

Supplementary information

Pubertal status

Descriptive statistics for pubertal status based on Tanner pubic hair stage for males (stage I [least advanced] to V [most advanced]) and age of menarche status for females at age 11, 13 and 16 years can be found in supplementary Table 1.

Associations with Academic attainment at 11

Linear regression was used to examine the association between physical activity and academic attainment assessed at 11 years old and the resulting standardised beta-coefficients can be found in Supplementary Tables 2 and 3.

Associations with Academic attainment at 13

Supplementary tables 4 and 5 present the associations with academic attainment at age 13 years.

Associations with Academic attainment at 16

Supplementary tables 6 and 7 present the associations with academic attainment at age 16 years. Results presented show that total volume of PA (represented by cpm) predicted decreased attainment across all areas of the curriculum assessed. Furthermore, when cpm was not controlled for, MVPA also predicted decreased attainment in some models. These results therefore suggest that light intensity PA, which comprised the majority of the cpm, may lead to decreased academic attainment.

Additional adjustment for Full scale IQ

In addition to the fully adjusted models presented (model 5 in results tables), full scale IQ was also included in regression analyses as an additional confounding variable. This was

assessed at ALSPAC clinics at age 8 only. The results of these analyses are presented in supplementary tables 8 and 9. While the standardised regression coefficients are somewhat attenuated when full scale IQ is also included in the models, the pattern of results continues to reflect the results presented in the main paper.

Analyses with only complete data

In order to ensure effects sizes in the fully adjusted models were due to confounding rather than missing data, for each association, model 1 was repeated for participants who had complete data at model 5. The resulting regression coefficients were slightly larger than when all available data were included and results summarised in supplementary tables 10 and 11.

Supplementary Table 1. Descriptive statistics for pubertal status

Characteristic		Males		Females	
		n	Percentage	n	Percentage
Pubertal status at 11	Experienced menarche	-	-	298	15.0
	Tanner stage I	528	39.0	-	-
	Tanner stage II	565	41.7	-	-
	Tanner stage III	206	15.2	-	-
	Tanner stage IV	53	3.9	-	-
	Tanner stage V	3	0.2	-	-
Pubertal status at 13	Experienced menarche	-	-	1123	60.5
	Tanner stage I	151	11.9	-	-
	Tanner stage II	301	23.7	-	-
	Tanner stage III	358	28.2	-	-
	Tanner stage IV	398	31.3	-	-
	Tanner stage V	62	4.9	-	-
Pubertal status at 16	Experienced menarche	-	-	1631	99.5
	Tanner stage I	3	0.3	-	-
	Tanner stage II	3	0.3	-	-
	Tanner stage III	29	2.7	-	-
	Tanner stage IV	359	33.9	-	-
	Tanner stage V	664	62.8	-	-

Supplementary Table 2. Associations between physical activity at 11 years old and academic attainment at 11 years old in males.

Model	cpm			mvpa			% time in mvpa		
	β	95% CI	p value	β	95% CI	p value	β	95% CI	p value
English mark									
Separate models									
1 n=1704	-0.164	-0.21 to -0.12	<0.001	-0.077	-0.12 to -0.03	<0.001	-0.025	-0.07 to 0.02	0.30
2 n = 1607	-0.154	-0.20 to -0.11	<0.001	-0.066	-0.11 to -0.02	0.01	-0.016	-0.06 to 0.03	0.52
3 n = 1527	-0.149	-0.20 to -0.10	<0.001	-0.073	-0.12 to -0.02	<0.001	-0.030	-0.08 to 0.02	0.23
4 n= 1102	-0.188	-0.25 to -0.13	<0.001	-0.109	-0.17 to -0.05	<0.001	-0.060	-0.12 to 0.00	0.05
5 n=991	-0.165	-0.22 to -0.11	<0.001	-0.113	-0.17 to -0.05	<0.001	-0.078	-0.14 to -0.02	0.01
Simultaneous models									
1	-0.307	-0.37 to -0.24	<0.001				0.197	0.13 to 0.26	<0.001
2	-0.305	-0.38 to -0.23	<0.001				0.206	0.14 to 0.28	<0.001
3	-0.273	-0.34 to -0.20	<0.001				0.168	0.10 to 0.24	<0.001
4	-0.309	-0.39 to -0.22	<0.001				0.167	0.08 to 0.25	<0.001
5	-0.236	-0.32 to -0.15	<0.001				0.096	0.01 to 0.18	0.03
Maths mark									
Separate models									
1 n=1708	-0.117	-0.16 to -0.07	<0.001	-0.040	-0.09 to 0.01	0.10	0.002	-0.05 to 0.05	0.94
2 n=1611	-0.111	-0.16 to -0.06	<0.001	-0.032	-0.08 to 0.02	0.21	0.008	-0.04 to 0.06	0.74
3 n=1531	-0.105	-0.15 to -0.06	<0.001	-0.038	-0.09 to 0.01	0.13	-0.006	-0.05 to 0.04	0.80
4 n=1104	-0.129	-0.19 to -0.07	<0.001	-0.066	-0.13 to -0.01	0.03	-0.029	-0.09 to 0.03	0.33
5 n=994	-0.104	-0.16 to -0.04	<0.001	-0.062	-0.12 to 0.00	0.05	-0.037	-0.10 to 0.02	0.24
Simultaneous models									
1	-0.249	-0.32 to -0.18	<0.001				0.182	0.11 to 0.25	<0.001
2	-0.248	-0.32 to -0.18	<0.001				0.189	0.12 to 0.26	<0.001
3	-0.216	-0.29 to -0.14	<0.001				0.151	0.08 to 0.22	<0.001
4	-0.229	-0.31 to -0.14	<0.001				0.138	0.05 to 0.22	<0.001
5	-0.166	-0.25 to -0.08	<0.001				0.085	0.00 to 0.17	0.06
Science mark									
Separate models									

