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*Original Article*

# Dietary and Lifestyle Characteristics and Metabolic Disorders in Reproductive-Age Women: Explorative Study in Peshawar Pakistan

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## ABSTRACT

Background: In rural areas, women significantly contribute to both household and agricultural activities. Their involvement in diverse tasks impacts their health, emphasizing the need to study how their lifestyle, dietary habits, and stress levels relate to metabolic health.

Objective: This cross-sectional study aims to examine the relationship between lifestyle, dietary diversity, psychological stress, and metabolic indicators among rural women of reproductive age.

Methods: Data were collected from 300 women aged 20 to 40, free from chronic conditions, using standardized subjective and objective measures. These included assessments of nutritional status, psychosocial factors, dietary habits, physical activity, sleep duration, body composition, blood pressure, and fasting glucose levels. Dietary patterns were analyzed using Principal Component and Factor Analysis via SPSS.

Results: The average age of the participants was 27 years. Mean weight was 61.7 ± 14.2 kg and mean height 156.3 ± 5.7 cm. About 31% were overweight and 13% underweight. The average Perceived Stress Score was 14.9, with 47.5% experiencing low stress and 8.5% high stress. Dietary diversity was low for 42.5% of the women. Sedentary lifestyles correlated strongly with adverse metabolic indicators. Principal dietary patterns identified were savory cereals, dairy-based vegetables, and high-fat red meat. High-fat red meat consumption showed strong correlations with increased BMI and visceral body fat.

Conclusion: Lifestyle factors, psychological stress, and dietary patterns, especially high consumption of red meat and fat, significantly influence metabolic health among rural women.

Keywords: Dietary patterns, lifestyle, metabolic markers, nutritional status, psychological factors, rural women, stress levels.

## INTRODUCTION

In Pakistan, over half of the population resides in rural areas where women, constituting approximately 49% of the national demographic, play a pivotal role in both domestic and agricultural realms (1). These women are integral to the agricultural workforce, supporting their families by managing both household duties and agricultural activities such as crop cultivation and livestock care. Such contributions are vital to the local economy and mirror findings from other developing nations that underscore the significant economic role played by rural women (2).

Research spanning various global settings has consistently highlighted factors influencing women's health and dietary status. Key elements include dietary habits, psychological stress, environmental influences, and the challenge of securing adequate family nutrition (3, 4, 5, 6). Despite the critical nature of these factors, many individuals still lack access to basic nutritional needs (5). Modern lifestyle choices further compound these issues, with poor dietary habits and inadequate nutrition intake linked to chronic diseases such as diabetes, renal disease, and cardiovascular disorders (8). Internationally, numerous health initiatives aim to mitigate these risks through dietary interventions, such as France's Nutrition and Health Program, which focuses on reducing cardiovascular

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risk through dietary improvements (9), and the Dietary Guidelines for Americans, which emphasize reducing serum cholesterol levels (10).

Metabolic syndrome, a cluster of conditions that significantly increase the risk of developing diabetes and cardiovascular diseases, exemplifies the chronic health challenges linked to lifestyle and diet (11). Stress has been identified as a major contributor to metabolic disorders, with research indicating that psychological stress might not only be prevalent but also a predictive factor for the syndrome, particularly affecting women who are more prone to stress-induced depression (12, 13, 14, 15). Additionally, dietary diversity and quality play critical roles in sustaining physical health and preventing illnesses, including mental disorders (16, 17).

The focus of the current exploratory study is the slum areas of Peshawar, where there is a pressing need to examine the dietary habits and lifestyle choices of reproductive-age women. This research aims to delineate the relationship between individual characteristics, modifiable lifestyle factors, particularly dietary intake, and the risk of metabolic disorders among this population. Furthermore, it seeks to assess how recommended lifestyle adjustments can influence standard blood biochemistry profiles, thereby providing evidence for the potential benefits of these interventions. The ultimate goal is to enhance understanding of how lifestyle and dietary habits influence metabolic health, thereby informing future health policies and interventions tailored to the needs of women in Peshawar's slum regions.

