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Determinants of obesity risk factors in pre-seniors and seniors in Central Java: 2023 survey analysis

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ABSTRACT

Background: Overweight and obesity are increasing globally and in Indonesia, particularly among pre-seniors and seniors. Age-related changes and behavioral factors heighten obesity risk. Data from the 2023 Indonesian Health Survey (SKI) show a high burden of obesity among older adults in Central Java. Objective: To identify determinants of overweight and obesity risk factors among pre-seniors and seniors in Central Java based on the 2023 SKI data. Methods: A cross-sectional study using secondary data from 23,602 respondents aged ≥45 years in Central Java. Nutritional status was assessed using Body Mass Index (BMI). Sociodemographic characteristics, consumption patterns, and physical activity were analyzed using chi-square tests and multivariate logistic regression to estimate Adjusted Odds Ratios (aOR). Results: 42.2% of respondents were overweight or obese. Risk factors included age ≥60 years (aOR=1.695), urban residence (aOR=1.349), and daily sweet beverage consumption (aOR=1.374). Protective factors included male sex (aOR=0.414), low education (aOR=0.628), marital status (married/widowed), and heavy physical activity (aOR=0.808). Moderate physical activity was not significant after adjustment. Conclusion: Obesity among pre-seniors and seniors in Central Java is influenced by demographic, social, and behavioral factors, indicating the need for tailored prevention strategies for older adults.

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INTRODUCTION

Obesity is a growing public health challenge, with more than two billion adults affected globally by 2021, and projections suggesting 3.8 billion by 2050. This makes obesity one of the greatest threats to global health, particularly in Asia, driven by demographic, lifestyle, and dietary changes. In Indonesia, obesity prevalence has risen from 10.5% in 2007 to 21.8% in 2018, with the 2023 Indonesian Health Survey (SKI) showing over 40% of elderly populations in Central Java are overweight, and 11.1% are obese (B et al., 2023; Kementerian Kesehatan, 2007, 2013, 2019).

As individuals age, obesity increases the risk of chronic diseases like type 2 diabetes, heart disease, and arthritis, which accelerate functional decline, limit mobility, and increase dependence

(Samper-Ternent & Al Snih, 2012). Obesity also burdens healthcare systems and reduces quality of life, underscoring the need for stronger public health policies promoting active lifestyles for older adults. The Ministry of Health of the Republic of Indonesia has published the National Obesity Control Guidelines, which focus on promotive and preventive strategies, including monitoring nutritional status, balanced nutrition education, limiting the consumption of risky foods, and creating environments that support physical activity.

These efforts aim to slow down the obesity rate increase and encourage health behavior changes in the population (Sulistyowati, 2015). However, there is a lack of recent national research specifically analyzing the determinants of obesity in pre-seniors and seniors at the provincial level. Most previous research has focused on obesity prevalence at a national level, with little attention paid to the specific risk factors that emerge at the provincial level, influenced by distinct social, demographic, and cultural contexts. Additionally, there is no study specifically identifying the risk factors in Central Java, a province that has unique socio-economic characteristics, lifestyle patterns, and consumption habits compared to other regions in Indonesia.

The decision to focus on consumption exposures such as sweet, salty, and fatty foods, soft drinks, energy drinks, instant noodles, and other dietary patterns is based on the direct and significant impact of these factors on weight gain and obesity in older adults. These dietary habits are more readily modifiable compared to other factors such as sleep, stress, comorbidities, and medication, which are harder to measure or intervene in large-scale surveys like the SKI. Moreover, consumption of unhealthy foods and beverages is a well-established contributor to obesity and is a major driver of the growing prevalence of overweight and obesity in Indonesia. This study aims to identify the determinants of obesity risk factors in pre-seniors and seniors in Central Java based on the 2023 Indonesian Health Survey (SKI) data.

The findings of this study are expected to provide empirical insights into the demographic, social, and behavioral factors contributing to increased obesity risk, serving as a foundation for developing more effective and targeted obesity prevention and control strategies for the elderly in Indonesia.

