

· 论 著 ·

老年人夜间睡眠时长、体力活动与失能的关联研究

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摘要: **目的** 探讨老年人夜间睡眠时长、体力活动与失能的关联, 为降低老年人失能风险、促进健康老龄化提供参考。**方法** 通过中国健康与养老追踪调查 (CHARLS) 项目 2020 年调查资料收集 ≥60 岁老年人的人口学信息、生活行为、慢性病和夜间睡眠时长等资料, 采用国际体力活动问卷短卷评估体力活动水平, 采用基础性日常生活活动能力量表评估失能情况; 采用多因素 logistic 回归模型分析老年人夜间睡眠时长、体力活动与失能的关联。**结果** 收集 11 126 名老年人资料, 其中男性 5 423 人, 占 48.74%; 女性 5 703 人, 占 51.26%; 年龄为 (69.92±7.08) 岁。夜间睡眠时长 <7 h 6 838 人, 占 61.46%; 体力活动水平 <600 MET-min/周 2 247 人, 占 20.20%。失能 3 213 人, 检出率为 28.88%。多因素 logistic 回归分析结果显示, 调整年龄、性别、婚姻状况、文化程度、居住地、吸烟、饮酒和慢性病共病等变量后, 与夜间睡眠时长 7~8 h 相比, <7 h ($OR=1.535$, 95% CI : 1.386~1.700) 和 >8 h ($OR=1.186$, 95% CI : 1.003~1.402) 老年人失能风险增加 53.5% 和 18.6%; 与体力活动水平 ≥600 MET-min/周相比, <600 MET-min/周 ($OR=2.106$, 95% CI : 1.901~2.335) 老年人失能风险增加 110.6%; 与夜间睡眠时长 7~8 h 且体力活动水平 ≥600 MET-min/周相比, 夜间睡眠时长 <7 h 且体力活动水平 <600 MET-min/周 ($OR=3.299$, 95% CI : 2.831~3.843)、夜间睡眠时长 >8 h 且体力活动水平 <600 MET-min/周 ($OR=2.566$, 95% CI : 1.954~3.369)、夜间睡眠时长 7~8 h 且体力活动水平 <600 MET-min/周 ($OR=1.911$, 95% CI : 1.564~2.334)、夜间睡眠时长 <7 h 且体力活动水平 ≥600 MET-min/周 ($OR=1.503$, 95% CI : 1.334~1.692) 老年人失能风险分别增加 229.9%、156.6%、91.1% 和 50.3%。**结论** 老年人夜间睡眠时长过短或过长及体力活动水平低可增加失能风险。

关键词: 夜间睡眠时长; 体力活动; 失能; 老年人

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Association between nighttime sleep duration, physical activity and disability among the elderly

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Abstract: Objective To investigate the association between nighttime sleep duration, physical activity and disability among the elderly, so as to provide the basis for reduce the risk of disability and promote healthy aging. **Methods** Based on the 2020 database of China Health and Retirement Longitudinal Study (CHARLS), demographic information, lifestyle behaviors, chronic diseases and nighttime sleep duration were collected from people aged 60 years and older. Physical activity level was evaluated using the International Physical Activity Questionnaire-Short. Disability status was

