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Conclusion should elucidate how the results communicate to the theory presented as the basis of the study and provide a concise explanation of the allegation of the findings.

ACKNOWLEDGEMENT

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The Use of Organoids to Decode the Molecular Association with the Behavioral Traits in Schizophrenic Person

OPEN ACCESS

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Most essential but complex organ of a human body is brain. Several attempts have been made to understand the chemistry behind its functioning. So, that intricate cell signaling behind numerous neurodevelopmental disorders can be decoded. Moreover, determining the molecular basis behind neuro-disorders has been of great interest in the past years. Traditional methods of using animal models for disease modelling and drug designing have played a great role in generating the knowledge for our understanding. But despite the contribution, due to their unsatisfactory translatability of human brain make them less demanding for drug development.

Brain disorders, particularly Schizophrenia, in which brain functioning is immensely compromised. This complex disease comes with disorganized speech, impaired cognitive ability, weird behavior, and hallucination. Regardless, the scientific efforts that has been made to understand the pathophysiology of this disease, the knowledge is still fragmented as genetic make up behind Schizophrenia is still a mystery. The animal models used to explore its genetic, cellular basis and behavioral complexity have not provided enough theoretical information. In addition to this, human brain is quite distinct from animal brain in its development, structural and functional basis behind the psychiatric disorders. As the result of the limitation of animal models, researches are indulged in the development of better models to identify the mutations in the genes and how these are associated with behavioral traits and phenotype of Schizophrenic person. hiPSC-derived organoids have been developed that mimic the cerebral brain.

Organoids are actually a 3D cellular mass capable of artificially showing the function of an organ. These are usually produced by the differentiation of stem cells. For brain or cerebral organoids exhibiting regional identities, self-organizing embryonic stem cells are used. In case of Schizophrenia, cerebral Organoids have shown that mature neurons are extinct in the cortex but present more in subcortical areas. This happens due to nFGFR1 is more expressed in the subcortical cells but less expressed in cortical region which indicates that nFGFR1 may be involved in developmental abnormalities in cortical neurons in schizophrenia. So, getting this information regarding this disease has make it easy to develop drugs or offer preventive medicine for the people whose are at great risk of getting schizophrenia later in life.

Organoids more closely resemble the actual diseased condition than animal models, they have catalyzed the biological research and have shown potential to advance both translational and basic neuroscience studies. Additionally, organoids have been useful in drug discovery, drug toxicity assessments, development of personalized medicine, and therapeutic testing. The development of gene and cell-based therapeutics, more accurate disease modeling, high-throughput drug screening, and regenerative medicine are all anticipated to be aided by organoid technology in the future.

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Original Article

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Prevalence and Determinants of Anxiety Among Hospitalized Children in Nowshera

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ABSTRACT

Hospital admission is a stressful experience for children. It leads to high anxiety levels. **Objectives:** To investigate the prevalence of anxiety among hospitalized children and the causes contributing to its severity. **Methods:** 118 children fulfilling inclusion criteria were selected by convenient sampling to carry out a cross-sectional observational study in Qazi Complex, Nowshera from December 2023 to May 2024. The children were aged between 9-15 years. Data were collected using the State-Trait Anxiety Inventory for Children, a validated self-reported questionnaire. Anxiety levels were classified into mild, moderate, and severe anxiety depending upon scoring. **Results:** The results showed that prior hospitalizations, experiencing painful processes, and lengthy hospital stays considerably increased the probability of severe anxiety. Children experiencing painful procedures had an odds ratio of 6.27 ($p<0.001$) and those with a history of previous hospitalization were 4.56 times more expected to experience severe anxiety ($p<0.001$). The key factor was extended hospital stays, with an OR of 9.09 ($p<0.001$). Gender and age, however, did not significantly affect anxiety levels. **Conclusions:** The results emphasize the prerequisite for targeted interventions, such as decreasing hospital stays, reducing painful procedures, and providing emotional support. Understanding these features is vital for emerging attitudes to lessen anxiety in hospitalized children, thus refining their overall treatment results and well-being.

INTRODUCTION

Hospital admission is often an upsetting experience for children, as it represents an unexperienced and possibly frightening situation that interrupts their normal practices [1]. The mental disturbance of hospitalized children has also been reported by their attending nurses [2]. Anxiety is a common emotional response in children going through medical management, and prevalence of anxiety issues in hospitalized children has been progressively acknowledged in recent years especially during the pandemics [3, 4]. The World Health Organization (WHO) reports that psychological issues in children and adolescents, mainly anxiety, are on the upsurge worldwide [4]. Hospitalization may exacerbate these disorders, as kids are parted from their family members, faced with indefinite outcomes and exposed to invasive medical processes [5]. Several Studies suggest that children are mainly susceptible to developing anxiety during hospital visits because of their intellectual skill to understand the seriousness of their disease however inadequate handling skills [6, 7]. Several research have confirmed anxiety as a considerable problem among hospitalized children. For example, a study establishes mild to severe depression and anxiety (approximately 68% and 63%, respectively) in hospitalized children [8]. Another study proves that children going through surgery stated higher levels of preoperative anxiety, which not only affect their psychological state but also increased complaints of postoperative pain and enhanced recovery time. A latest study stressed the role of parent anxiety in provoking children's anxiety levels, with children whose parents showed high stress showing more severe symptoms [9, 10]. Furthermore, children with prolonged sickness or those needing recurrent hospital admissions are at greater risk of developing anxiety conditions due to recurrent experience

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to the hospital atmosphere [11]. The incidence of anxiety in hospitalized children is worrisome not only because of its direct psychological and emotional impact but also because it can hinder medical care. Anxiety can be a source of poor compliance with medical advice, prolonged hospital stays, and confrontation to treatment, additionally confounding recovery [12]. Understanding the prevalence of anxiety in hospitalized pediatric patients is significant for healthcare workers to develop directed interventions which report both the emotional and physical needs of these patients. Further research into the specific factors contributing to anxiety and the most operational ways to decrease it is essential for improving pediatric care and outcomes.

This study aims to investigate the prevalence of anxiety among hospitalized children and the associated determinants.

METHODS

A cross-sectional study was conducted in Qazi Complex, Nowshera. 118 children fulfilling the inclusion criteria were selected for study from December 2023 to May 2024. An approval was granted by the Ethical Committee of Nowshera College of Nursing and Health Sciences (Ref No. 065/NCIV/2023). A written and verbal consent was taken from guardians/parents of patients. Patients fulfilling inclusion criteria were included in this research. Sample size was calculated by open EPI software with margin of error 0.05 and Confidence Interval (CI) 95%. Convenience Sampling technique was used for data collection. Children between age 9 to 15 years and admitted to hospital for surgical or medical management were included in the study after taking consent from guardians. Mentally retarded children, unwilling to participate, and pediatric patients with intellectual disabilities were excluded from the study. In order to gather the information for study, a questionnaire The State-Trait Anxiety Scales Inventory for Children (STAIC) was administered for assessing trait and state anxiety, which include all variables to extract definite information. The reliability of STAIC has been proved by previous studies that indicate its internal consistency (Cronbach's alpha) in the range of 0.89 to 0.92 [13]. The anxiety levels were scored and labeled mild, moderate and severe. This questionnaire was used in the assessment of prevalence of anxiety in pediatric patients and the data were entered and analyzed using IBM-SPSS version 23.0.

RESULTS

The odds ratio (OR) of mean age group (12-15 years) is 1.43, indicating that children aged 12-15 are 43% more likely to experience severe anxiety compared to those aged 9-11 years, but this relationship is not statistically significant (p=0.351). In terms of counts, 16 out of 62 (25.8%) of the 12-15 age group experience severe anxiety, compared to 11 out of 56 (19.6%) of the 9-11 age group. Regarding gender, male have an OR of 1.19, suggesting they are 19% more likely to experience severe anxiety than female, though this is also not statistically significant (p=0.566). In numbers, 16 out of 66 (24.2%) male experience severe anxiety, compared to 11 out of 52 (21.2%) female. Another determinant, previous hospitalization, shows an OR of 4.56, meaning patients with a history of hospitalization are 4.56 times more likely to experience severe anxiety. This finding was highly significant (p<0.001). Here, 16 out of 38 (42.1%) patients with previous hospitalizations had severe anxiety, compared to 11 out of 80 (13.8%) without prior hospitalizations. Similarly, undergoing a painful procedure increases the odds by 6.27 times (p<0.001), with 18 out of 40 (45%) patients who underwent a painful procedure experiencing severe anxiety, compared to 9 out of 78 (11.5%) who did not. Finally, a hospital stay of more than 7 days shows the highest OR of 9.09, meaning these patients are 9.09 times more likely to suffer from severe anxiety (p<0.001). In terms of percentage, 19 out of 38 (50%) patients who stayed longer than 7 days experienced severe anxiety, compared to only 8 out of 80 (10%) with shorter stays. Overall, previous hospitalization, painful procedures, and extended hospital stays significantly increase the risk of severe anxiety, while age and gender show less influence (Table 1).

Table 1: Factors Influencing Anxiety among Hospitalized Patients

Characteristics	Anxiety level				Total (n=118)	p-value	OR (Severe vs Not Severe)
	Minimal or No (n=35)	Mild (n=27)	Moderate (n=29)	Severe (n=27)			
Age in Years (12-15 years)	17 (14)	11 (9)	18 (15)	16(14)	62 (53)	0.351	1.43
Gender of Patient (Male)	20 (17)	12 (10)	18(15)	16(14)	66(56)	0.566	1.19
Previous History of Hospitalization (Yes)	3(6)	5(4)	14(12)	16(14)	38(32)	<0.001	4.56
Undergone Painful Procedure During Hospital Stays (Yes)	3(3)	8(7)	11(9)	18(15)	40(34)	<0.001	6.27
Current Length of Stay at Hospital (>7 days)	1(1)	3(3)	15(13)	19(16)	38(32)	<0.001	9.09

Patients with a history of hospitalization (M=45.55, p<0.001) and those undergoing painful procedures (Mean=44.03, p<0.001) showed significantly higher anxiety levels compared to those without (Mean= 25.96 and Mean=26.24, respectively). Longer

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hospital stays (>7 days) also correlated with increased anxiety (Mean=47.79, p<0.001) versus shorter stays (Mean=24.90). In contrast, age (9-11 years: Mean=29.75, p=0.098; 12-15 years: Mean=34.55) and gender (male: Mean=32.64, p=0.778; female: Mean=31.81) did not significantly impact anxiety levels. Overall, the results highlight the substantial impact of hospitalization history, painful procedures, and prolonged stays on anxiety, with significant p-values (<0.001) indicating robust findings (Table 2).

Table 2: Mean Anxiety Scores by Demographic and Clinical Factors

Characteristics	N	Mean ± SD	p-value
Age in Years			
9-11 Years	56	29.75 ± 13.14	0.098
12-15 Years	62	34.55 ± 17.53	
Gender of Patient			
Male	66	32.64 ± 15.43	0.778
Female	52	31.81 ± 16.22	
Previous History of Hospitalization			
Yes	38	45.55 ± 14.02	<0.001
No	80	25.96 ± 12.20	
Undergone Painful Procedure During Hospital Stay			
Yes	40	44.03 ± 14.30	<0.001
No	78	26.24 ± 12.78	
Current Length of Stay at Hospital			
Up-to 7 days	80	24.90 ± 11.55	<0.001
> 7days	38	47.79 ± 11.49	

DISCUSSION

The results of this study demonstrate that numerous factors significantly contribute to the prevalence of anxiety among hospitalized children. Age and gender were not significant predictors of severe anxiety, whereas undergoing painful procedures, previous hospitalizations, and prolonged hospital stays were found to be critical contributors to heightened anxiety levels. These findings support and expand upon recent literature in the field. This study found no significant association between age and anxiety severity, with children aged 12-15 years only to some extent more likely to experience severe anxiety than those aged 9-11 years (OR=1.43, p=0.351). Likewise, gender was not a significant predictor (OR=1.19, p=0.566). This is steady with a previous study which also found no significant differences in anxiety levels based on gender [14, 15]. However, some literature proposes that younger children are more susceptible to anxiety due to less developed coping mechanisms [16]. The slight elevation of anxiety among older children in present study could be attributed to increased awareness of medical procedures and outcomes, but the differences were not statistically significant.The results of current study show that children with a history of hospitalization are over four times more likely to experience severe anxiety compared to those without previous hospitalizations (OR =4.56, p<0.001). This result is in line with the work which reported that repeated hospital admissions increase anxiety levels due to anticipation of discomfort and pain [17]. The consequence of repeated experiences to the hospital atmosphere was also highlighted in the study by Zheng *et al* that stressed the psychological problem of prolonged illness and recurrent hospital stays on pediatric patients [18]. A major finding in the present study was the solid association between increased anxiety and going through painful procedures (OR=6.27, p<0.001).This result is consistent with a previous study which identified preoperative anxiety as a main distress among children going through surgery [19]. Painful procedures have been demonstrated to trigger pre-emptive anxiety, where children panic about forthcoming pain depending on past experiences.Current pain management methods can considerably drop anxiety levels and upsurge patient recovery [16].This study underlines the need for childcare teams to reduce painful interventions when and wherever possible and arrange emotional support during required procedures. Children who stayed in the hospital for a period of more than seven days were nine times more likely to experience severe anxiety than those with shorter stay at hospital (OR=9.09, p<0.001).This strong connotation emulates findings that extended hospitalizations contribute to feelings of helplessness and separation, which aggravate anxiety indicators [20].The current study supports the significance of decreasing hospital stay periods when medically possible and integrating interventions to decrease anxiety during prolonged admissions.It is suggested that long hospital stays, and painful procedures are the most important backers to anxiety.It emphasizes the need for targeted interventions.Recent appraisals have revealed effective involvements like parental involvement, cognitive-behavioral techniques, and play therapy in decreasing anxiety. The role of child friendly atmosphere and pain lessening approaches in anxiety management has also been highlighted [16].These approaches are well supported by the findings of this study, that suggest that addressing these high-risk factors could considerably improve anxiety levels. However, some of the limitations are inculcated in the study. The study results were students of Qazi Complex, Nowshera, and therefore may not be generalized to other schools that are in different zones with different socio-economic and cultural backgrounds. Also, using only the children's self-rated anxiety scores may be problematic because the children could produce biased scores by either inflating or underestimating their symptoms. However, the study has several strengths compared to previous works in the field of pediatric

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anxiety: First, chronic markers for severe anxiety were examined (e.g., bedtime, length of the hospital stay, presence of painful procedures) and were supported by significant statistical data. Most importantly, in contrast to numerous systematic reviews, this work establishes the size of these predictors, providing information for specific prevention strategies. Extending research to other geographical locations and different clinical communities would increase the applicability of the results and improve the understanding of the nature of anxiety in children admitted to hospitals.

CONCLUSIONS

In conclusion, this research offers valuable consideration into the causes contributing to anxiety among hospitalized children. Although gender and age seem to have slight influence, painful procedures, prolonged hospital stays, and previous hospitalizations considerably escalate the risk of severe anxiety. These outcomes are consistent with recent literature, and they suggest the need for directed interventional strategies aimed at decreasing hospital related stressors. Strategies such as minimizing painful interventions, decreasing hospital stays, and providing psychological support can play a important role in improving the mental health and overall results of pediatric patients.

