

35 ~ 75 岁常住居民体重调整腰围指数与“三高”共病的相关性研究

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摘要:目的 探究体重调整腰围指数 (Weight-adjusted Waist Index, WWI) 与“三高”共病之间的关联, 为“三高”共病的防治提供科学依据。方法 基于 2015—2024 年南通海安市国家心血管病高危人群早期筛查与综合干预项目, 通过问卷调查、体格测量、实验室检测等方法收集数据, 采用 F 检验、 χ^2 检验和多因素 logistic 回归分析模型进行数据分析。结果 男性、目前吸烟、饮酒、非在婚, 以及高龄、腰围、体重、体质指数、收缩压、舒张压、血糖、总胆固醇、甘油三酯、低密度脂蛋白胆固醇, 和低高密度脂蛋白胆固醇人群的“三高”共病患病率更高。多因素 logistic 回归分析结果显示, WWI 与“三高”共病存在正相关关系 ($OR = 1.31$, 95% $CI: 1.27 \sim 1.36$)。相比年龄 ≥ 60 岁人群, 在年龄 < 60 岁的人群中 WWI 与“三高”共病之间的正相关关系更强 ($OR = 1.26$ 比 $OR = 1.46$, 交互作用检验 $P < 0.001$)。结论 WWI 与“三高”共病呈正相关, 且在 < 60 岁人群中相关性更强。

关键词: 体重调整腰围指数; 三高; 共病; 年龄

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Association of weight-adjusted waist index and comorbidities of hypertension, diabetes, and dyslipidemia among 35 to 75 years old residents

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Abstract: Objective To explore the association of the weight-adjusted waist index (WWI) and the comorbidities of hypertension, diabetes, and dyslipidemia, and to provide evidence for prevention and control of comorbidities of hypertension, diabetes, and dyslipidemia. **Methods** Data were obtained through questionnaires, physical examinations, and laboratory tests based on the programme of screening and intervention subjects with high risk cardiovascular diseases in Hai'an, Nantong city from 2015 to 2024. Statistical analyses included F -tests, chi-square tests, and multivariate logistic regression models. **Results** Male, current smoking, drinking, unmarried and individuals with high age, waist circumference, body weight, body mass index, systolic blood pressure, diastolic blood pressure, blood glucose, total cholesterol, triglyceride, low-density lipoprotein cholesterol, and individuals with low high-density lipoprotein cholesterol had a higher incidence of comorbidities of hypertension, diabetes, and dyslipidemia. Multivariate logistic regression analysis showed a positive association between WWI and the comorbidities of hypertension, diabetes, and dyslipidemia ($OR = 1.31$, 95% $CI: 1.27 - 1.36$). Compared to individuals aged ≥ 60 years, the positive association between WWI and the comorbidities of hypertension, diabetes, and dyslipidemia was stronger in individuals aged < 60 years ($OR = 1.26$ vs. $OR = 1.46$, interaction test $P < 0.001$). **Conclusion** WWI is positively associated with the comorbidities of hypertension, diabetes, and dyslipidemia, and the positive association is stronger in individuals aged < 60 years old.

Keywords: Weight-adjusted waist index; Hypertension; Diabetes; Dyslipidemia; Comorbidity; Age

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共病 (multimorbidity) 是指同一个体同时存在两种或两种以上的慢性病^[1]。共病不仅会增高患者残疾和死亡的风险,而且会增加医疗保健支出^[1-2]。目前我国中老年人慢性病共患病形式严峻,总体呈上升趋势^[3-4]。截止到 2022 年,45 岁以上中老年人慢性病共病率达到 58.21%^[3]。高血压、糖尿病和血脂异常(以下简称为“三高”)是我国中老年人人群中常见的慢性病共病,在危险因素和发病机制等多方面存在共同点,并且与其他疾病都存在广泛关联^[5-6]。肥胖是“三高”的主要危险因素之一^[7]。体重调整腰围指数 (Weight-adjusted Waist Index, WWI) 结合了腰围和体质量,作为一种新兴的评价复合型肥胖的指标,能较全面地反映个体脂肪分布和体型差异^[8-9]。本研究旨在讨论 WWI 与“三高”共病的相关性,为“三高”共病的综合防控提供科学依据。