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measured using the basic Activities of Daily Living (ADL) scale. Association between nighttime sleep duration, physical activity and disability among the elderly were analyzed using multivariable logistic regression model. **Results** Totally 11 126 elderly participants were enrolled, with 5 423 males (48.74%) and 5 703 females (51.26%). The mean age was (69.92±7.08) years. Among them, 6 838 individuals (61.46%) had a nighttime sleep duration of <7 hours, and 2 247 individuals (20.20%) had a physical activity level of <600 MET-min/week. A total of 3 213 individuals were identified as having disability, with a detection rate of 28.88%. Multivariable logistic regression analysis showed that, after adjusting for age, gender, marital status, education level, residence, smoking, alcohol consumption, and multimorbidity of chronic diseases, compared with a nighttime sleep duration of 7–8 hours, those with <7 hours ($OR=1.535$, 95% CI : 1.386–1.700) and >8 hours ($OR=1.186$, 95% CI : 1.003–1.402) had an increased risk of disability by 53.5% and 18.6%, respectively. Compared with a physical activity level of ≥ 600 MET-min/week, those with <600 MET-min/week ($OR=2.106$, 95% CI : 1.901–2.335) had an increased risk of disability by 110.6%. Compared with those who had a nighttime sleep duration of 7–8 hours and a physical activity level of ≥ 600 MET-min/week, the elderly with a nighttime sleep duration of <7 hours and a physical activity level of <600 MET-min/week ($OR=3.299$, 95% CI : 2.831–3.843), a nighttime sleep duration of >8 hours and a physical activity level of <600 MET-min/week ($OR=2.566$, 95% CI : 1.954–3.369), a nighttime sleep duration of 7–8 hours and a physical activity level of <600 MET-min/week ($OR=1.911$, 95% CI : 1.564–2.334), and a nighttime sleep duration of <7 hours and a physical activity level of ≥ 600 MET-min/week ($OR=1.503$, 95% CI : 1.334–1.692) had an increased risk of disability by 229.9%, 156.6%, 91.1%, and 50.3%, respectively. **Conclusion** Short or long nighttime sleep duration and low physical activity levels can increase the risk of disability in the elderly.

Keywords: nighttime sleep duration; physical activity; disability; the elderly

失能是指在年龄、疾病等因素作用下个体的身体功能和主要生活活动能力受损的状态，老年人生理储备功能、认知功能和社会参与下降^[1]，失能检出率为 6.9%~82.8%^[2]。研究表明，失能不仅导致老年人生理功能减退和心理障碍^[3]，还增加家庭经济负担。随着失能老年人数增加，家庭成员在照护方面投入的时间、精力和经济成本不断攀升，预计 2035 年老年人照护成本将是 2020 年的 2 倍^[4]。老年人的生活方式与失能风险密切相关，其中睡眠和体力活动是关键的生活方式。调查显示，43% 的老年人存在失眠^[5]，35.7% 的老年人体力活动不足^[6]。研究表明，每日步行有利于降低老年人失能风险，而睡眠时长过短或过长均会增加老年人失能风险^[7-8]。本研究基于中国健康与养老追踪调查 (China Health and Retirement Longitudinal Study, CHARLS) 项目 2020 年数据库分析老年人夜间睡眠时长、体力活动与失能的关联，为降低老年人失能风险、促进健康老龄化提供参考。

1 资料与方法

1.1 资料来源

CHARLS 项目采用概率比例抽样方法，抽取全国 28 个省（自治区、直辖市） ≥ 45 岁中老年人作为研究对象，项目通过北京大学生物医学伦理委员会审查 (IRB00001052-11015)。本研究以 CHARLS 项

目 2020 年数据库中 ≥ 60 岁老年人为研究对象，排除夜间睡眠时长、体力活动等资料缺失者。

1.2 方法

1.2.1 一般资料收集

收集年龄、性别、婚姻状况、文化程度和居住地等人口学信息，吸烟、饮酒等生活行为，以及慢性病等资料。慢性病包括高血压、血脂异常、糖尿病、恶性肿瘤、慢性肺疾病、肝病、心脏病、脑卒中、肾病、消化系统疾病、记忆相关疾病、关节炎或风湿病、哮喘、情绪和心理障碍，本研究将同时患有 2 种及以上慢性病定义为慢性病共病^[9]。

1.2.2 夜间睡眠时长调查

根据 CHARLS 项目调查问卷中“过去 1 个月内，每天晚上真正睡着的时间大约是几小时？”调查夜间睡眠时长。参考文献 [10]，夜间睡眠时长分为 <7 h、7~8 h 和 >8 h。