## METHODS

This cross-sectional study was conducted in the rural district of Peshawar, Pakistan, where a diverse sample of 310 pre-menopausal women was selected from remote areas such as Palosi, Regi, Pishtahara Paya, Badhber, and Lakarai Kaniza. Selection criteria included being non-pregnant, non-nursing, free from chronic conditions, and appearing healthy. Local health facilities provided preliminary demographic data, which facilitated the random selection of households for the study based on the distribution of residents and estimated number of dwellings (18).

Data collection employed a mix of qualitative and quantitative methods through face-to-face interviews using structured questionnaires. These instruments gathered comprehensive data on participants' physical activity levels, usual dietary intake, family wealth index, sociodemographic status, stress levels, nutritional and health status, and dietary diversity. The wealth index was derived from durable asset ownership, including electronics, transportation, and agricultural resources. The Global Physical Activity Questionnaire (GPAQ) was utilized to assess physical activity across work, transit, and recreational domains, reflecting activity patterns in developing countries as part of the WHO STEPs initiative (19).

Dietary diversity was evaluated using the Minimum Dietary Diversity for Women (MDD-W) introduced by the Food and Agriculture Organization and the Food and Nutrition Technical Assistance Project in 2014, which involves ten food groups. Consumption from at least five of these groups indicates a higher likelihood of meeting micronutrient needs (18). The frequency of dietary intake was recorded using a food frequency questionnaire.

Stress levels were measured using the Perceived Stress Scale (PSS), which is widely used to assess an individual's perception of stress. Participants answered ten questions, with their responses scored to categorize stress into high, moderate, or low levels.

Nutritional and metabolic indicators were assessed by measuring body weight, height, and waist and hip circumferences using standard scales and a stadiometer. Body mass index (BMI) and Waist to Hip Ratio (WHR) were calculated accordingly. Blood sugar levels were determined using the Prink technique with the AccuaCheck Performa on fasting participants. Blood pressure was measured using an automatic sphygmomanometer after participants rested for about ten minutes.

Statistical analysis was conducted using SPSS, where data were analyzed for accuracy and suitability for further research through descriptive statistics, including mean, mode, median, range, and frequency. Differences in scaled and categorical variables were examined using the Chi-square test and Student's T-test, respectively. One-way ANOVA was employed to compare more than two groups. Principal Component Analysis (PCA) was used to identify dietary patterns from the nutrient profiles and similarity indices of 35 dietary groups, revealing patterns such as "cereals- savoury," "vegetables- dairy," and "red meat — high fat," with corresponding factor loadings illustrated in subsequent figures.

