ORIGINAL ARTICLE

Pre-Employment Screening and Health Risk Profile among Newly Recruited Employees at a Public Medical University in Karachi: A Retrospective Cross-Sectional Study

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ABSTRACT

Background: Despite the growing burden of non-communicable diseases, screening of employees remains uncommon in Pakistan.

Objective: To analyze the health risk profile of newly hired employees at a public sector University in Karachi, Pakistan.

Methods: This retrospective cross-sectional study analyzed medical records of 280 newly hired employees who joined the university between 2019 and 2022. Data extraction was conducted over three months (January-March 2025). Hemoglobin concentration (g/dL) was obtained from laboratory reports provided by each employee and classified using WHO sex specific cut offs. Blood pressure was recorded by a trained nurse using a manual sphygmomanometer in a seated position after resting for five minutes. BMI was calculated as weight (kg) divided by height in metres squared (m²). Associations were assessed using the Chi-square test; p ≤0.05 was considered significant.

Results: Anemia was significantly more prevalent among females (23.8%) than males (3.9%, p=0.001). Elevated blood pressure or hypertension was more common in males (p = 0.029) and in those with higher BMI (p<0.001). Only one-quarter of employees had a normal BMI; overweight/obesity was significantly associated with older age (p=0.001) and family history of Diabetes (p<0.001).

Conclusion: The results of this study demonstrate the high rates of obesity, hypertension, and anemia among workers, with noticeable differences by age, gender, and BMI. Comprehensive and focused actions are required to control and prevent these disorders.

Keywords: Occupational health, pre-employment screening, hypertension, obesity, anemia, Pakistan, cross-sectional.

INTRODUCTION

Non-communicable diseases (NCDs) are chronic conditions that are not transmitted from person to person and are often linked to modifiable lifestyle factors such as unhealthy diet, physical inactivity, tobacco use, and harmful alcohol consumption. They are the leading cause of mortality worldwide, accounting for approximately 74% of all global deaths [1, 2]. Major NCDs include cardiovascular diseases, Diabetes, cancers, chronic respiratory diseases, and stroke. According to the World Health Organization (WHO), an estimated 1.28 billion adults globally have hypertension, and 14% of adults worldwide live with Diabetes [3]. Anemia, another significant public health concern, affects an estimated 29.9% of women of reproductive age and 39.8% of children aged 6-59 months globally, with the highest prevalence in South Asia and Sub-Saharan Africa [4]. The WHO defines anemia as a hemoglobin concentration of less than 11 g/dL in pregnant women and children under five, and less than 12 g/dL in non-pregnant women [4]. Nutritional deficiencies, malabsorption, infections, inflammations, chronic illnesses, and gynecological and obstetric emergencies may lead to anemia [5, 6]. In Pakistan, anemia is common among women and children, particularly in rural areas and socioeconomically disadvantaged groups [7, 8].

The burden of NCDs is disproportionately high in low- and middle-income countries (LMICs), where over three-quarters of NCD-related deaths occur [1]. Hypertension is the term used to describe a spike in blood pressure, either systolic or diastolic [9]. Hypertension and obesity are also major contributors to Pakistan's NCD burden. National surveys and meta-analyses have reported hypertension prevalence ranging from 18.9% in the general adult population to over 26% in young adults [10-12].

Body Mass Index (BMI) measures an individual's fat index [13]. The commonly used method to calculate relative weight and classify obesity is the BMI. It is a valuable predictor for determining the level of danger of several illnesses, especially those connected to underweight, overweight, and obesity [14]. Obesity rates are rising steadily, with urban populations and

higher BMI categories showing strong associations with elevated blood pressure and diabetes risk [13-15].

Despite this growing burden, there is limited literature from Pakistan on the health status of newly hired employees, particularly in the context of pre-employment screening. Such screening offers a unique opportunity to detect undiagnosed NCDs and risk factors early, enabling timely intervention. It also has implications for workforce productivity, as healthier employees are more likely to maintain consistent attendance, perform effectively, and incur lower healthcare costs for employers. This study sought to determine the prevalence and distribution of key health risks among newly hired employees at a public sector medical university in Karachi. Therefore, the study objective was to analyze the health risk profile of newly hired employees at a public sector University in Karachi, Pakistan.