RESEARCH METHOD

This study employed a cross-sectional design using secondary data from the 2023 Indonesian Health Survey (SKI). The study population consisted of all respondents aged over 45 years residing in Central Java, with a total sample size of 23,602. The dependent variable was nutritional status, categorized by Body Mass Index (BMI) as normal, overweight, or obese. BMI was measured using standardized procedures to ensure accuracy, with trained field staff performing height and weight measurements using calibrated instruments. For height, a stadiometer was used, and for weight, a digital scale with a high level of precision was employed. Calibration of these instruments was regularly performed according to the SKI protocols to minimize measurement errors, especially in older adults.

Independent variables included sociodemographic factors (age, gender, education, residence, marital status), consumption patterns (sweet foods, sweet beverages, salty foods, fatty foods, soft drinks, energy drinks, instant noodles), and physical activity (heavy or moderate). Data analysis included univariate analysis for frequency distribution, chi-square tests for bivariate analysis, and multivariate logistic regression to identify the determinants of overweight and obesity. Results were presented as Odds Ratios (OR), Adjusted Odds Ratios (aOR), and 95% Confidence Intervals (CI), with significance set at $p < 0.05$.

RESULTS AND DISCUSSIONS

The largest group of respondents were pre-seniors (45-59 years), accounting for 61.62%, with a slightly higher proportion of females (53.3%) compared to males (46.7%). Most respondents had

low education (74.5%) and resided in urban areas (73.8%), with the majority being married (81.4%) (Table 1).

Table 1. Frequency distribution

Variable	Valid	
	n	%
Age (years)		
45 – 59	14,544	61.62
60 and above	9,058	38.38
Gender		
Male	11,024	46.7
Female	12,578	53.3
Education		
Low	17,575	74.5
High	6,027	25.5
Residence		
Urban	17,410	73.8
Rural	6,192	26.2
Marital Status		
Single	356	1.5
Married	19,209	81.4
Widowed	553	2.3
Divorced	3,484	14.8
Nutritional Status		
Normal	13,645	57.8
Overweight	7,341	31.1
Obese	2,616	11.1
Sweet Foods		
≥1 time/day	3,006	12.7
1-6 times/week	17,112	72.5
≤3 times/month	2,534	10.7
Never	950	4.0
Sweet Beverages		
≥1 time/day	14,650	62.1
1-6 times/week	6,518	27.6
≤3 times/month	1,291	5.5
Never	1,143	4.8
Salty Foods		
≥1 time/day	8,394	35.6
1-6 times/week	11,168	47.3
≤3 times/month	2,673	11.3
Never	1,367	5.8
Fatty Foods		
≥1 time/day	12,553	53.2
1-6 times/week	9,622	40.8
≤3 times/month	1,070	4.5
Never	357	1.5
Soft Drink		
≥1 time/day	347	1.5
1-6 times/week	808	3.4
≤3 times/month	2,290	9.7
Never	20,157	85.4
Energy Drinks		
≥1 time/day	208	0.9
1-6 times/week	519	2.2
≤3 times/month	1,094	4.6
Never	21,781	92.3
Instant Noodles		
≥1 time/day	485	2.1
1-6 times/week	9,688	41.0
≤3 times/month	8,798	37.3

Variable	Valid	
	n	%
Never	4,631	19.6
Physical Activity Heavy		
Yes	7,832	33.2
No	15,770	66.8
Moderate		
Yes	18,090	76.6
No	5,512	23.4

Regarding nutritional status, 57.8% of respondents had normal weight, while 42.2% were overweight or obese. Consumption patterns indicated high-risk behavior: 72.5% consumed sweet foods 1–6 times per week, and 62.1% consumed sweet beverages daily.

