This is the author-created version of the following work:

Munro, Neil Richard, Teague, Samantha, Somoray, Klaire, Simpson, Aaron, Budden, Timothy, Jackson, Ben, Rebar, Amanda, and Dimmock, James (2026) *Effect of exercise on depression and anxiety symptoms: systematic umbrella review with meta-meta-analysis.* **British Journal of Sports Medicine, . (In Press)**

Access to this file is available from:

https://researchonline.jcu.edu.au/91059/

Please refer to the original source for the final version of this work:

https://doi.org/10.1136/bjsports%2D2025%2D110301

Supplementary material index

Appendix 1 – Database search terms

SCOPUS

((TITLE (depression OR anxiety OR "Mood disorder" OR "Behavioural symptoms" OR depress* OR mood OR compulsive OR ocd) OR ABS (depression OR anxiety OR "Mood disorder" OR "Behavioural symptoms" OR depress* OR mood OR compulsive OR ocd))) AND ((TITLE (exercise OR yoga OR sports OR running OR jogging OR "physical conditioning" OR "exercise therapy" OR "Physical activity") OR ABS (exercise OR yoga OR sports OR running OR jogging OR "physical conditioning" OR "exercise therapy" OR "Physical Activity"))) AND ((TITLE ("Meta-Analysis" OR "Meta Analysis" OR systematic OR umbrella) OR ABS ("Meta-Analysis" OR "Meta Analysis" OR systematic OR umbrella))) AND ((TITLE (rct OR random* OR "control trial") OR ABS (rct OR random* OR "control trial")))

PsychINFO

(tiab(depression) OR tiab(anxiety) OR tiab(mood) OR tiab(behavioral issues) OR tiab(Mental Health) OR tiab(depressive)) AND (tiab(Exercise) OR tiab(Yoga) OR tiab(Running) OR tiab(jogging) OR tiab(Sport) OR tiab(Exercise Therapy) AND tiab(physical activity)) AND (tiab(Meta Analysis) OR tiab(meta-analysis) OR tiab(systematic review) OR tiab(umbrella)) AND (tiab(RCT) OR tiab(randomised control trial) OR tiab(randomized control trial) OR tiab(randomised control) OR tiab(randomized trial))

CINAHL

TI (depression OR anxiety OR "Mood disorder" OR "Behavioural symptoms" OR depress* OR mood OR compulsive OR ocd OR "Mental Health") AND TI (exercise OR yoga OR sports OR running OR jogging OR "physical conditioning" OR "exercise therapy" OR "Physical activity") AND TI (rct OR random* OR "control trial" AND TI ("Meta-Analysis" or "Meta Analysis" or systematic or umbrella)

Ovid MEDLINE

1 - exp Depression/ or exp Anxiety/ or exp Mood Disorders/ or Depressive.mp. or exp Behavioral Symptoms/ [mp=title, book title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms, population supplementary concept word, anatomy supplementary concept word]

2 - exp Exercise/ or Yoga/ or exp Sports/ or exp Running/ or exp exercise therapy/ or physical conditioning.mp. [mp=title, book title, abstract, original title, name of

substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms, population supplementary concept word, anatomy supplementary concept word]

3 - "Randomized Controlled Trials as Topic"/ or RCT.mp. or random*.mp. [mp=title, book title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms, population supplementary concept word, anatomy supplementary concept word]

4 – 1 and 2 and 3

5 - limit 4 to (meta analysis or "review" or "systematic review")

6 - limit 5 to (meta analysis or "review" or "systematic review")

SPORTDiscus
(depression OR anxiety OR "Mood disorder" OR "Behavioural symptoms" OR depress* OR mood OR compulsive OR ocd OR "Mental Health") AND TI (exercise OR yoga OR sports OR running OR jogging OR "physical conditioning" OR "exercise therapy" OR "Physical activity") AND (rct OR random* OR "control trial" AND TI ("Meta-Analysis" or "Meta Analysis" or systematic or umbrella)

EMBASE
((TITLE (depression OR anxiety OR "Mood disorder" OR "Behavioural symptoms" OR depress* OR mood OR compulsive OR ocd) OR ABS (depression OR anxiety OR "Mood disorder" OR "Behavioural symptoms" OR depress* OR mood OR compulsive OR ocd))) AND ((TITLE (exercise OR yoga OR sports OR running OR jogging OR "physical conditioning" OR "exercise therapy" OR "Physical activity") OR ABS (exercise OR yoga OR sports OR running OR jogging OR "physical conditioning" OR "exercise therapy" OR "Physical Activity"))) AND ((TITLE ("Meta-Analysis" OR "Meta Analysis" OR systematic OR umbrella) OR ABS ("Meta-Analysis" OR "Meta Analysis" OR systematic OR umbrella))) AND ((TITLE (rct OR random* OR "control trial") OR ABS (rct OR random* OR "control trial")))

COCHRANE LIBRARY

Title Abstract Keyword (depression OR anxiety OR "Mood disorder" OR "Behavioural symptoms" OR depress* OR mood OR compulsive OR ocd OR "Mental Health") AND Title Abstract Keyword (exercise OR yoga OR sports OR running OR jogging OR "physical conditioning" OR "exercise therapy" OR "Physical activity") AND Title Abstract Keyword (rct OR random* OR "control trial" AND Title Abstract Keyword ("Meta-Analysis" or "Meta Analysis" or systematic or umbrella)

Supplementary Table 1 - Characteristics of individual studies

Meta-Analysis Study reference	Component studies (n=)	Population sample total (n=)	Population characteristics	Intervention categories	Outcome categories	AMSTAR Categorisation
Axelsdottir, 2021	4	159	Youth Under 18; Depression symptoms	Mixed exercise	Depression	High
Aylett 2018,	6	204	Adults aged 18 and over; Anxiety symptoms	Aerobic	Anxiety	High
Bailey, 2017	16	771	Youth and Adolescents aged 12 to 25; Depressive symptoms, clinical and non-clinical, and depression diagnosis	Mixed exercise, aerobic and combined aerobic and resistance sub-categories	Depression	Low
Bjorkman, 2021	10	605	Adults aged 18 and over; Post Traumatic Stress Disorder	Mixed exercise	Anxiety	Critically low
Bridie, 2012	9	519	Late Adulthood aged 60 and over; Depression symptoms	Mixed exercise	Depression	Low
Carter, 2016	8	384	Youth Under 18; Depressive symptoms	Mixed exercise	Depression	Critically low
Carter, 2019	17	1428	Postnatal females; Depression symptoms	Mixed exercise	Depression	Low
Carter, 2021	9	515	Youth & Adolescent aged under 25; Anxiety symptoms	Mixed exercise	Anxiety	Low
Chen, 2025	10	514	College students; Anxiety symptoms	Mixed exercise	Anxiety	Critically low
Chi, 2013	6	365	Late Adulthood aged 55 and over; Depression symptoms	Mind-body, duration up to 12 weeks and above 24 weeks.	Depression	Critically low
Conn, 2010 (a)	60	2679	Adults aged 18 and over; Depression symptoms	Mixed exercise, supervised and unsupervised sub-categories	Depression	Critically low
Conn, 2010 (b)	13	2786	Adults aged 18 and over; Anxiety symptoms	Mixed exercise	Anxiety	Critically low
Correia, 2024	13	1058	Adults aged 18 to 65; Depression diagnosis	Mixed exercise, frequency up to 150 minutes per week and over 150 minutes per week. Intensity light to moderate, moderate, and moderate to vigourous. Group and individual based activity.	Depression	Critically low
Cramer, 2013	7	281	Adults aged 18 and over; Depression and anxiety symptoms	Mind-body	Depression and anxiety	Low
Cramer, 2018	5	279	Adults aged 18 and over; Anxiety symptoms	Mind-body	Depression and anxiety	Low
Daley, 2009	5	221	Postnatal females; Postnatal depression	Mixed exercise	Depression	Critically low
Daley, 2014	6	348	Prenatal females; Depression symptoms	Mixed exercise	Depression	Critically low
Daley, 2018	8	528	Postnatal females; Mothers with depression <1 year postpartum	Mixed exercise, including group based sub-category	Depression	Critically low
Davis, 2021	6	215	Adults aged 18 to 65; Depression diagnosis	Aerobic	Depression	Critically low
Ensari, 2015	36	1233	Adults aged 18 and over; Depression symptoms	Mixed exercise	Anxiety	Critically low
Gaia, 2024	9	500	Adults aged 18 and over; Depression and anxiety symptoms	Aerobic	Depression and anxiety	High
Gallegos, 2017	4	174	Adults aged 18 and over; Post Traumatic Stress Disorder	Mind-body	Anxiety	Critically low
Gong, 2015	6	375	Prenatal females; Depression symptoms	Mind-body	Depression	Critically low
Guo, 2020	10	573	College students, age not explicit; Depression symptoms	Mixed exercise	Depression	Critically low
Han, 2025	22	1564	Adults aged 18 and over; Depression symptoms	Mixed exercise	Depression	High
Heissel, 2023	41	2658	Adults aged 18 to 65; Depression symptoms	Mixed exercise, aerobic, resistance, group-based, individual, supervised and unsupervised sub-categories. Intensity, low, moderate and vigourous.	Depression	Low
Huang, 2023	50	3366	Emerging adults aged 18 to 30; Depressive mood	Mixed exercise, duration 6 to 8 weeks, 10 to 12 weeks, 14 to 17 weeks, 18 to 24 weeks. Frequency, 2, 3, 4 and 5 days per week. Mind-body activities, qijong, wushushanda and yoga. Aerobic, basketball and resistance.	Depression	Critically low
Jazayeri, 2022	42	1558	Adults aged 18 and over; Depression symptoms	Aerobic, resisatance and combined sub-categories	Depression	Critically low
Ko, 2023	5	328	Late Adulthood aged 60 and over; Depression symptoms	Mind-body, yoga.	Depression	Critically low
Krogh, 2017	35	2498	Adults aged 18 and over; Major depression symptoms	Mixed exercise	Depression	Low
Lawlor, 2001	10	432	Adults aged 18 and over; Depression diagnosis	Mixed exercise	Depression	Low
Lee, 2021	22	1025	Adults aged 18 to 59, and aged 60 and over; Depression symptoms	Mixed exercise, aerobic, individual, group, supervised and unsupervised sub-categories.	Depression	Critically low
Li, 2023	35	5293	Youth Under 18; Depression symptoms	Mixed exercise, aerobic, resistance, group-based and mind-body sub-categories.	Depression	High
Li, 2024	12	658	Youth aged 6 to 35; Depression symptoms	Aerobic	Depression	Critically low
Lin, 2022	17	1910	Emerging adults aged 18 to 30; Depression and anxiety symptoms	Mind-body	Depression and anxiety	Low
Liu, 2022	20	2866	Perinatal females; Perinatal Depression symptoms	Mixed exercise, mind-body, aerobic, individual and group-based sub-categories. Bout duration 40 to 90 minutes and above 150 minutes. Duration 3 to 4 weeks, 6 to 9 weeks, and 12 weeks and above	Depression	Low

Liu, 2023	17	1463	Prenatal females; Depression diagnosis	Mixed exercise	Depression	Critically low
Luo, 2022	15	2003	Emerging adults aged 18 to 30; Depression and anxiety symptoms	Mixed exercise, frequency 3 days or less per week and 4 days a week or more. Duration 8 weeks or less and over 8 weeks	Depression and anxiety	Critically low
Mahmoudi, 2022	26	1354	Late Adulthood aged 60 and over; Depression symptoms	Mixed exercise, aerobic and combined aerobic and resistance sub-categories. Female and male categorisation. Exercise duration 9 to 24 weeks, and above 24 weeks.	Depression	Low
Martínez-Domínguez, 2018	27	3662	Adults aged 40 and over; Anxiety symptoms	Mixed exercise, duration 12 to 18 weeks and 6 to 14 months, intensity low and medium	Anxiety	Critically low
Mead, 2010	23	907	Adults aged 18 and over; Depression symptoms	Mixed exercise, including aerobic, resistance and mixed exercise sub-categories	Depression	High
Morres, 2018	11	455	Adults aged 18 and over; Major depressive disorder	Mixed exercise	Depression	Low
Morres, 2022	16	2025	Perinatal females; Perinatal Depression symptoms	Mixed exercise	Depression	Low
Nebiker, 2018	29	1424	Adults aged 18 and over; Depression diagnosis	Aerobic and resistance.	Depression	Critically low
Park, 2014	24	3152	Late Adulthood aged 65 and over; Depression symptoms at 3 months, 6 months, and 12 months	Mixed exercise	Depression	Critically low
Ramos-Sanchez, 2021	13	731	Adults aged 18 and over; Diagnosed Anxiety	Mixed exercise	Anxiety	High
Robertson, 2012	8	295	Adults aged 18 and over; Depression symptoms	Aerobic, walking, including group walking sub-category	Anxiety	Critically low
Rosenbaum, 2014	20	1298	Adults aged 18 and over; Depressive symptoms with a mental illness	Mixed exercise	Depression	Critically low
Rosenbaum, 2015	7	383	Adults aged 18 and over; Post Traumatic Stress Disorder	Mixed exercise	Depression and anxiety	Critically low
Rossi, 2024	29	1980	Adults aged 18 to 65; Depression symptoms	Resistance, duration 11 weeks or less and 12 weeks or more. Frequency 1 to 2 times per week and 3 or more times per week.	Depression	Low
Sanchez-Polan, 2021	13	2531	Prenatal females; Depression symptoms	Mixed exercise	Depression	Low
Sani, 2023	4	243	Adults aged 18 and over; Depression symptoms	Mind-body	Depression	Low
Schuch, 2016	9	384	Adults aged 18 and over; Major depressive disorder	Mixed exercise	Depression	High
Stubbs, 2017	6	262	Adults aged 18 and over; Depression symptoms	Aerobic	Anxiety	Low
Volbehr, 2018	11	603	Adults aged 18 to 65; Depression and anxiety symptoms	Mind-body	Depression	Critically low
Wang 2014,	4	247	Adults aged 18 and over; Anxiety symptoms	Mind-body	Anxiety	Critically low
Wang, 2022	19	1205	Youth Under 18; Depression diagnosis and depression symptoms	Mixed exercise	Depression	Critically low
Wang, 2023	12	1260	Postnatal females; Postnatal depression	Mixed exercise, aerobic walking exercise, mind-body yoga activity.	Depression	Low
Yu, 2024	47	3954	Perinatal females; Depression and anxiety symptoms	Mixed exercise	Depression and anxiety	Low
Yue, 2025	32	3401	Adults aged 18 and over; Depression and anxiety symptoms	Mixed exercise	Depression and anxiety	Critically low
Zeng, 2023	12	731	Adults aged 45 and over; Depression symptoms	Mind-body activities, tai-chi. Duration 9 to 24 weeks and above 24 weeks.	Depression	Critically low
Zhang, 2023	13	433	Youth Under 18; Depression symptoms	Mixed exercise, aerobic, individual and group-based sub-categories. Duration 8 weeks or less, 8 to 12 weeks, over 12 weeks. Frequency 1 or 2 days per week, 3 days a week or more. Intensity low or moderate to vigourous.	Depression	Low
Zoogman, 2019	38	2295	Adults aged 18 and over; Anxiety symptoms	Mind-body, yoga	Anxiety	Critically low

Supplementary Table 2 - AMSTAR-2 categorisation

	AMSTAR 2 - Critical domains							AMSTAR 2 - Non critical domains									Overall AMSTAR 2 rating
	2	4	7	9	11	13	15	1	3	5	6	8	10	12	14	16	
	Protocol registered	Literature search	List of excluded studies	Risk of bias from studies included studies	Appropriate meta-analytical methods	Consideration of bias in results	Assessment of publication bias	PICO criteria applied	Included study designs explained	Study selection in duplicate	Data extraction in duplicate	Included studies described	Funding sources stated	Impact of risk of bias on results	Heterogeneity explained	Conflict of interest reported	
Axelsdottir, 2021	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	**High**
Aylett, 2018	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	**High**
Bailey, 2017	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	**Low**
Bjorkman, 2021	No	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	**Critically low**
Bridle, 2012	No	Yes	Partial	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	**Low**
Carter, 2016	No	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	**Critically low**
Carter, 2019	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	**Low**
Carter, 2021	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	**Low**
Chen, 2025	Yes	Yes	No	No	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	**Critically low**
Chi, 2013	No	Yes	No	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	**Critically low**
Conn, 2010 (a)	No	Yes	No	No	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	No	**Critically low**
Conn, 2010 (b)	No	Yes	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	**Critically low**
Correia, 2024	Yes	Yes	No	Yes	Yes	No	No	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	**Critically low**
Cramer, 2013	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	**Low**
Cramer, 2018	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	No	**Low**
Daley, 2009	No	Yes	No	Partial	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	**Critically low**
Daley, 2014	No	Yes	No	No	Yes	No	No	Yes	Yes	Yes	Yes	No	Yes	No	Yes	Yes	**Critically low**
Daley, 2018	Yes	Yes	No	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	**Critically low**
Davis, 2021	No	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	No	**Critically low**
Ensari, 2015	No	Yes	No	No	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	**Critically low**
Gaia, 2024	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	**High**
Gallegos, 2017	No	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	**Critically low**
Gong, 2015	No	Yes	Yes	No	Yes	No	No	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	**Critically low**
Guo, 2020	No	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	**Critically low**
Han, 2025	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	**High**
Heissel, 2023	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	**Low**
Huang, 2023	No	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	No	No	Yes	Yes	No	Yes	Yes	**Critically low**
Jazayeri, 2022	No	Yes	No	No	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	No	No	Yes	Yes	**Critically low**
Ko, 2023	No	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	**Critically low**
Krogh, 2017	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	**Low**
Lawlor, 2001	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	**Low**
Lee, 2021	Yes	Yes	No	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	**Critically low**
Li, 2023	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	**High**
Li, 2024	Yes	Yes	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes	Yes	Yes	No	Yes	Yes	**Critically low**
Lin, 2022	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	**Low**
Liu, 2022	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	**Low**
Liu, 2023	No	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	**Critically low**
Luo, 2022	No	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	**Critically low**
Mahmoudi, 2022	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	**Low**
Martínez-Domínguez, 2018	No	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	**Critically low**
Mead, 2010	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Partial	Yes	Yes	Yes	Yes	**High**
Morres, 2018	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	No	**Low**
Morres, 2022	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	**Low**
Nebiker, 2018	No	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	**Critically low**
Park, 2014	No	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	No	**Critically low**
Ramos-Sanchez, 2021	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	**High**
Robertson, 2012	No	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	No	No	No	No	**Critically low**
Rosenbaum, 2014	Yes	Yes	No	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	**Critically low**
Rosenbaum, 2015	No	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	**Critically low**
Rossi, 2024	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	**Low**
Sanchez-Polan, 2021	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	**Low**
Sani, 2023	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	**Low**
Schuch, 2016	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	**High**
Stubbs, 2017	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	**Low**
Volbehr, 2018	No	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	**Critically low**
Wang, 2014	No	Yes	No	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	**Critically low**
Wang, 2022	No	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	**Critically low**
Wang, 2023	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	**Low**
Yu, 2024	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	**Low**
Yue, 2025	Yes	No	No	Yes	No	Yes	Yes	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	**Critically low**
Zeng, 2023	No	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	**Critically low**
Zhang, 2023	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	**Low**
Zoogman, 2019	No	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	No	No	Yes	No	Yes	Yes	No	**Critically low**

