=531) (M age=21.4yrs)	SM, PA and CE decreased perceived stress [not reported] (PP & compared to no intervention)	PA (n=144); CE (n=131)	SM (n=124); No intervention (n=132)	PSS	PP	NS
	Gallego 2015(53)	Spain	University	RCT (3)	University students (n=125) (M age=20.1yrs)	MBCT reduced stress [not reported] (BG) (PP for MBCT $d=0.67$)	PE (n=42); MBCT (incl. yoga) (n=41)	No intervention (n=42)	DASS-21	PP	No
	Khalsa 2012(44)	USA	Secondary school	C-RCT (2)	Adolescents (n=121) (M age=16.8yrs)	No effect [0.07 BG]	PE (n=47); Yoga (n=74)	None	PSS	PP	No
	Noggle 2012(43)	USA	Secondary school	C-RCT (2)	Adolescents (n=51) (M age=17.2yrs)	No effect [not reported]	Yoga (n=36); PE (n=15)	None	PSS	PP	Yes
	Norris 1992(62)	UK	Secondary school	RCT (3)+ non-random no-exercise ctrl group	Adolescents (n=80) (M age=16.7yrs)	AE-high decreased stress [not reported] (BG)	AE-high (n=22); AE-mod (n=19)	Stretching (n=19); No intervention (n=20)	PSS	PP	NS
	O'Dougherty 2012(58)	USA	Community	RCT (2)	Sedentary young women (n=372) (M age=25.2yrs)	No effect [not reported]	AE (n=203)	No intervention (n=169)	PSS	PP	NS

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	Rotheram-Borus 2016(60)	South Africa	Community	C-RCT (2)	Unemployed men (n=142) (M age=21.9yrs)	No effect [not reported]	Soccer program (n=72)	WL (n=70)	10-item stress measure	PP	NS
	Sabourin 2016(45)	Canada	University	RCT (4)	Female university students with high (n=81) or low (n=73) anxiety sensitivity (M age=18.8yrs)	CBT+AE-running reduced stress in women with high AS [not reported] (PP), no BG difference	CBT+AE-running (high AS) (n=44); CBT+AE-running (low AS) (n=39)	HE (high AS) (n=37); HE (low AS) (n=34)	DASS-21	PP	No
	Smith 2011(38)	USA	University	non-random CT (3)	University students with elevated DASS scores (n=81) (M age=21.2yrs)	Integrated Yoga and Yoga as exercise decreased stress [not reported] (BG)	Integrated Yoga (n=34); Yoga as exercise (n=15)	No intervention (n=32)	DASS	PP	No
Substance Use	Melnyk 2013(42)	USA	Secondary school	C-RCT (2)	Adolescents (n=807) (M age=14.7yrs)	COPE decreased alcohol use [not reported] (BG)	COPE Program (incl. PA) (n=374)	Healthy Teens program (n=433)	YRBS	PP, FU (6mo)	Unclear
	Rotheram-Borus 2016(60)	South Africa	Community	C-RCT (2)	Unemployed men (n=142) (M age=21.9yrs)	Soccer decreased methamphetamine use [not reported] (BG)	Soccer program (n=72)	WL (n=70)	AUDIT	PP	NS
	Weinstock 2014(64)	USA	University	RCT (2)	Sedentary university students scoring ≥ 8 on the AUDIT (n=31) (M age=20.6yrs)	No effect on days drinking [0.48]; # drinks/week [0.15], heavy drinking episodes [0.26] (BG)	MET-Ex+CM (n=16); MET-Ex (n=15)	None	TLFB	PP	NS
	Weinstock 2016(49)	USA	University	RCT (2)	Sedentary university students scoring ≥ 8 on the AUDIT (n=70) (M age=20yrs)	MoI+EC and MoI+EC+CM decreased alcohol use [not reported] (PP), no BG difference [0.01]	MoI+EC (n=36), MoI+CM (n=34)	None	TLFB	PP, FU (4mo)	Yes

