SUPPLEMENTARY MATERIALS

Associations of moderate-to-vigorous-intensity physical activity and body mass index with glycated haemoglobin within the general population: a cross-sectional analysis of the 2008 Health Survey for England

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Table S1 - Confounder analysis based on the criteria of changing the regression coefficient for either total accumulated moderate-to-vigorous-intensity physical activity (MVPA) time or body mass index (BMI) by 10% or more once added individually to a basic model adjusted for age, ethnicity, sex and accelerometer wear-time

Table S2 - Sample of adults with valid accelerometer data: comparison of the basic characteristics between the included and excluded participants

Table S3 - Sensitivity analyses: adjusted linear regression models showing the associations between continuous measures of total accumulated moderate-to-vigorous-intensity physical activity (MVPA) time and waist circumference with glycated haemoglobin (HbA1c)

Table S4 - Sensitivity analyses: interaction analysis: adjusted linear regression models showing the associations between continuous measures of total accumulated moderate-to-vigorous-intensity physical activity (MVPA) time and waist circumference with glycated haemoglobin (HbA1c) stratified by MVPA and waist circumference levels

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Table S6 - Sensitivity analyses: adjusted linear regression models showing the associations between mutually exclusive categories of moderate-to-vigorous-intensity physical activity (MVPA) time and obesity status with glycated haemoglobin (HbA1c)

Figure S1 - Flow chart of study participants

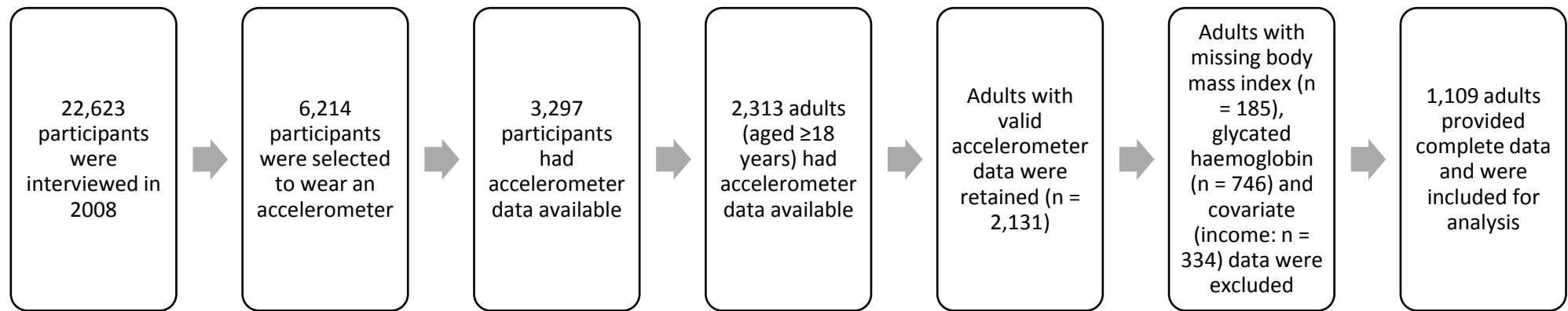| 22,623 participants were interviewed in 2008 | → | 6,214 participants were selected to wear an accelerometer | → | 3,297 participants had accelerometer data available | → | 2,313 adults (aged ≥18 years) had accelerometer data available | → | Adults with valid accelerometer data were retained (n = 2,131) | → | Adults with missing body mass index (n = 185), glycated haemoglobin (n = 746) and covariate (income: n = 334) data were excluded | → | 1,109 adults provided complete data and were included for analysis |

Table S1 - Confounder analysis based on a criteria of changing the regression coefficient for either total accumulated moderate-to-vigorous-intensity physical activity (MVPA) time or body mass index (BMI) by 10% or more once added individually to a basic model adjusted for age, ethnicity, sex and accelerometer wear-time

	MVPA (30 minutes/day): Beta †	% Change in MVPA Beta	BMI (1 kg/m²): Beta ‡	% Change in BMI Beta
HbA1c [mmol/mol] (dual units) [%]	-1.08619 -0.09939	-	0.27118 0.02481	-
Covariate individually added to basic model (age, sex, ethnicity and accelerometer wear-time)				
Disease index	-1.00775 -0.09221	7.2	0.26435 0.02419	-2.5
Reported fruit & vegetable consumption	-1.09698 -0.10037	-1.0	0.26803 0.02452	-1.2
Income	-1.06915 -0.09783	1.6	**0.23041** **0.02108**	**-15.0**
Smoking status	-1.05337 -0.09638	3.0	0.28741 0.02630	6.0
Socioeconomic status	-1.15279 -0.10548	-6.1	0.26994 0.02470	-0.5
Any prescribed medication	**-0.97137** **-0.08888**	**10.6**	0.25601 0.02343	-5.6