1.2.3 体力活动评估

CHARLS 项目 2020 年数据库中将体力活动分为高强度体力活动（如搬运重物、有氧运动、快速骑车和耕作等）、中等强度体力活动（如搬运轻物、拖地、常速骑车和疾走等）和轻度体力活动（如散步、行走等），参考文献 [11]，体力活动时间分为 0 min、10~<30 min、30~<120 min、120~<240 min 和 ≥ 240 min，以平均值计算每日 3 种体力活动时间。根据 CHARLS 项目调查问卷中“通常每周有多少天做

某项活动至少 10 min?”评估每周各体力活动频率。采用代谢当量 (metabolic equivalent, MET) 评估体力活动水平^[12], 根据国际体力活动问卷短卷^[13]评价指标, 将轻度、中等和高强度体力活动的 MET 分别赋值 3.3、4.0 和 8.0, 每周各体力活动水平 (MET-min/周) 等于该体力活动对应的 MET 赋值×每周频率 (d/周) × 每日时间 (min/d), 每周总体力活动水平为 3 种体力活动水平之和。参考文献^[14], 总体力活动水平分为<600 MET-min/周和≥600 MET-min/周。

1.2.4 失能评估

采用基础性日常生活活动能力量表^[15]评估失能情况。该量表包括穿衣、上下床、进食、如厕、室内移动和洗澡 6 项, 选项分为“没有困难”“有困难但仍可以完成”“有困难需要帮助”“无法完成”; ≥1 项选择“有困难但仍可以完成”“有困难需要帮助”“无法完成”, 判定为失能^[16]。

1.3 统计分析

采用 SPSS 20.0 软件统计分析。定量资料服从正态分布的采用均数±标准差 ($\bar{x}\pm s$) 描述; 定性资料采用相对数描述, 组间比较采用 χ^2 检验。采用多因素 logistic 回归模型分析老年人夜间睡眠时长、体力活动与失能的关联。检验水准 $\alpha=0.05$ 。

2 结 果

2.1 老年人基本情况

收集 11 126 名老年人资料, 其中男性 5 423 人, 占 48.74%; 女性 5 703 人, 占 51.26%。年龄为 (69.92±7.08) 岁。有配偶 8 678 人, 占 78.00%。小学以下文化程度 5 748 人, 占 51.66%。居住在农村 6 640 人, 占 59.68%。吸烟 2 779 人, 占 24.98%。饮酒 3 656 人, 占 32.86%。有慢性病共病 7 343 例, 占 66.00%。

2.2 老年人夜间睡眠时长、体力活动和失能分析

夜间睡眠时长<7 h 6 838 人, 占 61.46%; 夜间睡眠时长 7~8 h 3 271 人, 占 29.40%; 夜间睡眠时长>8 h 1 017 人, 占 9.14%。体力活动水平<600 MET-min/周 2 247 人, 占 20.20%; 体力活动水平≥600 MET-min/周 8 879 人, 占 79.80%。失能 3 213 人, 检出率为 28.88%。年龄、性别、婚姻状况、文化程度、居住地、吸烟、饮酒、慢性病共病、夜间睡眠时长和体力活动水平不同的老年人失能检出率比较, 差异有统计学意义 (均 $P<0.05$)。见表 1。

2.3 夜间睡眠时长、体力活动与失能的关联

以失能为因变量 (0=否, 1=是), 分别以夜间

表 1 老年人失能检出率比较

Table 1 Comparison of detection rate of disability among the elderly

项目	调查人数	失能检出人数	检出率/%	χ^2 值	P值
年龄/岁				259.235	<0.001
60~<70	6 143	1 449	23.59		
70~<80	3 773	1 219	32.31		
≥80	1 210	545	45.04		
性别				145.351	<0.001
男	5 423	1 278	23.57		
女	5 703	1 935	33.93		
婚姻状况				86.387	<0.001
有配偶	8 678	2 322	26.76		
无配偶	2 448	891	36.40		
文化程度				260.033	<0.001
小学以下	5 748	2 014	35.04		
小学	2 280	610	26.75		
初中	1 822	364	19.98		
高中及以上	1 276	225	17.63		
居住地				102.564	<0.001
城市	4 486	1 058	23.58		
农村	6 640	2 155	32.45		
吸烟				89.282	<0.001
是	2 779	607	21.84		
否	8 347	2 606	31.22		
饮酒				89.814	<0.001
是	3 656	843	23.06		
否	7 470	2 370	31.73		
慢性病共病				455.814	<0.001
有	7 343	2 604	35.46		
无	3 783	609	16.10		
夜间睡眠时长/h				118.479	<0.001
<7	6 838	2 203	32.22		
7~8	3 271	711	21.74		
>8	1 017	299	29.40		
体力活动水平/ (MET-min/周)				386.119	<0.001
<600	2 247	1 026	45.66		
≥600	8 879	2 187	24.63		