1 对象与方法

1.1 对象 2015—2024 年,在江苏省南通市海安市每年开展心血管病高危人群早期筛查与综合干预项目,共 10 期。研究对象纳入标准为:年龄 35~75 岁;过去一年常住 6 个月以上的居民;自愿签署知情同意书。以区或乡镇为单位,采用方便抽样方法,依据当地地理特点、人口结构及项目承担单位条件等因素,选取 5 个区或乡镇为整群,后根据纳入标准在每个区或镇招募符合条件的人群进行调查。每年度筛查均在选取的 5 个区或乡镇按相同的纳入标准重新招募人群,既往年度参加筛查的人群不再参加之后新年度的筛查。共 22 873 人参加项目调查,排除 1 154 人(1 人未测量腰围、63 人未检测总胆固醇、225 人未检测高密度脂蛋白胆固醇、210 人未检测甘油三酯、655 人未检测低密度脂蛋白胆固醇),最终共 21 719 人纳入分析。本研究通过国家心血管病中心伦理委员会审查(伦理编号:2014-574),所有调查对象均自愿签署了本研究的知情同意书。

1.2 方法 (1)问卷调查:调查员均经过统一培训,采用面对面形式进行现场调查。每年调查内容主要包括年龄、婚姻状况、受教育程度、吸烟、饮酒等信息。(2)体格测量:调查员均经过统一培训,身高、体重测量要求脱掉鞋帽,仅穿单薄衣服,身高测量结果精确到 0.1 cm,体重测量结果精确到 0.1 kg;腰围以肚脐水平线为参照,测量点在肚脐上方 1 cm 处,测量结果精确到 0.1 cm;血压测量前调查对象静坐休息 5 min,测量右侧手臂,若前两次测量收缩压差值大于 10 mmHg,则需测量第三次,取后两次测量值的均值。高血压定义:平均收缩压大于等于 140 mmHg 和(或)平均舒张压大于等于 90 mmHg 者,或自报经临床确

诊的高血压病史,或过去两周有服用降压药物史^[10]。(3)实验室检测:使用 BeneCheck PD-G001-2 快速血糖分析仪测量空腹血糖,糖尿病定义:至少 8 h 未进食状态下,空腹血糖大于等于 7 mmol/L 或在进食 8 h 内随机检测的血糖大于等于 11 mmol/L 或已被医院诊断糖尿病,或近 2 周服用降血糖药物者^[10];使用 Cardiocheck PA 型快速血脂检测仪测量空腹总胆固醇、甘油三酯、高密度脂蛋白胆固醇、低密度脂蛋白胆固醇。血脂异常定义:总胆固醇大于等于 6.2 mmol/L,或甘油三酯大于等于 2.3 mmol/L,或高密度脂蛋白小于 1.0 mmol/L,或低密度脂蛋白大于等于 4.1 mmol/L,或自报过去两周内使用降脂药^[10]。

1.3 定义 WWI = 腰围 (cm) / 体重 (kg)^{1/2}^[8], WWI 四分位数分组: Q1 (< 24.79), Q2 (24.80 ~ 30.69), Q3 (30.70 ~ 37.29), Q4 (≥ 37.30)。“三高”共病是指至少患高血压、糖尿病和血脂异常中的两种及以上疾病^[11]。目前吸烟定义为在调查时或近期仍然保持吸烟行为的人^[10]。饮酒定义为近 12 个月内每个月至少有 1 次的饮酒行为的人^[10]。

1.4 统计学方法 数据均采用 R 4.2.3 软件进行分析。定量资料采用 $\bar{x} \pm s$ 表示,组间比较用 F 检验。定性资料采用 $n(\%)$ 表示,组间比较用 χ^2 检验。变量赋值见表 1。采用多因素 logistic 回归模型分析 WWI 与“三高”共病之间的关联,并建立 logistic 回归模型分析分层变量与 WWI 的相乘交互作用。检验水准 $\alpha = 0.05$ 。