Authors Contribution

Conceptualization: RA
Methodology: RA, BT, IS
Formal analysis: RA, QUAA, NA
Writing review and editing: RA, QUAA, NA

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

Conflicts of Interest

The authors declare no conflict of interest.

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REFERENCES

[1] Daughtrey HR, Ruiz MO, Felix N, Saynina O, Sanders LM, Anand KJS. Incidence of Mental Health Conditions Following Pediatric Hospital Admissions: Analysis of a National Database.Frontiers in Pediatrics.2024Feb;12.doi:10.3389/fped.2024.1344870.

[2] Penwill NY, Wong CT, Taylor DB, Freyleue SD, Bordogna AL, Bode RS, *et al.* Hospitalists' Perceptions of Pediatric Mental Health Boarding: Quality of Care and Moral Distress.Hospital Pediatrics.2023Mar;13(3):233-45.doi:10.15 42/hpeds .2022-006913.

[3] Correale C, Tondo I, Falamesca C, Capitello TG, Vigevano F, Specchio N, et al. Depression and Anxiety in Hospitalized Children with Epilepsy During COVID-19 Pandemic: Preliminary Findings of A Cross-Sectional Study. European Psychiatry.2021Apr;64 (S1): 670-671. doi: 10.1192/j.eurpsy.2021.1780.

[4] WHO. Mental Health of Adolescents. 2021. [Last Cited: 7th Jan 2025].Available at:www.who .int/news-room/fact-sheets/detail/adolescent-mental-health.

[5] Ginanjar MR, Ardianty S, Apriliyani K. Factors Related Anxiety Level On Hospitalized Children.Masker Medika.2021Oct;9(1):359-64.doi:10.52523/MASKER MEDIKA.V9I1.439.

[6] Liang Y, Huang W, Hu X, Jiang M, Liu T, Yue H, *et al.* Preoperative Anxiety in Children Aged 2–7 Years Old: A Cross-Sectional Analysis of The Associated Risk Factors.Translational Pediatrics.2021Aug;10(8): 2024. doi: 10.21037/tp-21-215.

[7] Delvecchio E, Salcuni S, Lis A, Germani A, Di Riso D. Hospitalized Children: Anxiety, Coping Strategies, and Pretend Play. Frontiers in Public Health.2019 Sep; 7: 1-8. doi:10.3389/fpubh.2019.00250.

[8] Correale C, Falamesca C, Tondo I, Borgi M, Cirulli F, Truglio M, *et al.* Depressive Anxiety Symptoms in Hospitalized Children With Chronic Illness During the First Italian COVID-19 Lockdown.Children.2022Aug; 9(8):1156. doi:10.3390/children9081156.

[9] Kaynak H and Çövener Ç. The Effect of Parents on The Hospital Anxiety Level of Hospitalized Children. Journal Of Education And Research In Nursing.2020 Dec; 17(4): 312-316. doi: 10.5222/head.2020.65471.

[10] Lestari AW, Lee CK, Hayati H. The Impact of Parental Psychological Distress on Child Behavior Issues in Hospitalized Children.La Pediatria Medica E Chirurgica.2023Jun;45(1).doi:10.4081/pmc.2023.311.

[11] Kadan G. Children in Hospital. Research on Prenatal, Postnatal, and Early Childhood Development.2020; 98-116). doi: 10.4018/978-1-7998-2952-2.ch006.

[12] Çelikol Ş, Tural Büyük E, Yıldızlar O. Children's Pain, Fear, and Anxiety During Invasive Procedures. Nursing Science Quarterly.2019Jul;32(3):226-32. doi:10.1177/0894318419845391.

[13] Essau CA, Muris P, Ederer EM. Reliability and Validity of the Spence Children's Anxiety Scale and the Screen for Child Anxiety-Related Emotional Disorders in German Children. Journal of Behavior Therapy and Experimental Psychiatry.2002Mar;33(1) : 1-8. doi:10.1016/S0005-7916(02)00005-8.

[14] Doupnik S, Hill D, Palakshappa D, Worsley D, Bae H, Shaik A, *et al.* Parent Coping Support Interventions During Acute Pediatric Hospitalizations.Pediatrics. 2017; 140(3): 1-16. doi:10.1542/peds.2016-4171.

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[15] Eijlers R, Staals L, Legerstee J, Berghmans J, Strabbing E, Van Der Schroeff M, *et al.* Predicting Intense Levels of Child Anxiety During Anesthesia Induction at Hospital Arrival.Journal of Clinical Psychology in Medical Settings.2020;28:313-322.doi :10.1007/s10880-020-09716-6.

[16] Ahmadipour M, Sattari H, Nejad MA. Incidence and Risk Factors Related to Anxiety of Children and Adolescents Before Elective Surgery.European Journal of Translational Myology.2022;32(2).doi:10. 4081/ejtm.2022.10449.

[17] Liu W, Xu R, Jia J, Shen Y, Li W, Bo L. Research Progress on Risk Factors of Preoperative Anxiety in Children: A Scoping Review. International Journal of Environmental Research and Public Health.2022; 19(16). doi:10.3390/ijerph19169828.

[18] Zheng K, Abraham C, Bruzzese JM, Smaldone A. Longitudinal Relationships Between Depression and Chronic Illness in Adolescents: An Integrative Review. Journal of Pediatric Health Care.2020;34(4): 333-45. doi:10.1016/j.pedhc.2020.01.008.

[19] Morin H, Worsley D, Zhang X, Faerber J, Pettit AR, Kenyon CC, *et al.* Depression and Anxiety Symptoms During and After Pediatric Asthma Hospitalization. Hospital Pediatrics.2021;11(11):1272-9.doi:10.1542/ hpeds.2020-000950.

[20] Raj R, Nguyen M, Pozzo AM, Marsac ML, Vselvoshakaya O, Meadows AL. Effects of Trauma and Anxiety on Adherence in Pediatric Type 1 Diabetes. Diabetes Spectrum.2022;35(2):171-8.doi :10.2337/ds21-0024.

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Original Article

Influence of Lithium On Micro-Hardness of Dental Tissues

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ABSTRACT

Lithium in pregnancy is related to the risk of preterm birth. The study is related to the influence of Lithium in which female rabbits were involved as an experimental model, the drug was given during pregnancy which might instigate the defects of teeth in their developing offspring which were utilized as a sample to evaluate the micro-hardness of dental tissues i.e. enamel and dentine. **Objective:** To evaluate the influence of lithium on the micro-hardness of dental tissues. **Methods:** The subjects were divided into two sets i.e. investigational and regulator, containing seven subjects per cluster (n=7), the sum of 168 samples. Micro-hardness was estimated on two tissues of teeth. Vickers Hardness gradation was tested by taking three indentations on each sample for enamel and dentine, distinctly with 50 gm of weight for 15 sec. **Results:** The statistical analysis was done by applying Student's t-tests using SPSS version 25. A noteworthy decline occurred in maxillary incisors, premolars, and molars, with p-values of 0.001, 0.012, and 0.003, separately. Comparatively, mandibular teeth, affected the incisors and molars, with p-values 0.003 and 0.011. Hardness affected the dentine of maxillary incisors, premolars, and molars, with p-values of 0.006, 0.005, and 0.004 individually. Micro-hardness in dentine was lowered in all the maxillary and mandibular teeth except mandibular molars. **Conclusions:** It was concluded that the tested values indicated the drug's effect on maxillary and mandibular teeth by reduced standards. The clinicians should therefore be careful prescribing the medication, particularly during pregnancy, eluding the unfortunate consequence of neonate's teeth.

INTRODUCTION

Publications up to 2023 were reviewed through a systematic search using electronic databases discovering the micro-hardness of enamel and dentine affected by Lithium. Prior reports revealed that Lithium escalation could be supportive in managing patients suffering from major depressive disorder (MDD) who do not or have a limited reaction to antidepressant usage [1]. Lithium in pregnancy is related to the risk of preterm birth. The risks and benefits of management would be consumed to monitor the policymaking, as recommended by Hastie *et al.*, [2]. In another study, it was noticed that individuals with Type1 diabetes mellitus (T1DM) destructively triggered enamel and dentine micro-hardness [3].Thermal management can also deproteinize humanoid dentine devoid of effects on the mechanical aspect, while chemical deproteinization alters the mechanical properties and crystallography of dentine [4]. According to former studies on re-mineralization, all mediators utilized in the study of early carious lesions, the Fluoride polish showed the maximum micro-hardness with minimum enamel solubility (ES) related to re-mineralizing mediators [5].Ghelejkhani *et al.*, reported that Fluoride varnish amplified the enamel micro-hardness. Laser therapy before the application of re-mineralizing mediators did not improve the enamel fight to demineralization [6]. Zhang *et al.*, fictitious lithium and cobalt co-doped mesoporous bioactive glass nanoparticles (Li-Co-MBGNs) using a reformed sol-gel technique.The antibacterial action compared to Staphylococcus aureus and Escherichia coli, indicates the usage in bone tissue production.General, outcomes indicated the viability of the kind in bone tissue production [7]. An in vitro study by Borges *et al.*, in which they assessed the effect of pressed lithium disilicate, through Knoop micro-hardness (KHN) of a light-cured resin cement at two

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complexities.The increasing ceramic thicknesses condensed the micro-hardness of resin cement. Augmented gravity in resin cement exhibited abridged micro-hardness in entirely all considered individuals. Improved ceramic opacity decreased the KHN of resin cement at individual zeniths for altogether ceramics [8]. Kiełczykowska *et al.*, evaluated the impact of selenium on lithium content, and homeostasis of microelements i.e. iron, zinc, copper, and manganese in the kidney and liver of rats experiencing lithium disclosure.The results of selenium as an adjuvant to lithium therapy, only one dose of Selenium seemed necessary to clarify its influence on elementary microelements and lithium addition in organs for the period of lithium exposure [9]. The effect on Dentine revealed the consequence of nanoparticle-built intra-canal pharmaceuticals on the root dentine micro-hardness test in two sets, Calcium hydroxide in addition to a regulator cluster. Vickers hardness standards remained predictable. Graphene oxide-silver nanoparticles built intra-canal treatment presented minimum consequence on micro-hardness of root dentine equated for Calcium hydroxide [10]. The survey of the literature revealed an altered effect on the micro-hardness by the use of Lithium regarding the restorations of teeth, and the influence on different body organs, whereas in the current experimental study, the consequence of Lithium was explored on the teeth of offspring by giving the drug systematically during pregnancy to the female rabbits. This type of study has not been reported showing the effect of drugs on teeth during their developmental stages.

This study aims to evaluate the influence of lithium on the micro-hardness of dental tissues.

METHODS

The quasi-experimental study design was planned, utilizing female rabbits as an experimental model. The study was conducted from January 2024- July 2024. Female rabbits were chosen for their reproductive physiology and hormonal relevance to lead toxicity and liver health studies. Subjects (1.5–2.0 kg) were divided into control and treated groups (n=7 each). The acceptable sample size (E=10–20) was calculated by subsequent formula [11]: E=Total number of animals – Total number of groups. The study was conducted at Baqai Medical University and the female rabbits were taken from the animal house of the University. The spell of the study was about two years. Female rabbits of 1.5 to 2.0 kg were designated for trial. Healthy offspring at the age of three months were used. Male rabbits, animals less than 1.5 to 2.0 kg, Subjects more than three months of age, and animals stated as unhealthy by the veterinary surgeon with any injuries, rashes, or edema were excluded from the study. Unhealthy subjects were excluded based on veterinary examination and/or laboratory tests, ensuring only healthy individuals were included. Lithium Carbonate is available under the professional name (Neurolith® SR. 400 mg) [12]. The required dose of the selected medication was prepared considering the total mass of the subject, meticulously according to Clark's rule [13]. Dose=Adult dose × (Weight Kg / 70). Preparation of the medication was done by dissolving one tablet in 10 ml of distilled water, and 3 ml (80 mg/kg) of the medication was given orally, two times per week to female rabbits of experimental subjects throughout the phase of pregnancy till the delivery of their offspring. These offspring were sacrificed at the age of three months for the investigational purpose of acquiring their maxilla and mandible. Extraction of teeth was executed including all three classes of teeth i.e. central Incisor, first Premolar, and the first Molar originating from the upper and lower jaws. Twelve samples (teeth) were engaged from the subjects of the study and regular groups, the total number of samples for the experimental purpose was 168. This benchmark could extract sufficient evidence to depict the conclusion. The methodology of sample preparation for testing micro-hardness was conducted according to the same procedure described in one of our published articles [14]. Samples preparation was accomplished by "Cold mounting" using Epoxy mount resin (Diglycidyl Ether Resin) and epoxy mount hardener (N-Amino-ethyl-piperazine). Resin and the hardener were placed inside the moulds (in grams) of 10:3 which were hardened at room temperature. Teeth were set in vertical positions and placed in a mould for informal admittance to enamel and dentine. The dimension of the mould was related to the diameter/height i.e. 30/15 mm, according to the size of the teeth. The transparent mounting material enabled for easy identification and location of the dental tissues. Grinding of the specimens was done after hardening of the samples before the polishing procedure. It was steered by waterproof emery papers having Si-C (Silicon Carbide) bits of 180, 220, 320, 400, 600, 800, and 1000 grit dimensions, with continuous water irrigation. Grinding machine, (Model No. Maopao 260 E). The polishing of samples was conducted on the polishing appliance (Model No. DUO 12 Benetec). The polishing spinning wheels were shielded with a fabric saturated by a reasonable abrasive material, Alumina (Aluminum Oxide: Al_2O_3) suspension in H2O progressively with 0-500 rpm. A Vickers hardness testing machine (Model No.402 MVD), was used to determine the hardness of the tooth structure. The diamond-shaped square-based pyramid of 136o was enforced on the refined surface of the sample, positioned on the appliance podium underneath the precise load of 50 gm with a Dwell time of 15 secs for individual samples. Three indentations for the enamel and dentine were taken. The magnitudes of the indentation were recorded in the automatic machine for scheming the micro-hardness of the dental tissues. The following formula was applied to calculate the micro-hardness [15]. HV=1.854 L / d2. Whereas: L=Denotes the applied load on the indenter in kg, D= mean diagonal of indentation, in mm

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and H=Vickers micro-hardness degree (kg/mm2). The images were perceived using an optical microscope (Model No. MMD-GX 51 Olympus), to focus on a high-quality expanded image. Pictures of the trial models were reserved at 100 X magnification. The data were analyzed on SPSS version 25. Descriptive analysis was accomplished by computing mean and standard deviation while inferential analysis was prepared by relating an independent t-test after examination of the data for normality. By using the Shapiro-Wilk test, the significance level was kept at 0.05.

RESULTS

The results indicated variations in the toughness (HV) values of both tissues i.e. enamel and dentine. A noteworthy reduction in the micro-hardness was perceived in maxillary incisors, premolars, and molars, showing the p-values as 0.001, 0.012, and 0.003, correspondingly, while in mandibular teeth, incisors, and molars were affected, with the p-values 0.003 and 0.011, mandibular premolars were least affected. Results of dentine showed a significant reduction of hardness in maxillary incisors, premolars, and molars, having the p-values 0.006,0.005, and 0.004. However minimal change in dentine micro-hardness of mandibular teeth was observed. The particulars of micro-hardness were summarized with statistical analysis to conclude. The values of Vickers hardness (HV) are represented through mean and standard deviations of the dental tissues i.e. Enamel and dentine comprising of control in addition to the experimental group of both maxillary and mandibular teeth expressed in Table 1.