Supplementary Table 3 - Depression synthesis results

Population sub category	Outcome	Overall papers (n=)	Individual meta-analysis effects (n=)	Component studies (n=)	Participant population (n=)	CCA Score	Standardised mean difference estimate	Standard error	P value	Confidence Interval upper boundary	Confidence Interval lower boundary	Heterogeneity (I2)
Late adulthood (over 55)	Depression	6	8	72	5,860	0.88%	-0.41	0.05	<0.0001	-0.51	-0.30	0.00
Adults (18+)	Depression	23	27	428	24,154	1.56%	-0.66	0.07	<0.0001	-0.79	-0.54	91.09
Emerging adults (college students)	Depression	4	4	54	4,180	1.42%	-0.81	0.12	<0.0001	-1.06	-0.57	60.14
Youth (under 18)	Depression	6	6	79	7,474	10.53%	-0.53	0.08	<0.0001	-0.81	-0.24	49.54
Female prenatal	Depression	4	4	42	4,717	18.67%	-0.46	0.07	<0.0001	-0.59	-0.32	0.03
Female postnatal	Depression	4	4	42	3,437	26.92%	-0.70	0.11	<0.0001	-0.92	-0.48	0.00
Female perinatal	Depression	11	11	150	15,518	12.62%	-0.52	0.07	<0.0001	-0.66	-0.39	67.06
Clinical depression diagnosis	Depression	7	8	79	4,960	1.70%	-0.73	0.10	<0.0001	-0.93	-0.53	52.08
Non-clinical depression diagnosis	Depression	2	2	24	1,617	14.81%	-0.81	0.09	<0.0001	-0.98	-0.64	0.00

Exercise sub category	Outcome	Overall papers (n=)	Individual meta-analysis effects (n=)	Component studies (n=)	Participant population (n=)	CCA Score	Standardised mean difference estimate	Standard error	P value	Confidence Interval upper boundary	Confidence Interval lower boundary	Heterogeneity (I2)
Aerobic	Depression	15	19	181	9,941	1.48%	-0.81	0.12	0.00	-1.01	-0.60	89.67
Resistance	Depression	8	8	93	4,770	3.96%	-0.62	-0.16	<0.0001	-0.93	-0.31	90.45
Mind body (Yoga, Tai Chi, Qigong, Pilates & Wushusanda)	Depression	13	16	90	7,257	0.96%	-0.53	0.07	<0.0001	-0.66	-0.39	64.22
Mixed exercise (not defined in other categories)	Depression	35	39	631	48,696	1.15%	-0.60	0.04	<0.0001	-0.68	-0.52	78.46
Group exercise	Depression	7	7	70	4,858	2.42%	-0.71	0.12	<0.0001	-0.93	-0.47	55.49
Individual	Depression	5	5	41	2,263	2.72%	-0.38	0.14	0.01	-0.65	-0.11	82.71
Intensity low	Depression	4	4	17	1,063	0.97%	-0.69	0.20	<0.0001	-1.09	-0.30	70.69
Intensity moderate	Depression	4	4	43	3,217	1.30%	-1.02	0.34	0.01	-1.68	-0.35	88.53
Intensity moderate to vigourous	Depression	2	2	11	591	0.00%	-0.78	0.24	0.00	-1.26	-0.31	20.87
Intensity vigourous	Depression	3	3	17	981	0.90%	-0.65	0.08	<0.0001	-0.99	-0.31	0.00
Duration - Short term up to 8 weeks	Depression	4	4	21	958	0.00%	-0.76	0.16	<0.0001	-1.07	-0.45	17.90
Duration - Medium term 9 to 24 weeks	Depression	4	7	45	2,874	0.00%	-0.44	0.07	<0.0001	-0.57	-0.31	46.83
Duration - Long term over 24 weeks	Depression	2	2	20	987	0.00%	-1.11	0.46	0.02	-2.01	-0.21	85.82
Frequency - 1 to 2 days a week	Depression	3	3	30	1,820	0.00%	-0.43	0.15	0.01	-0.73	-0.13	73.75
Frequency - 3 or more days a week	Depression	4	6	39	2,270	0.00%	-0.52	0.12	<0.0001	-0.75	-0.29	58.90
Supervised	Depression	3	3	93	4,624	2.78%	-0.69	0.20	0.00	-1.08	-0.30	90.58
Unsupervised	Depression	3	3	35	1,698	2.78%	-0.46	0.10	<0.0001	-0.66	-0.26	0.00

Overall AMSTAR-2 category	Outcome	Overall papers (n=)	Individual meta-analysis effects (n=)	Component studies (n=)	Participant population (n=)	CCA Score	Standardised mean difference estimate	Standard error	P value	Confidence Interval upper boundary	Confidence Interval lower boundary	Heterogeneity (I2)
AMSTAR-2 High	Depression	6	6	97	8,582	1.95%	-0.61	0.19	0.00	-0.86	-0.36	79.21
AMSTAR-2 Low	Depression	19	19	319	25,258	2.19%	-0.64	0.06	<0.0001	-0.75	-0.52	80.08
AMSTAR-2 Critically Low	Depression	25	32	384	24,090	1.07%	-0.60	0.06	<0.0001	-0.70	-0.49	86.76

Overall category	Outcome	Overall papers (n=)	Individual meta-analysis effects (n=)	Component studies (n=)	Participant population (n=)	CCA Score	Standardised mean difference estimate	Standard error	P value	Confidence Interval upper boundary	Confidence Interval lower boundary	Heterogeneity (I2)
Depression OVERALL	Depression	50	57	800	57,930	1.16%	-0.61	-0.04	<0.0001	-0.69	-0.54	86.00

Supplementary Table 4 - Anxiety synthesis results

Population sub category	Outcome	Overall papers (n=)	Individual meta-analysis effects (n=)	Component studies (n=)	Participant population (n=)	CCA Score	Standardised mean difference estimate	Standard error	P value	Confidence Interval upper boundary	Confidence Interval lower boundary	Heterogeneity (I2)
Adults (18+)	Anxiety	17	18	184	13,186	0.98%	-0.40	0.07	<0.0001	-0.52	-0.27	75.80
Emerging adults (college students)	Anxiety	4	4	48	4,186	1.33%	-0.59	0.03	<0.0001	-0.65	-0.53	0.00
Female perinatal	Anxiety	1	1	17	1,481	0.00%	-1.09	0.12	<0.0001	-1.42	-0.76	88.44
Clinical anxiety diagnosis	Anxiety	2	2	19	935	6.25%	-0.42	0.10	<0.0001	-0.61	-0.22	0.00

Exercise sub category	Outcome	Overall papers (n=)	Individual meta-analysis effects (n=)	Component studies (n=)	Participant population (n=)	CCA Score	Standardised mean difference estimate	Standard error	P value	Confidence Interval upper boundary	Confidence Interval lower boundary	Heterogeneity (I2)
Aerobic	Anxiety	5	7	32	1,235	0.00%	-0.60	0.10	<0.0001	-0.87	-0.33	64.43
Resistance	Anxiety	1	1	5	300	0.00%	-0.56	0.14	<0.0001	-0.84	-0.28	0.00
Mind body (Yoga, Tai Chi, QiJong, Pilates & Wushusanda)	Anxiety	8	9	74	5,175	0.74%	-0.50	0.09	<0.0001	-0.67	-0.32	58.69
Mixed exercise (not defined in other categories)	Anxiety	12	13	170	14,208	1.15%	-0.45	0.07	<0.0001	-0.60	-0.30	89.41
Group exercise	Anxiety	1	1	2	72	0.00%	-0.60	0.18	0.00	-0.94	-0.26	0.00
Intensity low	Anxiety	2	2	9	903	24.00%	-0.68	0.27	0.02	-1.21	-0.14	0.00
Intensity moderate	Anxiety	2	2	13	2,069	24.00%	-0.24	0.19	0.21	-0.61	0.13	79.22
Intensity vigourous	Anxiety	1	1	5	225	0.00%	-0.17	0.04	0.27	-0.53	0.19	0.00
Duration - Short term up to 8 weeks	Anxiety	2	2	12	267	0.00%	-0.70	0.12	<0.0001	-0.92	-0.47	0.00
Duration - Medium term 9 to 24 weeks	Anxiety	2	4	23	2,285	0.00%	-0.50	0.07	<0.0001	-0.64	-0.37	0.00
Duration - Long term over 24 weeks	Anxiety	1	1	7	1,013	0.00%	-0.03	0.10	0.76	-0.18	0.13	0.00
Frequency - 1 to 2 days a week	Anxiety	1	1	6	293	0.00%	-0.71	0.12	<0.0001	-0.95	-0.47	0.00
Frequency - 3 or more days a week	Anxiety	2	5	24	2,327	0.00%	-0.50	0.09	<0.0001	-0.67	-0.33	9.44

Overall category	Outcome	Overall papers (n=)	Individual meta-analysis effects (n=)	Component studies (n=)	Participant population (n=)	CCA Score	Standardised mean difference estimate	Standard error	P value	Confidence Interval upper boundary	Confidence Interval lower boundary	Heterogeneity (I2)
AMSTAR-2 High	Anxiety	3	3	24	1,160	3.94%	-0.36	0.10	<0.0001	-0.53	-0.19	0.00
AMSTAR-2 Low	Anxiety	6	6	44	3,396	0.00%	-0.57	0.11	<0.0001	-0.87	-0.27	25.11
AMSTAR-2 Critically Low	Anxiety	14	15	258	14,812	0.36%	-0.47	0.08	<0.0001	-0.61	-0.34	89.58

Overall category	Outcome	Overall papers (n=)	Individual meta-analysis effects (n=)	Component studies (n=)	Participant population (n=)	CCA Score	Standardised mean difference estimate	Standard error	P value	Confidence Interval upper boundary	Confidence Interval lower boundary	Heterogeneity (I2)
Anxiety OVERALL	Anxiety	23	24	258	19,368	52.00%	-0.47	0.06	<0.0001	-0.59	-0.36	84.26

Figure 1 - PRISMA flowchart of study selection process
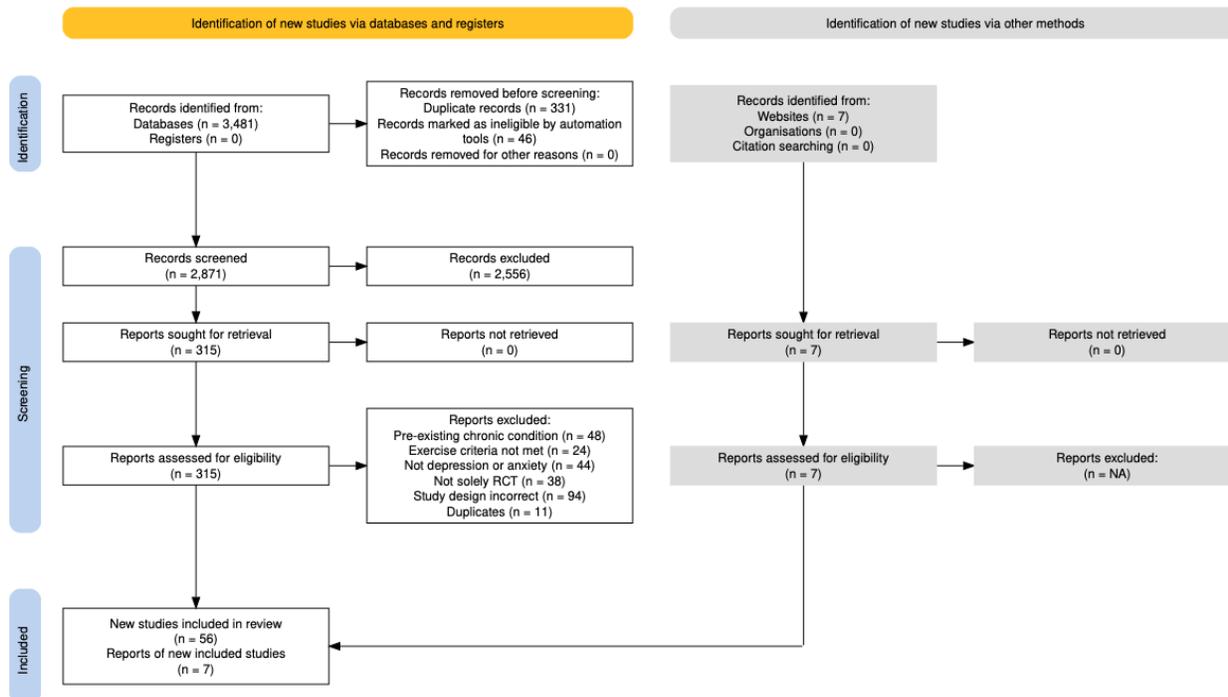
Figure 2a - Funnel plot analysis of publication bias for Depression
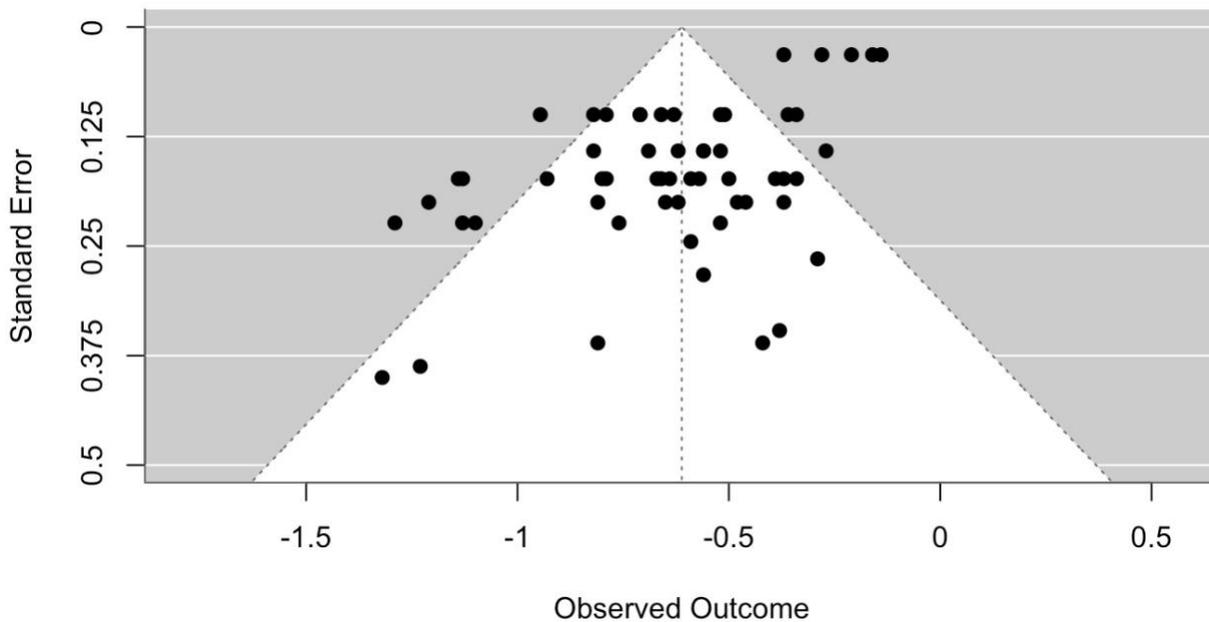
Figure 2b - Funnel plot analysis of publication bias for Anxiety
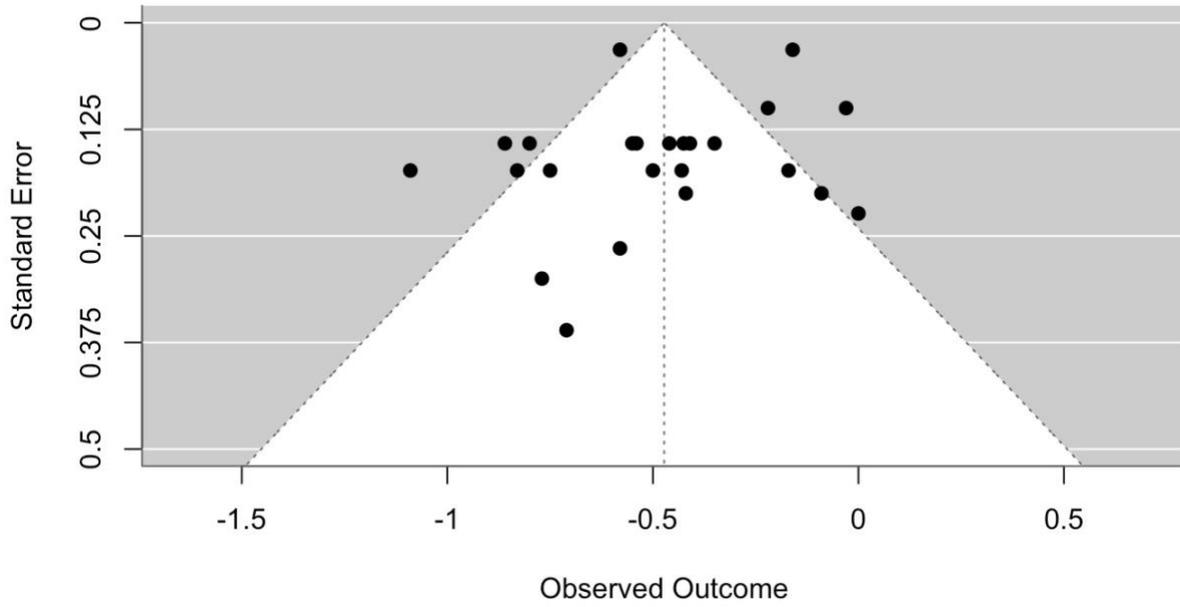
Figure 3 - Forest plot for depression outcomes on all studies