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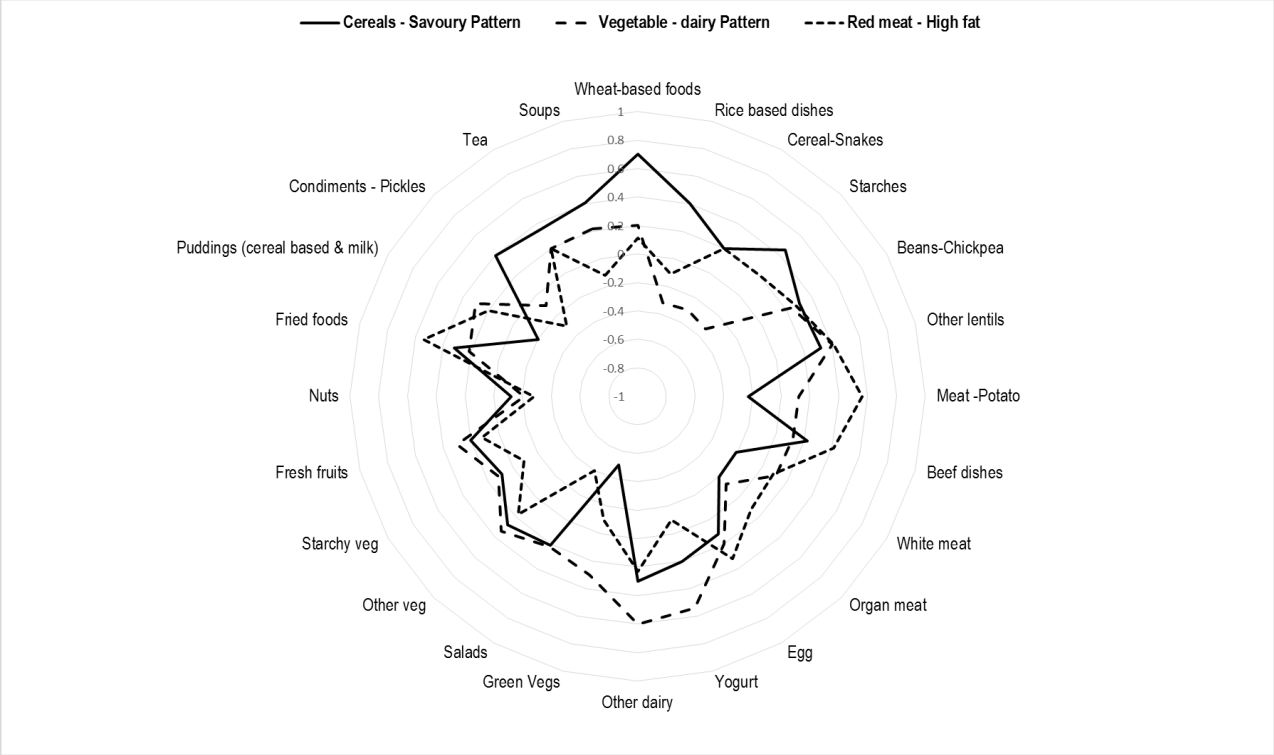


## RESULTS

In the current study, 310 pre-menopausal women from rural areas of Peshawar participated, and all data were meticulously collected and analyzed in line with the study's objectives. Prior to analysis, the data underwent thorough checks for entry errors, homogeneity, and distribution to ensure accuracy and consistency. The sociodemographic characteristics of the participants are detailed in Table 1, which reflects a cohort with an interquartile age range of 20–40 years. The majority of these women belonged to nuclear families (55%), with 53% married and 47% single, and a notable proportion lacked formal education. The typical monthly income was reported as RS 29,000, aligning with the national average for family size in Pakistan.

Nutritional and metabolic health assessments included measurements of physical attributes and key health indicators such as body mass index (BMI), mid-arm circumference (MUAC), fasting blood glucose levels, and blood pressure. The results, as shown in Table 2, revealed mean heights and weights of 156.3 cm and 61.7 kg, respectively, with an average BMI of 25.2 Kg/m^2. The study found 39.0% of participants to be of normal weight, 31.0% overweight, 13.0% underweight, and 18.0% obese. The average fasting blood glucose level was 5.7 mmol/L, with systolic and diastolic blood pressures averaging 116.6 mmHg and 79.2 mmHg, respectively, all within normal ranges.

The assessment of dietary diversity, stress levels, and lifestyle characteristics revealed that most women reported a diet that met their needs, likely due to access to diverse food sources such as grains, vegetables, fruits, eggs, milk, and dairy products from agricultural and livestock activities (20). Only 8.5% of the participants reported high levels of perceived stress, which is lower than expected and may reflect the relatively stable provision of basic needs within the cohort (21). The physical activity data indicated that the majority of women led sedentary lifestyles, a finding consistent with patterns observed in other Asian populations (22, 23). Average sleep duration was within normal limits.

The relationship among anthropometric data, metabolic indicators, lifestyle, stress levels, and dietary habits is compiled in Table 4. Visceral body fat showed a significant correlation with stress levels, whereas correlations with total body fat, fasting glucose, and systolic blood pressure were moderate. Physical activity levels were inversely correlated with systolic blood pressure, though not significantly, and showed a negative trend with visceral body fat and fasting blood sugar levels. Sleep patterns had a slight negative correlation with visceral body fat. Dietary intake of dairy and vegetables was negatively correlated with diastolic blood pressure, visceral body fat, and fasting blood sugar, whereas high red meat consumption correlated with higher BMI, visceral body fat, diastolic blood pressure, and total body fat (26).