Table 1: Micro-Hardness of Dental Tissues Treated with Lithium

Samples (Teeth)	Micro-hardness- Unit H.V Mean ± SD (n=7)					
	Enamel			Dentine		
	Control	Treated	p-value	Control	Treated	p-value
Maxillary Incisor	246.27 ± 17.09	187.80 ± 34.97	0.001	52.174 ± 6.16	52.17 ± 6.16	0.006
Maxillary First Premolar	236.40 ± 43.97	181.36 ± 22.72	0.012	34.960 ± 3.12	34.96 ± 3.12	0.005
Maxillary first Molar	266.30 ± 33.92	198.27 ± 12.43	0.003	31.419 ± 2.48	31.42 ± 2.48	0.004
Mandibular Incisor	264.84 ± 21.03	208.27 ± 9.62	0.003	49.617 ± 6.19	49.62 ± 6.19	0.058
Mandibular First Premolar	239.82 ± 42.02	225.10 ± 18.90	0.414	36.507 ± 4.21	36.51 ± 4.21	0.044
Mandibular First Molar	250.18 ± 23.95	199.46 ± 37.96	0.011	41.220 ± 3.03	41.22 ± 3.03	0.570

Images of indentation at three locations on Enamel and dentine on the prepared samples are shown in Figure 1.

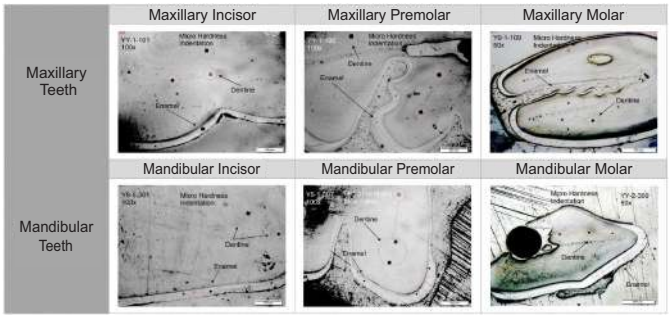

Figure 1: Photographic Representation of Vickers Hardness On Enamel and Dentine Showing Indentation On Three Points

The contrast of micro-hardness in the tissue of teeth i.e. enamel in the group of maxillary arches is presented in Figure 2.

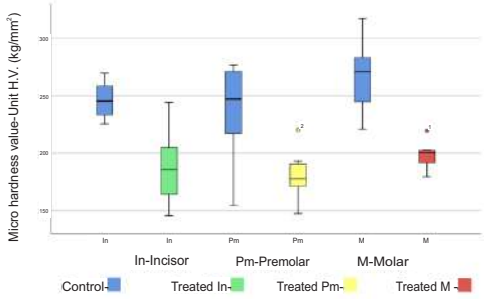

Figure 2: Micro-hardness of Enamel in Maxillary Teeth

Those of mandibular teeth are within reach in Figure 3.

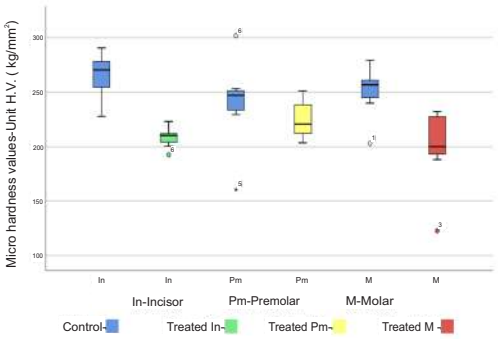

Figure 3: Micro-Hardness of Enamel in Mandibular Teeth

The comparable data of hardness values of dentine in normal and trial groups was analyzed. Micro-hardness of the dentine of maxillary teeth is represented in Figure 4.

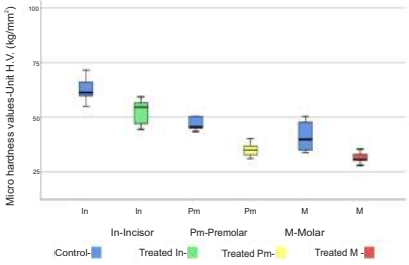

Figure 4: Micro-Hardness of Dentine in Maxillary Teeth

The dentine in mandibular teeth is interpreted in Figure 5.

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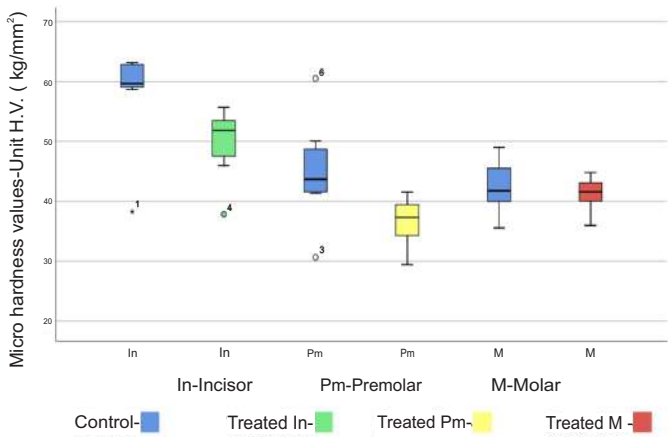

Figure 5: Micro-Hardness of Dentine in Mandibular Teeth

DISCUSSION

Little information is available on the prevalence of enamel defects in the developing stage affected by the administration of medication. Adversative drug responses could implicate all organs of the body. Assessment of micro-hardness in enamel and dentine is important related to dental hard tissue which is another degree for the 'healthiness' of these tissues. Micro-hardness measurement using the VHN test is an accepted technique. The Vickers Pyramid Number (HV) or Diamond Pyramid Hardness (DPH) has been documented as the Unit of the hardness [16].The hardness of the teeth was restrained using a Vickers diamond indenter in a typical micro-hardness test by Chun *et al.* The hardness rate of Enamel samples remained around (HV= 274.8 ± 18.1) which was about 4.2 times greater as compared to dentine (HV= 65.6 ± 3.9).It was reported that Enamel conceived greater resistance appropriate for grinding the foods, and dentine had upper strength resistance.The dissimilar parts of dental tissues may give diverse conformations along with interior features, as discovered by scanning electron micrographs [17]. In the contemporary study, mean micro-hardness standards of enamel in control and treated subjects were revealed as (236.40 ± 43.97 to 266.30 ± 33.92) and (181.36 ± 22.72 to 225.10 ± 18.90) respectively, regarding the dentine-tested hardness value of control (31.419 ± 2.48 to 52.174 ± 6.16) and treated (31.41 ± 2.48 to 52.174 ± 6.16) the results appeared in line with the reported values. Gaining additional understanding of the effects of these medications on the teeth of small mammals like rabbits. In the current study, a range of doses was administered to rabbits, meant to determine the effects of a selected drug on the developing teeth of their offspring, the results of such tests have been reported in the existing study. The results revealed that micro-hardness was significantly reduced in the enamel of all the maxillary teeth. Micro-hardness values showed a noteworthy reduction in dentine except for the mandibular molars.According to Chuenarrom *et al.*, the alteration of the denting period did not affect the micro-hardness values of dental tissues. The Knoop hardness numbers (KHN) standards of Enamel and Vickers hardness numbers (VHN) of Dentine were provoked by differences in the applied loads.Hence, the tooth firmness figure for diverse loads may not be suitable for evaluation with the results.The study was conducted by applying different test loads [18].Relating to the present study, a variation in the micro-hardness after the use of a drug was channeled by applying a particular weight of 50 gm with Dwell time of 15 sec.This parameter was kept uniform for all the samples.There is a dearth of published data regarding the consequences of Lithium on evolving teeth. However, the consequences of the drug's effect on developing teeth are presented in the contemporary study. Moreover, there is scarce evidence about neonatal imperfections following in-utero exposure of Lithium.The practice of the Vickers hardness tester for assessing the standards of enamel micro-hardness e.g. diamond burs adversely affected enamel micro-hardness and meaningfully reduced it.Standards of healthy enamel micro-hardness were attained by 40 and 60 µm instead of 90 µm abrasive strips. Using 15 µm abrasive strips and Sof Lex abrasive discs, the micro-hardness standards acquired remained greater, related to those documented for healthy enamel [19]. Influence on alveolar bone reported by Wadke *et al.*, that lithium might improve alveolar bone development for the period of orthodontic retention, which might influence the orthodontic management period in patients getting lithium, and orthodontic tooth movement (OTM) [20]. Micro-hardness of root dentine indicated reduction by a gold standard intra-canal medicament i.e. Calcium hydroxide (CH). A natural extract, propolis, acted better to CH in eliminating endodontic microbes, A Vickers hardness indentation appliance with a load of 200 g and dwell period of 15 s at 24 h, 3, and 7 days were cast off for micro-hardness analysis. After 7 days, it was established that the highest micro-hardness assessment was (64.43 ± 1.69), while CH was revealed to be the lowermost value as (48.46 ± 1.60). The root dentine micro-hardness improved with the application of propolis, while it reduced dentine sections after the use of CH [21]. Published literature provided information regarding the micro-hardness of human teeth and the use of Lithium for restoration procedures in dental practice. Micro-hardness of dentine was also assessed by the use of intra-canal medicament. On the other hand, the present study was conducted on a different constraint to assess the micro-hardness of enamel and dentine on developing teeth influenced by a medication administered to the mother during pregnancy, such kind of study has not been

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described in the published literature.

CONCLUSIONS

It was concluded that a better understanding of the mechanical properties of enamel and dentine may facilitate the practitioners to relate and apply it in clinical practice. It was thus comprehensible that Lithium could lead to developmental defects of dental tissues, therefore it must be considered obligatory to take the medication by doctor's recommendation during pregnancy to escape the risk of developing defects in newborns.

Authors Contribution

Conceptualization: SN
Methodology: SN
Formal analysis: SN
Writing review and editing: SN, AM

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

Conflicts of Interest

The authors declare no conflict of interest.

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REFERENCES

[1] Ercis M, Ozerdem A, Singh B. When and How to Use Lithium Augmentation for Treating Major Depressive Disorder. The Journal of Clinical Psychiatry.2023 Mar; 84(2): 46076. doi: 10.4088/JCP.23ac14813.

[2] Hastie R, Tong S, Hiscock R, Lindquist A, Lindström L, Wikström AK. Maternal Lithium Use and the Risk of Adverse Pregnancy and Neonatal Outcomes: A Swedish Population-Based Cohort Study. BioMed Central Medicine.2021 Dec;19:1-8. doi: 10.1186/ s12916-021-02170-7.

[3] Saghiri MA, Sheibani N, Kawai T, Nath D, Dadvand S, Amini SB *et al.* Diabetes Negatively Affects Tooth Enamel and Dentine Microhardness: An in-Vivo Study. Archives of Oral Biology.2022 Jul; 139: 105434. doi: 10.1016/j.archoralbio.2022.105434.

[4] Saghiri MA, Vakhnovetsky J, Dadvand S, Samadi E, Linfante JC, Conte M. Impact of Deproteinization Methods On the Physical and Mechanical Properties of Dentin. Materialia.2022Sep;25:101551.doi: 10.1016/j.mtla.2022.101551.

[5] Dhillon SN, Deshpande AN, Macwan C, Patel KS, Shah YS, Jain AA. Comparative Evaluation of Micro-Hardness and Enamel Solubility of Treated Surface Enamel with Resin Infiltrant, Fluoride Varnish, and Casein Phosphopeptide-Amorphous Calcium Phosphate: An in Vitro Study. International Journal of Clinical Pediatric Dentistry.2020; 13(Suppl 1): S14. doi : 10.5005/jp-journals-10005-1833.

[6] Ghelejkhani A, Nadalizadeh S, Rajabi M. Effect of Casein-Phosphopeptide Amorphous Calcium Phosphate and Fluoride with/Without Erbium, Chromium-Doped Yttrium, Scandium, Gallium, and Garnet Laser Irradiation On Enamel Micro-hardness of Permanent Teeth. Dental Research Journal.2021 Jan; 18(1): 20. doi: 10.4103/1735-3327.311427.

[7] Zhang X, Nan K, Zhang Y, Song K, Geng Z, Shang D *et al*. Lithium and Cobalt Co-Doped Mesoporous Bioactive Glass Nanoparticles Promote Osteogenesis and Angiogenesis In Bone Regeneration. Frontiers in Bioengineering and Biotechnology.2024Jan;11:1288393.doi:10.3389/fbioe.2023.1288393.

[8] Borges LP, Borges GA, Correr AB, Platt JA, Kina S, Correr-Sobrinho L *et al.* Effect of Lithium Disilicate Ceramic Thickness, Shade and Translucency On Transmitted Irradiance and Knoop Micro-hardness of A Light Cured Luting Resin Cement. Journal of Materials Science: Materials in Medicine.2021 Aug; 32: 1-9. doi: 10.1007/s10856-021-06562-2.

[9] Kiełczykowska M, Polz-Dacewicz M, Kopciał E, Mitrus O, Kurzepa J, Marzec Z *et al.* Selenium Prevents Lithium Accumulation and Does Not Disturb Basic Microelement Homeostasis in Liver And Kidney of Rats Exposed to Lithium. Annals of Agricultural and Environmental Medicine.2020;27(1):129-33.doi: 10.26444/aaem/105926.

[10] Nasim I, Jaju KK, Shamly M, Vishnupriya V, Jabin Z. Effect of Nanoparticle Based Intra-Canal Medicaments On Root Dentin Micro-Hardness.Bio-information.2022;18(3):226.doi:10.6026/97320630018226.

[11] Charan J and Kantharia N. How to Calculate Sample Size in Animal Studies? Journal of Pharmacology and Pharmaco-therapeutics.2013 Dec;4(4):303-6.doi: 10.4103/0976-500X.119726.

[12] Nazir S, Naqvi NH, Masood A, Naema N. SEM-EDX Analysis for Surface Aberrations of Neonate's Teeth Influenced by the use of Lithium in Pregnancy. World Journal of Dentistry.2012 Sep; 2(2): 105-10.doi:10.5005/jp-journals-10015-1065.

[13] Kumar P and Clark ML. Kumar and Clark's Cases in Clinical Medicine E-Book: Kumar and Clark's Cases in Clinical Medicine E-Book. Elsevier Health Sciences. 2020 Oct.

[14] Nazir S, Ali A, Zaidi S. Micro Hardness of Dental Tissues Influenced by Administration of Aspirin During Pregnancy.International Journal of Morphology.2015Jun;33(2):586-593.doi:10.4067/S0717-95022015000200028.