AE=Aerobic Exercise; AS=Anxiety Sensitivity; ASI=Anxiety Sensitivity Index; AUDIT=World Health Organization's Alcohol Use Disorders Identification Test; BAI= Beck Anxiety Inventory; BASC-2-SRP= Behaviour Assessment System for Children - (Second Edition) - Self-Report of Personality; BCS=Body Cathexis Scale; BDI=Beck Depression Inventory; BDI-II=Beck Depression Inventory-II; BG=Between Group Effects; BYI-II= Beck Youth Inventory II; CBT=Cognitive Behavioural Therapy; CE=combined aerobic + resistance; CDI-(2)=Children's Depression Inventory-(2); CES-D=Centre for Epidemiological Studies-Depression; CM=Contingency Management; C-RCT=Cluster Randomised Control Trail; CSAI-2=Competitive State Anxiety Inventory-2; CSEI=Coopersmith Self Esteem Inventory-A; CT=Controlled trial; DASS=Depression, Anxiety, Stress Scale; EC=Exercise Contracting; FU=Follow Up; GSW=Global Self-Worth; HADS= Hospital Anxiety Depression Scale; HE=Health-education; HHS= Herth Hope Scale; IPPA=Inventory of Positive Psychological Attitudes-32R; ITT=Intention to Treat Analysis; Low=Low Intensity; MAACL=Multiple Affect Adjective Check List; MET-Ex=Motivational Enhancement Therapy for Exercise; Mo=Months; MoI=Motivational Interviewing; MoD=Moderate-intensity; n=sample size; NS=Not stated; M=Mean; MBCT=Mindfulness Based Cognitive Therapy; Mo=Months; NHP=Nottingham Health Profile; PHSCS=Piers-Harris Children's Self-Concept

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Scale; POMS-SF=The Profile of Mood States-Short Form; QoL=Quality of Life; PA=Physical Activity; PANAS=Positive and Negative Affect; PANAS-C=The Positive and Negative Affect Schedule for Children; PBS=Personal Burnout Scale; PE=Physical Education; PI=Post Intervention; PMR=Progressive Muscle Relaxation; POMS-(SF)=Profile of Mood States-(Short Form); PP=Pre-Post Intervention; PSS= Perceived Stress Scale; PSW=Physical Self-Worth; RCT=Randomised Control Trail; RE=Resistance Exercise; RS=Resilience Scale; RSES=Rosenberg Self-Esteem Scale; SCL90=Hopkins Symptom Checklist; SIMS=Situational Motivation Scale; SM=Stress-management; SPP=Self-Perception Profile for Adolescents ; STAI=State Trait Anxiety Inventory; STAIC=State-Trait Anxiety Inventory for Children; STAXI-2 State-Trait Anger Expression Inventory-2; SSRS=Social Skills Rating System; TAS=Test Anxiety Survey; TLFB=Timeline Follow back; TSCS=Tennessee Self-Concept Scale; VAS=Visual Analog Scale; VIG=Vigorous-intensity; Wks=Weeks; wait-list=Wait list; YRBS=Youth Risk Behaviour Survey; Yrs=Years

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Table 2: TIDiER table describing characteristics of the interventions