A significant correlation was observed between the red meat-high fat dietary pattern and both visceral body fat and BMI ($r=0.330$, $p<0.001$), with trends showing higher BMIs and body fat in the quintiles consuming more red meat (figures 1 and II). The lifestyle factors, notably physical activity, significantly influenced the women's nutritional status, as evidenced by the health metrics of the

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moderately active compared to the sedentary groups detailed in Table 5. Women with moderate physical activity levels exhibited significantly lower weights, BMI, visceral body fat, and blood pressure, indicating better cardiovascular and metabolic health.

Stress significantly impacted nutritional and metabolic health, with stressed women consuming poorer diets and demonstrating higher weights, BMIs, and MUACs (Table 6 and 7). Women reporting higher stress levels also had significantly higher total and visceral body fat, as well as blood pressure, compared to their less stressed counterparts. In contrast, women with lower stress scores reported greater dietary diversity and longer sleep durations, underscoring the interplay between stress and health outcomes (29, 30, 31).

**Table 1 Socio-economic characteristics of the women**

| Characteristics | | Mean ± SD / N (%) |
|---|---|---|
| Age (year) | | 27.1±6.6<br>(Range: 20 – 40) |
| Marital Status | Married | 164.1 (53%) |
| | Single | 146.1 (47%) |
| Education Level | Illiterate | 149.1(48%) |
| | SSC or below | 97.1(31%) |
| | HSSC | 34.1(11%) |
| | Graduates | 30.1(10%) |
| Family types | Joint | 140.1(45%) |
| | Nuclear | 170.1(55%) |
| Family Size | | 7±1.6 |
| Family Size categories | <=5 | 41.1(13%) |
| | 6-10 | 158.1(51%) |
| | >10 | 111.1(36%) |
| Parity | Single | 146.1(47%) |
| | None | 30.1(10%) |
| | <=3 children | 62.1(20%) |
| | 4-5 children | 53.1(17%) |
| | >5 children | 19.1(6%) |
| Monthly Income (PKR)* | | 29.1±19 |

* Income in Thousand

**Table-2: Nutritional and metabolic Indicators of the women.**

| Indicators / Nutritional Status | Mean ± SD (Range) |
|---|---|
| Weight (Kg) | 61.7±14.2<br>(Range: 41 – 120) |
| Height (cm) | 156.3±5.6<br>(Range: 144 – 172) |
| Mid Upper Arm Circumference – MUAC (cm) | 28.1±4.6<br>(Range: 18 – 45) |
| Body mass Index – BMI (Kg/m2) | 25.2±5.7<br>(Range: 14.5 – 44.2) |
| Normal (BMI: 18.5 – 24.9) | 120.0 (39%) |
| Underweight (BMI: <18.5) | 40.0 (13%) |
| Overweight (BMI:25- 30) | 95.0 (31%) |
| Obese (BMI: >30) | 55.0 (18%) |
| Fasting blood glucose – FBG (mg/dl) | 90.8±10.1<br>(Range: 65 – 144) |
| Tot Body Fat (%) | 37.2±9.1<br>(Range: 19 – 57) |

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| Indicators / Nutritional Status | Mean ± SD (Range) |
|---|---|
| Visceral Body fat (%) | 5.7±2.6<br>(Range: 2 – 16) |
| Systolic Blood Pressure (mmHg) | 116.6±11.2<br>(Range: 90 – 180) |
| Diastolic Blood Pressure (mmHg) | 79.2±9.1<br>(Range: 57 – 128) |