DOI: https://doi.org/10.54393/pbmj.v8i3.1165

[15] Avner SH. Tools of the Metallurgist. Introduction to Physical Metallurgy.22nd ed. New York, McGraw-Hill. 2006: 1-63.
[16] Arief DS, Badri M, Dalil M, Reforiandi A, Permana AS. Calibration of Vickers Hardness Test Pt. Tenaris Seamless Pipe Indonesia Jaya Cilegon Using Standar Blok. Journal of Ocean, Mechanical and Aerospace-Science and Engineering. 2020 Nov; 64(3): 81-7. doi: 10.36842/jomase.v64i3.203.
[17] Chun KJ, Choi HH, Lee JY. Comparison of Mechanical Property and Role Between Enamel and Dentin in the Human Teeth. Journal of Dental Biomechanics. 2014; 5. doi: 10.1177/1758736014520809.
[18] Chuenarrom C, Benjakul P, Daosodsai P. Effect of Indentation Load and Time On Knoop and Vickers Micro-Hardness Tests for Enamel and Dentin. Materials Research.2009;12:473-6.doi:10.1590/S1516-14392009000400016.
[19] Serbanoiu DC, Vartolomei AC, Ghiga DV, Pop SI, Panainte I, Moldovan M et al. Comparative Evaluation of Dental Enamel Microhardness Following Various Methods of Interproximal Reduction:A Vickers Hardness Tester Investigation. Biomedicines.2024 May; 12(5): 1132. doi: 10.3390/biomedicines12051132.
[20] Wadke A, Kommuri K, Talluri S, Kalladka M, Kalladka G, Khan J. Effect of Lithium on Orthodontic Tooth Movement: A Systematic Review of Animal Studies. Turkish Journal of Orthodontics.2024Mar;37(1):63. doi:10.4274/TurkJOrthod.2023.2022.149.
[21] Naeem MM, Sarwar H, Nisar A, Ahmed S, Shabbir J, Khurshid Z *et al.* Effect of Propolis On Root Dentine Micro-Hardness When Used As An Intra-Canal Medicament: An in Vitro Study. Journal of Functional Biomaterials.2023Mar;14(3):144.doi:10.3390/jfb14030144.

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Enhancing Nurses' Professional Quality of Life: A Psycho-Educational Intervention Study

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ABSTRACT

The nursing staff's professional quality of life is significantly impacted by their exposure to other people's trauma and anguish on the job. By reducing secondary trauma, compassion fatigue, and burnout, the project intends to develop a psycho-education-based solution that will enhance nurses' professional quality of life. **Objective:** To assess the impact of a psycho-education-based intervention on nurses' professional quality of life, stress, anxiety, depression, and resilience. **Methods:** This quasi-experimental study assessed stress, anxiety, depression, and resilience through pre- and post-testing. Purposive sampling was used, and participants were assigned to intervention or control groups without randomization. The ProQOL, BRS, and DASS scales measured outcomes. Data analysis included repeated measures ANOVA for group differences and bivariate correlation analysis. **Results:** The results showed that the intervention doesn't have an effect on compassion satisfaction and stress while it significantly decreases burnout, secondary trauma stress, and depression. The current study also found out an increase in the levels of anxiety for the participants at the assessment after intervention. The compassion satisfaction significantly increased, while burnout, secondary trauma, anxiety, stress, and depression decreased significantly. Furthermore, burnout showed to be negatively correlated with resilience, while secondary trauma stress was not correlated with resilience. Compassion fatigue was also positively correlated with resilience. **Conclusion:** The research concludes that the interventions based on psycho-education are significant to be utilized in the healthcare sector.

INTRODUCTION

Although compassion and concern have been frequently regarded as vital traits in healthcare, nurses who might be exposed to people's distress and pain on a regular schedule are at danger of developing emotional exhaustion [1]. Charles Figley invented this terminology of compassion fatigue within the 1980's. Compassion fatigue has been extensively accepted by the psychiatric profession from its very establishment [2]. Similarly, Professional burnout, also known as work - related emotional and physical exhaustion, is a condition of depletion in workers caused by long-term contact to employment difficulties [3]. Recurrent exposure to a patient's trauma can result in secondary trauma stress disorder (STS), a disease that resembles the symptoms of post-traumatic stress disorder (PTSD). Nurses who work with the critically ill, injured, or people at the end of their lives for long periods of time are more vulnerable to the detrimental consequences of indirect trauma [4]. The compassion satisfaction of oncology healthcare workers is low, according to Ortega-Compos et al. (2020). Additionally, they experience somewhat higher degrees of compassion fatigue and comparatively higher levels of burnout [5]. Emergency responders including nursing staff have been found to be at an increased danger of covert experience of traumatic experience and, as a result, will have higher susceptibility to the development for secondary traumatic stress indicators. Employee satisfaction or contentment from work has been the most powerful determinant of secondary trauma stress signs [6]. Notwithstanding growing concerns about the welfare of healthcare professionals, there is a dearth of study on secondary trauma stress (STS) and compassion fatigue among nurses in Pakistan. According to one study, 94.2% of nurses reported average degrees of burnout and 84.7% reported

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average levels of compassion fatigue [7]. These statistics highlight a critical gap in research and intervention strategies addressing occupational stress in Pakistani nurses. Resilience, according to literature has been recognized to be an important significant predictor against the negative consequences of stressful and traumatic experiences on psychological and emotional wellbeing [8]. In terms of compassion fatigue, a few studies have shown that resilience can help reduce the weariness that comes with providing care [9]. Acknowledging this process is vital for developing interventions targeted at improving nurses' psychological health so that they can provide high-quality, efficient, and empathetic services to individuals [10]. The level of distress varies by demographic and work-related factors, with younger nurses, those with fewer years of experience, and those working in critical care and psychiatric settings exhibiting higher levels of burnout and STS [11]. The effectiveness of psycho-educational interventions in healthcare professionals, especially in low- and middle-income countries, has not been thoroughly studied, despite the fact that international studies have investigated intervention strategies like mindfulness training, stress management workshops, and Cognitive-Behavioral Therapy (CBT)-based programs [12]. By putting into practice and assessing a psycho-educational intervention intended to enhance nurses' resilience, psychological health, and professional quality of life, this study aims to close this knowledge gap. The Professional Quality of Life (ProQOL) Model by Stamm (2010), which views professional well-being as a balance between compassion fatigue and compassion fulfillment, serves as the foundation for the intervention [13]. Compassion satisfaction refers to the positive psychological benefits of caregiving, while compassion fatigue encompasses both burnout and secondary trauma stress. The intervention began with discussions in a psychoeducational group setting on issues such as resiliency, awareness, compassion, and autonomy. It tackles the fundamental reasons and consequences of excessive stress, burnout, and secondary trauma as a method which integrates psychoeducation with treatment alliance and assistance to promote coping and psychological wellness both within and beyond the profession [14]. This study examines whether a psycho-educational intervention lowers psychological discomfort and enhances nurses' professional quality of life. Assessing the prevalence of burnout, compassion fatigue, and secondary trauma stress among nurses working in acute care and psychiatric settings, assessing how well the intervention reduces distress and builds resilience, investigating the relationship between resilience and professional quality of life, and figuring out whether the effects of the intervention last for a month are all part of the goals. According to the hypotheses, professional quality of life scores will improve after the intervention and stay stable at follow-up; resilience will have a negative correlation with burnout but no significant relationship with secondary trauma stress; and the intervention will significantly reduce depression, burnout, and secondary trauma stress.

This study offered important insights into how structured interventions might reduce psychological distress and improve nurses' professional quality of life, which is crucial given the growing awareness of mental health issues among frontline healthcare workers.

METHODS

This quasi-experimental study was conducted from June 2022- November 2022 at United-Christian Hospital and the Punjab Institute of Mental Health, Lahore, Pakistan. Ethical approval was obtained from the Institutional Research Board and Ethics Committee at Forman Christian College (IRB Ref: IRB-333/05-2022), and all participants provided written informed consent. Using purposive sampling, registered nurses with at least one year of clinical experience were recruited, while those with less experience, on extended leave, or retired were excluded. Participants were assigned to an intervention group, which received a structured two-hour psycho-education seminar, or a control group, which received no intervention. The seminar covered secondary trauma, burnout, compassion fatigue, and stress management. Assessments were conducted at three time points: baseline (pre-intervention), immediately post-intervention, and at a one-month follow-up. Data collection utilized validated psychological scales, including the Professional Quality of Life Scale (ProQOL), Depression, Anxiety, and Stress Scale-21 (DASS-21), and Brief Resilience Scale (BRS), all demonstrating strong internal consistency (Cronbach's alpha: 0.72–0.94). Statistical analysis, performed using SPSS v.26, included descriptive statistics, normality tests, one-way repeated measures ANOVA, and Pearson correlation, with significance set at $p < 0.05$. Ethical guidelines were strictly followed, ensuring participant confidentiality, voluntary withdrawal, and referrals to therapists if needed. This study design ensured methodological rigor while evaluating the impact of psycho-education on nurses' professional quality of life.

RESULTS

The study examined how a psycho-educative seminar affected the psychological distress and work-related quality of life of healthcare professionals. The participants' demographic details were compiled in table 1. With an average of 6.26 years of work experience (SD = 5.07), the mean age was 30.50 years (SD = 6.58). Most participants were female (84.1%), had a bachelor's degree (81.7%), and were employed in gynecology (52.4%).

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Table 1: Micro-Hardness of Dental Tissues Treated with Lithium

Variables	Mean ± SD	%
Age	30.50 ± 6.58	-
Years of Experience	6.26 ± 5.07	-
Gender (Women)	-	84.1
Education (Bachelor's)	-	81.7
Department (Gynecology)	-	52.4

Cronbach's alpha values for reliability analyses ranged from 0.70 to 0.95, indicating strong internal consistency for all scales. The Brief Resilience Scale exhibited acceptable inter-item correlations (r = 0.35). Table 2 presented the reliability coefficients.

Table 2: Reliability of Study Scales

Variables	Cronbach's α
Compassion Satisfaction	0.83
Burnout	0.75
Secondary Trauma Stress	0.82
Depression	0.95
Anxiety	0.70

Repeated measures ANOVA revealed significant improvements in key psychological outcomes following the intervention (Table 3).

Table 3: Repeated Measures ANOVA: Pre- and Post-Intervention Scores

Variables	F	p	ηp^2
Burnout	30.053	<0.001	0.276
Secondary Trauma Stress	23.390	<0.001	0.226
Depression	11.899	0.001	0.129
Anxiety	8.468	0.005	0.096

Figure 1 illustrated the mean scores for all subscales measured before and after the intervention.

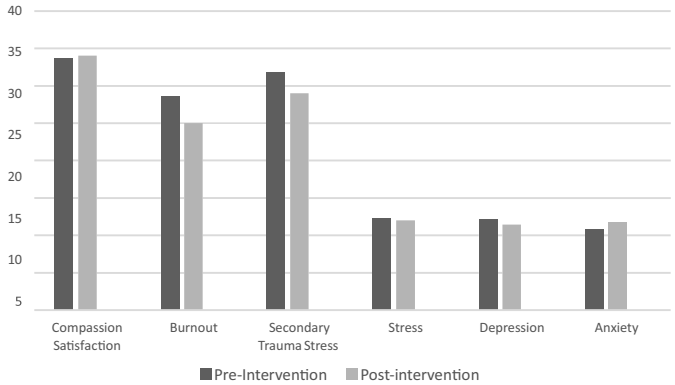

Figure 1: Pre-intervention and Post-Intervention Mean scores for all Subscales

The experimental group showed reduced Burnout ($F(1,80) = 30.053$, $p < 0.001$, $\eta p^2 = 0.276$). Depression ($F(1,80) = 11.899$, $p = 0.001$, $\eta p^2 = 0.129$), and Secondary Trauma Stress ($F(1,80) = 23.390$, $p < 0.001$, $\eta p^2 = 0.226$). There was a substantial decrease in anxiety as well ($F(1,80) = 8.468$, $p = 0.005$, $\eta p^2 = 0.096$). These improvements were sustained at the one-month follow-up (Table 4).

Table 4: Follow-Up Effects of the Intervention

Variables	F	p	ηp^2
Burnout	64.165	<0.001	0.772
Secondary Trauma Stress	61.415	<0.001	0.759
Depression	30.807	<0.001	0.612

Figure 2 illustrated the mean scores for all subscales at Pre-Intervention, Post-Intervention, and One-Month Follow-Up, highlighting sustained improvements in burnout, secondary trauma, depression, and resilience, with a transient increase in anxiety.

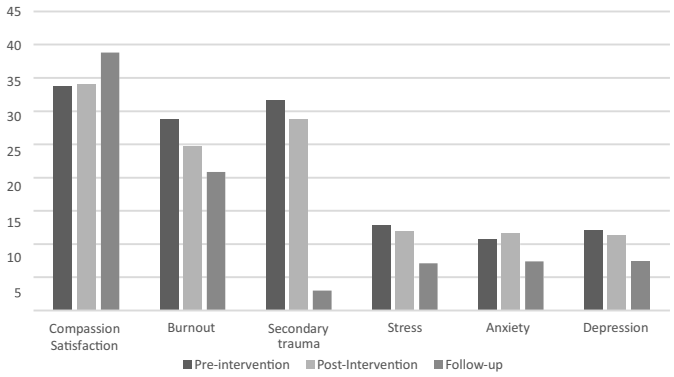

Figure 2: Pre-Intervention, Post-Intervention and One-Month Follow-Up Mean Scores For Subscales

The protective impact of resilience in reducing work-related stress was shown by correlation analysis, which showed that resilience was inversely correlated with burnout ($r = -0.222$, $p = 0.046$) and positively correlated with compassion satisfaction ($r = 0.244$, $p = 0.027$) (Table 5). With long-lasting effects at follow-up, the psycho-educative intervention dramatically enhanced healthcare professionals' psychological outcomes and professional quality of life. The results demonstrate how focused interventions can improve resilience and lessen stress at work (Table 5).

Table 5: Correlations between Resilience and Outcomes

Variables	Mean ± SD	p-Value
Compassion Satisfaction	0.244	0.027
Burnout	-0.222	0.046

DISCUSSION

In order to improve the nursing staff's compassion satisfaction and address secondary trauma and burnout, the research study sought to develop an intervention. In the end, each of these elements influences the nurses' professional quality of life while they are employed at various institutions. The study also focused on the psychological distress, namely stress, anxiety and depression. The research study was designed by dividing the participants into control group and experimental group. The intervention was based on psycho-education

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and a two hours seminar was created. Both the groups were tested before and after the intervention on three measures of professional quality of life, psychological distress and resilience. It is well researched that there is a higher prevalence of burnout in nurses while their levels of compassion satisfaction are lower, therefore making this an important area of research [15]. Given their exposure to traumatic experiences, as well as other individual characteristics, nursing staff is more susceptible to secondary trauma stress. Health care workers who experience secondary trauma stress and burnout may suffer grave consequences that include sadness, emotional distress, and even suicidal thoughts. These effects may affect a considerable section in the profession. The necessity to identify, assess, and manage burnout is a primary concern since health care personnel are constantly in danger [16]. The intervention that is studied in this research is based on psychoeducation, self-awareness and skills training. Exercises for managing stress and burnout at work were also included in the intervention. For the experimental group, the psycho-education seminar included pre- and post-testing and a one-month follow-up. The current study's hypothesis was that the psycho-educative intervention would enhance the nursing staff's professional quality of life and lessen psychological discomfort. The results suggest that the intervention doesn't have an effect on compassion satisfaction and stress while it significantly decreases burnout, secondary trauma stress, and depression. Another finding that was unexpected was that anxiety increased at the post assessment. The follow-up showed that the compassion satisfaction levels of the experimental group got significantly higher. Moreover, the seminar did not focus much on the concept of compassion satisfaction. This limitation is another reason for not getting a significant increase in the nurses' level of compassion satisfaction. Other factors that contribute towards the development of compassion satisfaction include personality differences among individuals as well as work environment [17]. Both these factors were not considered in the current research study, which could explain the results. In line with findings from other research showing the long-term advantages of psychoeducation for healthcare professionals, long-term results showed significant improvements in all assessed variables for the experimental group [18]. Additionally, resilience showed a negative correlation with burnout and a positive correlation with compassion fulfillment; however, no significant correlation was observed with secondary trauma stress, most likely as a result of the resilience measure's narrow scope. Comprehensive resilience assessment tools could provide more accurate insights [19]. Other than resilience training, addressing institutional factors such as long working hours and staffing shortages is essential for reducing work-related stress and psychological distress [20]. Sharing these findings with hospital management could help implement structural changes and support similar interventions to benefit healthcare professionals. The limitations of the current study included the inability to compare groups at the one-month follow-up since only the experimental group was assessed. Unmeasured factors may have influenced follow-up scores. Additionally, the resilience measure lacked comprehensive constructs, leading to inconsistencies with existing literature. Data collection was also prolonged due to limited resources and institutional support.

