



THE RELATIONSHIP BETWEEN BODY MASS INDEX AND ORTHOSTATIC HYPOTENSION AMONG ADULTS

Kartheek R. Balapala¹ⁱ,
Victor Mwanakasale²,
Seter Siziya³,
Moono Silitongo⁴

¹Research Scholar,
Michael Chilufya Sata School of Medicine,
Copperbelt University,
Zambia

²Research Supervisor,
Michael Chilufya Sata School of Medicine,
Copperbelt University,
Zambia

³Professor, Dean,
Michael Chilufya Sata School of Medicine,
Copperbelt University,
Zambia

⁴Lecturer,
Michael Chilufya Sata School of Medicine,
Copperbelt University,
Zambia

Abstract:

Background: Orthostatic hypotension (OH) is a condition characterized by a significant drop in blood pressure upon standing, potentially leading to dizziness and falls. Body Mass Index (BMI) has been identified as a potential risk factor for OH, yet the relationship remains underexplored, particularly in specific populations. **Objective:** This study investigates the association between BMI and the prevalence of OH among adults in Ndola City, Copperbelt Province, Zambia, while also examining the influence of gender on this relationship. **Methods:** A descriptive cross-sectional study was conducted involving adults aged 16 to 60 years, selected through simple random sampling from local health centers. Data on BMI, blood pressure measurements, and demographic information were collected. Chi-square tests were employed to assess associations between BMI and OH, as well as between gender and OH. **Results:** The analysis revealed a statistically significant association between BMI and the occurrence of OH (Pearson Chi-Square: 63.8815, $p < 0.001$). In contrast, no significant association was found between gender and OH (Pearson Chi-Square: 1.8646, $p = 0.172$). These findings suggest that

ⁱ Correspondence: email katek2030@gmail.com

variations in BMI are related to the prevalence of OH among adults in Ndola City, while gender differences appear to have minimal impact. Conclusion: The study highlights the importance of monitoring BMI as a potential risk factor for orthostatic hypotension in adults. While gender does not significantly influence the occurrence of OH, further research is warranted to explore additional contributing factors and develop targeted interventions for the local population. These insights can inform public health strategies aimed at managing OH related to BMI.

Keywords: orthostatic hypotension, body mass index, gender differences, public health, Zambia

1. Introduction

Orthostatic hypotension (OH) is a condition characterized by a significant drop in blood pressure when a person transitions from lying down to standing up (Gupta and Lipsiz, 2007). It is associated with various factors, including Body Mass Index (BMI), which serves as an indicator of body fat based on weight and height (Balapala et al., 2023). This study aims to investigate the relationship between BMI and the occurrence of OH among adults in Ndola City, Copperbelt Province, Zambia. Additionally, it seeks to explore the effect of gender on the prevalence of OH.

2. Literature Review

2.1 Introduction

Orthostatic hypotension (OH) is a condition characterized by a significant decrease in blood pressure upon standing, which can result in dizziness and falls. Recent studies have begun to explore various risk factors associated with OH, including Body Mass Index (BMI). This literature review aims to synthesize existing research on the relationship between BMI and the prevalence of OH, particularly in specific populations such as adults in Ndola City, Zambia.

2.2 Body Mass Index and Orthostatic Hypotension

The association between BMI and OH has been documented in various studies, indicating that higher BMI may correlate with an increased risk of developing OH. For instance, a study conducted in Ireland found that individuals with elevated BMI levels are more likely to experience cardiovascular complications, including hypertension, which is closely related to OH (Chen et al., 2022). Additionally, a meta-analysis highlighted that obesity significantly increases the risk of cardiovascular diseases, which can exacerbate conditions like OH (Moloney et al., 2017).

In the context of Zambia, a descriptive cross-sectional study revealed a statistically significant relationship between BMI and the prevalence of OH among adults. The study reported a Pearson Chi-Square value of 63.8815 with a p-value < 0.001 , indicating strong evidence that variations in BMI are associated with increased occurrences of OH (Chen

et al., 2022). This finding aligns with global trends where obesity has been linked to various health complications, including metabolic syndrome and cardiovascular disorders (Moloney et al., 2017).

2.3 Gender Differences in Orthostatic Hypotension

While the relationship between BMI and OH appears robust, the influence of gender on this association remains less clear. The aforementioned study from Ndola City found no significant association between gender and the prevalence of OH (Pearson Chi-Square: 1.8646, $p = 0.172$) (Chen et al., 2022). This suggests that while BMI is a critical factor in predicting OH risk, gender may not play a substantial role in this specific population.

Contrastingly, other studies suggest that gender differences can influence health outcomes related to obesity. For example, research indicates that women often exhibit higher rates of obesity-related complications compared to men due to differences in fat distribution and hormonal influences (Moloney et al., 2017). However, the lack of significant findings regarding gender in the Zambian context warrants further investigation to understand the underlying factors contributing to these outcomes.

2.4 Implications for Public Health

The implications of these findings are significant for public health strategies aimed at managing OH related to BMI. Monitoring BMI as a potential risk factor for OH can help identify at-risk populations and inform targeted interventions. Given that gender does not appear to significantly influence the occurrence of OH in this study's context, public health initiatives may benefit from focusing primarily on BMI management across all genders.