Table 3: Dietary, perceived stress and lifestyle characteristics of the women

| Characteristics | | Mean ± SD / N (%) |
|---|---|---|
| Dietary Diversity score | | 6.8±0.9 |
| Dietary Diversity level | Low diversity | 132.0 (42.3%) |
| | Adequate | 178.0 (57.7%) |
| Perceived Stress Score (PSS) | | 14.9±7.8 |
| Perceived Stress level | Low | 148.0 (47.4%) |
| | Moderate | 138.0 (44.2%) |
| | High | 27.0 (8.4%) |
| MET – Min per week | | 556.0±215 |
| Physical Activity level | Sedentary | 179.0 (57.4%) |
| | Moderate | 133.0 (42.6%) |
| Duration of sleep (hrs) | | 7.18±1.98 |

Table-4: Life style & Perceived stress and dietary patterns with indicators of metabolic disorders:

| | BMI | TBF | VBF | FBG | SBP | DBP |
|---|---|---|---|---|---|---|
| PSS | 0.128* | 0.198* | 0.299** | 0.125* | 0.155* | 0.081 |
| PAL (MET-Min / Week) | -0.109* | -0.059 | -0.108 | -0.111 | -0.144* | -0.087 |
| Sleep duration | -0.068 | -0.078 | -0.186* | -0.043 | -0.061 | -0.017 |
| Cereals – Savory | -0.077 | -0.089 | -0.029 | -0.021 | -0.026 | -0.029 |
| Vegetable – dairy | -0.058 | -0.074 | -0.115* | -0.118* | -0.016 | -0.156* |
| Red meat – High fat | 0.341** | 0.208** | 0.331** | 0.067 | 0.118* | 0.263** |

BMI=Body Mass Index, TBF=Total Body Fat, VBF=Visceral Body Fat, FBG=Fasting Blood Glucose, SBP=Systolic Blood Pressure, DBP=Diastolic Blood Pressure, PSS=Perceived Stress Scale, PAL=Physical Activity Level, MET =Metabolic Equivalent of task
* $p<0.05$, ** $p<0.01$

Table 5: Nutritional and metabolic indicators by physical activity level (PAL)

| Indicators | Mean±SD | | Mean Difference | p-value |
|---|---|---|---|---|
| | Sedentary PAL (n=178) | Moderate PAL (n=132) | | |
| Age (Year) | 27±6.7 | 27±5.7 | 0.18 | NS |
| Weight (kg) | 63.3±15.5 | 59.1±11.9 | 4.07 | 0.009 |
| Height (cm) | 156.4±5.9 | 157.2±5.6 | 0.88 | NS |
| BMI | 26±6.1 | 24±4.7 | 1.97 | 0.001 |
| TBF (%) | 37.7±9.5 | 36.1±8.9 | 1.46 | NS |
| VBF (%) | 5.7±2.9 | 5.2±1.9 | 0.62 | 0.035 |
| SBP (mmHg) | 118±10.8 | 114±10.9 | 4.5 | <0.001 |
| DBP (mmHg) | 79±9.7 | 77±7.3 | 2.1 | 0.021 |
| FBG (mg/dl) | 91±10.7 | 90±9.3 | 1.2 | NS |

PAL= Physical Activity Level; BMI= Body Mass Index; TBF=Total Body Fat; VBF=Visceral Body Fat; SBP=Systolic Blood Pressure; DBP= Diastolic Blood Pressure; FBG=Fasting blood glucose; NS=Non Significant

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Table- 6: Anthropometric measurement by level of PSS

| Indicators | Mean±SD | | | P for trend |
|---|---|---|---|---|
| | Levels of Perceived Stress | | | |
| | Low | Moderate | High | |
| Age (Year) | 26.6±5.5[a] | 26.5±6.4[a] | 30.8±7.4[b] | 0.003 |
| Weight (kg) | 58.6±10.8[a] | 60.8±13.4[a] | 81.1±18.6[b] | 0.000 |
| Height (cm) | 157±5.7[a] | 157±5.6[a] | 155±6.1[a] | NS |
| BMI | 23.7±4.2[a] | 24.7±5.3[a] | 33.5±6.8[b] | 0.000 |
| MUAC | 27.4±4.2[a] | 27.7±4.4[a] | 31.6±5.9[b] | 0.000 |