表 1 多因素 logistic 回归分析变量赋值

Table 1 Multivariate logistic regression analysis variable assignment

变量	赋值
性别	1 = 男性, 2 = 女性
目前吸烟	0 = 否, 1 = 是
饮酒	0 = 否, 1 = 是
学历	0 = 初中及以下, 1 = 高中及以上
婚姻状态	0 = 非在婚, 1 = 在婚
“三高”共病	0 = 否, 1 = 是
“两种”共病	0 = 否, 1 = 是
“三种”共病	0 = 否, 1 = 是
体重调整腰围指数	连续型变量
年龄 (岁)	连续型变量
体质指数 (kg/m ²)	连续型变量

2 结果

2.1 一般特征描述 本研究共 21 719 人纳入最终分析,“三高”共病 6 252 人 (28.8%), 其中同时患两种疾病 4 987 人 (23.0%), 患三种疾病 1 265 人 (5.8%)。男性、吸烟、饮酒、非在婚,以及高年龄、腰

围、体重、体质指数、收缩压、舒张压、血糖、总胆固醇、甘油三酯、低密度脂蛋白胆固醇, 和低高密度脂蛋白胆固醇人群的“三高”共病患病率更高 ($P < 0.001$)。见表 2。

表 2 一般特征描述 [$n(\%) / (\bar{x} \pm s)$]
Table 2 General feature description [$n(\%) / (\bar{x} \pm s)$]

特征	“三高”共病		χ^2/F 值	P 值
	否	是		
性别			37.65	<0.001
男性	5 371 (68.7)	2 447 (31.3)		
女性	10 096 (72.6)	3 805 (27.4)		
年龄(岁)	58.2 ± 10.1	61.6 ± 8.6	527.68	<0.001
腰围(cm)	82.4 ± 9.4	88.2 ± 9.3	1 715.29	<0.001
体重(kg)	63.4 ± 10.0	68.1 ± 11.2	905.36	<0.001
体质指数(kg/m ²)	25.1 ± 3.3	26.9 ± 3.3	1 240.45	<0.001
收缩压(mmHg)	136.0 ± 18.9	150.9 ± 17.2	2 927.26	<0.001
舒张压(mmHg)	80.1 ± 10.5	85.7 ± 10.4	1 288.97	<0.001
血糖(mmol/L)	5.7 ± 1.1	7.5 ± 2.4	5 610.19	<0.001
总胆固醇(mmol/L)	4.4 ± 0.9	4.7 ± 1.2	374.03	<0.001
甘油三酯(mmol/L)	1.2 ± 0.6	2.0 ± 1.1	4 212.14	<0.001
低密度脂蛋白胆固醇(mmol/L)	2.4 ± 0.7	2.5 ± 0.9	161.84	<0.001
高密度脂蛋白胆固醇(mmol/L)	1.5 ± 0.4	1.2 ± 0.4	1 700.91	<0.001
目前吸烟			10.99	<0.001
否	13 216 (71.6)	5 231 (28.4)		
是	2 251 (68.8)	1 021 (31.2)		
饮酒			30.30	<0.001
否	13 392 (71.9)	5 233 (28.1)		
是	2 075 (67.1)	1 019 (32.9)		
学历			0.11	0.737
初中及以下	13 514 (71.2)	5 473 (28.8)		
高中及以上	1 953 (71.5)	779 (28.5)		
婚姻状态			13.24	<0.001
非在婚	1 460 (67.8)	692 (32.2)		
在婚	14 007 (71.6)	5 560 (28.4)		

2.2 多因素 logistic 回归分析 在调整年龄、性别、目前吸烟、饮酒、体质指数、学历、婚姻状态等因素后, 多因素 logistic 回归分析结果显示, WWI 与“三高”共病存在正相关关系 ($OR = 1.31$, 95% CI : 1.27 ~ 1.36)。相比于 Q1 组, WWI 在 Q4 组与“三高”共病

的正相关性更高 ($OR = 2.15$, 95% CI : 1.95 ~ 2.37), 且这种正相关性在 WWI 四分位数分组中持续升高 (趋势性检验 $P < 0.001$), 见表 3。此外, 在两种疾病共患和三种疾病共患中也显示出相似的结果, 见表 4。

表 3 体重调整腰围指数与“三高”共病的多因素 logistic 回归分析

Table 3 Multivariate logistic regression analysis of weight-adjusted waist index and comorbidities of hypertension, diabetes, and dyslipidemia

