Table E.1.4.d.2: Effects of physical activity on body composition among people living with HIV

Questions: What is the association between physical activity and body composition? Is there a dose response association (volume, duration, frequency, intensity)? Does the association vary by type or domain of PA?
Population: People living with HIV
Exposure: Greater volume, duration, frequency, or intensity of physical activity
Comparison: No physical activity or lesser volume, duration, frequency, or intensity of physical activity
Outcomes: Body mass index, waist and hip circumference, body fat percentage, lean body mass, fat mass, skeletal muscle mass

Exercise modality	Study	No. of Studies No. of participants	AMSTAR 2 Score	GRADE CRITERIA					Summary of findings	CERTAINTY
				Risk of Bias	Inconsis-tency	Imprecision	Indirectness	Publication Bias		
Aerobic Exercise	O'Brien, 2016 *(67)*	24 RCTs, N=936	high	**Body mass index (BMI)**					Results showed no change in BMI of participants for four comparisons in the aerobic or combined aerobic and PRE group compared with non-exercising control; constant aerobic exercise compared with non-exercising control; combined aerobic and PRE exercise group compared with non-exercising control and combined aerobic exercise and diet/nutrition counselling group compared with diet/nutritional counselling group only.	HIGH (no effect)
				No serious risk of bias	No serious inconsistency	No serious imprecision	No serious indirectness	No publication bias		
				Lean body mass					Meta-analyses of 3 studies, n=68 showed a significant increase in lean body mass of weighted mean difference 1.75 kg (95% CI 013, 3.37,p=0.03] 4 studies, n=89}) for participants in the aerobic or combined aerobic and PRE group compared with participants in the non-exercising control group. No difference in lean body mass was reported for participants in the combined aerobic and PRE exercise group compared with non-exercising control group.	MODERATE (+ve effect)
				Serious risk of bias	No serious inconsistency	No serious imprecision	No serious indirectness	No serious publication bias		
				Leg muscle area					In 2 studies,(Dolan 2006, Grinspoon 2000,, n=60) which had low heterogeneity at 11%, a significant increase in change in weighted mean difference of 4.79 cm^{2}([95%CI 2.04, 7.54 ,p=0.0007]2 studies, n=60 in leg muscle area among participants in the combined aerobic and PRE group compared with the non-exercising control group.	MODERATE (+ve effect)
				Serious risk of bias	No serious inconsistency	No serious imprecision	No serious indirectness	No serious publication bias		
				Percentage body fat					Meta analyses of 2 studies, n=119 showed a significant decrease of weighted mean of 1.12% body fat[95%CI −2.18, −0.07,p=0.04 was found for participants in the constant aerobic exercise group compared with participants in the non-exercising control group . There was also found a significantly greater decrease in percent body fat of 2.35 % 95%CI−4.20, −0.50,p=0.01]2 studies, n=93] was reported among participants in the combined aerobic exercise and diet or nutrition counselling group compared with diet or nutritional counselling group..	HIGH (+ve effect)
				Serious risk of bias	No serious inconsistency	No serious imprecision	No serious indirectness	No serious publication bias		

									heterogeneity was moderate at 46%, but not significant.	
				Fat mass					There was no change in fat mass for two comparisons of participants in the aerobic or combined aerobic {4 studies, n=102and PRE group compared with non-exercising control, and combined aerobic and PRE exercise group compared with non-exercising control{3 studies,n=81]	MODERATE (no effect)
				Serious risk of bias	No serious inconsistency	No serious imprecision	No serious indirectness	No serious publication bias		
				Waist and hip circumference and waist-to-hip ratio					No significant differences were found in waist circumference, hip circumference or waist-to-hip ratio for participants in the aerobic or combined aerobic and PRE group compared with non-exercising control; as well as participants in the constant aerobic versus exercise groups and combined aerobic and PRE exercise groups. Results found a slight increase in waist-to-hip ratio of 0.02 for participants in the combined exercise and diet or nutrition counselling group compared with diet or nutritional counselling group, however, these results were not clinically important.	MODERATE (inconclusive)
				Serious risk of bias	No serious inconsistency	No serious imprecision	No serious indirectness	No serious publication bias		
	O'Brien, 2010 *(69)*	14 RCTS, N= 454	high	**BMI**					Age of participants range from 18 – 58 years, about 30 % were female. Nine studies assessed body composition with duration of intervention ranging from 12-24 weeks ,3 times a week for 30-120 mins.. Eleven meta-analyses were completed, of which 4 included the same studies and were duplicates. Results showed no change in BMI (WMD: 0.85kg/cm2, 95% CI: -0.62, 2.31, n=49, *P*=0.26) (Lox 1995, Perna 1999) for participants in the aerobic exercise group compared with participants in the non-exercising control group, and no difference in change in fat mass (WMD: 0.07 kg, 95% CI: -1.22, 1.36, n=60, *P*=0.92) (Grinspoon 2000, Dolan 2006) for participants in the combined aerobic and PRE group compared with the non-exercising control group.	MODERATE (no effect)
				Serious risk of bias	No serious inconsistency	No serious imprecision	No serious indirectness	No serious publication bias		
				Hip circumference					No change was reported in hip circumference (WMD: 0.11cm, 95% CI: -0.63, 0.85, n=142, *P*=0.77) (Smith 2001, Mutimura 2008a) for participants in the aerobic exercise groups compared with participants in the non-exercising control groups, as well as participants in the constant aerobic exercise groups compared with the non-exercising control groups.	MODERATE (no effect)
				Serious risk of bias	No serious inconsistency	No serious imprecision	No serious indirectness	No publication bias		