Author	Physical Activity/Exercise Interventions	Exercise intensity/type	Non Physical Activity/Exercise Interventions	Personnel delivering treatment	Individual/group	Duration frequency
Aras 2016(51)	Rock climbing: "Climbing training by using a top-rope method. Before a one-hour climbing exercise, a standard warm-up and cool-down protocol was applied composing of a 5min run and 10min stretching. Warm-up running exercise was done at a lower level as recommended"	CBD [likely MODERATE to VIGOROUS], Strength training	No intervention	Safety instructor	Not stated	60min/3xwk/8wks
Baghurst 2014(52)	PA: "Classes were offered for a tremendous array of sports and games, and individuals signed up based on the activities they wanted to participate in. The activities that were represented included basketball, volleyball, badminton, table tennis, martial arts, tennis, racquetball, softball, bowling, soccer, and touch football." CE: "Both aerobic and anaerobic fitness were emphasized, and the focus was improving physical fitness over participating in a sport"	PA: CBD [likely MODERATE], AEROBIC; CE: CBD [likely MODERATE to VIGOROUS] AEROBIC and RESISTANCE	SM: "The SM groups divided their time between lectures (25%); cognitive-behavioural exercises, concepts, and hands-on participation (25%); mental and physical relaxation strategies, techniques instruction, and practice (25%); and exercise and wellness participation (25%);" Control group = No intervention	Reads as instructors	Group	50min 3xwk/16wks
Balkin 2007(36)	RE: (weight lifting) Anaerobic exercise, further information not stated; AE: Aerobic exercise, further information not stated	RE: CBD, RESISTANCE; AE: CBD, AEROBIC	No intervention	Not stated	Not stated	(frequency, duration ns) 6wks
Bao 2015(63)	Tai Chi: "The Tai Chi intervention focused on the coordination of individual postures, balance, body awareness and breathing. The Yang-style Tai Chi (24 forms) was used. During the sessions, the instructor demonstrated the Tai Chi movements, and participants imitated the motions and postures. New Tai Chi movements were introduced in each session" Gymnastics: "China's 8th edition broadcasting gymnastics, which are a form of physical exercise with stronger exercise intensity than the Tai Chi"	Tai Chi: CBD [likely LIGHT]; Gymnastics: CBD [likely MODERATE to VIGOROUS]	NA	Tai Chi: A martial arts coach of the Tai Chi from Shandong Sports Team; Gymnastics: Not stated	Group	60min 5xwk/52wks

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Berger 1988(61)	AE: "(running/jogging) Joggers ran 3 times a wk for a minimum of 20 mins per session. They monitored their exercise pulse rates and maintained a jogging intensity of 65-80% of their age-adjusted HR"	Aerobic MODERATE to VIGOROUS, AEROBIC	Discussion group: "Self-selected health projects that formed the bases of the periodic group meetings. The participants and the leader helped each other by providing information, practical assistance, encouragement, and reinforcement for behavioural health practices"; PRM: "Benson's relaxation response, a common method of stress reduction"	Not stated	Group	Joggers: 20min 3xwk/12wks; PMR: 20min 5xwk/12wks; Discussion: 75min wk/12wks
Bonhauser 2005(40)	Enhanced PE: "The first step included minimum activity with no weight transfer: stretching, and nonstrenuous arm, leg and trunk movement. The second step included Weight transfer activities and incorporated dynamic large muscle movements such as fast walking, running and jumping. The third step consisted of sports practice. Women chose dance, aerobics, track practice and volleyball. Men chose soccer, basketball, volleyball and track practice"; Standard PE: "Classes consisted of a variety of mixed activities, including general training (running, jumping), playing games and practicing sports that changed from session to session"	Enhanced PE: CBD [likely MODERATE to VIGOROUS]; Standard PE: CBD [likely MODERATE to VIGOROUS]	NA	Teacher	Group	Enhanced PE: 90min 3xwk/10wks; Standard PE: 90min 1xwk/10wks
Cecchini-Estrada 2015(46)	PA-1: "Epstein's TARGET strategies: "PA intervention program based on Epstein's TARGET strategies (Task, Authority, Reward, Groupings, Assessment, Time)" taught by physical education teacher;" PA-2: "Usual programmed training sessions taught by physical education teacher, without Epstein's TARGET;" PA-3: "Usual programmed training sessions, no physical education teacher present"	PA-1, PA-2, PA-3: CBD	Stretching/flexibility: "The control group carried out placebo physical exercise, defined as 3 days/wk of stretching and flexibility exercises"	PE Teachers	Group	60min 3xwk/8wks
Daley 2006 (50)	AE-mod: "A range of aerobic exercise activities (e.g., stepping, cycling, rowing, dance and walking) and were asked to exercise intermittently at moderate intensity (40-59% of HR reserve). Exercise counselling for behaviour change was also an integral part of the exercise sessions;" CE-low: "light body-	AE-mod: MODERATE, AEROBIC; CE-low: LIGHT, AEROBIC/RESISTANCE	No intervention	Researcher	Individual	60min 3xwk/8 wks