变量	患病率 (%)	“三高”共病			
		OR 值 (95% CI) ^b	P 值	OR 值 (95% CI) ^c	P 值
体重调整腰围指数 ^a	6 252 (28.8)	1.45 (1.40, 1.50)	<0.001	1.31 (1.27, 1.36)	<0.001
体重调整腰围指数四分组					
Q1 (<24.79)	870 (16.0)	1.00		1.00	
Q2 (24.80 ~ 30.69)	1 441 (26.5)	1.77 (1.61, 1.95)	<0.001	1.54 (1.40, 1.70)	<0.001
Q3 (30.70 ~ 37.29)	1 809 (33.3)	2.32 (2.11, 2.55)	<0.001	1.85 (1.68, 2.04)	<0.001
Q4 (≥37.30)	2 132 (39.2)	2.89 (2.63, 3.18)	<0.001	2.15 (1.95, 2.37)	<0.001
趋势线检验 P 值			<0.001		<0.001

注: a 进行 Z 值函数转换; b 调整年龄、性别; c 调整年龄、性别、目前吸烟、饮酒、体质指数、学历、婚姻状态。

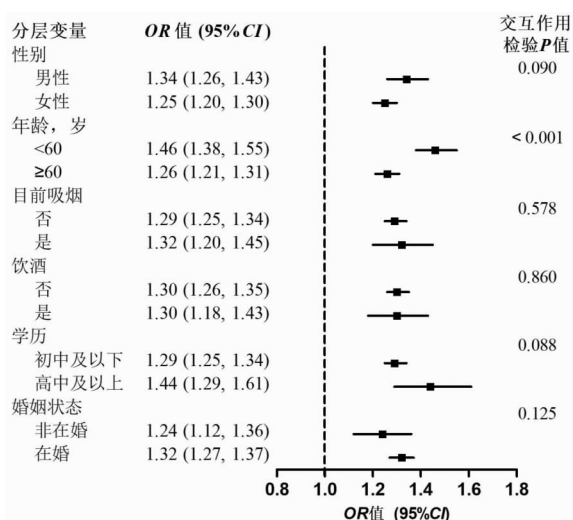
表 4 体重调整腰围指数与“两种”和“三种”共病的多因素 logistic 回归分析

Table 4 Multivariate logistic regression analysis of weight-adjusted waist index and “two” and “three” comorbidities

变量	“两种”共病		“三种”共病	
	OR 值(95% CI) ^b	P 值	OR 值(95% CI) ^b	P 值
体重调整腰围指数 ^a	1.28(1.23, 1.33)	<0.001	1.31(1.23, 1.39)	<0.001
体重调整腰围指数四分组				
Q1(<24.79)	1.00		1.00	
Q2(24.80~30.69)	1.40(1.26, 1.56)	<0.001	2.22(1.77, 2.79)	<0.001
Q3(30.70~37.29)	1.69(1.52, 1.87)	<0.001	2.63(2.11, 3.29)	<0.001
Q4(≥37.30)	2.00(1.79, 2.22)	<0.001	2.74(2.19, 3.43)	<0.001
趋势线检验 P 值		<0.001		<0.001

注:a 进行 Z 值函数转换;b 调整年龄、性别、目前吸烟、饮酒、体质指数、学历、婚姻状态。

2.3 WWI 与“三高”共病的分层分析 每个分层变量模型剔除对应分层变量后分别调整年龄、性别、目前吸烟、饮酒、体质指数、学历、婚姻状态后发现, 相比年龄≥60 岁人群, 在年龄<60 岁的人群中 WWI 与“三高”共病之间的正相关关系更强($OR = 1.26$ 比 $OR = 1.46$, 交互作用检验 $P < 0.001$)。见图 1。



注:a 进行 Z 值函数转换;b 剔除对应分层变量后分别调整年龄、性别、目前吸烟、饮酒、体质指数、学历、婚姻状态。

图 1 体重调整腰围指数^a与“三高”共病的分层分析^b

Fig. 1 Stratified analysis of weight-adjusted waist index and comorbidities of hypertension, diabetes, and dyslipidemia

3 讨论

WWI 作为一种新型的人体测量指数, 不仅兼顾了腰围的优点, 同时还减弱了与体质指数的联系, 既可以区分脂肪和肌肉质量, 还能反映中心性肥胖问题^[12-16]。研究显示, WWI 升高与心血管疾病、骨质疏松症、卒中、高血压、糖尿病等^[15-20]多种疾病密切相关^[9]。