Sedentary time	-1.18817 -0.10872	-9.4	0.27013 0.02472	-0.4
Light-intensity physical activity time	-1.11946 -0.10243	-3.1	0.27152 0.02484	0.1

*All analyses controlled for primary sampling units, clustering and survey weights. Confounders were considered for inclusion as follows: primarily using all the available data, in separate models for MVPA and BMI with glycated haemoglobin (HbA1c) as the dependent variable, confounders were included based on a criteria of changing the regression coefficient for either MVPA or BMI by 10% or more once added individually to a basic model adjusted for age, ethnicity, sex, and accelerometer wear-time. **Bold** indicates a ≥10% change in the regression coefficient for either MVPA or BMI.*

† Beta coefficients represent the average difference in HbA1c (mmol/mol) (%) for each 30 minutes/day increment in MVPA

‡ Beta coefficients represent the average difference in HbA1c (mmol/mol) (%) for each 1 kg/m^2 increment in BMI

Table S2 - Sample of adults with valid accelerometer data: comparison of the basic characteristics between the included and excluded participants

Characteristic	Included (N = 1,109)	Excluded (N = 1,022)	p-value
Age (in years) †	51.0 (16.5)	50.6 (18.8)	0.601
Body Mass Index (kg/m^2) †	27.3 (4.8)	27.7 (5.4)	0.085
Missing	0 (0.0)	185 (18.1)	
Waist Circumference (cm) †	92.9 (13.9)	94.0 (15.0)	0.100
Missing	0 (0.0)	229 (22.4)	
Ethnicity ‡			0.063
White	1,055 (94.2)	953 (92.1)	
Non-White	54 (5.8)	69 (7.9)	
Sex ‡			0.278
Men	523 (50.2)	458 (48.3)	
Women	586 (49.8)	564 (51.7)	
Total Accumulated Moderate-to-Vigorous-Intensity Physical Activity Time † (no. of minutes/valid day)	30.8 (25.8)	29.7 (24.9)	0.318
Moderate-to-Vigorous-Intensity Physical Activity Time in Bouts of ≥10 Minutes † (no. of minutes/valid day)	10.8 (16.2)	10.0 (14.6)	0.233

All analyses controlled for primary sampling units, clustering and survey weights.

† Continuous variable; Mean (Standard Deviation); p-value based on unpaired t-test

‡ Categorical variable; n (Proportion (%)); p-value based on chi-squared test

Table S3 - Sensitivity analyses: adjusted linear regression models showing the associations between continuous measures of total accumulated moderate-to-vigorous-intensity physical activity (MVPA) time and waist circumference with glycated haemoglobin (HbA1c)

Adjusted linear regression model	HbA1c (dual units)	MVPA (30 minutes/day)		Waist Circumference (1 cm)	
		Beta (99% CI) †	p-value	Beta (99% CI) ‡	p-value
Model 1	[mmol/mol] [%]	**-0.9 (-1.4, -0.4)** **-0.08 (-0.13, -0.03)**	**<0.001**	**0.1 (0.1, 0.1)** **0.01 (0.01, 0.01)**	**<0.001**
Model 2	[mmol/mol] [%]	**-0.6 (-1.0, -0.1)** **-0.05 (-0.10, -0.01)**	**0.003**	**0.1 (0.1, 0.1)** **0.01 (0.01, 0.01)**	**<0.001**

*All analyses controlled for primary sampling units, clustering and survey weights. **Bold** indicates statistical significance at p<0.01. Model 1 adjusted for: age, ethnicity, income, sex, any prescribed medication, and accelerometer wear-time. Model 2 additionally adjusted for waist circumference (for MVPA analysis) and MVPA (for waist circumference analysis).*

† Beta coefficients represent the average difference in HbA1c (mmol/mol) (%) for each 30 minutes/day increment in MVPA

‡ Beta coefficients represent the average difference in HbA1c (mmol/mol) (%) for each 1 cm increment in waist circumference

Table S4 - Sensitivity analyses: interaction analysis: adjusted linear regression models showing the associations between continuous measures of total accumulated moderate-to-vigorous-intensity physical activity (MVPA) time and waist circumference with glycated haemoglobin (HbA1c) stratified by MVPA and waist circumference levels