1 n=1710	-0.139	-0.19 to -0.09	<0.001	-0.073	-0.12 to -0.03	<0.001	-0.032	-0.08 to 0.02	0.18
2 n=1613	-0.125	-0.17 to -0.08	<0.001	-0.055	-0.10 to -0.01	0.03	-0.017	-0.07 to 0.03	0.51
3 n=1534	-0.114	-0.16 to -0.06	<0.001	-0.059	-0.11 to -0.01	0.02	-0.028	-0.08 to 0.02	0.26
4 n=1106	-0.131	-0.19 to -0.07	<0.001	-0.078	-0.14 to -0.02	0.01	-0.042	-0.10 to 0.02	0.17
5 n=995	-0.102	-0.16 to -0.04	<0.001	-0.068	-0.13 to -0.01	0.03	-0.047	-0.11 to 0.01	0.13
Simultaneous models									
1	-0.243	-0.31 to -0.18	<0.001				0.144	0.08 to 0.21	<0.001
2	-0.239	-0.31 to -0.17	<0.001				0.157	0.09 to 0.23	<0.001
3	-0.200	-0.27 to -0.13	<0.001				0.117	0.05 to 0.19	<0.001
4	-0.215	-0.30 to -0.13	<0.001				0.116	0.03 to 0.20	0.01
5	-0.146	-0.23 to -0.06	<0.001				0.060	-0.03 to 0.15	0.18

Note: Tables include standardised beta coefficients (β) and 95% confidence intervals for physical activity variables predicting academic attainment. Separate models include either cpm, MVPA or % time in MVPA; Simultaneous models adjust for both cpm and % time in MVPA. Model 1 (minimally adjusted) adjusts for age of participants; model 2 adjusts for age plus birth weight and gestation; model 3 adjusts for variables in model 2 plus age of mother at delivery, mother's oily fish intake and whether the mother of participants smoked in the first three months of pregnancy; model 4 adjusted for variables in model 3 plus the inclusion of BMI Z score relative to UK 1990 reference data and pubertal stage of participant (recorded at time of outcome); model 5 (fully adjusted) adjusted for all confounders in model 4 plus ethnicity, maternal educational attainment and occupational social class.

Supplementary Table 3. Associations between physical activity at 11 years old and academic attainment at 11 years old in females.

Model	cpm			mvpa			% time in mvpa		
	β	95% CI	p value	β	95% CI	p value	β	95% CI	p value
English mark									
Separate models									
1 n=2114	-0.105	-0.15 to -0.06	<0.001	-0.006	-0.05 to 0.04	0.80	0.057	0.01 to 0.10	0.01
2 n = 1981	-0.108	-0.15 to -0.06	<0.001	-0.007	-0.05 to 0.04	0.76	0.057	0.01 to 0.10	0.01
3 n = 1882	-0.095	-0.14 to -0.05	<0.001	0.00	0.00 to 0.00	0.98	0.054	0.01 to 0.10	0.02
4 n= 1492	-0.073	-0.12 to -0.02	<0.001	0.007	-0.05 to 0.06	0.79	0.056	0.01 to 0.11	0.03
5 n=1316	-0.055	-0.11 to 0.00	0.04	0.005	-0.04 to 0.05	0.83	0.042	-0.01 to 0.09	0.11
Simultaneous models									
1	-0.269	-0.33 to -0.21	<0.001				0.240	0.18 to 0.30	<0.001
2	-0.270	-0.33 to -0.21	<0.001				0.239	0.18 to 0.30	<0.001
3	-0.243	-0.30 to -0.18	<0.001				0.218	0.16 to 0.28	<0.001
4	-0.211	-0.28 to -0.14	<0.001				0.199	0.13 to 0.27	<0.001
5	-0.159	-0.23 to -0.09	<0.001				0.151	0.08 to 0.22	<0.001
Maths mark									
Separate models									
1 n=2104	-0.085	-0.13 to -0.04	<0.001	-0.019	-0.06 to 0.02	0.38	0.019	-0.02 to 0.06	0.38
2 n=1973	-0.090	-0.13 to -0.05	<0.001	-0.021	-0.07 to 0.02	0.36	0.019	-0.03 to 0.06	0.40
3 n=1876	-0.080	-0.12 to -0.04	<0.001	-0.017	-0.06 to 0.03	0.47	0.015	-0.03 to 0.06	0.51
4 n=1485	-0.086	-0.14 to -0.04	<0.001	-0.036	-0.09 to 0.01	0.16	-0.008	-0.06 to 0.04	0.77
5 n=1309	-0.063	-0.11 to -0.01	0.02	-0.035	-0.09 to 0.02	0.19	-0.019	-0.07 to 0.03	0.48
Simultaneous models									
1	-0.184	-0.24 to -0.13	<0.001				0.145	0.09 to 0.20	<0.001
2	-0.191	-0.25 to -0.13	<0.001				0.148	0.09 to 0.21	<0.001
3	-0.169	-0.23 to -0.11	<0.001				0.130	0.07 to 0.19	<0.001
4	-0.152	-0.22 to -0.08	<0.001				0.096	0.03 to 0.16	0.01
5	-0.096	-0.17 to -0.02	0.01				0.048	-0.02 to 0.12	0.19
Science mark									
Separate models									