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	conditioning/stretching exercises, during which HR was maintained at <40% of HR reserve, and no exercise counselling or behavioural change advice was given"					
Gallego 2015(53)	PE: "An initial 15min period of individual static stretches, postural, and breathing corrections in supine, prone, seated, and all-fours positions. The main part comprised 30min of adapted sports games, emphasizing the respiratory and postural correction. The final 15mins involved paired static stretching, breathing and postural correction." MBCT (incl. yoga): "Participants were trained in body exploration (body scan), breathing with complete attention (mindful breathing), 3min breathing (breathing space), yoga and sitting meditation exercises (sitting meditation). Likewise, metaphors and poetry were used to illustrate the main concepts and components of mindfulness"	PE: CBD [likely MODERATE]; MBCT: CBD [likely SEDENTARY to LIGHT]	No intervention	PE: Specialist with 10 years' experience; MBCT: Therapist	Not stated	60min 1xwk/8wks
Hemat-Far 2012(37)	AE: "(jogging/running) 10mins jogging, stretching, 3 sets of 6min of moderate intensity running (60-65% MHR)"	AE: MODERATE, AEROBIC	No intervention	Researcher	Not stated	40-60min 3xwk/8wks
Hilyer 1982(54)	CE: "(weight training + running) 10min of flexibility exercises - 15 static flexibility movements done in a prescribed sequence. 5 movements were done in a supine position, 5 were done in a sitting position, and 5 in a standing position. Each movement was repeated 3 times and held for 5 sec at the point of maximum muscle extension. Each group followed the same strength development program consisting of basic strength movements done in a progressive systematic sequence. The strength program used was as follows: Bench Press—2 sets, 8 reps; Upright Rowing—2 sets, 8 reps; Curls—2 sets, 8 reps; Standing Press—2 sets, 8 reps; Sit-Ups—2 sets; Push-Ups—2 sets; Chins—2 sets. At the completion of the strength workout each counsellor would take the group out for a run"	CE: CBD, RESISTANCE/AEROBIC [likely MODERATE to VIGOROUS]	Rehabilitation program	Physical fitness counsellors	Group	90min 3xwk/20wks

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Khalsa 2012(44)	PE: "Schools standard PE elective"; Yoga: "A modified version of the Yoga Ed program for secondary schools. This secular program includes simple yoga postures, breathing exercises, visualization, and games with an emphasis on fun and relaxation and minimizing risk without unduly complex or physically athletic or demanding techniques. An important component of the program also includes development and training in the cognitive skills of mindfulness and self-awareness and a yoga based psychological and philosophical attitude."	PE: CBD [likely MODERATE to VIGOROUS]; Yoga: CBD [likely LIGHT]	NA	Yoga: Qualified yoga teacher; PE: NS	Group	30-40min 2-3xwk/11 wks
Khorvash 2012(47)	RE: (strength training) short-distance sprint running, strength (power) work- outs, and working with equipment. AE: (endurance training) aerobic warm-up and at least, 1200meter running at the beginning and by 2500meter gradually to the end of period	RE: CBD, RESISTANCE & AEROBIC (sprint intervals-running) [likely MODERATE to VIGOROUS]; AE: CBD, AEROBIC [likely MOD-VIG]	No intervention	Not stated	Not stated	90min 2xwk/10wks
MacMahon 1988(35)	AE: "Included long-distance running and vigorous basketball, causing a sustained elevation of each subject's HR to above 160BPM;" PE: "Coached by the same personnel as the aerobic program, but it consisted of activities designed to avoid sustained elevation of HR. This program included baseball, volleyball, basketball foul-shot contests, and instruction in wrestling"	AE: VIGOROUS, AEROBIC; PE: CBD [likely MODERATE]	NA	Physical education staff	Group	40min 3xwk/12wks
Melnik 2009(41)	COPE program: (incl. PA) "COPE includes 15-20 min of PA (e.g., Frisbee, kickball, walking, and relay games) for the purpose of building the teens' beliefs/confidence that they could engage in regular PA. The PA component was not intended to be exercise training"	CBD [likely MODERATE], AEROBIC	HE: "Instruction in health topics. Topics included information focusing on common adolescent health concerns, such as acne, safety, first aid, and information concerning careers in the health professions. There was no PA component in the attention control program"	Not stated	Group	50min 2-3x wk/9wks

