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Associations Between Accelerometer- Measured Movement Behaviour and MRI-Derived Adipose Tissue Depots in Type 2 Diabetes

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Abstract

Background

The association between waking-time movement composition and depot-specific adiposity in type 2 diabetes is unclear. We examined associations of accelerometer-derived movement behaviours with MRI-derived abdominal subcutaneous adipose tissue (ASAT), visceral adipose tissue (VAT), and liver proton density fat fraction (PDFF).

Methods

In this cross-sectional EPSONIP study, adults with type 2 diabetes underwent neck-to-knee MRI and 7-day wrist accelerometry. Sedentary time, light-intensity activity, and moderate-to-vigorous physical activity (MVPA) were analysed compositionally using isometric log-ratio coordinates. Outcomes were standardised; ASAT and VAT were height-normalised. Models adjusted for age and sex.

Results

Of 257 participants with valid accelerometry, 239 had ASAT/VAT and 234 liver PDFF data. More non-sedentary relative to sedentary time was associated with lower ASAT (β − 0.405 SD; 95% CI − 0.685 to − 0.125) and VAT (β − 0.523 SD; 95% CI − 0.909 to − 0.137), but not liver PDFF. MVPA relative to light activity was not clearly associated with any outcome. Reallocating 10 min/day from sedentary to non-sedentary time corresponded to − 0.019 SD lower ASAT and − 0.025 SD lower VAT.

Conclusions

More non-sedentary relative to sedentary waking time was associated with lower ASAT and VAT, but not liver PDFF. The cross-sectional design precludes causal inference.

Research in Context

What is already known about this subject?

Higher device-measured physical activity and lower sedentary time are generally associated with lower abdominal adiposity. MRI enables precise assessment of depot-specific adiposity, but relatively few studies in adults with type 2 diabetes have combined accelerometry with MRI-derived ASAT, VAT, and PDFF, and compositional modelling of waking-time movement behaviours has been little explored in this population.

What is the key question?

Is the waking-time composition of sedentary time, light-intensity activity, and moderate-to-vigorous

physical activity associated with MRI-derived ASAT, VAT, and PDFF in adults with type 2 diabetes recruited from primary care?

What are the new findings?

A waking-time composition characterised by relatively more non-sedentary time and less sedentary time was associated with lower ASAT and VAT, whereas no clear association was observed with PDFF. The contrast between MVPA and light-intensity activity was not clearly associated with any of the three outcomes.

How might this impact clinical practice in the foreseeable future?

The findings suggest that the overall balance between sedentary and non-sedentary waking time may be relevant to abdominal adiposity in adults with type 2 diabetes. Because the study is cross-sectional, the results should not be interpreted as evidence that changing movement behaviour will necessarily reduce abdominal adiposity.

Background

Type 2 diabetes is closely associated with obesity and adverse body-fat distribution, but cardiometabolic risk is not determined by total adiposity alone. Visceral adipose tissue (VAT), abdominal subcutaneous adipose tissue (ASAT), and ectopic liver fat represent distinct adipose tissue compartments with different metabolic associations[1–3]. Large-scale imaging studies have shown that, independent of BMI, higher visceral and liver fat are associated with increased cardiometabolic risk[3].

Current WHO guidelines recommend that adults, including those with chronic conditions, accumulate 150–300 min/week of moderate-intensity aerobic activity or 75–150 min/week of vigorous-intensity activity or an equivalent combination, and limit sedentary time[4]. However, conventional activity thresholds do not account for the interdependence of behaviours within a finite day, because time spent in one behaviour necessarily displaces time spent in another.

Movement behaviours can be quantified objectively using wrist-worn accelerometers, allowing assessment of sedentary time and activity-intensity profiles from raw accelerometer data using standardised processing methods[5]. Complementing these measures, magnetic resonance imaging (MRI) enables precise quantification of body-fat depots, including VAT, ASAT, and hepatic fat content measured as proton density fat fraction (PDFF)[3, 6].

To our knowledge, few studies have examined the waking-time composition of movement behaviours in relation to MRI-derived VAT, ASAT, and PDFF in adults with type 2 diabetes[7]. Evidence from populations recruited from primary care appears particularly limited. It therefore remains unclear whether the relative distribution of sedentary time, light-intensity activity, and moderate-to-vigorous physical activity (MVPA) is associated with these adipose tissue measures.