1 n=2110	-0.094	-0.14 to -0.05	<0.001	-0.005	-0.05 to 0.04	0.82	0.041	0.00 to 0.08	0.06
2 n=1977	-0.098	-0.14 to -0.05	<0.001	-0.008	-0.05 to 0.04	0.73	0.039	-0.01 to 0.08	0.08
3 n=1879	-0.085	-0.13 to -0.04	<0.001	-0.001	-0.07 to 0.07	0.98	0.037	-0.01 to 0.08	0.10
4 n=1487	-0.087	-0.14 to -0.04	<0.001	-0.008	-0.06 to 0.05	0.77	0.030	-0.02 to 0.08	0.24
5 n=1312	-0.075	-0.13 to -0.02	0.01	-0.007	-0.06 to 0.04	0.79	0.020	-0.03 to 0.07	0.45
Simultaneous models									
1	-0.228	-0.29 to -0.17	<0.001				0.197	0.14 to 0.25	<0.001
2	-0.231	-0.29 to -0.17	<0.001				0.195	0.14 to 0.25	<0.001
3	-0.206	-0.27 to -0.15	<0.001				0.177	0.12 to 0.24	<0.001
4	-0.204	-0.27 to -0.13	<0.001				0.169	0.10 to 0.24	<0.001
5	-0.168	-0.24 to -0.10	<0.001				0.136	0.07 to 0.21	<0.001

Supplementary Table 4. Associations between physical activity at 11 years old and academic attainment at 13 years old in males.

Model	cpm			mvpa			% time in mvpa		
	β	95% CI	p value	β	95% CI	p value	β	95% CI	p value
English mark									
Separate models									
1 n=1293	-0.134	-0.19 to -0.08	<0.001	-0.047	-0.10 to 0.01	0.093	0.016	-0.04 to 0.07	0.57
2 n = 1215	-0.129	-0.18 to -0.07	<0.001	-0.041	-0.10 to 0.01	0.015	0.019	-0.04 to 0.08	0.51
3 n = 1161	-0.128	-0.18 to -0.07	<0.001	-0.056	-0.11 to -0.00	0.049	-0.005	-0.06 to 0.05	0.86
4 n= 575	-0.162	-0.24 to -0.08	<0.001	-0.074	-0.16 to 0.01	0.078	-0.018	-0.10 to 0.06	0.67
5 n=532	-0.112	-0.19 to -0.03	0.07	-0.055	-0.14 to 0.03	0.189	-0.017	-0.10 to 0.06	0.68
Simultaneous models									
1	-0.301	-0.38 to -0.22	<0.001				0.233	0.16 to 0.31	<0.001
2	-0.299	-0.38 to -0.22	<0.001				0.234	0.15 to 0.31	<0.001
3	-0.264	-0.34 to -0.18	<0.001				0.187	0.11 to 0.27	<0.001
4	-0.303	-0.42 to -0.19	<0.001				0.199	0.08 to 0.31	0.01
5	-0.206	-0.32 to -0.09	0.01				0.131	0.01 to 0.25	0.03
Maths mark									
Separate models									
1 n=1293	-0.140	-0.19 to -0.09	<0.001	-0.082	-0.14 to -0.03	0.003	-0.031	-0.09 to 0.02	0.26
2 n=1214	-0.137	-0.19 to -0.08	<0.001	-0.083	-0.14 to -0.03	0.004	-0.034	-0.09 to 0.02	0.23
3 n=1159	-0.139	-0.20 to -0.08	<0.001	-0.091	-0.15 to -0.03	0.002	-0.045	-0.10 to 0.01	0.12
4 n=575	-0.150	-0.23 to -0.07	<0.001	-0.101	-0.18 to -0.02	0.018	-0.053	-0.14 to 0.03	0.22
5 n=531	-0.120	-0.20 to -0.04	0.01	-0.096	-0.18 to -0.01	0.028	-0.066	-0.15 to 0.02	0.13
Simultaneous models									
1	-0.241	-0.32 to -0.16	<0.001				0.142	0.06 to 0.22	<0.001
2	-0.235	-0.32 to -0.15	<0.001				0.136	0.06 to 0.22	0.01
3	-0.223	-0.30 to -0.14	<0.001				0.117	0.03 to 0.20	0.01
4	-0.227	-0.34 to -0.11	<0.001				0.108	-0.01 to 0.23	0.07
5	-0.151	-0.27 to -0.03	0.02				0.043	-0.08 to 0.17	0.50
Science mark									
Separate models									