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Melnyk 2013(42)	COPE program: (incl. PA) manualized 15-session educational and cognitive-behavioural skills-building program. Each session of COPE contains 15–20min of PA (e.g., walking, dancing, kick-boxing movements), not intended as an exercise training program, but rather to build beliefs in the teens that they can engage in and sustain some level of PA on a regular basis."	CBD [likely MODERATE], AEROBIC	Healthy Teens program: "The content was manualized and focused on safety and common health topics/issues for teens, such as road safety, dental care, infectious diseases, immunizations, and skin care. Control teens also received a manual with homework assignments each wk that focused on the topics being covered in class and were asked to review with his or her parent a newsletter that was sent home with the teens 4 times during the program."	High school teachers (with training)	Group	(duration ns) 1xwk/15wks
Nabkasorn 2006(39)	AE: (jogging) "Each session began with a 5-10min warm-up, continued with about 30min of group-based jogging exercise, and ended with a 5-10min cool-down. The exercise class was not strictly supervised, rather, each subject jogged at her own speed. The intensity was adjusted to maintain a constant heart rate of less than 50% of the maximal heart rate reserve"	AE: MODERATE, AEROBIC	WL	Physical fitness instructors	Group	50min 5xwk/8wks
Noggle 2012(43)	Yoga: "The yoga sessions were structured to include a 5min centering, a 5min warm-up, 15min of yoga postures/exercises, and a 5min closing relaxation. Breathing techniques were progressively incorporated during the initial centering. In addition, slow abdominal breathing was a focus throughout the duration of all sessions. Each session had a theme or talking point that was discussed throughout the session by the instructor;" PE: "Units included traditional sports such as tennis, volleyball, hockey, football, ultimate frisbee, and baseball. Non-traditional sports were also included, such as a ropes course, backcountry living skills, stress management, first aid/cardiac pulmonary resuscitation, and planned parenthood health and wellness"	Yoga: CBD [likely LIGHT]; PE: CBD [likely MODERATE]	NA	Yoga instructor; PE instructor	Group	30-40min 2-3xwk/10wks