				Waist circumference					Results showed no difference in change in waist circumference (WMD: -3.53cm, 95% CI: -10.25, 3.19, n=142, *P*=0.30) (Smith 2001, Mutimura 2008a) for participants in the aerobic exercise groups compared with participants in the non-exercising control groups, as well as participants in the constant aerobic exercise groups compared with the non-exercising control groups.	MODERATE (no effect)
				Serious risk of bias	No serious inconsistency	No serious imprecision	No serious indirectness	No serious publication bias		
				Waist-to hip ratio (WHR)					Results showed no change in waist-to-hip ratio (WMD: -0.51, 95% CI: -1.47, 0.45, n=142, *P*=0.30) (Smith 2001, Mutimura 2008a) for participants in the aerobic exercise groups compared with participants in the non-exercising control groups, as well as participants in the constant aerobic exercise groups compared with the non-exercising control groups.	MODERATE (no effect)
				Serious risk of bias	No serious inconsistency	No serious imprecision	No serious indirectness	No serious publication bias		
				Percent body fat					Meta-analyses showed a significant decrease in percent body fat of 1.12% (95% CI: -2.18, -0.07, n=119, *P*=0.04) (Lox 1995, Mutimura 2008a) for participants in the aerobic exercise group compared with participants in the non-exercising control group.	MODERATE (+ve effect)
				Serious risk of bias	No serious inconsistency	No serious imprecision	No serious indirectness	No serious publication bias		
				Leg muscle area					Meta-analysis also showed a significant increase in leg muscle area of 4.79 cm^2 among participants in the combined aerobic and PRE group compared with the non-exercising control group (95% CI: 2.04, 7.54, n=60, *P*=0.0007) (Grinspoon 2000, Dolan 2006).	MODERATE (+ve effect)
				Serious risk of bias	No serious inconsistency	No serious imprecision	No serious indirectness	No serious publication bias		
Resistance Exercise	O'Brien, 2017 *(66)*	20 RCTs, N=764	high	**BMI**					Mean age range of participants(men =77%) was 32- 49 years with PA interventions of at least 3 times a week for at least 20 mins ranging from 6-52 weeks. Nineteen of the RCTS assessed body composition. . Sixteen meta-analyses were performed, each for body mass index, lean body mass, fat mass, arm and thigh girth, leg muscle area, and waist circumference. Results demonstrated no change in BMI for three comparisons of participants (i) in the PRE or combined PRE and aerobic exercise group compared with non-exercising control; (ii) combined PRE and aerobic exercise group compared with non-exercising control and (iii) combined PRE (or combined PRE and aerobic exercise) and diet/nutrition counselling group compared with diet/nutritional counselling group.	MODERATE (no effect)
				Serious risk of bias	No serious inconsistency	No serious imprecision	Serious indirectness	No serious publication bias		
				Lean body mass					Meta-analyses demonstrated no change in lean body mass for three comparisons of	LOW (no effect)