To address this gap, we examined associations between accelerometer-derived waking-time movement behaviours and MRI-derived VAT, ASAT, and liver PDFF in adults with type 2 diabetes recruited from primary care. Movement behaviour was analysed using compositional data analysis of sedentary time, light-intensity activity, and MVPA, with conventional analyses of MVPA and WHO-based activity categories as complementary analyses.

We hypothesised that the waking-time composition of sedentary behaviour and physical activity would be associated with MRI-derived VAT, ASAT, and liver PDFF in adults with type 2 diabetes.

Materials and Methods

Study Protocol

This study used data from **EPSONIP** (Evaluating the Prevalence and Severity of NAFLD in Primary Care) [8], an MRI-based primary care study designed to evaluate what was then termed non-alcoholic fatty liver disease (NAFLD), now termed metabolic dysfunction-associated steatotic liver disease (MASLD), among adults with type 2 diabetes. Individuals aged 35–75 years with type 2 diabetes who were managed at participating primary healthcare centres in Östergötland County were eligible for inclusion between 2019 and 2023. Participants were mainly recruited in connection with routine annual diabetes visits, where they were informed about the study by clinical staff. During the coronavirus disease 2019 pandemic, when recruitment through routine visits was slower, additional eligible patients registered at the participating centres were contacted by postal invitation. Exclusion criteria were MRI contraindications, including claustrophobia, pacemaker, metal implants, severe obesity precluding MRI, and pregnancy, as well as alcohol dependence, previously diagnosed liver cirrhosis, or other chronic liver disease except MASLD. The study complied with the Declaration of Helsinki and was approved by the Swedish Ethical Review Authority (approval numbers 2018/176–31 and 2018/494–32). All participants provided written informed consent, and the protocol is registered at ClinicalTrials.gov (NCT03864510; registration date: 12 February 2019).

Body Fat Distribution

Participants underwent whole-body neck-to-knee MRI on Achieva dStream 1.5T scanners (Philips Healthcare, The Netherlands). VAT and ASAT were quantified using AMRA® Researcher (AMRA Medical AB, Linköping, Sweden), applying the same body-composition workflow as in the UK Biobank imaging study[3, 9]. Liver proton density fat fraction (PDFF) was also derived from MRI. VAT and ASAT volumes were normalised to height squared and expressed as L/ m².

Height-normalised VAT and ASAT and liver PDFF were used as outcomes in the regression analyses. Because these measures were right-skewed, they were natural-log transformed and subsequently standardised before analysis; untransformed values are reported descriptively.

For supplementary sensitivity analyses, AMRA-derived VAT, ASAT, and liver fat were expressed as sex- and BMI-referenced z-scores (z-VAT, z-ASAT, and z-LF). These z-scores were derived using virtual control groups (VCGs) matched on sex and BMI, initially within a ±1 kg/m² BMI interval. When fewer than 150 matched controls were available, the BMI interval was expanded symmetrically in 0.1 kg/m² increments until at least 150 controls were obtained. Each z-score therefore reflects the number of standard deviations by which an individual differed from the mean of the matched VCG. Because liver PDFF is right-skewed, log-transformed PDFF was used when deriving z-LF[9]. The UK Biobank data was accessed under project ID 6569. The UK Biobank study was approved by the North West Multicenter Research Ethics Committee, UK, and written informed consent was obtained prior to study entry.

Accelerometry

Each participant was fitted with a wrist-worn triaxial accelerometer (ActiGraph wGT3X-BT; Pensacola, FL) on the non-dominant arm and asked to wear it continuously for 7 consecutive days. The monitor was removed only for water exposure (e.g., showering or swimming). Participants logged daily bed and wake times to support identification of sleep–wake periods.

Using GGIR (v3.1-0) in R[5], we cleaned and transformed the wrist accelerometer signal sampled at 90Hz (idle sleep mode enabled). Calibration was performed using an automated gravity-based approach [10], and non-wear was flagged using the established range/variability rules[11]. We then computed Euclidean Norm Minus One (ENMO; negative values set to 0)[12] and extracted the wrist z-axis angle relative to the horizontal plane (z-angle) .