本研究发现, WWI 与“三高”共病之间存在正相

关关系, WWI 在 Q4 组与“三高”共病的正相关性更高, 且这种正相关性在 WWI 四分位数分组中持续升高。与 Chen 等和韩梦莹等发现 WWI 增加与多病发生风险呈正相关的结果相似^[20-24]。Lan 等^[22]也证实了 WWI 与“三高”共病的相关性, WWI 指数会增加“三高”共病的患病风险。可能的机制是: 高 WWI 可能表明脂肪组织功能障碍, 尤其是内脏脂肪的增加^[23]。脂肪细胞增大是内脏脂肪增加的主要表现, 可能会引发脂肪细胞缺氧和脂肪细胞内细胞器受到压力, 这些问题最终会导致内分泌、免疫反应、代谢疾病和 CVD 风险增加^[24]。

本研究进一步分析发现, 相比年龄≥60 岁人群, 在<60 岁的人群中 WWI 与“三高”共病之间的正相关关系更强。既往研究亦发现 WWI 与高血压的关系在<60 岁的人群中较强^[25], 这可能与该年龄人群存在不良生活习惯, 例如运动不足、高热量饮食等情况影响 WWI 指数, 因此与年龄的交互作用放大有关。因此, 本研究提示“三高”共病的防治工作应重点关注<60 岁群体的 WWI 变化。对于本研究的这个发现还需进一步论证, 并进一步探索 WWI 潜在机制和影响因素。

本研究利用近 10 年连续收集的数据作为支撑, 探索 WWI 与“三高”共病之间的关系, 创新性地发现年龄这一因素对 WWI 与“三高”共病关系的影响, 为未来对这一重要研究领域的进一步研究提供了参考。然而, 本研究仍然存在一定的局限性: (1) 作为横断面研究, 在因果关系推断中存在局限, 鼓励未来的研究使用其他方法来验证这些发现。(2) 研究人群是通过方便抽样招募的形式, 可能会存在选择偏倚。(3) 本研究缺少饮食、身体活动、睡眠情况等的数据, 不能完全排除相应残余混杂的影响。

综上所述, WWI 与“三高”共病呈正相关, 且在<60 岁人群中相关性更强。提示在今后“三高”共病的防治工作中应重点关注<60 岁人群的 WWI 变化, 将 WWI 控制在较低水平, 以延缓“三高”疾病的发生和