CONCLUSIONS

The research concludes that the interventions based on psycho-education, skills training, and self-awareness works well for the mental health issues in the healthcare sector. We also conclude that the psycho-educational seminars as a form of intervention are not only cost-effective for the institutions but also effective on reducing the psychological and mental health related issues. The healthcare departments can utilize this research as evidence for the operative use of psycho-educative interventions. The follow-up assessment results are evidence of the long-term effects of the intervention.

Authors Contribution

Conceptualization: ZK
Methodology: ZK
Formal analysis: ZK, ES
Writing, review and editing: ZK, ES

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

Conflicts of Interest

The authors declare no conflict of interest.

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REFERENCES

[1] Delaney MC. Caring for the caregivers: Evaluation of the effect of an eight-week pilot mindful self-compassion (MSC) training program on nurses' compassion fatigue and resilience. PLOS One. 2018 Nov; 13(11): e0207261. doi: 10.1371/journal.pone.0207261.

[2] Russo C, Aukhojee P, Tuttle BM, Johnson O, Davies M, Chopko BA et al. Compassion fatigue & burnout. InPower 2020 Jan: 97-115. doi: 10.1016/B978-0-12-817872-0.00007-0.

[3] Canu IG, Marca SC, Dell'Oro F, Balázs Á, Bergamaschi E, Besse C *et al*. Harmonized definition of

DOI: https://doi.org/10.54393/pbmj.v8i3.1167

occupational burnout: A systematic review, semantic analysis, and Delphi consensus in 29 countries. Scandinavian Journal of Work, Environment & Health. 2021 Mar; 47(2): 95-107. doi: 10.5271/sjweh.3935.

[4] Cross LA. Compassion fatigue in palliative care nursing: A concept analysis. Journal of Hospice & Palliative Nursing. 2019 Feb; 21(1): 21-8. doi: 10.1097/NJH.0000000000000477.

[5] Ortega-Campos E, Vargas-Román K, Velando-Soriano A, Suleiman-Martos N, Cañadas-de la Fuente GA, Albendín-García L *et al.* Compassion fatigue, compassion satisfaction, and burnout in oncology nurses: A systematic review and meta-analysis. Sustainability. 2019 Dec; 12(1): 72. doi: 10.3390/su12010072.

[6] Ogińska-Bulik N, Gurowiec PJ, Michalska P, Kędra E. Prevalence and predictors of secondary traumatic stress symptoms in health care professionals working with trauma victims: A cross-sectional study. PLOS One. 2021 Feb; 16(2): e0247596. doi: 10.1371/journal.pone.0247596.

[7] Ahmed T, Ali A, Rasheed A, Naz S. Compassion satisfaction, fatigue and burnout among nurses working in clinical departments at a tertiary care hospital in Karachi. Pakistan Journal of Physiology. 2019 Sep; 15(3): 19-22. doi: 10.69656/pjp.v15i3.1084.

[8] Labrague LJ. Psychological resilience, coping behaviours and social support among health care workers during the COVID-19 pandemic: A systematic review of quantitative studies. Journal of Nursing Management. 2021 Oct; 29(7): 1893-905. doi: 10.1111/jonm.13336.

[9] Alharbi J, Jackson D, Usher K. The potential for COVID-19 to contribute to compassion fatigue in critical care nurses. Journal of Clinical Nursing. 2020 May; 29(15-16): 2762. doi: 10.1111/jocn.15314.

[10] Xia W, Defang W, Xiaoli G, Jinrui C, Weidi W, Junya L *et al.* Compassion satisfaction and compassion fatigue in frontline nurses during the COVID-19 pandemic in Wuhan, China. Journal of Nursing Management. 2022 Oct; 30(7): 2537-48. doi: 10.1111/jonm.13777.

[11] Ekhtiari H, Rezapour T, Aupperle RL, Paulus MP. Neuroscience-informed psychoeducation for addiction medicine: A neurocognitive perspective. Progress in Brain Research. 2017 Jan; 235: 239-64. doi: 10.1016/bs.pbr.2017.08.013.

[12] Stamm B. The concise manual for the professional quality of life scale. 2010 Mar.

[13] Bailey AK, Sawyer AT, Robinson PS. A psychoeducational group intervention for nurses: Rationale, theoretical framework, and development. Journal of the American Psychiatric Nurses Association. 2023 May; 29(3): 232-40. doi: 10.1177/10783903211001116.

[14] Ruiz-Fernández MD, Pérez-García E, Ortega-Galán ÁM. Quality of life in nursing professionals: Burnout, fatigue, and compassion satisfaction. International Journal of Environmental Research and Public Health. 2020 Feb; 17(4): 1253. doi: 10.3390/ijerph17041253.

[15] Kelly L. Burnout, compassion fatigue, and secondary trauma in nurses: Recognizing the occupational phenomenon and personal consequences of caregiving. Critical Care Nursing Quarterly. 2020 Jan; 43(1): 73-80. doi: 10.1097/CNQ.0000000000000293.

[16] Milliard DB. The role of compassion satisfaction. InPower. 2020 Jan: 205-218. doi: 10.1016/B978-0-12-817872-0.00012-4.

[17] I El-Azzab S and T El-Nady M. Effectiveness of Psycho-Educational Program to Alleviate Depression, Anxiety, Stress, Pessimism and Provide Optimism for COVID-19 Isolation Nurses. Egyptian Journal of Health Care. 2021 Jun; 12(2): 965-80. doi: 10.21608/ejhc.2021.173651.

[18] Ratzon A, Farhi M, Ratzon N, Adini B. Resilience at work, burnout, secondary trauma, and compassion satisfaction of social workers amidst the COVID-19 pandemic. International Journal of Environmental Research and Public Health. 2022 May; 19(9): 5500. doi: 10.3390/ijerph19095500.

[19] Dall'Ora C, Ball J, Reinius M, Griffiths P. Burnout in nursing: a theoretical review. Human Resources for Health. 2020 Dec; 18: 1-7. doi: 10.1186/s12960-020-00469-9.

[20] Sirois FM, Owens J. Factors associated with psychological distress in health-care workers during an infectious disease outbreak: a rapid systematic review of the evidence. Frontiers in psychiatry. 2021 Jan; 11: 589545. doi: 10.3389/fpsyt.2020.589545.

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Association of Pelvic Floor Dysfunction with Conception Challenges Among PCOS Female

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ABSTRACT

Polycystic Ovary Syndrome (PCOS) is a common endocrine disorder in women, often linked to reproductive challenges and pelvic floor dysfunction. **Objective:** To find out the association of pelvic floor dysfunction and with conception challenges among females with Poly Cystic Ovary Syndrome. **Methods:** A cross sectional descriptive study was conducted; data were collected from Jinnah Hospital, Central Park Hospital, Suraya Azeem teaching hospital and from private clinics of Lahore. Data were collected after getting approval from University Research Ethical Committee from July to October 2024 with a Reference number RE-085-2024. Non probability purposive sampling technique was used. Pelvic floor dysfunction was confirmed through pelvic floor dysfunction inventedry-20 along with some self-made questions for descriptive statistics.192 married female were included in the study and data were analyzed through SPSS version 22.0 software. **Results:** Out of 192 respondents were of age group 21-30(68.2%).In distribution of BMI, 91 (47.4%) were overweight, 163 (84.9%) were trying to get pregnant, 170(88.5%) were facing difficulty in getting pregnant, 169(88%) of female faced miscarriages, 72(37.5%) females had 2 miscarriages, 78(40.6%) had 1 stillbirth, 83(43.2%) had 1 preterm birth, 154 (80.2%) were taking treatment of PCOS. 115(59.9%) had severe pelvic organ prolapse, 135(70.3%) had mild colorectal anal distress and 97(50.5%) had mild urinary distress. **Conclusions:** The study concluded that there is a high prevalence of severe pelvic floor dysfunction among PCOS females. Moreover, pelvic organ prolapse is significantly associated with miscarriages in women with PCOS.

INTRODUCTION

Polycystic Ovary Syndrome (PCOS) is very common health problem that is demonstrated as irregular periods, polycystic ovaries, and over production of androgens. Females with PCOS may experience a lot of issues like hirsutism, acne, mood swings, hair loss issues and other infertility issues [1]. Pelvic Floor Dysfunction (PFD) is a term that explains the impairment of muscles and connective tissues of the pelvic floor. The pelvic floor consists of group of muscles that act as a supportive sling to the pelvic organs, including the uterus, vagina, and in women, the bladder and rectum of particular interest, the influence of polycystic ovarian syndrome (PCOS) on PFD, this affects a significant portion of reproductive-aged women with prevalence rates of 5 to 15% [2]. Emerging research suggests that the hormonal disruptions may contribute to structural and functional changes in pelvic floor musculature [3]. Polycystic ovary syndrome is a syndrome that includes hormonal and reproductive problems. PCOS diagnosed females faces the problems like fertility, infertility and irregular feminine cycle [4]. PCOS diagnosed females faces the reproductive problems which causes higher rate of miscarriages, delays in conception, also minimizes the consequences of conception treatments. The literal meaning of infertility. According to American society of reproductive medicine practice committee is failure to conceive after 12 or more months of attempts of natural fertilization, it is also a major issue in the community [5]. The problems would include gestational diabetes, pre-eclampsia, fetal growth abnormalities and birth related issues like still births, preterm births and

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spontaneous abortions. The females with PCOS, faces a lot of pregnancy induced complications with higher risks of preterm births which increases fetal morbidity and mortality [6]. Approximately 50-70% women affected who has the symptoms of insulin resistance lead to other comorbidities High BP, sugar intolerance, dyslipidemia and diabetes [7]. Among infertile women negative emotions stress, anxiety is common. Infertility is associated with negative emotion and connected with poor quality of life [8]. Infertile women are more prone to mental illness, impaired quality of life and marital dissatisfaction [9]. Infertile women feelings and person quality of life profoundly affected by the lack of social support system [10]. Obesity related comorbidity directly affect the adipose tissue on sexual response. Infertile women lower satisfaction and sexual function as compare to fertile women due to many contributing factors like marital problem, intercourse time, and psychological burden of infertility [10]. Sexual dysfunctions are common among women with PCOS, with many experiencing reduced sexual desire, arousal issues, and painful intercourse [11].

Due to all these complications, there is a high need of care throughout the pregnancy and afterbirth as well [12].

METHODS

A cross-sectional descriptive study was carried out on married female with PCOS by students of DPT in University of Management and Technology for 4 months after getting approval from university Research Ethical Committee from July to October 2024 with Reference number RE-085-2024. Non probability purposive sampling technique was used to collect data and an informed consent was taken from each participant. Data were collected from Jinnah Memorial Hospital, Central Park Hospital, Surreya Azeem Teaching hospital and private clinics of Lahore. The sample size of 192 was calculated from RAO software with level of significance of 95% and expected margin of error of 5%. Married females with Age range (18 to 40 years) diagnosed with PCOS, were included whereas female with postmenopausal history or with any other endocrine disorder or who undergone Pelvic surgeries or with any other personality or Psychiatric disorder were excluded from the study. Those females who were not willing to participate were also excluded from the study. A structured questionnaire of pelvic floor dysfunction inventory-20 was used to confirm pelvic floor dysfunction along with self-made questions for demographics data and also included menstrual, medical and social history. Data were analyzed by software Statistical Packages of Social Sciences (SPSS) version 20.0 in the form of descriptive statistics including frequency tables, bar charts and bivariant chi square test was used to check association between variables pelvic organ prolapse with number of miscarriages. Data were kept confidential throughout the study.

RESULTS

Table 1 showed the demographics. According to the demographic data, majority of the participants were in between age range of 21-30 years (68.2%), BMI greater than 30 (52.1%) and marriage duration of 1-5 years (99%) were demonstrated.

Table 1: Demographic Characteristics of Study Participants

Variables	Frequency (%)
Age (Years)	
10-20	1 (0.5%)
21-30	131 (68.2%)
31-40	60 (31.3%)
BMI	
Underweight < 18.5	0 (0%)
Normal 18.6-24.9	1 (0.5%)
Overweight 25-29.9	91 (47.4%)
Obese >30	100 (52.1%)
Duration of Marriage (Years)	
1-5	99 (51.6%)
6-10	72 (37.5%)
11-15	16 (8.3%)
16-20	5 (2.6%)

Table 2 showed the medical history. According to the medical history, majority of the participants have gained weight, 79 (41.1%) 6-10kgs weight gained, 116 (60.4%) don't have hypertension, 183 (95.3%) don't have heart disease, 167 (87%) don't have thyroid issue, 168 (87.5%) don't have any surgery and 183 (95.3%) don't have gestational diabetes as demonstrated.

Table 2: Medical History of Study Participants

Variables	Frequency (%)
Experience Weight Gain	
No	31 (16.1%)
Yes	161 (83.9%)
Total Weight Gained (Kg)	
0	31 (16.1%)
1-5	46 (24%)
6-10	79 (41.1%)
11-15	23 (12%)
16-20	13 (6.8%)
Hypertension	
No	116 (60.4%)
Yes	76 (39.6%)
Heart Disease	
No	183 (95.3%)
Yes	9 (4.7%)
Thyroid Issue	
No	167 (87%)
Yes	25 (13%)
Surgeries	
No	168 (87.5%)

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Yes	24 (12.5%)
Gestational Diabetes	
No	183 (95.3%)
Yes	9 (4.7%)

Table 3 showed the fertility history. According to the fertility history, majority of the participants, 163 (84.9%) were trying to get pregnant, 170 (88.5%) are facing difficulty in getting pregnant, 169 (88%) had history of miscarriages, 72 (37.5%) had 2 miscarriages, 78 (40.6%) had 1 stillbirth, 83 (43.2%) had 2 preterm birth and 154 (80.2%) were taking PCOS treatment as demonstrated.