Daily consumption of salty and fatty foods was also common, with 47.3% and 53.2%, respectively. Consumption of soft drinks and energy drinks was low, while nearly half of respondents ate instant noodles 1–6 times per week. Most respondents (76.6%) engaged in moderate physical activity, with only 33.2% participating in heavy physical activity.

Table 2. Determinants of overweight and obesity

Variable	Nutritional Status				P value	OR	95% Confidence Interval		P value Model 1	aOR Model 1	95% Confidence Interval		P value Model 2	aOR Model 2	95% Confidence Interval	
	Overweight & Obesitas		Normal				Lower	Upper			Lower	Upper			Lower	Upper
	n	%	n	%												
Age (years)					0,000**	1,878	1,778	1,983	0,000**	1,892	1,785	2,005	0,000**	1,695	1,596	1,802
45 - 59	6.975	29,6%	7.569	32,1%												
60 and above	2.982	12,6%	6.076	25,7%												
Gender					0,000**	0,420	0,398	0,443	0,000**	0,459	0,434	0,486	0,000**	0,414	0,390	0,440
Male	3.434	14,5%	7.590	32,2%												
Female	6.523	27,6%	6.055	25,7%												
Education					0,000**	0,602	0,567	0,638					0,000**	0,628	0,589	0,670
Low	6.853	29,0%	10.722	45,4%												
High	3.104	13,2%	2.923	12,4%												
Residence Classification					0,000**	1,500	1,412	1,593					0,000**	1,349	1,265	1,439
Urban	7.787	33,0%	9.623	40,8%												
Rural	2.170	9,2%	4.022	17,0%												
Marital Status					0,000**											
Single	13	0,6	224	0,9	Ref								Ref			

Variable	Nutritional Status				P value	OR	95% Confidence Interval		P value Model 1	aOR Model 1	95% Confidence Interval		P value Model 2	aOR Model 2	95% Confidence Interval	
	Overweight & Obesitas		Normal													
	n	%	n	%			Lower	Upper			Lower	Upper			Lower	Upper
Married	28.219	34,8%	10.990	46,6%	0,031*	0,788	0,634	0,979					0,008**	0,736	0,587	0,921
Widowed	259	1,1%	294	1,2%	0,004**	0,669	0,509	0,878					0,032*	0,733	0,552	0,973
Divorced (Deceased)	1.347	5,7%	2.137	9,1%	0,559	0,935	0,746	1,172					0,536	0,928	0,732	1,176
Sweet Foods					0,079											
≥1 time/day	1.275	5,4%	1.731	7,3%	0,019*	0,836	0,720	0,971	0,000**	0,710	0,599	0,842	0,001**	0,757	0,638	0,899
1-6 times/week	7.243	30,7%	9.869	41,8%	0,010*	0,839	0,733	0,960	0,000**	0,746	0,640	0,869	0,002**	0,781	0,669	0,911
≤3 times/month	1.077	4,6%	1.457	6,2%	0,019*	0,833	0,715	0,970	0,009**	0,798	0,674	0,944	0,016*	0,811	0,684	0,961
Never	362	1,5%	588	2,5%	Ref				Ref				Ref			
Sweet Beverages					0,000**											
≥1 time/day	5.824	24,7%	8.826	37,4%	0,000**	1,396	1,237	1,575	0,000**	1,412	1,231	1,620	0,000**	1,374	1,197	1,579
1-6 times/week	2.939	12,5%	3.579	15,2%	0,074	1,122	0,989	1,272	0,002**	1,255	1,089	1,446	0,009*	1,211	1,050	1,398
≤3 times/month	646	2,7%	645	2,7%	0,302	0,920	0,784	1,078	0,970	0,997	0,838	1,185	0,915	1,010	0,848	1,202
Never	548	2,3%	595	2,5%	Ref				Ref				Ref			
Salty Foods					0,157											
≥1 time/day	3.574	15,1%	4.820	20,4%	0,104	0,908	0,808	1,020	0,367	0,944	0,832	1,070	0,203	0,921	0,811	1,046
1-6 times/week	4.670	19,8%	6.498	27,5%	0,263	0,937	0,835	1,050	0,634	0,970	0,857	1,098	0,444	0,952	0,841	1,079
≤3 times/month	1.163	4,9%	1.510	6,4%	0,046*	0,874	0,766	0,998	0,194	0,911	0,792	1,048	0,195	0,911	0,790	1,049
Never	550	2,3%	817	3,5%	Ref				Ref				Ref			
Fatty Foods					0,000**											
≥1	5.4	23,	7.11	30,	0,00	0,6	0,55	0,85	0,01	0,74	0,58	0,93	0,01	0,74	0,58	0,93