发展。

利益冲突声明 本研究不存在任何利益冲突

参考文献

- [1] Wang XW, Yao SS, Wang MY, et al. Multimorbidity among Two Million Adults in China[J]. International Journal of Environmental Research and Public Health, 2020, 17(10): 3395.
- [2] 于跃, 晋美曲珍, 白国霞, 等. 西藏居民高血压、血脂异常和糖尿病共病现状及影响因素研究[J]. 中国慢性病预防与控制, 2025, 33(6): 442 - 446.
- Yu Y, Jin MQZ, Bai GX, et al. Research on the comorbidity status and influencing factors of hypertension, dyslipidemia and diabetes among residents in Xizang[J]. Chinese Journal of Prevention and Control of Chronic Diseases, 2025, 33(6): 442 - 446. (In Chinese)
- [3] 王霁一, 冯星淋. 我国中老年人慢性病共患病率的变化趋势及影响因素分析[J]. 医学与社会, 2024, 37(7): 41 - 48.
- Wang JY, Feng XL. Analysis on trends and influencing factors of prevalence of multimorbidity of chronic diseases among middle-aged and elderly People in China[J]. Medicine and Society, 2024, 37(7): 41 - 48. (In Chinese)
- [4] 陈劭明, 张浩, 毛振兴. 我国中老年人慢性病共病模式变化趋势[J]. 郑州大学学报: 医学版, 2025, 60(4): 545 - 548.
- Chen JM, Zhang H, Mao ZX. Prevalence trends of chronic disease comorbidities among middle-aged and elderly People in China[J]. Journal of Zhengzhou University(Medical Sciences), 2025, 60(4): 545 - 548. (In Chinese)
- [5] 梁国欣, 张新蕾, 潘峰, 等. 北京市大兴区 60 ~ 79 岁社区居民“三高”共患病现状及其影响因素分析[J]. 首都公共卫生, 2024, 18(5): 311 - 315.
- Liang GX, Zhang XL, Pan F, et al. Analysis on the current status of “three highs” comorbidities and its influencing factors among residents aged 60 - 79 years in communities of Daxing district, Beijing[J]. Capital Journal of Public Health, 2024, 18(5): 311 - 315. (In Chinese)
- [6] 陈伟标, 张艳, 袁雪丽, 等. 深圳市老年人“三高”共病现状及关联因素分析[J]. 中国慢性病预防与控制, 2023, 31(1): 51 - 55.
- Chen WB, Zhang Y, Yuan XL, et al. Shenzhen the old “three highs” comorbidities present situation and the correlation factor analysis[J]. Chinese Journal of Prevention and Control of Chronic Diseases, 2023, 31(1): 51 - 55. (In Chinese)
- [7] 北京高血压防治协会, 中国老年学和老年医学学会, 北京市社区卫生协会, 等. 成人高血压合并 2 型糖尿病和血脂异常基层防治中国专家共识(2024 年版)[J]. 中国全科医, 2024, 27(28): 3453 - 3475, 3482.
- Beijing Hypertension Prevention and Control Association, China Society of Gerontology and Geriatrics, Beijing Community Health Association, etc. Chinese Expert Consensus on Primary Care Prevention and Treatment of Adult Hypertension Complicated with Type 2 Diabetes and Dyslipidemia (2024 Edition)[J]. Chinese General Practice, 2024, 27(28): 3453 - 3475, 3482. (In Chinese)
- [8] Xie F, Xiao Y, Li X, et al. Association between the weight-adjusted-waist index and abdominal aortic calcification in United States adults; results from the National health and nutrition examination survey 2013 - 2014[J]. Frontiers in Cardiovascular Medicine, 2022, 9: 948194.
- [9] Xiong Y, Shi W, Huang X, et al. Association between weight-adjusted waist index and arterial stiffness in hypertensive patients: the China H-type hypertension registry study[J]. Frontiers in Endocrinology, 2023, 14: 1134065.
- [10] 吴洵, 苏健, 陈路路, 等. 江苏省心血管病高危人群中高血压患者血压控制的随访研究[J]. 中华疾病控制杂志, 2023, 27(4): 399 - 405.
- Wu X, Su J, Chen LL, et al. A follow-up study on blood pressure control of patients with high blood pressure in high cardiovascular risk population in Jiangsu Province[J]. Chinese Journal of Disease Control & Prevention, 2023, 27(4): 399 - 405. (In Chinese)
- [11] 胡佳琪, 陈新洋, 刘明月, 等. 钢铁工人内脏型肥胖相关指标与高血压、糖尿病和血脂异常共病的相关性[J]. 现代预防医学, 2025, 52(8): 1372 - 1378, 1417.
- Hu JQ, Chen XY, Liu MY, et al. The correlation between visceral obesity related indicators of steelworkers and comorbidities of hypertension, diabetes and dyslipidemia[J]. Modern Preventive Medicine, 2025, 52(8): 1372 - 1378, 1417. (In Chinese)
- [12] Kim NH, Park Y, Kim NH, et al. Weight-adjusted waist index reflects fat and muscle mass in the opposite direction in older adults[J]. Age and Ageing, 2021, 50(3): 780 - 786.
- [13] Qin Z, Chang KX, Yang QB, et al. The association between weight-adjusted-waist index and increased urinary albumin excretion in adults: A population-based study[J]. Front Nutr, 2022, 9: 941926.
- [14] Ma M, Liu XL, Jia GX, et al. The association between body fat distribution and bone mineral density: evidence from the US population[J]. BMC Endocrine Disorders, 2022, 22(1): 170.
- [15] Zhang DL, Shi WR, Ding ZH, et al. Association between weight-adjusted-waist index and heart failure: Results from National Health and Nutrition Examination Survey 1999 - 2018[J]. Front Cardiovasc Med, 2022, 9: 1069146.
- [16] Tao JC, Zhang Y, Tan CX, et al. Associations between weight-adjusted waist index and fractures: a population-based study[J]. Journal of Orthopaedic Surgery and Research, 2023, 18(1): 290.
- [17] Ye JY, Hu YJ, Chen XR, et al. Association between the weight-adjusted waist index and stroke: a cross-sectional study[J]. BMC Public Health, 2023, 23(1): 1689.
- [18] Sun Q, Yang Y, Liu J, et al. Association of the weight-adjusted waist index with hypertension in the context of predictive, preventive, and personalized medicine[J]. The EPMA Journal, 2024, 15(3): 491 - 500.
- [19] Zhang TY, Zhang ZM, Wang XN, et al. Relationship between weight-adjusted-waist index and all-cause and cardiovascular mortality in individuals with type 2 diabetes[J]. Diabetes, Obesity and Metabolism, 2024, 26(12): 5621 - 5629.
- [20] Chen ZT, Wang XM, Zhong YS, et al. Association of changes in waist circumference, waist-to-height ratio and weight-adjusted-waist index with multimorbidity among older Chinese adults: results from the Chinese longitudinal healthy longevity survey (CLHLS)[J]. BMC Public Health, 2024, 24(1): 318.
- [21] 韩梦莹. 腰围、体重指数和体重调整腰围指数与高血压、高血糖和高血脂及其共病的关联性研究[D]. 沈阳: 中国医科大学, 2024.
- Han MY. Association study of Waist Circumference, body mass