Table 3: Reproductive History of Study Participants

Variables	Frequency (%)
Trying To Get Pregnant	
No	29 (15.1%)
Yes	163 (84.9%)
Difficulty in Getting Pregnant	
No	22 (11.5%)
Yes	170 (88.5%)
Any Miscarriage	
No	23 (12%)
Yes	169 (88%)
Number of Miscarriages	
0	9 (4.7%)
1	34 (17.7%)
2	72 (37.5%)
3	42 (21.9%)
4	35 (18.2%)
Number of Stillbirths	
0	46 (24%)
1	78 (40.6%)
2	51 (26.6%)
3	15 (7.8%)
4	2 (1%)
Number of Preterm Births	
1	72 (37.5%)
2	83 (43.2%)
3	36 (18.8%)
4	1 (0.5%)
Taking PCOS Treatment	
No	38 (19.8%)
Yes	154 (80.2%)

Table 4 showed pelvic floor dysfunction. According to pelvic floor distress inventory, majority of the participants, 115 (59.9%) are facing severe pelvic organ prolapse, 135 (70.3%) with mild colorectal anal distress and 97(50.5%) with mild urinary distress as demonstrated.

Table 4: Prevalence of Pelvic Floor Dysfunction among Study Participants

Variables	Frequency (%)
Pelvic Organ Prolapse Distress inventory	
Mild	2 (1%)
Moderate	75 (39.1%)
Severe	115 (59.9%)
Colorectal Anal Distress Inventory	
Mild	135 (70.3%)
Moderate	51 (26.6%)
Severe	6 (3.1%)
Urinary Distress inventory	
Mild	97 (50.5%)
Moderate	66 (34.4%)
Severe	29 (15.1%)

Table 5 showed the Correlation test was applied between number of miscarriages and pelvic organ prolapse. The test indicates a positive correlation between pelvic organ prolapse and total number of miscarriages as P- value is less than 0.05.

Table 5: Correlation of Pelvic Organ Prolapse with Total Number Miscarriages

Total Number of Miscarriages	Pelvic Organ Prolapse			p-Value
	Mild	Moderate	Severe	
0	0	5	4	0.008
1	0	18	16	
2	0	26	46	
3	0	11	31	
4	2	15	18	
Total	2	75	115	

DISCUSSION

Pelvic Floor Dysfunction (PFD) presents a significant health challenge affecting women worldwide, particularly those grappling with Polycystic Ovary Syndrome (PCOS), a hormonal disorder commonly associated with infertility and other reproductive health issues [13]. This cross-sectional observational study was undertaken in Lahore, Pakistan, to investigate the prevalence of PFD among 192 married females aged 18 to 40 years who were clinically diagnosed with PCOS. No association of conception challenges was found with anorectal and urinary incontinence. The study by Taghavi *et al.*, provided insights into specific mechanisms linking PCOS and pelvic floor dysfunction, suggesting that hormonal disturbances and chronic inflammation may contribute synergistically to the development of PFD symptoms [14]. These findings complement these insights by demonstrating a notable burden of PFD symptoms among participants, reinforcing the clinical relevance of early detection and management strategies in this population [15]. The study by Antônio *et al.*, provided the results that there is no significance difference between case control groups in strength of

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pelvic floor muscles, in PCOS females [16]. Polycystic ovary syndrome (PCOS) is a complex endocrine disorder with systemic implications, including reproductive and metabolic challenges [17]. PCOS as an inflammatory and lifestyle-related endocrinopathy, affecting various physiological functions [18].The association between mental health and reproductive system disorders, emphasizing the psychological burden often experienced by women with PCOS. Furthermore, the impact of female reproductive disorders on sperm quality within the female genital tract, suggesting potential fertility complications [19].An in-depth analysis of the complications and challenges associated with PCOS, discussing its influence on conception and overall reproductive health.These studies collectively reinforce the significance of understanding the association between PCOS, pelvic floor dysfunction, and conception challenges, emphasizing the need for comprehensive clinical management [20]. The study is not generalized as it was only done in Lahore, due to limited time span.The study was done on married females only, but should also involve unmarried population for early detection and prevention of severity of the condition.

CONCLUSIONS

The study concluded that there is a high prevalence of pelvic floor dysfunction among PCOS females. Moreover, there is significant association of pelvic organ prolapse with miscarriages in female who are suffering from polycystic ovarian syndrome. Pelvic floor dysfunction in female can be minimized by educating female about strengthening exercises of pelvic floor muscle and so risk of miscarriages can be minimized.

Authors Contribution

Conceptualization: NF, MM
Methodology: AA, HT, SK, AR
Formal analysis: AR
Writing, review and editing: NF, MM

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

Conflicts of Interest

The authors declare no conflict of interest.

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REFERENCES

[1] Ajmal N, Khan SZ, Shaikh R. Polycystic ovary syndrome (PCOS) and genetic predisposition: A review article. European journal of obstetrics & gynecology and reproductive biology: X. 2019 Jul; 3: 100060. doi: 10.1016/j.eurox.2019.100060.

[2] Tim S and Mazur-Bialy AI. The most common functional disorders and factors affecting female pelvic floor.Life.2021Dec;11(12):1397.doi:10.3390/life11121397.

[3] Saei Ghare Naz M, Ramezani Tehrani F, Behroozi-Lak T, Mohammadzadeh F, Kholosi Badr F, Ozgoli G. Polycystic ovary syndrome and pelvic floor dysfunction:a narrative review.Research and Reports in Urology.2020May:179-85.doi:10.2147/RRU.S249611.

[4] Miao H, Yang H, Yin M, Wang Y, Fang Y, Yang M *et al.* Menstrual abnormalities effects on clinical features and in vitro fertilization pregnancy outcomes in women with polycystic ovarian syndrome. American Journal of Obstetrics and Gynecology Global Reports.2024May;4(2):100332.doi:10.1016/j.xagr.2024.100332.

[5] Silvestris E, De Pergola G, Rosania R, Loverro G. Obesity as disruptor of the female fertility. Reproductive Biology and Endocrinology.2018Dec; 16:1-3. doi: 10.1186/s12958-018-0336-z.

[6] Mirza FG, Tahlak MA, Rjeili RB, Hazari K, Ennab F, Hodgman C *et al.* Polycystic Ovarian Syndrome (PCOS): Does the Challenge End at Conception?. International Journal of Environmental Research and Public Health.2022Nov;19(22):14914.doi:10.3390/ijerph192214914.

[7] Li X, Cui T, Song X, Tian W, Lin Y, Zhang H. Comparison of health-related quality of life in different polycystic ovary syndrome phenotypes:A cross-sectional study. European Journal of Obstetrics & Gynecology and Reproductive Biology.2022Apr;271:189-94.doi:10.1016/j.ejogrb.2022.02.014.

[8] Bahadur A, Kumari S, Mundhra R, Khoiwal K, Das A, Heda A *et al.* Anxiety, Depression, and Quality of Life Among Infertile Women: A Case-Control Study. Cureus. 2024 Mar; 16(3). doi: 10.7759/cureus.55837.

[9] Qureshi N, Shah SM, Arzeen N, Arzeen S. Psychological Distress and Mental Well-Being Among Doctors Working In Major Teaching Hospitals Of Peshawar, Pakistan.Khyber Medical University Journal.2021Mar;13(1):40-2.doi:10.35845/kmuj.2021.20141.

[10] Pastoor H, Mousa A, Bolt H, Bramer W, Burgert TS, Dokras A *et al.* Sexual function in women with polycystic ovary syndrome: a systematic review and meta-analysis. Human reproduction update.2024 May; 30(3): 323-40. doi: 10.1093/humupd/dmad034.

[11] Loh HH, Yee A, Loh HS, Kanagasundram S, Francis B, Lim LL.Sexual dysfunction in polycystic ovary syndrome:a systematic review and meta-analysis. Hormones.2020 Sep;19:413-23.doi:10.1007/s42000-020-00210-0.

DOI: https://doi.org/10.54393/pbmj.v8i3.1202

[12] Ni Z, Mei S, You S, Lin Y, Cheng W, Zhou L *et al.* Adverse effects of polycystic ovarian syndrome on pregnancy outcomes in women with frozen-thawed embryo transfer: Propensity score-matched study. Frontiers in Endocrinology.2022Jun;13:878853.doi:10.3389/fendo.2022.878853.

[13] Hajam YA, Rather HA, Kumar R, Basheer M, Reshi MS. A review on critical appraisal and pathogenesis of polycystic ovarian syndrome.Endocrine and Metabolic Science.2024Jan:100162.doi:10.1016/j.endmts.2024.100162.

[14] Taghavi SA, Bazarganipour F, Allan H, Khashavi Z, Reisi N, Dosha N *et al.* Pelvic floor dysfunction and polycystic ovary syndrome. Human Fertility. 2017 Oct; 20(4): 262-7. doi: 10.1080/14647273.2017.1292003.

[15] Mashayekh-Amiri S, Asghari Jafarabadi M, Rashidi F, Mirghafourvand M. Translation and measurement properties of the pelvic floor distress inventory-short form (PFDI-20) in Iranian reproductive age women. BioMed Central Women's Health.2023Jun; 23(1): 333. doi: 10.1186/s12905-023-02493-y.

[16] Antônio FI, Bo K, Ferriani RA, de Sá MF, de Sá Rosa e Silva AC *et al.* Pelvic floor muscle strength and urinary incontinence in hyperandrogenic women with polycystic ovary syndrome.International Urogynecology Journal.2013Oct;24:1709-14.doi:10.1007/s00192-013-2095-x.

[17] Patel S. Polycystic ovary syndrome (PCOS), an inflammatory, systemic, lifestyle endocrinopathy. The Journal of steroid biochemistry and molecular biology.2018Sep;182:27-36.doi:10.1016/j.jsbmb.2018.04.008.

[18] Zaks N, Batuure A, Lin E, Rommel AS, Reichenberg A, Grice D *et al.* Association between mental health and reproductive system disorders in women:a systematic review and meta-analysis. JAMA network open.2023Apr;6(4):e238685.doi:10.1001/jamanetworkopen.2023.8685.

[19] Mahdavinezhad F, Gharaei R, Farmani AR, Hashemi F, Kouhestani M, Amidi F. The potential relationship between different human female reproductive disorders and sperm quality in female genital tract. Reproductive Sciences.2021Apr:1-6.doi:10.1007/s43032-021-00520-7.

[20] Palomba S, Santagni S, Falbo A, La Sala GB. Complications and challenges associated with polycystic ovary syndrome:current perspectives. International journal of women's health.2015Jul: 745-63.doi:10.2147/IJWH.S70314.

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The Bidirectional Link Between Mental Health Conditions and Functional Gastrointestinal Disorders Among Medical Students: A Cross-Sectional Study in KPK

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ABSTRACT

Functional gastrointestinal disorders are common among medical students worldwide, but little is known about how common they are in KPK, Pakistan. **Objective:** To find out how common FGIDs are among KPK medical students and investigate their connections to other mental health conditions. **Methods:** This cross-sectional study assessed the FGIDs and mental health of medical students in KPK, Pakistan, using the Rome IV criteria, GAD-7, and PHQ-9 scales. **Results:** The study found that 162 medical students (104 men and 58 females) with a median age of 18 (between 18 and 25) had an 11.7% FGID frequency (females 15.52% vs. males 9.62%), with GERD (12.3%) and IBS (27.5%) being the most common conditions, followed by FD (2.5%). Additionally, the IBS-FD, GERD-FD, GERD-IBS-FD, and GERD-FD overlapping distributions were 1.2%, 6.2%, 1.9%, and 1.2%, respectively. The prevalence of GAD and MDD were 17.9% and 22.2%, respectively. Multivariable logistic regression analysis revealed that the prevalence of GERD alone was significantly greater in MDD patients than in non-MDD patients ($p<0.01$). With p-values of 0.042 and 0.001, respectively, FD alone also showed a strong association with MDD and GAD. Additionally, a significant connection ($p = 0.024$) was seen between IBS and GAD. Participants with GAD showed the highest overlap between FD, IBS, and GAD ($p = 0.02$). **Conclusions:** FGIDs were rather common among the medical students in this study (11.7%). Furthermore, these results imply that MDD is linked to FGIDs and OS among Pakistani KPK medical students.

INTRODUCTION

Irritable Bowel Syndrome (IBS), non-organic bloating, non-organic constipation, functional diarrhea, and non-specified functional digestive illness are among the many conditions that fall within the broad category of functional gastrointestinal disorders. These disorders are the most common, affecting up to 40% of the broader population across the globe [1]. These disorders typically manifest as chronic symptoms, often exhibiting significant overlap across symptoms [2]. Recent research indicates that the progression of these disorders is associated with specific physiological processes like the gut-brain connection, protracted infections, inherited factors, gut flora, and antibiotic use [3, 4]. Since its establishment in 1992, Physicians worldwide have been evaluating FGIDs primarily using the Rome IV criteria [5, 6]. Like other nations, Pakistan is seeing a rise in concern regarding FGIDs; yet, the lack of information indicates that the problem is still being ignored. It is yet unknown how common all FGIDs are in Pakistan. Irritable Bowel Syndrome (IBS), the most common FGID in the country, has a 33.2% incidence rate, according to one study [7]. Stress, sleep disruptions, and an established family record of IBS are all strongly correlated with the identification of functional IBS in college students, with a frequency of 15.5% [8]. Female participants exhibited more intense manifestations; s, however, most of the males suffering from constipation

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used medications to alleviate the symptoms [9]. In a tertiary care facility, functional constipation affected around 37.5% of the children aged 2 to 14 [10]. There is little information available on the health of FGID patients in Pakistan. Furthermore, not enough research has been done on the impact of locally performed endoscopic examinations on mental health. According to one study, the prevalence of IBS is 14% higher in males than in women [11]. Studies have assessed how common IBS is among medical staff and students [12].

Since there were fewer research on FGIDs in Pakistan than in other Asian countries, a cross-sectional survey was designed to ascertain the prevalence of FGIDs in a Pakistani community.

