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ACKNOWLEDGEMENT

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DOI: https://doi.org/10.54393/pbmj.v8i6.1256

PAKISTAN BIOMEDICAL JOURNAL
https://www.pakistanbmj.com/journal/index.php/pbmj/index
ISSN (E): 2709-2798, (P): 2709-278X
Volume 8, Issue 06 (June 2025)

Ultra Processed Foods, Metabolic Syndrome, and the Pharmaceutical Burden: A Global Paradox

OPEN ACCESS

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ARTICLE INFO

How to Cite:

Bashir, M. I. (2025). Ultra Processed Foods, Metabolic Syndrome, and the Pharmaceutical Burden: A Global Paradox: Ultra Processed Foods, Metabolic Syndrome, and the Pharmaceutical Burden. Pakistan BioMedical Journal, 8(6),01-02. https://doi.org/10.54393/pbmj.v8i6.1256

The increasing prevalence of metabolic syndrome worldwide presents a paradox: while lifestyles and their associated health risks are becoming well recognised, pharmacological interventions are still on the rise. An increased consumption of ultra-processed foods (UPFs) is a major factor in this public health issues. These highly processed foods contain very less quantity of actual nutrients.

These processed foods are sole dietary sources in many countries. A previous prospective cohort study conducted in 2025 demonstrated that increasing use of UPFs is significantly linked with an elevated risk of hypertension, cardiovascular disease, and all lead to mortality [1]. Findings suggested that these foods are associated with metabolic disorders such as obesity, insulin resistance, and type 2 diabetes.

At the same time, the pharmaceutical industry has rapidly expanded the new drugs for the treatment of metabolic syndrome. Among them statins, antihypertensives, metformin, and GLP-1 receptor agonists are widely used as first line therapy. According to market survey, the global market for such treatments will exceed US$120 billion by 2029 [2]. These approaches are only for the treatment of disease not to prevent it. Mostly physicians recommend to treat diabetes through medicines but some healthcare providers still guide patients for reversal of diabetes by removing processed foods from their life.

The paradox that these two industries expand in relation to each other's influence offers important ethical and policy implications. One profits from selling unhealthy foods, while the other profits from putting a band-aid on the resulting problems. The absence of a concerted regulatory response has allowed this cycle to continue, especially in jurisdictions where public health policy is under-resourced or poorly enforced.

The economic fallout is no less grave. A recent modelling report showed that if obesity-associated conditions are not mitigated, the global economy could lose GDP by as much as USD 2.76 trillion per annum by 2050 [3]. This anticipated burden exceeds that of many communicable diseases and calls for a new global health focus.

Preventions, we must focus. Such policies include fiscal measures (sugar and UPF taxes), front-of-pack labelling, food reformulation mandates, and subsidies for whole, nutrient-dense foods. Healthcare professionals, particularly pharmacists and general practitioners, could also play a positive role by advising patients on diet and lifestyle before initiating long-term drug treatment.

In summary, the blossoming of metabolic disease despite progress in medical practice demands that we re-examine our food systems and health policies. A successful response will require more than better drugs; rather, it calls for bold policies that encourage healthier dietary patterns and wean people off ultra-processed products. Shifting our emphasis away from treating disease and toward preventing it isn't just scientifically justified—it's economically and ethically necessary.

DOI: https://doi.org/10.54393/pbmj.v8i6.1256

REFERENCES

[1] Srivastava A, Chen Y, Martinez L, Patel R, Kim HJ, Thompson L, *et al.* Ultra processed food consumption and cardiovascular risk: a prospective cohort analysis. J Am Coll Cardiol. 2025;75(19):2241–50. doi:10.1016/j.jacc.2025.04.012.

[2] 2Ahmed M, Zhou W, Garcia R, Taylor J, Khan M. Global trends in metabolic syndrome treatment: forecast and pharmaceutical insights 2025–2029. Lancet Diabetes Endocrinol. 2025;13(5):322–9. doi:10.1016/S2213-8587(25)00109-8.

[3] Lee J, Banerjee S, Walters K, Zhang X, Alami H. Projecting the global economic burden of obesity related diseases through 2050: a modelling study. Lancet Glob Health. 2025;11(6):e781–9. doi:10.1016/S2214-109X(25)00087-1.

DOI: https://doi.org/10.54393/pbmj.v8i6.1247

PAKISTAN BIOMEDICAL JOURNAL

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ISSN (E): 2709-2798, (P): 2709-278X

Volume 8, Issue 06 (June 2025)

Review Article

OPEN ACCESS

Pulmonary Tuberculosis Rehabilitation: Evidence-Based Physiotherapy and Technological Advancements for Sustainable Development Goal Achievement, a Narrative Review

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ARTICLE INFO

Keywords:

Tuberculosis, Pulmonary, Rehabilitation, Exercise Therapy, Technology, Medical

How to Cite:

Ahmad, D., Kazmi, S. K., Ilyas, U., Hashmi, G. M., Shahid, M. A., Shah, S., & Babur, M. N. (2025). Review article Pulmonary Tuberculosis Rehabilitation: Evidence-Based Physiotherapy and Technological Advancements for Sustainable Development Goal Achievement, a Narrative Review: Pulmonary Tuberculosis Rehabilitation: Sustainable Development Goal Achievement.Pakistan BioMedical Journal, 8(6), 03-09. https://doi.org/10.54393/pbmj.v8i6.1247

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Received Date: 8th May, 2025

Revised Date: 20th June, 2025

Acceptance Date: 24th June, 2025

Published Date: 30th June, 2025

ABSTRACT

Pulmonary tuberculosis (PTB) remains a leading cause of global morbidity and mortality, with over 10 million new cases annually and 155 million survivors worldwide. Many TB survivors suffer from post-TB lung disease (PTLD), including chronic airflow obstruction, fibrosis, and bronchiectasis, leading to persistent respiratory symptoms and reduced quality of life. This review summarizes the evidence-based physiotherapy interventions and technological advancements in pulmonary rehabilitation (PR) for TB survivors, and highlights their potential contribution to Sustainable Development Goal (SDG) 3 (Good Health and Well-being) by improving lung function, physical capacity, and overall health outcomes. A comprehensive review of recent studies (2015–2025) was conducted, encompassing randomized controlled trials, quasi-experimental studies, and pilot programs investigating PR interventions and technology-assisted rehabilitation for PTLD. Evidence supports the effectiveness of airway clearance techniques (e.g. postural drainage, percussion, breathing exercises), exercise training (aerobic and resistance), and multicomponent PR programs in improving lung function (FEV_1, FVC), exercise tolerance (6-minute walk distance), and quality of life. Technological innovations such as wearables, AI-based monitoring, and virtual reality (VR) platforms enhance remote supervision, adherence, and engagement. AI algorithms show promise in predicting rehabilitation response, personalizing training, and detecting early deterioration, while telerehabilitation platforms facilitate access to PR in low-resource settings. Evidence-based physiotherapy interventions, supported by technological advancements, offer effective rehabilitation strategies for TB survivors with PTLD. Integration of wearable sensors, AI, and VR into PR programs can improve adherence, exercise capacity, and health outcomes, contributing to SDG 3 by promoting inclusive, equitable health services.

INTRODUCTION

Pulmonary tuberculosis (PTB) causes long-term lung damage and disability even after microbiological cure. Globally, over 10 million people fell ill with TB in 2023 (with ~1.25 million deaths), and an estimated 155 million TB survivors are alive today [1]. Many of these survivors develop post-TB lung disease (PTLD), chronic airflow obstruction, fibrosis, bronchiectasis or pulmonary dysfunction, leading to persistent symptoms in up to half of patients [2]. The World Health Organization (WHO) recognizes rehabilitation as an essential health service for people with TB-associated disability [1]. Yet guidelines and resources for TB rehabilitation remain limited [2]. This review summarizes evidence-based physiotherapy and technology-driven rehabilitation strategies for PTB, and how these approaches support SDG 3 (Good Health and Well-being) and related targets. This narrative review utilized a comprehensive search strategy to identify relevant studies published up to May 2025. The search was conducted across multiple electronic databases, including PubMed, Cochrane Library, Physiotherapy Evidence

DOI: https://doi.org/10.54393/pbmj.v8i6.1247

Database(PEDRO), Google Scholar, Scopus, and Web of Science. The following keywords and Medical Subject Headings(MeSH)terms were used in various combinations: "Pulmonary tuberculosis" OR "PTB", "Chest physiotherapy" OR "airway clearance techniques", "Technology AND Chest Physiotherapy", "Tele rehabilitation" AND" Chest Physiotherapy" and "Wearables" OR "AI" AND "pulmonary rehabilitation". Articles were included if they: Examined chest physiotherapy or cervicothoracic/ribcage mobilization in patients with pulmonary tuberculosis, were published in English and included randomized controlled trials, cohort studies, case series, or relevant narrative reviews. Articles were excluded if they focused on non-pulmonary tuberculosis, pharmacological interventions without a physiotherapy component, or were conference abstracts without full-text availability. Additional articles were identified through a manual search of reference lists from the included studies. The selected articles were analyzed for key outcomes such as improvement in pulmonary function, reduction in symptoms, quality of life, and adherence to therapy.

Airway Clearance and Breathing Exercises

Chest physiotherapy (postural drainage, percussion, breathing techniques) is often used to clear sputum and improve ventilation. For example, rehabilitation programs for TB sequelae include hypertonic saline nebulization plus physiotherapy to loosen secretions[3].

Exercise Training and Muscle Strengthening

Aerobic and strength exercises (walking, cycling, resistance training) improve lung mechanics and muscle function. Studies report that structured exercise regimens increase exercise tolerance and muscle strength in TB survivors [4]. In one review, TB patients completing exercise programs had significantly better dyspnea scores, longer 6-minute walk distance (6MWD) and higher quality-of-life (QoL) scores than controls [5]. Exercise training can also enhance metabolic recovery – for example, improving muscle mass in malnourished TB patients may aid drug absorption and recovery[6].

Pulmonary Rehabilitation Packages

Comprehensive rehab includes aerobic training, strength training, breathing exercises, and education. Multicomponent programs (modelled on COPD rehab) have been applied to PTLD. For instance, a 6–12-week pulmonary rehabilitation program (supervised exercise plus airway clearance techniques and education) showed clear benefits[7]. One multicenter trial in Brazil, Italy and France demonstrated that TB survivors undergoing rehab had improved lung function (FEV_1, FVC) and markedly higher 6 Minutes' Walk Distance(MWD) than non-rehabilitated controls [1]. Nutritional counselling, smoking cessation advice and mental health support are also integral parts of TB rehab programs. Exercise training, education and behaviour change have been shown to improve lung function and exercise capacity in PTLD. For example, TB survivors completing a short (3-week) PR program had significant gains in 6 MWD and lung function (FEV_1, FVC) and oxygenation [8]. A Ugandan PR program for PTLD likewise reported clinically important improvements in patient-reported outcomes and exercise tests. Thus, PR is effective in PTLD, but traditional programs are scarce in low-resource settings[9]. Novel digital tools wearables, AI, VR, and tele-rehabilitation, are being explored to extend PR access and boost outcomes in TB-related lung disease.

Continuous Activity Monitoring

Wearable sensors (pedometers, accelerometers, smartwatches, pulse oximeters) enable objective tracking of patient activity and vital signs. For example, tri-axial accelerometers are a standard tool in PR: one pilot study used a wearable armband to monitor steps and intensity 24/7 during an inpatient PR course[10]. These devices can reliably quantify exercise duration and intensity, motivating adherence. In chronic respiratory disease PR, integration of wearable trackers is increasingly common [11]. In practice, a TB survivor might wear a fitness tracker during home exercises or daily walks, allowing clinicians to remotely assess adherence and adjust the program.

Physiologic Sensing

Wearables that measure oxygen saturation, heart rate or breathing rate can alert to desaturation or breathlessness. AI-linked wearables in PR can detect anomalies or early exacerbations from these signals [12]. (For example, machine learning applied to continuous oxygen/respiration data in a PR program could predict a patient's 6MWD response)[12]. Although specific trials of wearables in TB rehab are limited, by analogy with COPD management, simple pulse oximetry patches or wrist-worn oximeters could be used to monitor SpO_2 trends during exercise.

Outcome Tracking

Wearables feed into exercise diaries and tele-rehab apps. Mobile apps can pull data from smart bands to show patients' step counts or exercise logs. In other PR programs, activity tracker data has been used to provide feedback and set personalized goals. For example, a mobile PR platform for lung cancer patients recorded increased average steps and improved 6 MWD [12]. In summary, wearable tech enables remote supervision of TB survivors: clinicians can gauge how much activity patients do, reinforcing compliance with the rehab plan. In general, pulmonary rehab (COPD, post-COVID), Machine Learning algorithms(MLA)analyze patient data(demographics, prior spirometry, activity levels) to predict rehab response. In one study of post-COVID patients, ML models (random forest, boosting) classified patients' 6MWD performance (low/medium/high) with ~84–94% accuracy. Such tools could be adapted for PTLD: e.g. using AI to predict which TB survivors need more intensive training or identifying those who will gain the most from rehab. AI can also analyze

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sensor data in real time (from wearables or smartphones) to detect exercise anomalies or guide pacing. AI-driven apps can serve as virtual physiotherapists. Chatbot interfaces (via mobile phone messaging or apps) use natural-language processing to coach patients through exercises, answer questions, and send reminders [12]. For instance, AI "virtual assistants" have been shown to give personalized education, medication/exercise reminders and even symptom triage in chronic lung disease rehab. Patients report these tools improve adherence by prompting workouts and clarifying technique. While no chatbot trial in PTLD has been published yet, analogous COPD apps show better adherence in tech-assisted rehab [12].

Predictive Analytics

AI can forecast long-term outcomes from short-term data. For example, recurrent neural networks analyzing home spirometry can predict lung-function decline before it becomes clinically evident. In PTLD, similar models might identify patients at risk of rapid deterioration or re-hospitalization, allowing early intervention. Overall, AI in digital PR is emerging: integrating smart algorithms into telerehab platforms could optimize exercise plans and patient monitoring for TB survivors, even though dedicated studies in TB are still needed .

Immersive Exercise Programs

Virtual reality platforms create gamified, immersive environments for rehab. Although TB-specific VR research is lacking, VR-based pulmonary rehab has been studied in COPD and other lung conditions [13]. A 2023 review of 32 studies found consistently positive results: VR exercises improved functional outcomes, breathing control and patient engagement in lung cancer, COPD and asthma patients. For example, VR cycling or breathing-exercise games were reported to reduce dyspnea and improve exercise tolerance compared to standard exercises. By making rehab fun and interactive, VR may boost motivation and adherence [13]. Virtual reality allows the tailoring of exercise intensity and feedback. Immersive VR headsets (or even cheaper smartphone-based VR kits) can present simulated environments (e.g. virtual forests or gaming scenarios) that respond to patient effort. This can train respiratory muscles or aerobically stress patients in a safe, controlled way. In trials, patients found VR pulmonary rehab "enjoyable, motivating and flexible," with the ability to individualize workout schedules and monitor progress remotely [14]. While most VR trials are in higher-income settings, these platforms could, in principle, be used at home by TB survivors if affordable VR equipment is available.

Remote Supervised Programs

Tele-rehabilitation uses video calls, apps and web portals to deliver PR at home. This approach has been piloted in PTLD. A recent Brazilian RCT protocol will compare 8weeks of supervised telerehab (via videoconference) versus usual care in PTLD patients. The intervention group will perform guided exercises at home with online supervision; outcomes (6MWD, spirometry, QoL) will be measured. The researchers anticipate improved physical capacity, QoL, and also better accessibility and lower costs through home-based video-therapy [15, 16]. In TB populations, similar smartphone PR apps could be deployed (even as simple as WhatsApp-guided exercise sessions). Importantly, telerehab extends PR to rural or mobility-limited patients: a video conferenced program removes travel barriers and offers personalized follow-up [17, 18].

Table 1: Results of Various Studies Conducted for Improvement in Pulmonary Function Utilizing Technology

References	Study Design	Intervention	Comparison	Sample Size	Key Findings
[19]	Stepped-wedge cluster RCT	99DOTS (digital adherence monitoring via toll-free calls + SMS reminders)	Routine DOT (directly observed therapy)	1,913 patients	No significant improvement in treatment success (ITT analysis).
[20]	Review	PEP mask + spirometer (12-week airway clearance program)	No control group	Not reported	Improved sputum clearance, ↑ FEV1.
[21]	Experimental	AI-based cough sound analyzer	No control group	Not reported	High relapse prediction accuracy (89% sensitivity).
[22]	Quasi-Experimental	UBICU (gamified respiratory incentive spirometer + app + cloud monitoring)	TriFlo (traditional flow-based RIS)	30 healthy adults	- UBICU significantly improved lung re-expansion (↑ impedance, *p* = 0.01).
[23]	Retrospective Cohort	Aerobika® OPEP device	Acapella® OPEP device	619 vs. 1,857 (PS-matched)	↓ 30-day severe exacerbations (12.0% vs. 17.4%, *p*=0.001).- ↓ 12-month hospitalizations (0.7 vs. 0.9 PPPY, *p*=0.01). - Longer time to first exacerbation (*p*=0.01).

DOI: https://doi.org/10.54393/pbmj.v8i6.1247

[24]	RCT	Standard anti-TB therapy + Active Cycle of Breathing Techniques (ACBTs) for 8 weeks	Standard anti-TB therapy alone	40 (20 per group)	- Significant improvements in FEV1, FEV1/FVC ratio, PEF, and BCSS scores in the ACBT group.- Greater chest expansion at all thoracic levels in the ACBT group.- Reduced perceived exertion and improved heart rate recovery in the ACBT group.- No significant difference in 6MWT distance between groups.
[25]	RCT	Group A: Postural Drainage + Steam (3 sessions/week for 6 weeks) Group B: Deep Breathing Exercises + Steam (3 sessions /week for 6 weeks)	Group A vs. Group B	48 (24 per group)	Postural Drainage (Group A) showed greater improvements in oxygen saturation (p=0.001), dyspnea reduction (p=0.003), and exertion levels (p=0.055) compared to Deep Breathing Exercises.- Significant within -group improvements in both interventions, but postural drainage was superior.
[26]	Randomized Controlled Trial	Video Directly Observed Therapy (VDOT):- Synchronous smart-phone app for medication observation. - Average time per dose: 16.5 min.	Directly Observed Therapy (DOT): - In-person observation by health workers. - Average time per dose : 44.1 min (including travel).	405 (203 VDOT, 202 DOT)	High treatment completion rates: 96.1% (VDOT) vs. 94.6% (DOT), *p=0.474*.Time/cost savings: VDOT reduced observation time by 62.6% and costs by 52.1% *(p<0.01)*.- Patient preference: 96% of VDOT users found it convenient vs. 56.6% for DOT *(p<0.001)*.
[27]	RCT	SMS Group: Reminder SMS messages sent to patients after TB diagnosis.WBOTs Group: Paper slip reminders delivered by Ward-Based Outreach Teams.	Standard of Care (SOC): No reminders.	314 (SOC = 104, SMS = 105, WBOTs = 105)	SMS Group: 88% treatment initiation vs. 78% in SOC (*p=0.062*). Faster initiation (median: 4 days vs. 8 days, *p<0.001)*.WBOTs Group: 73% initiation (similar to SOC, *p=0.956*). Median initiation time: 8 days vs. 13 days *(p<0.001)*.- SMS was more effective than WBOTs in reducing delays.

This review highlights the critical role of evidence-based physiotherapy and emerging technological interventions in addressing PTB sequelae and advancing progress toward SDG 3. Despite microbiological cure, many TB survivors experience significant residual lung dysfunction, including PTLD characterized by chronic airflow obstruction, fibrosis, bronchiectasis, and reduced exercise capacity [28, 29]. The WHO now recognizes rehabilitation as an essential component of TB management; however, implementation remains limited, particularly in resource-constrained settings. Traditional rehabilitation strategies, including airway clearance techniques and breathing exercises (e.g., postural drainage, percussion, active cycle of breathing techniques), remain cornerstone interventions [25]. Studies from Pakistan underscore the importance of such techniques in improving oxygenation, reducing dyspnea, and enhancing lung function parameters (e.g., FEV_1, FVC) [24, 25]. Notably, structured exercise programs comprising aerobic and resistance training have consistently demonstrated benefits in exercise tolerance, muscle strength, and quality of life for TB survivors [4, 5]. These findings align with recommendations from COPD rehabilitation, supporting the adaptation of multicomponent pulmonary rehabilitation (PR) packages to the PTLD population [7, 8]. Emerging technologies offer promising avenues to expand PR accessibility and effectiveness, especially in low-resource settings where traditional in-person programs are scarce [9]. Wearable sensors, including accelerometers, smartwatches, and oximeters, provide continuous monitoring of physical activity and vital signs, facilitating remote supervision and personalized feedback [10, 11]. Though studies directly assessing wearables in TB rehab are limited, analogous COPD research suggests strong potential for integration into PR programs. AI-

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enhanced wearables and predictive analytics could further refine rehabilitation by tailoring exercise plans and detecting exacerbations early, as demonstrated in other chronic lung diseases [12]. Moreover, mobile applications and chatbot-based platforms hold potential to deliver exercise guidance, reminders, and education remotely. While specific trials in TB are lacking, COPD studies have shown that AI-driven virtual coaching improves adherence and patient satisfaction [12]. Virtual reality (VR)–based PR offers additional advantages, including immersive, gamified exercise experiences that enhance motivation and adherence [13, 14]. Despite these promising advances, several challenges remain. Many studies in this review were limited by small sample sizes, single-center designs, short follow-up durations, and lack of long-term outcome data [25, 30].