- index and weight – adjusted waist circumference index with Hypertension, hyperglycemia, hyperlipidemia and their comorbidities [D]. Shenyang: China Medical University, 2024. (In Chinese)
- [22] Lan YM, Zheng QB, Lin CJ, et al. Association of weight – adjusted – waist index with all – cause and cardiovascular mortality in hypertension: a prospective cohort study [J]. BMC Public Health, 2025, 25(1): 2628.
- [23] Bays H. Central obesity as a clinical marker of adiposopathy; increased visceral adiposity as a surrogate marker for global fat dysfunction [J]. Current Opinion in Endocrinology, Diabetes, and Obesity, 2014, 21(5): 345 – 51.
- [24] Engin A. Endothelial dysfunction in obesity and therapeutic targets [J]. Advances in Experimental Medicine and Biology, 2024, 1460: 489 – 538.
- [25] 曹小波, 张华, 张宇, 等. 基于 NHANES 数据分析体重调整腰围指数与高血压的关系 [J]. 实用心脑血管病杂志, 2025, 33(6): 37 – 41, 53.
- Cao XB, Zhang H, Zhang Y, et al. Relationship of Weight – Adjusted waist index and hypertension based on NHANES data [J]. Practical Journal of Cardiac Cerebral Pneumal and Vascular Disease, 2025, 33(6): 37 – 41, 53. (In Chinese)