睡眠时长、体力活动水平、夜间睡眠时长和体力活动水平不同组合为自变量, 分别建立 3 个多因素 logistic 回归模型, 其中模型 1 未调整变量; 模型 2 调整年龄、性别、婚姻状况、文化程度和居住地; 模型 3 在模型 2 的基础上进一步调整吸烟、饮酒和慢性病共病。结果显示, 与夜间睡眠时长 7~8 h 相比, 夜间睡眠时长<7 h、>8 h 增加老年人失能风险 (均 $P<0.05$); 与体力活动

水平 ≥ 600 MET-min/周相比, 体力活动水平 < 600 MET-min/周增加老年人失能风险 ($P<0.05$); 与夜间睡眠时长 7~8 h 且体力活动水平 ≥ 600 MET-min/周相比, 夜间睡眠时长 7~8 h 且体力活动水平 < 600 MET-min/周、夜间睡眠时长 < 7 h 且

体力活动水平 ≥ 600 MET-min/周、夜间睡眠时长 < 7 h 且体力活动水平 < 600 MET-min/周、夜间睡眠时长 > 8 h 且体力活动水平 < 600 MET-min/周增加老年人失能风险 (均 $P<0.05$)。见表 2。

表 2 老年人夜间睡眠时长、体力活动与失能关联的多因素 logistic 回归分析

Table 2 Multivariable logistic regression analysis of the association between nighttime sleep duration, physical activity and disability among the elderly						
变量	模型1		模型2		模型3	
	OR值 (95%CI)	P值	OR值 (95%CI)	P值	OR值 (95%CI)	P值
夜间睡眠时长/h						
7~8	1.000		1.000		1.000	
<7	1.711 (1.553~1.886)	<0.001	1.660 (1.502~1.834)	<0.001	1.535 (1.386~1.700)	<0.001
>8	1.499 (1.280~1.757)	<0.001	1.208 (1.025~1.423)	0.024	1.186 (1.003~1.402)	0.046
体力活动水平/ (MET-min/周)						
≥ 600	1.000		1.000		1.000	
<600	2.571 (2.336~2.830)	<0.001	2.179 (1.971~2.408)	<0.001	2.106 (1.901~2.335)	<0.001
夜间睡眠时长和体力活动水平组合						
夜间睡眠时长 7~8 h 且体力活动水平 ≥ 600 MET-min/周	1.000		1.000		1.000	
夜间睡眠时长 7~8 h 且体力活动水平 < 600 MET-min/周	2.345 (1.938~2.837)	<0.001	1.990 (1.636~2.419)	<0.001	1.911 (1.564~2.334)	<0.001
夜间睡眠时长 < 7 h 且体力活动水平 ≥ 600 MET-min/周	1.678 (1.497~1.882)	<0.001	1.626 (1.447~1.827)	<0.001	1.503 (1.334~1.692)	<0.001
夜间睡眠时长 < 7 h 且体力活动水平 < 600 MET-min/周	4.521 (3.910~5.228)	<0.001	3.713 (3.197~4.312)	<0.001	3.299 (2.831~3.843)	<0.001
夜间睡眠时长 > 8 h 且体力活动水平 ≥ 600 MET-min/周	1.340 (1.101~1.630)	0.003	1.115 (0.912~1.362)	0.288	1.086 (0.885~1.333)	0.427
夜间睡眠时长 > 8 h 且体力活动水平 < 600 MET-min/周	3.676 (2.842~4.754)	<0.001	2.661 (2.038~3.473)	<0.001	2.566 (1.954~3.369)	<0.001