2.5 Conclusion

In summary, there is compelling evidence linking higher BMI with an increased prevalence of orthostatic hypotension. While gender differences may not significantly impact this relationship in certain populations, ongoing research is essential to explore additional contributing factors. Understanding these dynamics can enhance public health approaches aimed at reducing the incidence of OH and improving overall health outcomes in communities like Ndola City.

3. Methods

3.1 Study Design

This research utilized a descriptive cross-sectional design conducted in Ndola City. The study population included adults aged 16 to 60 years, who were selected through simple random sampling from local health centers (Balapala et al., 2023).

3.2 Data Collection

Data were collected on participants' BMI, blood pressure measurements, and demographic information, including age and gender. Chi-square tests were employed to assess the association between BMI and OH, as well as between gender and OH.

4. Results

4.1 Association Between BMI and OH

The analysis revealed a statistically significant association between BMI and the occurrence of OH. The results of the chi-square tests are as follows: Pearson Chi-Square: 63.8815, p-value = 0.000, Likelihood-Ratio Chi-Square: 47.2373, p-value = 0.000, Cramér's V: 0.2880, indicating a moderate association. Fisher's exact test also supported these findings, with p-values of 0.000 for both two-sided and one-sided tests. These results suggest that variations in BMI are related to the prevalence of OH among adults in Ndola City (Balapala et al., 2023).

4.2 Gender and OH

In contrast, the analysis of the relationship between gender and OH yielded different results. The chi-square tests indicated no significant association: Pearson Chi-Square: 1.8646, p-value = 0.172, Likelihood-Ratio Chi-Square: 1.8732, p-value = 0.171, Cramér's V: 0.0492, indicating a very weak association, Fisher's exact test results further confirmed the lack of significance, with p-values of 0.219 for the two-sided test and 0.109 for the one-sided test. These findings suggest that the observed differences in OH prevalence between genders are likely due to chance rather than a true association (Balapala et al., 2023).

Table 1: BMI, Gender and OH

	OH recording		
BMI kg/m2	No	Yes	Total
≥18.5	618	27	645
<18.5	94	31	125
Total	712	58	770
Gender	No	Yes	Total
Female	361	24	385
Male	351	34	385
Total	712	58	770

5. Discussion

The findings of this study indicate a significant relationship between Body Mass Index (BMI) and the occurrence of orthostatic hypotension (OH), suggesting that higher BMI values may increase the risk of developing this condition. This aligns with previous research that has established BMI as a critical factor in assessing health risks, particularly cardiovascular issues, which are often exacerbated by obesity (Yiengprugsawan et al.,

2014; Baser et al., 2020). Elevated BMI is associated with various comorbidities, including hypertension and diabetes, both of which can contribute to the development of OH (Gupta & Lipsitz, 2007; Baser et al., 2020). Conversely, the analysis revealed no significant association between gender and OH prevalence. This finding is consistent with other studies that have indicated gender differences in health outcomes may be influenced more by biological and lifestyle factors rather than direct associations with conditions like OH (Balapala et al., 2023; Metcalf et al., 2011). For instance, while some literature suggests that females may have a higher prevalence of certain cardiovascular diseases, the impact of gender on OH remains less clear (Garn & Haskell, 1959; Baser et al., 2020). Moreover, the lack of significant findings regarding gender suggests that other demographic factors, such as age and lifestyle choices, may play a more crucial role in the development of OH. This is supported by evidence indicating that older age groups are more susceptible to both obesity and OH due to physiological changes associated with aging (Yiengprugsawan et al., 2014; Gupta & Lipsitz, 2007).

In summary, while BMI appears to be a significant predictor of OH among adults in Ndola City, the absence of a gender-related effect suggests that public health interventions should focus on managing BMI and associated risk factors across all demographics rather than targeting specific genders. Future research should continue to explore these relationships to develop effective strategies for preventing OH in diverse populations.

6. Limitations

Further longitudinal studies needed.

7. Conclusion

This research highlights the importance of monitoring BMI as a potential risk factor for orthostatic hypotension among adults in Ndola City. While gender does not appear to significantly influence the occurrence of OH, further studies are warranted to explore other contributing factors and to develop targeted interventions for the local population.

Use of Artificial Intelligence (AI)-assisted Technology for Manuscript Preparation

The authors confirm that there was no use of artificial intelligence (AI)-assisted technology for assisting in the writing or editing of the manuscript, and no images were manipulated using AI.

Ethical Approval Statement

The study (as part of doctoral research project) was conducted after getting approval from the National Health Research Authority, Lusaka on 29 September 2023 with Ref No: NHRA0001/29/09/2023

Declaration of Patient Consent

The authors certify that they have obtained all appropriate patient consent.

Financial Support and Sponsorship Statement

Nil.

Data Availability Statement

The datasets analysed during the current study are available from the corresponding author upon reasonable request.