Movement exposures were derived from waking wear time. Waking time was delineated by estimating the main sleep episode for each 24-h day using bed/wake diaries when available; otherwise, the sleep window was identified using the heuristic distribution of change in z-angle (HDCZA) algorithm[13]. Sleep outcomes were not analysed; sleep detection was used only to distinguish sleep from waking periods.

Intensity categories were derived from ENMO using published acceleration thresholds[14, 15]. Time spent in light-intensity (35 mg to <100mg), moderate-intensity (100 mg to <400mg), and vigorous-intensity (≥400 mg) activity was summarised as **total daily minutes,** and MVPA was defined as time ≥100 mg [14, 15]. Here, mg denotes milli-g units of acceleration. **Sedentary time** was defined as **<35 mg**and was summarised as total daily minutes. Days were included when wear time met pre-specified criteria: ≥16 h of valid signal within the 24-h day used for sleep–wake segmentation, and valid wear for at least two-thirds of the time classified as awake. Only valid days contributed to the movement exposure estimates. Participants were included in the actigraphy analyses if they had at least 6 valid days. When recordings extended beyond 7 days, all additional valid days were retained in the calculation of participant-level movement estimates.

Statistical Analysis

Movement behaviour was analysed using compositional data analysis, with conventional activity metrics as complementary analyses. The waking-time movement composition comprised sedentary time, light-intensity activity and moderate-to-vigorous physical activity (MVPA) and was expressed using isometric log-ratio (ILR) coordinates. The first ILR coordinate contrasted non-sedentary time (the geometric mean of light-intensity activity and MVPA) with sedentary time, whereas the second contrasted MVPA with light-intensity activity.

All components of the movement composition were strictly positive; therefore, no zero-replacement procedure was required.

To aid interpretation, model-based predicted differences in standardised log-transformed fat outcomes were estimated for hypothetical reallocations of 10, 30, and 60 min/day from sedentary time to non-sedentary time at the mean observed waking-time composition, with the reallocated time distributed proportionally between light-intensity activity and MVPA.

Complementary analyses examined WHO-weighted MVPA, calculated as moderate-intensity activity plus twice vigorous-intensity activity, both continuously (per +10 min/week) and categorically according to WHO guideline thresholds.

Associations with MRI-derived fat outcomes were estimated using linear regression. Outcomes were natural-log transformed and subsequently standardised; results are presented as β coefficients in SD units with 95% confidence intervals. Models were adjusted for age and sex.

Supplementary analyses included models using continuous sex- and BMI-referenced z-score outcomes and models further adjusted for smoking status, weekly alcohol consumption, binge-drinking frequency, and food habits. The parent EPSONIP study was powered for 400 participants; the present analysis included all participants with valid accelerometry and MRI data. Analyses were performed using complete cases for the variables included in each model; consequently, sample size could differ between outcomes and between age- and sex-adjusted and further-adjusted models. Statistical analyses were conducted in R, with actigraphy data processed using GGIR (v3.1-0). Two-sided p-values <0.05 were considered statistically significant.

Results

Of the 345 invited participants, 338 remained in the broader cohort after exclusions, of whom 257 had valid accelerometry data. Model-specific sample sizes for the main age- and sex-adjusted analyses were 239 for ASAT, 239 for VAT, and 234 for liver PDFF; 231 participants had complete data for all three MRI-derived outcomes (Figure 1). Participant characteristics are presented in Table 1.

Table 1. Participant characteristics, movement behaviours, and MRI-derived adiposity.

