Electronic supplementary material

Adherence to aerobic and muscle-strengthening activities guidelines: A systematic review and meta-analysis of 3.3 million participants across 31 countries

Online supplemental emethod 1. Electronic search strategy.

PubMed

#1 ((("aerobic"[All Fields] AND "aerobic"[All Fields]) OR OR "exercise"[MeSH Terms] OR "exercise"[All Fields] AND ("exercise"[MeSH Terms] OR "exercise"[All Fields] OR ("physical"[All Fields] AND "activity"[All Fields]) OR "physical activity"[All Fields]) AND ("muscle-strengthening"[All Fields] AND ("activable"[All Fields] OR "activate"[All Fields] OR "activated"[All Fields] OR "activates"[All Fields] OR "activating"[All Fields] OR "activation"[All Fields] OR "activations"[All Fields] OR "activator"[All Fields] OR "activator s"[All Fields] OR "activators"[All Fields] OR "active"[All Fields] OR "actived"[All Fields] OR "actively"[All Fields] OR "actives"[All Fields] OR "activities"[All Fields] OR "activity s"[All Fields] OR "activitys"[All Fields] OR "motor activity"[MeSH Terms] OR ("motor"[All Fields] AND "activity"[All Fields]) OR "motor activity"[All Fields] OR "activity"[All Fields])) AND ("strengthen"[All Fields] OR "strengthened"[All Fields] OR "strengthening"[All Fields] OR "strengthens"[All Fields])) OR ("muscle-strengthening"[All Fields] AND ("exercise"[MeSH Terms] OR "exercise"[All Fields] OR "exercises"[All Fields] OR "exercise therapy"[MeSH Terms] OR ("exercise"[All Fields] AND "therapy"[All Fields]) OR "exercise therapy"[All Fields] OR "exercise s"[All Fields] OR "exercised"[All Fields] OR "exerciser"[All Fields] OR "exercisers"[All Fields] OR "exercising"[All Fields])))

#2 ("adherance"[All Fields] OR "adhere"[All Fields] OR "adhered"[All Fields] OR "adherence"[All Fields] OR "adherences"[All Fields] OR "adherent"[All Fields] OR "adherents"[All Fields] OR "adherer"[All Fields] OR "adherers"[All Fields] OR "adheres"[All Fields] OR "adhering"[All Fields]) AND ("guideline"[Publication Type] OR "guidelines as topic"[MeSH Terms] OR "guidelines"[All Fields] OR "recommendation as topic"[MeSH Terms] OR "recommendation"[All Fields])

#3 #1 AND #2

Web of Science

#1 TOPIC: ("aerobic physical activity" OR "exercise")

#2 TOPIC: ("muscle-strengthening" OR “strengthening” OR “strengthen” OR “strengthened” OR “strengthens”)

#3 TOPIC: ("adherence" OR “adhering”)

#4 TOPIC: ("guideline" OR “guidelines” OR “recommendation”)

#5 #4 AND #3 AND #2 AND #1

SPORTDiscus

S1 (MH " aerobic physical activity") OR (MH "exercise")

S2 (MH " muscle-strengthening") OR ‘strengthening’ OR ‘strengthen’ OR ‘strengthened’ OR ‘strengthens’

S3 ((MH "adherence") OR ‘adhering’

S4 (MH "guideline") OR ‘guideline’ OR ‘recommendation’

S5 S4 AND S3

EMBASE

(('adherence'/exp OR adherence OR adhering:ti,ab,kw) AND 'physical activity':ti,ab,kw OR exercise:ti,ab,kw) AND ('resistance training':ti,ab,kw OR 'strengthening exercise':ti,ab,kw) AND (guideline:ti,ab,kw OR recommendation:ti,ab,kw OR guidelines)

Scopus

(TITLE-ABS-KEY (adherence OR adhering) AND TITLE-ABS-KEY ("aerobic physical activity" OR exercise OR "physical activity") AND TITLE-ABS-KEY (strength OR strengthening OR muscle-strengthening OR strengthen OR strengthening) AND TITLE-ABS-KEY (guidelines OR guideline OR recommendations))

Online supplemental emethod 2. Excluded studies and reasons for exclusion.

Ahn, H., Choi, H. Y., & Ki, M. (2010). The association between levels of physical activity and low handgrip strength: Korea National. People, 39(4), 412-23.

Reason for exclusion: Duplicated

Bennie, J. A., De Cocker, K., Teychenne, M. J., Brown, W. J., & Biddle, S. J. (2019). The epidemiology of aerobic physical activity and muscle-strengthening activity guideline adherence among 383,928 US adults. International Journal of Behavioral Nutrition and Physical Activity, 16(1), 1-11.

Reason for exclusion: Duplicated

Bennie, J. A., Teychenne, M. J., De Cocker, K., & Biddle, S. J. (2019). Associations between aerobic and muscle-strengthening exercise with depressive symptom severity among 17,839 US adults. Preventive medicine, 121, 121-127.

Reason for exclusion: Duplicated

Bennie, J. A., De Cocker, K., Biddle, S. J., & Teychenne, M. J. (2020). Joint and dose-dependent associations between aerobic and muscle-strengthening activity with depression: A cross-sectional study of 1.48 million adults between 2011 and 2017. Depression and anxiety, 37(2), 166-178.

Reason for exclusion: Duplicated

Bennie, J. A., De Cocker, K., & Duncan, M. J. (2021). Associations of muscle-strengthening and aerobic exercise with self-reported components of sleep health among a nationally representative sample of 47,564 US adults. Sleep Health, 7(2), 281-288.

Reason for exclusion: Duplicated

Bennie, J. A., Ding, D., & De Cocker, K. Dose-dependent associations of joint aerobic and muscle-strengthening exercise with obesity: A cross-sectional study of 280,605 adults. Journal of sport and health science, S2095-2546.