Exercise impact on DEPRESSION
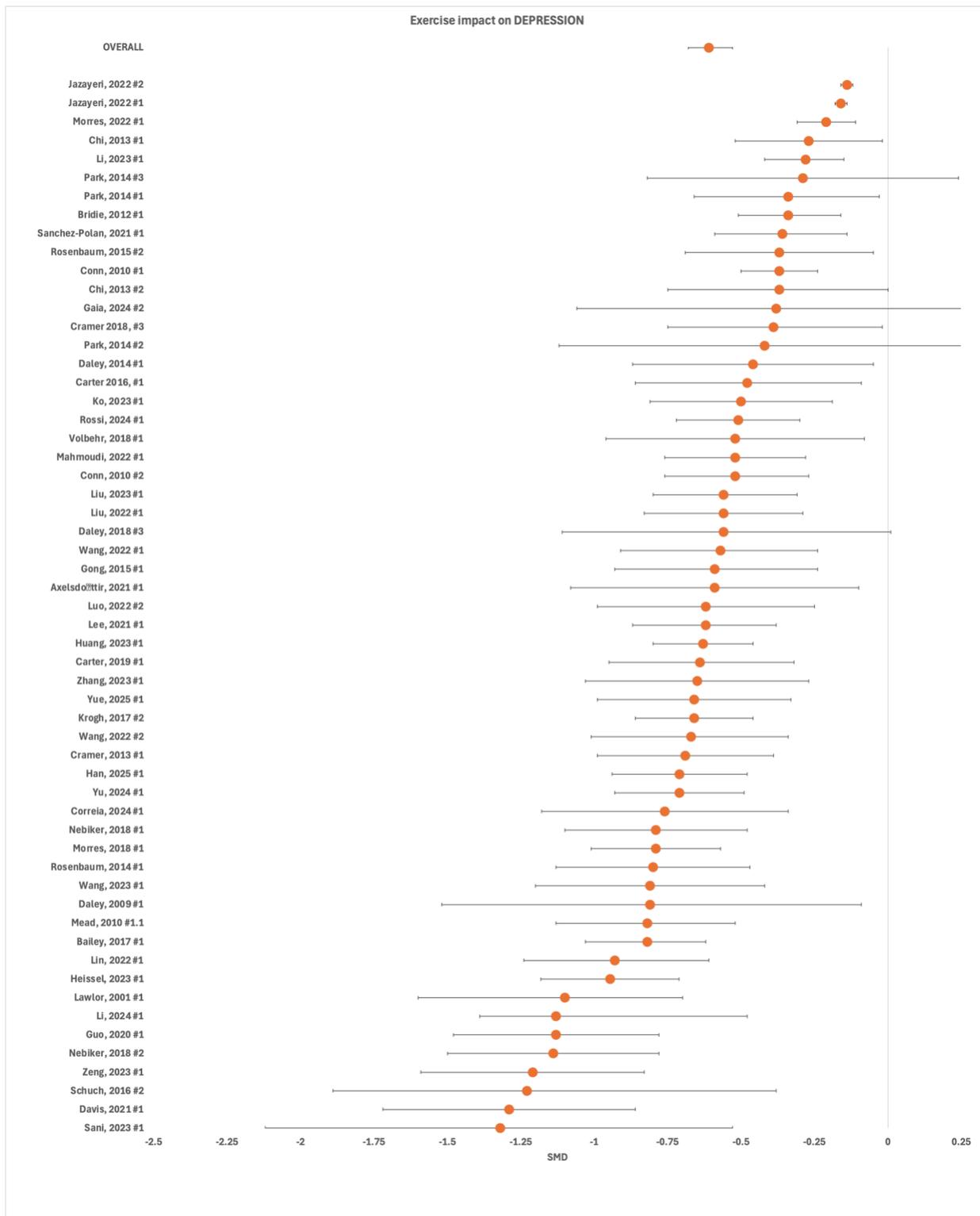
Figure 3a - Forest plot for depression outcomes by category
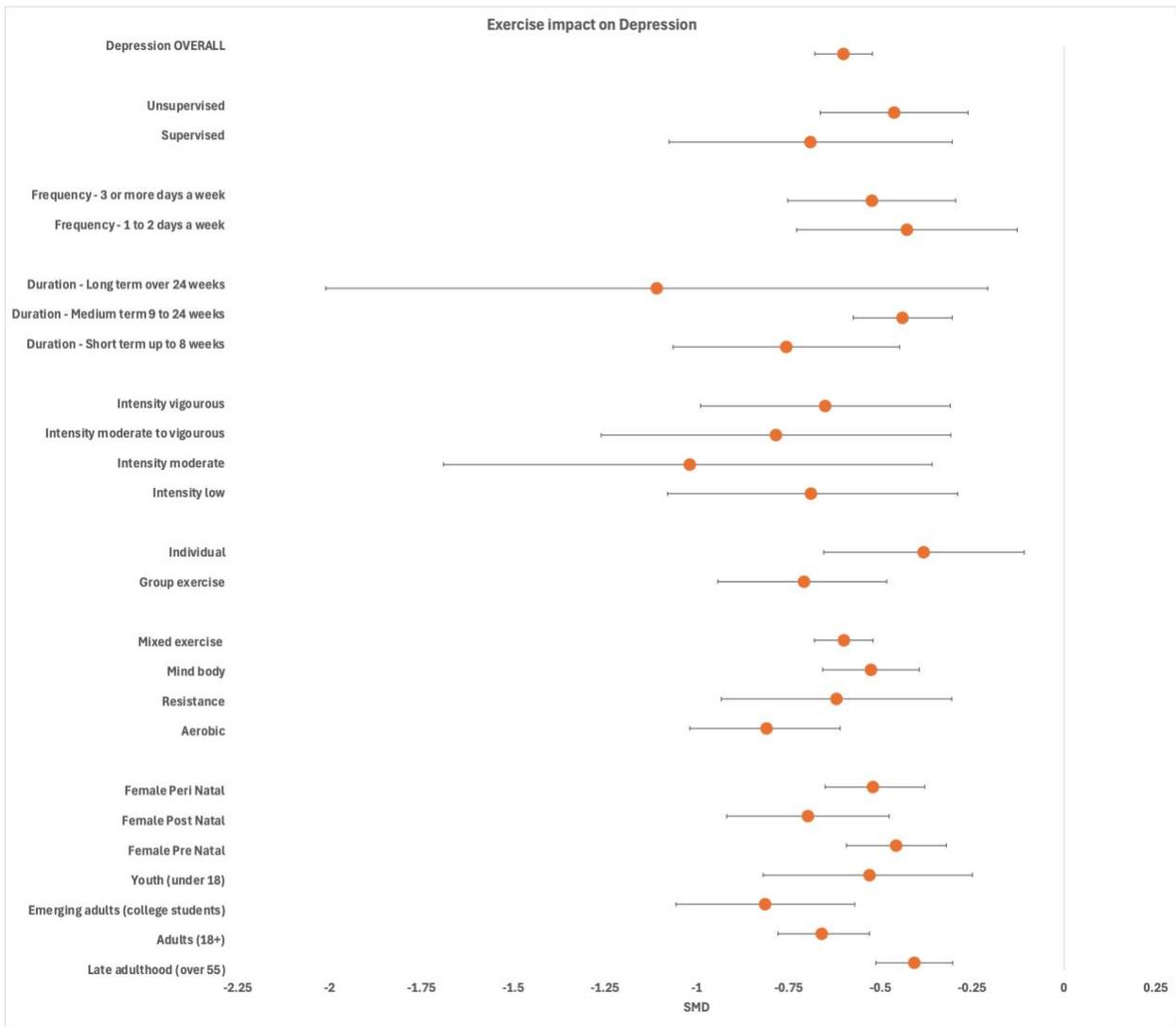
Figure 4 - Forest plot for depression – Late adulthood
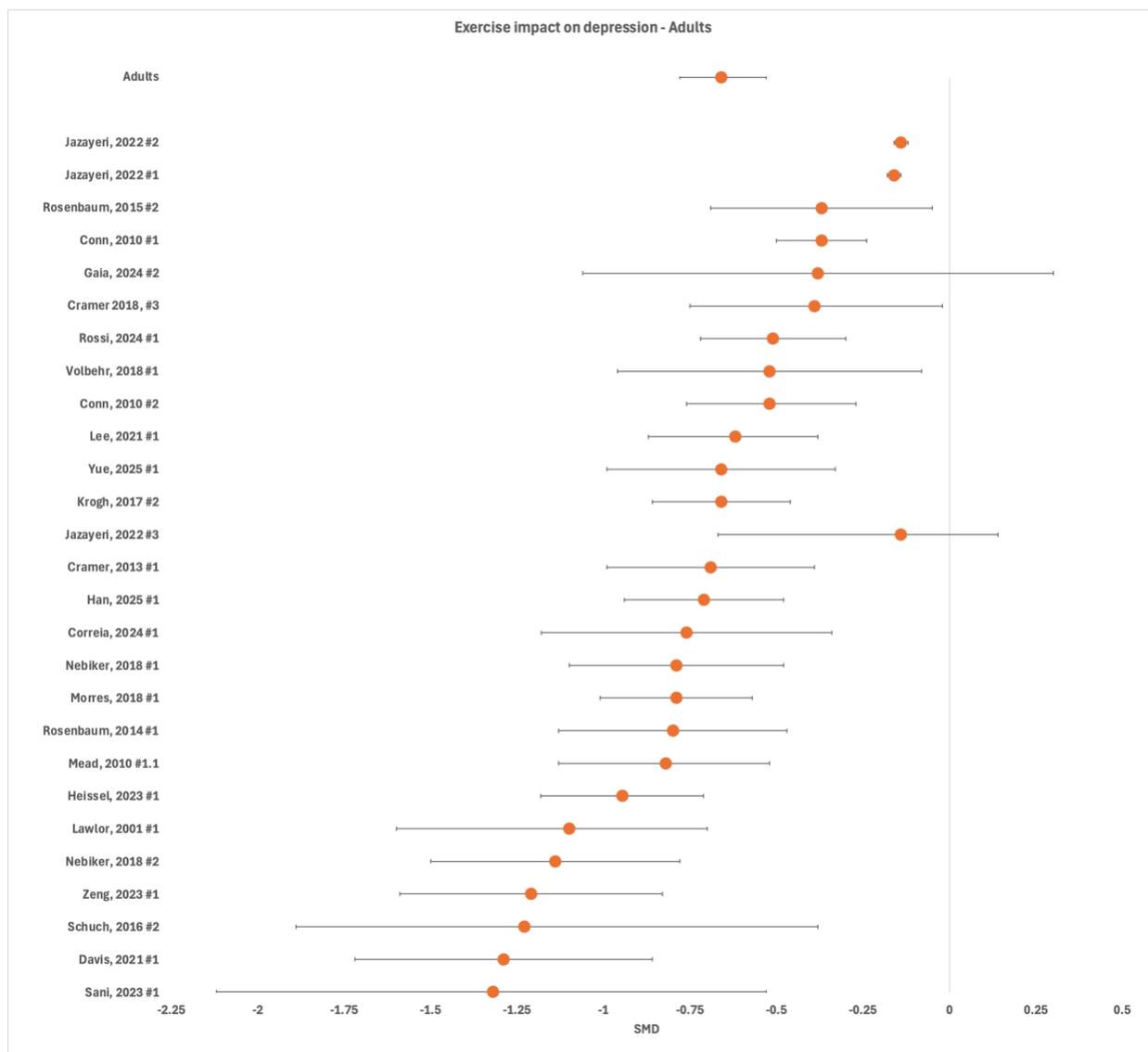

Exercise impact on depression - Late adulthood
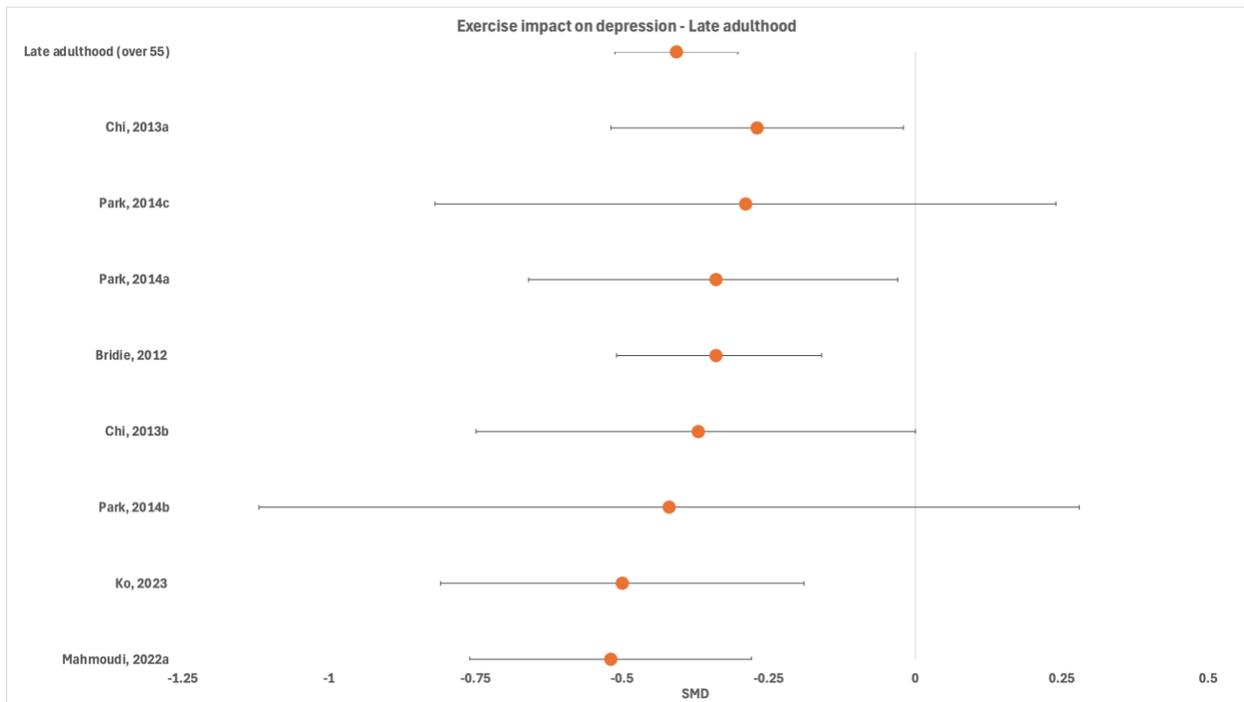
Figure 5 - Forest plot for depression – Adults