Variable	Nutritional Status				P value	OR	95% Confidence Interval		P value Model 1	aOR Model 1	95% Confidence Interval		P value Model 2	aOR Model 2	95% Confidence Interval	
	Overweight & Obesitas		Normal													
	n	%	n	%			Lower	Upper			Lower	Upper			Lower	Upper
time/day	42	1%	1	1%	1**	87	1	7	1*	0	6	4	2*	0	5	6
1-6 times/week	3.947	16,7%	5.675	24,0%	0,013*	0,756	0,605	0,944	0,056	0,797	0,631	1,006	0,073	0,806	0,637	1,020
≤3 times/month	445	1,9%	625	2,6%	0,017*	0,738	0,575	0,948	0,063	0,780	0,601	1,014	0,131	0,816	0,627	1,063
Never	123	0,5%	234	1,0%	Ref				Ref				Ref			
Soft Drink					0,360											
≥1 time/day	160	0,7%	187	0,8%	0,133	0,849	0,687	1,051	0,171	0,833	0,641	1,082	0,248	0,856	0,657	1,115
1-6 times/week	331	1,4%	477	2,0%	0,526	1,047	0,908	1,208	0,641	0,959	0,803	1,145	0,933	0,992	0,830	1,187
≤3 times/month	982	4,2%	1.308	5,5%	0,467	0,968	0,887	1,056	0,006*	0,866	0,780	0,960	0,020*	0,884	0,796	0,981
Never	8.484	35,9%	11.673	49,5%	Ref				Ref				Ref			
Energy Drinks					0,159											
≥1 time/day	93	0,4%	115	0,5%	0,486	0,907	0,689	1,194	0,744	1,059	0,752	1,490	0,884	1,026	0,727	1,448
1-6 times/week	221	0,9%	298	1,3%	0,902	0,989	0,829	1,179	0,213	0,872	0,702	1,082	0,094	0,830	0,667	1,033
≤3 times/month	427	1,8%	667	2,8%	0,032*	1,146	1,012	1,298	0,162	1,110	0,959	1,285	0,298	1,081	0,933	1,253
Never	9.216	39,0%	12.565	53,2%	Ref				Ref				Ref			
Instant Noodles					0,190											
≥1 time/day	207	0,9%	278	1,2%	0,865	0,984	0,814	1,189	0,806	1,025	0,839	1,252	0,930	1,009	0,825	1,234
1-6 times/week	4.011	17,0%	5.677	24,1%	0,319	1,037	0,966	1,113	0,092	1,069	0,989	1,155	0,192	1,053	0,974	1,139
≤3 times/month	3.781	16,0%	5.017	21,3%	0,439	0,972	0,904	1,045	0,916	1,004	0,930	1,084	0,828	1,009	0,934	1,089
Never	1.958	8,3%	2.673	11,3%	Ref				Ref				Ref			
Physical Activity																
Heavy					0,00	0,6	0,63	0,70	0,00	0,75	0,71	0,80	0,00	0,80	0,76	0,85