Reason for exclusion: Duplicated

Blackwell, D. L., & Clarke, T. C. (2016). Occupational Differences Among Employed Adults Who Met 2008 Federal Guidelines for Both Aerobic and Muscle-strengthening Activities: United States, 2008-2014. National health statistics reports, (94), 1-12.

Reason for exclusion: Duplicated

Blackwell, D. L., & Clarke, T. C. (2018). State variation in meeting the 2008 federal guidelines for both aerobic and muscle-strengthening activities through leisure-time physical activity among adults aged 18-64: United States, 2010-2015. National health statistics reports, (112), 1-22.

Reason for exclusion: Duplicated

Branscum, P., & Fairchild, G. (2019). Differences in determinants of aerobic and muscle strengthening physical activity among college students: a reasoned action approach. Journal of Sports Sciences, 37(1), 90-99.

Reason for exclusion: Non-representative sample

Buckner, S. L., Loenneke, J. P., & Loprinzi, P. D. (2017). Single and combined associations of accelerometer-assessed physical activity and muscle-strengthening activities on plasma homocysteine in a national sample. Clinical physiology and functional imaging, 37(6), 669-674.

Reason for exclusion: Duplicated

Carlson, S. A., Fulton, J. E., Schoenborn, C. A., & Loustalot, F. (2010). Trend and prevalence estimates based on the 2008 Physical Activity Guidelines for Americans. American journal of preventive medicine, 39(4), 305-313.

Reason for exclusion: Duplicated

Centers for Disease Control and Prevention (CDC. (2013). Suicide among adults aged 35-64 years--United States, 1999-2010. MMWR. Morbidity and mortality weekly report, 62(17), 321-325.

Reason for exclusion: Duplicated

Harris, C. D., Watson, K. B., Carlson, S. A., Fulton, J. E., Dorn, J. M., & Elam-Evans, L. (2013). Adult participation in aerobic and muscle-strengthening physical activities—United States, 2011. Morbidity and Mortality Weekly Report, 62(17), 326-330.

Reason for exclusion: Duplicated

Chen, S., Malete, L., & Ling, J. An examination of physical activity guidelines and health-related quality of life among US older adults. Preventive medicine, 156, 106986.

Reason for exclusion: Duplicated

Dankel, S. J., Loenneke, J. P., & Loprinzi, P. D. (2016). The individual, joint, and additive interaction associations of aerobic-based physical activity and muscle strengthening activities on metabolic syndrome. International journal of behavioral medicine, 23(6), 707-713.

Reason for exclusion: Duplicated

Desmond, R., Jackson, B. E., & Hunter, G. (2015). Utilization of 2013 BRFSS Physical Activity Data for State Cancer Control Plan Objectives: Alabama Data. Southern Medical Journal, 108(5), 290-297.

Reason for exclusion: Duplicated

Du, Y., Liu, B., Sun, Y., Snetselaar, L. G., Wallace, R. B., & Bao, W. (2019). Trends in adherence to the physical activity guidelines for Americans for aerobic activity and time spent on sedentary behavior among US adults, 2007 to 2016. JAMA network open, 2(7), e197597.

Reason for exclusion: Study design

Lange, C., & Manz, K. (2017). Health-enhancing physical activity during leisure time among adults in Germany. Journal of Health Monitoring, 2(2).

Reason for exclusion: Duplicated

Grøntved, A., Pan, A., Mekary, R. A., Stampfer, M., Willett, W. C., Manson, J. E., & Hu, F. B. (2014). Muscle-strengthening and conditioning activities and risk of type 2 diabetes: a prospective study in two cohorts of US women. PLoS medicine, 11(1), e1001587.

Reason for exclusion: Non-representative sample

Hyde, E. T., Whitfield, G. P., Omura, J. D., Fulton, J. E., & Carlson, S. A. (2021). Trends in meeting the Physical Activity Guidelines: muscle-strengthening alone and combined with aerobic activity, United States, 1998–2018. Journal of Physical Activity and Health, 18(S1), S37-S44.

Reason for exclusion: Duplicated

Hyde, E. T., Watson, K. B., Omura, J. D., Janz, K. F., Lee, S. M., Fulton, J. E., & Carlson, S. A. (2021). Surveillance of Meeting the Youth Physical Activity Guideline: Impact of Including Vigorous-Intensity and Bone-Strengthening Activities. Research Quarterly for Exercise and Sport, 1-6.

Reason for exclusion: Duplicated

Kim, J. (2017). Longitudinal trend of prevalence of meeting physical activity guidelines among korean adults. Exercise Medicine, 1.

Reason for exclusion: Study design

Lim, J., Park, S., & Kim, J. S. (2021). Joint association of aerobic physical activity and muscle-strengthening activities with metabolic syndrome: the Korean National Health and Nutrition Examination Survey 2014-2015. Epidemiology and health, 43, e2021096.

Reason for exclusion: Duplicated

Mama, S. K., Bhuiyan, N., Foo, W., Segel, J. E., Bluethmann, S. M., Winkels, R. M., ... & Schmitz, K. H. (2020). Rural-urban differences in meeting physical activity recommendations and health status in cancer survivors in central Pennsylvania. Supportive Care in Cancer, 28(10), 5013-5022.

Reason for exclusion: Clinical population

Mekary, R. A., Grøntved, A., Despres, J. P., De Moura, L. P., Asgarzadeh, M., Willett, W. C., ... & Hu, F. B. (2015). Weight training, aerobic physical activities, and long-term waist circumference change in men. Obesity, 23(2), 461-467.

