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**Use of accelerometers to compare physical activity levels in participants with asthma grouped by body mass index and asthma severity**

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**Abstract**

**Background:** Patients with asthma may find it impacts their ability to be physically active. Physical activity (PA) has been demonstrated to be lower in asthmatics compared to healthy controls. Obesity is commonly linked with difficult-to-control asthma and can worsen outcomes. At least 150 minutes of moderate physical activity (PA) per week is recommended for all adults by the World Health Organisation. We aimed to compare PA levels in patients with difficult-to-control asthma and body mass index (BMI)  $\geq 25$  kg/m<sup>2</sup> (DOW group) and two control groups with mild-moderate asthma, one with BMI  $< 25$  kg/m<sup>2</sup> (MHW group) and one with BMI  $\geq 25$  kg/m<sup>2</sup> (MOW group).

**Methods:** This cross-sectional study used 7-day recordings from wrist-worn accelerometers to compare PA between groups. We recorded inactive time, light (LPA) and moderate-vigorous physical activity (MVPA). We also measured novel metrics: intensity gradient (IG) reflecting PA intensity, and average acceleration (AA) reflecting PA volume. Parameters were compared across groups using ANOVA testing for normally distributed data and Kruskal-Wallis for skewed data. Correlation analysis explored associations between PA parameters and asthma measures. As AA was most closely correlated with asthma measures, we compared the highest and lowest AA quartiles using unpaired t and Mann-Whitney U tests, depending on normality.

**Results:** 75 participants were recruited, 25 per group. Inactive time was significantly higher ( $p < 0.001$ ), and LPA ( $p = 0.007$ ), MVPA ( $p < 0.001$ ), IG ( $p = 0.0001$ ) and AA ( $p < 0.0001$ ) all significantly lower in DOW group compared to MHW and MOW groups, even after adjusting for age and BMI. For AA, notable correlations included beclometasone dipropionate-equivalent dose of inhaled corticosteroid ( $r = -0.591$ ,  $p < 0.0001$ ), asthma-related quality of life score ( $r = 0.531$ ,  $p < 0.0001$ ) and six-minute walk distance ( $r = 0.719$ ,  $p < 0.0001$ ). Highest and lowest AA quartiles had significant differences in 14 of 21 asthma outcomes including the above, and pre-bronchodilator forced expiratory volume in 1 second, 6-point asthma control questionnaire and BMI.

**Conclusions:** Participants with difficult-to-control asthma who were overweight/obese performed less physical activity, and activity of reduced intensity and volume compared to participants with milder asthma with normal or elevated BMI. Suboptimal physical activity profile is a treatable trait which could be targeted to improve asthma-related outcomes in appropriate patients.

	MHW (mild-	MOW (mild-	DOW (Difficult-to-	P value
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	moderate healthy weight)	moderate overweight)	control overweight asthma)	(MHW vs MOW vs DOW)
Inactive time	1079 (1037- 1122)	1128 (1094 to 1161)	1202 (1170 -1234)	<b>&lt;0.001</b>
LPA	259 (228- 289)	237 (212 to 263)	196 (171 - 222)	<b>0.0065</b>
MVPA	103 (80 - 127)	79 (58 to 99)	42 (33 - 52)	<b>&lt;0.001</b>
Intensity gradient	-2.63 (-2.97 - -2.33)	-2.62 (-2.74 - -2.55)	-2.85 (-2.96 - -2.73)	<b>0.0001</b>
Average acceleration	27.8 (21.7 - 31.0)	24.4 (20.4 - 27.5)	17.1 (13.7 - 20.5)	<b>&lt;0.0001</b>

Abbreviations used in table: MVPA moderate to vigorous physical activity, LPA low physical activity.

Units: inactive time, LPA and MVPA- minutes per day, average acceleration- mg.

Data expressed as mean with 95% confidence intervals for inactive time, LPA and MVPA; and median and interquartile range for intensity gradient and average acceleration.