Variable	N	Overall N = 257	Female N = 97	Male N = 160
Participant characteristics				
Age, years	257	64.0 (7.9)	63.8 (8.1)	64.2 (7.7)
BMI, kg/m²	248	29.3 [26.1, 32.4]	29.9 [27.0, 33.9]	28.7 [25.8, 31.5]
HbA1c, mmol/mol	257	49.0 [44.0, 57.0]	48.0 [44.0, 56.0]	49.0 [44.0, 58.0]
Diabetes duration, years	255	7.0 [3.0, 12.0]	7.0 [3.0, 12.0]	7.0 [3.0, 12.0]
Current glucose-lowering medications				
Metformin	255	199 (78%)	71 (74%)	128 (81%)
SGLT2	248	65 (26%)	23 (25%)	42 (27%)
GLP-1 receptor agonist	246	13 (5%)	9 (10%)	4 (3%)
DPP-4 inhibitor	247	4 (2%)	1 (1%)	3 (2%)
Sulfonylurea	248	19 (8%)	6 (6%)	13 (8%)
Pioglitazone	246	0 (0%)	0 (0%)	0 (0%)
Insulin	246	52 (21%)	15 (16%)	37 (24%)
Accelerometry and movement behaviour				
Valid accelerometer days	257			
6 days		34 (13%)	8 (8%)	26 (16%)
7 days		197 (77%)	82 (85%)	115 (72%)
8 days		23 (9%)	6 (6%)	17 (11%)
9 days		2 (1%)	1 (1%)	1 (1%)
10 days		1 (0%)	0 (0%)	1 (1%)
Sleep duration, min/day	257	395.0 [353.9, 433.1]	410.1 [370.6, 441.4]	387.5 [348.1, 422.3]
Total waking time, min/day	257	966.9 [935.0, 1007.2]	954.2 [919.0, 986.5]	972.7 [942.1, 1017.4]
Sedentary time, min/day	257	752.0 [697.2, 799.0]	740.9 [676.8, 790.8]	757.4 [708.0, 804.9]
Light-intensity activity, min/day	257	156.8 [123.3, 192.4]	157.9 [124.5, 200.9]	156.8 [123.1, 187.0]

Moderate-intensity activity, min/day	257	50.3 [33.9, 79.5]	45.6 [28.8, 76.8]	52.2 [34.5, 81.5]
Vigorous-intensity activity, min/day	257	0.3 [0.1, 0.9]	0.2 [0.1, 0.8]	0.3 [0.2, 0.9]
Moderate-to-vigorous physical activity, min/day	257	51.3 [34.2, 80.8]	45.6 [28.9, 77.4]	53.7 [35.6, 81.7]
WHO-weighted MVPA, min/week	257	369.2 [241.2, 573.4]	324.8 [206.7, 546.7]	382.2 [254.3, 576.7]
WHO MVPA category, min/week	257			
<150		23 (9%)	15 (15%)	8 (5%)
150 to <300		66 (26%)	26 (27%)	40 (25%)
≥300		168 (65%)	56 (58%)	112 (70%)
MRI-derived adiposity				
VAT volume, L	239	5.8 [4.4, 7.9]	5.0 [3.7, 6.0]	6.6 [4.8, 8.8]
ASAT volume, L	239	8.2 [6.1, 10.6]	10.7 [8.4, 13.8]	6.5 [5.1, 8.7]
VAT index, L/m²	239	2.0 [1.5, 2.6]	1.9 [1.4, 2.2]	2.1 [1.6, 2.8]
ASAT index, L/m²	239	2.6 [1.9, 3.7]	3.9 [3.3, 4.9]	2.1 [1.6, 2.7]
Liver PDFF, %	234	5.8 [2.7, 12.7]	6.3 [3.2, 13.6]	5.6 [2.6, 12.3]

Values are mean (SD), median [25th, 75th percentile], or n (%), as appropriate.

The table describes participants with valid accelerometry (N = 257). Variable-specific N may be lower because of missing data.

MVPA, moderate-to-vigorous physical activity. WHO-weighted MVPA was calculated as moderate-intensity activity plus twice vigorous-intensity activity.

ASAT, abdominal subcutaneous adipose tissue; VAT, visceral adipose tissue; PDFF, proton density fat fraction. VAT and ASAT indices were calculated as volume divided by height squared.

In the compositional model, a higher relative proportion of non-sedentary time compared with sedentary time was associated with **lower ASAT (β −0.405 SD; 95% CI −0.685 to −0.125) and VAT (β −0.523 SD; 95% CI −0.909 to −0.137), whereas no clear association was observed with liver PDFF (β −0.167 SD; 95% CI −0.572 to 0.238)** (Table 2).

The coordinate contrasting **MVPA with light-intensity activity was not clearly associated with ASAT (β −0.221 SD; 95% CI −0.532 to 0.090), VAT (β −0.002 SD; 95% CI −0.430 to 0.426), or liver PDFF (β 0.114 SD; 95% CI −0.327 to 0.555)** (Table 2; Figure 2).

Table 2. Age- and sex-adjusted associations between waking-time movement composition and MRI-derived adiposity.