Exercise impact on depression - Adults

Figure 6 - Forest plot for depression – Emerging adults
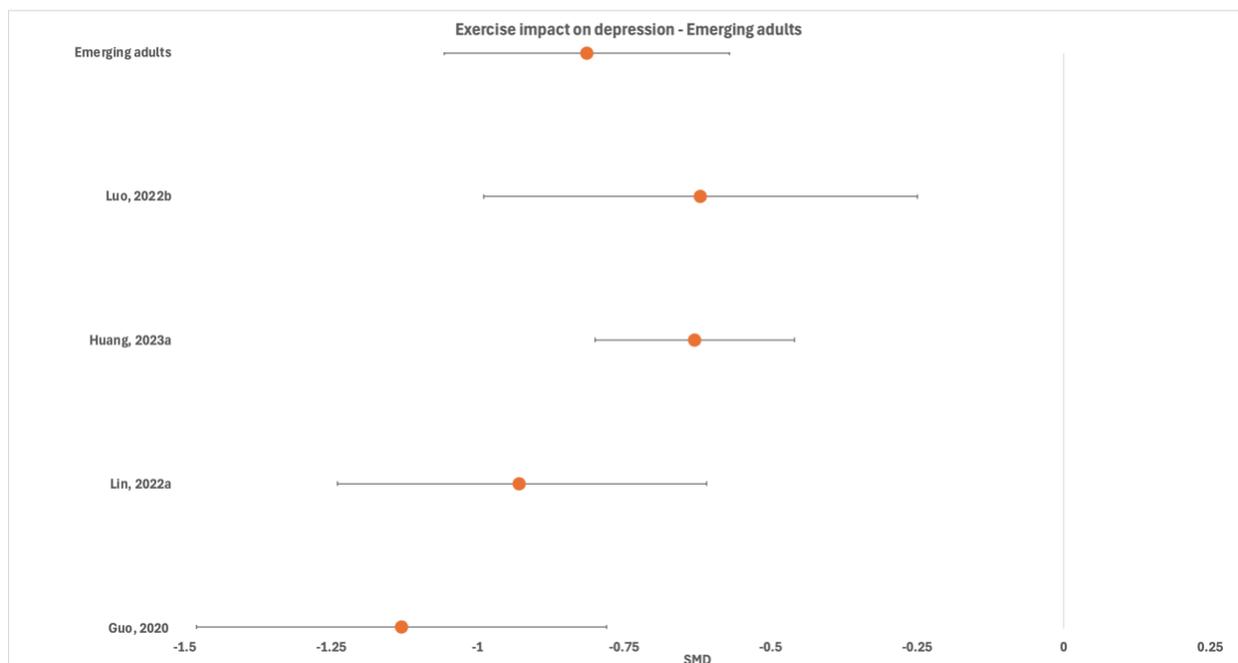
Figure 7 - Forest plot for depression – Youth
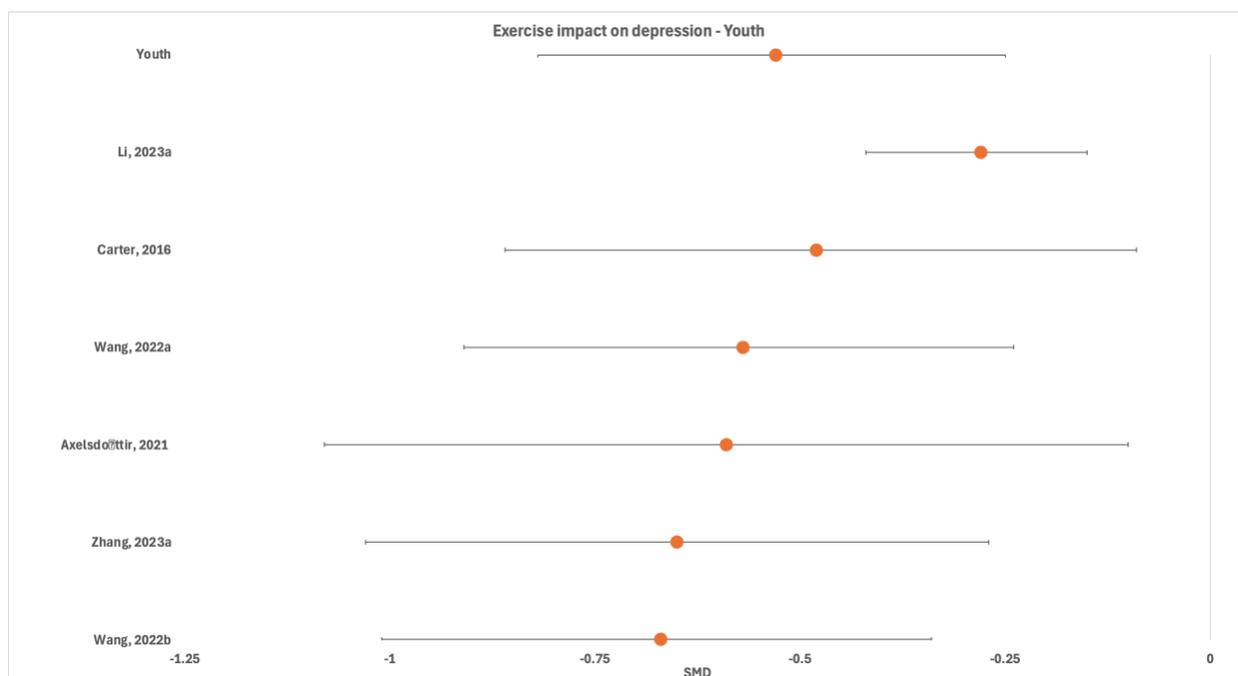
Figure 8 - Forest plot for depression – Prenatal
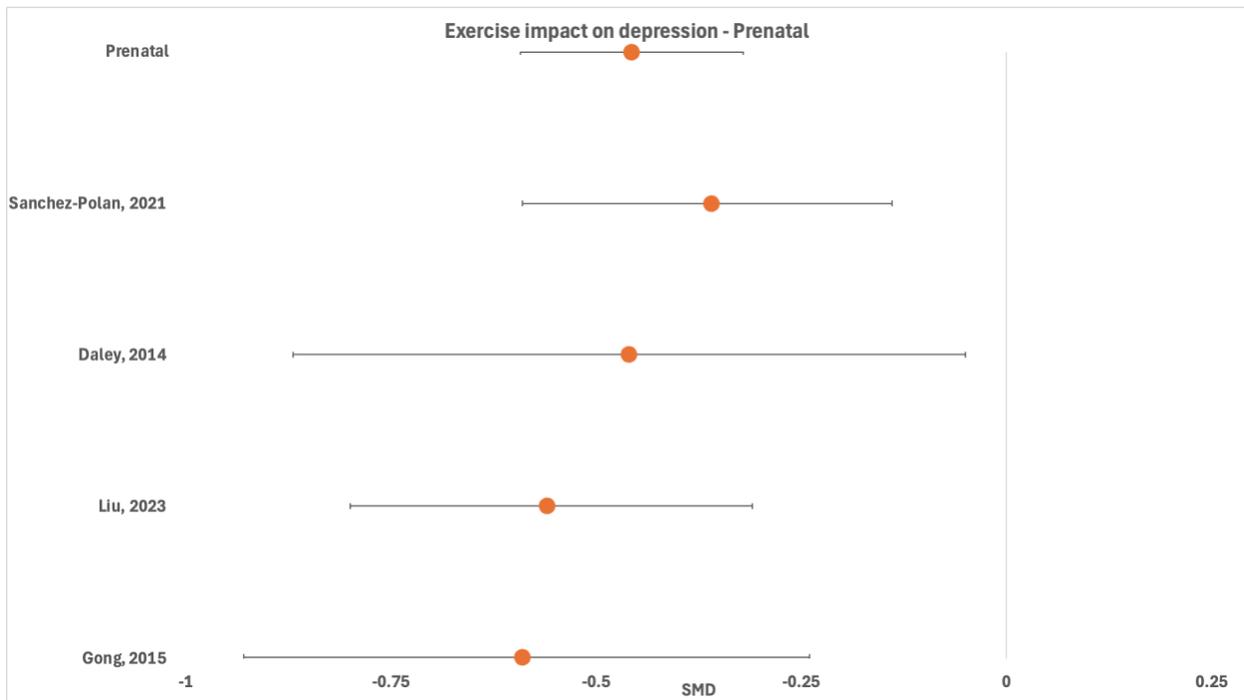
Figure 9 - Forest plot for depression – Postnatal
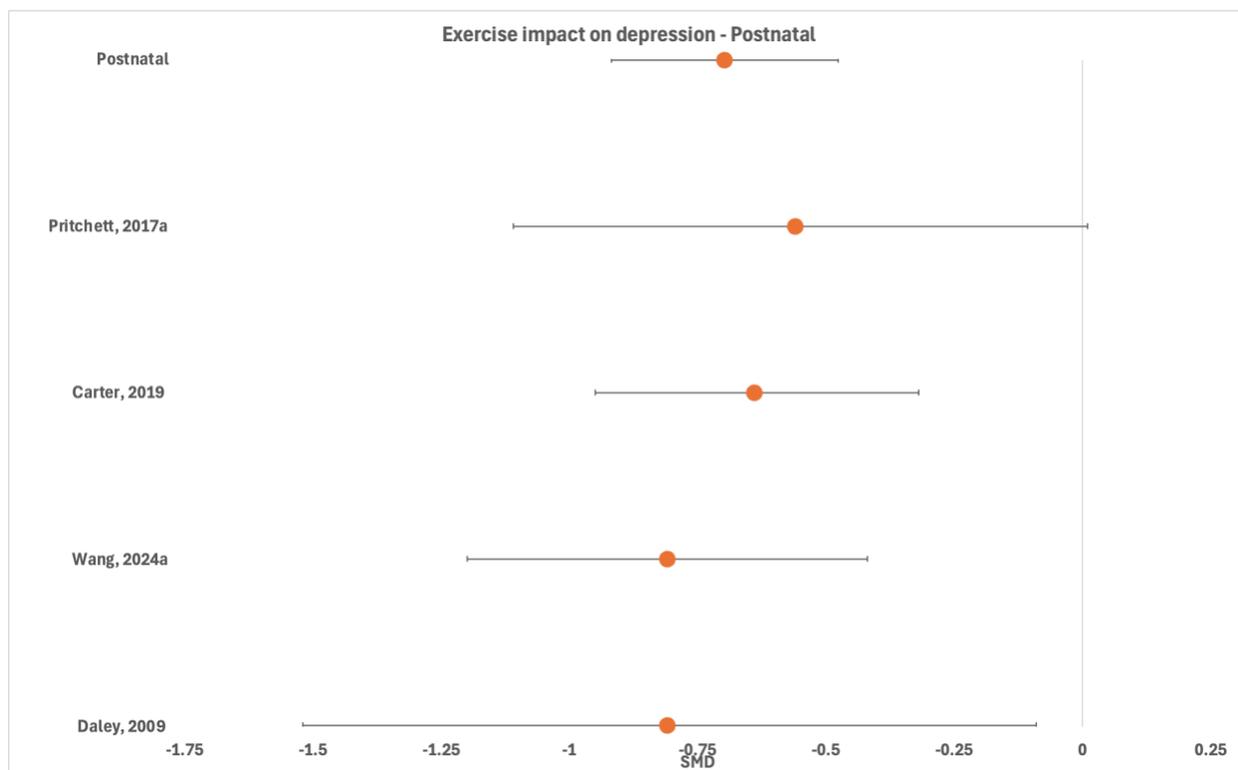
Figure 10 - Forest plot for depression – Perinatal

Exercise impact on depression - Perinatal
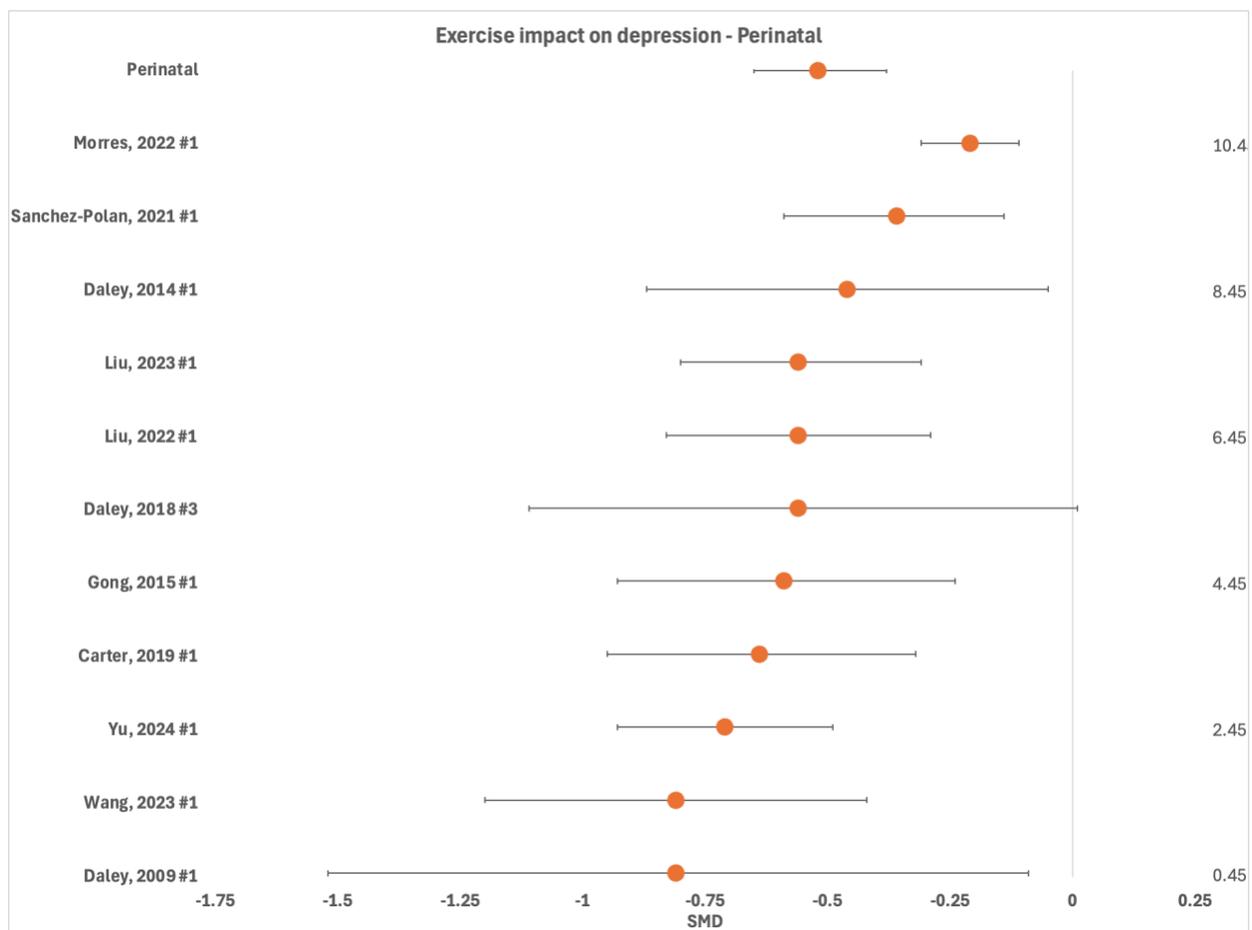
Figure 11 - Forest plot for depression – Aerobic

Exercise impact on depression - Aerobic
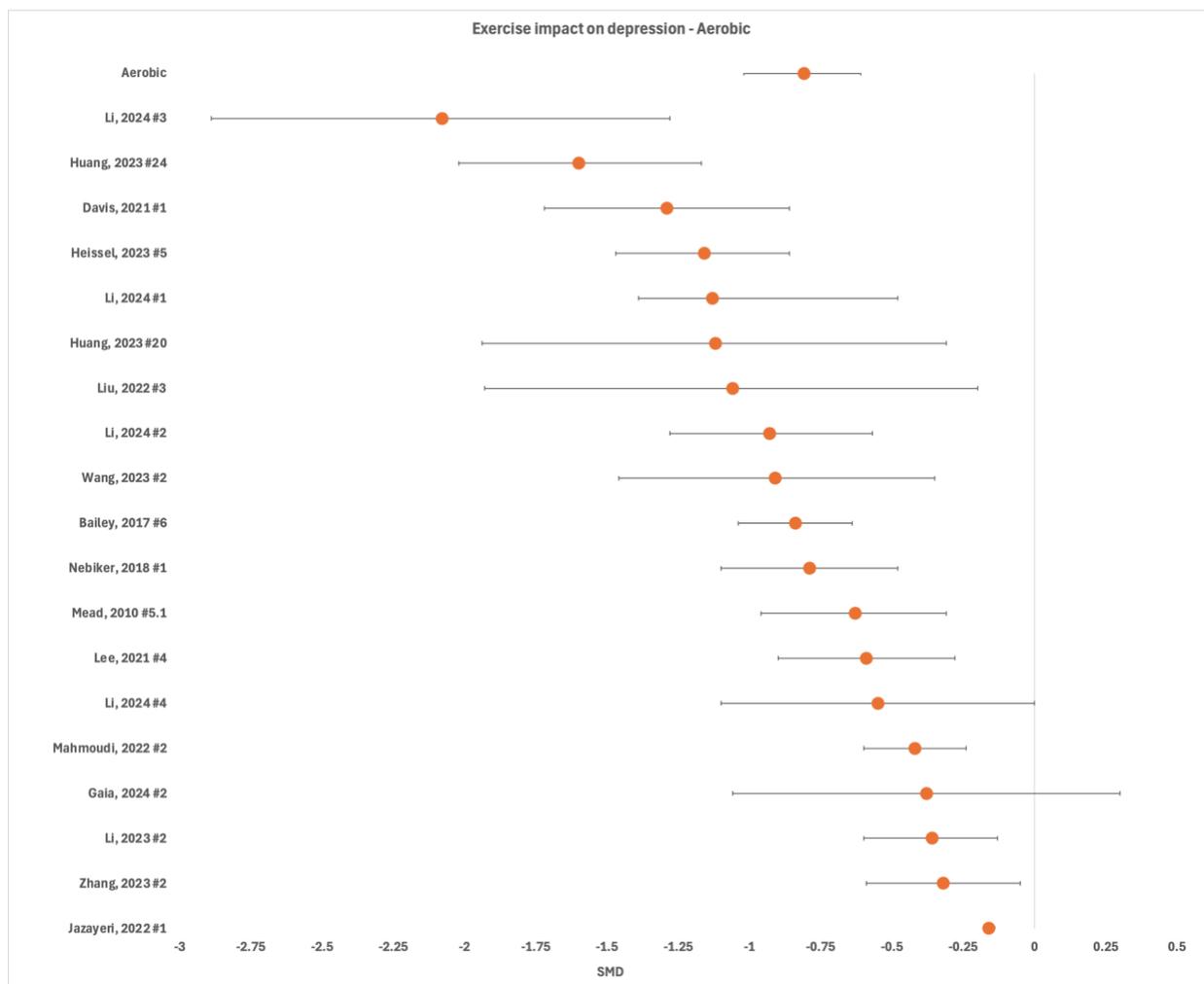
Figure 12 - Forest plot for depression – Resistance

Exercise impact on depression - Resistance
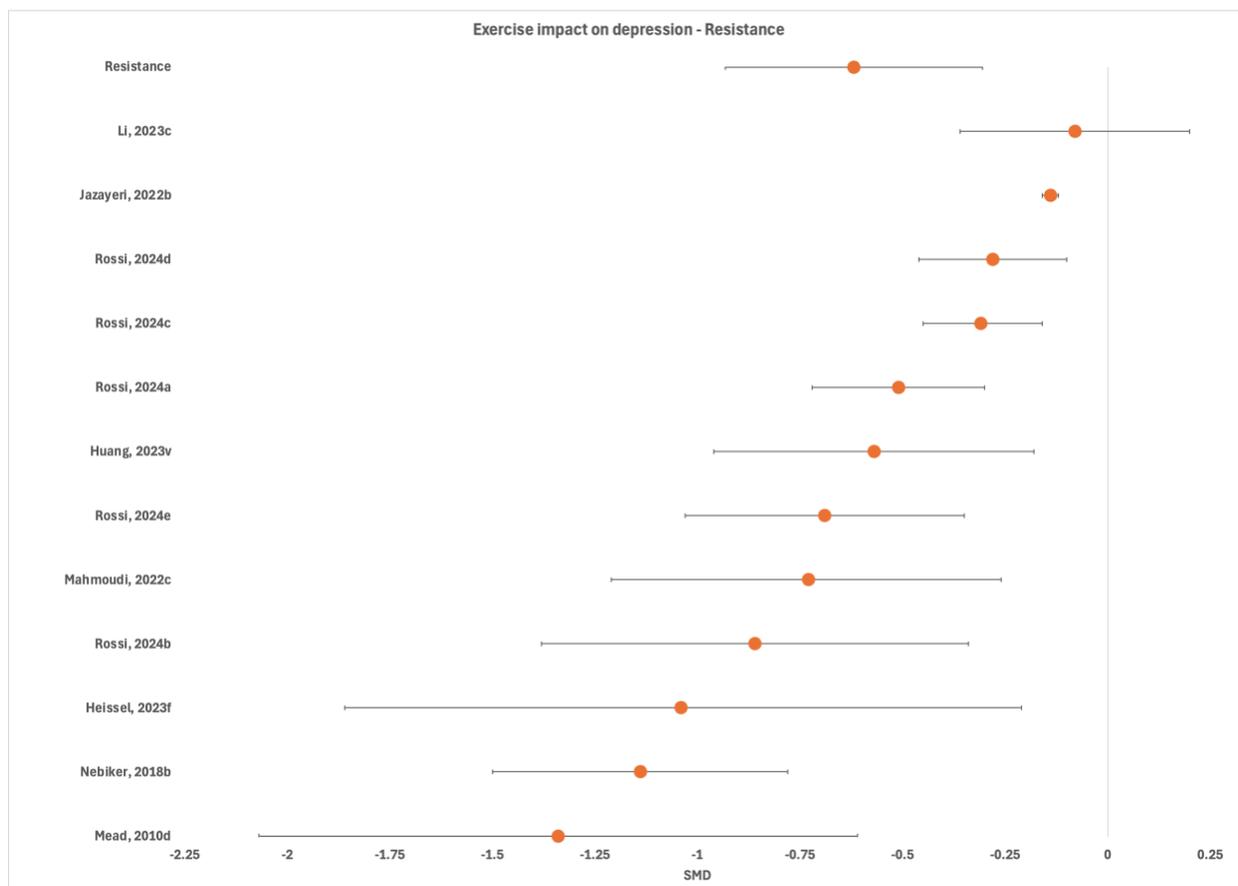
Figure 13 - Forest plot for depression – Mindbody