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Norris 1992(62)	AE-high: "Followed a recommended protocol for aerobic exercise to music, and maintained a level of 70-75% MHR;" AE-mod: "Followed a recommended protocol for aerobic exercise to music, and maintained a level of 50-60% MHR"	AE-high: VIGOROUS, AEROBIC; AE-mod: MODERATE, AEROBIC	Stretching: "The stretching group completed a recognized protocol for flexibility training which involved little increase in resting HR and was accompanied by music;" No Intervention	Experienced Instructor	Group	25-30min 2xwk/10wks
O'Dougherty 2012(58)	AE: "Exercise intensity was set at 65–70% of age predicted MHR for the first 4 wks of exercise, 70–75% of the MHR for wks 5–8, 75–80% of the MHR for wks 9–12, and 80–85% of the MHR for the final stage, which ranged from 2 to 6 wks depending on each participant's menstrual cycle length. The options for exercise were to use the any of the following equipment: the elliptical, stair stepper or treadmill. Walking or jogging outdoors was not permitted except when participant travel precluded use of gym facilities and equipment"	AE: MODERATE to VIGOUROUS, AEROBIC	No intervention	Certified fitness professionals	Individual	30min 5xwk/16wks
Robledo-Colonia 2012(59)	AE: Sessions consisted of walking (10 min), aerobic exercise (30 min), stretching (10 min), and relaxation (10 min). Aerobic activities were prescribed at moderate to vigorous intensity, aiming for 55–75% of MHR"	AE: MODERATE to VIGOUROUS, AEROBIC	No intervention	Physiotherapist	Group	60min 3xwk/12wks
Roth 1987(55)	AE: (walking/running): "Running and brisk walking were the aerobic exercise activities used in the class. Each subject also participated in warm-up and cool-down stretching exercise each day. Each subject was initially given an individualized exercise prescription that would elicit an exercise heart rate that was approximately 75% of predicted maximum"	AE: VIGOROUS, AEROBIC	PMR: "During the first meetings, the subjects were taught an abbreviated version of Jacobson's progressive muscle relaxation training procedure. Later in the class, other techniques, such as mental imagery procedures, were introduced and practiced. Toward the end of the class, very few explicit instructions were provided, and individual flexibility in the utilization of the various techniques taught was encouraged;" No intervention	Instructor trained in exercise physiology & clinical psychology	Group	30min 3xwk/11 wks
Rotheram-Borus 2016(60)	Soccer: "Soccer practices were held late in the afternoon, so that the young men would have to abstain from alcohol and drugs for most of the day prior to the soccer practice. Competitive games were held on Saturdays	Soccer: CBD [likely VIG], AEROBIC	WL	Soccer Coaches	Group	Duration ns/2xwk/6mths

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	so that families and female partners could attend. There was fruit and water available at the games for all attendees"					
Sabourin 2016(45)	CBT + AE: "The third session included running. "Participants ran as a group for 10min, during which they were instructed to pay attention to the physical sensations and reflect on how these paralleled anxiety sensations"	CBT+AE-running: LIGHT to MODERATE, AEROBIC/RESISTANCE	HE: "The health education condition focused on the importance of exercise, nutrition, and sleep on optimal health, using a brief video presentation, followed by an interactive discussion of the topics. The interactive discussion was added to make the two groups comparable in format (therapist-led group interactive discussion) and duration."	Therapist	Group then individual	10min/3xwk/14 wks
Smith 2011(38)	Both yoga groups engaged in a Hatha yoga style that was heavily influenced by the Kripalu method of yoga practice. Yoga groups began each session with warm-up, stretching, and breathing exercises to prepare for yoga postures. Integrated Yoga: "At the beginning of each session, warm-up, stretching, and breathing exercises were accompanied by a meditation for the day that was based on 1 of the yamas or niyamas of yogic philosophy. Participants were instructed to reflect on this statement as they executed the day's poses and were reminded of the phrase as well as appropriate associated reflections pertaining to the poses being taught" Yoga-as-exercise: "The spiritual meditation was omitted, and participants were guided through a meditation using mindful breathing"	Yoga: CBD [likely LIGHT]	No intervention	Yoga instructor	Group	60min 2xwk/7wks
Taspinar 2014(57)	Hatha Yoga: "After warm-up workouts,ardha navasana, marichyasana, shalabhasana, balasana, chaturanga dandasana, adho mukho svanasana, tadasana, vrksasana, uttanasana, utkatasana, utthita trikonasana, parivitta trikonasana, utthita parsvakonasana, salamba sarvangasana, viparita karani, sarvangasana, and shavasana were performed;" RE: (weight training): "The exercises used were chest press, shoulder press, lat pull	Yoga: CBD [likely LIGHT] RE: CBD, RESISTANCE	No intervention	Yoga: Yoga instructor; RE: NS	Not stated	50min 3xwk/7wks