Reason for exclusion: Non-representative sample

Merlo, C. L., Jones, S. E., Michael, S. L., Chen, T. J., Sliwa, S. A., Lee, S. H., ... & Park, S. (2020). Dietary and Physical Activity Behaviors Among High School Students-Youth Risk Behavior Survey, United States, 2019. MMWR supplements, 69(1), 64-76.

Reason for exclusion: Duplicated

Mu, L., Cohen, A. J., & Mukamal, K. J. (2015). Prevalence and predictors of resistance and aerobic exercise among hypertensive adults in the United States. Journal of human hypertension, 29(6), 394-395.

Reason for exclusion: Duplicated

Murphy, L. B., Hootman, J. M., Boring, M. A., Carlson, S. A., Qin, J., Barbour, K. E., ... & Helmick, C. G. (2017). Leisure Time Physical Activity Among US Adults With Arthritis, 2008− 2015. American Journal of Preventive Medicine, 53(3), 345-354.

Reason for exclusion: Clinical population

Nie, J., Haberstroh, M., Acosta, T., Huang, W., Wang, Y., & Barengo, N. C. (2021). Independent and joint associations between leisure time physical activity and strength activities with mortality outcomes in older adults at least 65 years of age: a prospective cohort study. The Journals of Gerontology: Series A, 76(12), 2122-2131.

Reason for exclusion: Study design

Oftedal, S., Smith, J., Vandelanotte, C., Burton, N. W., & Duncan, M. J. (2019). Resistance training in addition to aerobic activity is associated with lower likelihood of depression and comorbid depression and anxiety symptoms: a cross sectional analysis of Australian women. Preventive Medicine, 126, 105773.

Reason for exclusion: Non-representative sample

Oftedal, S., Holliday, E. G., Reynolds, A. C., Bennie, J. A., Kline, C. E., & Duncan, M. J. (2022). Prevalence, Trends, and Correlates of Joint Patterns of Aerobic and Muscle-Strengthening Activity and Sleep Duration: A Pooled Analysis of 359,019 Adults in the National Health Interview Survey 2004–2018. Journal of Physical Activity and Health, 19(4), 246-255.

Reason for exclusion: Duplicated

Quinn, T. D., Wu, F., Mody, D., Bushover, B., Mendez, D. D., Schiff, M., & Fabio, A. (2019). Associations Between Neighborhood Social Cohesion and Physical Activity in the United States, National Health Interview Survey, 2017. Preventing Chronic Disease, 16, E163.

Reason for exclusion: Duplicated

Schoenborn, C. A., & Stommel, M. (2011). Adherence to the 2008 adult physical activity guidelines and mortality risk. American journal of preventive medicine, 40(5), 514-521.

Reason for exclusion: Duplicated

Siahpush, M., Levan, T. D., Nguyen, M. N., Grimm, B. L., Ramos, A. K., Michaud, T. L., & Johansson, P. L. (2019). The association of physical activity and mortality risk reduction among smokers: Results from 1998–2009 national health Interview surveys–national death index linkage. Journal of Physical Activity and Health, 16(10), 865-871.

Reason for exclusion: Duplicated

Song, M., Nam, S., Buss, J., & Lee, S. J. (2020). Assessing the prevalence of meeting physical activity recommendations among US healthcare workers: Data from the 2015 National Health Interview Survey. Archives of Environmental & Occupational Health, 75(7), 422-430.

Reason for exclusion: Duplicated

Strain, T., Fitzsimons, C., Kelly, P., & Mutrie, N. (2016). The forgotten guidelines: cross-sectional analysis of participation in muscle strengthening and balance & co-ordination activities by adults and older adults in Scotland. BMC public health, 16(1), 1-12.

Reason for exclusion: Study design

Sudeck, G., Geidl, W., Abu-Omar, K., Finger, J. D., Krauß, I., & Pfeifer, K. (2021). Do adults with non-communicable diseases meet the German physical activity recommendations?. German Journal of Exercise and Sport Research, 51(2), 183-193.

Reason for exclusion: Duplicated

Sung, J. H., Son, S. R., Baek, S. H., & Kim, B. J. (2021). Association of occupation with the daily physical activity and sedentary behaviour of middle-aged workers in Korea: a cross-sectional study based on data from the Korea National Health and Nutrition Examination Survey. BMJ open, 11(11), e055729.

Reason for exclusion: Study design

Tarasenko, Y., Chen, C., & Schoenberg, N. (2017). Self-reported physical activity levels of older cancer survivors: Results from the 2014 National Health Interview Survey. Journal of the American Geriatrics Society, 65(2), e39-e44.

Reason for exclusion: Duplicated

Tarasenko, Y. N., Linder, D. F., & Miller, E. A. (2018). Muscle-strengthening and aerobic activities and mortality among 3+ year cancer survivors in the US. Cancer Causes & Control, 29(4), 475-484.

Reason for exclusion: Duplicated

Tittlbach, S. A., Hoffmann, S. W., & Bennie, J. A. (2022). Association of meeting both muscle strengthening and aerobic exercise guidelines with prevalent overweight and obesity classes-results from a nationally representative sample of German adults. European Journal of Sport Science, 22(3), 436-446.

Reason for exclusion: Duplicated

Visaria, A., Nagaraj, B., Shah, M., Kethidi, N., Modak, A., Shahani, J., ... & Raghuwanshi, M. (2022). Low Amount and Intensity of Leisure-time Physical Activity in Asian Indian Adults. American Journal of Health Promotion, 36(3), 440-449.

Reason for exclusion: Duplicated

Walker, T. J., Tullar, J. M., Diamond, P. M., Kohl, H. W., & Amick, B. C. (2017). The relation of combined aerobic and muscle-strengthening physical activities with presenteeism. Journal of Physical Activity and Health, 14(11), 893-898.