Means with similar letters in the rows are statistically NOT significant

Table- 7: Body fat, dietary, physical activity and metabolic characteristics by PSS

| Indicators | Mean±SD | | | p-for trend |
|---|---|---|---|---|
| | Levels of Perceived Stress | | | |
| | Low | Moderate | High | |
| Total Body fat (%) | 36.1±7.8[a] | 36.2±9.8[a] | 45.1±10.2[b] | 0.000 |
| Visceral Body fat (%) | 5.2±1.9[a] | 5.2±2.4[a] | 9.3±3.9[b] | 0.000 |
| Fasting Blood glucose (mg/dl) | 90±8.2[a] | 90.5±12.2[a] | 95±6.9[a]* | NS |
| Systolic BP (mmHg) | 115±10.7[a] | 117±11.2[ab] | 121±12.8[b] | 0.038 |
| Diastolic BP (mmHg) | 78.2±9.4[a] | 78.2±8.2[a] | 83±9.2[b] | 0.032 |
| Dietary Diversity score | 5±2.4[a] | 5±2.2[a] | 4±2.2[b] | 0.003 |
| Sleeping duration (hours) | 8±2.2[a] | 7±2.2[a] | 5.3±2.5[b] | 0.000 |
| MET-Min / Week | 649.3±209[a] | 485±191.2b* | 392±119[b]* | 0.000 |

Means with similar letters in the rows are statistically NOT significant

* Difference between Low and High groups is marginal (p=0.06)


*Figure 1 Trend in Body Mass Index by Quintiles of Red Meat – High Fat Patterns*

p-for trend <0.001

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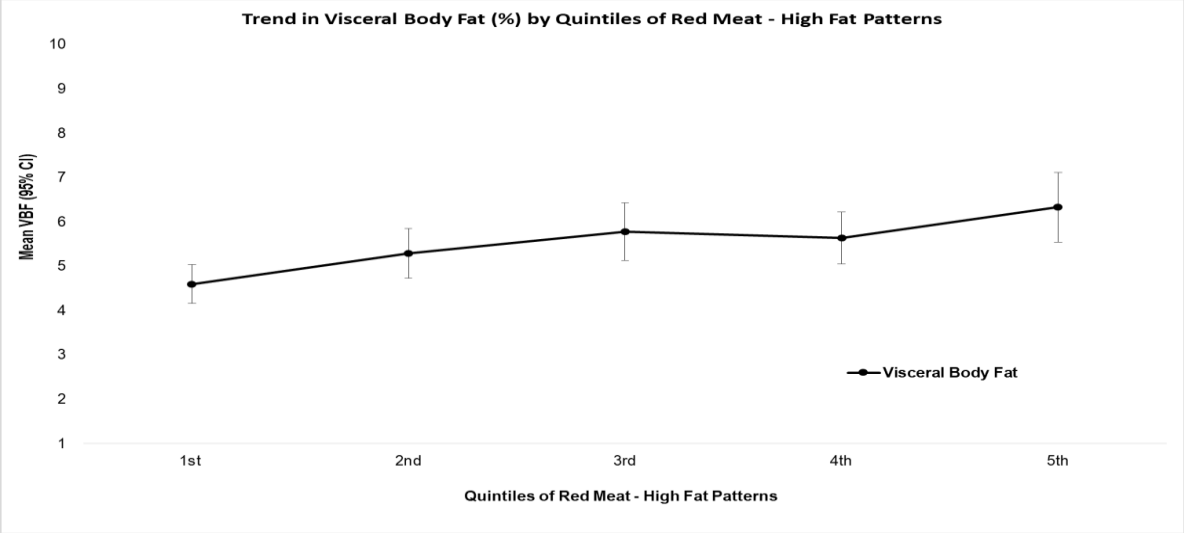


*Figure 2 Trend in Visceral Body Fat by Quintiles of Red Meat – High Fat Patterns*

p-for trend <0.001

## DISCUSSION

This cross-sectional study investigated the relationship between lifestyle, dietary diversity, and perceived stress with metabolic indicators among reproductive-age women in rural Peshawar. Random selection facilitated the recruitment of participants from several localities, leveraging local health institutions to capture a demographic representative of the rural districts. The sample comprised 310 premenopausal women who were non-lactating, non-pregnant, and free from chronic diseases, reflecting a specific health demographic within the population.