Implications for SDG-3

Integrating physiotherapy and technological advancements in TB rehabilitation directly supports SDG Target 3.8 (achieving universal health coverage, including rehabilitation services) and 3.4 (reducing premature mortality from non-communicable diseases through prevention and treatment). By enhancing functional recovery and quality of life, these interventions contribute to the broader goal of good health and well-being for all.

CONCLUSIONS

It was concluded that while traditional physiotherapy remains foundational in pulmonary TB rehabilitation, innovative technological solutions, including wearables, AI, VR, and tele-rehabilitation, hold substantial promise for enhancing outcomes, extending access, and contributing to SDG achievement. Collaborative efforts across disciplines and settings are crucial to realize the full potential of these interventions for TB survivors worldwide.

Authors Contribution

Conceptualization: DA
Methodology: DA, SKK, UI, GHM
Formal analysis: UI, GMH
Writing review and editing: DA, MAS, SS, MNB

All authors have read and agreed to the published version of the manuscript.

Conflicts of Interest

The authors declare no conflict of interest.

Source of Funding

The author received no financial support for the research, authorship and/or publication of this article.

REFERENCES

[1] Silva DR, de Queiroz Mello FC, Galvão TS, Dalcolmo M, Dos Santos AP, Torres DD *et al.* Pulmonary rehabilitation in patients with post-tuberculosis lung disease: a prospective multicentre study. Archivos de Bronconeumología.2025Feb.doi:10.1016/j.arbres.2025.02.007.

[2] Mbanje C, Kuhn I, Musakwa N, Calvi M, Boccia D, Muhwa JC *et al.* A scoping review of interventions to address TB-associated respiratory disability. Eclinicalmedicine.2024Jul;73.doi:10.1016/j.eclinm.2024.102646.

[3] Meca AD, Mititelu-Tarțău L, Bogdan M, Dijmarescu LA, Pelin AM, Foia LG. Mycobacterium tuberculosis and pulmonary rehabilitation: From novel pharmacotherapeutic approaches to management of post-tuberculosis sequelae.Journal of Personalized Medicine.2022Apr;12(4):569.doi:10.3390/jpm12040569.

[4] Hiwalkar T, Shinde S, Dhumale A.Effect of Multicomponent Exercise Program on Pain and Functional Mobility in Antitubercular Drug Therapy-Induced Peripheral Neuropathy in Pulmonary Tuberculosis Survivors. Cureus.2024Jul;16(7).doi:10.7759/cureus.65431.

[5] Upadhyay S, Prakash P, Singh B, Singh GV, Agarwal K. Role of Pulmonary Rehabilitation in Fully Treated Cases of Pulmonary Tuberculosis on Exercise Capacity and Quality of Life.Journal of the Indian Academy of Clinical Medicine.2023 Jul; 24.

[6] Akkerman OW, Ter Beek L, Centis R, Maeurer M, Visca D, Muñoz-Torrico M *et al.* Rehabilitation, optimized nutritional care, and boosting host internal milieu to improve long-term treatment outcomes in tuberculosis patients. International Journal of Infectious Diseases.2020Mar;92:S10-4.doi:10.1016/j.ijid.2020.01.029.

[7] Beauchamp MK, Evans R, Janaudis-Ferreira T, Goldstein RS, Brooks D. Systematic review of supervised exercise programs after pulmonary rehabilitation in individuals with COPD.Chest.2013 Oct; 144(4): 1124-33. doi: 10.1378/chest.12-2421.

[8] Orooj M, Pant A, Mujaddadi A, Jain M, Ahmed I. Short-term pulmonary rehabilitation among post-pulmonary tuberculosis patients during coronavirus disease 2019 pandemic. Thoracic Research and Practice.2023May;24(3):131.doi:10.5152/ThoracResPract.2023.22147.

[9] Robertson N, Mudarshiru B, Siddharthan T, Zawedde-Muyanja S, Kirenga B, Rezai Gharai L *et al.* Characterization of Post-TB Lung Disease and Its Impact on Quality of Life in Uganda: A Prospective Cohort Study. In A64. Tackling Tuberculosis: Insights and Innovations.2024May:A2350-A2350.doi:10.1164/ajrccm-conference.2024.209.1_MeetingAbstracts.A2350.

DOI: https://doi.org/10.54393/pbmj.v8i6.1247

[10] Rutkowski S, Buekers J, Rutkowska A, Cieślik B, Szczegielniak J. Monitoring physical activity with a wearable sensor in patients with COPD during in-hospital pulmonary rehabilitation program: A pilot study. Sensors.2021Apr;21(8):2742.doi:10.3390/s21082742.

[11] Oliveira TR, Fernandes AT, Santino TA, Menescal FE, Nogueira PA. Effects of using wearable devices to monitoring physical activity in pulmonary rehabilitation programs for chronic respiratory diseases: a systematic review protocol. PLOS ONE. 2024Jul;19(7):e0308109.doi:10.1371/journal.pone.0308109.

[12] Karthika M, Sreedharan JK, Shevade M, Mathew CS, Ray S. Artificial intelligence in respiratory care. Frontiers in Digital Health.2024Dec;6:1502434.doi:10.3389/fdgth.2024.1502434.

[13] Pittara M, Matsangidou M, Pattichis CS. Virtual reality for pulmonary rehabilitation: comprehensive review. JMIR Rehabilitation and Assistive Technologies. 2023 Oct; 10(1): e47114. doi: 10.2196/47114.

[14] Dalko K, Elsuson HA, Kalter I, Zilezinski M, Hofstetter S, Stoevesandt D *et al.* Virtual Reality Applications for the Implementation of Domestic Respiratory Rehabilitation Programs for Patients with Long COVID and Post-COVID Condition: Scoping Review. Journal of Medical Internet Research Serious Games. 2024 May; 12(1): e52309. doi: 10.2196/52309.

[15] Sakunrag I, Boontha N, Boonpattharatthiti K, Dhippayom T. Impact of tele-pulmonary rehabilitation in patients with chronic obstructive disease: a systematic review and network meta-analysis.Telemedicine and e-Health.2025Apr;31(4):441-50.doi:10.1089/tmj.2024.0476.

[16] Srinivas M, Jagadeesh GT, Kamarthi P, Patil NJ, Venkataramanappa JS. Effect of Tele-rehabilitation in a Patient with Pulmonary Tuberculosis: A Case Study. Indian Journal of Respiratory Care.2024Jan;13(1):65.doi:10.5005/jp-journals-11010-1088.

[17] Iribarren SJ, Schnall R, Stone PW, Carballo-Diéguez A. Smartphone applications to support tuberculosis prevention and treatment: review and evaluation. Journal of Medical Internet Research mHealth and uHealth.2016 May; 4(2): e5022. doi: 10.2196/mhealth.5022.

[18] Lester R, Park JJ, Bolten LM, Enjetti A, Johnston JC, Schwartzman K *et al.* Mobile phone short message service for adherence support and care of patients with tuberculosis infection: Evidence and opportunity. Journal of Clinical Tuberculosis and Other Mycobacterial Diseases.2019Aug;16:100108.doi: 10.1016/j.jctube.2019.100108.

[19] Cattamanchi A, Crowder R, Kityamuwesi A, Kiwanuka N, Lamunu M, Namale C *et al.* Digital adherence technology for tuberculosis treatment supervision: A stepped-wedge cluster-randomized trial in Uganda. PLOS Medicine.2021May;18(5):e1003628.doi: 10.1371/journal.pmed.1003628.

[20] Van Kampen SC, Wanner A, Edwards M, Harries AD, Kirenga BJ, Chakaya J *et al.* International research and guidelines on post-tuberculosis chronic lung disorders: a systematic scoping review. British Medical Journal Global Health.2018Jul;3(4):e000745. doi: 10.1136/bmjgh-2018-000745.

[21] Lee KR, Kim T, Im S, Lee YJ, Jeong S, Shin H *et al.* A wearable stethoscope for accurate real-time lung sound monitoring and automatic wheezing detection based on an AI algorithm. Engineering. 2025 Jan. doi: 10.1016/j.eng.2024.12.031.

[22] Aguilar-Zambrano J, Wilches-Luna EC, Asencio-Santofimio H, Valencia M, Riveros D, Navarro A *et al.* UBICU: A Gamified Respiratory Incentive System for Pulmonary Re-expansion. IEEE Access.2025Jan. doi: 10.1109/ACCESS.2025.3528754.

[23] Tse J, Wada K, Wang Y, Coppolo D, Kushnarev V, Suggett J. Impact of oscillating positive expiratory pressure device use on post-discharge hospitalizations: a retrospective cohort study comparing patients with COPD or chronic bronchitis using the Aerobika® and Acapella® devices. International Journal of Chronic Obstructive Pulmonary Disease.2020Oct;15:2527-38.doi: 10.2147/COPD.S256866.

[24] Abdullah M, Ahmad M, Ahmad S, Ashraf HI, Rehman SA. Effects of Active Cycle of Breathing Techniques on Pulmonary Function, Sputum Clearance, Chest Expansion, and Exercise Capacity in Tuberculosis Patients. Journal of Health, Wellness and Community Research. 2025. doi: 10.61919/n0b9qr87.

[25] Ashraf S, Hassan Z, Rehman SU. Effects of Postural Drainage and Deep Breathing Exercises on Dyspnea, Oxygen Saturation and Level of Exertion in Elderly Post-COVID-19 Patients.Pakistan Journal of Rehabilitation.2022Jul;11(2):152-9.doi:10.36283/pjr.zu.11.2/020.

[26] Guo P, Qiao W, Sun Y, Liu F, Wang C. Telemedicine technologies and tuberculosis management: a randomized controlled trial.Telemedicine and E-Health.2020Sep;26(9):1150-6.doi:10.1089/tmj.2019.0190.

[27] Mwansa-Kambafwile JR, Chasela C, Levin J, Ismail N, Menezes C. Treatment initiation among tuberculosis patients: the role of short message service (SMS) technology and Ward-based outreach teams (WBOTs). BioMed Central Public Health.2022Feb;22(1): 318. doi: 10.1186/s12889-022-12736-6.

[28] Mbanje C, Kuhn I, Musakwa N, Calvi M, Boccia D, Muhwa JC *et al.* A scoping review of interventions to

DOI: https://doi.org/10.54393/pbmj.v8i6.1247

address TB-associated respiratory disability. E-Clinical-Medicine.2024 Jul; 73. doi: 10.1016/j.eclinm .2024.102646.

[29] Da Silva TS and Arêas GP. Effect of pulmonary rehabilitation on functional capacity in individuals treated for pulmonary tuberculosis: a systematic review protocol. Joanna Briggs Institute Evidence Synthesis.2022Oct;20(10):2552-8.doi:10.11124/ JBIES-21-00314.

[30] Wahyudi DA, Xanda AN, Sukesi N, Puspita L, Wardani PK, Yurlina E *et al.* Active Cycle of Breathing to Respiratory Rate in Patients with Lung Tuberculosis. International Journal of Pharmaceutical Research (09752366).2021Jan;13(1).doi:10.31838/ijpr/2021.13 .01.681.

DOI: https://doi.org/10.54393/pbmj.v8i6.1236

PAKISTAN BIOMEDICAL JOURNAL
https://www.pakistanbmj.com/journal/index.php/pbmj/index
ISSN (E): 2709-2798, (P): 2709-278X
Volume 8, Issue 06 (June 2025)

Original Article

OPEN ACCESS

Association Analysis of *CYP2A6* Gene Variant (rs1801272A>T) with Nicotine Metabolism and Smoking Tendency among Pakistani Youth

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ARTICLE INFO

Keywords:
Smoking Genetics, Cytochrome Gene, *CYP2A6* Variants, c.479T>A Locus

How to Cite:
Yasmin, I., Ali, H., Rafeh, M., Sikandar, M., Kashif, A., Salahuddin, M., Shafeeq, A., & Saif, R. (2025). Association Analysis of CYP2A6 Gene Variant (rs1801272A>T) with Nicotine Metabolism and Smoking Tendency among Pakistani Youth: CYP2A6 Gene Variant (rs1801272A>T) with Nicotine Metabolism and Smoking Tendency.Pakistan BioMedical Journal, 8(6),10-15. https://doi.org/10.54393/ pbmj.v8i6.1236

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Received Date: 22nd April, 2025
Revised Date: 2nd June, 2025
Acceptance Date: 10th June, 2025
Published Date: 30th June, 2025

ABSTRACT

Cytochrome P450 2A6 *(CYP2A6)* is a key enzyme in nicotine metabolism, with its genetic variants playing a role in smoking behavior. Particularly, g.40848628A>T is significantly associated with nicotine metabolism and smoking tendency in different populations. **Objectives:** To examine the genetic diversity of this locus and association analysis within smokers and non-smokers cohorts among Pakistani youth. **Methods:** The allele-specific ARMS PCR genotyping technique was applied to examine a total of 100 samples as a case-control study of n=50 from each cohort. **Results:** From the sampled individuals, 92% were found to be homozygous wild-type (AA), 7% were heterozygous (AT), and 1% were homozygous mutant (TT). PLINK software was used for the Chi-square test yielded, χ^2 (1, n=100) =2.91, p=0.088, suggesting a non-significant trend towards association, where alternative allele frequencies were calculated as 0.07 and 0.02 in cases and control cohorts, respectively. Similarly, Hardy-Weinberg Equilibrium (HWE) p=0.1714 indicates genotype frequencies did not significantly deviate from HW expectations and no error or selection in the overall samples. The carriers of the alternative allele have 3.688 times higher odds of being affected by the condition compared to non-carriers with the reference allele. **Conclusions:** It was concluded that future studies with a larger sample size may help to clarify the population structure of the subject locus. Genome-wide association studies using next-generation sequencing may also aid in predicting nicotine metabolism and resistance to smoking cessation in the Pakistani population.

INTRODUCTION

Cigarette smoking, a prevalent source of nicotine, poses significant health risks across all age groups, particularly with a concerning surge in popularity among Pakistani adolescents. Nicotine, a proven addictive substance, exhibits varying degrees of dependence in individuals due to the metabolism by the Cytochrome P450 family 2 subfamilies A member 6 *(CYP2A6)* gene product [1, 2]. This primary protein transforms nicotine into its byproduct, cotinine and other metabolites. Divergent levels of *CYP2A6* protein influence nicotine metabolism, impacting an individual's tendency towards smoking. Wild-type *CYP2A6* proteins with normal activity facilitate the standard breakdown of nicotine, mitigating its effects on the brain and discouraging the development of smoking dependence. Conversely, mutated *CYP2A6* proteins with impaired activity hinder nicotine metabolism, allowing its retention in the body, leading to prolonged brain effects with relatively lower cigarette consumption [3, 4]. Despite the well-known health risks associated with smoking, it remains a substantial global health burden. Adult smoking prevalence is 32.6% and 6.5% in men and women, respectively, contributing to ~7.7 million annual deaths

DOI: https://doi.org/10.54393/pbmj.v8i6.1236

worldwide among its total smokers of 1.14 billion [5]. Alarmingly, low and middle-income countries, constituting 80% of total smokers globally, face an increased prevalence of tobacco use [6]. In Pakistan, 13.4% age-standardized prevalence of tobacco use is reported in urban and rural areas with its alarming rates of 16.3% & 11.7% respectively [7]. This escalating trend of tobacco use in Pakistan has prompted the scientific community to delve into its genetic aspects involved in smoking tendency, levels of cigarette consumption, depth of inhalation and smoking cessation ability of the individuals [7-9].The *CYP2A6* gene exhibits numerous variants associated with nicotine metabolism across diverse populations [10].The subject genetic variant located on Chr.19 NC_000019.10 at 19q13.2 locus (NG_008377.1: g.6820T>A, and (ATG start) position 1799T>A).Chromosomal positioning is g.40848628A>T in the (GCF_000001405.40) genome assembly, current variant corresponds to c.479T>A (r.500) in the NM_000762.6 transcript, affecting the protein's p. L160H position situated on exon 3 of total 6907-nucleotide position of *CYP2A6* gene.This variant impacts the protein's function, reflected in its encoded protein ID NP_000753.3 of 494 amino acids. Notably, rs1801272A>T, associated with poor nicotine metabolism, has a global AAF (T=0.0092) as per the 1000Genome database [11].The (A) allele signifies normal *CYP2A6* protein activity, while the (T) allele may alter activity, influencing nicotine metabolism [12].The subject variant was genotyped through allele-specific ARMS-PCR, followed by assessments for (HWE), (χ2), and (OR) statistics.Subsequently, the derived (AAF) will be determined in both cases and controls.

This study aims to find association and correlation insights between the subject variant and nicotine metabolism that may influence smoking tendency among Pakistani youth.

METHODS

Sample inclusion-exclusion criteria and DNA extraction: A comprehensive genotyping study of 100 individuals was carried out, encompassing specimens from both adolescent smokers (n=50) and non-smokers controls (n=50) based on the Rao statistics of sample size calculation. The study was conducted from May 2024 onward. smokers and non-smokers individuals aged 18–30 were included with known smoking history. Sample size was calculated using Rao's statistical formula, based on 80% power, 0.05 alpha, and expected odds ratios derived from previous literature. The primary objective is to investigate the potential association and correlation between the CYP2A6 locus with nicotine metabolism/dependency among Pakistani youth. Blood samples from human male adolescents aged 18–30 years were collected from Diagnostic Zone Lab, Lahore (Ref: DZL#004/25) and Shah Medical Center, Swat, using K_3-EDTA vacutainers and stored at 4°C until subsequent analysis. Through proper channel ethical guidelines were followed for sample collection. Data of the article is available within the manuscript and supplementary file(s). Article medRxiv preprint is also available https://doi.org/10.1101/2025.04.16.25325925. Genomic DNA extraction was performed using column-based kit method (www.favorgen.com), adhering to the manufacturer's instructions for precise and consistent DNA extraction. Primer designing: The allele-specific ARMS primers were designed through specialized software named OligoCalc and validated by NetPrimer. The ARMS-PCR protocol was employed to amplify both wild and mutant-type variants from each sample. Specifically, one ARMS primer was designed for each variant, strategically incorporating a mismatch at the 4nt position from the 3' end of the sequence. Additionally, to uphold PCR accuracy, two internal control (IC) primers were also employed in the experimental setup during optimization. This comprehensive primer design and PCR strategy aim to enhance the precision and reliability of the genetic variant analysis [13]. This comprehensive primer design was seen (Table 1).

Table 1: Primers Sequence Attributes

ARMS/ IC	Sequence (5'-3')	Tm (°C)	Length (bp)	Product Size (bp)
Reverse Common	GCGTGGTATTCAGCAACG	56.22	24	150
Forward Normal	CGCCAGTGCCCTGGA	55.12	26	
Forward Mutant	CGCCAGTGCCCTGGT	55.26	26	
Forward (IC)	TAACCCACAGCCTCCTACAC	60.50	20	618
Reverse (IC)	TCAGCATCCTCCTCTGGAC	59.50	19	

PCR amplification, each sample, encompassing both wild-type and mutant-type variants were undergoing amplification using a thermocycler.Two distinct PCR reactions were executed for each sample, with each reaction involving the reverse common primer paired separately with forward ARMS primers designed for the wild and mutant-type allele. At the same time, the reverse internal control (IC) and forward internal control (IC) primers were also used to amplify the internal control regions in the process of optimization. The final volume of 14µL, which contained 1µL of 50ng/L genomic DNA as well as the 10mM of each primer, 0.015 IU/µL of Taq polymerase, 2.5 mM each MgCl2 and dNTPs, and 1x Taq buffer with PCR-grade water DEPC treated water was considered as a reaction mixture.To begin the touch-down PCR protocol, an initial denaturation at 94°C was carried out, and 35 cycles were to be repeated with a denaturation of 94°C 30 s, annealing was to begin at 58.4°C with a reduction of 0.5°C/cycle repeated 10 times and the remaining 25 cycles were to be conducted at 54°C 30 s, extension of 72°C 30 s and a final extension of 72°C 07 min [14]. Thereafter, the reaction mixture was transferred to 4°C. This elaborate

DOI: https://doi.org/10.54393/pbmj.v8i6.1236

PCR process seeks to provide a specific and sound amplification of target genomic make-up of DNA (Figure 1).

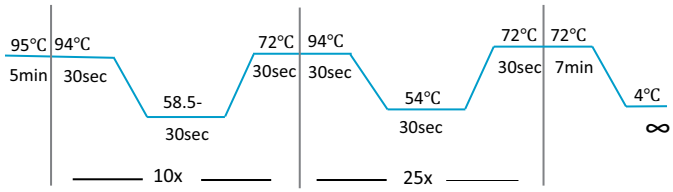

Figure 1: Thermal Cyclic Conditions of ARMS-PCR

The PLINK data analysis toolset was used in computing both observed and expected genotyping frequencies, incorporating considerations for HWE through the application of the equation: p2 + 2pq + q2 = 1. The analysis was extended to Chi-square testing, employing the formula: $\chi 2 = \Sigma(O-E)2/E$, to ascertain the association between the subject variant rs1801272 with nicotine metabolism/dependency and smoking behavior within the sample set. Additionally, p-values and odds-ratios (OR) were undertaken followed by alternative allele frequencies for further enriching the statistical insights using following PLINK commands on command line interface e.g., —assoc for association and correlation tests, —logistic for logistic regression, — hardy for Hardy Weinberg equilibrium, and —model for Dominant (DOM), recessive (REC) models prediction.