Reason for exclusion: Non-representative sample

Watson, K. B., Whitfield, G., Chen, T. J., Hyde, E. T., & Omura, J. D. (2021). Trends in Aerobic and Muscle-Strengthening Physical Activity by Race/Ethnicity Across Income Levels Among US Adults, 1998–2018. Journal of Physical Activity and Health, 18(S1), S45-S52.

Reason for exclusion: Duplicated

Xin, F., Zhu, Z., Chen, S., Chen, H., Hu, X., Ma, X., ... & Tang, Y. (2022). Prevalence and correlates of meeting the muscle-strengthening exercise recommendations among Chinese children and adolescents: Results from 2019 Physical Activity and Fitness in China—The Youth Study. Journal of Sport and Health Science, 11(3), 358-366.

Reason for exclusion: Study design

Zhao, G., Li, C., Ford, E. S., Fulton, J. E., Carlson, S. A., Okoro, C. A., ... & Balluz, L. S. (2014). Leisure-time aerobic physical activity, muscle-strengthening activity and mortality risks among US adults: the NHANES linked mortality study. British journal of sports medicine, 48(3), 244-249.

Reason for exclusion: Duplicated

Online supplemental eTable 1. Characteristics of studies included in the meta-analysis.

Author, year	Country	Study design	Source of information	Study period	N (% females) / Age	Physical activity assessment and physical active definition	Overall prevalence
Bennie et al. 2016 [21]	Australia	Cross-sectional	National Nutrition and Physical Activity Survey (NNPAS)	2011-2012	9,284 (54.1) / 18-85 years	Active Australia Survey ≥150 MVPA min per week and ≥2 sessions per week of strength or toning activities	15%
Bennie et al. 2017 [22]	Finland	Cross-sectional	Regional Health and Well-being Study	2013-2014	69,032 (52.0) / ≥ 18 years	Self-reported Finnish recommendations: ≥150 moderate-intensity min per week or ≥75 vigorous-intensity min per week or an equivalent combination of both and reporting MVPA on ≥3 days per week and ≥2 times per week of MSA and/or balance training	10.8%
Bennie et al. 2020 A [23]	USA	Cross-sectional	US Behavioral Risk Factor Surveillance System (BRFSS) surveys	2011-2017	1,677,108 (51.6) / ≥ 18 years	Behavioural Risk Factor Surveillance System Meeting both 150 min per week of moderate-intensity aerobic physical activity, or 75 min per week of vigorous-intensity aerobic physical activity, or an equivalent combination of both and ≥ 2 sessions per week of MSA	20.2%

Bennie et al. 2020 B [24]	South Korea	Cross-sectional	Korea National Health and Nutritional Examination Survey (KNHANES)	2014-2015	9,120 (50.3) / 20-80 years	GPAQ Meeting both MVPA ≥150 minutes per week and muscle strengthening exercise ≥2 sessions per week	15.4%
Bennie et al. 2021 [25]	Germany	Cross-sectional	German Health Update survey	2014	24,016 (51.1) / ≥ 18 years	Interview Survey Physical Activity Questionnaire Meeting both MVPA ≥150 minutes per week and muscle strengthening exercise ≥2 sessions per week	22.6%
Bennie and Wiesner 2022 [26]	28 European countries	Cross-sectional	European Health Interview Survey	2013-2014	280,605 (52.1) / ≥ 18 years	European Health Interview Survey – Physical Activity Questionnaire (EHIS-PAQ) Aerobic physical activity ≥ 150 min/ per week and muscle strengthening exercise ≥ 2 sessions per week	15.0%
CDC 2011 [39]	USA	Cross-sectional	National Youth Physical Activity and Nutrition Study (NYPANS)	2010	9,701 (NR) / 14–18 years	NYPANS questions Aerobic physical activity and muscle-strengthening activity participation in ≥60 minutes of aerobic activity per day, 7 days per week and MSA on ≥3 days per week)	15.3%
Chen et al. 2021 [9]	USA	Cross-sectional	Youth Risk Behavior Survey (YRBS)	2011-2019	86,869 (49.3) / 14-18 years	YRBS questions Aerobic physical activity and muscle-strengthening activity	19.2%

						participation of ≥ 60 min of aerobic activity per day, 7 days per week and MSA on ≥ 3 days per week	
Churilla et al. 2022 [27]	USA	Cross-sectional	US Behavioral Risk Factor Surveillance System (BRFSS) surveys	2019	323,435 (49.6) / ≥ 18 years	Behavioural Risk Factor Surveillance System Aerobic physical activity ≥ 150 min per week and muscle strengthening exercise ≥ 2 sessions per week	23.5%
de Cocker et al. 2020 [28]	UK	Cross-sectional	Health Survey for England (HSE) study	2012-2016	14,050 (56.0%) / ≥ 16 years	Self-reported questionnaire ≥ 150 min of moderate activity or 75 min of vigorous activity per week or an equivalent combination of both; and undertaking MSA on at least two days per week	25.7%
Dankel et al. 2016 [29]	USA	Cross-sectional	National Health and Nutrition Examination Survey (NHANES)	2003-2006	4,587 (49.0) / ≥ 20 years	Accelerometry (ActiGraph 7164) and questionnaire Accelerometer-determined physical activity ≥ 150 min per week of MVPA and ≥ 8 days of MSA within the past 30 days	11.0%
Dorner et al. 2021 [30]	Austria	Cross-sectional	Austrian Health Interview Surveys	2014 and 2019	31,232 (51.2%) / ≥ 15 years	European Health Interview Survey – Physical Activity Questionnaire (EHIS-PAQ) Aerobic physical activity ≥ 150 min per week and muscle	23.8%