1 n=1300	-0.092	-0.15 to -0.04	<0.001	-0.073	-0.13 to -0.02	0.009	-0.046	-0.10 to 0.01	0.10
2 n=1221	-0.081	-0.14 to -0.02	0.01	-0.071	-0.13 to -0.01	0.013	-0.047	-0.10 to 0.01	0.10
3 n=1166	-0.077	-0.13 to -0.02	0.01	-0.076	-0.13 to -0.02	0.010	-0.055	-0.11 to 0.00	0.06
4 n=578	-0.077	-0.16 to -0.01	0.07	-0.031	-0.11 to 0.05	0.470	-0.001	-0.09 to 0.09	0.98
5 n=533	-0.078	-0.17 to 0.01	0.08	-0.045	-0.13 to 0.04	0.314	-0.022	-0.11 to 0.07	0.62
Simultaneous models									
1	-0.122	-0.20 to -0.04	<0.001				0.042	-0.04 to 0.12	0.30
2	-0.098	-0.18 to -0.02	0.02				0.024	-0.06 to 0.11	0.57
3	-0.078	-0.16 to 0.01	0.07				0.002	-0.11 to 0.11	0.97
4	-0.153	-0.27 to -0.03	0.01				0.108	-0.01 to 0.23	0.08
5	-0.128	-0.25 to 0.00	0.05				0.070	-0.06 to 0.20	0.28

N.B: Large reduction in sample size when add pubertal status into the model. While there are a decent number of respondents to this question, only a reduced number also have KS3 data. This reduction does not influence the results unduly but for girls some results are not significant when use puberty assessed at 13 rather than at the time of the physical activity measurement.

Supplementary Table 5. Associations between physical activity at 11 years old and academic attainment at 13 years old in females.

Model	cpm			mvpa			% time in mvpa		
	β	95% CI	p value	β	95% CI	p value	β	95% CI	p value
English mark									
Separate models									
1 n=1577	-0.135	-0.18 to -0.09	<0.001	-0.030	-0.08 to 0.02	0.233	0.039	-0.01 to 0.09	0.12
2 n = 1477	-0.141	-0.19 to -0.09	<0.001	-0.029	-0.08 to 0.02	0.261	0.041	-0.01 to 0.09	0.12
3 n = 1408	-0.126	-0.18 to -0.07	<0.001	-0.022	-0.07 to 0.03	0.397	0.039	-0.01 to 0.09	0.14
4 n= 788	-0.159	-0.23 to -0.09	<0.001	-0.057	-0.13 to 0.01	0.114	0.007	-0.07 to 0.08	0.85
5 n=693	-0.142	-0.21 to -0.07	<0.001	-0.059	-0.13 to 0.01	0.106	0.001	-0.07 to 0.08	0.98
Simultaneous models									
1	-0.294	-0.36 to -0.23	<0.001				0.236	0.17 to 0.30	<0.001
2	-0.302	-0.37 to -0.24	<0.001				0.242	0.18 to 0.31	<0.001
3	-0.274	-0.34 to -0.21	<0.001				0.222	0.15 to 0.29	<0.001
4	-0.296	-0.39 to -0.20	<0.001				0.202	0.11 to 0.29	<0.001
5	-0.257	-0.35 to -0.16	<0.001				0.171	0.08 to 0.27	<0.001
Maths mark									
Separate models									
1 n=1579	-0.087	-0.14 to -0.04	<0.001	-0.010	-0.06 to 0.04	0.701	0.027	-0.02 to 0.08	0.28
2 n=1478	-0.096	-0.15 to -0.05	<0.001	-0.018	-0.07 to 0.03	0.479	0.019	-0.03 to 0.07	0.47
3 n=1407	-0.081	-0.13 to -0.03	<0.001	-0.005	-0.05 to 0.04	0.843	0.025	-0.03 to 0.08	0.34
4 n=789	-0.116	-0.19 to -0.05	<0.001	-0.052	-0.12 to 0.02	0.144	-0.027	-0.10 to 0.04	0.44
5 n=693	-0.087	-0.16 to -0.01	0.02	-0.055	-0.13 to 0.02	0.136	-0.042	-0.11 to 0.03	0.26
Simultaneous models									
1	-0.194	-0.26 to -0.13	<0.001				0.158	0.09 to 0.22	<0.001
2	-0.196	-0.26 to -0.13	<0.001				0.151	0.08 to 0.22	<0.001
3	-0.178	-0.25 to -0.11	<0.001				0.144	0.08 to 0.21	<0.001
4	-0.176	-0.27 to -0.08	<0.001				0.090	0.00 to 0.18	0.06
5	-0.106	-0.20 to -0.01	0.03				0.028	-0.07 to 0.12	0.57
Science mark									
Separate models									

1 n=1584	-0.064	-0.11 to -0.01	0.01	-0.028	-0.08 to 0.02	0.260	-0.005	-0.05 to 0.04	0.84
2 n=1482	-0.073	-0.12 to -0.02	0.01	-0.039	-0.09 to 0.01	0.132	-0.016	-0.07 to 0.04	0.55
3 n=1412	-0.069	-0.12 to -0.02	0.01	-0.034	-0.09 to 0.02	0.208	-0.010	-0.06 to 0.04	0.70
4 n=791	-0.119	-0.19 to -0.05	<0.001	-0.096	-0.17 to -0.03	0.007	-0.071	-0.14 to 0.00	0.05
5 n=694	-0.112	-0.19 to -0.04	<0.001	-0.116	-0.19 to -0.04	0.002	-0.093	-0.17 to -0.02	0.01
Simultaneous models									
1	-0.111	-0.18 to -0.04	<0.001				0.070	0.00 to 0.14	0.04
2	-0.113	-0.18 to -0.04	<0.001				0.061	-0.01 to 0.13	0.08
3	-0.113	-0.18 to -0.04	<0.001				0.066	0.00 to 0.14	0.07
4	-0.128	-0.22 to -0.03	0.01				0.014	-0.08 to 0.11	0.77
5	-0.088	-0.19 to 0.01	0.09				-0.035	-0.13 to 0.06	0.49

Supplementary Table 6. Associations between physical activity at 11 years old and academic attainment at 16 years old in males.