RESULTS

CYP2A6 gene variant (rs1801272A>T) showed the variability in Pakistani sampled population, which is in accordance to the previous studies and other world populations (Figure 2).

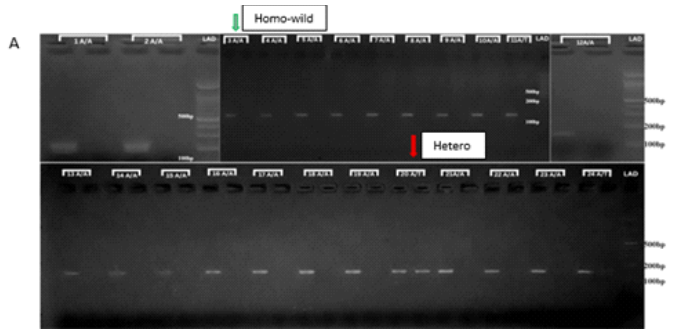

Figure 2: Gel Picture of ARMS-PCR Amplification of Targeted Variant within Cases A. Green and Red Arrows Shows Homozygous-Wild Type and Heterozygous Samples

The study depicts Chr.19 locus g.40848628 is variable and under-selection (Figure 3).

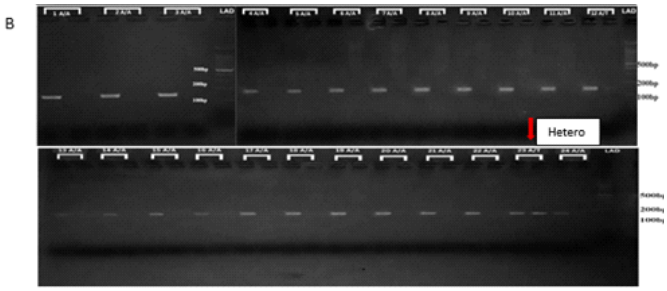

Figure 3: Gel Picture of ARMS-PCR Amplification of Targeted Variant within Controls (B), Red Arrow Shows Heterozygous Samples

A total of 100 samples were genotyped, (smokers=50) and (non-smokers=50). After experimental and statistical analyses, it was concluded that within smoker's cohort, there are 05 heterozygous (AT), 44 homozygous-wild (AA) and 01 sample was observed as homozygous-mutant. Similarly, within non-smokers, 02 and 48 individuals are heterozygous, homozygous-wild respectively and none of the sample was observed as homozygous-mutant. Remaining samples gel pictures are provided in Supplementary Figure 1. The overall genotypic frequencies in our sampled population are 0.92 as homozygous-wild, 0.07 reflected as the heterozygous and 0.01 as the homozygous-mutant. Thereafter, the analysis *(HWE)* of Chi-square was also taken out to check whether our sampled population is in his principle or not and the following results of 42 (1, N=100), 0.1714, which manifests that our sampled population is in accordance with the *HWE* equilibrium as the p-value is above the set threshold confidence interval of 0.05 so accepting our null-hypothesis of observing *HWE*, means no selection and population is randomly bred. In addition, there was also an alternative allele frequency observed as 0.07and 0.02 in our cases and control cohorts with a 2.90, $\chi 2$ statistics value and p=0.088 that indicates insignificant relationship of screened variant with nicotine metabolism and smoking tendency in youth of Pakistan. Similarly, an odds-ratio (OR) of 3.688 was also shown indicating relative risk of subject phenotype is higher and indicating that the prevalence of the odds/mutant variant is about 4 rid higher in cases compared to controls (Table 2).

Table 2: Plink Association of *CYP2A6* Gene Variant (rs1801272A>T) with Nicotine Metabolism and Smoking Tendency among Pakistani Youth

Sample	Chr.Pos.	cDNA variant NM_000762.6	Protein variant NP_000753.3	Genotypic Frequencies			Alternative Allele Frequencies		p-value (OR)
				Homo-wild (AA)%	Hetero-(AT)%	Homo-mutant (TT)%	Case	Contr.	
100	19:40848628	c.479A>Tr.500	p. L160H	92	7	1	0.07	0.02	0.088 (3.68)

Subject cDNA variant c.479A>T alters the lucine amino acid (aa) to histidine at the 160th position, this aa is responsible for slower nicotine metabolism, which makes an individual more prone to quit smoking easily as compared to those with normal *CYP2A6* activity. Further, functional genetics studies are still needed to confirm and validate this postulated hypothesis. Another statistical test named Cochran-Armitage Trend test was also conducted to evaluate the association between subject variant and our selected phenotype, assessing whether the frequency of

DOI: https://doi.org/10.54393/pbmj.v8i6.1236

minor allele differs between smokers and non-smokers individuals The test yielded a chi-square value of2.453 (df=1) and a p-value=0.1173, indicating no significant association, which suggests that the genotype distribution at this variant does not show a meaningful trend between allele dosage and disease status in our sampled population. Similarly, dominant (DOM) and recessive (REC) models testing were also used to explore the potential genetic association of our subject variant with the nicotine metabolism. However, both models yielded NA values for chi-square and p-values, indicating lack of variation in genotype distribution to perform statistical testing. This suggests that neither a dominant nor a recessive model pattern could be established for this variant in the given dataset, because only (1+5) = 6 vs. 44 genotypes were observed in affected and (0+2) = 2 vs. 48 in unaffected population respectively. The logistic regression analysis was also applied under the additive genetic settings which effectively models binary traits while adjusting covariates, suggesting that for each additional copy of the affected allele, the odds of being affected increase by a factor of 3.16. The additive model assumes a linear effect of each additional risk allele on subject phenotype susceptibility. However, the p-value=0.1455 is not significant, indicating no strong association due to limited sample size, low allele frequency or random variation.

DISCUSSION

The current study examined the association between the *CYP2A6* gene variant rs1801272A>T with nicotine metabolism and smoking behavior among Pakistani youth. The statistics revealed no significant association with nicotine metabolism and smoking tendency among our sampled population. Current results showed overall l92% of the sampled population was homozygous-wild (AA), 7% was heterozygous (AT), 1% was homozygous-mutant (TT) with p-value=0.088 and OR=3.68. As individuals with the "T" allele tend to metabolize nicotine more slowly, leading to lower cigarette consumption and potentially have reduced risk of nicotine addiction [15, 16]. Prior research around the globe has reported genetic associations on *CYP2A6* polymorphisms in nicotine metabolism.One of the European study indicated that the rs1801272(A) allele frequency is around 5% in CEU and IBS populations, with a reported p-value=0.81 [17]. In the Mexican population, the allele frequency was found to be <1%, leading to its exclusion from statistical analysis due to low prevalence [17].An Egyptian study reported association between this variant and nicotine metabolism, with statistical significance [18]. In contrast, Japanese populations exhibit a higher frequency of loss of function of the *CYP2A6* protein, correlating with slower nicotine metabolism and altered smoking tendencies, with a reported p-value=0.34 [19].The current study genotypic distribution showed that among cases, only five individuals were heterozygous (AT), while the majority (44/50) were homozygous wild-type (AA), a one sample was observed as homo-mutant (TT). While in controls, two individuals carried the heterozygous variant, with the rest (48/50) being homozygous wild. This suggests that the rs1801272T variant is rare in the Pakistani population, limiting its influence on smoking behaviour [1]. Nicotine metabolism is primarily mediated by *CYP2A6*, which converts nicotine into cotinine. Genetic variations in *CYP2A6* may influence smoking initiation, dependency and cessation activities.Studies indicate that slow metabolizers, due to reduced function of the *CYP2A6* protein, tend to smoke less and experience lower nicotine dependence [20]. As far as the clinical relevance and pharmacogenomics are concerned, this variant may influence the effectiveness of the nicotine replacement therapy (NRT) for smoking cessation [19, 21]. However, rs1801272A>T alone is not a major determinant of smoking behaviour in Pakistani youth.

CONCLUSIONS

It was concluded that this pilot study suggested the variability of the subject *CYP2A6* gene locus rs1801272A>T and seems not significantly associated with nicotine metabolism and smoking tendency among Pakistani youth with p-value=0.088 and OR=3.68. Further, large sample size single locus genotyping or GWA studies may be conducted to evaluate the smoking genetics in the Pakistani population.

Authors Contribution

Conceptualization: RS
Methodology: IY, HA, MY, MS, AK, MS, AS, RS
Formal analysis: RS
Writing review and editing: IY, HA

All authors have read and agreed to the published version of the manuscript.

Conflicts of Interest

The authors declare no conflict of interest.

Source of Funding

The authors gratefully acknowledge the support of Qarshi University, Lahore, Pakistan, whose funding made this pilot-scale study possible, their commitment to advancing research and innovation is deeply appreciated.

DOI: https://doi.org/10.54393/pbmj.v8i6.1236

REFERENCES

[1] Tomaz PR, Kajita MS, Santos JR, Scholz J, Abe TO, Gaya PV *et al*. Cytochrome P450 2A6 and 2B6 polymorphisms and smoking cessation success in patients treated with varenicline. European journal of Clinical Pharmacology.2019Nov;75:1541-5.doi: 10.1007/s00228-019-02731-z.

[2] Yuan JM, Nelson HH, Carmella SG, Wang R, Kuriger-Laber J, Jin A *et al. CYP2A6* genetic polymorphisms and biomarkers of tobacco smoke constituents in relation to risk of lung cancer in the Singapore Chinese Health Study.Carcinogenesis.2017Apr; 38(4): 411-8. doi: 10.1093/carcin/bgx012.

[3] Verde Z, Santiago C, Rodríguez González-Moro JM, de Lucas Ramos P, López Martín S, Bandrés F *et al.* 'Smoking genes': a genetic association study.PLOS One.2011Oct;6(10):e26668.doi:10.1371/journal.pone .0026668.

[4] Jones SK, Wolf BJ, Froeliger B, Wallace K, Carpenter MJ, Alberg AJ. Nicotine metabolism predicted by *CYP2A6* genotypes in relation to smoking cessation: a systematic review. Nicotine and Tobacco Research. 2022 May; 24(5): 633-42. doi: 10.1093/ntr/ntab175.

[5] Reitsma MB, Kendrick PJ, Ababneh E, Abbafati C, Abbasi-Kangevari M, Abdoli A *et al.* Spatial, temporal, and demographic patterns in prevalence of smoking tobacco use and attributable disease burden in 204 countries and territories, 1990–2019: a systematic analysis from the Global Burden of Disease Study 2019.The Lancet.2021Jun;397(10292):2337-60.

[6] Schoedel KA, Hoffmann EB, Rao Y, Sellers EM, Tyndale RF.Ethnic variation in *CYP2A6* and association of genetically slow nicotine metabolism and smoking in adult Caucasians. Pharmacogenetics and Genomics.2004Sep;14(9):615-26.doi:10.1097 /00008571-200409000-00006.

[7] Siddiqi K, Siddiqui F, Boeckmann M, Islam Z, Khan A, Dobbie F *et al.* Attitudes of smokers towards tobacco control policies: findings from the Studying Tobacco users of Pakistan (STOP) survey.Tobacco Control. 2022Jan;31(1):112-6.doi:10.1136/tobaccocontrol-2020-055995.

[8] Al Koudsi N, O'Loughlin J, Rodriguez D, Audrain-McGovern J, Tyndale RF. The genetic aspects of nicotine metabolism and their impact on adolescent nicotine dependence.Journal of Pediatric Biochemistry.2010 Jun; 1(02): 105-23. doi: 10.1055/s-0036-1586369.

[9] Pehlivan S, Uysal MA, Cagatay T, Nursal AF, Cinar CK, Erkan F *et al. CYP2A6* gene variants may explain smoking status in a Turkish cohort.Psychiatry and Clinical Psychopharmacology.2019Jul;29(3):340-5. doi: 10.1080/24750573.2018.1547177.

[10] Perez-Paramo YX, Watson CJ, Chen G, Thomas CE, Adams-Haduch J, Wang R *et al.* Impact of genetic variants in the nicotine metabolism pathway on nicotine metabolite levels in smokers.Cancer Epidemiology, Biomarkers and Prevention. 2023 Jan; 32(1): 54-65. doi: 10.1158/1055-9965.EPI-22-0868.

[11] Consortium GP, Auton A, Brooks LD, Durbin RM, Garrison EP, Kang HM. A global reference for human genetic variation.Nature.2015Oct;526(7571):68-74.

[12] Chenoweth MJ, Lerman C, Knight J, Tyndale RF. Influence of *CYP2A6* genetic variation, nicotine dependence severity, and treatment on smoking cessation success. Nicotine and Tobacco Research. 2023 Jun; 25(6): 1207-11. doi: 10.1093/ntr/ntac268.

[13] Amjad G, Saif R, Hussain MG. Genetic Association of CYP1A2 Gene Variant (rs762551) with Caffeine Induced-Hypertension Susceptibility and Cytochrome P450 1A2 Protein Analyses.bioRxiv. 2023 Oct: 2023-10. doi: 10.1101/2023.10.07.561327.

[14] Khalid A, Ashraf H, Asim H, Ayman M, Saif R. Association Analysis of LCORL Genetic Variant (rs657074013) with Wither-Height in Pakistani Goats: Association of LCORL Variant (rs657074013) with Goat Height.Futuristic Biotechnology.2023Sep:46-50. doi: 10.54393/fbt.v3i02.46.

[15] Murphy SE. Nicotine metabolism and smoking: ethnic differences in the role of P450 2A6.Chemical Research in Toxicology.2017Jan;30(1):410-9.doi: 10.1021/acs.chemrestox.6b00387.

[16] Bergen AW, Michel M, Nishita D, Krasnow R, Javitz HS, Conneely KN *et al.* Drug metabolizing enzyme and transporter gene variation, nicotine metabolism, prospective abstinence, and cigarette consumption. PLOS One.2015Jul;10(7):e0126113.doi:10.1371/journal .pone.0126113.

[17] Pérez-Rubio G, López-Flores LA, Ramírez-Venegas A, Noé-Díaz V, García-Gómez L, Ambrocio-Ortiz E *et al.* Genetic polymorphisms in *CYP2A6* are associated with a risk of cigarette smoking and predispose to smoking at younger ages. Gene.2017Sep;628:205-10. doi:10.1016/j.gene.2017.07.051.

[18] Langlois AW, Chenoweth MJ, Twesigomwe D, Scantamburlo G, Whirl-Carrillo M, Sangkuhl K *et al.* PharmVar GeneFocus: *CYP2A6*.Clinical Pharmacology & Therapeutics.2024Oct;116(4):948-62.doi: 10.1002/cpt.3387.

[19] Ezzeldin N, El-Lebedy D, Darwish A, El Bastawisy A, Abd Elaziz SH, Hassan MM *et al.* Association of genetic polymorphisms *CYP2A6** 2 rs1801272 and CYP2A6* 9 rs28399433 with tobacco-induced lung Cancer: case-control study in an Egyptian population. BioMed Central Cancer. 2018 Dec; 18: 1-9. doi: 10.1186/s12885-018-4342-5.

DOI: https://doi.org/10.54393/pbmj.v8i6.1236

[20] Giratallah H, Chenoweth MJ, Pouget JG, El-Boraie A, Alsaafin A, Lerman C *et al. CYP2A6* associates with respiratory disease risk and younger age of diagnosis: a phenome-wide association Mendelian Randomization study. Human Molecular Genetics. 2024 Jan; 33(2): 198-210. doi: 10.1093/hmg/ddad172.

[21] Perez-Paramo YX and Lazarus P. Pharmacogenetics factors influencing smoking cessation success; the importance of nicotine metabolism. Expert Opinion on Drug Metabolism and Toxicology. 2021Mar;17(3): 333-49. doi: 10.1080/17425255.2021.1863948.

DOI: https://doi.org/10.54393/pbmj.v8i6.1261

PAKISTAN BIOMEDICAL JOURNAL
https://www.pakistanbmj.com/journal/index.php/pbmj/index
ISSN (E): 2709-2798, (P): 2709-278X
Volume 8, Issue 06 (June 2025)

Original Article

OPEN ACCESS

Impact of COVID-19 Pandemic on the Expanded Programme on Immunization (EPI) Vaccination Uptake in Lahore, Pakistan - A Cross-Sectional Study

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ARTICLE INFO

Keywords:
COVID-19, Expanded Program of Immunization, Pandemic, Vaccination

How to Cite:
Gohar, A., Farooqi, H. H., Tariq, H., Khan, A. U., Khan, A. R. S., Shah, S. S. H., & Afzal, U. (2025). Impact of COVID-19 Pandemic on the Expanded Programme on Immunization (EPI) Vaccination Uptake in Lahore, Pakistan - A Cross-Sectional Study: COVID-19 Pandemic on the EPI Vaccination Uptake. Pakistan BioMedical Journal, 8(6), 16-19. https://doi.org/10.54393/pbmj.v8i6.1261

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Received Date: 30th April, 2025
Revised Date: 10th June, 2025
Acceptance Date: 17th June, 2025
Published Date: 30th June, 2025

ABSTRACT

The 2019 (COVID-19) Coronavirus pandemic has presented a variety of challenges which have not only affected the society's health but also the economies, the sociocultural trends and political situations. Routine health-related programs have been harmed. **Objectives:** To provide an insight into the prevalence of delay of Expanded Program of Immunization (EPI) and its causative factors during the pandemic in the province of Punjab, Pakistan. **Methods:** After approval from the Ethical Review Board, this prospective, cross-sectional study was carried out at Ameer ud Din Medical College (AMC) from July 1, 2023, to September 1, 2023. An interview-based survey was conducted across the suburbs of college. **Results:** About 66% participants were female parents, out of which 51.3% indicated that their children's vaccinations had been delayed for more than a week. Participants who had delayed their children's vaccination visits owing to a fear that the children would not be able to follow the proper precautions for protection against COVID-19 were 10%, while 16% of respondents stated that the fear of COVID-19 exposure while traveling to and from the health facility was the reason for the delay in vaccination. Fear of COVID-19 exposure at the health facility caused 33% of cases to delay the vaccination uptake. **Conclusions:** It was concluded that COVID-19 harmed EPI-associated vaccination uptake. Solutions to the reasons for delay were ignored by the involved parents and healthcare setups.

INTRODUCTION

The 2019 Coronavirus pandemic (COVID-19) has been found extremely contagious, especially through aerosol transmission [1, 2]. By the middle of April 2020, it had been reported that around two million cases and 120,000 deaths from COVID-19 had occurred across the world [3, 4]. On February 26, 2020, the first case of COVID-19 was registered in Pakistan [5, 6]. On March 23, 2020, the restriction on movement was introduced. Knowledge of the virulence and the aftereffects of the disease was still little known at that time [7]. The situation with the current pandemic spread of COVID-19, the unprecedented effects of which have left an indelible trace in the development of the social context in the world, as well as the state of delivery of the basic system of health services, will entail a strong impact on the management of other infectious ailments. Based on this, there should be a focus on how it can affect vaccine delivery, which is a very essential component of our health system. The risks of morbidity and mortality posed by vaccine-preventable diseases (VPDs) to countries that already have poor coverage rates will be compounded in case their coverage is affected in any way or the other [8, 9]. VPDs cover polio, measles, mumps, rubella, diphtheria, pertussis, tetanus, hepatitis B, rotavirus diarrhea, severe childhood forms of tuberculosis,

DOI: https://doi.org/10.54393/pbmj.v8i6.1261

meningitis and pneumonia by Haemophilus inflenza type B, pneumococcal pneumonia and Japanese encephalitis [10, 11]. FIC is the child who has attained all the doses of the required immunizations as recommended by the immunization schedule [12]. The COVID-19 pandemic unfolds against the background of insufficient immunization in our country. With Coronavirus and the resultant lockdowns, the EPI machinery has been badly disrupted. Fixed immunization (or vaccination) centers located within basic health units are unable to cater to their catchment population. Shifts in health-seeking behaviours due to an urgent need for social distancing and complete and partial lockdowns may be contributing to a delay in routine childhood vaccination visits [13, 14]. Other contributing factors may be a parent's fear of contagion, overstretched health services, and a reallocation of government resources from immunization activities to the control of COVID-19 [15]. It is evident from history that past global disease outbreaks, pandemics and wars created the lack of access to health care facilities, leading to an increase in morbidity and mortality. Similarly, COVID-19 weakened our already frail healthcare systems [16]. The primary research question in this study was to examine the impact of the COVID-19 lockdown on routine immunization in Pakistan.

This study aims to measure the delay in immunization rates during this pandemic in Pakistan, the duration of delay in immunization and the reasons for delay, including reasons specifically related to the spread of the COVID-19 pandemic. The findings of our research are paramount in identifying barriers to timely vaccination in public health emergencies and thus for implementing pandemic preparedness strategies at the national level.