The study's findings demonstrated that most women had metabolic and nutritional parameters within normal ranges, with an average BMI and MUAC indicating moderate nutritional status. Dietary diversity scores varied, with a significant portion of the sample achieving sufficient dietary diversity, which correlated with better metabolic profiles. This supports the hypothesis that greater dietary diversity, which includes the consumption of a wider range of food groups, is associated with better health outcomes. However, the consumption of red meat was strongly linked to higher BMI, visceral body fat, and adverse blood pressure indices, which is consistent with existing literature indicating that high meat diets are often correlated with poorer cardiovascular and metabolic outcomes (26).

Stress levels showed a notable correlation with metabolic parameters; higher perceived stress was linked to increased visceral body fat and less favorable metabolic indicators. This finding aligns with previous research suggesting that stress can significantly impact physical health and is particularly relevant in discussions on chronic disease management and prevention (29, 30).

The study utilized robust data collection methods, including face-to-face interviews and standardized questionnaires, enhancing the reliability of the data. However, the use of convenience sampling and the study's cross-sectional nature limit the generalizability of the results and the ability to infer causality. The study's focus on a rural demographic may not reflect the experiences of urban women, who may have different lifestyle and dietary patterns.

Additionally, the study did not account for some potentially confounding variables such as genetic predispositions and long-term health histories, which could influence metabolic health. Future studies could benefit from incorporating these factors to provide a more comprehensive analysis of the influences on metabolic health.

The relationship between lifestyle factors and metabolic health as identified in this study underscores the importance of holistic health approaches in rural healthcare strategies. Interventions aimed at improving dietary diversity and managing stress could be beneficial in this demographic, potentially mitigating the risk of chronic conditions associated with poor diet and high stress. Such insights are vital for policymakers and healthcare providers focusing on rural health optimization.

## CONCLUSION

This study illustrates the significant influence of lifestyle, dietary diversity, and stress on the metabolic health of reproductive-age women in rural Peshawar. Despite generally healthy metabolic indicators across the cohort, high red meat consumption was associated with adverse metabolic profiles, highlighting the need for dietary guidance. Elevated stress levels were linked to increased

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visceral body fat, emphasizing the impact of psychosocial factors on physical health. The findings suggest that enhancing dietary diversity and implementing stress reduction programs could improve metabolic health. These interventions are particularly pertinent for rural healthcare strategies, where tailored approaches can help mitigate the risk of chronic diseases and enhance overall community health outcomes.