				Serious risk of bias	No serious inconsistency	No serious imprecision	Serious indirectness	No serious publication bias	participants (i) in the PRE or combined PRE and aerobic exercise group compared with non-exercising control; (ii) combined PRE and aerobic exercise group compared with non-exercising control and (iii) combined PRE (or combined PRE and aerobic exercise) and testosterone group compared with the testosterone only group.	
				leg muscle area					Results for leg muscle area results demonstrated a significant increase in change in leg muscle area of 4.79 cm^2 in 2 studies(Dolan 2006]; Grinspoon 2000., n=60 95%CI 2.04, 7.54, p=0.0007among participants in the combined PRE and aerobic exercise group compared with the non-exercising control No difference was found in leg muscle area for participants in the PRE (or combined PRE and aerobic exercise) and testosterone group compared with the testosterone only group.	LOW (+ve effect)
				Serious risk of bias	No serious inconsistency	No serious imprecision	Serious indirectness	No serious publication bias		
				Fat mass					Results demonstrated no change in fat mass for three comparisons of participants (i) in the PRE or combined PRE and aerobic exercise group compared with non-exercising control; (ii) combined PRE and aerobic exercise group compared with non-exercising control, and (iii) combined PRE (or combined PRE and aerobic exercise) and testosterone group compared with	MODERATE (no effect)
				Serious risk of bias	No serious inconsistency	No serious imprecision	Serious indirectness	No serious publication bias		
				waist circumference					No significant differences were found in change in waist circumference for participants in the combined PRE and aerobic exercise group compared with no exercise.	LOW (no effect)
				Serious risk of bias	No serious inconsistency	No serious imprecision	Serious indirectness	No serious publication bias		
				arm and thigh girth					Results demonstrated a significant increase in change in arm and thigh girth of 7.91 cm among participants in 2 studies (Lox 1995 ; Spence 1990 ,n=46 95% CI 2.18, 13.65, p=0.007)in the PRE group compared with the aerobic exercise group. The point estimate is greater than 5 cm, therefore indicating a potential clinically important greater increase in girth among PRE versus aerobic exercisers. Heterogeneity was present in meta-analysis for arm and thigh girth.	MODERATE (+ve effect)
				Serious risk of bias	No serious inconsistency	No serious imprecision	Serious indirectness	No serious publication bias		

	O'Brien, 2008 *(74)*	10 RCTs, N=332	high	Serious risk of bias	No serious inconsistency	No serious imprecision	Serious indirectness	No serious publication bias	Age of the participants ranges from 18-66 years(women<30%) . PA intervention was at least 3x a week for a from 6-16 weeks. Nine of the 10 studies assessed weight and/or body composition. Six meta-analyses were performed for body composition. Meta-analysis showed a statistically significant and clinically important increase in arm and thigh girth of 7.91cm (95%CI: 2.18, 13.65; p0.007; n46) for participants in the PRE or combined PRE and aerobic exercise intervention group compared to the non-exercising control group. Given that many participants in the individual studies were diagnosed with AIDS-related wasting syndrome, increases in body composition may be interpreted as a favourable outcome. This meta-analysis was statistically significant for heterogeneity (p = 0.08; I^2 = 67.4%) using a random effects model. Reasons for heterogeneity may be attributed to the different methods in which mean arm and thigh girth was measured between studies. The other five meta-analyses for body composition showed no difference among groups.	MODERATE (+ve effect)
	Poton, 2017 *(78)*	13 RCTs, N=291	moderate	Serious risk of bias	No serious inconsistency	No serious imprecision	Serious indirectness	No serious publication bias	The mean age of participants in the individual trials was 40.2 ± 4.8 years with PA intervention ranging from 6-24 weeks for at least 3 days a week. Seven of the 13 studies assessed lean body mass with RT intervention ranging from 12-24 weeks for at least 3 days a week. The bias-corrected standardised mean difference (Hedges' g) was used to assess effect size (g) measure to quantify lean body mass after progressive resistance training. In general, there was no change in lean body mass (LBM), with an overall effect size of 0.26 (−0.001 to 0.52; p = 0.051). In addition, there was low heterogeneity for trials investigating lean body mass (I^2 = 0.00; p = 0.88). However, the quality of included studies for lean body mass (score PEDro = 5) was low, which leaves open the possibility that various biases to exist and limit the generalisation of these results	MODERATE (no effect)
Multimodal Exercise	Pedro, 2017 *(72)*	5 RCTs, N=253	high	Serious risk of bias	No serious inconsistency	No serious imprecision	Serious indirectness	No publication bias	Intervention duration ranged from 12- 24 weeks , 3 days a week for a least 20 mins. All 5 studies assessed body fat percentage. The authors found a decrease in body fat percentage in response to aerobic and concurrent training. There was also a reduction in trunk and limb fat and an increase in lean mass. Furthermore, one	HIGH (+ve effect)

									study showed that body fat percentage decreased after aerobic training. One of the limitation was that authors of this study did not conduct heterogeneity test among the studies together with small sample size. In summary, it might not be possible to conclude that physical training improves body composition; therefore, more studies are needed, using validated methods to investigate the effects of different types of training on body composition in individuals with HIV-associated lipodystrophy.	
	Filippas 2006 *(80)*	9 RCTs, N=469	low	Serious risk of bias	No serious inconsistency	No serious imprecision	Serious indirectness	No publication bias	Mean age of participants in the studies ranged from 18 to 71 years with 41% of them female within RCTs where the interventions were either aerobic, progressive resistance exercises or a combination of the two (at least 2 times a week for at least 20 mins for 6-24 weeks). The results showed that compared to non-exercising controls, aerobic exercise (AE) resulted in decreased body mass index (weighted mean difference [WMD] −1.31; 95% CI, −2.59, −0.03; n=186), triceps skinfold thickness of subcutaneous fat (WMD −1.83 mm; 95% CI, −2.36, −1.30; n=144), total body fat (%) (standardised mean difference [SMD], −0.37; 95% CI, −0.74, −0.01; n=118), waist circumference (SMD −0.74 mm, 95% CI, −1.08, −0.39; n=142), and waist-hip ratio (SMD −0.94; 95% CI, −1.30, −0.58; n=142). Progressive resistive exercise (PRE) resulted in increased body weight (5.09 kg; 95% CI, 2.13, 8.05; n=46) and arm and thigh girth (SMD 1.08 cm; 95% CI, 0.35, 1.82; n=46). Aerobic exercise decreases adiposity and may improve certain lipid subsets. PRE increases body weight and limb girth.	MODERATE (+ve effect)