Model	cpm			mvpa			% time in mvpa		
	β	95% CI	p value	β	95% CI	p value	β	95% CI	p value
English mark									
Separate models									
1 n=1272	-0.197	-0.25 to -0.14	<0.001	-0.100	-0.15 to -0.05	<0.001	-0.028	-0.08 to 0.03	0.32
2 n = 1192	-0.195	-0.25 to -0.14	<0.001	-0.098	-0.15 to -0.04	0.001	-0.029	-0.09 to 0.03	0.31
3 n = 1136	-0.188	-0.24 to -0.13	<0.001	-0.113	-0.17 to -0.06	<0.001	-0.057	-0.11 to 0.00	0.04
4 n= 697	-0.192	-0.26 to -0.12	<0.001	-0.113	-0.19 to -0.04	0.002	-0.055	-0.13 to 0.02	0.14
5 n=635	-0.156	-0.23 to -0.08	<0.001	-0.089	-0.16 to -0.02	0.016	-0.041	-0.11 to 0.03	0.27
Simultaneous models									
1	-0.373	-0.45 to -0.30	<0.001				0.242	0.16 to 0.32	<0.001
2	-0.374	-0.45 to -0.29	<0.001				0.244	0.16 to 0.32	<0.001
3	-0.318	-0.40 to -0.24	<0.001				0.177	0.10 to 0.26	<0.001
4	-0.333	-0.44 to -0.23	<0.001				0.192	0.09 to 0.30	<0.001
5	-0.273	-0.38 to -0.17	<0.001				0.158	0.05 to 0.26	<0.001
Maths mark									
Separate models									
1 n=1214	-0.187	-0.24 to -0.13	<0.001	-0.093	-0.15 to -0.04	0.001	-0.024	-0.08 to 0.03	0.41
2 n=1136	-0.191	-0.25 to -0.13	<0.001	-0.093	-0.15 to -0.04	0.002	-0.025	-0.08 to 0.03	0.40
3 n=1081	-0.189	-0.25 to -0.13	<0.001	-0.107	-0.16 to -0.05	<0.001	-0.049	-0.11 to 0.01	0.09
4 n=653	-0.187	-0.26 to -0.11	<0.001	-0.118	-0.19 to -0.04	0.002	-0.061	-0.14 to 0.01	0.11
5 n=592	-0.145	-0.22 to -0.07	<0.001	-0.097	-0.17 to -0.02	0.012	-0.055	-0.13 to 0.02	0.16
Simultaneous models									
1	-0.358	-0.44 to -0.28	<0.001				0.236	0.16 to 0.32	<0.001
2	-0.372	-0.45 to -0.29	<0.001				0.246	0.16 to 0.33	<0.001
3	-0.333	-0.42 to -0.25	<0.001				0.196	0.11 to 0.28	<0.001
4	-0.313	-0.42 to -0.20	<0.001				0.171	0.06 to 0.28	<0.001
5	-0.227	-0.34 to -0.12	<0.001				0.111	0.00 to 0.22	0.05
Science mark									
Separate models									

1 n=724	-0.235	-0.31 to -0.16	<0.001	-0.137	-0.21 to -0.07	<0.001	-0.061	-0.13 to 0.01	0.10
2 n=692	-0.225	-0.30 to -0.15	<0.001	-0.127	-0.20 to -0.05	0.001	-0.055	-0.13 to 0.02	0.14
3 n=663	-0.203	-0.27 to -0.13	<0.001	-0.122	-0.19 to -0.05	0.001	-0.068	-0.14 to 0.00	0.07
4 n=396	-0.203	-0.30 to -0.11	<0.001	-0.133	-0.23 to -0.04	0.005	-0.080	-0.17 to 0.01	0.10
5 n=352	-0.168	-0.26 to -0.07	<0.001	-0.109	-0.20 to -0.01	0.027	-0.070	-0.17 to 0.03	0.16
Simultaneous models									
1	-0.423	-0.53 to -0.32	<0.001				0.253	0.15 to 0.36	<0.001
2	-0.417	-0.52 to -0.31	<0.001				0.256	0.15 to 0.36	<0.001
3	-0.347	-0.45 to -0.24	<0.001				0.191	0.08 to 0.30	<0.001
4	-0.329	-0.47 to -0.19	<0.001				0.167	0.03 to 0.31	0.02
5	-0.261	-0.41 to -0.12	<0.001				0.122	-0.02 to 0.26	0.10

Note: Tables include standardised beta coefficients (β) and 95% confidence intervals for physical activity variables predicting academic attainment. Separate models include either cpm, MVPA or % time in MVPA; Simultaneous models adjust for both cpm and % time in MVPA. Model 1 (minimally adjusted) adjusts for age of participants; model 2 adjusts for age plus birth weight and gestation; model 3 adjusts for variables in model 2 plus age of mother at delivery, mother's oily fish intake and whether the mother of participants smoked in the first three months of pregnancy; model 4 adjusted for variables in model 3 plus the inclusion of BMI Z score relative to UK 1990 reference data and pubertal stage of participant (recorded at time of outcome); model 5 (fully adjusted) adjusted for all confounders in model 4 plus ethnicity, maternal educational attainment and occupational social class. Correction for the effects of regression dilution using ICC increased coefficients from 0.16 to 0.35 for males for English GCSE attainment. For Maths, the coefficient increased to 0.25 and for Science increased to 0.27.