Exercise impact on depression - Mindbody
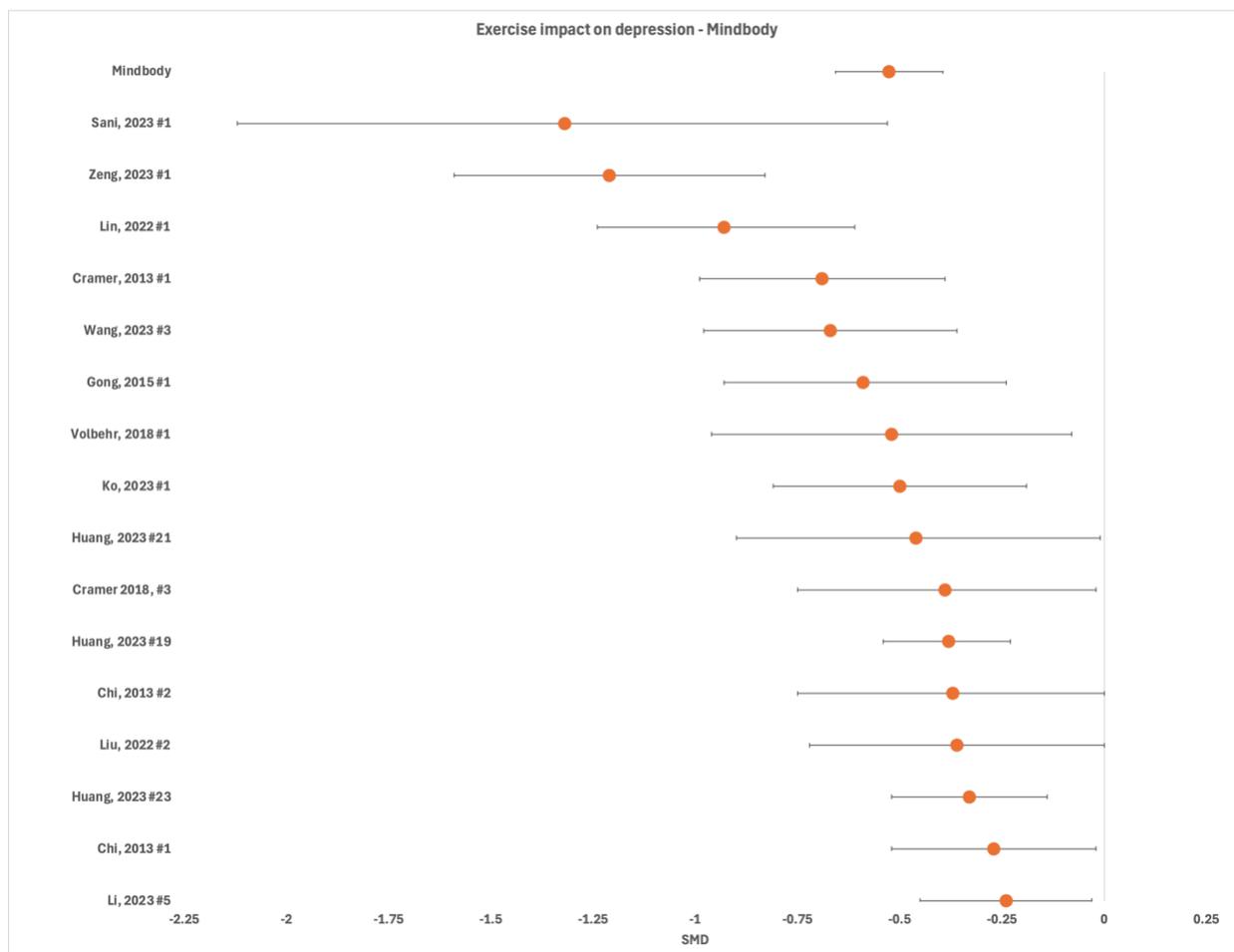
Figure 14 - Forest plot for depression – Mixed exercise
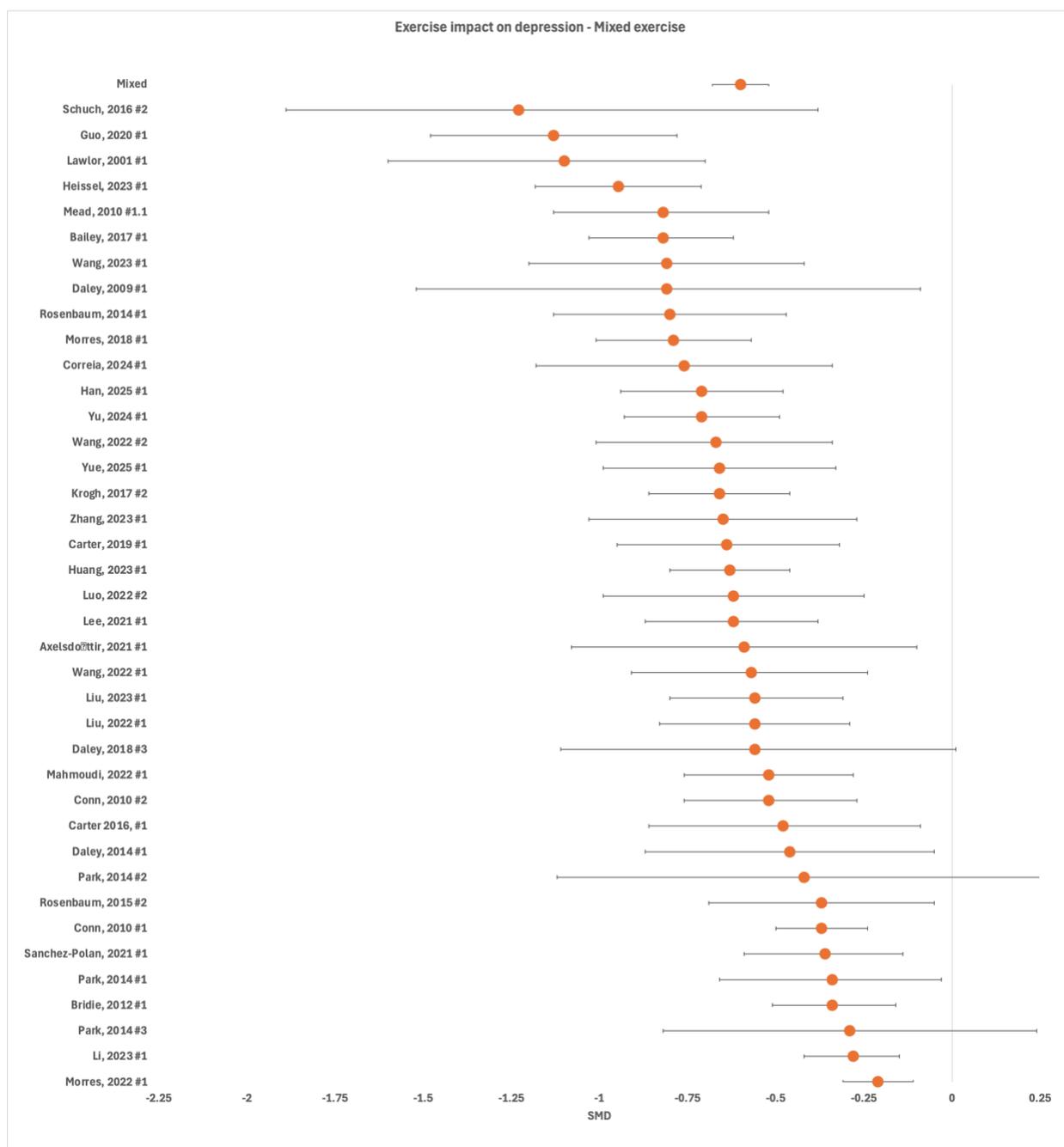
Figure 15 - Forest plot for depression – Group exercise

Exercise impact on depression - Group exercise
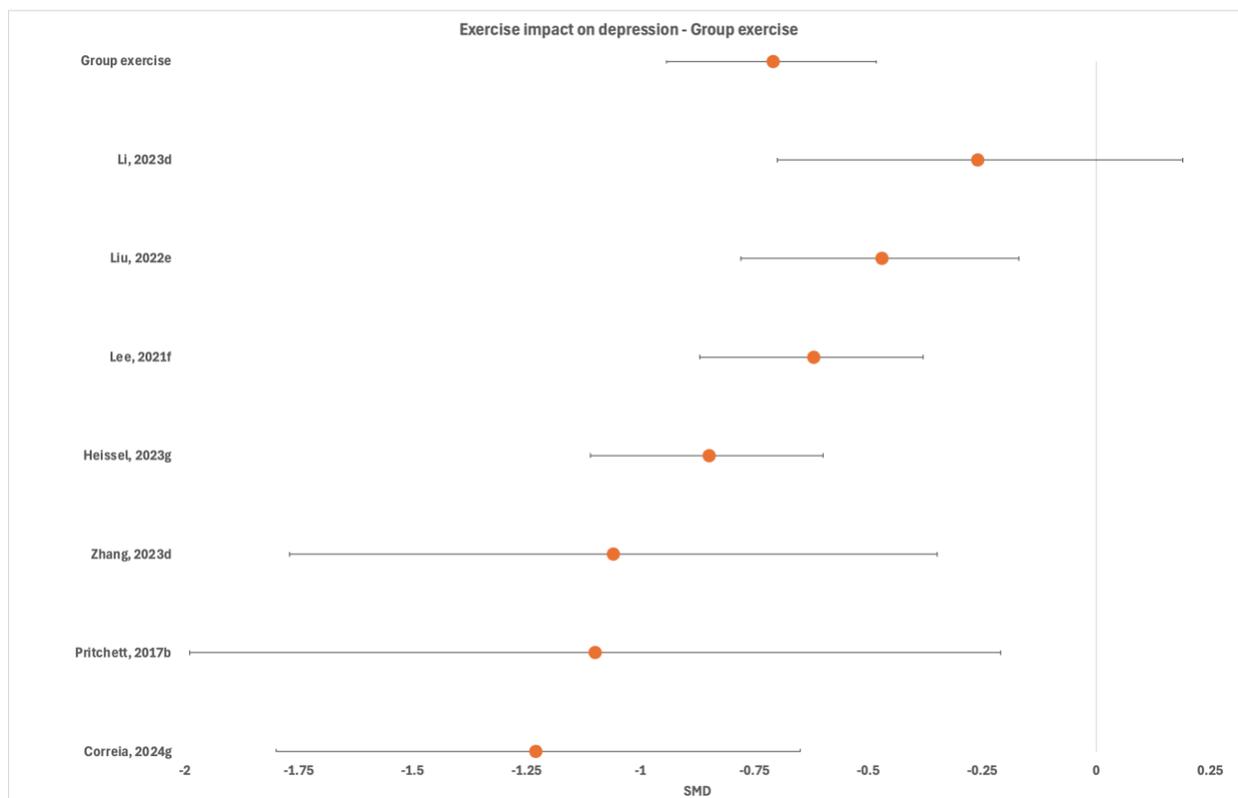
Figure 16 - Forest plot for depression – Individual exercise
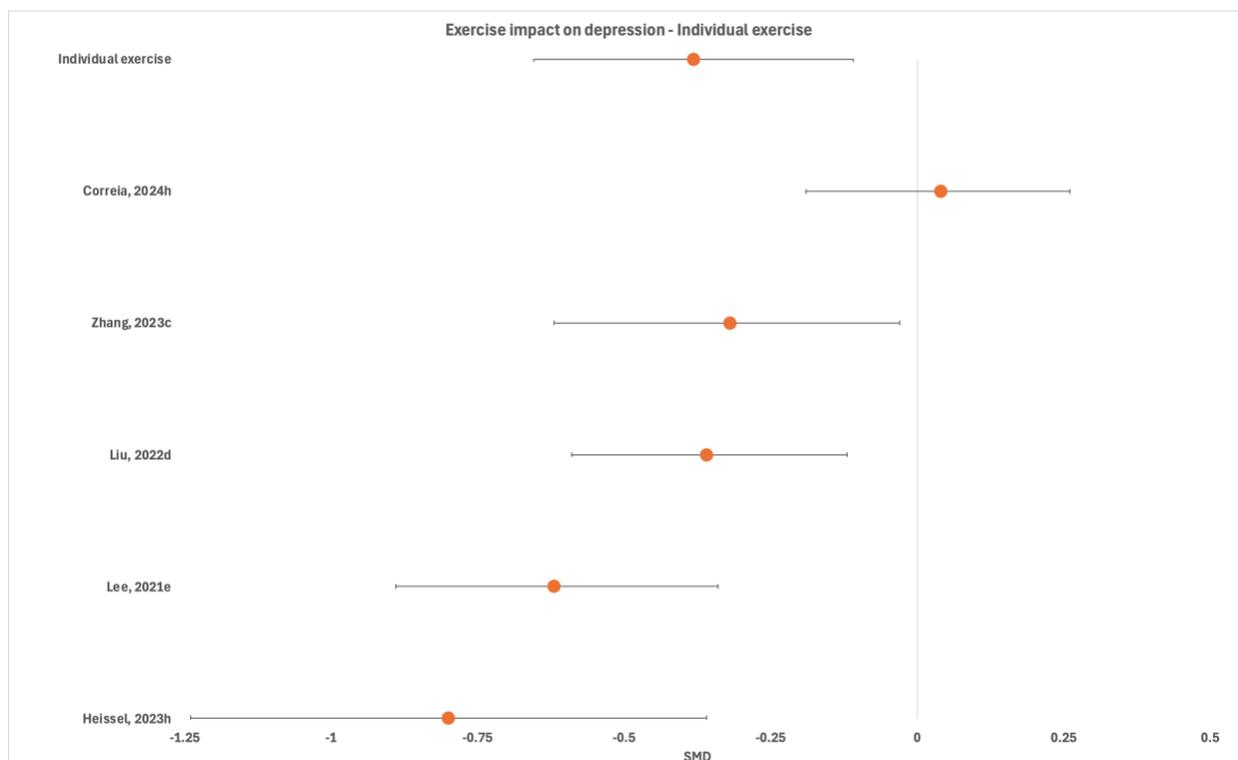
Figure 17 - Forest plot for depression – Exercise intensity

Exercise impact on depression - Exercise intensity
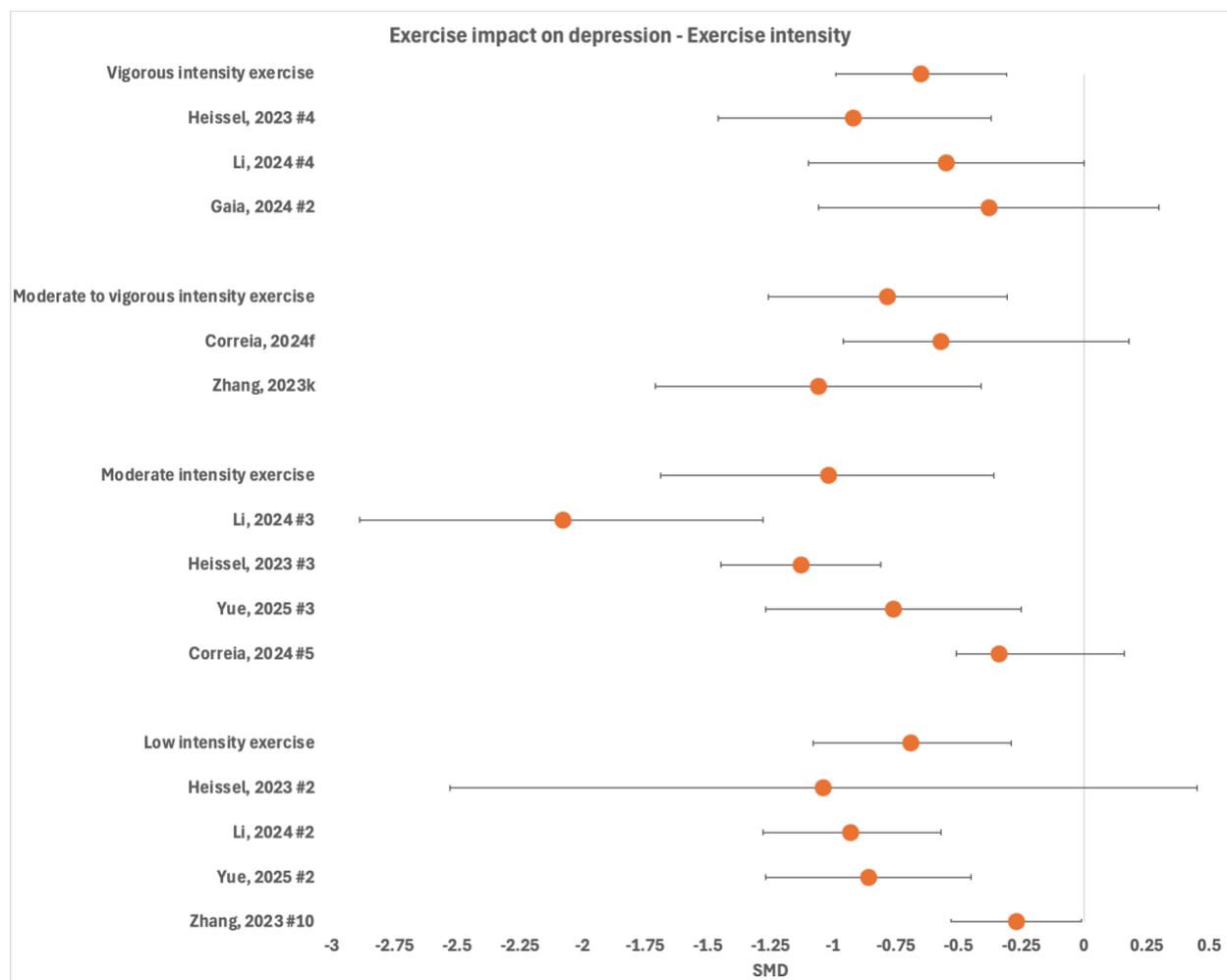
Figure 18 - Forest plot for depression – Exercise duration
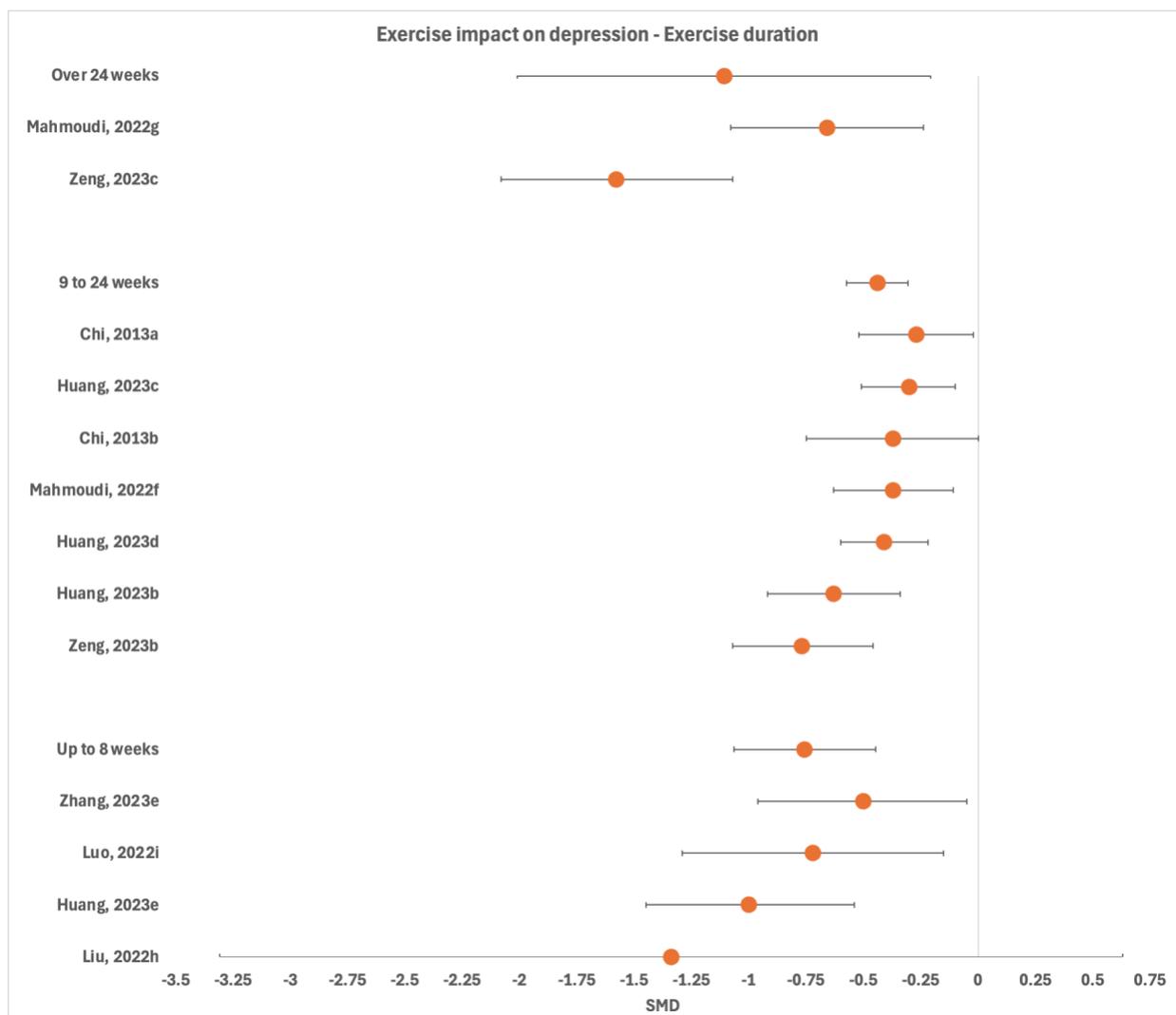
Figure 19 - Forest plot for depression – Exercise frequency
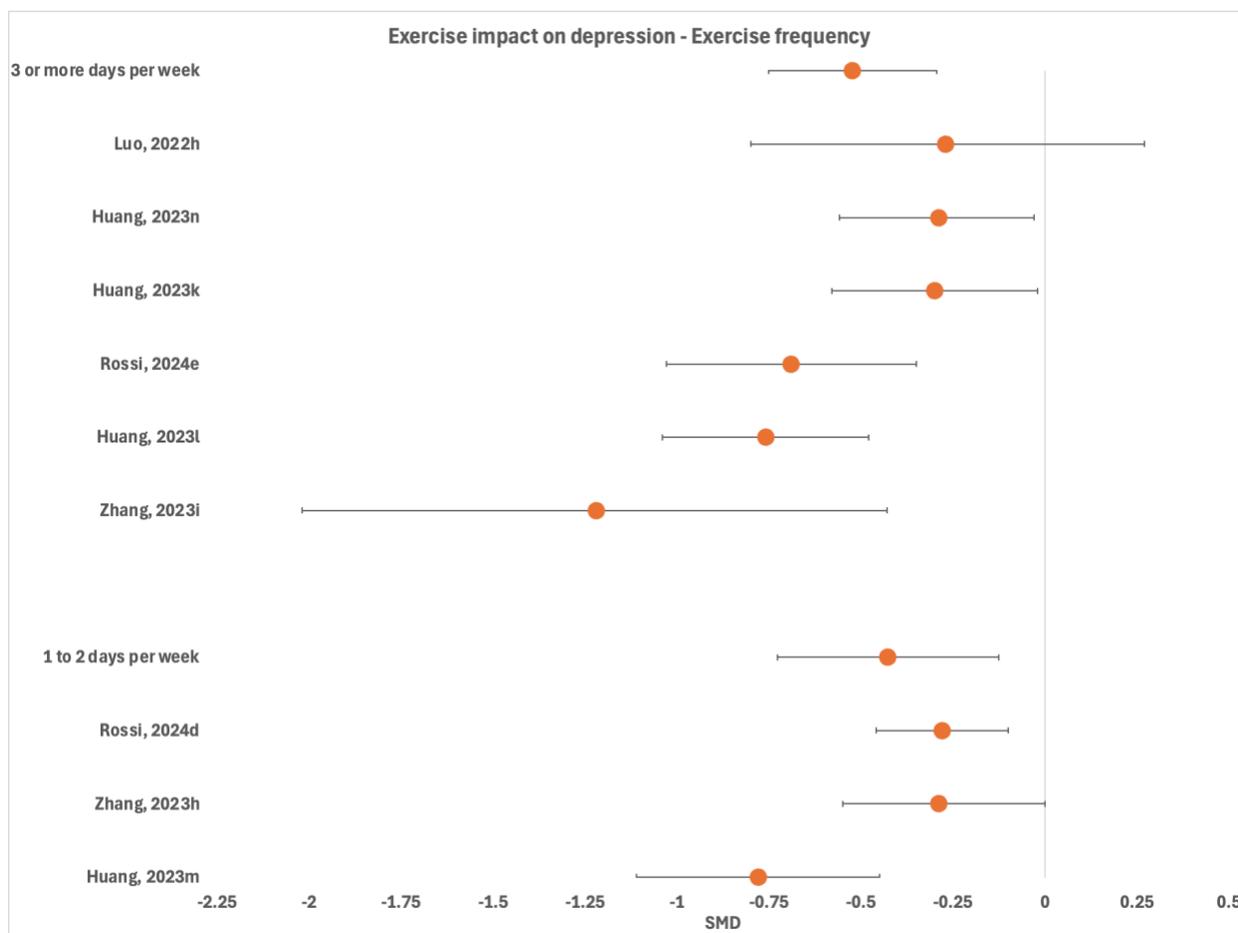
Figure 20 - Forest plot for depression – Exercise supervision