Acknowledgements

The authors would like to express their gratitude to the staff of the Michael Chilufya Sata School of Medicine at Copperbelt University and urban medical centers in Ndola City for their assistance in participant recruitment and data collection. We also thank the participants for their time and willingness to contribute to this research.

Conflict of Interest Statement

The authors declare no conflicts of interest.

About the Authors

Dr. Kartheek R. Balapala is a unique doctoral research scholar in clinical physiology, at Michael Chilufya Sata School of Medicine, Copperbelt University, Zambia. His research interests span postural changes in blood pressure, mental stress and family scapegoating abuse, together with their impacts on human behaviour. Over two decades ago, he graduated as a medical doctor, published over 49 papers in global medical and education journals, and challenges himself to think about both sides of the scientific aphorisms. A firm believer of contemplation with academic tenacity. As a renowned mental health researcher, Dr. Kartheek R. Balapala advocates the concept of visualization in medical sciences for better comprehension at medical institutions around the globe and serves as an Associate editor and board member for international medical research journals. He has been mentoring medical graduates, for the past 18 years across the globe and Africa. He published over 25 books on medical concepts in eight different languages across the European Union and the globe with LAP Lambert Academic Publishers. His book on the mind mapping techniques for medical concepts, based on Leonardo da Vinci's concept of mind mapping, implied for medical students is remarkably a novel contribution to twenty-first century medical knowledge.

ORCID: orcid.org/0000-0003-2405-5105

Dr. Victor Mwanakasale is currently professorial faculty member of Basic Sciences Department, at Michael Chilufya Sata School of Medicine, Copperbelt University, Zambia. He is a globally renowned researcher on tropical diseases.

Dr. Seter Siziya is professor of Biostatistics Department at Michael Chilufya Sata School of Medicine, Copperbelt University, Zambia. He is a globally renowned researcher on medical biostatistics and public health.

Dr. Moono Silitongo is a lecturer at Michael Chilufya Sata School of Medicine, Copperbelt University, Zambia. He is a medical researcher and doctoral scholar.

References

- Balapala K R, Mwanakasale V, Simapuka L F, Mbiydzenyuy N E, 2023. Blood pressure variations associated with ageing in Sub-Saharan Africa. *European Journal of Public Health Studies* 6(1). <http://dx.doi.org/10.46827/ejphs.v6i1.138>
- Baser O, Korkmaz M, Yilmaz M, 2020. The relationship between body mass index and orthostatic hypotension in elderly patients. *Journal of Geriatric Cardiology* 17(4): 239-244.
- Chen H, Morrison L, Sheehy T, Costelloe A, Griffin M, Quinn C, O'Connor M, Peters C, Lyons D, 2022. The use of body mass index in predicting orthostatic hypotension in older adults. *Age and Ageing* 51 (Supplement_3): <https://doi.org/10.1093/ageing/afac218.289>
- Denhart H, 2008. Deconstructing barriers: Perceptions of students labeled with learning disabilities in higher education. *Journal of Learning Disabilities* 41(6): 483-497. <http://dx.doi.org/10.1177/0022219408321151>
- Garn S M, Haskell W L, 1959. The relationship between obesity and hypertension: A review. *American Journal of Public Health* 49(1): 24-30.
- Gupta V, Lipsitz L A, 2007. Orthostatic hypotension in the elderly: Diagnosis and treatment. *American Journal of Medicine* 120(10): 841-847. <https://doi.org/10.1016/j.amjmed.2007.02.023>
- Metcalf P A, Jeffs J S, Smith J P, 2011. Gender differences in cardiovascular disease risk factors: A longitudinal study. *Heart* 97(11): 908-913.
- Moloney E, McGrath K, Lyons D, O'Connor M, Peters C, 2017. Fat is Protective? Orthostatic Hypotension and High BMI. *Age and Ageing* 46 (Suppl_3): iii13–iii59. <https://doi.org/10.1093/ageing/afx144.264>
- Yiengprugsawan V, Sleight A, McNeil J J, 2014. Obesity and its association with hypertension and diabetes among older adults in Thailand: A population-based study. *BMC Public Health* 14(1): 1162.

Creative Commons licensing terms

Author(s) will retain the copyright of their published articles agreeing that a Creative Commons Attribution 4.0 International License (CC BY 4.0) terms will be applied to their work. Under the terms of this license, no permission is required from the author(s) or publisher for members of the community to copy, distribute, transmit or adapt the article content, providing a proper, prominent and unambiguous attribution to the authors in a manner that makes clear that the materials are being reused under permission of a Creative Commons License. Views, opinions and conclusions expressed in this research article are views, opinions and conclusions of the author(s). Open Access Publishing Group and European Journal of Public Health Studies shall not be responsible or answerable for any loss, damage or liability caused in relation to/arising out of conflicts of interest, copyright violations and inappropriate or inaccurate use of any kind content related or integrated into the research work. All the published works are meeting the Open Access Publishing requirements and can be freely accessed, shared, modified, distributed and used in educational, commercial and non-commercial purposes under a [Creative Commons Attribution 4.0 International License \(CC BY 4.0\)](#).