Supplementary Table 7. Associations between physical activity at 11 years old and academic attainment at 16 years old in females.

Model	cpm			mvpa			% time in mvpa		
	β	95% CI	p value	β	95% CI	p value	β	95% CI	p value
English mark									
Separate models									
1 n=1609	-0.120	-0.17 to -0.07	<0.001	-0.033	-0.08 to 0.02	0.185	0.032	-0.02 to 0.08	0.19
2 n = 1512	-0.118	-0.17 to -0.07	<0.001	-0.032	-0.08 to 0.02	0.213	0.033	-0.02 to 0.08	0.10
3 n = 1441	-0.104	-0.15 to -0.05	<0.001	-0.024	-0.07 to 0.03	0.352	0.029	-0.02 to 0.08	0.26
4 n= 1017	-0.120	-0.18 to -0.06	<0.001	-0.050	-0.11 to 0.01	0.109	0.008	-0.05 to 0.07	0.80
5 n=911	-0.117	-0.18 to -0.06	<0.001	-0.068	-0.13 to -0.01	0.032	-0.017	-0.08 to 0.04	0.58
Simultaneous models									
1	-0.265	-0.33 to -0.20	<0.001				0.213	0.15 to 0.28	<0.001
2	-0.259	-0.33 to -0.19	<0.001				0.209	0.14 to 0.28	<0.001
3	-0.230	-0.30 to -0.16	<0.001				0.185	0.12 to 0.25	<0.001
4	-0.229	-0.31 to -0.15	<0.001				0.160	0.08 to 0.24	<0.001
5	-0.191	-0.27 to -0.11	<0.001				0.111	0.03 to 0.19	0.010
Maths mark									
Separate models									
1 n=1587	-0.125	-0.17 to -0.08	<0.001	-0.029	-0.08 to 0.02	0.243	0.028	-0.02 to 0.08	0.27
2 n=1491	-0.126	-0.18 to -0.08	<0.001	-0.028	-0.08 to 0.02	0.275	0.029	-0.02 to 0.08	0.27
3 n=1420	-0.117	-0.17 to 0.07	<0.001	-0.024	-0.07 to 0.03	0.352	0.023	-0.03 to 0.07	0.38
4 n=1001	-0.100	-0.16 to -0.04	<0.001	-0.028	-0.09 to 0.03	0.365	0.011	-0.05 to 0.07	0.72
5 n=898	-0.086	-0.15 to -0.03	0.01	-0.040	-0.10 to 0.02	0.191	-0.012	-0.07 to 0.05	0.69
Simultaneous models									
1	-0.265	-0.33 to -0.20	<0.001				0.208	0.14 to 0.27	<0.001
2	-0.268	-0.34 to -0.20	<0.001				0.210	0.14 to 0.28	<0.001
3	-0.244	-0.31 to -0.18	<0.001				0.188	0.12 to 0.26	<0.001
4	-0.193	-0.27 to -0.11	<0.001				0.138	0.06 to 0.22	<0.001
5	-0.139	-0.22 to -0.06	<0.001				0.081	0.00 to 0.16	0.05
Science mark									
Separate models									

1 n=920	-0.111	-0.17 to -0.05	<0.001	-0.025	-0.09 to 0.04	0.449	0.036	-0.03 to 0.10	0.28
2 n=870	-0.108	-0.17 to -0.04	<0.001	-0.017	-0.08 to 0.05	0.621	0.046	-0.02 to 0.11	0.17
3 n=824	-0.099	-0.17 to -0.03	<0.001	-0.013	-0.08 to 0.05	0.705	0.039	-0.03 to 0.11	0.26
4 n=569	-0.113	-0.19 to -0.03	0.01	-0.030	-0.11 to 0.05	0.467	0.028	-0.05 to 0.11	0.51
5 n=506	-0.111	-0.19 to -0.03	0.01	-0.035	-0.12 to 0.05	0.412	0.012	-0.07 to 0.10	0.78
Simultaneous models									
1	-0.244	-0.33 to -0.16	<0.001				0.199	0.11 to 0.28	<0.001
2	-0.251	-0.34 to -0.16	<0.001				0.214	0.13 to 0.30	<0.001
3	-0.228	-0.32 to -0.14	<0.001				0.193	0.10 to 0.28	<0.001
4	-0.224	-0.33 to -0.12	<0.001				0.172	0.07 to 0.28	<0.001
5	-0.201	-0.31 to -0.09	<0.001				0.143	0.03 to 0.25	0.01

Note: Correction for the effects of regression dilution using ICC increased coefficients from 0.11 to 0.25 for females for English GCSE attainment. For Maths, the coefficient increased to 0.18 and for Science increased to 0.32.