METHODOLOGY

This retrospective cross-sectional study was conducted at a public-sector medical university in Karachi, Pakistan. All newly recruited employees, regardless of age or prior experience, undergo a mandatory pre-employment medical examination at the university's Family Medicine clinic. The study was approved from Institution's review board (JSMU/IRB/2023/725). We analyzed the health records of employees who joined between 2019 and 2022, with data extraction from records carried out between January and March 2025.

The study population comprised all newly hired employees who underwent pre-employment medical examination during the study period, as all records contained complete demographic, anthropometric, and laboratory data. No records were excluded, and no missing data were found for the variables analyzed. This was therefore a census of the entire eligible population. Two hundred eighty employee records were identified and included in the final analysis. To ensure confidentiality, all personal identifiers (including name, employee number, contact details, and national identity number) were removed at the time of data abstraction and replaced with unique study codes.

The employee's age, gender, weight, height, body mass index (BMI), and blood pressure (BP) were recorded at the Family Medicine clinic of the university on a pre-prepared form developed by the faculty of Family Medicine for record keeping of the employee's health parameters. Trained Family physician noted medical history, including comorbidities (any ongoing illness or prior physician diagnosis), family history (Diabetes, hypertension, and ischemic heart disease), and addiction history on the same form based on the employee's self-report.

Laboratory reports, which each employee was required to bring during the pre-employment medical examination, were used to determine hemoglobin concentration (g/dL).

WHO sex and pregnancy-specific cut-offs were applied. Anemia was defined as Hb < 13.0 g/dL for adult males, < 12.0 g/dL for non-pregnant females, and < 11.0 g/dL for pregnant females. Severity was further classified using WHO thresholds. In adult males, mild anemia was defined as 11.0-12.9 g/dL, moderate as 8.0-10.9 g/dL, and severe as <8.0 g/dL. In non-pregnant females, mild anemia was 11.0-11.9 g/dL, moderate 8.0-10.9 g/dL, and severe <8.0 g/dL. In pregnant females, mild anemia was 10.0-10.9 g/dL, moderate 7.0-9.9 g/dL, and severe <7.0 g/dL [16]. BP was measured by trained registered nurses using a calibrated manual sphygmomanometer with an appropriately sized cuff after resting for at least 5 minutes. Measurement was rechecked after a rest period of at least 5 minutes by the nurse and physician in cases where the initial reading was high. The BP was classified according to American Heart Association (AHA) into regular (systolic blood pressure (SBP) less than 120 mm Hg and diastolic blood pressure (DBP) less than 80 mm Hg), elevated (SBP 120-129 mm Hg and DBP less than 80 mm Hg), stage 1 hypertension (SBP 130-139 mm Hg or DBP 80-89 mm Hg) and stage 2 hypertension (SBP 140 mm Hg or higher or DBP 90 mm Hg or higher) [17].

The same nurse measured the weight and height with a stadiometer, which also has a manual weighing scale. Employees were asked to remove their outer clothing and shoes, such as coats, before standing on the stadiometer. Employees were asked to stand with heels, buttocks, and upper back against the stadiometer and to look straight ahead. The measuring bar of the calibration rod was positioned horizontally on top of the employee's head, forming a 90° angle with the calibration rod, and the height was recorded to the nearest half inch from the lower border of the measuring rod at eye level. Weight was measured to the nearest half pound, which was zero-balanced before each employee was weighed. BMI was calculated as weight (kg) divided by height in metres squared (m²). For BMI, cut-offs were taken which included 18.5 kg/m2 for underweight, 18.5-22.9 kg/m2 for normal, 23-24.9 kg/m2 for overweight, 25-29 kg/m2 for obesity I, and >30 kg/m2 for obesity II [15].

Data were entered and analyzed using SPSS version 24. Descriptive statistics were computed for all variables: means and standard deviations for continuous variables, and frequencies and percentages for categorical variables. Associations between categorical variables (*e.g.*, gender, BMI categories, blood pressure categories, and anemia status) were assessed using the Chi-square test of independence. Statistical significance was set at $p<0.05$.