Movement composition contrast	β (95% CI)	P value	N
Abdominal subcutaneous adipose tissue (ASAT)			
Non-sedentary relative to sedentary time	−0.405 (−0.685 to −0.125)	0.005	239
MVPA relative to light-intensity activity	−0.221 (−0.532 to 0.090)	0.163	239
Visceral adipose tissue (VAT)			
Non-sedentary relative to sedentary time	−0.523 (−0.909 to −0.137)	0.008	239
MVPA relative to light-intensity activity	−0.002 (−0.430 to 0.426)	0.992	239
Liver proton density fat fraction (PDFF)			
Non-sedentary relative to sedentary time	−0.167 (−0.572 to 0.238)	0.417	234
MVPA relative to light-intensity activity	0.114 (−0.327 to 0.555)	0.610	234

β coefficients are expressed in SD units with 95% confidence intervals. All models were adjusted for age and sex.

ASAT and VAT were normalised to height squared, natural-log transformed, and standardised. Liver PDFF was natural-log transformed and standardised.

The first compositional coordinate contrasts non-sedentary time (the geometric mean of light-intensity activity and MVPA) with sedentary time. The second contrasts MVPA with light-intensity activity.

ASAT, abdominal subcutaneous adipose tissue; VAT, visceral adipose tissue; MVPA, moderate-to-vigorous physical activity; PDFF, proton density fat fraction.

At the mean waking-time composition, reallocating 10 min/day from sedentary to non-sedentary time, proportionally distributed between light-intensity activity and MVPA, was associated with -0.019 SD lower ASAT (95% CI – 0.032 to – 0.006) and – 0.025 SD lower VAT (95% CI – 0.043 to – 0.007). The corresponding estimate for liver PDFF was – 0.008 SD (95% CI – 0.027 to 0.011). Estimates for 30 and 60 min/day reallocations are presented in Supplementary Table S4.

Complementary analyses using WHO-weighted MVPA and WHO-based activity categories are presented in Supplementary Table S1. Sensitivity analyses using continuous sex- and BMI-referenced z-score outcomes are presented in Supplementary Table S2 and Supplementary Figure S1. These analyses were not uniformly consistent across outcomes and should therefore be interpreted as complementary to the age- and sex-adjusted compositional analyses.

Sensitivity analyses additionally adjusted for smoking status, weekly alcohol consumption, binge-drinking frequency, and food habits were based on smaller complete-case samples (N = 154 for ASAT and VAT and N = 149 for liver PDFF) and are presented in Supplementary Table S3.

Model-specific sample sizes are reported in Supplementary Table S5.

Discussion

In adults with type 2 diabetes recruited from Swedish primary care, a waking-time composition characterised by relatively more non-sedentary time and less sedentary time was associated with lower ASAT and VAT, whereas no clear association was observed with liver PDFF. The contrast between MVPA and light-intensity activity was not clearly associated with any of the three adiposity outcomes. Reallocating 10 min/day from sedentary to non-sedentary time corresponded to approximately 0.02 SD lower ASAT and 0.03 SD lower VAT, indicating relatively small differences in abdominal adiposity.

The observed associations with ASAT and VAT are broadly consistent with previous observational studies showing that higher physical activity and lower sedentary time are associated with lower abdominal adiposity. Accelerometer-based studies have reported inverse associations between moderate-to-vigorous physical activity and visceral adipose tissue[16], as well as associations between sedentary time and MRI-derived measures of abdominal adiposity[17]. Meta-analytic evidence further indicates that aerobic and resistance exercise can reduce abdominal subcutaneous adipose tissue[18], while aerobic exercise has also been associated with reductions in visceral adipose tissue[19]. The present study extends this literature by examining movement behaviour as a composition, thereby accounting for the fact that time spent in one waking behaviour necessarily displaces time spent in another, and by focusing specifically on adults with type 2 diabetes recruited from primary care.

In the present study, the compositional association with abdominal adiposity reflected primarily the relative balance between sedentary and non-sedentary time, whereas the contrast between MVPA and light-intensity activity was not clearly associated with ASAT or VAT. This does not indicate that activity intensity is unimportant, but rather that, within the movement composition observed in this cohort, the balance between sedentary and non-sedentary waking time showed a clearer association with abdominal adiposity than the relative distribution of active time between light-intensity activity and MVPA.