METHODS

This prospective, cross-sectional study was conducted for a duration of one month from July 1, 2023, to September 1, 2023. A sample size of 197 was calculated using the Open Epi calculator with a reference population [1] of 400, a confidence interval of 95%, a margin of error of 5% and a population proportion of 50%. Approval was taken from the Ethical Review Board of Ameer-ud-Deen Medical College, Post Graduate Medical Institute, under the reference number 00-15-A-2023. The study followed all relevant ethical guidelines, and approval was obtained prior to data collection. Participants from the suburbs of Post Graduate Medical Institute, like Rehmanpura and Shahdara, were recruited in this study using non-probability, consecutive sampling and the following selection criteria. The study population included parents from the suburbs of Lahore city, having children under two years of age and a vaccination facility available. Parents who do not have children below the age of two were excluded. Parents not present at home at the time of the survey were also excluded. Two researchers surveyed the houses in the above-mentioned locations and performed a survey-based scientific study. Informed consent and confidentiality of the data were maintained throughout the process. The questionnaire had four parts, including the demographic information of parents, immunization status, immunization during the COVID-19 outbreak, and the potential factors that parents could not or did not refuse to vaccinate their child or children. The survey reliability was confirmed with the help of the Cronbach alpha coefficient (0.78), and it was recognized as acceptable. It was developed in English and translated into Urdu using the assistance of an expert. The study asked questions in the native language and marked the answers accordingly. Data were collected using the following categorical variables: gender, age categories, education level of subjects, type of family (nuclear or combined), and employment. Collected data were compiled into SPSS version 26.0 and sent for data analysis to a statistician. Mean, median, mode and range values will be calculated for quantitative variables like age, frequencies and percentages for categorical variables.

RESULTS

A total of 315 parents were invited to take part in the research in but 77 respondents did not participate because the questionnaires are incomplete. A total of 238 participants carried out the analysis, which was above the minimum calculated sample size. Young mothers below the age of 30 years were the majority of participants. Most of the parents were graduates and educated (Table 1).

Table 1: Demographic Information of Included Participants

Category	Frequency (%)
Gender Distribution	
Female	157 (65.9%)
Male	81 (34.1%)
Category of Age	
Below 30	125 (52.5%)
Above 30	113 (47.5%)
Level of Education	
Postgraduate Level	63 (26.5%)
Uneducated	30 (12.6%)
Up To Graduation	145 (60.9%)
Type of Employment	
Government Service	50 (21.0%)
Private Sector	60 (25.2%)
Self Employed	128 (53.8%)
Type of Family	
Combined	157 (65.9 %)
Nuclear	81 (34.1%)

The majority of parents had their children's vaccinations within the prescribed time in past. But those who have had their children's vaccination schedules disrupted during the COVID-19 pandemic were afraid of contracting COVID-19 at

DOI: https://doi.org/10.54393/pbmj.v8i6.1261

the healthcare facilities(Table 2).

Table 2: Course of EPI Vaccination in the COVID-19 Pandemic and the Reasons Behind the Delay

Questions	Frequency (%)
A - Have your children's vaccinations always been according to schedule?	
No	31(13.0%)
Yes	207(87%)
B - Were any of your children's vaccinations due since the start of the COVID-19 pandemic in Pakistan, i.e. since the 15th of March 2020?	
No	0(0%)
Yes	238(100%)
C - If yes, then was the vaccination delayed for more than a week?	
No	116(48.7%)
Yes	122(51.3%)
D – Reasons behind the delay in vaccination	
Fear of children being unable to follow proper precautions to avoid COVID-19 exposure	12(9.83%)
Fear of COVID-19 exposure during going to and coming back from the health facility	20(16.39%)
Fear of exposure to COVID-19 at the health facility	40(32.78%)
Miscellaneous reasons	50(40.98%)

DISCUSSION

This research paper contains an evidence-based and detailed report on how the COVID-19 pandemic has affected immunization coverage in a sample population. The findings of the study revealed that COVID-19 hurt the timeliness of childhood immunization in Lahore city, Pakistan.This is the first study, to the best of our knowledge, measuring the impact of the COVID-19 pandemic on childhood immunization in the province of Punjab, Pakistan. A study in the United States showed that most patients failed to attend one of their scheduled visits (50%) and some of the patients missed two visits or more (27%). DTaP was the most common vaccine being missed during lockdown [1]. A Brazilian study reported that their infants were given an average of 10.6 doses out of 13 doses during lockdown, thus making them 2.4 doses short of the full immunization schedule [15]. The findings of a study conducted in Saudi Arabia which reported a delay of more than one month in the immunization of children by 23.4% of parents and fear of being infected by COVID-19 being the most common cause of delay are similar to the results of our study showing delay for more than one week of 51.3 % of parents and fear of being infected by COVID-19 being the second most common cause [14]. The results of our study are in line with the reports of Chandir *et al.*, who note a fall of vaccination rate by 51% in Sindh, Pakistan, affecting rural areas more than urban areas, and the outreach vaccination service more than fixed center services [17]. Our results coincide with the study by Shattock *et al.*, and Osei *et al.*, study, which showed the negative impact of conflict and war on immunization coverage [18, 19].Some factors identified in research undertaken by Bimpong *et al.*, are the reason behind the decline in registered immunizations. One of the greatest challenges that have been experienced in many other countries is the reluctance by parents to vaccinate their kids due to fear of infecting their kids in the process.The problem of vaccine hesitancy is already aggravated by preconceived ideas and myths about vaccination and misinformation, as well as rumours about COVID-19. Besides, the prohibition of social activity by the authorities and the absence or increase in the cost of transportation can also have played the key role in the reduction of the coverage [20].Our study showed that 40.98% of the participants had similar apprehensions. Another study by Saso *et al.*, in the United Kingdom, revealed that the causes of limiting the access of pregnant women and families/infants to antenatal clinics, primary health care centers to carry out their usual check-ups and follow-through the EPI schedule, respectively, were lockdown measures and social distancing [3]. We deduce that there is a huge impact of the pandemic, war and conflicts on immunization coverage. This could put people at more risk of vaccine-preventable disease (VPDs) outbreaks. Along with constant attempts to prevent the war, conflict and pandemic crises, there is a need to have strategies on more innovative ways of delivery or distribution of vaccines or meeting the surge in demand. It is essential to improve the Expanded Program on Immunization (EPI) performance with some infrastructure investments that can be justified by the extent of damage inflicted by the crises, or rather decentralized funding.

CONCLUSIONS

It was concluded that children in the sampled population had low EPI vaccinations due to the COVID-19 pandemic crisis. The main reason was the fear of getting COVID-19 in healthcare institutions, and then other reasons were connected with travelling and children not being able to follow protective strategies. These results identify essential challenges to routine immunization in times of public health crisis. To fill these gaps, the health leaders are to introduce a specific set of measures to decrease the level of fear toward vaccination, enforce more stringent measures of infection prevention at vaccination centers, and introduce mobile or community-based vaccine teams to support increased access. Incorporation of these strategies in the national immunization programs would ensure vaccination coverage is not affected in the case of future pandemics or emergencies.

Authors Contribution

Conceptualization: AG, HHF
Methodology: HT, AUK
Formal analysis: ARSK
Writing review and editing: SSHS, UA

DOI: https://doi.org/10.54393/pbmj.v8i6.1261

All authors have read and agreed to the published version of the manuscript.

Conflicts of Interest

The authors declare no conflict of interest.

Source of Funding

The author received no financial support for the research, authorship and/or publication of this article.

REFERENCES

[1] Onimoe G, Angappan D, Chandar MC, Rikleen S. Effect of COVID-19 pandemic on well child care and vaccination.Frontiers in Pediatrics.2022Apr;10: 873482. doi: 10.3389/fped.2022.873482.

[2] Mirza I, Lemango ET, Lindstrand A. Expanded Programme on Immunization (EPI): A Legacy of 50 Years and the Road Ahead. Vaccines.2025Jun;13(6): 649. doi: 10.3390/vaccines13060649.

[3] Saso A, Skirrow H, Kampmann B. Impact of COVID-19 on immunization services for maternal and infant vaccines: results of a survey conducted by imprint—the immunising pregnant women and infants network.Vaccines.2020Sep;8(3):556.doi: 10.3390/vaccines8030556.

[4] Jun JF. COVID-19 Stats. Vital Signs: Deaths Among Persons with Diagnosed HIV Infection, United States, 2010–2018. 2020 Jun: 1753.

[5] Abid K, Bari YA, Younas M, Tahir Javaid S, Imran A. <? covid19?> Progress of COVID-19 Epidemic in Pakistan. Asia Pacific Journal of Public Health.2020 May; 32(4): 154-6. doi: 10.1177/1010539520927259.

[6] Ilyas N, Azuine RE, Tamiz A. COVID-19 pandemic in Pakistan. International Journal of Translational Medical Research and Public Health.2020Feb;4(1): 37-49. doi: 10.21106/ijtmrph.139.

[7] Hoshen M, Shkalim Zemer V, Ashkenazi S, Grossman Z, Gerstein M, Yosef N, Cohen M, Cohen HA. How to increase COVID-19 vaccine uptake among children? determinants associated with vaccine compliance. Frontiers in Pediatrics.2023Jan;10:1038308.doi: 10.3389/fped.2022.1038308.

[8] Amendola A and Canuti M. Vaccine-preventable diseases. In Global Health Essentials.Cham: Springer International Publishing.2023Sep:117-127.doi:10. 1007/978-3-031-33851-9_18.

[9] Baidya A, Willens V, Wonodi C, Moss WJ. Maintaining Immunizations for Vaccine-Preventable Diseases in a Changing World. Annual Review of Public Health. 2024 Dec; 46. doi: 10.1146/annurev-publhealth-071723-111427.

[10] Hamid H, Mallhi TH, Naseer MS, Younas I, Rashid MA, Pervaiz A *et al.* The COVID-19 pandemic threatens the Expanded Program on Immunization: recommendations for sustaining vaccination goals. Drugs and Therapy Perspectives. 2020 Nov; 36: 523-5. doi: 10.1007/s40267-020-00774-2.

[11] Wahl B and Pitzer VE. Expanded Programme on Immunization at 50 years: its legacy and future.The Lancet.2024May;403(10441):2265-7.doi:10.1016/ S0140-6736(24)00982-6.

[12] Tahseen SA, Naeem M, Sarwar S. Awareness of the mothers about Expanded Programme on Immunization and relation of immunization coverage with maternal education and Covid-19 Pandemic Lockdown.Journal of Sheikh Zayed Medical College. 2022 Jun; 13(2): 10-6.

[13] Khan A, Chakravarty A, Mahapatra J. Impact of COVID-19 pandemic on childhood immunization in a tertiary health-care center.Indian Journal of Community Medicine.2021Jul;46(3):520-3.doi: 10.4103/ijcm.IJCM_847_20.

[14] Alsuhaibani M and Alaqeel A. Impact of the COVID-19 pandemic on routine childhood immunization in Saudi Arabia. Vaccines.2020Oct;8(4):581.doi:10.33 90/vaccines8040581.

[15] Alves JG, Figueiroa JN, Urquia ML. Impact of COVID-19 on immunization of Brazilian infants.International Journal of Infectious Diseases.2021Jun;107:252-3. doi: 10.1016/j.ijid.2021.04.089.

[16] Lassi ZS, Naseem R, Salam RA, Siddiqui F, Das JK. The impact of the COVID-19 pandemic on immunization campaigns and programs: a systematic review.International Journal of Environmental Research and Public Health.2021 Feb; 18(3): 988. doi: 10.3390/ijerph18030988.

[17] Chandir S, Siddiqi DA, Setayesh H, Khan AJ. Impact of COVID-19 lockdown on routine immunization in Karachi, Pakistan.The Lancet Global Health.2020 Sep;8(9):e1118-20.doi:10.1016/S2214-109X(20)302 90-4.

[18] Shattock AJ, Johnson HC, Sim SY, Carter A, Lambach P, Hutubessy RC *et al.* Contribution of vaccination to improved survival and health: modelling 50 years of the Expanded Programme on Immunization.The Lancet.2024May;403(10441):2307-16.doi:10.1016/S 0140-6736(24)00850-X.

[19] Osei I, Sarwar G, Hossain I, Sonko K, Ceesay L, Baldeh B *et al*, Mackenzie GA. Attendance and vaccination at immunization clinics in rural Gambia before and during the COVID-19 pandemic.Vaccine.2022Oct; 40(44): 6367-73. doi: 10.1016/j.vaccine.2022.09.031.

[20] Bimpong KA, Nuertey BD, Seidu AS, Ajinkpang S, Abdul-Mumin A. Decline in Uptake of Childhood Vaccinations in a Tertiary Hospital in Northern Ghana during the COVID-19 Pandemic.BioMed Research International.2021;2021(1):6995096.doi:/10.1155/ 2021/6995096.

DOI: https://doi.org/10.54393/pbmj.v8i6.1258

PAKISTAN BIOMEDICAL JOURNAL
https://www.pakistanbmj.com/journal/index.php/pbmj/index
ISSN (E): 2709-2798, (P): 2709-278X
Volume 8, Issue 06 (June 2025)

Original Article

OPEN ACCESS

Parental Perceptions of Sensory Avoidance and Sleep Disturbances among Autistic Children in Lahore: A Cross-sectional Study

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ARTICLE INFO

Keywords:
Sensory Processing, Sleep Habits, Pediatric Sleep Problems, Sensory Avoidance Behaviours in Autistic Children

How to Cite:
Nasim, E., Liaquat, M., Toqueer, S., Jaffar, M., & Ahmad, T. (2025). Parental Perceptions of Sensory Avoidance and Sleep Disturbances among Autistic Children in Lahore: A Cross-sectional Study: Parental Perceptions of Sensory Avoidance and Sleep Disturbances among Autistic Children. Pakistan BioMedical Journal, 8(6), 20-25. https://doi.org/10.54393/pbmj.v8i6.1258

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Received Date: 3rd May, 2025
Revised Date: 19th June, 2025
Acceptance Date: 21st June, 2025
Published Date: 30th June, 2025

ABSTRACT

As literature shows, children with autism often experience sensory processing difficulties and sleep disturbances. **Objectives:** To determine parent-reported sensory avoidance behaviours and sleep habits in school-aged children with autism spectrum disorder in Lahore. **Methods:** This observational cross-sectional study was conducted on 249 autistic children. Outcome measures of this study were the prevalence of sensory avoidance behaviours and sleep habits. The standardized tools were the Short Sensory Profile (SSP) and the Children's Sleep Habits Questionnaire (CSHQ) to assess the sensory avoidance behaviours and sleep problems. Data were gathered by using SSP and CSHQ. Data were analyzed by using SPSS-27. **Results:** 38% were aged 3-7 years, and 61% were aged 8–12 years. Parent reports showed that 17% of children exhibited probable differences and 53% exhibited significant differences in tactile sensory avoidance behaviours. Movement sensitivity issues were definite in 54% and probable in 30% of children. Regarding auditory sensory avoidance, 55% showed significant changes, and 1% showed probable changes. For under-responsive behaviour. For visual and auditory sensory behaviours, only 44% showed typical performance. Overall, 74% of children demonstrated definite sensory avoidance behaviours across multiple domains, while 8% showed some level of sensory avoidance. Additionally, 20% did not display low energy behaviours. Regarding sleep habits, 16% had typical sleep patterns, 3% faced sleep issues at a minimum level, 22% faced sleep issues at an intermediate level, and the remaining 57% faced sleep issues at a severe level. A p-value was >0.05. Significant association between sensory avoidance behaviour and sleep habits. **Conclusion:** Sensory avoidance behaviour had a significant association with sleep habits.

INTRODUCTION

Autism Spectrum Disorder (ASD) is a complex neurodevelopmental condition characterized by deficits in social interaction, communication, and repetitive behaviours [1]. Globally, its prevalence has risen significantly over the past two decades, although regional estimates vary. The global prevalence of autism spectrum disorder (ASD) remained uncertain, with studies reporting significant variations across different regions. In low-income countries, underdiagnosis was prevalent due to limited access to assessment tools. Autism, originally coined to describe the self-isolating tendencies in individuals with schizophrenia, was later redefined in the 1940s by psychiatrists Leo Kanner and Hans Asperger. They characterized it as a distinct syndrome in children, marked by atypical social interaction, communication challenges, and repetitive behaviours. In contemporary discourse, the term Autism encompasses a diverse variety of neurological issues, unified by shared clinical features such as speech impairments, social difficulties, and restricted or repetitive behavioural patterns [1, 2]. Autism, along with other neurodevelopmental disorders, had been recognized as possessing a substantial genetic foundation; however, it had also been posited that environmental influences contributed meaningfully to its aetiology. Gene expression

DOI: https://doi.org/10.54393/pbmj.v8i6.1258

in autism has varied due to copy number variations and exposure to environmental toxins [3-5]. Some cases of autism have been linked to spontaneous genetic mutations [6]. These mutations had affected neuron movement, axon direction, and the formation of synapses. Structural genetic changes were found more frequently in autistic children than in typically developing peers [7, 8]. A specific gene mutation, CHD8, had been associated with autism and was linked to physical traits such as an enlarged head and widely spaced eyes [3]. Autism Spectrum Disorder (ASD) usually develops in early life, where the issue is diagnosed as early as three years old. The initial symptoms included such signs as a poor reaction to the name and uneasiness with eye contact [9-11]. Though most social and cognitive challenges were carried down into adulthood, communication skills may prove to change with time, especially during adolescent years. Intelligence and IQ are known to be rather fixed. Nevertheless, the quality of life may improve greatly with the help of effective social support systems, interventions, and accommodations [12, 13]. Data from 2020 indicated that Hong Kong, South Korea, the United States, Japan, and Ireland had the highest recorded rates, with Hong Kong reporting 372 cases per 10,000 children [5]. The growing incidence of autism spectrum disorder (ASD) could have been explained by the fact that there are increasing environmental risk factors that are likely to increase during the prenatal period, including exposure to air pollution, advanced age of a father, and maternal use of psychotropic drugs. Though there has been a critical influence of genetic predisposition, which influences ASD, environmental factors are believed to be major contributors to the development of ASD. They may be causing the increase of ASD if the environmental factors emerged more and more strongly with the progress of time [6]. Difficulties in sensory processing are also common to a great proportion of children with ASD [14]. Sensory processing in the clinical practice was the increased sensitivity to external stimuli, sounds, lights or odors [15]. The idea of sensory integration was pioneered and explained how people perceived, processed and used rudiments of sense [16]. Researcher contribution is the basis of therapeutic approaches to working on sensory input/awareness, self-management, motor performance, and praxis. Winnie Dunn devised this model in 1997 and divided the responses into the model of sensory processing; this was dependent on the neurological threshold and behavioural response. There are neurological thresholds: lower (having a high degree of reactivity to low stimulation) and generally higher. Depending on the behavioural response, thresholds work against or with one another, resulting in four sensory processing patterns being low registration, sensory seeking, sensory sensitivity, and sensory avoiding [7]. Sensory integration dysfunction (SID) is a disorder of communication, social interaction that is built on incorrect behavioural patterns. It elevates due to poor neural transmission between the sensory receptors, afferent systems, and other subcortical components, causing inadequacies in the reception of those stimuli, processing, and modulation of the stimulus. SID occurred as hypersensitivity, with even low stimuli provoking the inappropriate responses or hyposensitivity, requiring high stimuli to arouse neural responses. The malfunction traverses in tactile, vestibular, proprioceptive, auditory, visual, gustatory and olfactory systems that affect motor coordination, emotional steadiness and mental development [8]. Sleep disturbance is yet another of the commonly co-morbid challenges in autistic children. Instead, it has been found that sleep problems, including bedtime resistance, delayed sleep onset, and night awakenings, are very common in ASD, with more than 50% [9].

This study aims to investigate parental perceptions of sensory avoidance and sleep habits among school-aged children with autism spectrum disorder (ASD) in Lahore. Disrupted sleep exacerbated the cognitive decline in these children, further hindering their developmental progress. The findings provided valuable insights for occupational physiotherapists in formulating targeted sensory integration strategies to mitigate sensory avoidance behaviours. Implementing such interventions not only enhanced the well-being of autistic children but also served as a crucial alleviating factor for parental distress.

METHODS

This study followed a cross-sectional, descriptive design with correlational analysis and was conducted over a period of four months (January 2025 to Apr 2025) in private autistic centers located in Lahore, Pakistan. When a prevalence (p) of 73% was assumed (based on the previous literature), with a confidence level (Z) of 95% (Z=1.96) and a margin of error (d) of 5% (d=0.05), the sample size approximately equaled 303. Based on practical limitations and scarcity of resources, a sample size of 249 participants was recruited, which was considered satisfactory to address the descriptive and correlational aims of the study [17]. In this study, a selected sample of 249 participants from the total population was used for the collection of data from private autistic centers of Lahore. The study followed the ethical guidelines and ethical approval was taken. Non-probability sampling technique was used for this purpose. The outcomes of this study were assessing sensory avoidance and sleep habits using standardized

DOI: https://doi.org/10.54393/pbmj.v8i6.1258

tools: The Short Sensory Profile (SSP) and the Children's Sleep Habits Questionnaire (CSHQ). Both are validated tools commonly used in neurodevelopmental research. To assess the internal consistency of the tools in the present sample, Cronbach's alpha was calculated. The SSP showed a Cronbach's alpha of 0.89, while the CSHQ yielded a Cronbach's alpha of 0.83, indicating good reliability in this population. Children aged 3–12 years with Autism Spectrum Disorder (ASD), diagnosed according to DSM-5 criteria by a licensed clinician, were included in the study. Primary caregivers were involved in the child's care and provided detailed reports of the child's sensory and sleep behaviours. Children were excluded if they had a primary diagnosis of another developmental disorder, such as intellectual disability or a genetic syndrome, which might affect sensory or sleep patterns. Children on sedative medications, with severe medical or neurological conditions, or with co-existing psychiatric disorders were excluded. Single parents with more than one disabled child, or parents not residing in the same household as the child, were also excluded. Data were analyzed using SPSS version 27.0. Categorical variables were described as absolute frequencies (n) and relative frequencies (%), while continuous variables were expressed as mean ± standard deviation for parametric distributions or as median and percentiles for non-parametric distributions. The Chi-square test was used to assess associations between categorical variables. Pearson's or Spearman's correlation coefficients were applied, as appropriate, to examine relationships between continuous variables. A p-value of less than 0.05 was considered statistically significant.