RESULTS

Most of the newly hired employees were male (36.1%), and nearly half were under 30 (48.6%). The mean age of

Table 1: Demographic parameters and risk factors among employees at a public sector university in Karachi.

Variables	Groups	Frequency	Percentage
Age	18-29	139	49.6
	30-39	111	39.6
	40-49	24	8.6
	50 and more	6	2.1
Gender	Male	179	63.9
	Female	101	36.1
Comorbid conditions	Yes	16	5.7
	No	264	94.3
Family history	Yes	180	64.3
	No	100	35.7
Addiction	Smoking	24	8.6
	Pan/chaliya/gutka	22	7.9
	None	234	83.6

male employees was 30.45 ± 7.81 years (range: 18-67 years), while female employees had a mean age of 31.81 ± 7.02 years (range: 21-64 years). The average systolic blood pressure among males was 115.64 ± 10.06 mmHg (range: 80-150 mmHg) and among females was 112.97 ± 10.63 mmHg (range: 90-170 mmHg). Mean diastolic blood pressure was 75.75 ± 6.94 mmHg (range: 60-100 mmHg) in males and 74.10 ± 7.39 mmHg (range: 60-104 mmHg) in females. The mean hemoglobin concentration was 14.57 ± 1.20 g/dL (range: 11-18 g/dL) in males and 12.29 ± 1.49 g/dL (range: 8-16 g/dL) in females. Most had a family history of chronic diseases (64.3%), while only a small proportion reported smoking or chewing tobacco products (16.5%) (**Table 1**).

The overall prevalence of anemia was 11.1% (95% CI: 7.4-14.8%).

Table 2: Comparison of gender with different variables.

Variable	Groups	Male n(%)	Female n(%)	p-value
Anemia	No anemia	172 (96.1)	77 (76.2)	<0.001
	Mild anemia	07 (3.9)	10 (9.9)	
	Moderate anemia	0 (0)	14 (13.9)	
Body Mass Index	Underweight	15 (8.4)	03 (3.0)	0.078
	Normal	50 (27.9)	19 (18.8)	
	Overweight	25 (14.0)	14 (13.9)	
	Obese I	62 (34.6)	41 (40.6)	
	Obese II	27 (15.1)	24 (23.8)	
Blood Pressure	Normal	82 (45.8)	57 (56.4)	0.029
	Elevated	78 (43.6)	42 (41.6)	
	Stage 1	12 (6.7)	0 (0)	
	Stage 2	07 (3.9)	02 (2)	
Family history of Hypertension	No	123 (68.7)	45 (44.6)	<0.001
	Yes	56 (31.3)	56 (55.4)	
Family history of Diabetes Mellitus	No	111 (62.0)	43 (42.6)	0.002
	Yes	68 (38.0)	58 (57.4)	
Family history of Ischemic heart disease	No	159 (88.8)	90 (89.1)	0.942
	Yes	20 (11.2)	11 (10.9)	
Addiction	Smoking	24 (13.4)	0 (0)	<0.001
	Pan/chaliya/gutka	21 (11.7)	01 (1)	
	None	134 (74.9)	100 (99.0)	

When stratified by sex, anemia prevalence was 3.9% (95% CI: 1.0-6.8%) among males and 23.8% (95% CI: 15.3-32.2%) among females. Any female did not report pregnancy. Blood pressure abnormalities were more frequent in males, and elevated readings were widespread in employees aged 30-39 (18.5%). Overweight and obesity were strongly associated with higher blood pressure levels (p<0.001) (**Tables 2** and **3**).

Table 3: Comparison of blood pressure with different age groups and body mass index of employees.