Because VAT and ASAT were analysed after normalisation to height squared rather than adjustment for BMI or total adiposity, these findings should be interpreted as associations with height-normalised abdominal fat depot size rather than as evidence of BMI-independent fat distribution. The supplementary sex- and BMI-referenced z-score analyses addressed a related but distinct aspect of adiposity and yielded less consistent associations. These findings therefore do not support interpreting the observed associations as independent of overall adiposity.

In contrast, liver PDFF was not clearly associated with the compositional movement measures. Intervention studies in populations with MASLD have shown that structured exercise can reduce liver fat[20, 21]. However, such interventions are not directly comparable with the present cross-sectional analysis of habitual free-living movement behaviour. Liver fat is influenced by several metabolic and clinical factors, and associations with habitual movement behaviour may therefore differ from changes observed in response to prescribed exercise. The absence of a clear association in the present study should not be interpreted as evidence that physical activity has no effect on hepatic fat. The less

consistent findings in the BMI-referenced and additionally adjusted sensitivity analyses further indicate that the results were sensitive to outcome definition and model specification.

A major strength of this study is the use of objective measurements of both movement behaviour and MRI-derived compartment-specific adiposity in adults with type 2 diabetes recruited from primary care. The compositional approach also accounts for the interdependence of waking-time behaviours, while recruitment through primary care may improve the relevance of the findings to adults with type 2 diabetes encountered in routine clinical practice. Limitations include the cross-sectional design, which precludes conclusions about the direction or causality of the observed associations. Although greater non-sedentary time could be associated with lower abdominal adiposity, the reverse direction is also possible, whereby individuals with greater abdominal adiposity may spend more time sedentary and less time physically active. Other limitations include varying complete-case sample sizes across analyses, potential residual confounding, and possible misclassification of activity type and intensity by accelerometry. In addition, compositional analyses are inherently relative and are not directly equivalent to absolute exposure-based models.

A further potential limitation is measurement reactivity. Participants were aware that their movement behaviour was being monitored, and wearing an accelerometer may itself temporarily alter physical activity and sedentary behaviour. Previous studies have reported small changes in activity behaviour across repeated days of accelerometer monitoring. Because day-specific changes were not examined in the present study, it is not possible to determine whether such reactivity occurred in this cohort. If present, it could have affected the measured waking-time composition and thereby reduced the extent to which the monitoring period represented participants' habitual behaviour.

Conclusion

In adults with type 2 diabetes in primary care, a waking-time composition characterised by relatively more non-sedentary time and less sedentary time was associated with lower ASAT and VAT, whereas no clear association was observed with liver PDFF. Overall, these findings support an association between movement composition and abdominal adiposity, but a clear association with liver PDFF was not observed.

Declarations

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During the course of preparing this work, the author(s) used ChatGPT (open AI) for the purpose of language editing, reformulation and revision of the text. Following the use of this tool/service, the author(s) formally reviewed the content for its accuracy and edited it as necessary. The author(s) take full responsibility for all the content of this publication.

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Conflict of interest

FI has received speaker fees and served on advisory boards for Novo Nordisk, Sanofi, Eli Lilly and Boehringer Ingelheim. JA has served on advisory boards or lectured for AstraZeneca, GlaxoSmithKline, and Chiesi Pharma. MF is an employee and shareholder of AMRA Medical AB. ODL is an employee, board member and shareholder of AMRA Medical AB. PL is a minority owner of AMRA Medical AB. CJC is a consultant for and shareholder of AMRA Medical AB. All other authors declare no competing interests.

Data availability statement

The data are available upon reasonable request from the corresponding author.

Ethics approval and consent to participate

The study was conducted in accordance with the Declaration of Helsinki and was approved by the Swedish Ethical Review Authority (approval numbers 2018/176–31 and 2018/494–32). All participants provided written informed consent to participate.

Consent for publication

Not applicable.