Exercise impact on depression - Exercise supervision
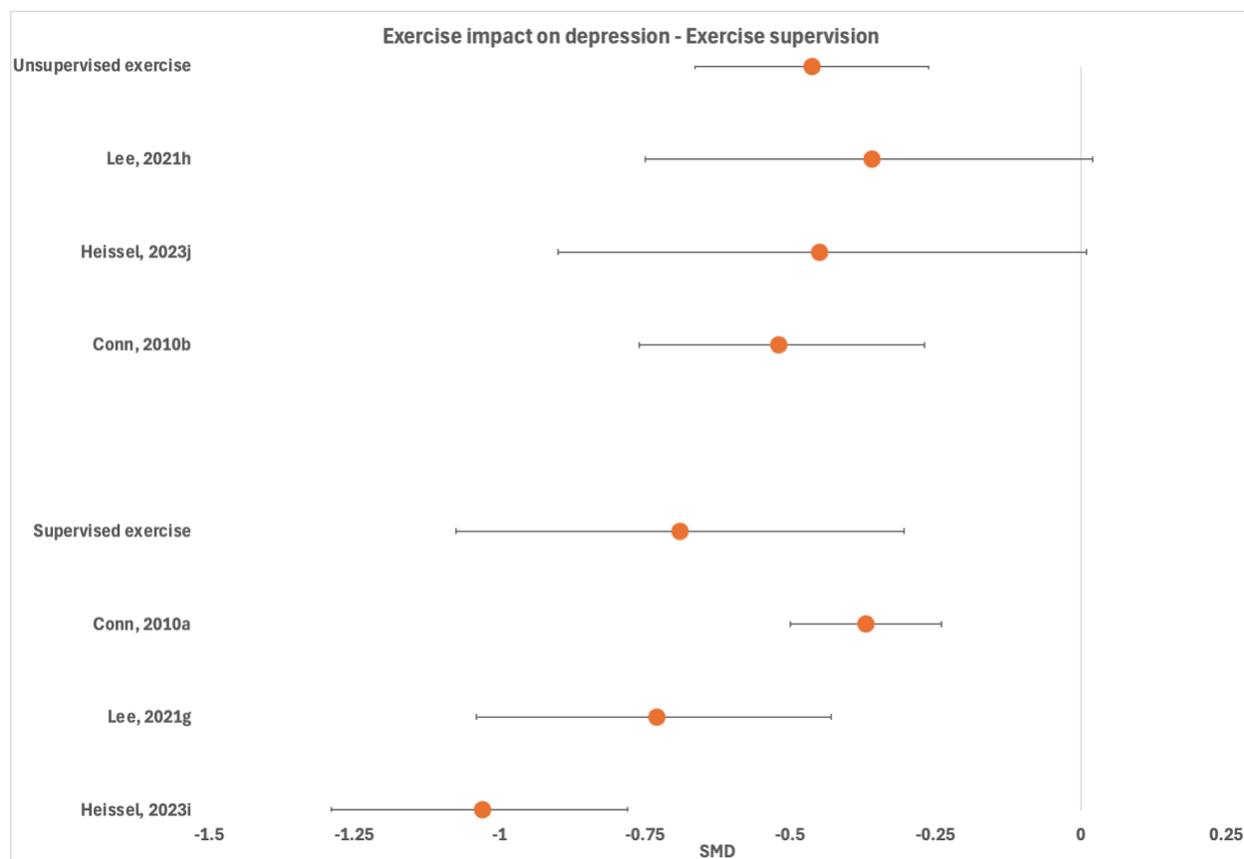
Figure 21 - Forest plot for depression – Clinical v non-clinical
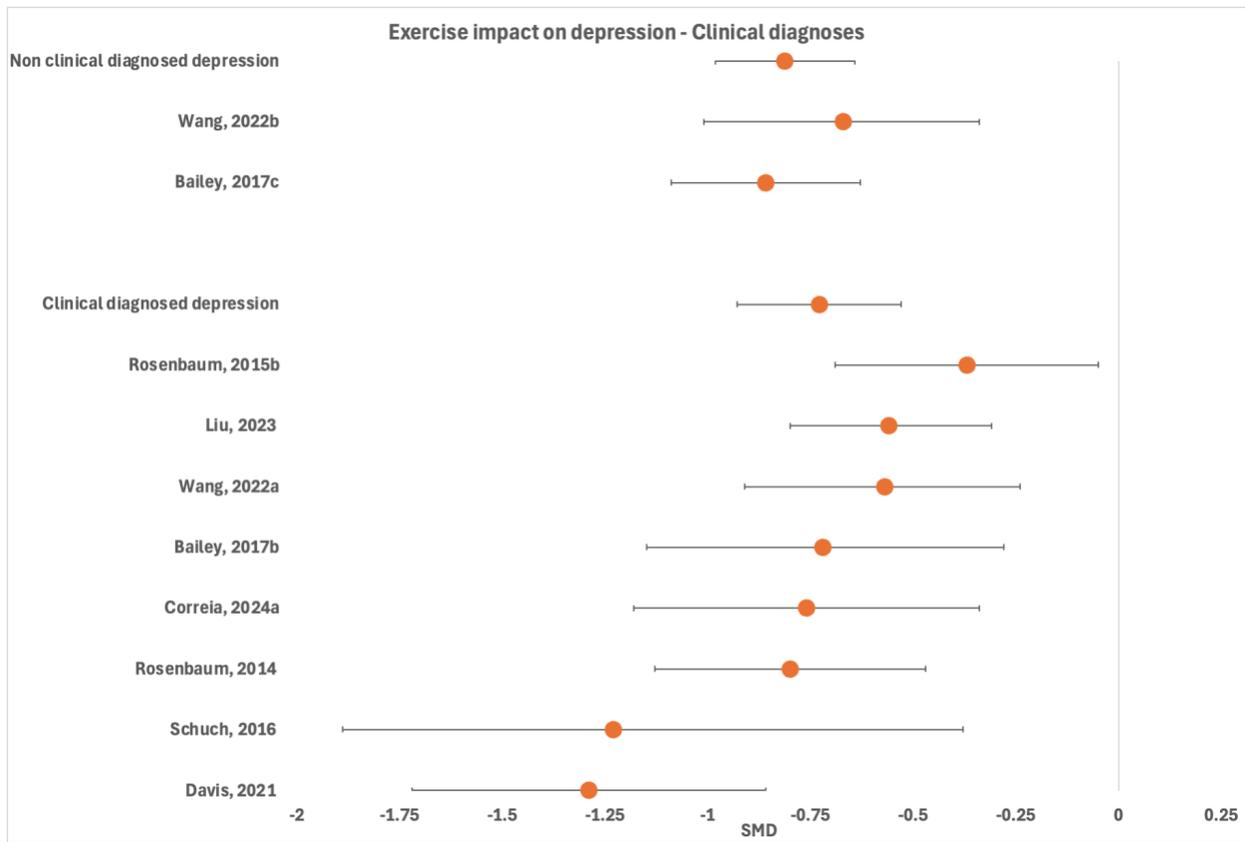
Figure 22 - Forest plot for depression – AMSTAR High

Exercise impact on depression - AMSTAR High
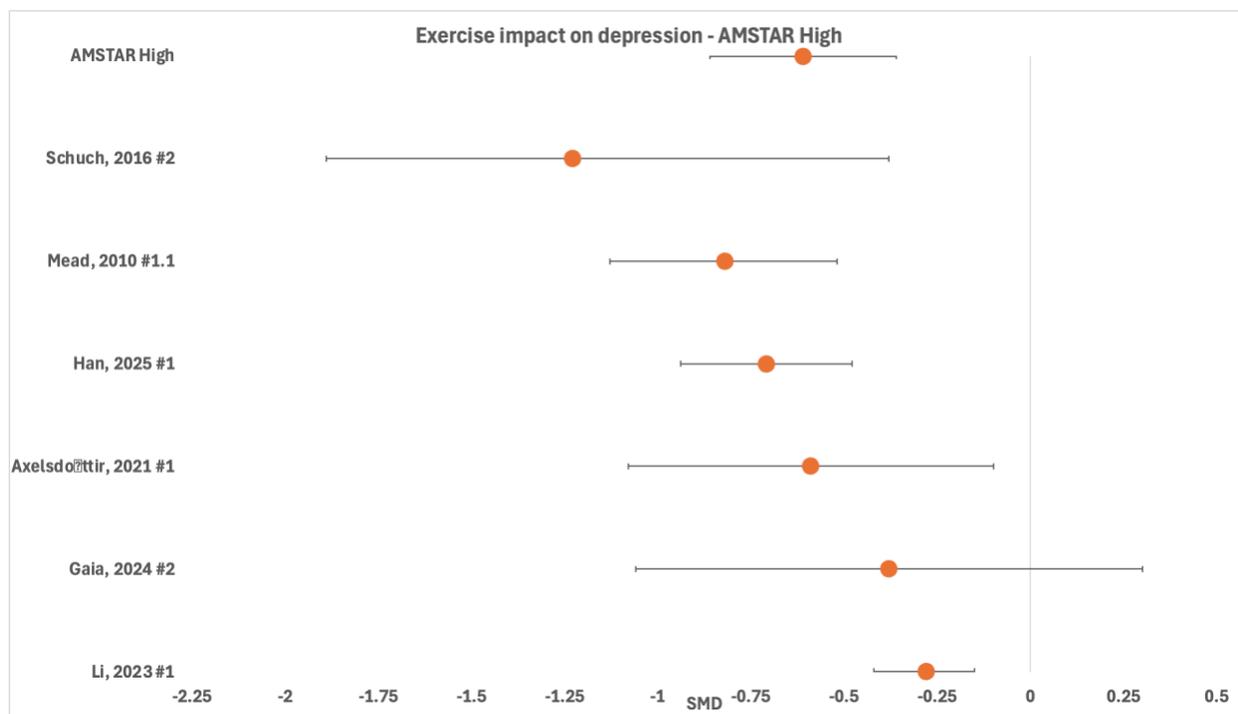
Figure 23 - Forest plot for depression – AMSTAR Low

Exercise impact on depression - AMSTAR Low
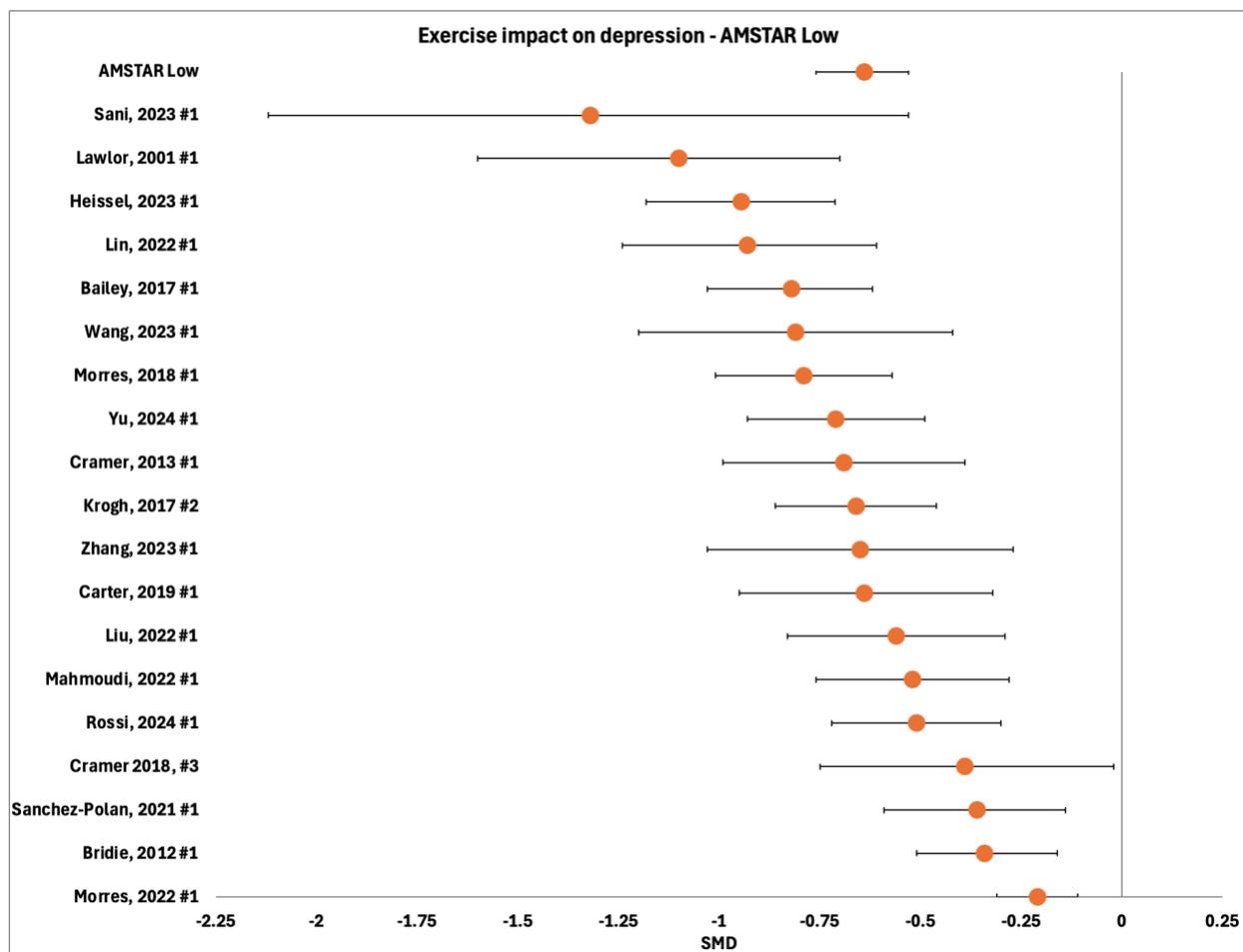
Figure 24 - Forest plot for depression – AMSTAR Critically low