Variable	Nutritional Status				P value	OR	95% Confidence Interval		P value Model 1	aOR Model 1	95% Confidence Interval		P value Model 2	aOR Model 2	95% Confidence Interval	
	Overweight & Obesitas		Normal				Lower	Upper			Lower	Upper			Lower	Upper
	n	%	n	%												
					0**	66	0	4	0**	9	5	5	0**	8	1	9
Yes	2.793	11,8%	5.039	21,3%												
No	7.164	30,4%	8.606	36,5%												
Moderate					0,000**	1,235	1,161	1,314	0,069	1,062	0,995	1,133	0,119	1,054	0,987	1,125
Yes	7.847	33,2%	10.243	43,4%												
No	2.110	8,9%	3.402	14,4%												

Respondents aged 60 and above had a significantly higher risk of obesity compared to those aged 45–59. Women were more likely to be obese than men, while urban residents exhibited a higher risk of obesity compared to those living in rural areas. Additionally, individuals with lower education levels were found to have a lower risk of obesity.

Consumption of sweet foods showed a protective relationship with obesity, though this might be influenced by reporting bias or health-related dietary changes. In contrast, daily consumption of sweet beverages was associated with a 37% increased risk of obesity. Heavy physical activity significantly reduced the risk of obesity, while moderate physical activity was not significantly associated with obesity after adjustments.

Discussion

Aging significantly impacts fat storage, with subcutaneous fat shifting to visceral areas, which are metabolically riskier. Hormonal changes, such as reduced testosterone in men and estrogen in postmenopausal women, accelerate abdominal fat accumulation, contributing to obesity and sarcopenic obesity. These conditions increase frailty and disability risks (Colleluori & Villareal, 2021; Mancuso & Bouchard, 2019). Moreover, BMI has limitations in older adults, particularly in detecting obesity in those with higher visceral fat at lower BMI values, as it does not account for changes in body composition such as muscle loss. While BMI is useful for initial screening, particularly for women, urban residents, and those with low physical activity, it often underdiagnoses obesity in seniors (McKee & John, 2021; Sruthi et al., 2025).

Gender differences further complicate obesity risk. Women tend to have higher body fat, especially after menopause, which increases their vulnerability to obesity (Muscogiuri et al., 2024; Saha et al., 2023). Men, on the other hand, accumulate more visceral fat, making waist circumference a more reliable indicator for assessing obesity-related health risks (Muhammad et al., 2022). This gender disparity is also reflected in the 2023 SKI data, which shows higher obesity risk in women. Education level also plays a critical role in obesity risk, with lower education linked to higher obesity rates, particularly because it limits access to health knowledge and healthier lifestyles (Hsieh et al., 2020; Witkam et al., 2021). Targeted health education is crucial for high-risk groups, particularly older adults with lower education levels. Additionally, urban residents in Central Java were found to have a higher obesity risk compared to rural residents, consistent with trends across Southeast Asia, where urbanization, higher income, and better education contribute to increased obesity rates due to lifestyle changes (Thapa et al., 2021).

Marital status also influences obesity risk. Married or widowed individuals had lower obesity risks, likely due to social support and shared eating habits, contrasting with Western

findings where marital status is often linked to higher obesity risk in men due to reduced social pressure to control weight (Klos & Sobal, 2013; Nikolic Turnic et al., 2024).

Consumption of sugary beverages was strongly associated with increased obesity risk, highlighting the need for public health interventions targeting sugary drink reduction, particularly for older adults (Fanda et al., 2020; Malik et al., 2006). Furthermore, physical activity plays a crucial role in obesity prevention. Heavy physical activity significantly reduces obesity risk by increasing energy expenditure and improving body composition (Brandt & Pedersen, 2022). Community-based exercise programs and senior-friendly environments are essential for encouraging physical activity among older adults (Dietz, 2004). Obesity management in seniors should focus not just on weight loss but also on preserving muscle mass and functional ability.

Combining aerobic and resistance exercise with a balanced diet can improve metabolic health and quality of life (Villani, 2022). Given BMI's limitations in seniors, alternative measures like waist circumference or body fat percentage are recommended for a more accurate diagnosis (Batsis et al., 2016). Comprehensive management should include community interventions, exercise programs, nutritional education, and creating environments that support active lifestyles (Dewar, 2025). Primary care must prioritize muscle preservation and functional capacity, addressing dietary, activity, and socio-economic barriers with interprofessional collaboration (Batsis & Zagaria, 2017).