Variable	Groups	Blood Pressure				p-value
		Normal	Elevated	Stage 1	Stage 2	
		n(%)	n(%)	n(%)	n(%)	
Age	18-29 years	70 (25.4)	59 (21.3)	5 (1.8)	2 (0.7)	0.012
	30-39 years	51 (18.5)	51 (18.5)	6 (2.2)	2 (0.7)	
	40-49 years	12 (4.3)	7 (2.5)	1 (0.4)	4 (1.4)	
	50 and more	3 (1.1)	2 (0.7)	0 (0.0)	1 (0.4)	
BMI	Underweight	15 (5.3)	3 (1.1)	0 (0.0)	0 (0.0)	<0.001
	Normal	44 (15.7)	22 (7.8)	1 (0.3)	2 (0.7)	
	Overweight	15 (5.3)	23 (8.2)	1 (0.3)	0 (0.0)	
	Obese I	51 (18.2)	46 (16.4)	3 (1.1)	3 (1.1)	
	Obese II	14 (5.0)	26 (9.2)	7 (2.5)	4 (1.4)	

Table 4: Comparison of body mass index of employees with different age groups and family history of Diabetes mellitus.

Variables	Groups	Underweight	Normal	Overweight	Obese I	Obese II	p-value
		n(%)	n(%)	n(%)	n(%)	n(%)	
Age	18-29 years	14 (5.1)	43 (15.3)	21 (7.6)	40 (14.5	18 (6.5)	0.001
	30-39 years	3 (1.1)	23 (8.3)	15 (5.4)	48 (17.4	21 (7.6)	
	40-49 years	1 (0.4)	2 (0.7)	1 (0.4)	13 (4.7)	7 (2.5)	
	50 and more	0 (0)	0 (0)	1 (0.4)	1 (0.4)	4 (1.4)	
F/H of DM	No	14 (5.0)	53 (18.9)	19 (6.8)	50 (17.8)	14 (5.0)	<0.001
	Yes	4 (1.4)	16 (5.7)	20 (7.1)	53 (18.9)	33 (11.8)	

Across the four recruitment years, the proportion of employees in each BMI category fluctuated but showed no statistically significant trend over time (p=0.214). Only about one-quarter of employees had a normal BMI (24.6%). The remainder were predominantly overweight or obese, with no significant difference between men and women. Obesity was more prevalent in older age groups and among those with a family history of Diabetes (p<0.001) (**Table 4**).

DISCUSSION

Our study had a large sample size of 280 employees, which consisted of a majority of males (63.9%). Out of these, 3.9% of males suffered from anemia, and out of the 101 females in our study, 23.8% reported having either mild or moderate anemia. These results suggest that female employees are significantly more likely to develop anemia than male employees. This trend is consistent with existing literature highlighting gender differences in anemia prevalence [18, 19]. Our study's difference in anemia rates between males and females was statistically significant. This finding further elevates the importance of considering gender when addressing public health concerns in workplace settings. The hemoglobin content in red blood cells can be impacted by dietary practices, job status, stress-related factors, and education regarding anemia and its symptoms. Anemia results from a diet deficient in fruit, green vegetables, and meat [18-20]. Menstruation, pregnancy, breastfeeding, and childbirth are also among the few factors that make women more susceptible to anemia than men [21].

According to our analysis, it was noted that there were more deranged values of blood pressure among males than in females. Similarly, values of deranged blood pressure were more prevalent in 30-39-year-old employees. Overweight and obese employees also showed a more deranged blood pressure profile than those with normal BMI. This indicates that hypertension is linked to male gender, increasing age, and increased BMI [22]. However, it is essential to note that the percentage of employees with elevated blood pressure remains relatively high, which may reflect a growing public health concern in the workforce. Our study showed that almost half of our population had deranged blood pressures between SBP 120-129 mm Hg and DBP less than 80 mm Hg, and stage 1 and 2 hypertension were not as frequently noted, which is consistent with previous studies [23]. In an Indian study conducted between 2012 and 2014 consisting of 1.3 million adults, the prevalence of hypertension in women and men was 23.6% and 27.4%, respectively [24]. The NCD Survey of Pakistan in 2016 revealed that 36.8% of men and 29.3% of women had stage I hypertension [25].