Exercise impact on depression - AMSTAR Critically low
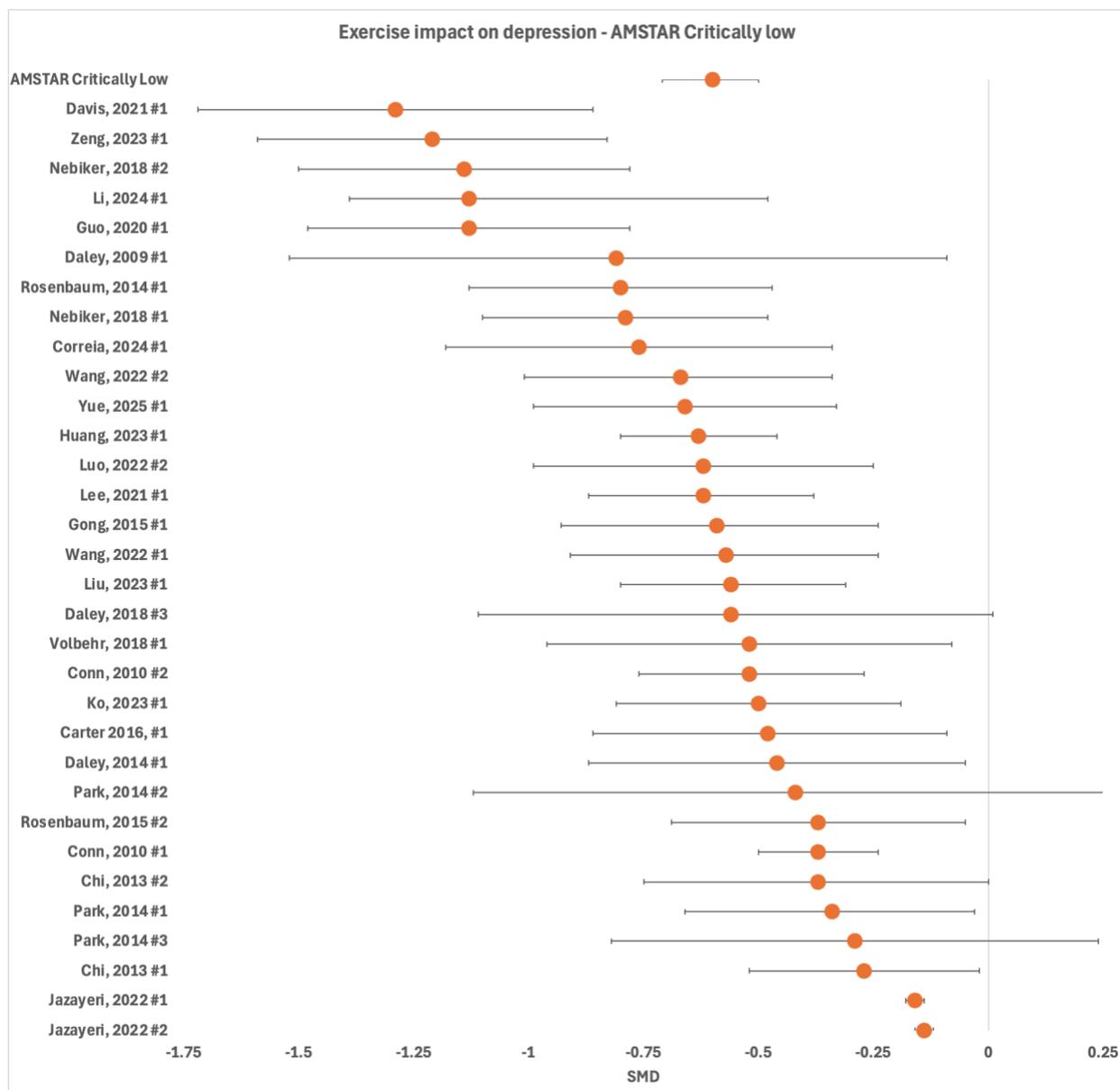
Figure 25 - Forest plot for anxiety outcomes on all studies
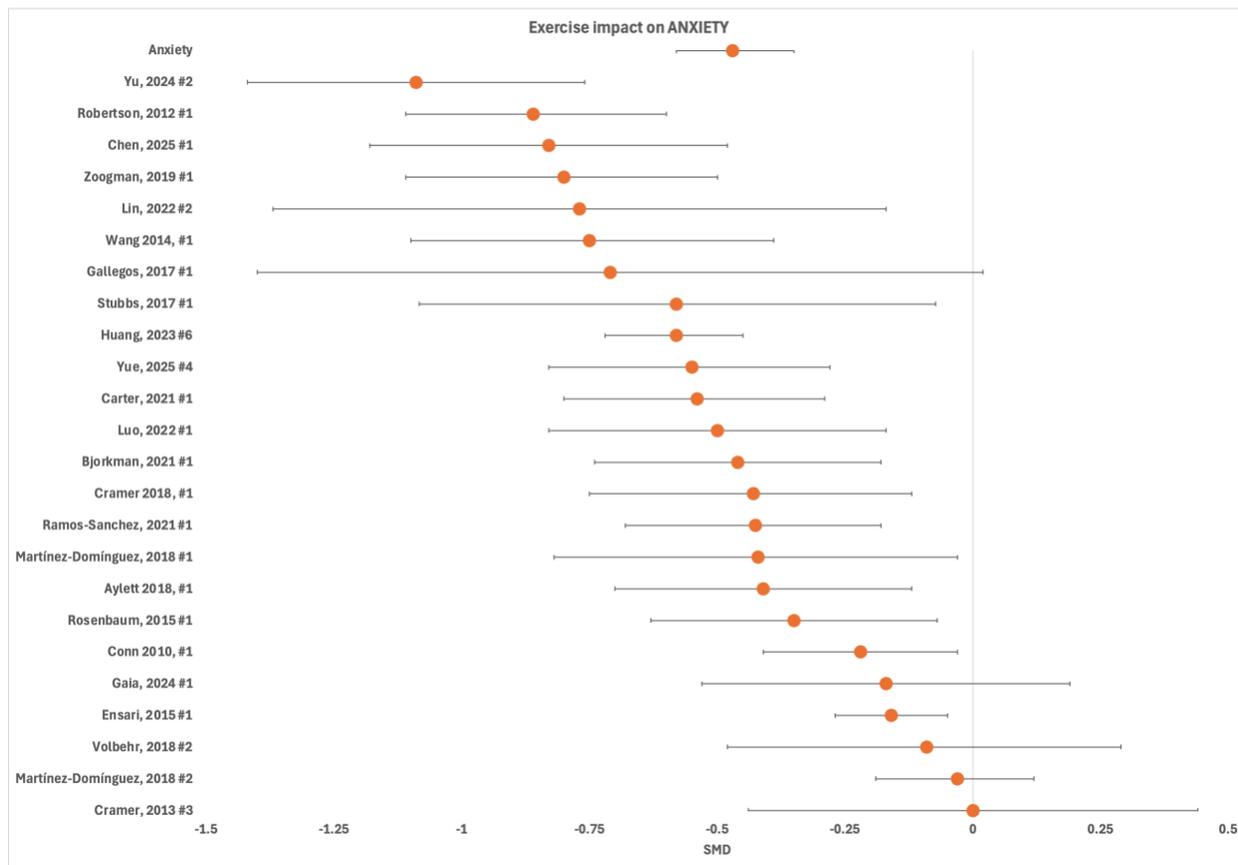
Figure 25a - Forest plot for anxiety outcomes by category
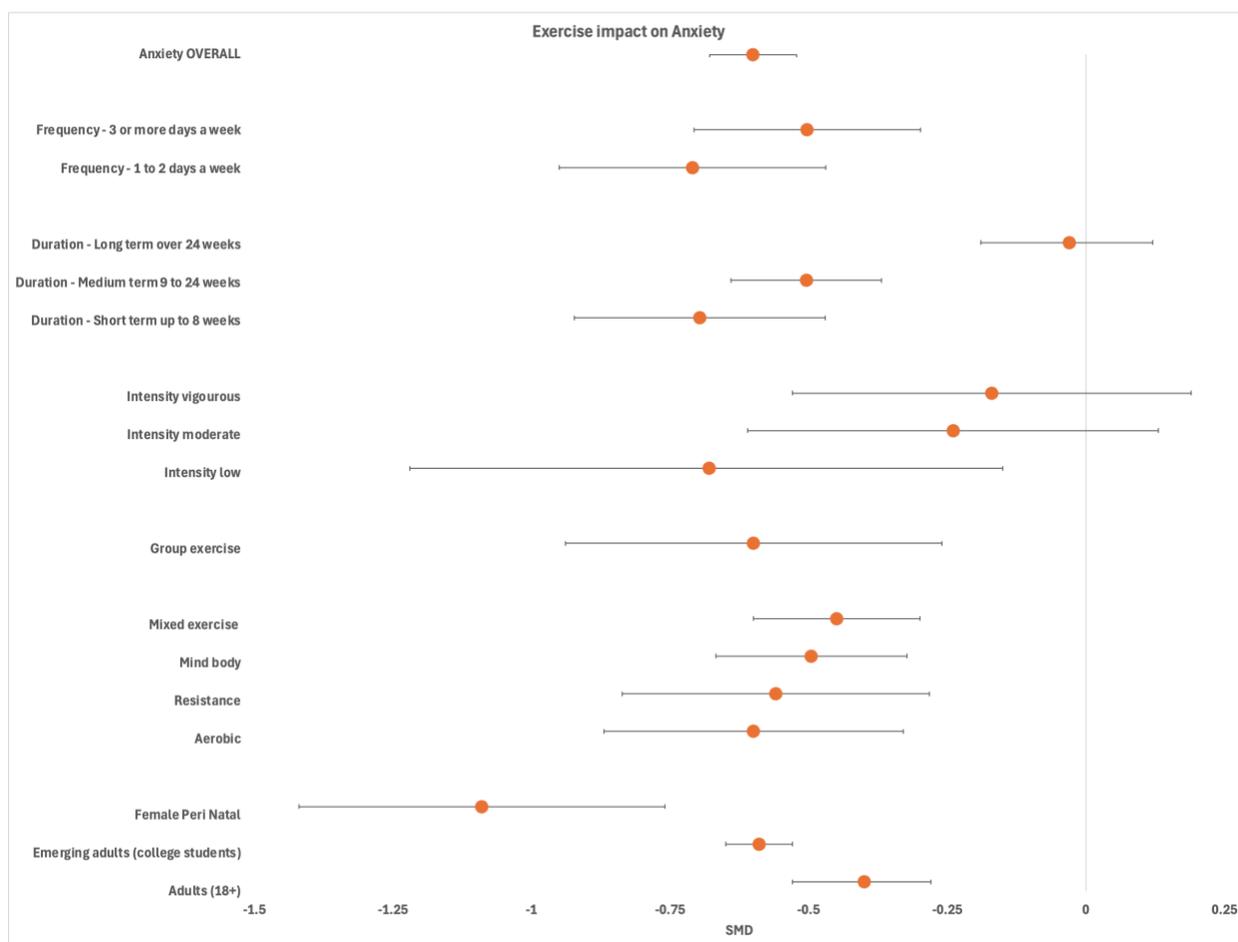
Figure 26 - Forest plot for anxiety – Adults

Exercise impact on anxiety - Adults
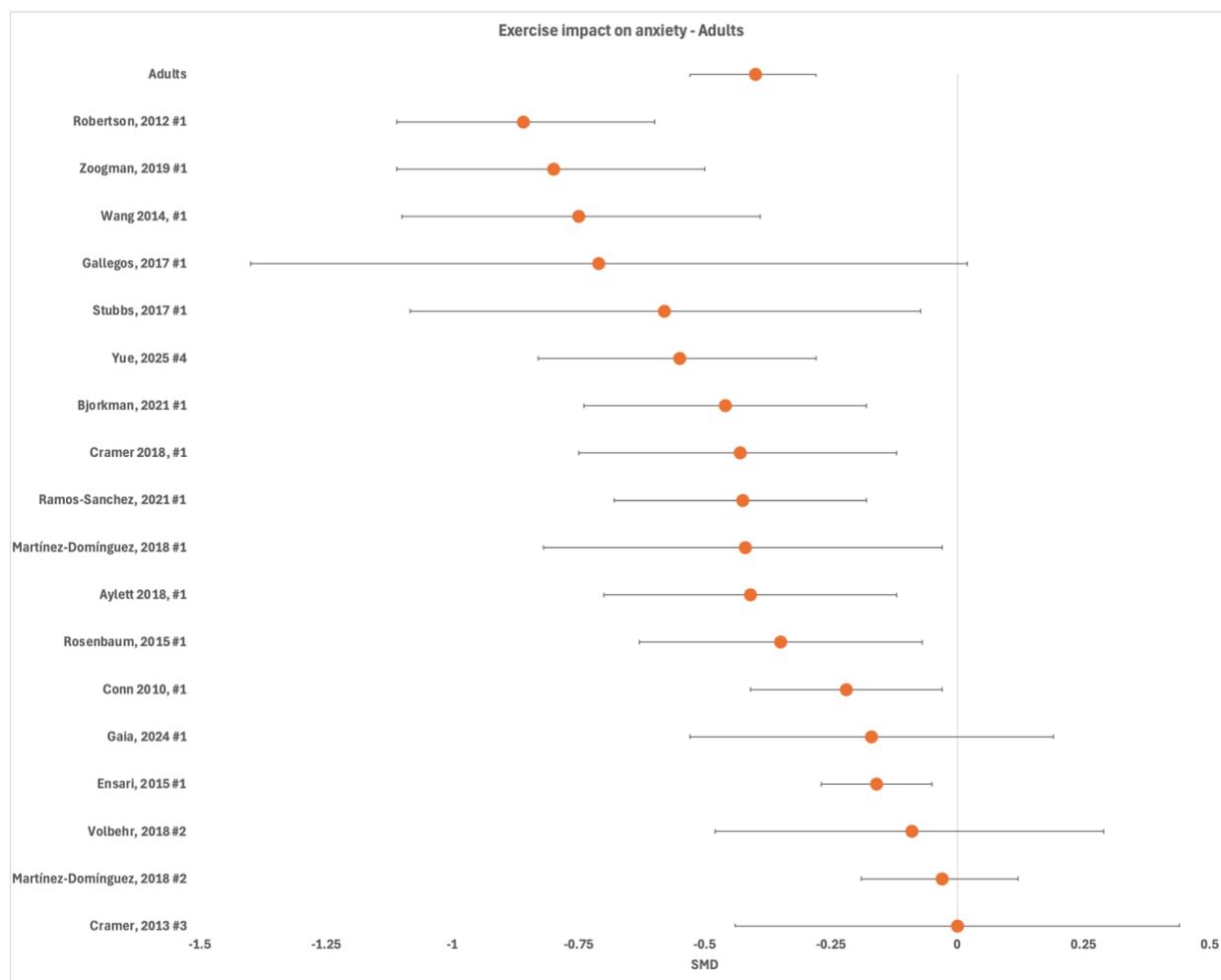
Figure 27 - Forest plot for anxiety – Emerging adults and Perinatal females
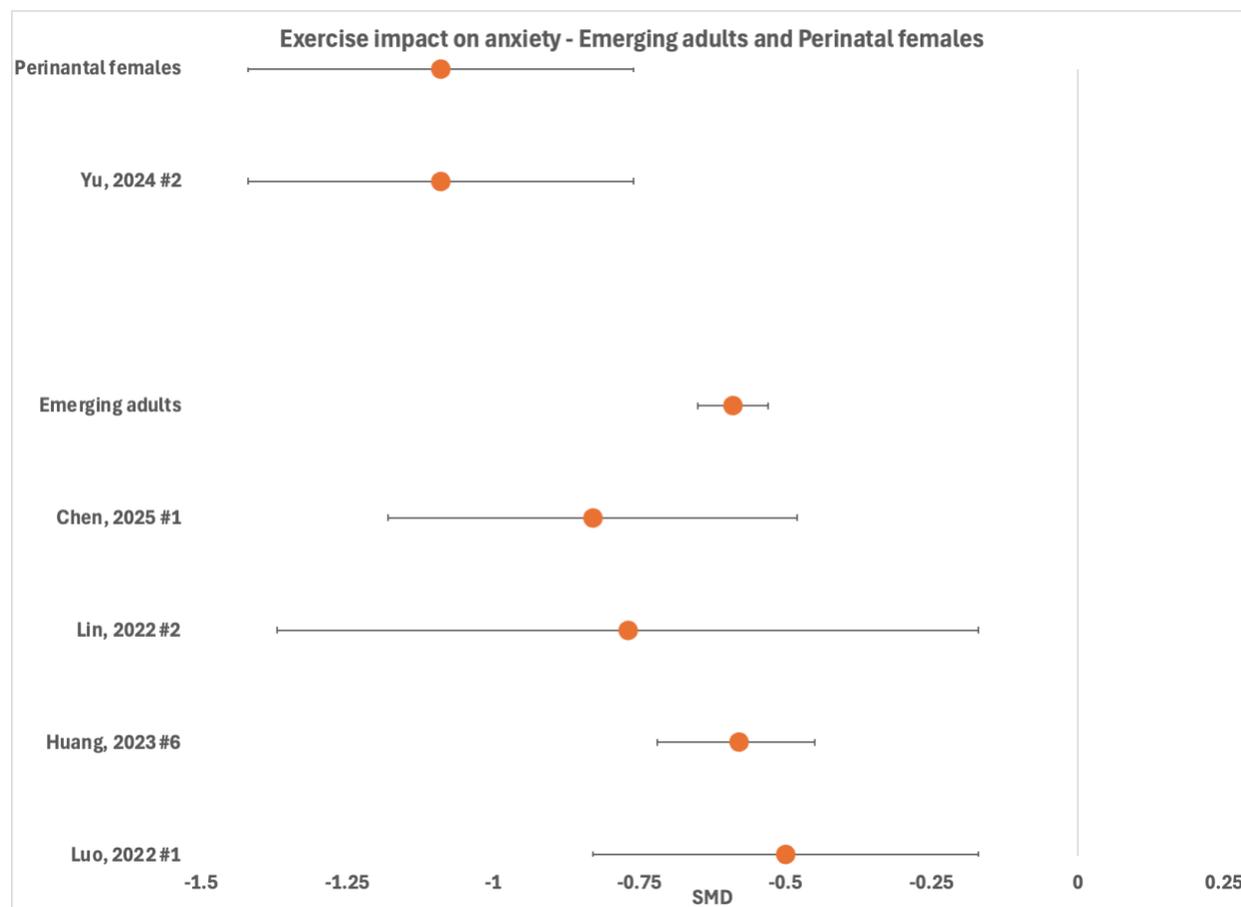
Figure 28 - Forest plot for anxiety – Exercise type