Author Contribution

K.A. wrote main manuscript, formal analysis, editing. prepared all figures and tables.P.A. formal analysis, editing and reviewO.D.L. editing and reviewP.L. editing and reviewN.D. editing and reviewC-J.C. editing and reviewS.K. editing and reviewA.M. editing and reviewO.S. editing and reviewP.N. editing and reviewM.F. editing and reviewM.E. editing and reviewF.I. editing and review

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Figures

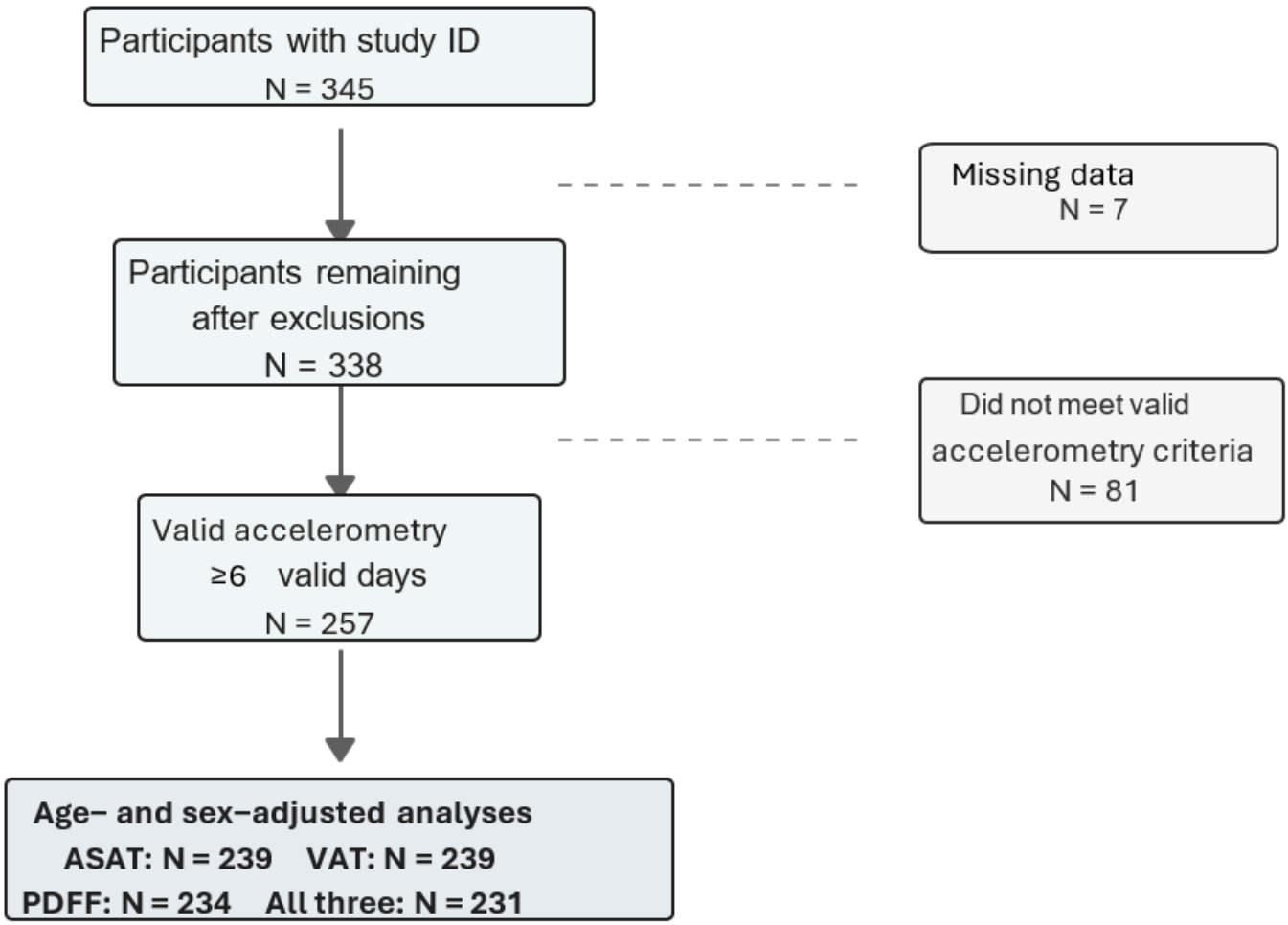


Figure 1

Participant flow from recruitment to analysis

Flowchart of participant selection and model-specific analytic sample sizes. Of 345 invited participants, 338 remained after exclusions and 257 had valid accelerometry. Model-specific sample sizes for the age- and sex-adjusted analyses were 239 for ASAT, 239 for VAT, and 234 for liver PDFF; 231 participants had complete data for all three MRI-derived outcomes.

