Supplementary material

Title

Tossing and turning: association of sleep quantity-quality with physical activity in COPD

Authors

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Details on Methods

The SenseWear Armband measures energy expenditure, number of steps, posture, sleep and physical activity through its internal sensors (i.e., accelerometer, heat flux, galvanic skin response, skin temperature and near-body ambient temperature). All data, including sleeping and position were automatically calculated from the SenseWear Software (version 8.1) and extracted to a spreadsheet. Posteriorly, data regarding physical activity, sedentary behavior and sleep were analysed manually on a minute-by-minute basis. Firstly, data during the night were considered using the information of position (lying) and activity classification (sleep).

Pulmonary function (SpiroBank G; MIR, Rome, Italy) was assessed by a well-trained technician according to international recommendations[1] and predicted values were calculated based on the Brazilian population.[2]

Functional exercise capacity was evaluated by the best of two 6-minute walking tests (6MWT), considering the reference values for the Brazilian population.[3,4]

Body composition was assessed by bioelectrical impedance (Biodynamics 310 TM; Biodynamics Corp., Shoreline, WA, USA) according to

the protocol of Lukaski *et al.*[5] Body weight and height were measured in a calibrated scale (Filizola model 31; Filizola, Sao Paulo, Brazil).

Supplementary Results

Patients classified as GOLD 3+4 (36%) spent more time lying in bed for sleep (TIB = 514 [IQR 496-571] min) than patients classified as GOLD 1+2 (TIB = 454 [IQR 417-513] min; *P*=0.013). However, they presented worse sleep quality, as demonstrated by a higher WASO (167 [IQR 117-209] *versus* 117 [IQR 84-186] min; *P*=0.017) and, consequently, a lower sleep efficiency (65 [IQR 55-73] *versus* 72 [IQR 67-77] %; *P*=0.034).

Table S1 shows that sleep fragmentation was frequent, with a median value of 6.9 bouts of sleep per night (5.9 in the non-fragmented group and 8.2 in the fragmented group). Although the fragmented sleep group presented higher TIB duration, they also presented greater WASO and lower sleep efficiency, characterizing worse sleep quality. Moreover, the proportion of awake time spent in LIPA was lower in the fragmented sleep group compared to the non-fragmented sleep group (*P*=0.04).

Table S1. Sleep and physical activity in daily life characteristics of the patients with fragmented *versus* non-fragmented sleep (based on the median number of sleeping bouts per night = 6.9).

Variables	**Lower sleep fragmentation** **n = 27**	**Higher sleep fragmentation** **n = 28**	***P***
Male gender, n (%)	10 (37)	18 (64)	.060
Age, years	66 [60 - 74]	67 [62 - 75]	.661
FEV_1, %pred	55 [42 - 62]	54 [34 - 66]	.674
mMRC	3 [1 - 3]	3 [1 - 3]	.685
HADS anxiety, score	5 [2.8 - 6.2]	5 [1 - 7]	.816
HADS depression, score	3 [2 - 5.2]	4 [1 - 6]	.865
BMI, kg/m^2	22 [20 - 29]	27 [23 - 30]	.219
FFMI, kg/m^2	18.7 [17.3 - 21.0]	20.7 [19.1 - 21.7]	.050
FMI, kg/m^2	4.8 [3.2 – 9.6]	6.6 [3.5 – 8.3]	.789
6MWD, m	490 [425 - 590]	479 [423 - 520]	.474
Sleep characteristics			
TIB, min	454 [399 - 510]	514 [447 - 587]	**.005**
TST, min	322 [251 - 382]	350 [279 - 383]	.533
Sleep efficiency, %	74 [70 - 82]	65 [61 - 70]	**.005**
Sleeping bouts, n	5.8 [4.5 – 6.4]	8.2 [7.3 – 10.2]	**<.0001**
Sleeping bouts duration, min	65 [49 - 103]	41 [31 - 51]	**<.0001**
WASO, min	96 [64 - 127]	166 [125 - 202]	**<.0001**
PADL characteristics			
Awake time, min/day	938 [874 - 1007]	853 [804 - 914]	**.005**
Time spent in SB, %Tawake	51.8 [40.2 - 69.1]	65.0 [54.8 - 78.1]	.114
Time spent in LIPA, %Tawake	40.4 [26.7 - 46.4]	28.9 [18.6 - 35.9]	**.040**
Time spent in MVPA, %Tawake	7.7 [1.6 - 13.2]	3.2 [1.1 - 7.0]	.259
Steps/day, n	8813 [3554 - 10951]	5914 [3452 - 9348]	.439
Total energy expenditure/day, kcal	1561 [1281 - 1730]	1508 [1238 - 1692]	.400
Average MET/day	1.7 [1.4 - 1.9]	1.5 [1.3 - 1.8]	.089

Values are presented as median [interquartile range].

Abbreviations – FEV_1: forced expiratory volume in the first second, mMRC: modified Medical Research Council, HADS: Hospital Anxiety and Depression Scale, BMI: body mass index, FFMI: fat-free mass index, FMI: fat mass index, 6MWT: 6-minute walking test, TIB: total time in bed, TST: total sleep time, WASO: wake after sleep onset, PADL: physical activity in daily life; SB: sedentary behaviour, LIPA: light intensity physical activity, MVPA: moderate-to-vigorous physical activity.

References

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