						strengthening exercise ≥ 2 sessions per week	
Duijvestijn et al. 2020 [31]	The Netherlands	Cross-sectional	Dutch Health Survey/Lifestyle Monitor by Statistics Netherlands	2018	226,083 (52.0%) / ≥ 12 years	Short Questionnaire to Assess Health-enhancing physical activity (SQUASH) Adolescents: Aerobic physical activity and muscle-strengthening activity participation in ≥ 60 min of aerobic activity per day, 7 days per week and MSA on ≥3 days per week Adults: Aerobic physical activity ≥ 150 min per week and muscle strengthening exercise ≥ 2 sessions per week	33.9% (12-17 years old) 43.5% (≥18 years old)
Lackinger and Dorner, 2015 [32]	Austria	Cross-sectional	Austrian Health Interview Survey	2006-2007	467 (46.7) / 20-29 years	IPAQ Aerobic physical activity ≥ 150 min per week and muscle strengthening exercise ≥ 2 sessions per week	39.4%
Lee et al. 2022 [33]	South Korea	Cross-sectional	National Health Insurance Service of South Korea	2018-2019	Cohort A: 76,395 (51.2) / ≥ 20 years Cohort B: 2,295 (53.5) / ≥ 20 years	Self-reported questionnaire ≥ 150 min of moderate activity or 75 min of vigorous activity per week or an equivalent combination of both; and undertaking MSA on at least two days per week	Cohort A: 14.5% Cohort B: 12.7%
Sandercock et al. 2022 [34]	UK	Cross-sectional	Active Lives Survey	2015-2017	275,182 (48.9) /	Active Lives dataset	26.5%

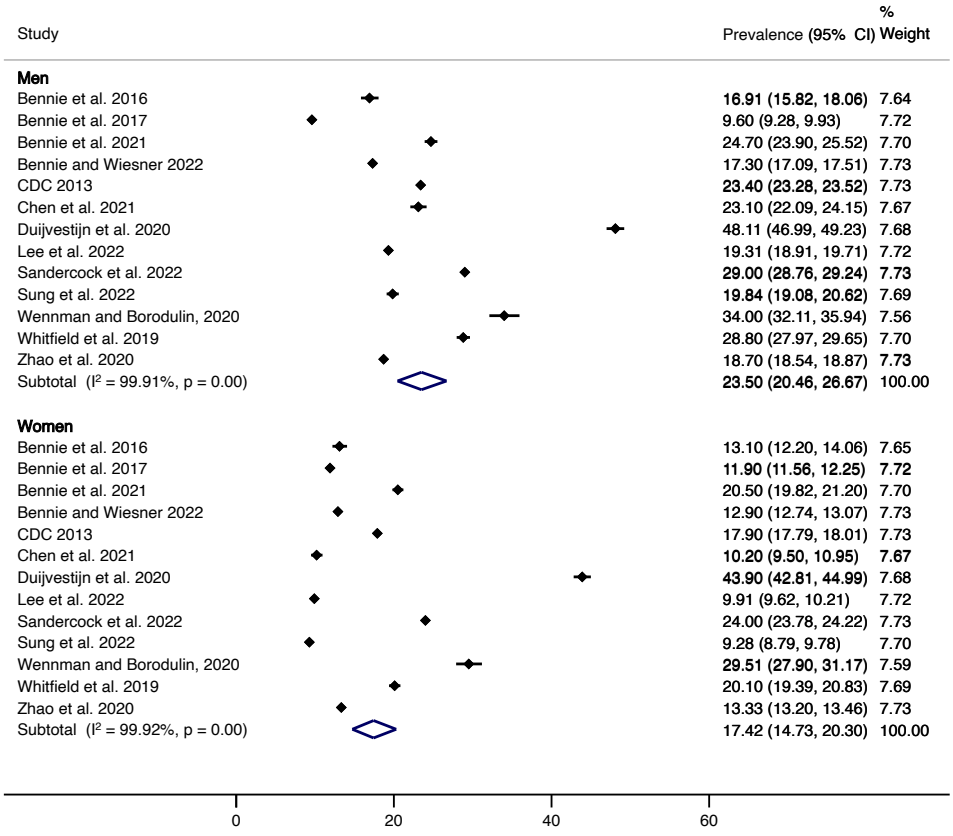
					18-95 years	150 min per week equivalent moderate physical activity including two sessions of strengthening activities	
Song et al. 2013 [35]	USA	Cross-sectional	National Health and Nutrition Examination Survey (NHANES)	1999-2006	6547 (48.9) / 12-17 years	Self-reported questionnaire Aerobic physical activity and MSA participation in ≥ 60 min of aerobic activity per day, 7 days per week and MSA on ≥3 days per week	16.3%
Sung et al. 2022 [36]	South Korea	Cross-sectional	Korea National Health and Nutritional Examination Survey (KNHANES)	2016-2019	23,505 (50.5) / ≥ 20 years	GPAQ Aerobic physical activity ≥ 150 min per week and muscle strengthening exercise ≥ 2 sessions per week	14.5%
Wennman and Borodulin, 2020 [37]	Finland	Cross-sectional	FinHealth 2017 Study	2017	5335 (56.0) / ≥ 18 years	FinHealth Health-Enhancing Physical Activity Questionnaire ≥ 150 min of moderate activity or 75 min of vigorous activity per week or an equivalent combination of both; and undertaking MSA on at least two days per week	34.2%
Whitfield et al. 2019 [38]	USA	Cross-sectional	National Health Interview Survey	2017	23,006 (51.8) / ≥ 18 years	Sample Adult Core questions 150–300 min of moderate-intensity, or 75–150 min of vigorous-intensity aerobic physical activity per week, or an equivalent combination of	24.3%

						moderate- and vigorous-intensity aerobic physical activity and MSA of at least moderate intensity that involve all major muscle groups on ≥ 2 days per week	
Zhao et al. 2020 [8]	USA	Prospective	National Health Interview Survey	1997-2014	479,856 (48.2) / ≥ 18 years	Sample Adult Core questions ≥ 150 min of moderate activity or 75 min of vigorous activity per week or an equivalent combination of both; and undertaking MSA on at least two days per week	15.9%
Abbreviations: GPAQ, Global Physical Activity Questionnaire; IPAQ, international physical activity questionnaire; MSA, Muscle-strengthening activities; MVPA, moderate-to-vigorous physical activity; NR, not reported.							