There was no relation of BMI with gender in this study. It was also noted that out of 280 patients, only 69 had normal BMI values, which make up only 24.6%. The rest of the employees had either underweight or overweight BMI values, some even reaching obese type I and II. This is an alarming situation for Pakistan's workforce as obesity itself is a threat to several other illnesses like hypertension, Diabetes, stroke, and heart diseases [26].

The findings related to the family history of Diabetes and hypertension among employees in this study provide significant insights into the prevalence of these chronic conditions within the population. According to the data, 112 (40%) patients had no family history of Diabetes or hypertension, but this does not exclude the chance of disease development later on in life, as lifestyle factors such as diet, physical activity, stress levels, and overall health behaviors play a crucial role in Diabetes and hypertension [27-30].

Our study describes the prevalence of obesity, elevated blood pressure, and anemia among employees of a public sector university in Karachi, highlighting potential areas for workplace health promotion. While the cross-sectional, single-site design limits causal inference and generalizability, the patterns observed suggest that these conditions warrant further attention in similar occupational settings. For anemia, particularly among women of reproductive age, future workplace health initiatives could explore the feasibility and impact of nutritional education, periodic screening, improved access to iron supplementation, and stress reduction strategies. Ensuring timely access to healthcare services may support early detection and management, potentially preventing progression to more severe stages.

Hypertension, a known risk factor for cardiovascular, cerebrovascular, and renal disease, was also observed in this workforce. Prospective workplace programs could evaluate strategies such as providing healthy meal options, regular blood pressure monitoring, physical activity promotion, stress management initiatives, and weight management support.

Addressing obesity in the workplace might involve piloting comprehensive wellness programs that integrate nutritional guidance, opportunities for physical activity, weight management resources, and mental health support, recognizing the links between obesity and mental health conditions such as depression and anxiety [31]. Identifying employees with higher BMI and offering tailored support—such as on one consultations with fitness or nutrition professionals could be tested for feasibility and effectiveness in future studies.

For employees reporting a family history of chronic conditions, targeted health monitoring, lifestyle counselling, and preventive education could be considered as part of a broader occupational health strategy. Any such interventions should ideally be implemented and evaluated in a prospective, multi-site context to assess their acceptability, cost, and impact before wider adoption.

This study had some limitations. It did not employ multivariable regression analysis to control for potential confounders such as age and sex. As a result, these unmeasured confounding effects may influence the observed associations. Also, the blood pressure was measured on a single occasion during the pre-employment examination; even with two readings averaged, this may overestimate hypertension prevalence due to the white coat effect. Finally, the single-site setting limits external validity, and the findings should be interpreted in the context of the local workforce and healthcare access patterns. Future studies with larger sample sizes should incorporate regression modeling to provide adjusted estimates and more robust conclusions.

CONCLUSION

This study demonstrates notable rates of obesity, elevated blood pressure, and anemia among employees of a public sector university in Karachi, with variations by age, gender, and BMI. These findings highlight potential areas for workplace health promotion, including educational initiatives, routine health examinations, lifestyle modification, and targeted support for employees at greater risk due to demographic or family history factors. While these results can inform the design of workplace wellness strategies, they are based on cross-sectional data from a single site; therefore, proposed interventions should first be piloted and evaluated in broader, prospective studies before large-scale implementation.

ETHICS APPROVAL

The study was approved from Institution's review board (JSMU/IRB/2023/725). All procedures performed in studies involving human participants were following the ethical standards of the institutional and/ or national research committee and the Helsinki Declaration.

CONSENT FOR PUBLICATION

Not applicable.

AVAILABILITY OF DATA

The data can be provided by the corresponding author on request.

FUNDING

None.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

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Declared none.

AUTHORS' CONTRIBUTION

KAS: Study conceptualization and critical review of the initial draft; AMB: Designing of the study and critical review of the initial draft; AAB, ZMA: Designing of the research and critical review of the initial draft; HZ: Result analysis and investigation, manuscript drafting; SMA: Manuscript critical review and revision of the initial draft. All authors read and approved the final manuscript.