RESULTS

This study comprised 249 autistic children. Out of them, 96 autistic children (38.5%) were in the age range of 3-7 years old, and 153 autistic children (61.4%) belonged to the 8 years to 12 years' age group. The average coded age value was 1.61+/-0.49 (Table 1).

Table 1: Descriptive Statistics for Age and Gender Distribution of Autistic Children (n=249)

Variables	Descriptive Statistics
Mean	1.6145
Standard Deviation	0.48770
Minimum value	1.0
Maximum Value	2.0
Total	249

The gender ratio included 123 boys (49.40%), 126 girls (50.60%) (Figure 1).

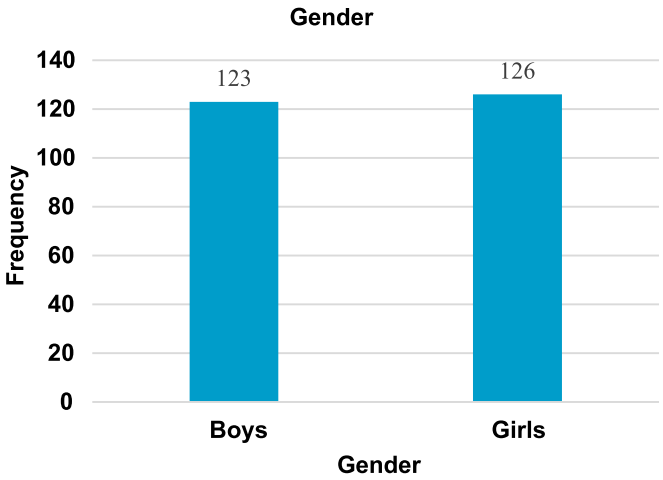

Figure 1: Gender Distribution of Autistic Children Showing 123 Were Boys and 126 Were Girls

Sensory avoidance behaviour was assessed using the Short Sensory Profile (SSP). 41 children showed typical performance, 22 subjects had shown some issues in sensory avoidance behaviours processing, and the remaining 1866 had shown significant differences in sensory avoidance behaviours processing (Table 2).

Table 2: Frequency of Sensory Avoidance Behaviours Assessed by Short Sensory Profile

Sensory Avoidance Behaviours	Frequency (%)
Typical Performance	41 (16.41%)
Probable Difference	22 (8.84%)
Significant Difference	186 (74.70%)
Total	249 (100%)

Sleep patterns were evaluated using the Children's Sleep Habits Questionnaire (CSHQ). Results showed that 42 children (16.9%) had typical sleep habits, 8 (3.2%) had mild sleep problems, 55 (22.1%) had moderate sleep problems, and 144 (57.8%) experienced severe sleep disturbances (Table 3).

Table 3: Distribution of Sleep Habits among Autistic Children

Sleep Habits	Frequency (%)
Typical Sleep Habits	42 (16.87%)
Mild Sleep Problems	8 (3.21%)
Moderate Sleep Problems	55 (22.09%)
Severe Sleep Problems	144 (57.83%)
Total	249 (100%)

A Chi-square test showed a significant association between age group and sensory avoidance behaviour (χ^2 = 9.22, df=2, p=0.010). However, no significant association was found between gender and sensory avoidance (χ^2 = 0.78, df=2, p=0.675). There was a statistically significant association between sensory avoidance behaviours and sleep disturbances (χ^2 = 15.62, df=6, p=0.016), indicating that children with greater sensory avoidance had more

DOI: https://doi.org/10.54393/pbmj.v8i6.1258

severe sleep issues (Table 4).

Table 4: Chi-Square Test Showing Association Between Sensory Avoidance, Age, Gender, And Sleep Habits

Variable Pair	χ^2 Value	df	p-Value	Interpretation
Age Group × Sensory Avoidance	9.22	2	0.010	Significant
Gender × Sensory Avoidance	0.78	2	0.675	Not Significant
Sensory Avoidance × Sleep Habits	15.62	6	0.016	Significant

DISCUSSION

Autism Spectrum Disorder (ASD) typically manifests during early childhood, with formal diagnoses frequently established by the age of three. Early indicators often comprised reduced responsiveness to auditory cues, such as one's name being called, and a pronounced aversion to maintaining eye contact [18, 19]. Although difficulties in social interaction and cognitive functioning generally persisted into adulthood, communicative abilities often showed improvement over time, particularly during adolescence [20, 21]. Cognitive aptitude, including intelligence quotient (IQ), tended to remain stable throughout the lifespan [22]. Nevertheless, the overall quality of life for individuals with ASD was markedly enhanced through the implementation of robust social support systems, tailored therapeutic interventions, and context-specific accommodations [23]. This observational study included children between the ages of 3 and 12 years who had autism spectrum disorder. Information was collected from their parents. According to parent reports, 17% of the children showed possible differences, and 53% showed clear differences in how they avoided touch. For taste and smell, 32% had clear differences and 12% had possible differences. Problems with movement sensitivity were definite in 54% of the children and possible in 30%. When it came to avoiding sounds, 55% showed clear signs and 1% showed possible signs. For under-responsiveness (less reaction to sensory input), 48% showed definite signs and 1% showed possible signs. Only 44% of the children showed normal behaviour in both seeing and hearing responses. Overall, 74% of the children had definite sensory avoidance in more than one area, and 8% had some level of sensory avoidance. Also, 20% of the children did not show signs of low energy behaviours. Olson, investigating the school-aged children with autism, found links between one-carbon metabolism (OCM) nutrients and sensory processing patterns, revealing significant associations between intake of vitamins B1, B12, and choline with specific sensory domains [24]. In contrast, the present study focused on parent-reported sensory avoidance behaviours and sleep habits without assessing nutritional factors. While the earlier research highlighted biological influences on sensory responses, our findings emphasized the behavioural manifestations of sensory avoidance across multiple domains, along with a notable association with sleep difficulties. Both studies underscore the complexity of sensory processing in autism, though from different perspectives biochemical versus behavioural. These differences suggest a need for integrative approaches in future research to better understand the interplay between diet, sensory behaviours, and overall well-being in autistic children. Aljaid examined sleep habits among autistic children under 15 years and found significant differences compared to typically developing peers, including shorter sleep duration, earlier bedtimes, and higher rates of sleep disturbances such as snoring and morning headaches [25]. Similarly, the present study revealed that a large proportion (57%) of autistic children experienced severe sleep problems, with only 16% displaying typical sleep patterns. Gulati reported that 77.5% of children with ASD were poor sleepers, supported by objective polysomnographic findings showing reduced sleep efficiency and altered sleep architecture [26].

CONCLUSIONS

It was concluded that sensory avoidance behaviour had a significant association with sleep habits. Early sensory integration therapies are recommended as they be employed in therapy programs in order to enhance sleep among the autistic children. Furthermore, education and training programs oriented to parents should be developed to control sensory challenges at home.

Authors Contribution

Conceptualization: EN
Methodology: ML, ST
Formal analysis: EN
Writing review and editing: EN, MJ, TA

All authors have read and agreed to the published version of the manuscript.

Conflicts of Interest

The authors declare no conflict of interest.

Source of Funding

The author received no financial support for the research, authorship and/or publication of this article.

REFERENCES

[1] Sauer AK, Stanton J, Hans S, Grabrucker A. Autism spectrum disorders: etiology and pathology. Exon Publications. 2021 Aug: 1-5. doi: 10.36255/exonpublications.autismspectrumdisorders.2021.etiology.

[2] Amaral DG. Examining the causes of autism. In Cerebrum: The Dana forum on brain science. 2017 Jan; (2017): cer-01.

DOI: https://doi.org/10.54393/pbmj.v8i6.1258

[3] Bhat S, Acharya UR, Adeli H, Bairy GM, Adeli A. Autism: cause factors, early diagnosis and therapies. Reviews in the Neurosciences. 2014 Dec; 25(6): 841-50. doi: 10.1515/revneuro-2014-0056.

[4] Masi A, DeMayo MM, Glozier N, Guastella AJ. An overview of autism spectrum disorder, heterogeneity and treatment options. Neuroscience Bulletin. 2017 Apr; 33: 183-93. doi: 10.1007/s12264-017-0100-y.

[5] Nkonyane F, Gurayah T, Lingah T. Challenges and coping strategies of parents of children with autism spectrum disorder in Eswatini. Journal of Child and Adolescent Mental Health. 2021 Sep; 33(1-3): 32-41. doi: 10.2989/17280583.2023.2259428.

[6] Taylor MJ, Rosenqvist MA, Larsson H, Gillberg C, D'Onofrio BM, Lichtenstein P *et al.* Etiology of autism spectrum disorders and autistic traits over time. Journal of the American Medical Association Psychiatry. 2020 Sep; 77(9): 936-43. doi: 10.1001/jamapsychiatry.2020.0680.

[7] Van den Boogert F, Klein K, Spaan P, Sizoo B, Bouman YH, Hoogendijk WJ *et al.* Sensory processing difficulties in psychiatric disorders: A meta-analysis. Journal of Psychiatric Research. 2022 Jul; 151: 173-80. doi: 10.1016/j.jpsychires.2022.04.020.

[8] Ilić-Savić I, Petrović-Lazić M, Resimić R. Sensory integration and its significance for functioning and development of children's speech. Medicinski Pregled. 2021; 74(5-6): 205-10. doi: 10.2298/MPNS2106205I.

[9] Mahaseth PK and Choudhary A. Sensory Integration Therapy Verses Conventional Physical Therapy Among Children with Cerebral Palsy On Gross Motor Function-A Comparative Randomized Controlled Trial. Annals of the Romanian Society for Cell Biology. 2021 Apr; 25(4).

[10] Kuhlthau K, Orlich F, Hall TA, Sikora D, Kovacs EA, Delahaye J *et al.* Health-related quality of life in children with autism spectrum disorders: Results from the autism treatment network. Journal of Autism and Developmental Disorders. 2010 Jun; 40: 721-9. doi: 10.1007/s10803-009-0921-2.

[11] Halstead EJ, Joyce A, Sullivan E, Tywyn C, Davies K, Jones A *et al.* Sleep disturbances and patterns in children with neurodevelopmental conditions. Frontiers in Pediatrics. 2021 Mar; 9: 637770. doi: 10.3389/fped.2021.637770.

[12] Draudvilienė L, Sosunkevič S, Daniusevičiūtė-Brazaitė L, Burkauskienė A, Draudvila J. The benefit assessment of the physiotherapy sessions for children with autism spectrum disorder. Baltic Journal of Sport and Health Sciences. 2020 Nov; 3(118): 25-32. doi: 10.33607/bjshs.v3i118.971.

[13] Warutkar VB, Kovela RK, Warutkar V. Review of sensory integration therapy for children with cerebral palsy. Cureus. 2022 Oct; 14(10). doi: 10.7759/cureus.30714.

[14] Guller B and Yaylaci F. Eating and sleep problems, related factors, and effects on the mental health of the parents in children with autism spectrum disorder. International Journal of Developmental Disabilities. 2024 May; 70(3): 406-15. doi: 10.1080/20473869.2022.2095689.

[15] Griffin ZA, Boulton KA, Thapa R, DeMayo MM, Ambarchi Z, Thomas E *et al.* Atypical sensory processing features in children with autism, and their relationships with maladaptive behaviors and caregiver strain. Autism Research. 2022 Jun; 15(6): 1120-9. doi: 10.1002/aur.2700.

[16] Holingue C, Volk H, Crocetti D, Gottlieb B, Spira AP, Mostofsky SH. Links between parent-reported measures of poor sleep and executive function in childhood autism and attention deficit hyperactivity disorder. Sleep Health. 2021 Jun; 7(3): 375-83. doi: 10.1016/j.sleh.2020.12.006.

[17] Ben-Sasson A, Hen L, Fluss R, Cermak SA, Engel-Yeger B, Gal E. A meta-analysis of sensory modulation symptoms in individuals with autism spectrum disorders. Journal of Autism and Developmental Disorders. 2009 Jan; 39: 1-1. doi: 10.1007/s10803-008-0593-3.

[18] Pickard H, Hirsch C, Simonoff E, Happé F. Exploring the cognitive, emotional and sensory correlates of social anxiety in autistic and neurotypical adolescents. Journal of Child Psychology and Psychiatry. 2020 Dec; 61(12): 1317-27. doi: 0.1111/jcpp.13214.

[19] Horiuchi F, Kawabe K, Oka Y, Nakachi K, Hosokawa R, Ueno SI. The association between autistic traits and sleep habits/problems in toddlers. Developmental Neuropsychology. 2020 Dec; 45(7-8): 485-95. doi: 10.1080/87565641.2020.1865357.

[20] Glod M, Riby DM, Rodgers J. Relationships between sensory processing, repetitive behaviors, anxiety, and intolerance of uncertainty in autism spectrum disorder and Williams syndrome. Autism Research. 2019 May; 12(5): 759-65. doi: 10.1002/aur.2096.

[21] Kadwa RA, Sahu JK, Singhi P, Malhi P, Mittal BR. Prevalence and characteristics of sensory processing abnormalities and its correlation with FDG-PET findings in children with autism. The Indian Journal of Pediatrics. 2019 Nov; 86: 1036-42. doi: 10.1007/s12098-019-03061-9.

[22] Burns CO, Dixon DR, Novack M, Granpeesheh D. A systematic review of assessments for sensory processing abnormalities in autism spectrum disorder. Review Journal of Autism and

DOI: https://doi.org/10.54393/pbmj.v8i6.1258

Developmental Disorders. 2017 Sep; 4: 209-24. doi: 10.1007/s40489-017-0109-1.

[23] Al-Farsi OA, Al-Farsi YM, Al-Sharbati MM, Al-Adawi S. Sleep habits and sleep disorders among children with autism spectrum disorders, intellectual disabilities and typically developing children in Oman: a case-control study. Early Child Development and Care. 2019 Dec; 189(14): 2370-80. doi: 10.1080/03004430.2018.1455671.

[24] Olson A, Krall JR, Baranova A, Slavin M. Nutritional Intake and Sensory Processing in School-Aged Children with Autism Spectrum Disorder. Nutrients. 2025 Feb; 17(4): 604. doi: 10.3390/nu17040604.

[25] Aljaid MS, Alharthi MS, Alrubie SS, Qattan FM, Almalki AS, Alzahrani ES *et al.* Comparative Analysis of Sleep Behavior in ASD Children: A Taif City Perspective. Bangladesh Journal of Medical Science. 2025 Feb: 123-32. doi: 10.3329/bjms.v24i10.79181.

[26] Gulati S, Sharma S, Singh A, Chowdhary SR, Meena A, Singh S *et al.* 1167 The spectrum of Co-morbidities in children with ASD (Autism Spectrum Disorder). Archives of Disease in Childhood. 2022 Aug; 107(Suppl 2): A323-4. doi: 10.1136/archdischild-2022-rcpch.523.

DOI: https://doi.org/10.54393/pbmj.v8i6.1259

PAKISTAN BIOMEDICAL JOURNAL

https://www.pakistanbmj.com/journal/index.php/pbmj/index

ISSN (E): 2709-2798, (P): 2709-278X

Volume 8, Issue 06 (June 2025)

OPEN ACCESS

Original Article

Prevalence of Urinary Incontinence among Middle Aged Women and Its Association with Quality of Life

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ARTICLE INFO

Keywords:
Urinary Incontinence, Middle-Aged Women, Quality of Life, Prevalence, Mental Health

How to Cite:
Jafar, M., Waqas, M., Touqeer, S., Nasim, E., & Ahmad, T. (2025). Prevalence of Urinary Incontinence among Middle Aged Women and Its Association with Quality of Life: Urinary Incontinence among Women. Pakistan BioMedical Journal, 8(6), 26-30. https://doi.org/ 10.54393/pbmj.v8i6.1259

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Received Date: 5th May, 2025
Revised Date: 19th June, 2025
Acceptance Date: 24th June, 2025
Published Date: 30th June, 2025

ABSTRACT

Existing literature had shown a significant rise in the prevalence of urinary incontinence among female. This increasing trend in urinary incontinence had been associated with a noticeable decline in quality of life. **Objective:** To evaluate the prevalence of urinary incontinence in middle aged women to find the association between urinary incontinence and quality of life of middle aged women. **Methods:** This observational cross-sectional analytical study was conducted in a six-month study duration in Lahore. Female patients aged 35 to 65 years were selected. Outcome measures of this study were measuring urinary incontinence and quality of life. Data were collected from Sir Ganga Ram Hospital. Data were gathered by using ICIQ-SF and SF12. Data were analyzed by using SPSS version 27.0`1. **Results:** This observational study enrolled middle-aged women aged 35 to 65 years. The majority (53%) were housewives, while 46% were employed. Regarding socioeconomic status, 53% reported financial stability, whereas 79% indicated economic instability a discrepancy suggesting possible reporting error. Marital status distribution showed that 59% were married, 12% unmarried, and 27% widowed. In terms of Quality of Life (QoL), 19% of participants reported poor physical health, 62% fair, and 17% good physical health. **Conclusions:** Most middle-aged women in this study experienced urinary incontinence, with greater severity linked to poorer physical and mental health, especially among housewives.

INTRODUCTION

Historically, urinary incontinence (urinary incontinence) had been defined as the involuntary expulsion of urine, verified through objective observation, and regarded primarily as a social or hygienic issue. Although this definition possessed a high degree of specificity, it had proven to be of limited clinical utility. Women who had reported subjective symptoms of urinary incontinence were often disregarded by clinicians if such episodes had not been witnessed during physical examination or if the condition had not been perceived by patients as a significant hygienic concern. In contrast, the contemporary definition characterized urinary incontinence as any reported instance of involuntary urinary leakage. Paradoxically, this broader interpretation had encompassed a wide range of individuals, including those who had only encountered occasional or incidental episodes [1]. Incontinence arose from disturbances in the micturition cycle, assuming an intact lower urinary tract. Urine flow occurred when intravesical pressure exceeded urethral pressure or when urethral closure pressure became zero. This could result from reduced urethral pressure with increased intravesical pressure, as in detrusor instability. Alternatively, excessive detrusor pressure during filling indicated impaired bladder compliance, often seen in interstitial cystitis or post-pelvic irradiation. Urethral instability caused sudden pressure loss, while genurinary incontinence ne stress incontinence occurred when intravesical pressure surpassed urethral

DOI: https://doi.org/10.54393/pbmj.v8i6.1259

pressure [2]. It was estimated that over 200 million women worldwide had experienced urinary incontinence. The reported prevalence of the condition ranged from 5.2% to 70.8%, with some studies indicating that the rates might have been higher in developing countries compared to developed nations [3]. Population studies from various countries had indicated that the prevalence of urinary incontinence ranged from approximately 5% to 70%, with the majority of studies reporting rates between 25% and 45%. These figures increased with age, and among women aged 70 years and older, more than 40% of the population had been affected [4]. Stress urinary incontinence involved involuntary urine leakage during physical exertion, commonly linked to pregnancy, childbirth, constipation, and obesity. Urge incontinence was characterized by involuntary leakage following a sudden, intense urge to void, often part of Overactive Bladder Syndrome (OAB). Mixed urinary incontinence involved both stress and urgency incontinence. Overflow incontinence resulted from urinary retention, causing frequent or continuous leakage due to an over-distended bladder. Nocturnal enuresis referred to involuntary nighttime urine leakage, often related to OAB or sleep apnoea. Reflex incontinence was caused by neurological damage impairing bladder function. Functional incontinence had no organic cause, typically linked to cognitive or physical impairments that hindered toilet use [5]. Stress urinary incontinence (urinary incontinence) was caused by failure of the bladder neck and urethra to maintain resistance during rest or exertion. This occurred due to weakened musculo-fascial support, urethral hypermobility, or nerve damage, particularly to the pudendal nerve. Affected women showed reduced urethral pressure and absent vascular pulsations. Reflex muscle contractions were impaired, compromising continence. Studies confirmed lower urethral length and pressure correlated with urinary incontinence severity. The core mechanism was inadequate transmission of abdominal pressure to the urethra during stress. Factors such as obesity, full bladder, or vigorous activity further aggravated symptoms [6]. Sphincter weakness often followed surgery, ageing, nerve problems, or muscle diseases. Treatments worked better when some urethral support remained. The "hammock theory" explained that the urethra was normally supported by tissue beneath it, helping keep it closed during pressure. If this support was damaged by childbirth, obesity, or constant straining, the urethra moved instead of closing. This led to urine leaking during coughing, lifting, or exercise. Without firm support, bladder pressure became stronger than urethral pressure [7]. Urinary incontinence (urinary incontinence) is a common yet often underreported condition among middle-aged women, significantly affecting their daily lives. Hormonal changes, childbirth, and aging contribute to weakened pelvic floor muscles, increasing the risk of urinary incontinence. This condition can lead to embarrassment, social withdrawal, and psychological distress. As a result, urinary incontinence negatively impacts the quality of life (QoL), including physical, emotional, and social well-being. Investigating this association between urinary incontinence and quality of life, this was crucial to gurinary incontinence de effective interventions and improve women's overall health outcomes [8-10].