Ultimately, addressing obesity in pre-seniors and seniors in Central Java requires integrated, evidence-based prevention and control strategies tailored to local conditions.

CONCLUSION

This study highlights that obesity in pre-seniors and seniors in Central Java is a significant public health issue, with over 40% of respondents being overweight or obese. Key determinants include older age, female gender, urban residence, sweet beverage consumption, and low levels of heavy physical activity, while heavy physical activity acts as a protective factor. These findings underscore the complex interaction between biological, socio-demographic, and lifestyle factors influencing obesity in older adults. Efforts to control obesity should focus on integrated promotive-preventive strategies, including reducing sugary beverage intake, promoting higher-intensity physical activity, and creating environments that support healthy aging.

Based on these significant determinants, the following operational policy recommendations for Central Java can be directly derived: 1) Implement community-based interventions aimed at reducing the intake of sugary beverages, including public health campaigns that emphasize the health risks associated with excessive sugar consumption and promote healthier alternatives. 2) Develop urban planning policies that integrate spaces for physical activity, such as parks and exercise areas, especially in densely populated urban areas, to encourage vigorous physical activity among older adults. 3) Promote programs that specifically target older adults to increase engagement in vigorous physical activity, such as senior-friendly fitness programs and activities that cater to their physical capabilities.

However, there are important limitations in generalizing the findings of this study. First, self-reported dietary measurements can be prone to recall bias or social desirability bias, which may affect the accuracy of the reported consumption patterns. Second, while BMI is a useful tool for identifying obesity, it has limitations in older adults, as it does not account for changes in body composition, such as muscle loss or the distribution of fat, which may lead to underestimation of obesity, particularly in those with sarcopenic obesity. Third, the study did not account for clinical factors such as comorbidities, medications, or other health conditions that may influence obesity risk. To address these limitations, future research should consider using longitudinal designs or repeated measures to track changes in obesity risk factors over time.

Additionally, future studies should incorporate non-BMI adiposity indicators, such as waist-to-hip ratio, waist circumference, or body fat percentage, to provide a more accurate measure

of obesity in older adults. These approaches would allow for a deeper understanding of the complex factors influencing obesity in this population and lead to more effective prevention and intervention strategies. The results of this study provide a solid foundation for developing targeted obesity control policies and interventions in Central Java and Indonesia.

References

B, K. P., Kementerian, K., & Ri, K. (2023). *DALAM ANGKA TIM PENYUSUN SKI 2023*. Kementerian Kesehatan Republik Indonesia.

Batsis, J. A., Mackenzie, T. A., Bartels, S. J., Sahakyan, K. R., Somers, V. K., & Lopez-Jimenez, F. (2016). Diagnostic accuracy of body mass index to identify obesity in older adults: NHANES 1999–2004. *International Journal of Obesity*, *40*(5), 761–767.

Batsis, J. A., & Zagaria, A. B. (2017). Addressing obesity in aging patients. *The Medical Clinics of North America*, *102*(1), 65.

Brandt, C., & Pedersen, B. K. (2022). Physical activity, obesity and weight loss maintenance. In *From Obesity to Diabetes* (pp. 349–369). Springer.

Colleluori, G., & Villareal, D. T. (2021). Aging, obesity, sarcopenia and the effect of diet and exercise intervention. *Experimental Gerontology*, *155*, 111561.

Dewar, S. (2025). A geriatrician's approach to managing the complex older adult with obesity. *Obesity*.

Dietz, W. H. (2004). The effects of physical activity on obesity. *Quest*, *56*(1), 1–11.