GENERATIVE AI AND AI-ASSISTED TECHNOLOGIES IN THE WRITING PROCESS

During the preparation of this work the authors limitedly used ChatGPT (GPT-4, OpenAI) to get language suggestions and do minor proofreading in some parts of the manuscript. After using this tool/service, the authors reviewed and edited the content as needed and take full responsibility for the content of the published article.

REFERENCES

1. Budreviciute A, Damiati S, Sabir DK, Onder K, Schuller-Goetzburg P, Plakys G, et al. Management and prevention strategies for non-communicable diseases (NCDs) and their risk factors. Front Public Health 2020; 8: 574111.
DOI: https://doi.org/10.3389/fpubh.2020.574111

2. World Health Organization. Non-communicable diseases. Available from: https://www.who.int/news-room/fact-sheets/detail/noncommunicable-diseases (Accessed 2025 Mar 29).

3. Kazmi T, Nagi M, Razzaq S, Khan M, Khan S, Khan M, et al. Burden of non-communicable diseases in Pakistan. East Mediterr Health J 2022; 28: 798-804.
DOI: https://doi.org/10.26719/emhj.22.083

4. World Health Organization. Anaemia. Available from: https://www.who.int/news-room/fact-sheets/detail/anaemia (Accessed 2025 Mar 29).

5. Bhadra P, Deb A. A review on nutritional anemia. Indian J Nat Sci 2020; 10(59): 18466-74.

6. Salokhiddinovna XY. Anemia of chronic diseases. Res J Trauma Disabil Stud 2023; 2(12): 364-72.

7. Habib A, Kureishy S, Soofi S, Hussain I, Rizvi A, Ahmed I, et al. Prevalence and risk factors for iron deficiency anemia among children under five and women of reproductive age in Pakistan: Findings from the National Nutrition Survey 2018. Nutrients 2023; 15(15): 3361.
DOI: https://doi.org/10.3390/nu15153361

8. Channar HB, Laghari ZA, Ali A, Din I. Factors and determinants associated with prevalence of anaemia in adults in Karachi, Pakistan. J Pak Med Assoc 2023; 73(11): 364-72.
DOI: https://doi.org/10.47391/JPMA.7430

9. Muntner P, Shimbo D, Carey RM, Charleston JB, Gaillard T, Misra S, et al. Measurement of blood pressure in humans: A scientific statement from the American Heart Association. Hypertension 2019; 73(5): e35-66.
DOI: https://doi.org/10.1161/HYP.0000000000000087

10. Elahi A, Ali AA, Khan AH, Samad Z, Shahab H, Aziz N, et al. Challenges of managing hypertension in Pakistan—a review. Clin Hypertens 2023; 29(1): 17.
DOI: https://doi.org/10.1186/s40885-023-00245-6

11. Rafique I, Saqib MAN, Munir MA, Qureshi H, Rizwanullah M, Khan SA, et al. Prevalence of risk factors for non-communicable diseases in adults: Key findings from the Pakistan STEPS survey. East Mediterr Health J 2018; 24: 33-41.

12. Riaz M, Shah G, Asif M, Shah A, Adhikari K, Abu Shaheen A. Factors associated with hypertension in Pakistan: A systematic

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review and meta-analysis. PLoS One 2021; 16(1): e0246085.
DOI: https://doi.org/10.1371/journal.pone.0246085

13. Mohajan D, Mohajan HK. Body mass index (BMI) is a popular anthropometric tool to measure obesity among adults. J Innov Med Res 2023; 2(4): 25 33.
DOI: https://doi.org/10.56397/jimr/2023.04.06

14. Khanna D, Peltzer C, Kahar P, Parmar MS. Body mass index (BMI): A screening tool analysis. Cureus 2022; 14(2): e22119.
DOI: https://doi.org/10.7759/cureus.22119

15. Girdhar S, Sharma S, Chaudhary A, Bansal P, Satija M. An epidemiological study of overweight and obesity among women in an urban area of North India. Indian J Community Med 2016; 41(2): 154-7.
DOI: https://doi.org/10.4103/0970-0218.173492

16. World Health Organization. Haemoglobin concentrations for the diagnosis of anaemia and assessment of severity. Available from: https://iris.who.int/bitstream/handle/10665/85839/WHO_NMH_NHD_MNM_11.1_eng.pdf