Supplementary Table 8. Associations between PA and academic attainment in males, adjusting for all confounders plus full scale IQ; model 6.

Model	cpm			mvpa			% time in mvpa		
	β	95% CI	p value	β	95% CI	p value	β	95% CI	p value
English at 11 years									
Separate models n= 909	-0.104	-0.16 to -0.05	<0.001	-0.072	-0.13 to -0.02	0.01	-0.051	-0.11 to 0.00	0.07
Simultaneous models	-0.148	-0.23 to -0.07	<0.001				0.058	-0.02 to 0.14	0.16
Maths at 11years									
Separate models n=912	-0.036	-0.09 to 0.02	0.19	-0.023	-0.08 to 0.03	0.40	-0.017	-0.07 to 0.04	0.52
Simultaneous models	-0.051	-0.13 to 0.03	0.21				0.020	-0.06 to 0.10	0.62
Science at 11 years									
Separate models n=913	-0.021	-0.07 to 0.03	0.43	-0.018	-0.07 to 0.03	0.49	-0.017	-0.07 to 0.04	0.52
Simultaneous models	-0.019	-0.10 to 0.06	0.64				-0.003	-0.07 to 0.07	0.93
English at 13 years									
Separate models n= 493	-0.088	-0.17 to -0.01	0.03	-0.050	-0.13 to 0.03	0.20	-0.025	-0.10 to 0.05	0.53
Simultaneous models	-0.143	-0.25 to -0.03	0.01				0.077	-0.03 to 0.19	0.18
Maths at 13years									
Separate models n=492	-0.109	-0.19 to -0.03	0.01	-0.114	-0.19 to -0.03	0.01	-0.102	-0.18 to -0.02	0.01
Simultaneous models	-0.073	-0.19 to 0.04	0.21				-0.049	-0.16 to 0.06	0.40
Science at 13 years									
Separate models n=495	-0.072	-0.16 to 0.02	0.12	-0.066	-0.16 to 0.02	0.15	-0.052	-0.14 to 0.04	0.26
Simultaneous models	-0.072	-0.20 to 0.06	0.28				-0.001	-0.25 to 0.24	0.99
English at 16 years									
Separate models n=590	-0.117	-0.19 to -0.05	<0.001	-0.070	-0.14 to 0.00	0.05	-0.040	-0.11 to 0.03	0.27
Simultaneous models	-0.189	-0.29 to -0.09	<0.001				0.097	-0.01 to 0.20	0.06
Maths at 16 years									
Separate models n=549	-0.117	-0.19 to -0.05	<0.001	-0.098	-0.17 to -0.03	0.01	-0.079	-0.15 to -0.01	0.03
Simultaneous models	-0.127	-0.23 to -0.02	0.02				0.014	-0.09 to 0.12	0.79
Science at 16 years									
Separate models n=330	-0.095	-0.18 to -0.01	0.03	-0.065	-0.15 to 0.02	0.14	-0.042	-0.13 to 0.04	0.33
Simultaneous models	-0.141	-0.027 to -0.01	0.04				0.059	-0.07 to 0.19	0.36

Supplementary Table 9. Associations between PA and academic attainment in females, adjusting for all confounders plus full scale IQ; model 6.

Model	cpm			mvpa			% time in mvpa		
	β	95% CI	p value	β	95% CI	p value	β	95% CI	p value
English at 11 years									
Separate models n= 1211	-0.032	-0.08 to 0.01	0.17	0.015	-0.03 to 0.06	0.52	0.040	-0.01 to 0.09	0.09
Simultaneous models	-0.112	-0.18 to -0.05	<0.001				0.116	0.05 to 0.18	<0.001
Maths at 11years									
Separate models n=1204	-0.040	-0.09 to 0.01	0.09	-0.033	-0.08 to 0.01	0.16	-0.032	-0.08 to 0.01	0.18
Simultaneous models	-0.033	-0.10 to 0.03	0.31				-0.009	-0.07 to 0.05	0.78
Science at 11 years									
Separate models n=1207	-0.050	-0.10 to 0.00	0.03	-0.004	-0.05 to 0.05	0.88	0.009	-0.04 to 0.06	0.71
Simultaneous models	-0.106	-0.17 to -0.04	<0.001				0.081	0.02 to 0.14	0.01
English at 13 years									
Separate models n= 647	-0.103	-0.17 to -0.04	<0.001	-0.047	-0.11 to 0.02	0.16	0.000	0.00 to 0.00	0.10
Simultaneous models	-0.183	-0.27 to -0.10	<0.001				0.120	0.03 to 0.21	0.01
Maths at 13years									
Separate models n=647	-0.070	-0.14 to 0.00	0.05	-0.050	-0.12 to 0.02	0.17	-0.048	-0.12 to 0.02	0.18
Simultaneous models	-0.067	-0.16 to 0.03	0.16				-0.004	-0.10 to 0.09	0.93
Science at 13 years									
Separate models n=649	-0.113	-0.19 to -0.04	<0.001	-0.122	-0.20 to -0.05	<0.001	-0.104	-0.18 to -0.03	0.01
Simultaneous models	-0.077	-0.18 to 0.03	0.14				-0.053	-0.15 to 0.05	0.30
English at 16 years									
Separate models n=854	-0.103	-0.16 to -0.05	<0.001	-0.070	-0.13 to -0.01	0.01	-0.033	-0.09 to 0.02	0.26
Simultaneous models	-0.148	-0.22 to -0.07	<0.001				0.068	-0.01 to 0.14	0.08
Maths at 16 years									
Separate models n=842	-0.076	-0.13 to -0.02	0.01	-0.048	-0.10 to 0.01	0.08	-0.034	-0.09 to 0.02	0.23
Simultaneous models	-0.097	-0.17 to -0.02	0.01				0.032	-0.04 to 0.11	0.39
Science at 16 years									
Separate models n=471	-0.112	-0.18 to -0.04	<0.001	-0.055	-0.13 to 0.02	0.14	-0.019	-0.09 to 0.06	0.62
Simultaneous models	-0.175	-0.27 to -0.08	<0.001				0.098	0.00 to 0.19	0.04