Exercise impact on Anxiety - By exercise type
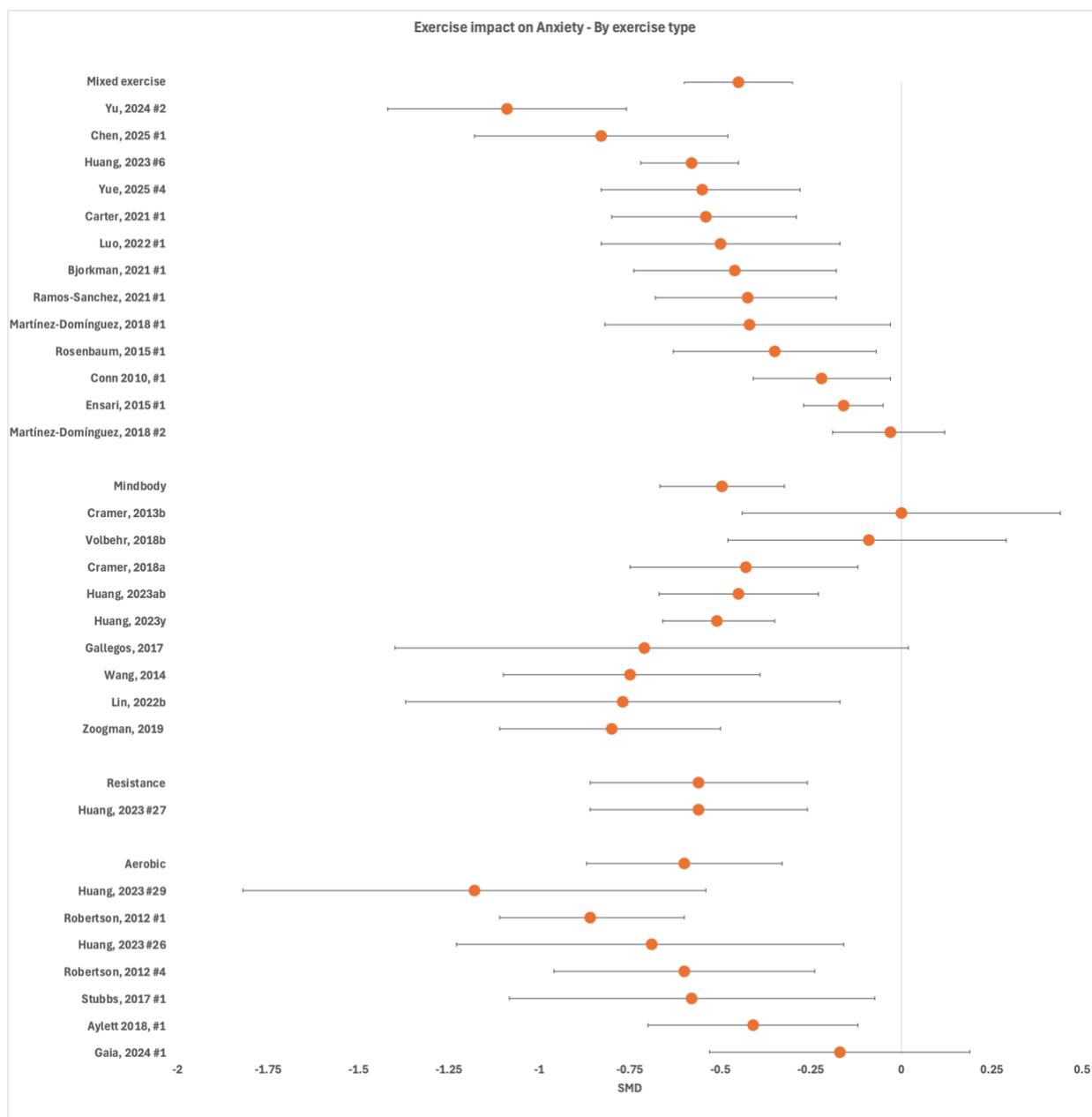
Figure 29 - Forest plot for anxiety – Group exercise

Exercise impact on Anxiety - By exercise type
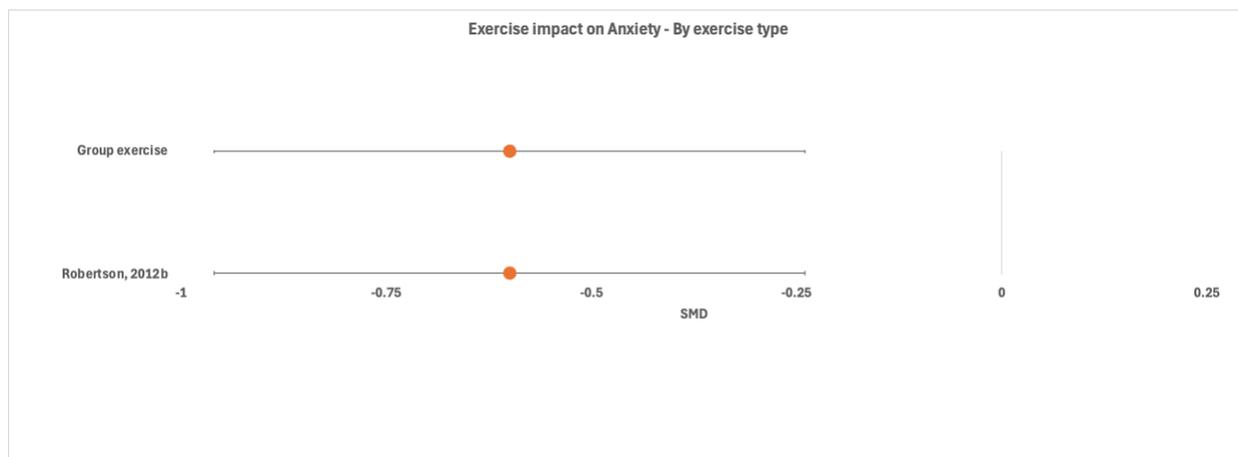
Figure 30 - Forest plot for anxiety – Exercise intensity
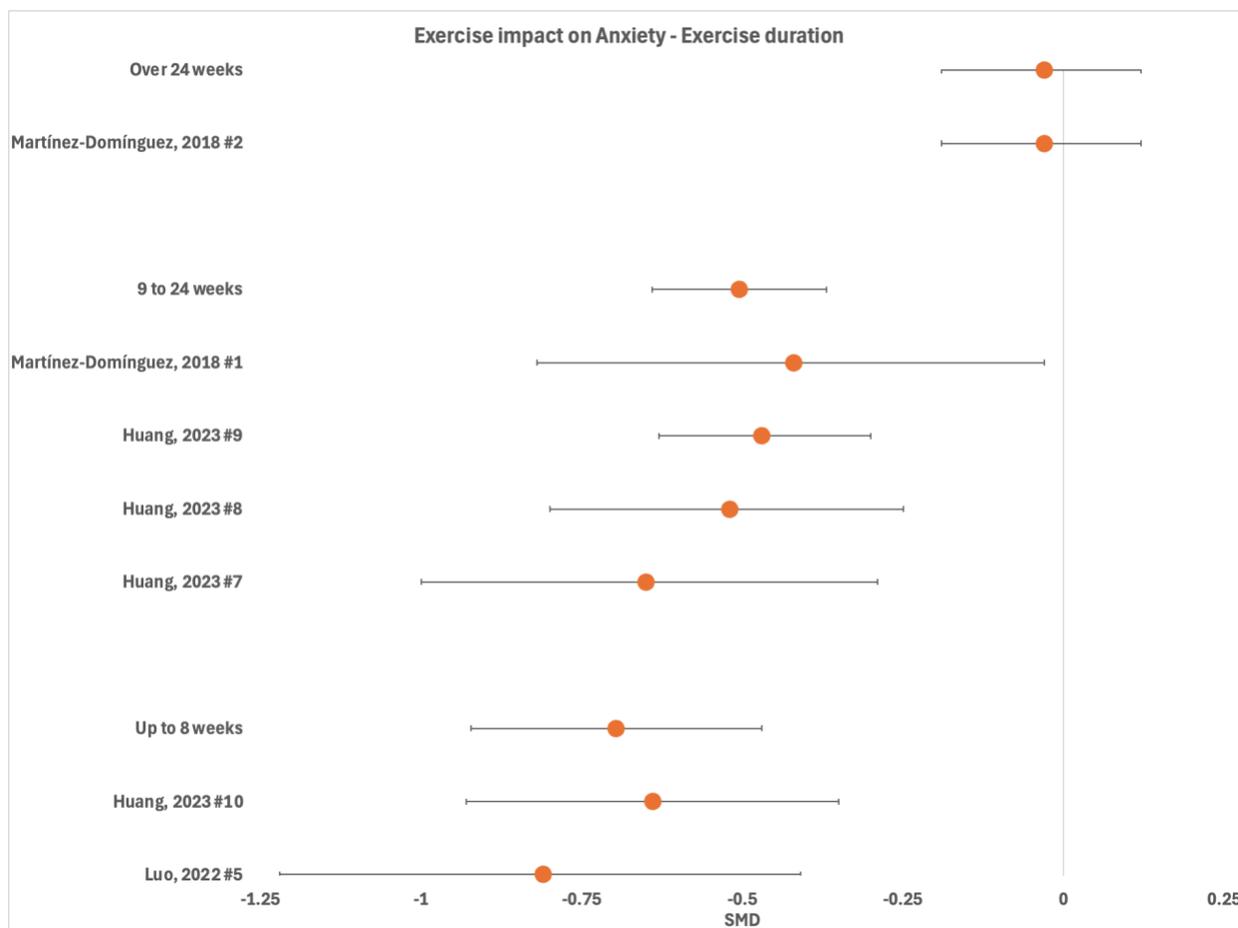

Exercise impact on Anxiety - Exercise intensity
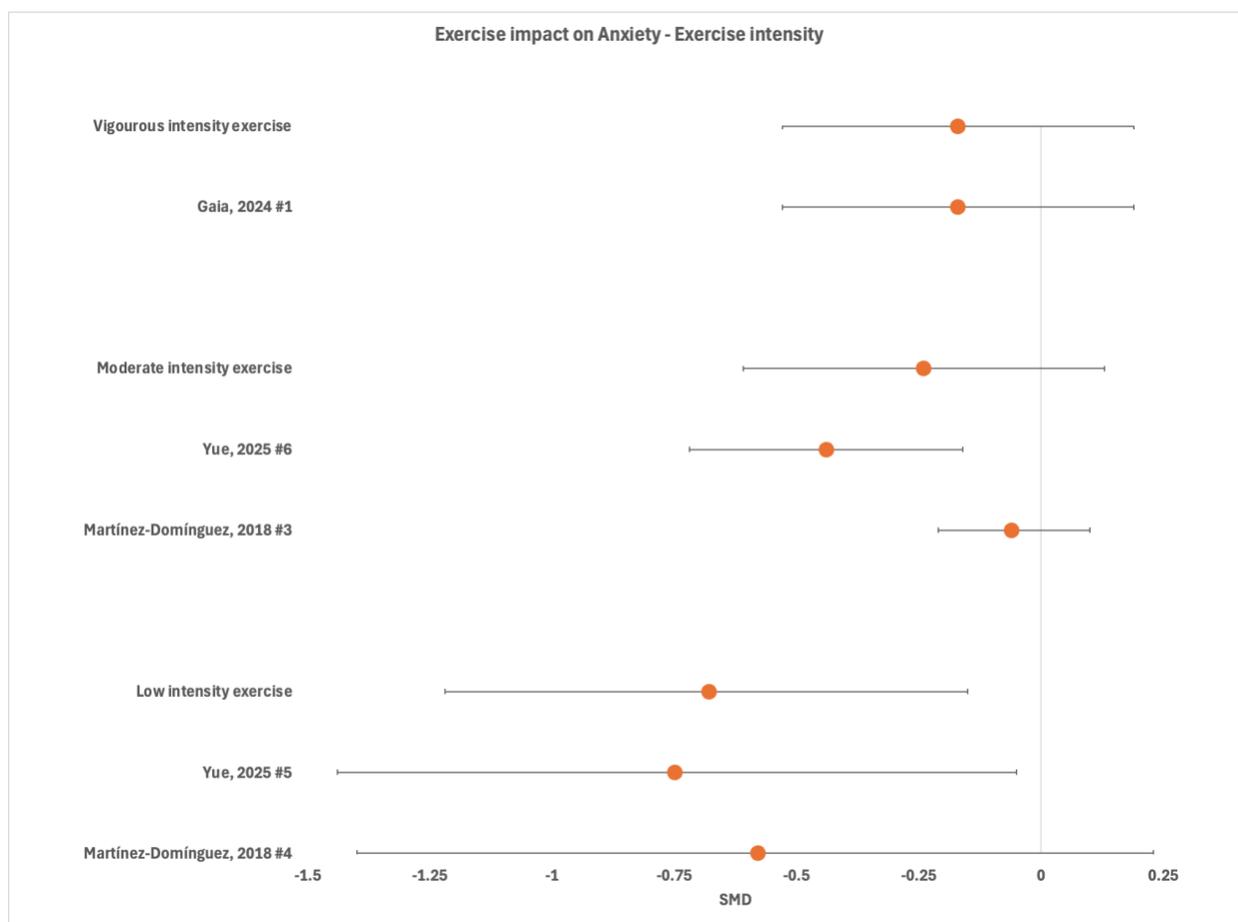
Figure 31 - Forest plot for anxiety – Exercise duration

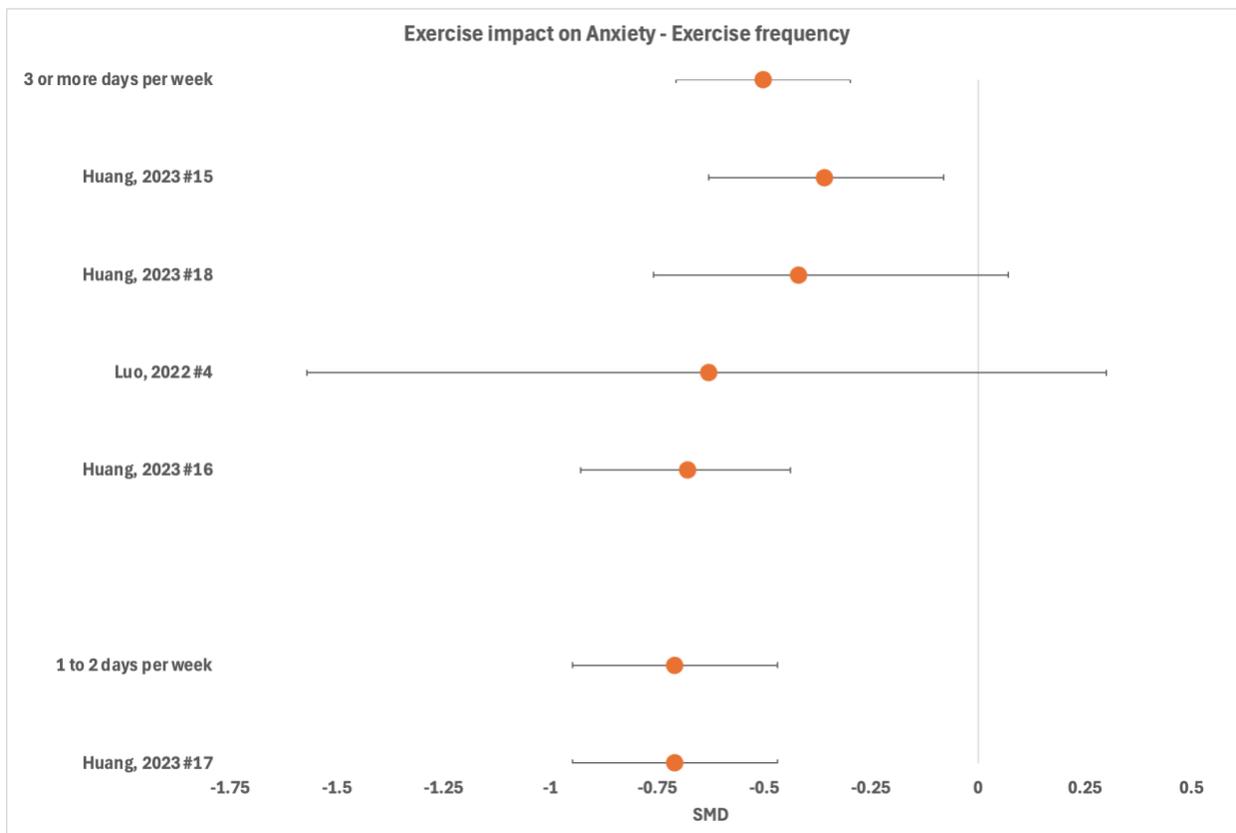**Figure 32 - Forest plot for anxiety – Exercise frequency**

Exercise impact on Anxiety - Exercise frequency

Figure 33 - Forest plot for anxiety – Clinical diagnoses
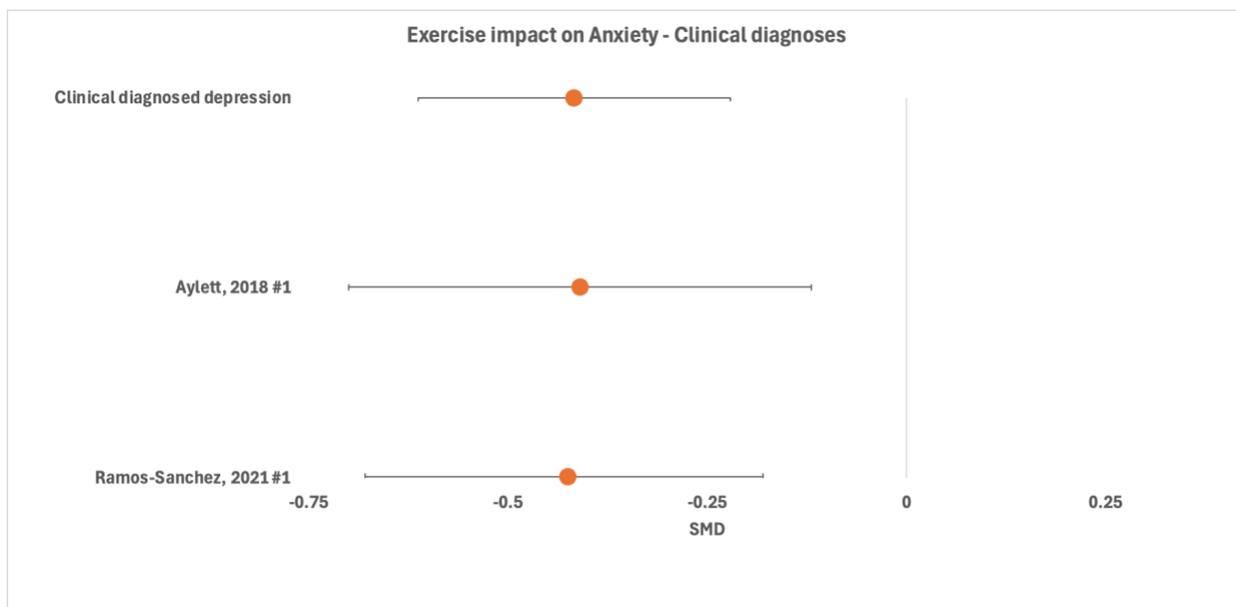

Exercise impact on Anxiety - Clinical diagnoses

Figure 34 - Forest plot for anxiety – AMSTAR categorisation

Exercise impact on Anxiety - AMSTAR categorisation