METHODS

Medical and dental students from various medical colleges in KPK, Pakistan, were to participate in the study. The study was conducted over a three-month period from 1st November 2024 to 1st January, 2025. Data was collected from the representative sample using a standardized, structured, self-administered questionnaire. The inclusion criteria were all medical students (MBBS and BDS) aged over 18 from 1st year to final year, as well as those who were able to read and write in English. In addition, those students who were willing to participate in the study and completed the questionnaire without any missing data. The exclusion criteria were as follows: 1) students who failed to give informed consent; 2) students who did not complete the online survey or who provided inadequate responses; and 3) students with a history of any chronic gastrointestinal disorder. Through an internet platform, our study disseminated a standardized questionnaire to all medical students in the province. The questionnaire was designed to cover the following five components: (1) Demographic characteristics such as age, sex, and BMI. (2) lifestyle habits covering breakfast habits, intake of fruits and vegetables, consumption of junk food and carbonated drinks, academic time, non-academic activities, smoking habit; (3) sleep patterns including sleep schedule, total sleep length, personal evaluation of sleep quality (good/poor); (4) Rome IV criteria was used to determine different gastrointestinal concerns including reflux, heartburn, visceral pain, upper abdominal burning, meal-induced bloating, premature satiety, chronic gut discomfort linked to defecation patterns, the occurrence rate, and persistence of these symptoms, and questions related to the different symptoms of IBS were separately asked in the questionnaire. The questionnaire also inquired about the characteristics of bowel movements, such as alterations in bowel movements over the past year, infections that preceded these changes, and total bowel movements recorded on a weekly basis. The stool's consistency was assessed using the validated Bristol stool scale [13]. A family history of inflammatory bowel disease, unintended weight loss (≥ 6 kg) during the previous three months, and any chronic gastrointestinal bleeding were also inquired about; (5) mental health status was assessed using the English versions of the Generalized Anxiety Disorder Assessment (GAD-7) and Patient Health Questionnaire-9 (PHQ-9) [14–16]. The online form took an average of eight to ten minutes to complete. A convenient non-probability sampling method was used to gather data from the representative sample. The Rome IV criteria were used to diagnose students with common FGIDs, including as GERD, non-organic diarrhea, and IBS [17]. GERD was diagnosed based on the occurrence of usual heartburn and regurgitation two or more times per week, as recommended globally by the World Gastroenterology Organization [18]. In this study, generalized anxiety disorder (GAD) was diagnosed with a GAD-7 score of ≥10, while major depressive disorder (MDD) was identified with a PHQ-9 threshold of ≥10 [19, 20]. [20] As a diagnostic tool, the GAD-7 cutoff of ≥10 demonstrated an 89% true-positive rate and an 82% true-negative rate for diagnosing GAD. For the diagnosis of MDD, the PHQ-9 cutoff of ≥13 showed 68% sensitivity and 92% specificity [21, 32]. To calculate the sample size for this investigation, the OpenEpi calculator was utilized. An ideal prevalence (P) of 0.10 was selected based on a previous study by Tran et al., [23]. 141 participants was deemed to be an adequate sample size, with a 95% confidence level and a 0.05 margin of error (d). An Excel spreadsheet (Microsoft Office 2013) was used to organize the data, and IBM SPSS (software version 29) was used to analyze it. A chi-square test was employed as a descriptive test, and different variable numbers were allocated to perform different logistic regression and descriptive tests. Multiple logistic regression tests were used to evaluate the relationship between FGIDs, GADs, and MDD among medical students from various medical colleges.

RESULTS

Medical students from various colleges were given a comprehensive survey, to which 162 respondents responded. The group consisted of 58 women and 104 men, with a median age of 18 (ranging from 18 to 25). According to the PHQ-9 and GAD-7 measures, Table 1 indicates that 17.9% of the participants (n=29) had Generalized Anxiety Disorder (GAD) and 22.2% (n=36) had Major Depressive Disorder (MDD).

Table 1: Demographic Profile of the participants with FGIDs and those without FGIDs

Variables	Non-FGIDs (n=143) Frequency (%) / Median (Range)	FGIDs (n=19) Frequency (%) / Median (Range)	Total	p-Value
Gender				
Male	95 (66.4%)	9 (47.3%)	104	0.086

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Female	48 (33%)	10 (52.6%)	58	
Age	22 (18-25)	22 (18-25)	22 (18-25)	0.037
Breakfast Habit (Irregular)	53 (37%)	11 (57.8%)	-	0.06[a]
Academic Time	-	-	-	0.377[a]
Morning Till After Noon	70 (48%)	8 (42.8%)	78	-
Evening Till Late Night	73 (51%)	11 (57.8%)	84	-
Non-Academic Activities	79 (55.2%)	7 (36%)	76	-
Smoking	4 (2.79%)	1 (5.2%)	5	0.469[a]
Sleep After Midnight	136 (93%)	18 (99%)	155	0.034
Junk/Fast Food Once A Day	25 (17.4%)	11 (57.8%)	36	<0.001
Fruit/Salad >Once /Day	44 (30.7%)	2 (15.7%)	46	0.034
Non-Vegetarian >Once/Day	17 (11.8%)	12 (63.15%)	29	<0.001
Carbonated Drinks >Once/Day	23 (16%)	10 (52.6%)	33	0.004
Independent Living	17 (11.88%)	2 (10.5%)	19	0.610[a]
GAD-7	22 (15.38%)	7 (36.8%)	162	0.031[a]
PHQ-9	28 (19.5%)	8 (42.1%)	162	0.486 0.004[b]

Values: a=Fisher Exact Test b=Linear by Linear Association

Frequency of different Functional Gastrointestinal conditions (GERD, FD, and IBS) Among Medical Students across Various Colleges:

It was clear from the data analysis that GERD and FGIDs were common in the student body. Overall, we found that 12.3% of participants had GERD. The prevalence of IBS was reported to be 27.8%. The overlap in prevalence for GERD-FD, GERD-IBS, IBS-FD, and GERD-IBS-FD was 2.1%, 6.2%, 1.9%, and 1.2%, respectively, as table 2 further illustrates.

Table 2: Frequency of Different FGIDs among the Desired Sample

GIT Disorders	Prevalence (%)
GERD	12.3%
FD	2.5%
IBS	27.8%
GERD and FD	2.1%
GERD and IBS	6.2%
IBS and FD	1.9%
GERD\IBS\FD	1.2%

GERD: Gastrointestinal Reflux Disease; FD: Functional Dyspepsia; IBS: Irritable Bowel Syndrome.

The bidirectional link Between Mental Health Conditions and Gastrointestinal Disorders:

The frequency of gastrointestinal illnesses was compared across various psychiatric states in Table 3. Three groups of patients were formed based on the presence or absence of gastrointestinal problems: 2) individuals who only met the criteria for one of the gastrointestinal disorders mentioned above; 3) individuals who experienced overlapping conditions, signifying situations in which two or three different functional digestive disorders occurred at the same time; and 4) individuals who did not meet the criteria for FD, IBS, or GERD. GERD was much more common in those with MDD than in those without MDD ($p<0.01$). Similarly, FD alone showed a strong connection with both MDD and GAD, with p-values of 0.042 and 0.001, respectively. Additionally, a strong association between GAD and IBS was discovered ($p=0.024$). Among GAD subjects, the overlap of FD, IBS, and GAD was most commonly observed ($p=0.02$).

Table 3: Comparative Study of Different Gastrointestinal Disorders across Different Psychological Conditions

Variables	Non-GAD (n = 133) Frequency (%)	GAD (n = 29) Frequency (%)	p-Value*	Non-MDD (n = 126) Frequency (%)	MDD (n = 36) Frequency (%)	p-Value
Non-GERD/FD/IBS	117 (87.96%)	25 (96.15%)	0.794	125 (99.2%)	33 (91.66%)	0.07
GERD Alone	16 (12.03%)	4 (13.7%)	0.504	1 (0.7%)	3 (8.3%)	0.01
FD Alone	20 (15.03%)	9 (31%)	0.042	16 (12.6%)	13 (36.11%)	0.001
IBS Alone	32 (24%)	13 (44.8%)	0.024	31 (24.6%)	14 (36.5%)	0.09
Overlap GERD-FD	1 (0.7%)	3 (10.3%)	0.003	1 (0.7%)	3 (8.3%)	0.01
Overlap GERD-IBS	1 (0.7%)	3 (10.3%)	0.003	1 (0.7%)	3 (8.3%)	0.01
Overlap FD-IBS	11 (8.2%)	6 (20.6%)	0.048	8 (6%)	9 (25%)	0.001
Overlap GERD-FD-IBS	1 (0.70%)	2 (6%)	0.026	1 (0.7%)	2 (5%)	0.045

GERD: Gastrointestinal Reflux Disease; FD: Functional Dyspepsia; IBS: Irritable Bowel Syndrome; GAD: Generalized Anxiety Disorder; MDD: Major Depressive Disorder

Predictors of FGIDs among Medical Students: Insights from a Binary Logistic Regression Model:

The multivariable logistic regression analysis in Table 4 showed that medical students with Generalized Anxiety Disorder (GAD) and Major Depressive Disorder (MDD) had a significantly higher risk of developing Functional Gastrointestinal Disorders (FGIDs) ($p<0.05$).

Table 4: Results from Multivariable Logistic Regression Analysis for Students with FGIDs

Predictors	Multivariable		p-Value
	Adjusted Odd Ratio	95% CI	
Gender	0.705	0.223-2.227	0.103
BMI	3.191	0.453-10.592	0.021
Lack of Extracurricular Activities	0.483	0.152-1.529	0.131

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Sleep After Mid Night	0.891	0.891-0.273	0.013
Poor Sleep Quality	0.999	0.156-3.98	-
Junk/Fast Food Once /Day	2.9	2.13-6.7	0.034
Fruit/Salad Once/Day	0.37	0.14-1.1	0.75
Non-Vegetarian>Once /Day	6.9	3.23-9.13	0.002
Carbonated Drinks>Once/Day	1.5	0.15-2.45	0.083
GAD	0.335	0.506-7.373	0.022
MDD	0.308	1.91-7.04	0.026

OR: Odd Ratio; CI: Confidence Interval; GAD: Generalized Anxiety Disorder; MDD: Major Depressive Disorder.

Predictors of Overlap FGIDs among Medical Students: Insights from a Binary Logistic Regression Model:

Using a multivariable logistic regression model (binary logistic regression), overlapping gastrointestinal disorders (GERD, FD, and IBS) were found to be significantly associated with Generalized Anxiety Disorder (GAD) and Major Depressive Disorder (MDD, as measured by PHQ-9). In particular, the p-value for MDD was 0.04 and that of GAD was 0.02. As seen in table 5, other covariates did not exhibit significant relationships.

Table 5: Results from Multivariable Logistic Regression Analysis for Students with Overlap Gastrointestinal Disorders

Predictors	Multivariable		p-Value
	Adjusted Odd Ratio	95% CI	
Gender	2.684	0.15-48.127	0.928
Lack of Extracurricular Activities	0.325	0.20-9.247	0.489
Living Alone	3.179	0.67-20.7	0.240
Sleep After Mid Night	6.5	0.9-48.55	0.06
Poor Sleep Quality	2.1	0.1-3.5	0.3
Junk/Fast Food >Once/Day	3.6	2.23-5.5	0.037
Fruit /Salad >Once /Day	0.34	0.7-2.3	0.68
Non-vegetarian >once /day	5.9	3.34-8.76	<0.001
Carbonated Drinks >Once/Day	1.11	0.19-2.83	0.076
GAD	5.109	0.144-220	0.02
MDD	8.077	4.4-32.4	0.04

DISCUSSION

Based on Rome IV criteria, the study offers detailed information on the frequency of FGIDs among students at several medical schools in KPK, Pakistan. The impact of food habits, lifestyle decisions, and different mental health conditions on the prevalence of FGIDs was also discussed in the study. The overall frequency of FGIDs in this study was 11.7%, with the most common conditions being GERD (12.3%) and IBS (27.5%), followed by FD (2.5%). Numerous investigations conducted worldwide have found varying rates of FGIDs in the youth population. The prevalence of FGIDs was 40.3%, according to a global study that included online surveys in 33 countries [22]. The frequency of FGIDs in Asian youth has not been extensively studied. 10.3% of Vietnamese medical students had FGIDs, with 5.5% suffering from irritable bowel disease and 6.5% from functional dyspepsia, per a recent study [23]. Another study among Indian students revealed an overall prevalence of FGIDs of 26.9%, with FD (15.2%) and IBS (6.2%) being the most common, followed by FC (2.1%) [24]. This study showed a higher rate of FD, but a lower rate of IBS as compared this study. This variation in the prevalence of various FGID categories may be caused by environmental, genetic, cultural, and dietary variables. The Rome IV criteria has not adequately classified the overlapping FGID conditions, such as FD-IBS and GERD-FGIDs. Although these overlapping conditions are quite prevalent in the general population and appeared to be separate phenomena, this study found that the OS for GERD-FD was 1.2%, GERD-IBS was 6.2%, IBS-FD was 1.2%, and GERD-IBS-FD was 1.2%. GERD and FGIDs, with a prevalence of 3% among Vietnamese students, align with these results [23, 25]. Mental disorders, particularly depression and anxiety, are increasingly common among young adolescents [26]. A 2015 meta-analysis found that mental diseases are more common among children and teenagers. This study, which aggregated data from 27 countries, found that the pooled prevalence of any anxiety condition was 6.5% and the pooled prevalence of Major Depressive Disorder (MDD) was 1.3% [27]. Mental health risks rise significantly during the transition from adolescence to young adulthood compared to younger age groups [28]. In this study, the prevalence of generalized anxiety disorder (GAD) and MDD among medical students was 17.9% and 22.2%, respectively. 6.8% of newly enrolled medical students in Vietnam had GAD and 10.2% had MDD, according to a comparable study [29]. With a 12-month incidence of 18.5%, MDD was the most common disorder among newly enrolled college students, followed by GAD at 16.7%, according to data from the WHO World Mental Health International College Student Project, which polled students from 19 universities in Australia and other Western nations [29]. Nonetheless, Asian societies frequently have lower rates of these mental health conditions than do Western nations [30, 31]. This study's MDD prevalence was much higher than the overall Pakistani community's prevalence of 27.8% [32]. The elevated prevalence of MDD among medical students in the research may be attributed to factors such as academic stress and poor sleep quality [33]. Prior studies have generally recognized the link between various gastrointestinal disorders and mental health issues. The general population has lower rates of anxiety and depression than people with FGIDs, like FD and IBS, according to systematic reviews [34]. These studies, however, did not differentiate between individuals with FGIDs alone or those with overlapping symptoms, which may have compromised the true influence of mental health conditions on the presence of different gastrointestinal illnesses. Clearly, these

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findings demonstrated a substantial correlation between MDD and GERD alone, FD alone, and the overlap between GERD-FD and FD-IBS, but not with IBS alone. On the other hand, GAD was significantly associated with FD alone, IBS alone, and overlapping FGIDs. This study also illustrated a connection between FD-IBS and depression, which is consistent with a Korean study that used Rome IV criteria and discovered a greater prevalence of depression in FD-IBS overlap patients compared to those without overlap [35]. In this study, the occurrence of FGIDs tends to be more in females as compared to males (15.52% vs. 9.62%). Notably, sex -specific differences in FGID rates are not yet fully understood [36]. However, some research on FGIDs among students found that women were more likely than males to have these illnesses, especially IBS [37]. Furthermore, studies have revealed that compared to men, women with FD-IBS overlap experience more severe gastrointestinal symptoms and sadness [38]. Furthermore, FGIDs and the post-midnight sleep schedule were revealed to be significantly correlated by the study. According to earlier studies, FGID symptoms can arise and worsen as a result of circadian rhythm disturbances, irregular sleep patterns, inadequate sleep, eating late at night, being exposed to stressful situations late at night, and the influence of psychological factors on sleep disturbances [39]. These findings illustrated the need of enough sleep for gastrointestinal symptoms and health. This study also identified several dietary risk factors linked to the development of functional gastrointestinal disorders (FGIDs). Multivariate analysis revealed that a higher incidence of FGIDs was independently linked to eating junk food and a non-vegetarian diet more frequently each day. The correlation with FGID symptoms may be explained by the high protein content of a non-vegetarian diet, which may elicit an immune response [40]. The link between junk food and FGIDs may also be due to the fact that foods high in fat may change the motility of the intestines and saturated lipids may change the gut microbiota, making a person more likely to become overweight, which is strongly linked to FGIDs on its own. Human health is also negatively impacted by a diet low in fiber and heavy in salts, spices, and preservatives [41, 42]. Numerous studies have also connected fast food consumption to FGIDs [43, 44]. Also, regular consumption of fruits and vegetables has appeared to be protective against FGIDs [45]. However, the study lacks this association. Further studies regarding the intake of fruits and vegetables in relation to FGIDs are needed to ascertain this association. There are few limitations to this study. First, the diagnosis was made through clinical criteria. Structural abnormalities and other pathologies whose symptoms mimic FGIDs and GERD were not excluded through endoscopic investigations. Another constraint was that an unequal gender distribution (male 64% vs. female 36%) were experienced. Additionally, a self-reported questionnaire was used, there was a chance of underreporting or exaggerating disease-related data. This study only includes medical students, which does not reflect the true burden of FGIDs among KPK's local population. However, analysis of this study became important as students were included from all the medical colleges throughout the province. Future research with a larger sample size is necessary to allow for a more thorough examination of the connection between mental health conditions and FGIDs.