Supplementary Table 10. Model 1 repeated with only participants who have complete data at model 5 for males

Model	Cpm		mvpa		% time in mvpa	
	β	p value	β	p value	β	p value
English at 11 years						
1 (with model 5 cases)	-0.183	<0.001	-0.096	<0.001	-0.042	0.18
– separate N=991						
1 (with model 5 cases)	-0.329	<0.001			0.198	<0.001
- simultaneous						
Maths at 11 years						
1 (with model 5 cases)	-0.134	<0.001	-0.064	0.05	-0.022	0.48
– separate N=994						
1 (with model 5 cases)	-0.254	<0.001			0.163	<0.001
- simultaneous						
Science at 11 years						
1 (with model 5 cases)	-0.129	<0.001	-0.070	0.03	-0.033	0.30
– separate N=995						
1 (with model 5 cases)	-0.226	<0.001			0.132	<0.001
- simultaneous						
English at 13 years						
1 (with model 5 cases)	-0.139	<0.001	-0.039	0.37	0.021	0.63
– separate N=532						
1 (with model 5 cases)	-0.319	<0.001			0.250	<0.001
- simultaneous						
Maths at 13 years						
1 (with model 5 cases)	-0.139	<0.001	-0.086	0.05	-0.043	0.33
– separate N=531						
1 (with model 5 cases)	-0.224	<0.001			0.118	0.06
- simultaneous						
Science at 13 years						
1 (with model 5 cases)	-0.092	0.03	-0.040	0.36	-0.008	0.85
– separate N=533						
1 (with model 5 cases)	-0.178	<0.001			0.120	0.05

- simultaneous

English at 16 years

1 (with model 5 cases) -0.211 <0.001 -0.106 0.01 -0.033 0.41

– separate N=635

1 (with model 5 cases) -0.406 <0.001 0.265 <0.001

- simultaneous

Maths at 16 years

1 (with model 5 cases) -0.194 <0.001 -0.104 0.01 -0.035 0.40

– separate N=592

1 (with model 5 cases) -0.362 <0.001 0.230 <0.001

- simultaneous

Science at 16 years

1 (with model 5 cases) -0.227 <0.001 -0.141 0.01 -0.072 0.18

– separate N=352

1 (with model 5 cases) -0.396 <0.001 0.225 <0.001

- simultaneous

Supplementary Table 11. Model 1 repeated with only participants who have complete data at model 5 for females

Model	Cpm		mvp		% time in mvp	
English at 11 years	β	p value	β	p value	β	p value
1 (with model 5 cases) – separate N=1316	-0.079	<0.001	0.013	0.63	0.068	0.01
1 (with model 5 cases) - simultaneous	-0.234	<0.001			0.227	<0.001
Maths at 11 years						
1 (with model 5 cases) – separate N=1309	-0.090	<0.001	-0.032	0.25	0.001	0.98
1 (with model 5 cases) - simultaneous	-0.169	<0.001			0.116	<0.001
Science at 11 years						
1 (with model 5 cases) – separate N=1312	-0.094	<0.001	0.003	0.91	0.047	0.09
1 (with model 5 cases) - simultaneous	-0.235	<0.001			0.207	<0.001
English at 13 years						
1 (with model 5 cases) – separate N=693	-0.172	<0.001	-0.066	0.08	0.007	0.86
1 (with model 5 cases) - simultaneous	-0.318	<0.001			0.219	<0.001
Maths at 13 years						
1 (with model 5 cases) – separate N=693	-0.113	<0.001	-0.055	0.15	-0.028	0.46
1 (with model 5 cases) - simultaneous	-0.170	<0.001			0.086	0.09
Science at 13 years						
1 (with model 5 cases) – separate N=694	-0.116	<0.001	-0.107	0.01	-0.082	0.03
1 (with model 5 cases)	-0.112	0.03			-0.007	0.90

- simultaneous

English at 16 years

1 (with model 5 cases) -0.137 <0.001 -0.051 0.12 0.018 0.58

- separate N=911

1 (with model 5 cases) -0.271 <0.001 0.200 <0.001

- simultaneous

Maths at 16 years

1 (with model 5 cases) -0.122 <0.001 -0.036 0.28 0.014 0.68

- separate N=898

1 (with model 5 cases) -0.235 <0.001 0.170 <0.001

- simultaneous

Science at 16 years

1 (with model 5 cases) -0.139 <0.001 -0.033 0.46 0.039 0.39

- separate N=352

1 (with model 5 cases) -0.277 <0.001 0.216 <0.001

- simultaneous