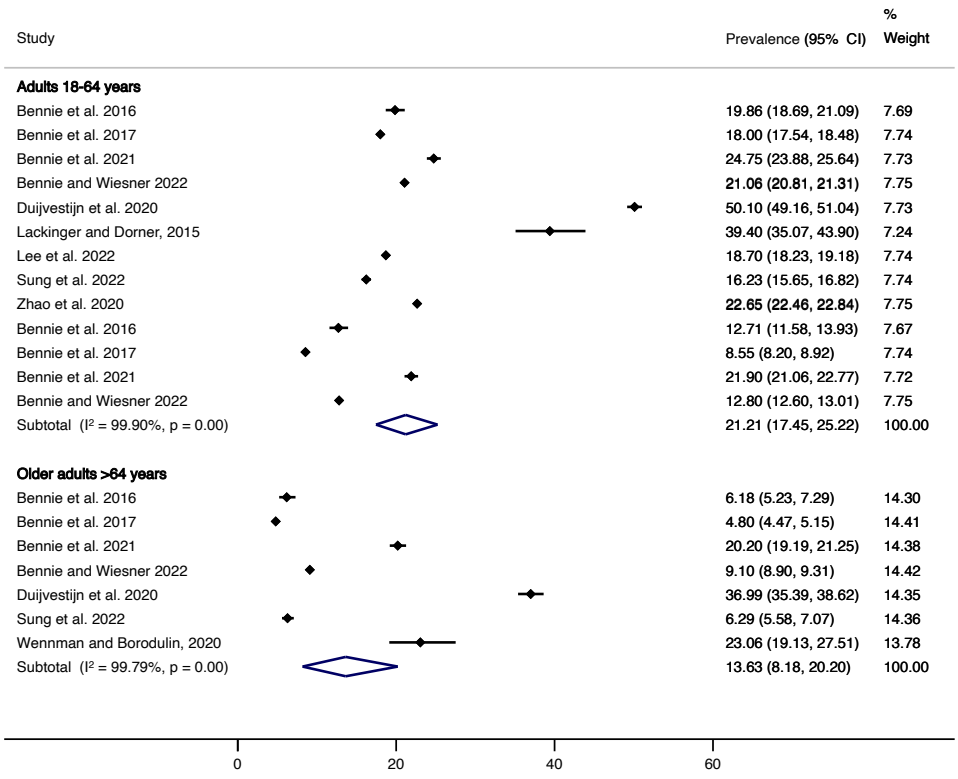
Online supplemental eTable 2. Results of the quality assessment checklist for prevalence studies.

Study	1	2	3	4	5	6	7	8	9	Total score	Summary on the overall risk of study bias
Bennie et al. 2016	0	0	0	0	0	0	0	0	0	0	Low risk
Bennie et al. 2017	0	0	0	1	0	0	1	0	0	2	Low risk
Bennie et al. 2020 A	0	0	0	1	0	0	0	0	0	1	Low risk
Bennie et al. 2020 B	0	0	0	0	0	0	1	0	0	1	Low risk
Bennie et al. 2021	0	0	0	0	0	0	1	0	0	1	Low risk
Bennie & Wiesner 2022	0	0	0	0	0	0	1	0	0	1	Low risk
CDC 2011	0	0	0	0	0	0	1	0	0	1	Low risk
Chen et al. 2021	0	0	0	0	0	0	0	0	0	0	Low risk
Churilla et al. 2022	0	0	0	0	0	0	0	0	0	0	Low risk
De Cocker et al. 2020	0	0	0	1	0	0	1	0	0	2	Low risk
Dankel et al. 2016	0	0	0	0	0	0	0	0	0	0	Low risk
Dorner et al. 2021	0	0	0	0	0	0	1	0	0	1	Low risk
Duijvestijn et al. 2020	0	0	0	0	0	0	0	0	0	0	Low risk
Lackinger & Dorner, 2015	0	0	0	0	0	0	0	0	0	0	Low risk
Lee et al. 2022	0	0	0	1	0	0	0	0	0	0	Low risk
Sandercock et al. 2022	0	0	0	0	0	0	1	0	0	1	Low risk
Song et al. 2013	0	0	0	1	0	0	0	0	0	1	Low risk
Sung et al. 2022	0	0	0	0	0	0	0	0	0	0	Low risk
Wennman & Borodulin, 2020	0	0	0	0	0	0	1	0	0	1	Low risk
Whitfield et al. 2019	0	0	0	0	0	0	1	0	0	1	Low risk
Zhao et al. 2020	0	0	0	0	0	0	0	0	0	0	Low risk