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	down, cable biceps curl, triceps push down, leg extension, leg curl, sit-ups, and reverse sit-ups. The order of the exercises was planned so that they were directed at major muscle groups first and then minor muscle groups and at least 1-2min of rest was required between the sets of reps. At least 2-3min of rest was required when passing between the exercise stations and at least 1 day of rest was required between exercise sessions"					
Weinstock 2014(64)	MET-Ex + CM: "The same MET intervention as outlined above, plus 8 wks of CM for exercise. The exercise activity contracts identified 3 specific exercise activities to be completed by the participant within the upcoming wk. Options included walking with a pedometer, walking or jogging on a treadmill for 15min, or attending an exercise class at the gym. Each exercise bout was explicitly defined in terms of duration and length, as well as objective verification needed for proving completion. initial exercise activities were in the light (<40% VO2 Max) to moderate (40% – <60% VO2 Max) intensity range as tolerated by the participant" MET-Ex: "Interventionists provided personalized feedback about the student's exercise habits in comparison to population norms and exercise guidelines at the time. Next, a discussion about how exercise fit within the participant's lifestyle goals and values was conducted. Last, the student in conjunction with the interventionist developed a change plan to begin exercising"	MET-ex: LIGHT to MODERATE, AEROBIC/RESISTANCE	NA	kinesiologist & clinical psychologist	Not stated	MET: 50min single session; MET+CM: (duration ns) 1xwk/8wks
Weinstock 2016(49)	EC: "Intervention reinforced participants for attending the exercise contracting sessions (regardless of exercise activity completion). Collaboratively, the therapist and participant completed an exercise contract. The contract contained at least three specific exercise activities to be completed EC: within the upcoming wk. Exercise activities were selected by the participants to ensure the activities were of interest. Activities ranged widely and	EC: CBD [likely MODERATE to VIGOROUS], AEROBIC	NA	Therapist	Individual	10-15min/frequency ns/8wks

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	<p>included jogging on a treadmill, attending an exercise class, and swimming. Each activity was explicitly defined in terms of intensity and duration, as well as objective verification needed for proving completion;"</p> <p>CM: "Participants in the MoI+CM were reinforced for completion and verification of exercise activities specified on the wkly exercise contract. Participants earned one draw from a prize bowl for each exercise activity completed. For each wk in which at least three activities were completed, participants received bonus draws;"</p> <p>MoI: "The MoI sessions were framed as a "wellness intervention" for increasing exercise and adhered to the principles of MI. As the focus of the intervention was to promote exercise, motivation to reduce heavy drinking was not discussed unless first raised by participants within the context of starting and maintaining an exercise routine"</p>					
Wipfli 2011(56)	<p>AE: "(cycling) stationary cycling at 70% of age-predicted MHR;"</p> <p>Stretching/yoga: "Participants in this group were led through a series of stretches and yoga poses, holding each stretch/pose for 15–30s, with 10–20s of rest in between. The routine included yoga poses such as upward- and downward-facing dog, cat pose, and warrior pose, along with typical standing hamstring, quadriceps, and calf stretches"</p>	<p>AE: MODERATE to VIGOROUS, AEROBIC; Stretching/yoga: CBD [likely LIGHT]</p>	NA	Researchers	Not stated	30min 3xwk/7wks

AE=Aerobic Exercise; CBT=Cognitive Behavioural Therapy; CE=combined aerobic + resistance; CBD: Cannot Be Determined; CM=Contingency Management; EC=Exercise Contracting; HE=Health-education; HR=Heart Rate; MET-Ex=Motivational Enhancement Therapy for Exercise; MoI=Motivational Interviewing; MBCT=Mindfulness Based Cognitive Therapy; MHR=Maximum Heart Rate; Min=Minutes; Mo=Months; Mod=Moderate-intensity; NA=Not Applicable; NS= Not stated; PA=Physical Activity; PE=Physical Education; PMR=Progressive Muscle Relaxation; RE=Resistance Exercise; S=Seconds; SM= Stress-management; Wks=Weeks; wait-list=Wait list; Yrs=Years;