This study highlighted the impact of urinary incontinence on women's quality of life, promoting greater awareness and early intervention. It supports the development of targeted strategies to improve women's overall health and well-being.

METHODS

With a 95% confidence level, 5% margin of error and estimated prevalence of urinary incontinence of 50%, sample size of the proposed observational, cross-sectional analytical study was calculated with the Raosoft online sample size calculator, (http://www.raosoft.com/samplesize.html) based on a 95% confidence level, 5% margin of error and an estimated prevalence of 50 % to provide maximum variability due to the unavailability of local prevalence data. Coupled with the assumption of large population size (more than 10,000 population size) the required sample size was calculated to be 151 participants. The recruiting method adopted in this sample was the non-probability convenience sampling method and was a sample recruited within a period of 6 months of a particular hospital, Sir Ganga Ram Hospital. The study included female participants aged 35 to 65 years who presented to Sir Ganga Ram Hospital, reported urinary or pelvic health concerns, and provided informed consent. Women were excluded if they were younger than 35 or older than 65 years, pregnant or within six months postpartum, had known cognitive or neurological impairments, or declined to participate. The study was carried out in Sir Ganga Ram Hospital in a time duration of six months in Lahore. Using two standardized and validated questionnaires (International Consultation on Incontinence Questionnaire Short Form-ICIQ-SF and Short Form-12 Health Survey-SF-12) data were collected by personal interviews after obtaining written informed consent and ethical permission amongst eligible participants. The respondents were tackled in the outpatient departments and the questionnaires were administered by trained data collectors in a confidential room to make them give honest answers. Interviews consisted of about 1520 minutes. Categorical variables were summarized using frequencies and percentages, while continuous variables were reported using means and standard deviations where appropriate. Data analysis was performed using SPSS version 27.0. Descriptive statistics were applied for demographic variables, while the Chi-square test was used

DOI: https://doi.org/10.54393/pbmj.v8i6.1259

to explore associations between urinary incontinence and both physical and mental health. A significance level of $p < 0.05$ was considered statistically significant.

RESULTS

A total of 151 female participants, aged between 35 and 65 years, were included in the study. Results showed that , 11.92% (n = 18) of the women were in the 35–45 years age group, 43.05% (n = 65) were aged 46–55 years, and the remaining 45.03% (n = 68) belonged to the 56–65 years age group (Figure 1).

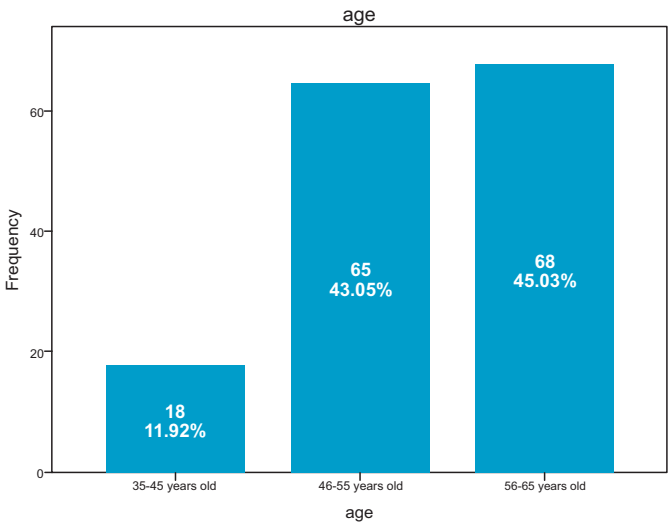

Figure 1: Age Distribution of Study Participants (N = 151)

All participants were female with a gender distribution of 100% female (n = 151) (Table 1).

Table 1: Gender Distribution of Study Participants (N = 151)

Gender	Frequency (%)
Female	151 (100)
Total	151 (100)

The prevalence of urinary incontinence (UI) was found to be 72.8% (n = 110) while 27.2% (n = 41) reported no symptoms (Table 2). This indicated that nearly three-fourths of the study population experienced some form of UI.

Table 2: Prevalence of Urinary Incontinence

Prevalence of Urinary Incontinence	Frequency (%)
Absent	41 (27.2)
Present	110 (72.8)
Total	151 (100)

Regarding self-rated physical health, results show that 19.2% (n = 29) of women reported poor physical health, 62.9% (n = 95) reported fair, and 17.9% (n = 27) reported good physical health (Table 3).

Table 3: Self-Reported Physical Health Status among Women

Physical Health	Frequency (%)
Poor	29 (19.2)
Fair	95 (62.9)
Good	27 (17.9)
Total	151 (100)

Chi-square test was used to determine the relationship between urinary incontinence and physical health. The result of the analysis was significant ($\chi^2 = 74.371$, $p < 0.001$) which shows that urinary incontinence was linked significantly to poorer self-reported physical health. To be more specific, the more participants experienced UI or the more severe its manifestations were, the more of them reported poor or fair physical condition. There was a statistically significant association between urinary incontinence (urinary incontinence) and mental health. As the incidence of urinary incontinence increased, physical health declined (Table 4).

Table 4: Chi-Square Test Showed the Association Between Urinary Incontinence and Physical Health

Test	Value	Significant Value
Chi-square	74.371	0.00
Number of Valid Cases	151	

Nevertheless, another Chi-square test was conducted to assess the correlation between mental health and urinary incontinence. Its significance was also statistical ($\chi^2 = 88.298$, $p < 0.001$), implying that those with UI had more chances of reporting worse or poor mental health whereas good mental health was largely reported by the individuals without any of the UI symptoms. There was a statistically significant association between urinary incontinence (urinary incontinence) and mental health. As the incidence of urinary incontinence increased, mental health declined (Table 5).

Table 5: Chi-Square Test Showed the Association Between Urinary Incontinence and Mental Health

Test	Value	Significant Value
Chi-square	88.298	0.00
Number of Valid Cases	151	

DISCUSSION

Urinary incontinence (urinary incontinence) affected women at various stages of life and was frequently associated with contributing factors such as obesity, diabetes mellitus, multi-parity, physical inactivity, tobacco use, excessive caffeine intake, chronic constipation, and recurrent urinary tract infections [1]. The premenopausal period represented a particularly vulnerable phase, owing to physiological changes within the pelvic and genitourinary systems [6, 7]. Women commonly reported limitations in social participation and difficulties in maintaining intimate relationships, particularly due to leakage during sexual activity [11-15]. Many adopted rigorous hygiene practices, driven by concerns over loss of control and perceived embarrassment [10]. As such, urinary incontinence was recognized as a condition with

DOI: https://doi.org/10.54393/pbmj.v8i6.1259

extensive physical, sexual, and psychological repercussions [4, 16]. Results of this study showed i.e. this observational investigation encompassed middle-aged female participants ranging from 35 to 65 years of age. Within the cohort, 11% fell within the 35-45 age brackets, 45% were aged 46-55, and 46% belonged to the 56-65 age group. All subjects were women. A majority (53%) identified as housewives, while 46% reported active employment. In terms of socioeconomic classification, 53% declared financial stability, whereas a notably higher proportion 79% indicated economic hardship, a statistical incongrurinary incontinence suggestive of potential reporting inconsistencies. Marital status was distributed as follows: 59% were married, 12% unmarried, and 27% widowed. Regarding self-perceived physical health, 19% of participants rated their condition as poor, 62% as fair, and 17% as good. Concerning mental wellbeing, 37% reported poor, 25% fair, and 37% good mental health. Symptoms indicative of urinary incontinence were observed in 72% of respondents, while 27.2% reported no such symptoms. With respect to urinary incontinence (urinary incontinence), 23.85% experienced mild, 25% moderate, and 23.18% severe manifestations. A 3×2 contingency analysis examining the association between urinary incontinence and physical health indicated that 16 participants without urinary incontinence reported fair physical health possibly reflecting outlier data while 25 without urinary incontinence reported good physical health. Among individuals experiencing urinary incontinence, 29 reported poor, 79 fair, and 2 good physical health, the latter suggestive of less severe symptomatology. A statistically significant correlation was established between the presence and severity of urinary incontinence and both physical and mental health outcomes, with a clear decline in health status observed as urinary incontinence severity increased [16-18]. A second 3×2 contingency analysis exploring the relationship between urinary incontinence and mental health demonstrated that among participants without urinary incontinence, one reported fair and forty reported good mental wellbeing again raising the possibility of anomalous data. Conversely, among those exhibiting urinary incontinence symptoms, 57 reported poor, 37 fair, and 16 good mental health, findings consistent with milder forms of urinary incontinence in the latter subset. A previous study conducted in Portugal among 80 women with urinary incontinence found that those reporting mild to moderate symptoms experienced a higher quality of life and greater sexual satisfaction, while higher prevalence of urinary incontinence was linked to increased emotional distress and reliance on maladaptive coping strategies such as self-blame and religious coping [18]. In comparison, the present study similarly identified a significant association between urinary incontinence, higher prevalence, and both physical and mental health. As urinary incontinence symptoms increased, participants in the current study reported declines in physical wellbeing and heightened psychological distress. Additionally, a higher prevalence of poor mental health was observed among those with higher incidence of urinary incontinence. Both studies underscore the detrimental impact of urinary incontinence on women's quality of life and emphasize the need for supportive interventions [19, 20].

CONCLUSIONS

Urinary incontinence is highly prevalent among middle-aged women and is significantly associated with poorer physical and mental health. This study found that nearly three-quarters of participants experienced urinary incontinence, with increasing severity linked to greater declines in quality of life. The findings highlight the urgent need for early identification and targeted interventions to improve both the physical and psychological well-being of affected women.

Authors Contribution

Conceptualization: TA
Methodology: MJ, MW
Formal analysis: ST, EN, TA
Writing, review and editing: MJ, MW, ST, EN, TA

All authors have read and agreed to the published version of the manuscript.

Conflicts of Interest

The authors declare no conflict of interest.

Source of Funding

The author received no financial support for the research, authorship and/or publication of this article.

REFERENCES

[1] Minassian VA, Bazi T, Stewart WF. Clinical epidemiological insights into urinary incontinence. International Urogynecology Journal. 2017 May; 28: 687-96. doi: 10.1007/s00192-017-3314-7.

[2] Wyndaele M and Hashim H. Pathophysiology of urinary incontinence. Surgery (Oxford). 2017 Jun; 35(6): 287-92. doi: 10.1016/j.mpsur.2017.03.002.

[3] Islam RM, Bell RJ, Hossain MB, Davis SR. Types of urinary incontinence in Bangladeshi women at midlife: Prevalence and risk factors. Maturitas. 2018 Oct; 116: 18-23. doi: 10.1016/j.maturitas.2018.07.012.

[4] Milsom I and Gyhagen M. The prevalence of urinary incontinence. Climacteric. 2019May;22(3):217-22. doi: 10.1080/13697137.2018.1543263.

[5] Bardsley A. An overview of urinary incontinence. British Journal of Nursing. 2016Oct;25(18):S14-21. doi: 10.12968/bjon.2016.25.18.S14.

DOI: https://doi.org/10.54393/pbmj.v8i6.1259

[6] Cervigni M and Gambacciani M. Female urinary stress incontinence. Climacteric.20150ct;18(sup1):30-6. doi: 10.3109/13697137.2015.1090859.
[7] Aoki Y, Brown HW, Brubaker L, Cornu JN, Daly JO, Cartwright R. Urinary incontinence in women. Nature Reviews Disease Primers.2017Jul;3(1):1-20.doi: 10.1038/nrdp.2017.42.
[8] Dai S, Chen H, Luo T. Prevalence and factors of urinary incontinence among postpartum: systematic review and meta-analysis. BioMed Central Pregnancy and Childbirth.2023Oct;23(1):761.doi:10.1186/s12884-023-06059-6.
[9] Yağmur Y and Gül S. Urinary incontinence in women aged 40 and older: Its prevalence, risk factors, and effect on quality of life.Nigerian Journal of Clinical Practice.2021Feb;24(2):186-92.doi:10.4103/njcp.njcp_626_18.
[10] Mazur-Bialy AI, Kołomańska-Bogucka D, Nowakowski C, Tim S. Urinary incontinence in women: modern methods of physiotherapy as a support for surgical treatment or independent therapy. Journal of Clinical Medicine.2020 Apr; 9(4): 1211. doi: 10.3390/jcm9041211.
[11] Khandelwal C and Kistler C. Diagnosis of urinary incontinence. American Family Physician. 2013 Apr; 87(8): 543-50.
[12] Bernards AT, Berghmans BC, Slieker-ten Hove MC, Staal JB, de Bie RA, Hendriks EJ. Dutch gurinary incontinence delines for physiotherapy in patients with stress urinary incontinence: an update. International Urogynecology Journal. 2014 Feb; 25: 171-9. doi: 10.1007/s00192-013-2219-3.
[13] Trowbridge ER and Hoover EF. Evaluation and treatment of urinary incontinence in women. Gastroenterology Clinics. 2022 Mar; 51(1): 157-75. doi: 10.1016/j.gtc.2021.10.010.
[14] Shang X, Fu Y, Jin X, Wang C, Wang P, Guo P *et al.* Association of overweight, obesity and risk of urinary incontinence in middle-aged and older women: a meta epidemiology study. Frontiers in Endocrinology .2023Oct;14:1220551.doi:10.3389/fendo.2023.1220551.
[15] Chow PM, Chuang YC, Hsu KC, Shen YC, Liu SP. Impact of female stress urinary incontinence on quality of life, mental health, work limitation, and healthcare seeking in China, Taiwan, and South Korea (LUTS Asia): results from a cross-sectional, population-based study.International Journal of Women's Health.2022Dec:1871-80.doi:10.2147/IJWH.S383651.
[16] Veronese N, Smith L, Pizzol D, Soysal P, Maggi S, Ilie PC *et al.* Urinary incontinence and quality of life: a longitudinal analysis from the English Longitudinal Study of Ageing. Maturitas. 2022 Jun; 160: 11-5. doi: 10.1016/j.maturitas.2022.01.010.
[17] Najafi Z, Morowatisharifabad MA, Jambarsang S, Rezaeipandari H, Hemayati R. Urinary incontinence and related quality of life among elderly women in Tabas, South Khorasan, Iran.BioMed Central Urology.2022Dec;22(1):214.doi:10.1186/s12894-022-01171-9.
[18] Pizzol D, Demurtas J, Celotto S, Maggi S, Smith L, Angiolelli G *et al.* Urinary incontinence and quality of life: a systematic review and meta-analysis. Aging Clinical and Experimental Research.2021Jan; 33: 25-35. doi: 10.1007/s40520-020-01712-y.
[19] Hassan S, Malik KK, Khursheed MA, Seikh AH, Ali A, Siddiqui AA. Frequency of Different Types of Urinary Incontinence and Their impact on Quality of Life of Pakistani Women: Different Types of Urinary Incontinence and Their impact on Quality of Life. Pakistan BioMedical Journal. 2022 Jun: 291-5. doi: 10.54393/pbmj.v5i6.190.
[20] Fahim F, Fahim WB, Lakhta G, Khan FR. Urinary Incontinence in Pakistani Women: Impact on Quality of Life and Treatment-Seeking Behavior. Progress in Medical Sciences. 2022; 6(1): 1-7. doi: 10.47363/PMS/2022(6)169.

DOI: https://doi.org/10.54393/pbmj.v8i6.1257

PAKISTAN BIOMEDICAL JOURNAL
https://www.pakistanbmj.com/journal/index.php/pbmj/index
ISSN (E): 2709-2798, (P): 2709-278X
Volume 8, Issue 06 (June 2025)

Original Article

OPEN ACCESS

Attitude of Healthcare Workers Towards the Termination of Pregnancy in Peshawar, Pakistan

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ARTICLE INFO

Keywords:
Attitude, Healthcare Workers, Termination of Pregnancy, Abortion

How to Cite:
Arif, E., Ullah, A., Taj, J., Ullah, S., Jamal, A., Ayub, R., Taharat, A., Anwar, S., Arshad, R., & Aftab, R. (2025). Attitude of Healthcare Workers Towards the Termination of Pregnancy in Peshawar, Pakistan: Healthcare Workers Towards the Termination of Pregnancy. Pakistan BioMedical Journal, 8(6). 31-36. https://doi.org/10.54393/pbmj.v8i6.1257

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Received Date: 8th May, 2025
Revised Date: 18th June, 2025
Acceptance Date: 23rd June, 2025
Published Date: 30th June, 2025

ABSTRACT

Unsafe abortion remains a major public health issue in Pakistan, including Peshawar, due to restrictive laws, stigma, and limited access to safe services. **Objectives:** To assess the healthcare workers' perspective towards the termination of pregnancy and their legal and religious perceptions regarding it. **Methods:** A cross-sectional study was conducted among gynecologists, Lady Health Workers (LHWs), and nurses in the Gynecology and Obstetrics Department of public and private hospitals in Peshawar from January 2025 to March 2025. Structured questionnaires were distributed among 200 healthcare workers, and their responses were analyzed using SPSS version 20.0. The frequencies and percentages were calculated for qualitative variables, and the chi-square test was applied to check statistically significant association between different categorical variables, with a p-value<0.05 considered significant. **Results:** Among healthcare workers in Pakistan, nearly all (96.5%) agreed to terminate pregnancies when the mother's life was at risk, while approval was also high for severe fetal anomalies (87.5%). However, most disapproved of TOP for socio-economic reasons like unaffordability, unplanned pregnancy, or extramarital pregnancy. Though 66% were aware of Pakistan's TOP laws, many found them ambiguous, and 85.5% desired stricter regulations. Religion was the primary reason for not performing abortions. Significant differences in views were observed between specialities and sectors, with private providers holding more liberal attitudes on several TOP-related issues. **Conclusions:** Most healthcare workers showed a negative attitude toward abortion, largely influenced by religious beliefs, and many advocated for clearer and stricter abortion laws.

INTRODUCTION

Termination of pregnancy (TOP), commonly referred to as abortion, remains a deeply sensitive and contentious issue globally, particularly within conservative socio-religious contexts such as Pakistan. The topic lies at the intersection of health, ethics, law, religion, and culture. While Pakistan permits abortion under restricted circumstances, primarily to save the woman's life or to provide necessary treatment, the law remains ambiguous and inconsistently interpreted by both providers and patients [1]. The healthcare workers (HCWs), who serve as the frontline providers, play a pivotal role in the accessibility, quality, and ethical delivery of these services. Yet, their personal beliefs, cultural influences, and systemic constraints heavily influence their attitudes toward abortion [2]. Across South Asia, studies suggest that healthcare workers' perspectives range from supportive to highly stigmatized, with factors like religion, gender, professional role, and training significantly shaping their views [3, 4]. In Pakistan, societal norms rooted in religious conservatism often inhibit open dialogue on reproductive rights, including abortion, thereby limiting women's access to safe procedures. Despite the high incidence of unsafe abortions contributing to maternal morbidity and mortality, there remains a scarcity of localized research, particularly from

DOI: https://doi.org/10.54393/pbmj.v8i6.1257

the conflict-affected and traditionally conservative regions like Khyber Pakhtunkhwa, where Peshawar is situated [5]. The unsafe termination of pregnancy continues to be a significant public health issue in Pakistan, with estimates suggesting over 2 million induced abortions annually, most of them unsafe [6]. Despite the critical need for post-abortion care and counselling, many healthcare providers harbor stigmatized attitudes rooted in religious and societal norms, leading to judgmental care or outright refusal to provide services [7]. In conservative regions like Peshawar, these attitudes may be exacerbated by tribal customs, lack of formal training on reproductive rights, and limited exposure to gender-sensitive health discourse [8]. Existing research predominantly focuses on urban centers like Lahore or Karachi, leaving a knowledge gap regarding the socio-cultural and institutional dynamics influencing HCWs in peripheral and conservative regions. This knowledge vacuum creates challenges in designing targeted interventions, policy reforms, or education programs to mitigate the risks associated with unsafe abortions. Understanding the attitude of healthcare workers toward termination of pregnancy in Peshawar is not merely an academic exercise but a pressing health system priority. Given their gatekeeping role, HCWs' perceptions can either facilitate or hinder access to safe abortion services. Documenting these attitudes can inform culturally appropriate training programs, reproductive health policies, and behavior change interventions aimed at reducing maternal mortality linked to unsafe abortion. Furthermore, it enables stakeholders to uncover region-specific social, institutional, and personal that shape health service delivery in Peshawar [9, 10]. Additionally, with global and national commitments to achieving Sustainable Development Goals (SDG 3: Good Health and Well-being), including reductions in maternal mortality, there is an urgent need to address unsafe abortion practices through evidence-based strategies.