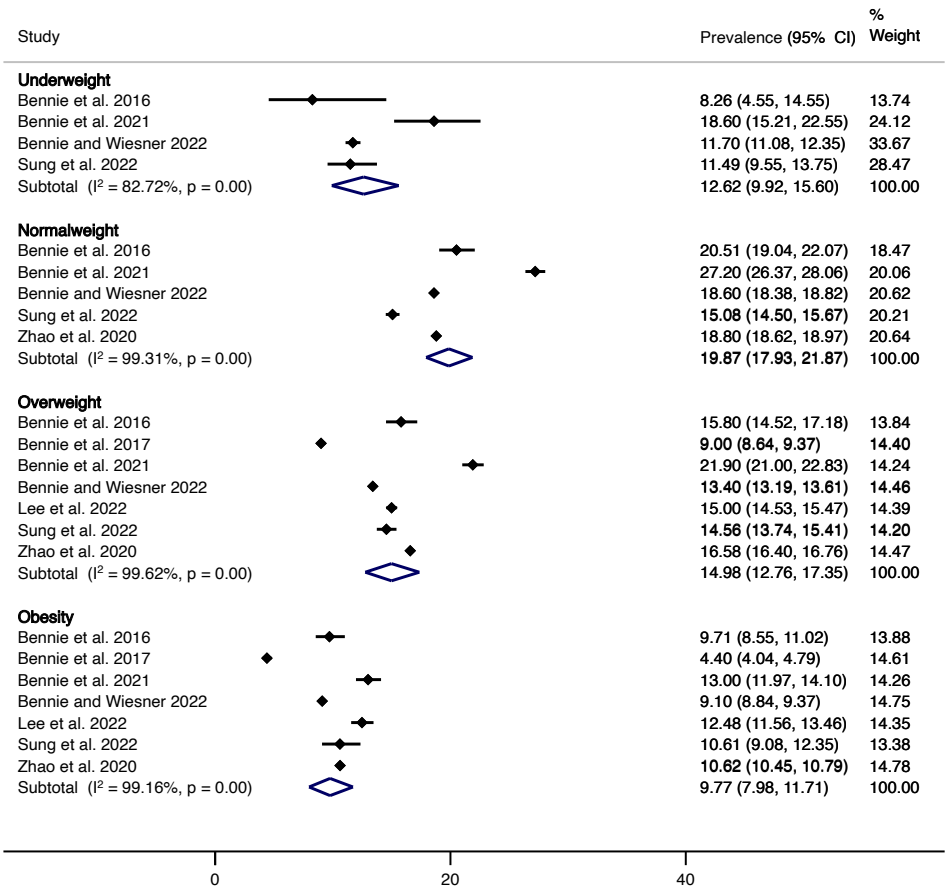
Online supplemental eFigure 1. Forest plot of adherence to aerobic and muscle-strengthening activities guidelines by sex.



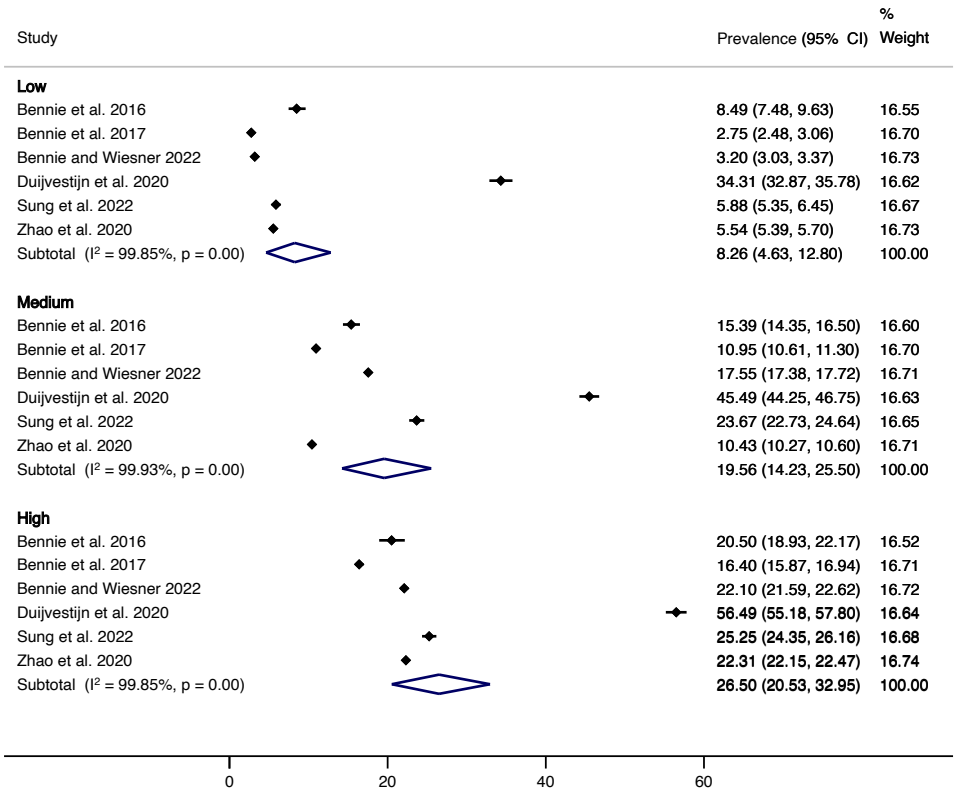
Online supplemental eFigure 2. Forest plot of adherence to aerobic and muscle-strengthening activities guidelines by age.