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参考文献

- [1] 刘兰. 浅析现代化进程下的“积极老龄化”战略 [J]. 老龄化研究, 2024, 11: 242.
- Liu L. An analysis of the “Active Aging” strategy in the process of modernization [J]. Aging Research, 2024, 11: 242. (In Chinese)
- [2] Du M, Liu M, Liu J. The mutual longitudinal mediating effects of psychological and physical disorders on cognitive impairment among older adults [J]. Journal of Affective Disorders, 2024, 362: 477 – 484.
- [3] Sun YH, Li XD, Liu HY, et al. Predictive role of depressive symptoms on frailty and its components in Chinese middle – aged and older adults: a longitudinal analysis [J]. BMC Public Health, 2024, 24(1): 2201.
- [4] Lin CC, Li CI, Liu CS, et al. Relationship of depression and mortality in community – residing elderly individuals: mediating role of frailty and quality of Life [J]. BMC Geriatrics, 2025, 26(1): 16.
- [5] Hu HX, Xie LY, Hao YQ, et al. Assessment of bidirectional and Threshold – Response associations between cognitive function and physical performance: nationwide Cross – Sectional study [J]. JMIR Public Health and Surveillance, 2025, 11: e80575.
- [6] Gao PY, Ma LZ, Wang XJ, et al. Physical frailty, genetic predisposition, and incident dementia: a large prospective cohort study [J]. Translational Psychiatry, 2024, 14(1): 212.
- [7] Fan P, Li H, Xu H, et al. A chain mediation model reveals the association between depression and cognitive function in the elderly [J]. Scientific Reports, 2024, 14(1): 31375.
- [8] Dong Q, Bu X, Wang T, et al. Profiles of physical frailty, social frailty, and cognitive impairment among older adults in rural areas of China: a latent profile analysis [J]. Frontiers Public Health, 2024, 12: 1424791.
- [9] Vaughan L, Corbin AL, Goveas JS. Depression and frailty in later Life: a systematic review [J]. Clinical Interventions in Aging, 2015, 10: 1947 – 1958.
- [10] Gao PY, Fu Y, He XY, et al. Genetic mechanisms, brain structures, and peripheral biomarkers mediate the relationship between physical frailty and neuropsychiatric disorders [J]. Journal of Advanced Research, 2026, 82: 685 – 699.
- [11] Huo ZH, Lin JE, Bat BKK, et al. Diagnostic accuracy of dementia screening tools in the Chinese population: a systematic review and meta – analysis of 167 diagnostic studies [J]. Age and Ageing, 2021, 50(4): 1093 – 1101.
- [12] Weeks SK, McGann PE, Michaels TK, et al. Comparing various short – form Geriatric Depression Scales leads to the GDS – 5/15 [J]. Journal of Nursing Scholarship: an Official Publication of Sigma Theta Tau International Honor Society of Nursing, 2003, 35(2): 133 – 137.
- [13] Fried LP, Tangen CM, Walston J, et al. Frailty in older adults: evidence for a phenotype [J]. The Journals of Gerontology. Series A, Biological Sciences and Medical Sciences, 2001, 56(3): M146 – M156.
- [14] Wu C, Smit E, Xue QL, et al. Prevalence and correlates of frailty among Community – Dwelling Chinese older adults: the China health and retirement longitudinal study [J]. The Journals of Gerontology. Series A, Biological Sciences and Medical Sciences, 2018, 73(1): 102 – 108.
- [15] Habich A, Garcia – Cabello E, Abbatantuono C, et al. The effect of cognitive reserve on the cognitive connectome in healthy ageing [J]. GeroScience, 2025, 47(3): 3507 – 3523.
- [16] Chithiramohan T, Santhosh S, Threlfall G, et al. Culture – fair cognitive screening tools for assessment of cognitive impairment: a systematic review [J]. Journal of Alzheimer’s Disease Reports, 2024, 8(1): 289 – 306.
- [17] Smith L, Shin JI, Oh H, et al. Body mass index and mild cognitive impairment among Middle – Aged and older adults from low – and Middle – Income countries [J]. Journal of Alzheimer’s Disease, 2022, 85(3): 1095 – 1105.
- [18] Zhang W, Chen YN, Chen N. Body mass index and trajectories of the cognition among Chinese middle and old – aged adults [J]. BMC Geriatrics, 2022, 22(1): 613.
- [19] Chen J, Zhang J, Wang H, et al. Obesity paradox in cognitive function: a longitudinal study of BMI and cognitive impairment in older adult Chinese population [J]. Frontiers in Aging Neuroscience, 2025, 17: 1543501.
- [20] Someya Y, Tamura Y, Kaga H, et al. Sarcopenic obesity is associated with cognitive impairment in community – dwelling older adults: the bunkyo health study [J]. Clinical Nutrition, 2022, 41(5): 1046 – 1051.
- [21] Twait EL, Wu JH, Kamarioti M, et al. Association of amyloid – beta with depression or depressive symptoms in older adults without dementia: a systematic review and meta – analysis [J]. Translational Psychiatry, 2024, 14(1): 25.
- [22] Sălcudean A, Bodo CR, Popovici RA, et al. Neuroinflammation – A crucial factor in the pathophysiology of Depression – A comprehensive review [J]. Biomolecules, 2025, 15(4): 502.
- [23] Cui LL, Li S, Wang SM, et al. Major depressive disorder: hypothesis, mechanism, prevention and treatment [J]. Signal Transduction and Targeted Therapy, 2024, 9(1): 30.
- [24] Arosio B, Calvani R, Ferri E, et al. Sarcopenia and cognitive decline in older adults: targeting the muscle – brain axis [J]. Nutrients, 2023, 15(8): 1853.

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