3 讨 论

本研究基于 CHARLS 项目 2020 年数据库, 共纳入 11 126 名 ≥ 60 岁老年人, 检出失能 3 213 人, 检出率为 28.88%, 与洪燕芳等^[17] 调查结果相近。本研究结果显示, 夜间睡眠时长 < 7 h、 > 8 h、体力活动水平 < 600 MET-min/周、夜间睡眠时长 < 7 h 且体力活动水平 < 600 MET-min/周、夜间睡眠时长 < 7 h 且体力活动水平 ≥ 600 MET-min/周与老年人失能存在统计学关联, 提示老年人夜间睡眠时长过短或过长及低体力活动水平可增加失能风险, 睡眠时长过短和低体力活动水平共同增加失能风险。建议社区医务人员将保持合理的夜间睡眠时长和积极参与运动锻炼纳入老年人健康教育, 帮助老年人改善不良生活方式, 提高其健康水平和生活质量。

夜间睡眠时长 < 7 h 老年人失能风险增加 53.5%, 与其他研究结果^[8] 类似。睡眠时长减少影响老年人免疫功能和能量代谢, 导致身体功能衰退, 增加跌倒和失能风险; 也可引起神经内分泌系统紊乱, 增加认知功能下降风险, 进一步导致失能^[18]。建议老年人应保持充足的夜间睡眠时长, 以保证良好的功能储备。本研究还发现, 夜间睡眠时长 > 8 h 增加老年人失能风险, 与 VINCENT 等^[8] 研究结果一致, 但与基于 CHARLS 项目 2015 年数据库分析结果相反^[19], 这可能与夜间睡眠时长的分组不一致和后者研究对象为 ≥ 45 岁人群有关。体力活动水平 < 600 MET-min/周与老年人失能风险之间存在正向关联, 与马仁涛等^[16] 研究结果一致。体力活动水平越高, 肌纤维缩短速度越快, 肌肉功能改善更加明显^[20], 提示老年人应积极参与运动锻炼, 提高体力活动水平, 以降低

失能风险。

夜间睡眠时长<7 h 且体力活动水平<600 MET-min/周老年人失能风险增加最多,为229.9%。相关基础研究表明,睡眠不足可激活核因子 κ B信号通路,上调促炎因子表达、C反应蛋白浓度^[21],而低体力活动减少抗炎细胞因子分泌^[22],两者协同加剧慢性低度炎症,加速肌肉萎缩,共同增加失能风险。提示该类型老年人应作为社区健康管理的优先群体,也提示单一生活方式的干预效果有限,需制定“睡眠-运动”协同管理策略,提高老年人日常生活活动能力。夜间睡眠时长<7 h 且体力活动水平 \geq 600 MET-min/周($OR=3.299$)老年人与失能的关联强度较夜间睡眠时长<7 h 且体力活动水平<600 MET-min/周($OR=1.503$)老年人弱。这可能是因为睡眠节律紊乱通过抑制雷帕霉素靶蛋白复合物1(mTORC1)磷酸化,减少核糖体蛋白S6激酶1和真核翻译起始因子4E结合蛋白1的激活,从而降低肌肉蛋白的翻译效率^[23],而体力活动通过激活mTOR通路部分抵消此效应^[24],表明老年人需维持适度体力活动以延缓功能衰退。

本研究数据来源于CHARLS项目,样本量充足、代表性好,结果外推性好。但本研究存在局限性:采用横断面研究设计,无法从因果时序的角度论证三者之间的关系;核心变量的数据由研究对象自我报告,存在一定主观偏倚。未来需开展前瞻性队列研究,结合可穿戴设备监测体力活动动态指标,系统评估不同体力活动类型、强度及持续时间与夜间睡眠时长对老年人失能的影响,为制定针对性的健康管理策略提供依据。

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