Fanda, R. B., Salim, A., Kurnia, T. M., Shita, P. U., Clara, L. D., & Brief, A. S. A. C. P. (2020). Tackling High Consumption of Sugar Sweetened Beverages (SSB) in Indonesia. *Center for Health Policy and Management*.

Hsieh, T.-H., Lee, J. J., Yu, E. W.-R., Hu, H.-Y., Lin, S.-Y., & Ho, C.-Y. (2020). Association between obesity and education level among the elderly in Taipei, Taiwan between 2013 and 2015: A cross-sectional study. *Scientific Reports*, *10*(1), 20285.

Kementerian Kesehatan. (2007). *Riset Kesehatan Dasar (Riskesdas) 2007*.

Kementerian Kesehatan. (2013). *Riset Kesehatan Dasar (Riskesdas) 2013*.

Kementerian Kesehatan. (2019). *Laporan Nasional Riskesdas 2018*. Kementerian Kesehatan.

Klos, L. A., & Sobal, J. (2013). Marital status and body weight, weight perception, and weight management among US adults. *Eating Behaviors*, *14*(4), 500–507.

Malik, V. S., Schulze, M. B., & Hu, F. B. (2006). Intake of sugar-sweetened beverages and weight gain: a systematic review. *The American Journal of Clinical Nutrition*, *84*(2), 274–288.

Mancuso, P., & Bouchard, B. (2019). The impact of aging on adipose function and adipokine synthesis. *Frontiers in Endocrinology*, *10*, 137.

McKee, A. M., & John, E. (2021). Obesity in the Elderly. *Endotext [Internet]*.

Muhammad, T., Balachandran, A., Kumar, P., & Srivastava, S. (2022). Obesity-related measures and successful ageing among community-dwelling older adults in India: a cross-sectional study. *Scientific Reports*, *12*(1), 17186.

Muscogiuri, G., Verde, L., Vetrani, C., Barrea, L., Savastano, S., & Colao, A. (2024). Obesity: a gender-view. *Journal of Endocrinological Investigation*, *47*(2), 299–306.

Nikolic Turnic, T., Jakovljevic, V., Strizhkova, Z., Polukhin, N., Ryaboy, D., Kartashova, M., Korenkova, M., Kolchina, V., & Reshetnikov, V. (2024). The association between marital status and obesity: a systematic review and meta-analysis. *Diseases*, *12*(7), 146.

Saha, A., Mandal, B., Muhammad, T., Barman, P., & Ahmed, W. (2023). RETRACTED ARTICLE: Gender-specific determinants of overweight and obesity among older adults in India: evidence from a cross-sectional survey, 2017-18. *BMC Public Health*, *23*(1), 2313.

Samper-Ternent, R., & Al Snih, S. (2012). Obesity in older adults: epidemiology and implications for disability and disease. *Reviews in Clinical Gerontology*, *22*(1), 10–34.

Sruthi, K. G., Aditya, C., Panda, P., Mohanty, J. R., & Behera, M. R. (2025). Prevalence of normal weight obesity among adults in Southeast Asia: Insights from a systematic review and meta-analysis. *Metabolism Open*, 100416.

Sulistyowati, L. S. (2015). *Pedoman Umum Pengendalian Obesitas*. https://extranet.who.int/ncdccs/Data/IDN_B11_Buku Obesitas-1.pdf

Thapa, R., Dahl, C., Aung, W. P., & Bjertness, E. (2021). Urban–rural differences in overweight and obesity among 25–64 years old Myanmar residents: a cross-sectional, nationwide survey. *BMJ Open*, *11*(3),

e042561.
Villani, A. (2022). Lifestyle strategies for the management of obesity in older adults: from controversies to alternative interventions. *Healthcare*, *10*(10), 2107.
Witkam, R., Gwinnutt, J. M., Humphreys, J., Gandrup, J., Cooper, R., & Verstappen, S. M. M. (2021). Do associations between education and obesity vary depending on the measure of obesity used? A systematic literature review and meta-analysis. *SSM-Population Health*, *15*, 100884.