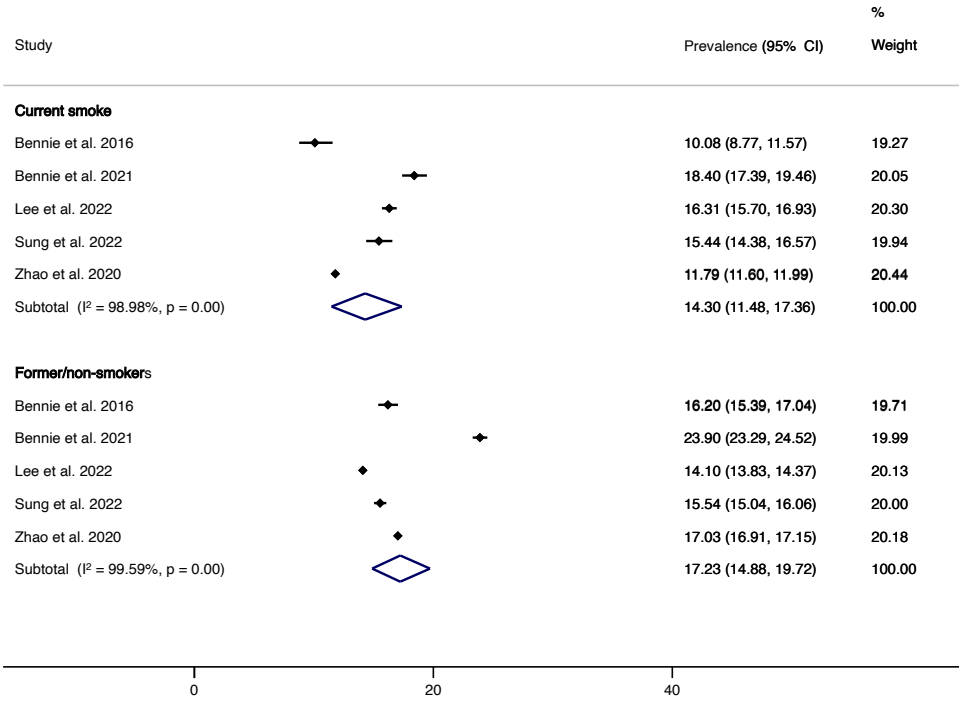
Online supplemental eFigure 3. Forest plot of adherence to aerobic and muscle-strengthening activities guidelines by weight status.



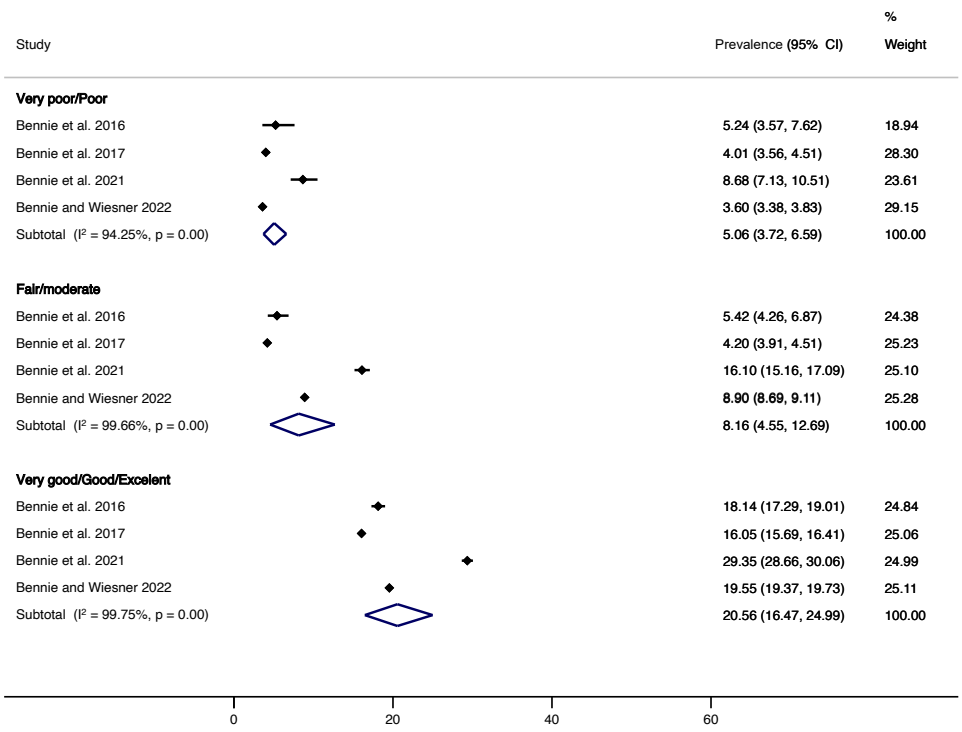
Online supplemental eFigure 4. Forest plot of adherence to aerobic and muscle-strengthening activities guidelines by education level.



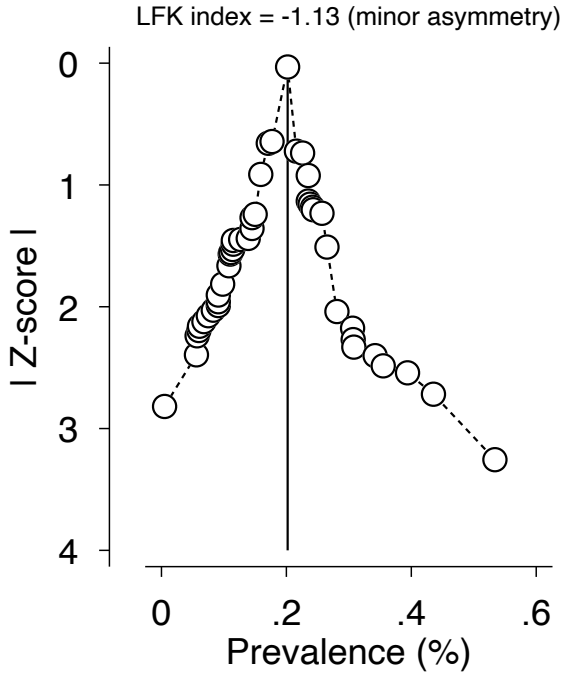
Online supplemental eFigure 5. Forest plot of adherence to aerobic and muscle-strengthening activities guidelines by smoking status.



Online supplemental eFigure 6. Forest plot of adherence to aerobic and muscle-strengthening activities guidelines by self-rated health status.



Online supplemental eFigure 7. Doi plot for adults ≥ 18 years old.



Online supplemental eFigure 8. Doi plot for adolescents aged 12-17 years old.