This study aimed to contribute to that evidence by exploring the views of those most directly responsible for implementing reproductive health services in one of Pakistan's most sensitive regions

METHODS

This study followed a cross-sectional, descriptive design with correlational analysis and was conducted over a period of four months (January 2025 to Apr 2025) in private autistic centers located in Lahore, Pakistan. When a prevalence (p) of 73% was assumed (based on the previous literature), with a confidence level (Z) of 95% (Z=1.96) and a margin of error (d) of 5% (d=0.05), the sample size approximately equaled 303. Based on practical limitations and scarcity of resources, a sample size of 249 participants was recruited, which was considered satisfactory to address the descriptive and correlational aims of the study [17]. In this study, a selected sample of 249 participants from the total population was used for the collection of data from private autistic centers of Lahore. The study followed the ethical guidelines and ethical approval was taken. Non-probability sampling technique was used for this purpose. The outcomes of this study were assessing sensory avoidance and sleep habits using standardized tools: The Short Sensory Profile (SSP) and the Children's Sleep Habits Questionnaire (CSHQ). Both are validated tools commonly used in neurodevelopmental research. To assess the internal consistency of the tools in the present sample, Cronbach's alpha was calculated. The SSP showed a Cronbach's alpha of 0.89, while the CSHQ yielded a Cronbach's alpha of 0.83, indicating good reliability in this population. Children aged 3–12 years with Autism Spectrum Disorder (ASD), diagnosed according to DSM-5 criteria by a licensed clinician, were included in the study. Primary caregivers were involved in the child's care and provided detailed reports of the child's sensory and sleep behaviours. Children were excluded if they had a primary diagnosis of another developmental disorder, such as intellectual disability or a genetic syndrome, which might affect sensory or sleep patterns. Children on sedative medications, with severe medical or neurological conditions, or with co-existing psychiatric disorders were excluded. Single parents with more than one disabled child, or parents not residing in the same household as the child, were also excluded. Data were analyzed using SPSS version 27.0. Categorical variables were described as absolute frequencies (n) and relative frequencies (%), while continuous variables were expressed as mean ± standard deviation for parametric distributions or as median and percentiles for non-parametric distributions. The Chi-square test was used to assess associations between categorical variables. Pearson's or Spearman's correlation coefficients were applied, as appropriate, to examine relationships between continuous variables. A p-value of less than 0.05 was considered statistically significant.

RESULTS

Results suggest that 145 (72.5%) of our research participants were gynecologists, 40 (20%) were nurses, and 15 (7.5%) were LHWs. 72.5% of the participants had a working experience of 1-5 years. 9.5% had an experience of 6-10 years, while 18% of participants had a working experience of above 10 years. In the case of women with psychological illness having a healthy fetus at a viable stage, only 29.5% of the HCWs were in favor of an induced abortion. Similarly, as far as TOP in the case of parents' socioeconomic instability was concerned, 93.5% of the HCWs showed complete disagreement. In the case of a

DOI: https://doi.org/10.54393/pbmj.v8i6.1257

fetus with congenital defects, 87.5% of participants were in favor of TOP. Similarly, 96.5% of HCWs agreed to terminating the pregnancy if it poses some serious threat to the mother's life. Most HCWs, i.e., 67.5%, opposed terminating the pregnancy that poses some serious risk to the mother's mental health. Moreover, 14% of HCWs were in favor of TOP if the pregnancy was a result of an extramarital or premarital relationship. 67% of the HCWs were of the view that they should not even carry out abortion in women who get pregnant as a result of rape. 94% of HCWs were also against the TOP in case of an unplanned pregnancy. 69.5% of the HCWs were trained in the TOP. 42.5% of HCWs were of the view that they would get stigmatized by society if they provided safe abortion. This study sample included 96% Muslims and 4% Christians. 91.5%. 92% of HCWs make their professional decisions in light of their religious beliefs, while 8% of HCWs take professional decisions independent of this regard. 66% of HCWs were aware of Pakistan's law regarding TOP. 47.5% of HCWs said the law is ambiguous and should be clarified further. To determine differences in views among physicians, nurses, and LHWs on several statements related to abortion, the chi-square test was utilized. Significant differences were observed between different categories of healthcare workers (e.g., gynecologists, nurses, and LHWs) regarding several issues. For instance, their knowledge of abortion laws in Pakistan differed significantly (p=0.014), as did their perceptions about the ambiguity of these laws (p=0.011). Opinions also varied significantly on whether abortion should be allowed in cases of extramarital pregnancy (p=0.001), due to financial constraints (p=0.0002), or following rape (p=0.048). Similarly, differences were noted in views about allowing abortion in any circumstance (p=0.049) and on the issue of female autonomy in making abortion-related decisions (p=0.032). In contrast, no statistically significant differences were found among healthcare worker groups concerning abortion when the mother's life is at risk (p=0.516), in the case of fetal abnormalities (p=0.163), or for unwanted/unplanned pregnancies (p=0.128), indicating a shared consensus across these roles (Table 1).

Table 1: Comparison of Abortion-Related Opinions Across Health Care Providers

Statements	Gynecologist (n=145)	Nurses (n=40)	LHWs (n=15)	Total (n=200)	p-Value
Aware of Pakistan's law regarding the termination of pregnancy	106 (%)	20 (50%)	6 (40%)	132 (66%)	0.002
The Pakistani Penal Code clarifies all confusions related to the termination of pregnancy	88 (60%)	15 (36.5%)	2 (13%)	105 (52.5%)	0.001
Abortion should be made legal and easily accessible	23 (15.8%)	8 (20%)	1 (6.6%)	32 (16%)	0.242
Abortion should be legal if a pregnancy resulted from a premarital or extramarital relationship	12 (8%)	12 (30%)	4 (26.6%)	28 (14%)	0.003*
Abortion should be legal if a family cannot afford to raise the child	12 (8%)	10 (25%)	5 (33%)	27 (13.5%)	0.002*
Abortion should be legal if pregnancy was a result of rape	43 (29.6%)	20 (50%)	3 (20%)	66 (33%)	0.013*
Abortion should be legal if the pregnancy is unplanned or unwanted	9 (6%)	2 (5%)	1 (6.6%)	12 (6%)	0.171
Prefer the restricted law of abortion	141 (97%)	25 (62.5%)	5 (33%)	171 (85.5%)	<0.0001*
Safe abortion should be made accessible under any circumstances	67 (46%)	21 (52.5%)	4 (26.6%)	92 (46%)	0.654
Abortion should be legal if the fetus shows signs of serious congenital anomalies	142 (97.9%)	27 (67.5%)	6 (40%)	175 (87.5%)	<0.0001*
Abortion should be legal if a woman's life is in danger	143 (98%)	36 (90%)	7 (46%)	193 (96.5%)	0.51
Women should have the right to decide for themselves whether to have an abortion	51 (35%)	21 (52.5%)	3 (20%)	75 (37.5%)	0.032

The counts reflect how many respondents answered "Yes" to each statement. * Represents that the value is statistically significant.

Results show the frequencies and percentages of abortion-related statements in different medical sectors (public, private, and NGOs). 76.5% of the respondents were from public hospitals, 16.5% from private sector hospitals, and 7% were from NGOs. Healthcare providers working in various sectors had significantly different knowledge and attitudes towards abortion. Awareness of Pakistan's abortion laws was higher among public sector respondents, 70.5%, as compared to workers of NGOs, 28.5% (p=0.0049). Support for access to safe abortion in any condition, abortion in cases of unplanned pregnancy, and women's autonomy to decide on abortion by private sector providers were the highest, at 85%, 18% and 78.7% respectively; and all differences were statistically significant at p=0.00045, p=0.0035, and p<0.0001 respectively. While overall support for abortion to save the life of a woman was high in all three sectors (96.5%), this too

DOI: https://doi.org/10.54393/pbmj.v8i6.1257

was significantly different by sector (p=0.038). But there was no significant difference between the groups when it came to attitudes towards abortion in cases of rape or fetal defects or for financial hardship (Table 2).

Table 2: Comparison of Abortion-Related Opinions Across Sectors of Health Care Providers

Statements	Public sectors (n= 33)	Private sectors (n= 33)	NGOs (n=14)	Total (n=200)	p-Value
Aware of Pakistan's law regarding the termination of pregnancy	108 (70.5%)	20 (60.5%)	4 (28.5%)	132 (66%)	0.0049
The Pakistani Penal Code clarifies all confusions related to the termination of pregnancy	77 (50%)	22 (66.6%)	6 (42.8%)	105 (52.5%)	0.176
Abortion should be made legal and easily accessible	20 (13%)	9 (27%)	3 (21%)	32 (16%)	0.116
Abortion should be legal if a pregnancy resulted from a premarital or extramarital relationship	21 (13%)	5 (15%)	2 (14%)	28 (14%)	0.961
Abortion should be legal if a family cannot afford to raise the child	19 (12%)	6 (18%)	2 (14%)	27 (13.5%)	0.677
Abortion should be legal if pregnancy was a result of rape	51 (33%)	12 (36%)	3 (21%)	66 (33%)	0.599
Abortion should be legal if the pregnancy is unplanned or unwanted	4 (2.6%)	6 (18%)	2 (14%)	12 (6%)	0.0035*
Prefer the restricted law of abortion	142 (92.8%)	23 (70%)	6 (42%)	171 (85.5%)	0.0001*
Safe abortion should be made accessible under any circumstances	60 (39%)	28 (85%)	4 (28%)	92 (46%)	0.00045*
Abortion should be legal if the fetus shows signs of serious congenital anomalies	139 (90%)	29 (87%)	11 (78.5%)	175 (87.5%)	0.338
Abortion should be legal if a woman's life is in danger	150 (98%)	31 (94%)	12 (85.7%)	193 (96.5%)	0.038*
Women should have the right to decide for themselves whether to have an abortion	42 (27%)	26 (78.7%)	7 (50%)	75 (37.5%)	>0.0001*

NGO = non-governmental organizations * Represents that the value is statistically significant

Findings show that the reasons for the unfavorable attitude of HCWs towards TOP: the majority (78%) declared their religious beliefs to be the reason for not providing abortion services, while some provided other reasons. One item in the questionnaire assessed the reason for refusal of termination of pregnancy. Although the question was formatted in multiple-choice style for clarity, participants were instructed to select only one primary reason that best represented their view (Table 3).

Table 3: Reasons for Refusal of Termination of Pregnancy

Reasons	Frequency (%)
Against the Religion	156 (78%)
Out-of-Scope Practice	4 (2%)
Against Personal Values	6 (3%)
No Training	4 (2%)
Against the Law	21 (10.5%)
Social Stigma	3 (1.5%)
Afraid of Being Called an Abortionist	1 (0.5%)
Other	5 (2.5%)
Total	200 (100%)

DISCUSSION

The focus of this study was healthcare professionals employed in gynecology departments across a variety of public and private hospitals. This study showed that restricted and stricter attitudes of healthcare workers towards the termination of pregnancy (85.5%), as compared to the study done in Ethiopia and Pakistan, which showed 35.4% and 67.3% of HCWs were against abortion under any circumstances, respectively [12, 8]. In a qualitative study conducted in South Africa, complex patterns of attitudes were found in the health care workers towards the termination of pregnancy. These included a combination of personal interest, religious and moral beliefs, and fears of being stigmatized, which played an important role in the decision not to get involved in the provision of abortion [13]. These results were consistent with the findings of this study that religion was a major factor affecting the attitude of health care workers towards the termination of pregnancy. The debate hinged on a fundamental religious and legal issue concerning the point at which the fetus could be regarded as a human being. There are four schools of Islam, with slightly different approaches to abortion. In Pakistan, most of the Muslims follow the Hanafi school of thought. Hanafi jurists allowed women to terminate their pregnancies until the fourth month [14]. It is important to note that the Hanafi women had the right to terminate their pregnancies even without their husbands' consent. However, the Hanafi women were not allowed to terminate their pregnancies without a good reason. Abortion is still considered a sinful act in Pakistan. This may be the reason most doctors have a negative opinion on abortion. In contrast to the results of these studies, opposite findings were found in the three different studies conducted in three different countries: Ethiopia, India, and Mexico. In Ethiopia, mid-level health care providers (HCPs) had a positive opinion towards safe abortion (by 54.1%) [15]. In India, about 62% of HCPs had a positive opinion regarding medical abortion [16]. In Mexico, a large majority of about 71.1% of the healthcare providers

DOI: https://doi.org/10.54393/pbmj.v8i6.1257

had a positive opinion on abortion [17]. The 2nd most influential factor, according to this study, which is hindering healthcare providers from providing abortion, is Pakistan's law regarding the termination of pregnancy. The frequency of healthcare providers who do not provide abortion because it is against the law was found to be 21 (10.5%). In 1990, the government of Pakistan amended its colonial-era Criminal Code of 1860 regarding abortion. The amendments aimed to better align it with Islamic teachings. According to the 1990 amendment, the conditions of legal abortion are dependent on the stage of development of the fetus (i.e., whether or not its organs are formed). Traditionally, Islamic scholars have believed that the fetus's organs are formed by the 4th month of pregnancy. Before the organs are formed, abortion is only allowed to save the life of the woman or to provide "necessary treatment". After organs are formed, abortions are permitted only to save the woman's life [18]. According to the Pakistan Penal Code (PPC), Section 338 defines Isqat-i-Haml as the unlawful miscarriage of a fetus whose organs are not yet formed, unless done in good faith to save the woman's life or provide necessary treatment. Section 338-B defines Isqat-i-Janin as causing miscarriage when fetal organs have formed, which is only permissible if it is done in good faith to save the mother's life [19]. This research concluded, 47.5% of the healthcare workers declared the above-stated law ambiguous and wanted to know the clear implication of the term "good faith" as stated by the above law. The significant preference among respondents for stricter abortion laws suggests a perception that current legal provisions are either insufficiently clear or ethically inadequate. This interpretation should be understood in the context of Pakistan's socioreligious environment, where abortion is legally permissible under limited conditions, but often perceived as taboo. The statistical significance ($p=0.032$) reinforces the relevance of these attitudes in shaping clinical practice and legal advocacy. The findings of this study highlight important discrepancies in knowledge and attitudes around abortion between different sectors within the healthcare provider population. Employees of the public sector had a greater understanding of the legal parameters, whereas workers in the private sector were more in favor of the availability of abortion services in instances of both a non-planned pregnancy and a woman's choice to abort ($p<0.05$). These results align with earlier studies regarding the attitude of private healthcare providers, who are more likely to be in favor of abortion given that they interact with more patients and are therefore exposed to varying degrees of healthcare needs [20,].

CONCLUSIONS

Most healthcare workers expressed negative attitudes toward abortion, primarily due to religious beliefs, and called for clearer and stricter abortion laws. The study highlights the need for better training on safe abortion care and legal knowledge, integration of religious and ethical counselling in medical education, public awareness to reduce stigma, clearer legislation, psychosocial support services, and further research to improve abortion care in Pakistan.

Authors Contribution

Conceptualization: EA
Methodology: AU, JT, SU, AJ, RA[1], AT, SA, RA[2], RA[3]
Formal analysis: RA, SA
Writing review and editing: EA, AU, SU

All authors have read and agreed to the published version of the manuscript.

Conflicts of Interest

The authors declare no conflict of interest.

Source of Funding

The author received no financial support for the research, authorship and/or publication of this article.

REFERENCES

[1] Engelbrecht MC. Termination of pregnancy policy and services: an appraisal of the implementation and operation of the Choice on Termination of Pregnancy Act (92 of 1996) (Doctoral dissertation, University of the Free State). 2005.

[2] Heggie C, Tong L, Heran A, Bhambhani I, McKibbon S, Paynter M. The role of doulas and community birth workers in abortion and contraception care: An international scoping review. Contraception. 2024 May; 110482. doi: 10.1016/j.

[3] Baig M, Jan R, Lakhani A, Ali SA, Mubeen K, Ali SS *et al.* Knowledge, attitude, and practices of mid-level providers regarding post abortion care in Sindh, Pakistan. Journal of Asian Midwives. 2017; 4(1): 21-34.

[4] Abhary MN, Shaghaghi F, Safinejad H, Asadi L, Mohebbi-Dehnavi Z. The Effects of Unsafe Abortion on the Health System from a Socio-economic Perspective: A Narrative Review. Journal of Midwifery & Reproductive Health. 2023 Oct; 1(4).

[5] Sathar Z, Singh S, Shah IH, Niazi MR, Parveen T, Mulhern O *et al.* Abortion and unintended pregnancy in Pakistan: new evidence for 2023 and trends over the past decade. British Medical Journal Global Health. 2025 Jan; 10(1). doi: 10.1136/bmjgh-2024-017239.

DOI: https://doi.org/10.54393/pbmj.v8i6.1257

[6] Singh S, Wulf D, Jones H. Health professionals' perceptions about induced abortion in South Central and Southeast Asia. International Family Planning Perspectives. 1997 Jun; 59-72. doi: org/10.2307/2950825.

[7] Kamran I and Mir AM. Women's access to safe abortion and postabortion care services in Pakistan: the role of gender and related factors. In Handbook on Sex, Gender and Health: Perspectives from South Asia. Singapore: Springer Nature Singapore. 2024 Jul; 1-21. doi: 10.1007/978-981-19-9265-0_15-1.

[8] Hussain R, Fikree FF, Siddiqui N. Laws, myths and the lived experience of abortion in Pakistan. Asian Journal of Women's Studies. 2021; 27(1): 35–53. doi:10.1080/12259276.2021.1879612.

[9] Siddiqui A, Ullah H, Nisa Z. Training mid-level providers to deliver post-abortion care in KP: An implementation evaluation. Health Policy Plan. 2022: 37(9); 1239–48. doi: org/10.1093/heapol/czac058.

[10] Nooreen S, Wahab S, Rehman K, Rehman R, Afridi SK. Determinants of Self-Induced Abortion In Unintended Pregnancies: Insights from Private Maternity Clinics Peshawar. Journal of Saidu Medical College Swat. 2025 May; 15(2): 184-91. doi: 10.52206/jsmc.2025.15.2.1035.

[11] Ibrahim ZM, Mohamed ML, Taha OT, Ghoneim HM, Mohamed HS, Abdellah AM *et al.* Knowledge, attitude and practice towards abortion and post abortion care among Egyptian private obstetricians and gynecologists. The European Journal of Contraception and Reproductive Health Care. 2020 Jul; 25(4): 245-50. doi: 10.1080/13625187.2020.1760239.

[12] Geta T, Israel E, Kebede C. Client satisfaction with abortion care service and its associated factors among women in Ethiopia: a systematic review and meta-analysis. BioMed Central Women's Health. 2024 May; 24(1): 287. doi: 10.1186/s12905-024-03139-3.

[13] Dempsey B, Callaghan S, Higgins MF. Providers' experiences with abortion care: A scoping review. PLOS ONE. 2024 Jul; 19(7): e0303601. doi: 10.1371/journal.pone.0303601.

[14] Khalid G, Saleh AM, Shabila N, Bogren M, Shakely D. Attitudes towards induced abortion among gynecologists in Kurdistan region of Iraq. BMC Women's Health. 2023 Nov; 23(1): 609. doi: 10.1186/s12905-023-02768-4

[15] Ackon AL. Knowledge, Attitudes and Practices of Medical Abortion Amongst Doctors at the Greater Accra Regional Hospital, Accra Ghana (Doctoral dissertation, University of Ghana). 2023.

[16] Jadav D, C Bhargava D, Meshram V, S Shekhawat R, Kanchan T. Medical termination of pregnancy: A global perspective and Indian scenario. Medico-Legal Journal. 2024 Mar; 92(1): 34-42. doi: 10.1177/00258172231155317.

[17] Dayananda I, Walker D, Atienzo EE, Haider S. Abortion practice in Mexico: a survey of health care providers. Contraception. 2012 Mar; 85(3): 304-10. doi: 10.1016/j.contraception.2011.07.011.

[18] Lokubal P, Corcuera I, Balil JM, Frischer SR, Kayemba CN, Kurinczuk JJ *et al.* Abortion decision-making process trajectories and determinants in low-and middle-income countries: A mixed-methods systematic review and meta-analysis. E-Clinical Medicine. 2022 Dec; 54. doi: 10.1016/j.eclinm.2022.101694.

[19] Muhammad T. From Objectives Resolution to Sharia Legislation: Tracing the Islamization of Laws in Pakistan. Tanazur. 2025 Jun; 6(3): 22-66.

[20] Adair L, Lozano N, Ferenczi N. Abortion attitudes across cultural contexts. International Perspectives in Psychology. 2024 Jul. doi: 10.1027/2157-3891/a000101.