P-value of MVPA x Waist Circumference interaction term	Stratification	HbA1c (dual units)	MVPA (30 minutes/day)		Waist Circumference (1 cm)	
			Beta (99% CI) †	p-value	Beta (99% CI) ‡	p-value
<0.001	Low Waist Circumference	[mmol/mol] [%]	-0.3 (-0.7, 0.0) -0.03 (-0.06, 0.00)	0.024	-	-
	High Waist Circumference	[mmol/mol] [%]	**-1.8 (-3.0, -0.5)** **-0.16 (-0.28, -0.05)**	**<0.001**	-	-
	MVPA <150 mins/week	[mmol/mol] [%]	-	-	**0.1 (0.1, 0.2)** **0.01 (0.01, 0.02)**	**<0.001**
	MVPA ≥150 mins/week	[mmol/mol] [%]	-	-	**0.1 (0.0, 1)** **0.01 (0.00, 0.01)**	**<0.001**

*All analyses controlled for primary sampling units, clustering and survey weights. 'High Waist Circumference' was defined as having a waist circumference of ≥102 cm for men and ≥88 cm for women. **Bold** indicates statistical significance at p<0.01. Models adjusted for: age, ethnicity, income, sex, any prescribed medication, and accelerometer wear-time.*

† Beta coefficients represent the average difference in HbA1c (mmol/mol) (%) for each 30 minutes/day increment in MVPA

‡ Beta coefficients represent the average difference in HbA1c (mmol/mol) (%) for each 1 cm increment in waist circumference

Table S5 - Sensitivity analyses: weighted mutually exclusive category prevalence

	Weighted Prevalence [%]			
Method	'Physically active & non-obese'	'Physically active & obese'	'Physically inactive & non-obese'	'Physically inactive & obese'
Reference	45.9%	10.7%	29.9%	13.5%
1	37.8%	19.0%	20.0%	23.2%
2	36.1%	20.5%	20.7%	22.7%
3	14.3%	1.8%	61.5%	22.4%

All analyses controlled for primary sampling units, clustering and survey weights.

Reference Method = Mutually exclusive categories derived and utilised in the main analysis

Method 1 = 'Obese' was defined as having a waist circumference of ≥102 cm for men and ≥88 cm for women

Method 2 = 'Obese' was defined as having a body mass index of ≥27.5 kg/m^2

Method 3 = Participants were only classified into the 'physically active' categories if they accumulated ≥150 minutes/week of MVPA in bouts of ≥10 minutes

Table S6 - Sensitivity analyses: adjusted linear regression models showing the associations between mutually exclusive categories of moderate-to-vigorous-intensity physical activity (MVPA) time and obesity status with glycated haemoglobin (HbA1c)

Method	HbA1c (dual units)	'Physically active & non-obese'		'Physically active & obese'		'Physically inactive & non-obese'		'Physically inactive & obese'
		Beta (99% CI) †	p-value	Beta (99% CI) †	p-value	Beta (99% CI) †	p-value	
Reference	[mmol/mol] [%]	**-3.5 (-5.2, -1.9)** **-0.32 (-0.47, -0.18)**	**<0.001**	**-2.1 (-4.1, -0.2)** **-0.19 (-0.37, -0.02)**	**0.005**	-1.9 (-3.8, 0.0) -0.17 (-0.35, 0.00)	0.012	Reference
1	[mmol/mol] [%]	**-4.1 (-5.9, -2.2)** **-0.37 (-0.54, -0.21)**	**<0.001**	**-2.5 (-4.4, -0.6)** **-0.23 (-0.40, -0.05)**	**0.001**	**-3.1 (-5.0, -1.2)** **-0.29 (-0.46, -0.11)**	**<0.001**	Reference
2	[mmol/mol] [%]	**-2.9 (-4.1, -1.7)** **-0.27 (-0.38, -0.16)**	**<0.001**	**-1.5 (-2.9, -0.2)** **-0.14 (-0.27, -0.02)**	**0.004**	-0.9 (-2.9, 1.1) -0.08 (-0.27, 0.01)	0.229	Reference
3	[mmol/mol] [%]	**-3.4 (-4.7, -2.1)** **-0.31 (-0.43, -0.20)**	**<0.001**	-2.0 (-4.3, 0.3) -0.18 (-0.39, 0.03)	0.027	**-1.7 (-3.0, -0.4)** **-0.16 (-0.28, -0.04)**	**0.001**	Reference

All analyses controlled for primary sampling units, clustering and survey weights.

Reference Method = Mutually exclusive categories derived and utilised in the main analysis

Method 1 = 'Obese' was defined as having a waist circumference of ≥102 cm for men and ≥88 cm for women

Method 2 = 'Obese' was defined as having a body mass index of ≥27.5 kg/m^2

Method 3 = Participants were only classified into the 'physically active' categories if they accumulated ≥150 minutes/week of MVPA in bouts of ≥10 minutes

***Bold** indicates statistical significance at p<0.01. Models adjusted for: age, ethnicity, income, sex, any prescribed medication, and accelerometer wear-time.*

† Beta coefficients represent the average difference in HbA1c (mmol/mol) (%) in comparison to the 'physically inactive and obese' category