17. Flack JM, Adekola B. Blood pressure and the new ACC/AHA hypertension guidelines. Trends Cardiovasc Med 2020; 30(3): 160-4.
DOI: https://doi.org/10.1016/j.tcm.2019.05.003

18. Shah SA, Soomro U, Ali O, Tariq Y, Waleed MS, Guntipalli P, et al. The prevalence of anemia in working women. Cureus 2023; 15(8): e44104.
DOI: https://doi.org/10.7759/cureus.44104

19. Ahmad R, Afsar HH, Afsar M, Mazhar S, Chaudhry S, Ashraf A, Anwar A. Frequency of anaemia in patients presenting to a tertiary care hospital in Lahore, Pakistan. Pak J Med Health Sci 2018; 12(3): 1296-9.

20. Bano R, Ahmad N, Sharma BC, Agarwal A. Nutritional anemia in the medical students. Indian Med Gaz 2012; 1: 16-8.

21. Ali SA, Abbasi Z, Shahid B, Moin G, Hambidge KM, Krebs NF, et al. Prevalence and determinants of anemia among women of reproductive age in Thatta Pakistan: Findings from a cross-sectional study. PLoS One 2020; 15(9): e0239320.
DOI: https://doi.org/10.1371/journal.pone.0239320

22. Riaz M, Shah G, Asif M, Shah A, Adhikari K, Abu Shaheen A. Factors associated with hypertension in Pakistan: a systematic review and meta analysis. PLoS One 2021; 16(1): e0246085.
DOI: https://doi.org/10.1371/journal.pone.0246085

23. Tariq M, Din MAU, Mustafa ZU, Rana SA, Kazmi R, Qamar A, et al. Assessment of the risk factors of hypertension among adults in Pakistan: A retrospective analysis. Pak Armed Forces Med J 2023; 73(Suppl 1): S119-23.
DOI: https://doi.org/10.51253/pafmj.v73i3SUPPL-1.3910

24. Geldsetzer P, Manne Goehler J, Theilmann M, Davies JI, Awasthi A, Vollmer S, et al. Diabetes and hypertension in India: A nationally representative study of 1.3 million adults. JAMA Intern Med 2018; 178(3): 363-72.
DOI: https://doi.org/10.1001/jamainternmed.2017.8094

25. Farrukh F, Abbasi A, Jawed M, Almas A, Jafar T, Virani SS, et al. Hypertension in women: A South-Asian perspective. Front Cardiovasc Med 2022; 9: 880374.
DOI: https://doi.org/10.3389/fcvm.2022.880374

26. Sarma S, Sockalingam S, Dash S. Obesity as a multisystem disease: Trends in obesity rates and obesity-related complications. Diabetes Obes Metab 2021; 23(Suppl 1): 3-16.
DOI: https://doi.org/10.1111/dom.14290

27. Yeh YK, Yen F, Hwu C. Diet and exercise are a fundamental part of comprehensive care for type 2 diabetes. J Diabetes Investig 2023; 14(8): 936-9.
DOI: https://doi.org/10.1111/jdi.14043

28. World Health Organization. Physical activity. Available from: https://www.who.int/health-topics/physical-activity (Accessed 2025 Mar 29).

29. Emelianov VV, Mutalimova NM, Baisova MA, Gruzhevsky VA, Koilakaeva NA, Markov AA. The influence of lifestyle (diet, physical activity, stress) on blood pressure. Rev Latinoam Hipertens 2024; 19(9): 380-5.
DOI: https://doi.org/10.5281/zenodo.14182130

30. Diaz KM, Shimbo D. Physical activity and the prevention of hypertension. Curr Hypertens Rep 2013; 15(6): 659-68.
DOI: https://doi.org/10.1007/s11906-013-0386-8

31. Steptoe A, Frank P. Obesity and psychological distress. Philos Trans R Soc Lond B Biol Sci 2023; 378(1822): 20220225.
DOI: https://doi.org/10.1098/rstb.2022.0225