DOI: https://doi.org/10.54393/pbmj.v8i6.1229

PAKISTAN BIOMEDICAL JOURNAL
https://www.pakistanbmj.com/journal/index.php/pbmj/index
ISSN (E): 2709-2798, (P): 2709-278X
Volume 8, Issue 06 (June 2025)

Case Study

OPEN ACCESS

Habit Reversal Training and Relaxation Training for the Treatment of Adult-Onset Trichotillomania due to Premature Greying

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ARTICLE INFO

Keywords:
Trichotillomania, Habit Reversal Training, Stress Management, Relaxation Training, Behavioral Intervention

How to Cite:
Haqqi, S. A., Farhan, S., Shah, S. Z. A., Kalhoro, S., Ali, S. K., Maheshwary, N., Asif, M. I., & Asif, W. (2025). Habit Reversal Training and Relaxation Training for the Treatment of Adult-Onset Trichotillomania due to Premature Greying: Habit Reversal and Relaxation in Adult Trichotillomania. Pakistan BioMedical Journal, 8(6), 37-42. https://doi.org/10.54393/pbmj.v8i6.1229

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Received Date: 14th April, 2025
Revised Date: 28th May, 2025
Acceptance Date: 8th June, 2025
Published Date: 30th June, 2025

ABSTRACT

This case study demonstrates the use of Habit Reversal Training (HRT) combined with Relaxation Training (RT) in addressing trichotillomania. The subject, a 28-year-old woman, reported experiencing stress and frequent lateness to work. Her hair-pulling behavior, triggered by the early appearance of grey hair, led her to spend 30 to 60 minutes each morning pulling her hair, which contributed to her tardiness. Over the course of 14 weekly therapy sessions, interventions included self-monitoring, psychoeducation, identification and modification of visual triggers, stimulus-response strategies, and restructuring daily routines. The treatment resulted in reduced stress and effective control of hair-pulling behaviors. The case suggests that incorporating a hair care regimen into therapy may further enhance positive outcomes. It also highlights the importance of considering both psychological and societal influences in the development and treatment of trichotillomania.

INTRODUCTION

Theoretical and Research Basis for Treatment

Trichotillomania is defined by a persistent, overwhelming urge to pull out hair from various body regions, leading to noticeable hair loss, significant emotional distress, and disruption in daily functioning. Unlike hair loss from dermatological conditions, the hair loss seen in trichotillomania results from self-inflicted trauma, highlighting the role of psychological factors. The disorder is diagnosed more often in women, with prevalence estimates ranging from 1% to 2% [1]. Unlike dermatological forms of alopecia, the hair loss seen in trichotillomania results from self-inflicted trauma, as individuals deliberately pull out their own hair—highlighting the role of psychological influences. The condition is diagnosed more

DOI: https://doi.org/10.54393/pbmj.v8i6.1229

often in women, with estimated prevalence rates ranging from 1% to 2%. Studies indicate that hair-pulling episodes are often set off by particular triggers, such as stressful life events, certain hair textures, or specific emotional states [2]. Focused and automatic are the two subtypes of trichotillomania. With focused trichotillomania, people pull their hair consciously and purposefully, frequently as a coping mechanism for stress or boredom, and they are more conscious of what they are doing [3]. Automatic trichotillomania, on the other hand, happens unconsciously and frequently happens when a person is distracted or working on another task [4]. This distinction has been questioned, though, by Grant and Chamberlain (2021), who propose that both targeted and automatic hair-pulling can happen during the same episode or at separate periods for the same person [5]. These characteristics could be clinically significant, although they don't always indicate different subtypes. Trichotillomania has been connected to a number of psychological issues; stressful life events, such as traumatic experiences, interpersonal disputes, or pressures from the workplace or school, can cause or exacerbate hair-pulling episodes. Additionally, in people with trichotillomania, more frequent and severe hair pulling is associated with higher levels of stress [5]. Additionally, Woods *et al.*, (2006) investigated the psychological elements, such as stress, linked to trichotillomania [6]. The findings showed that, in comparison to those without the illness, those with trichotillomania reported higher levels of chronic stress [7]. According to the authors' hypothesis, stress may either cause or sustain the symptoms of trichotillomania [8]. A mix of behavioral therapy, medication, and support techniques are commonly used to treat trichotillomania [9-11]. The Habit Reversal Training (HRT) component of Cognitive-Behavioral Therapy (CBT) has demonstrated notable effectiveness in assisting people in reducing hair-pulling behaviors by raising awareness and creating other coping mechanisms [12]. Another potential strategy is Acceptance and Commitment Therapy (ACT), which aims to help people resolve to change their behavior and accept their urges without acting on them [6]. Although results can vary and frequently point to the necessity for integrated therapeutic approaches, pharmacological therapies, such as Selective Serotonin Reuptake Inhibitors (SSRIs) like fluoxetine, have also been utilized to address trichotillomania [2]. In order to effectively cure trichotillomania and enhance general quality of life, it is imperative that various treatment methods be integrated and customized to each patient's needs. This particular viewpoint was the focus of the current case study. Habit Reversal Training, Relaxation Training, and a hair care regimen were the main components of the psychotherapy. One type of cognitive behavioral treatment is habit reversal training. Research has repeatedly shown that HRT is one of the most successful therapies for trichotillomania, outperforming medication with either SSRIs or Clomipromine [3]. This is why Habit Reversal Training was selected. Based on Cognitive Behavioral Therapy (CBT), Habit Reversal Training (HRT) aims to recognize and change maladaptive thoughts and actions. The relationship between stressor and hair-pulling is strengthened when someone pulls their hair to relieve stress after being exposed to a particular stressor or occurrences. This habit is reinforced by the momentary respite [13]

Case Introduction

A 28-year-old unmarried female patient presented to a campus-based clinic with complaints of stress and workplace issues involving getting late for work. During the second session, the patient revealed that she gets late to work because she has a habit of checking and plucking her scalp hair. She expressed that it was an embarrassing problem and she was reluctant to share it at the first session. This hair pulling behaviour was motivated by her fear of developing grey hair, which she suspected was occurring. It was stated by the patient that although plucking out greying hair brings a strong sense of satisfaction and relieves her of stress, she feared developing extensive alopecia due to her habits [14]. The patient reported that hair pulling behaviour had commenced six months ago when she first noticed three strands of greying hair. Furthermore, the patient reported that initially she used to pluck white hair only and would spend time searching for those, "hunting down white hair" felt like a game and relieved her of stress. But from last month not all the plucked hair was white; in fact, the majority were black, and she pulled them out of suspicion that they might turn white in the future. Since the hair pulling was not restricted to one specific scalp site alopecia was not that obvious at this stage because she plucked hair from different sites every day and is not focused on one or few specific sites. However, one could observe small patches of hair loss dispersed across the scalp. She mentioned that she has started covering her head so that people cannot see the hair loss [15].

Presenting Complaints

The initial problems disclosed by patient included stress and workplace issues, notably conflicts. She revealed that her emotional distress was precipitated by difficulties with her office manager due to her persistent tardiness and issues with punctuality. The apprehension of facing termination exacerbated her stress levels, thereby leading to poor work performance which in turn aggravated her

DOI: https://doi.org/10.54393/pbmj.v8i6.1229

symptoms of stress further. Patient reported experiencing physical manifestations of stress, including symptoms such as neck stiffness and migraines. These physiological effects can be attributed to the heightened stress levels she experienced. It was during second session that patient was getting late to work due to her habit of hair pulling and that she had started to develop diffuse alopecia [16].

History

Patient stated that she had only lately started tugging her hair and that she had no past or childhood history of doing so. She added that there was no family history of trichotillomania or other mental illnesses. Although patient admitted to feeling anxious at test times, she explained that this had never gotten to the point where it affected her academic performance. She revealed that about six months ago, she saw some greying hairs on her head and felt compelled to pull them out. This first incident of hair pulling eventually evolved into a ritualistic behavior for her.

Assessment

Patient discussed her presenting problems, which are mentioned above, in an intake interview. During the second session, she disclosed the reason for her tardiness to work, which was her tendency to pull her hair. Using the Depression, Anxiety, Stress Scale (DASS-21; Lovibond and Lovibond, 1995), a preliminary screening for symptoms of stress, anxiety, and depression was conducted. This 21-item scale gauges how severe stress, anxiety, and sadness are. The Depression Anxiety Stress Scale (DASS-21) results showed that moderate stress was present, and the anxiety and depression scores were within the normal range. The Milwaukee Inventory for Styles of Trichotillomania-Adult Report was administered, confirming that the hair pulling style was focused [1]. The Psychiatric Institute Trichotillomania Scale (PITS; Winchel et al., 1992) was also administered to further understand the extent and nature of hair pulling [11]. It was revealed that she spent 30 minutes to one hour each day pulling her hair, this involved both the inspection and the actual act of taking out hair, mostly in the morning before work. She reported that she was rarely ever able to resist the urge to pull hair and it was frequently impacting one major life activity at this point (i.e., work life). It was also indicated that she worries daily about hair pulling, and distress caused by it is moderately severe. On further probing she revealed that she only started to worry about hair loss recently when she started to pull black hair based on suspicion and observed small patches of hair loss. Upon inspection mild loss of hair (seen only if area is pointed out) was observed. A few (2 to 3) strands of greying hair could also be seen. She was asked to keep track of how many hairs she pulled each day, and it was found that she pulled 20 to 30 hair strands daily [17].

Case Conceptualization

The workplace conflicts, issues of tardiness, and the resulting stress in this situation was coming from hair pulling behaviour (trichotillomania) of the patient. Moreover, the obsession with pulling white hair was found to stem from the fear of getting older and not finding a suitor for marriage as her age was showing up in her hair. In many cultures, including some Asian and Middle Eastern societies, there can be significant societal pressure on women to conform to certain beauty standards and expectations. Particularly, marriageability in South Asian societies is commonly tied with age, physical appearance, lineage, and economic status. With women expected to marry before their thirties there is an immense pressure on them which is tied to their chronological age. The patient stated that her grey hair reminded her of her marriageability, which is dropping with age. Patient talked extensively about her fear of not getting married because of greying hair, she stated that in Pakistan suitors and their families scrutinize you a lot. She stated that her self-image had suffered considerably since her hair started greying. Research has established that in Asian countries delayed or late marriages lead to negative consequences for the individuals. This, patient's fears were not irrational and were a reaction to society's attitudes towards marriageability of women and the process of selection of suitors for marriage in Pakistan. The primary goal of the treatment decided by the patient was to stop the hair pulling behaviour.

Course of Treatment and Assessment of Progress

The psychological treatment consisted of Habit Reversal Therapy (HRT) combined with relaxation training, while HRT treatment targeted symptoms of Trichotillomania, the relaxation training was included to manage elevated levels of stress. Treatment lasted for 14 sessions each of forty-five minutes conducted on weekly basis. During the initial phase the assessment and functional analysis of hair pulling behaviour was done, the focus was on exploring more about the visual trigger (i.e., white hair), provision of psychoeducation about trichotillomania, goal setting, and teaching self-monitoring strategies. The patient was instructed to maintain a record of the duration spent on hair pulling, the number of hair strands pulled, and the visual documentation of pulled hair through photographs. Additionally, the patient was advised to keep track of the ratio of white to black hair strands pulled during each session. The purpose was to make her realize that at this point she was pulling most of the hair on the basis of suspicion of them turning grey and also to make her aware of the hair loss. Relaxation training was introduced during

DOI: https://doi.org/10.54393/pbmj.v8i6.1229

the third and fourth sessions, also during third session it was revealed that the patient was pulling an average of 20-30 strands of hair per day, and the ratio of white to black hair among the pulled hair was 2:20, which was substantiated by the patient's pictorial record. She was given a task to do deep breathing exercise daily particularly after waking up. The fourth session focused on awareness training and introduced the patient to the concept of avoiding triggers. A strengths and weaknesses worksheet was utilized to facilitate the patient's realization that she possessed the necessary resources to manage the issue. The fifth session focused on the patient's fear of greying hair, which was examined in-depth. She acknowledged feeling overwhelmed by societal and parental pressure to get married and that grey hair reminded her of her age and the possibility of rejection by potential suitors. To address this, she was introduced to the concept of cognitive defusion and taught how to distance herself from such unhelpful thoughts. She extensively talked about her fears and brought up some family related issues. hat her self-image had lately suffered a lot and she feels hopeless day by day as her problems with hair is aggravating. During the subsequent session, the patient reported continued urges to inspect her hair. To manage her primary trigger, namely white hair, the patient agreed to employ several stimulus response interventions, such as gradually reducing the time spent on hair inspection by 5 minutes each week and engaging in visually stimulating activities like playing video games particularly the ones involving sorting and targeting specific visual cues like Fruit Ninja or sorting games on Lumosity. As most hair pulling occurred in the morning just after waking up, the patient's morning routine was reviewed and restructured to limit hair inspection time, and an alarm was set to indicate when to stop hair inspection. Through seventh, eighth, and ninth session the progress was monitored, and we discussed any obstacles or barriers which showed up during implementation of behavioural strategies. The barriers were discussed, and she was taught how to manage those by positive self-affirmation techniques and relaxation training. Stress and its management were also monitored. It was reported that issues at the office were resolving slightly since she was being able to manage time. In the tenth session patient reported that she was developing resistance towards hair pulling urge and was finding it easier to avoid hair pulling but still she couldn't resist hair inspection. Additionally, she suggested temporarily dyeing her hair to eliminate the visual trigger. She got her hair dyed and it proved effective in removing the trigger temporarily; she reported in the eleventh session that she felt confident and satisfied. Subsequent progress was monitored throughout the twelfth and thirteenth sessions, with a focus on implementation of behavioural strategies and relaxation training. According to patient, she felt better about herself and realised that she cared about other but not herself and it felt great that she was now focused on her wellbeing. In addition, the patient's stress and its management were continuously monitored. To augment the treatment regimen, a further behavioural strategy involving hair care was introduced, with the patient instructed to engage in activities such as applying hair masks and oiling as a means of promoting self-love and self-care. In the fourteenth therapy session, the patient reported the successful avoidance of tardiness to work for one week and a concurrent ability to refrain from hair pulling and hair inspection for the first time in six months. At the conclusion of the fourteenth week of treatment, a positive outcome was achieved with regards to the resolution of trichotillomania. Furthermore, the patient displayed a significant reduction in stress levels compared to the pre-treatment phase. A follow up session was conducted with a gap of two weeks and it was reported by the patient that she hadn't experienced any urge to inspect or pull hair [18, 19].

Complicating Factors

Patient was not comfortable in discussing her fears surrounding marriageability, prioritizing the cessation of her hair-pulling habit while consciously avoiding delving into the underlying cause. She claimed that because she expected upsetting and unpleasant memories associated with the topic to surface, she did not want to talk about it. The possible scope of her treatment may have been limited by this avoidance.

Access and Barriers to Care

In this instance, there were no obstacles to care or problems with access.

Follow-Up

The patient was booked for a follow-up appointment one month later. She admitted throughout the discussion that she still uses several techniques, namely meditation and hair care. Even so, she no longer had to deal with tension or disputes at work because of her tardiness. She did express persistent pressure and worry about marriage and possible rejection by potential suitors, though. The patient was counselled to think about counselling and treatment, particularly acceptance and commitment therapy, as a way to deal with these ongoing problems.

Treatment Implications of the Case

In this instance, the trichotillomania symptoms brought on by early greying were resolved by the combination of HRT and RT. Studies have shown that this combined approach is effective. Compared to a control group, HRT plus RT significantly reduced hair-pulling symptoms, according to

DOI: https://doi.org/10.54393/pbmj.v8i6.1229

a randomized controlled experiment by Woods, Twohig, and Flessner (2006). The addition of RT to HRT improved treatment outcomes and led to a higher reduction in the intensity of hair-pulling [1]. In this instance, adding a hair care routine to the Habit Reversal Training (HRT) and relaxation training (RT) interventions was beneficial because it reinforced the outcomes attained and helped to sustain the treatment effects. The patient's relationship with her hair improved as a result of it. The patient countered the destructive inclinations connected with hair pulling by actively devoting time and energy to hair care, which led to a progressive development of respect and appreciation for her hair. A major factor in supporting the outcomes of HRT and RT was this mentality change from destructive to self-nurturing behavior. Additionally, the hair care routine offered a useful substitute for hair removal and examination. The patient was able to swap out the unhealthy and compulsive behaviors for healthier ones by focusing their attention and energy on constructive and pleasant hair care activities. This substitution supported the behavioral adjustments made possible by HRT and assisted in ending the hair-pulling cycle. The hair care routine also served as a reminder and a way to reinforce the gains that were obtained during the sessions [20].

Authors Contribution

Conceptualization: WA
Methodology: SAH, SF, SZAS, SK , SKA, NM, WA, MIA
Formal analysis: SAH, SF, SZAS, SK, SKA, NM, WA, MIA
Writing, review and editing: SAH, SF, SZAS, SK, SKA, NM, WA, MIA

All authors have read and agreed to the published version of the manuscript.

Conflicts of Interest

The authors declare no conflict of interest.

Source of Funding

The author received no financial support for the research, authorship and/or publication of this article.

REFERENCES

[1] Flessner CA, Woods DW, Franklin ME, Cashin SE, Keuthen NJ. Milwaukee inventory for styles of trichotillomania—adult version. PsycTESTS Dataset. 2008. doi:10.1037/t14240-000.

[2] Bennett LP and Ryznar R. A Review of Behavioral and Pharmacological Treatments for Adult Trichotillomania. Psychology International. 2024 Apr; 6(2): 509-30. doi: 10.3390/psycholint6020031.

[3] Bloch MH, Landeros-Weisenberger A, Dombrowski P, Kelmendi B, Wegner R, Nudel J *et al.* Systematic review: pharmacological and behavioral treatment for trichotillomania. Biological Psychiatry. 2007 Oct; 62(8): 839-46. doi: 10.1016/j.biopsych.2007.05.019.

[4] Twohig MP and Woods DW. A preliminary investigation of acceptance and commitment therapy and habit reversal as a treatment for trichotillomania. Behavior Therapy. 2004 Sep; 35(4): 803-20. doi: 10.1016/S0005-7894(04)80021-2.

[5] Grant JE and Chamberlain SR. Automatic and focused hair pulling in trichotillomania: Valid and useful subtypes?. Psychiatry Research. 2021 Dec; 306: 114269. doi: 10.1016/j.psychres.2021.114269.

[6] Woods DW, Twohig MP. Trichotillomania: An ACT-enhanced Behavior Therapy Approach Workbook. Oxford: Oxford University Press; 2008.

[7] Odlaug BL, Chamberlain SR, Grant JE. Motor inhibition and cognitive flexibility in pathologic skin picking. Progress in Neuro-Psychopharmacology and Biological Psychiatry. 2010 Feb; 34(1): 208-11. doi: 10.1016/j.pnpbp.2009.11.008.

[8] Mythen G, Walklate S, Peatfield EJ. Assembling and deconstructing radicalisation in PREVENT: A case of policy-based evidence making?. Critical Social Policy. 2017 May; 37(2): 180-201. doi: 10.1177/0261018316683463.

[9] Lovibond PF and Lovibond SH. The structure of negative emotional states: Comparison of the Depression Anxiety Stress Scales (DASS) with the Beck Depression and Anxiety Inventories. Behaviour Research and Therapy. 1995 Mar; 33(3): 335-43. doi: 10.1016/0005-7967(94)00075-U.

[10] Axas A. Are Brain Games really as they seem?. Scientific Kenyon: The Neuroscience Edition. 2023 Sep; 7(1): 107-15.

[11] Winchel RM, Jones JS, Molcho A, Parsons B, Stanley B, Stanley M. The Psychiatric Institute Trichotillomania Scale (PITS). Psychopharmacology Bulletin. 1992; 28(4): 463-76.

[12] Crosby JM, Dehlin JP, Mitchell PR, Twohig MP. Acceptance and commitment therapy and habit reversal training for the treatment of trichotillomania. Cognitive and Behavioral Practice. 2012 Nov; 19(4): 595-605. doi: 10.1016/j.cbpra.2012.02.002.

[13] Ricketts E, Bose D, Piacentini J. Obsessive-Compulsive and Related Disorders. Child and Adolescent Psychopathology, Third Edition. 2017 Jan: 560-609. doi: 10.1002/9781394258932.ch17.

[14] Ong CW, Woods DW, Franklin ME, Saunders SM, Neal-Barnett AM, Compton SN *et al.* The role of psychological flexibility in acceptance-enhanced behavior therapy for trichotillomania: Moderation and mediation findings. Behaviour Research and Therapy. 2023 May; 164: 104302. doi: 10.1016/j.brat.2023.104302.

DOI: https://doi.org/10.54393/pbmj.v8i6.1229

[15] Falkenstein MJ, Mouton-Odum S, Mansueto CS, Goldfinger Golomb R, Haaga DAF. Comprehensive Behavioral Treatment of Trichotillomania. Behaviour Modification. 2016; 40(3): 376-396. doi:10.1177/01454 45515616369.

[16] Domínguez LN, Everett GJ, Jafferany M, Skurya J. Trichotillomania Treatment Update. Actas Dermosifiliogr. 2024; 115(2): 123-134. doi:10.1016/j.ad. 2024.01.004.

[17] Richmond LM. Trichotillomania Etiology Differs Among Patients, Calls for Personalized Treatment. Psychiatry News. 2024; 59(8): 30-32. doi:10.1176/ appi.pn.2024.08.8.30.

[18] Grant JE and Chamberlain SR. Trichotillomania. American Journal of Psychiatry. 2016 Sep; 173(9): 868-74. doi: 10.1176/appi.ajp.2016.15111432.

[19] Halder A. Premature greying of hairs, premature ageing and predisposition to cancer in Jajjal, Punjab: a preliminary observation. Journal of Clinical and Diagnostic Research. 2007; 6: 577-80.

[20] Farhat LC, Olfson E, Nasir M, Levine JLS, Li F, Miguel EC *et al.* Pharmacological and behavioral treatment for trichotillomania: An updated systematic review with meta-analysis. Depress Anxiety. 2020; 37(8): 715-727. doi:10.1002/da.23028.