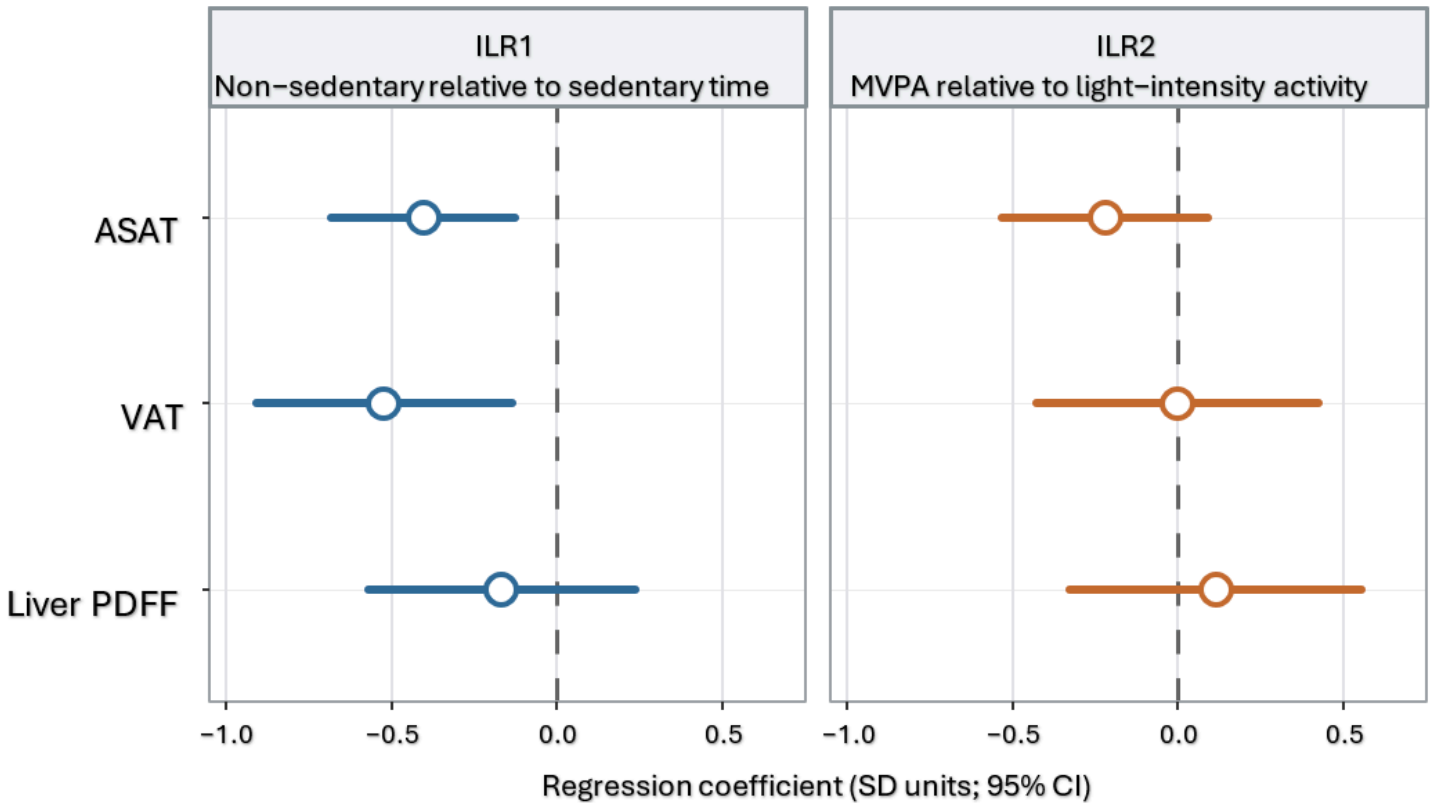


Figure 2

Associations between waking-time movement composition and MRI-derived adiposity

Forest plot of age- and sex-adjusted associations between compositional movement measures and standardised log-transformed MRI-derived fat outcomes. Points represent β coefficients and horizontal lines indicate 95% confidence intervals. The dashed vertical line indicates the null value (β = 0). ILR1 contrasts non-sedentary time (geometric mean of light-intensity activity and MVPA) with sedentary time, and ILR2 contrasts MVPA with light-intensity activity.

Supplementary Files

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