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## REFERENCES

1. Pakistan Bureau of statistics (2017). "Pakistan Census " Available online: http://www.pbs.gov.pk/content/population-census.
2. Begum, R. and G. Yasmeen (2011). "Contribution of Pakistani women in agriculture: productivity and constraints." Sarhad Journal of Agriculture 27(4).
3. Kraja, F., et al. (2016). "Socio-Demographic and Lifestyle Correlates of Self-Perceived Health Status in a Population-Based Sample of Albanian Adult Men and Women." Mater Sociomed 28(3): 173-177.
4. Weigel, M. M., et al. (2016). "Association of household food insecurity with the mental and physical health of low-income urban Ecuadorian women with children." Journal of environmental and public health 2016.
5. Singh, M. (2018). "Health and welfare of women and child survival: a key to nation building." The Indian Journal of Pediatrics 85(7): 523-527.
6. Carskadon, M. A. and W. C. Dement (2005). "Normal human sleep: an overview." Principles and practice of sleep medicine 4: 13-23.
7. Skillgate, E., et al. (2017). "Healthy lifestyle behavior and risk of long duration troublesome neck pain or low back pain among men and women: results from the Stockholm Public Health Cohort." Clin Epidemiol 9: 491-500.
8. McCullough, M. L., et al. (2002). "Diet quality and major chronic disease risk in men and women: moving toward improved dietary guidance." The American journal of clinical nutrition 76(6): 1261-1271.
9. Hercberg, S., et al. (2008). "The French national nutrition and health program: 2001–2006–2010." International Journal of Public Health 53(2): 68-77.
10. Verschuren, W. M., et al. (1995). "Serum total cholesterol and long-term coronary heart disease mortality in different cultures: Twenty-five—year follow-up of the seven countries study." Jama 274(2): 131-136.
11. Resnick, H. E., et al. (2003). "Insulin resistance, the metabolic syndrome, and risk of incident cardiovascular disease in nondiabetic American Indians: the Strong Heart Study." Diabetes care 26(3): 861-867.
12. Pyykkönen, A.-J., et al. (2010). "Stressful life events and the metabolic syndrome: the prevalence, prediction and prevention of diabetes (PPP)-Botnia Study." Diabetes care 33(2): 378-384.
13. Aschbacher, K., et al. (2014). "Chronic stress increases vulnerability to diet-related abdominal fat, oxidative stress, and metabolic risk." Psychoneuroendocrinology 46: 14-22.
14. Parker, G. and H. Brotchie (2010). "Gender differences in depression." International review of psychiatry 22(5): 429-436.
15. Steptoe, A. and M. Kivimäki (2013). "Stress and cardiovascular disease: an update on current knowledge." Annual review of public health 34: 337-354.
16. Weng, T.-T., et al. (2012). "Is there any relationship between dietary patterns and depression and anxiety in Chinese adolescents?" Public health nutrition 15(4): 673-682.
17. Ruel, M. T. (2003). "Operationalizing dietary diversity: a review of measurement issues and research priorities." The Journal of nutrition 133(11): 3911S-3926S.
18. Food and Agriculture Organization (2015). "Women in Agriculture in Pakistan. Report available online: http://www.fao.org/3/a-i4330e.pdf.".
19. World Health Organization, 2005
20. Sibhatu, K. T., et al. (2015). "Production diversity and dietary diversity in smallholder farm households." Proceedings of the National Academy of Sciences 112(34): 10657-10662.
21. Hiza, H. A., et al. (2013). "Diet quality of Americans differs by age, sex, race/ethnicity, income, and education level." Journal of the Academy of Nutrition and Dietetics 113(2): 297-306.
22. Sahebkar, M., et al. (2018). "Prevalence and correlates of low physical activity in the Iranian population: National survey on non-communicable diseases in 2011." Scandinavian journal of medicine & science in sports 28(8): 1916-1924.
23. Hallal, P. C., et al. (2012). "Global physical activity levels: surveillance progress, pitfalls, and prospects." The lancet 380(9838): 247-257.

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24. Hamer, M. (2012). "Psychosocial stress and cardiovascular disease risk: the role of physical activity." Psychosomatic Medicine 74(9): 896-903.
25. Rosengren, A., et al. (2004). "Association of psychosocial risk factors with risk of acute myocardial infarction in 11 119 cases and 13 648 controls from 52 countries (the INTERHEART study): case-control study." The lancet 364(9438): 953-962.
26. Wang, Y. and M. A. Beydoun (2009). "Meat consumption is associated with obesity and central obesity among US adults." International journal of obesity 33(6): 621.
27. Woodcock, J., et al. (2010). "Non-vigorous physical activity and all-cause mortality: systematic review and meta-analysis of cohort studies." International journal of epidemiology 40(1): 121-138.
28. Carnethon, M. R. (2009). "Physical activity and cardiovascular disease: how much is enough?" American journal of lifestyle medicine 3(1_suppl): 44S-49S.
29. Roberts, C. J., et al. (2014). "Increases in weight during chronic stress are partially associated with a switch in food choice towards increased carbohydrate and saturated fat intake." European Eating Disorders Review 22(1): 77-82.
30. Zellner, D. A., et al. (2006). "Food selection changes under stress." Physiology & behavior 87(4): 789-793.
31. Stetson, B. A., et al. (1997). "Prospective evaluation of the effects of stress on exercise adherence in community-residing women." Health Psychology 16(6): 515.