CONCLUSIONS

The current study investigated the prevalence of Functional Gastrointestinal Disorders (FGIDs) among medical students in Khyber Pakhtunkhwa (KPK), Pakistan, using the Rome IV criteria. The findings indicated that a noteworthy 11.7% of these pupils had FGIDs. Additionally, this research demonstrated an association between Major Depressive Disorder (MDD), FGIDs, and Occupational Stress (OS) among medical students in KPK, Pakistan.

Authors Contribution

Conceptualization: MS
Methodology: SAK
Formal analysis: EUH, MAK
Writing, review and editing: SK, HA, SI

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

Conflicts of Interest

The authors declare no conflict of interest.

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REFERENCES

[1] Black CJ, Drossman DA, Talley NJ, Ruddy J, and Ford AC. Functional gastrointestinal disorders: advancements in understanding and management. The Lancet. 2020; 396(10263): 1664-74. doi: 10.1016/S0140-6736(20)32115-2.

[2] Ghoshal UC, Singh R, Chang FY, Hou X, Wong BC, Kachintorn U. Facts and fiction: Epidemiology of uninvestigated and functional dyspepsia in Asia. Journal of Neurogastroenterology And Motility. 2011 Jul; 17(3): 235. doi: 10.5056/jnm.2011.17.3.235.

[3] Holtmann G., Shah A., and Morrison M. Pathophysiology of functional gastrointestinal disorders: a holistic overview. Digestive Diseases. 2018 Mar; 35(Suppl. 1): 5-13. doi: 10.1159/000485409.

[4] Paula H, Grover M, Halder SL, Locke III GR, Schleck CD, Zinsmeister AR *et al.* The study focuses on

DOI: https://doi.org/10.54393/pbmj.v8i3.1221

nonenteric infections, the use of antibiotics, and the likelihood of developing functional gastrointestinal disorders. Neurogastroenterology & Motility. 2015 Nov; 27(11): 1580-6. doi: 10.1111/nmo.12655.

[5] Lacy BE and Patel NK. Rome criteria, and a diagnostic approach to irritable bowel syndrome. Journal of clinical medicine. 2017 Oct; 6(11): 99. doi: 10.3390/jcm6110099.

[6] Aziz I, Törnblom H, Palsson OS, Whitehead WE, Simrén M. How the change in IBS criteria from Rome III to Rome IV impacts on clinical characteristics and key pathophysiological factors? Official journal of the American College of Gastroenterology ACG. 2018 Jul; 113(7): 1017-25. doi: 10.1038/s41395-018-0074-z.

[7] Bachani P, Kumar L, Kumar N, Fatima M, Naz S, Memon MK *et al*. Prevalence of irritable bowel syndrome and frequency of symptoms in the general population of Pakistan. Cureus. 2021 Jan; 13(1). doi: 10.7759/cureus.12541.

[8] Tauseef H, Siddque H, Akhtar M, Hurera A. Frequency of irritable bowel syndrome (IBS) and its risk factors among MBBS students of Allama Iqbal Medical College, Lahore. Pakistan Journal of Medicine Health Science. 2021; 15: 2062-7. doi: 10.53350/pjmhs211572062.

[9] Mawani M, Azeem A, Gheewala S, Butt N, Abid S. Understanding constipation: A cross-sectional study from a developing country setting. JCPSP: Journal of the College of Physicians and Surgeons—Pakistan. 2019; 29(3): 284. doi: 10.29271/jcpsp.2019.03.284.

[10] Muhammad S., Nawaz G., Jamil I, Rehman AU, Hussain I, and Akhter S. Pediatric patients with lower urinary tract symptoms often experience constipation. Journal of the College of Physicians and Surgeons Pakistan. 2015 Nov; 25(11): 815.

[11] Jafri W, Yakoob J, Jafri N, Islam M, Ali QM. Irritable bowel syndrome and health seeking behavior in different communities of Pakistan. Journal of Pakistan Medical Association. 2007; 57(6): 285.

[12] Naeem SS, Siddiqui EU, Kazi AN, Memon AA, Khan ST, and Ahmed B. Prevalence and factors associated with irritable bowel syndrome among medical students of Karachi, Pakistan: a cross-sectional study. Notes from BMC research. 2012 Dec; 5: 1-5. doi: 10.1186/1756-0500-5-255.

[13] Riegler G, Esposito I. The Bristol scale stool form remains a valuable tool in both medical practice and clinical research. Tech Coloproctol. 2001 Dec; 5: 163-4. doi: 10.1007/s101510100019.

[14] Hammer J, Eslick GD, Howell SC, Altiparmak E, Talley NJ. Diagnostic yield of alarm features in irritable bowel syndrome and functional dyspepsia. Gut. 2004 May; 53(5): 666-72. doi: 10.1136/gut.2003.021857.

[15] Ngoc TL, Le MA, Nguyen HT, Vo HV, Le NQ, Tang LN *et al*. Patient Health Questionnaire (PHQ-9): A depression screening tool for people with epilepsy in Vietnam. Epilepsy & Behavior. 2021 Dec; 125: 108446. doi: 10.1016/j.yebeh.2021.108446.

[16] Mughal AY, Stockton MA, Bui Q, Go V, Ha TV, Pence BW *et al*. Validation of screening tools for common mental health disorders in the methadone maintenance population in Hanoi, Vietnam. BMC psychiatry. 2021 Dec; 21: 1-9. doi: 10.1186/s12888-021-03493-8.

[17] Palsson OS, Whitehead WE, Van Tilburg MA, Chang L, Chey W, Crowell MD *et al*. Development and validation of the Rome IV diagnostic questionnaire for adults. Gastroenterology. 2016 May; 150(6): 1481-91. doi: 10.1053/j.gastro.2016.02.014.

[18] Hunt R, Armstrong D, Katelaris P, Afihene M, Bane A, Bhatia S *et al*. World gastroenterology organization global guidelines: GERD global perspective on gastroesophageal reflux disease. Journal of clinical gastroenterology. 2017 Jul; 51(6): 467-78. doi: 10.1097/MCG.0000000000000854.

[19] Garabiles MR, Lao CK, Yip P, Chan EW, Mordeno I, Hall BJ. Psychometric validation of PHQ-9 and GAD-7 in Filipino migrant domestic workers in Macao (SAR), China. Journal of personality assessment. 2020 Nov; 102(6): 833-44. doi: 10.1080/00223891.2019.1644343.

[20] Manea L, Gilbody S, McMillan D. Optimal cut-off score for diagnosing depression with the Patient Health Questionnaire (PHQ-9): a meta-analysis. C major. 2012 Feb; 184(3): E191-6. doi: 10.1503/cmaj.110829.

[21] Villarreal-Zegarra D, Barrera-Begazo J, Otazú-Alfaro S, Mayo-Puchoc N, Bazo-Alvarez JC, Huarcaya-Victoria J. Sensitivity and specificity of the Patient Health Questionnaire (PHQ-9, PHQ-8, PHQ-2) and General Anxiety Disorder scale (GAD-7, GAD-2) for depression and anxiety diagnosis: a cross-sectional study in a Peruvian hospital population. BMJ open. 2023 Sep; 13(9): e076193. doi: 10.1136/bmjopen-2023-076193.

[22] Sperber AD, Bangdiwala SI, Drossman DA, Ghoshal UC, Simren M, Tack J *et al*. Worldwide prevalence and burden of functional gastrointestinal disorders, results of Rome Foundation Global Study. Gastroenterology. 2021 Jan; 160(1): 99-114. doi: 10.1053/j.gastro.2020.04.014.

[23] Tran TTT, Luu MN, Tran LL, Nguyen D, Quach DT, Hiyama T. Vietnamese new-entry medical students exhibit a correlation between mental health conditions and functional gastrointestinal disorders. PLoS One. 2023 Jul; 18(7): e0289123. doi: 10.1371/journal.pone.0289123.

DOI: https://doi.org/10.54393/pbmj.v8i3.1221

[24] Goyal O., Nohria S., Dhaliwal AS, Goyal P., Soni RK, Chhina RS *et al.* The study examined the prevalence, overlap, and risk factors for Rome IV functional gastrointestinal disorders among college students in northern India. Indian Journal of Gastroenterology, April 2021, 40: 144-53. doi: 10.1007/s12664-020-01106-y.

[25] Kaji M, Fujiwara Y, Shiba M, Kohata Y, Yamagami H, Tanigawa T *et al.* Prevalence of overlaps between GERD, FD and IBS and impact on health-related quality of life. Journal of gastroenterology and hepatology. 2010 Jun; 25(6): 1151-6. doi: 10.1111/j.1440-1746.2010.06249.x.

[26] Centers for Disease Control and Prevention. Anxiety and depression in children: Get the facts. Atlanta, GA: CDC; 2022.

[27] Polanczyk GV, Salum GA, Sugaya LS, Caye A, Rohde LA. Annual research review: A meta-analysis of the worldwide prevalence of mental disorders in children and adolescents. Journal of child psychology and psychiatry. 2015 Mar; 56(3): 345-65. doi: 10.1111/jcpp.12381.

[28] Brice L, Zdanowicz N, de Becker E, de Timary P, and Lorant V. Adolescents in Transition to Young Adulthood: Evolution of Mental Health Status and Risk Factors Associated with Depressive and Anxiety Disorder. Psychiatria Danubina. 2019 Sep; 31(suppl 3): 371-5.

[29] Auerbach RP, Mortier P, Bruffaerts R, Alonso J, Benjet C, Cuijpers P *et al.* WHO world mental health surveys international college student project: Prevalence and distribution of mental disorders. Journal of abnormal psychology. 2018 Oct; 127(7): 623. doi: 10.1037/abn0000362.

[30] Kessler RC, Chiu WT, Demler O, Walters EE. Prevalence, severity, and comorbidity of 12-month DSM-IV disorders in the National Comorbidity Survey Replication. Archives of general psychiatry. 2005 Jun; 62(6): 617-27. doi: 10.1001/archpsyc.62.6.617.

[31] Lee S, Tsang A, Zhang MY, Huang YQ, He YL, Liu ZR *et al.* The study examined the lifetime prevalence and inter-cohort variation in DSM-IV disorders in metropolitan China. Psychological medicine. 2007 Jan; 37(1): 61-71. doi: 10.1017/S0033291706008993.

[32] Hira, Shahid., Muhammad, Hasan., Osama, Ejaz., Hashim, Raza, Khan., Muhammad, Usman, Idrees., Mishal, Ashraf *et al.* The Severity of Depression, Anxiety, and Stress: Recommendations from Joint Work of Research Center and Psychology Clinics in COVID-19 Pandemic. Frontiers in Psychiatry, (2022). doi: 10.3389/fpsyt.2022.839542. doi: 10.3389/fpsyt.2022.839542.

[33] Ruyue, Shao., He, Ping., Bin, Ling., Li, Tan., Lu, Xu., Yanhua, Hou *et al.* Prevalence of depression and anxiety and correlations between depression, anxiety, family functioning, social support and coping styles among Chinese medical students. BMC Psychology. 2020. doi: 10.1186/S40359-020-00402-8.

[34] Lee C, Doo E, Choi JM, Jang SH, Ryu HS, Lee JY *et al.* The increased level of depression and anxiety in irritable bowel syndrome patients compared with healthy controls: systematic review and meta-analysis. Journal of neurogastroenterology and motility. 2017 Jul; 23(3): 349. doi: 10.5056/jnm16220.

[35] Coss-Adame E, Rao SS. Brain and gut interactions in irritable bowel syndrome: new paradigms and new understandings. Current gastroenterology reports. 2014 Apr; 16: 1-8. doi: 10.1007/s11894-014-0379-z.

[36] Chang L, Toner BB, Fukudo S, Guthrie E, Locke GR, Norton NJ *et al.* Gender, age, society, culture, and the patient's perspective in the functional gastrointestinal disorders. Gastroenterology. 2006 Apr; 130(5): 1435-46. doi: 10.1053/j.gastro.2005.09.071.

[37] Tan YM, Goh KL, Muhidayah R, Ooi CL, and Salem O. Prevalence of irritable bowel syndrome in young adult Malaysians: a survey among medical students. Journal of gastroenterology and hepatology. 2003 Dec; 18(12): 1412-6. doi: 10.1046/j.1440-1746.2003.03212.x.

[38] Nam K, Kim N, Song HJ, Baik GH, Choi SC, Kim HJ et al. Gender difference in the overlap of irritable bowel syndrome and functional dyspepsia: a prospective nationwide multicenter study in Korea. Journal of Gastroenterology. 2021 Jun; 56: 537-46. doi: 10.1007/s00535-021-01775-2.

[39] Orr WC, Fass R, Sundaram SS, and Scheimann AO. The impact of sleep on gastrointestinal functioning in prevalent digestive disorders is a topic of discussion. The Lancet Gastroenterology & Hepatology. 2020 Jun; 5(6): 616-24. doi: 10.1016/S2468-1253(19)30412-1.

[40] Chey WD. The role of food in the functional gastrointestinal disorders: introduction to a manuscript series. Official journal of the American College of Gastroenterology| ACG. 2013 May; 108(5): 694-7. doi: 10.1038/ajg.2013.62.

[41] Cani PD, Everard A. Talking microbes: when gut bacteria interact with diet and host organs. Molecular nutrition and food research. 2016 Jan; 60(1): 58-66. doi: 10.1002/mnfr.201500406.

[42] Chouliaras G, Kondyli C, Bouzios I, Spyropoulos N, Chrousos GP, Roma-Giannikou E. Dietary habits and abdominal pain-related functional gastrointestinal disorders: a school-based, cross-sectional analysis

DOI: https://doi.org/10.54393/pbmj.v8i3.1221

of Greek children and adolescents. Journal of neurogastroenterology and motility. 2019 Jan; 25(1): 113. doi: 10.5056/jnm17113.

[43] Shau JP, Chen PH, Chan CF, Hsu YC, Wu TC, James FE I *et al.* Fast foods-are they a risk factor for functional gastrointestinal disorders? 2016: 393-401.

[44] Schnabel L, Buscail C, Sabate JM, Bouchoucha M, Kesse-Guyot E, Alles B *et al.* Association between ultra-processed food consumption and functional gastrointestinal disorders: results from the French NutriNet-Santé cohort. Official journal of the American College of Gastroenterology| ACG. 2018 Aug; 113(8): 1217-28. doi: 10.1038/s41395-018-0137-1.

[45] Tabibian SR, Hajhashemy Z, Shaabani P, Saneei P, Keshteli AH, Esmaillzadeh A *et al.* The association exists between the consumption of fruits and vegetables and functional dyspepsia in adults. Neurogastroenterology & Motility. 2021 Sep; 33(9): e14129. doi: 10.1111/nmo.14129.