Abbreviations: PICO = population, intervention, comparator, outcome; RoB = risk of bias; RCTs = randomised controlled trials

1. O'Brien, 2016

   - BMI: The authors of the review did not downgrade BMI on the GRADE quality of evidence because this was an objective outcome of interest and publication bias was not suspected.
   - Lean body mass: Downgraded to MODERATE due to attrition and performance bias reported in the review
   - Leg muscle area: Downgraded to MODERATE due to attrition and performance bias reported in the review
   - Percentage body fat: Downgraded to MODERATE due to attrition and performance bias. Upgraded from MODERATE to HIGH due to large magnitude of effect.
   - Fat mass: Downgraded to MODERATE due to attrition and performance bias reported in the review.
   - Waist and hip circumference and waist-to-hip ratio: Downgraded to MODERATE due to attrition and performance bias reported in the review.

2. O'Brien, 2010

BMI; Hip circumference; waist circumference; waist-to hip ratio; percent body fat, fat mass, leg muscle area: were downgraded to MODERATE due to attrition bias because of high withdrawal rates in most of the studies (>15%) and also because of lack of blinding which may have resulted in performance bias .

3. O'Brien, 2017

   - BMI: Graded MODERATE because the authors of the review were moderately confident in the effect estimate of a non-significant increase of 0.40 kg/m^2 for body mass index comparing PRE (or combined PRE and aerobic exercise) with no exercise. The outcome was downgraded on the certainty of evidence because publication bias was suspected and that withdrawal rates among the majority of included studies were >15%.
   - Lean body mass; Leg muscle area; Waist circumference: Downgraded to LOW because a high risk of performance bias existed across the included studies as 85% of them had a high risk of performance bias due to lack of participant blinding to the exercise intervention.
   - Fat mass: The authors of the review graded the outcome as MODERATE because they were moderately confident with the effect estimate of a non-significant increase of 0.36 kg in fat mass comparing PRE (or combined PRE and aerobic exercise) with non-exercising control. The outcome was downgraded on the certainty of evidence due to incomplete outcome data (withdrawals of included studies were >15%).
   - Arm and thigh girth: First downgraded to VERY LOW because a high risk of performance bias existed across the included studies as 85% of them had a high risk of performance bias due to lack of participant blinding to the exercise intervention. Furthermore, heterogeneity was reported in the meta-analyses done for arm and thigh girth. The very low GRADE was then upgraded to MODERATE due to the evident dose-response relationship in the results.

4. O'Brien, 2008: Downgraded to LOW because of a lot of variation among individual studies in the types of interventions, participants and outcomes, which may have led to heterogeneity and Indirectness. Also, there is RoB due to attrition bias because of high withdrawal rates (>15%). There was also lack of blinding to the PRE intervention which may have resulted in the performance bias. The authors also report a possibility of performance bias due to increased levels of interaction between the investigators and participants in the exercise group resulting in more favourable outcomes for exercisers compared to non-exercisers. The review also used a small number of studies (n = 10) and there was total outcome data not available for 69 (17%) participants. The LOW grade was then upgraded to MODERATE due to the evident dose-response relationship evident in the results.

5. Poton 2017: Downgraded to MODERATE due to possible serious RoB as there was no clear description of randomization, concealment of allocation. Also, the quality of included studies for lean body mass (score PEDro = 5) was low, which leaves open the possibility that various biases to exist and limit the generalisation of these results. There was also evidence of indirectness in the review.

6. Pedro, 2017: downgraded to MODERATE due to indirectness which might have been caused by different type of individual indifference studies, and different type of intervention and different type of assessment methods. The MODERATE grade was then upgraded to HIGH due to the evident dose-response relationship evident in the results.

7. Fillipas, 2006: Downgraded to LOW due to serious RoB as there was no clear description of randomization, concealment of allocation and blinding, average of >15% withdrawal rates among the studies that assessed body composition with one of the study having 51% withdrawal rate. There was also evidence of indirectness in the review and a substantial level of heterogeneity for body fat mass and waist to hip ratio. However, due to evidence of a large dose-response relationship, we then upgraded the certainty to MODERATE.