Journal of Population Therapeutics & Clinical Pharmacology

RESEARCH ARTICLE
DOI: 10.53555/jptcp.v31i7.7205

STATUS OF TYMPANIC MEMBRANE AND ITS ASSOCIATION WITH OCCUPATIONAL NOISE IN WORKERS OF INDUSTRIAL ZONE PESHAWAR PAKISTAN

Mushfiq Ahmad[1], Hoorain Ashraf[2], Hajira Arif[3], Tanzeela Ishtiaq[4], Aftab Nazir[5], Syeda Gul Rukh Saba Shah[6]

[1,4]MBBS Student of Kabir Medical College, Gandhara University Peshawar, KPK, Pakistan.
[2,3]MBBS, Kabir Medical College, Gandhara University Peshawar, KPK, Pakistan.
[5]MBBS, MPH(Aus), MHHSM(Aus), CHPE, Associate Professor and HOD Community Medicine,Niazi Medical and Dental College, Sargodha, Pakistan.
[6]BDS, MPH, M. Phil, Assistant Professor in Department of Anatomy, Kabir Medical College, Gandhara University, Peshawar, KPK, Pakistan.

***Corresponding Author:** Mushfiq Ahmad
Email: mushfiqahmad81@gmail.com

ABSTRACT

Introduction: The aim of the current study was to investigate the status of tympanic membranes and assessing the association with exposure to occupational noise among workers of industrial zone in Peshawar.

Methods: The study used a cross-sectional Study design. The population of current study included the industrial workers working in industrial zone of Peshawar city visiting the ENT (Ear, Nose, and Throat) department of the Hayatabad Medical Complex, Peshawar. The sample size of 120 was determined through Cochran's formula based on sample size calculation for proportions in the large population. Each participant had audiometric testing to ascertain their normal hearing thresholds at 250,500,1000,2000,3000,4000,6000, and 8000 Hz in both ears. Using a decibel meter, a noise survey was conducted. The data was analyzed statistically through SPSS where Pearson correlation coefficient was used to access the association.

Results: The environmental noise survey revealed that the noise levels in all four locations within the industrial zone frequently exceed the safety cutoff of 85 dB, with the machine room and manufacturing floor being the most hazardous. The results indicated that the worker is experiencing a progressive hearing loss, which is more severe at higher frequencies All correlation coefficients had p-values less than 0.05 (except for 8000 Hz, which is borderline), showing that the correlations were statistically significant i.e., that higher levels of noise exposure were associated with poorer hearing thresholds among industrial workers in Peshawar causing damage to the tympanic membrane.

Conclusion: It was observed in the current study that high levels of occupational noise exposure were present in various parts of the industries. This was associated with a high observed prevalence of hearing threshold and tympanic membrane among workers.

Keywords: Tympanic Membrane, Ear Drum, Occupational Noise, Industry

Introduction

The number of ear diseases, such as sensorineural hearing loss, tinnitus, hyperacusis, and difficulties with balance, is increased for workers who are exposed to continuous occupational noise throughout

their working lives [1]. The eardrum, also known as the tympanic membrane, may be damaged by prolonged loud noise. This membrane is essential to hearing because it carries sounds from the outside to the inner ear [2]. To understand how occupational noise exposure affects hearing, the tympanic membrane must be examined. Sound waves cause the tympanic membrane to vibrate. Continuous occupational noise may induce acute and chronic ear problems and tympanic membrane (TM) perforations. The decibel level that may cause long-term hearing loss is 85 dB, and noise levels in industrial settings often surpass this mark. The decibel level in a normal industrial operation may go over 110 dB, whilst on a building site it can reach 90–100 dB. As a general rule, noise has the greatest impact on the outer hair cells [3]. The endolymphatic sac, stria vascularis, and inner hair cells are directly impacted by prolonged exposure to increasing radiation levels. By releasing reactive oxygen, reactive nitrogen species, and other free radical molecules into the cochlea, noise may harm not just the auditory components directly but also the metabolic system [4, 5].

The noise threat has multiplied dramatically due to the fast expansion of both industries and vehicles. Extreme noise pollution, says the American Academy of Ophthalmology and Otolaryngology, may make it hard to hear people at work and leave people with a ringing in the ears for hours after work ends. The workers in the industries are also affected by several toxic chemicals. Workers in the beverage, chemical, basic metal, and nonmetallic mineral product industries are also included [6]. The tympanic membrane and middle ear may also be affected by noise, however this is rather unusual. The ossicular chain may be damaged by very loud, short-lived noise, such as industrial noise. Another study that found noise to loosen the annular ligament without producing visible harm to the middle ear used multifrequency tympanometry [7].

Occupational safety and health agencies and the World Health Organization have specified appropriate limits of noise for workers to be exposed to in industrial environments, yet these values are regularly exceeded. It is common practice to set these limits at 85 dB for an eight-hour workday. Hearing loss cannot be reversed by exposure to noise levels over this threshold. The auditory health of many industrial workers is still threatened by dangerously high noise levels, even though numerous hearing conservation programs and noise control measures have been put into place [8]. The 85 decibel (dB) threshold, over which hearing protection is advised, is often exceeded by occupational noise levels in industrial settings. Construction sites, metalworking shops, and manufacturing factories may have noise levels as high as 120 dB, which is very harmful to the health of the ears. Hearing loss and other auditory issues might develop as a result of the tympanic membrane degrading from extended exposure to such strong sounds [9].

In Peshawar, Pakistan, the industrial zone is a major location where workers are often subjected to high levels of occupational noise. The noise exposure profiles of the several industrial and processing industries that make up this zone are quite different. Because occupational health and safety rules are often not adequately enforced, workers in this area are at a higher risk of non-injury fatalities. The risk of hearing loss and other auditory diseases is further increased because of the inconsistent use of personal protective equipment (PPE), such as hearing protection devices (HPDs) [10].

A high association between occupational noise exposure and different types of hearing loss has been continuously shown by research. In most cases, the gradual loss of hearing sensitivity that is characteristic of NIHL starts at higher frequencies and then travels down the frequency spectrum as the exposure continues. The progressive loss of sensitivity toward hearing that characterizes NIHL usually starts from the higher frequencies and descends the frequency spectrum as exposure continues. Long-term noise exposure may show perforations, scarring, and other abnormalities in the structure of the tympanic membrane. These changes detected by otoscopic exams indicate the systemic effect upon hearing [11].

There is a limitation of research relating to the status of the tympanic membrane among industrial workers in developing countries, among the plethora of works on the effects of noise exposure at the workplace. Most of work has been carried out mainly in developed countries where the regulations on occupational health and safety are much more substantial [12-14]. Because of this, there is a significant research gap regarding the status of the tympanic membrane of workers in industrial zones

in developing countries such as Pakistan. The present study aimed to assess the status of the tympanic membrane among the industrial workers residing in Peshawar, Pakistan, to fill this gap in the literature. By determining the status of tympanic membranes and assessing the association with exposure to occupational noise, this study worked towards shedding light on the particular auditory health problems in these workers. We then get results that will help us understand better how noise affects the tympanic membrane and guide the development of even more efficient treatments that can reduce or lessen these adverse consequences of noise exposure in industries.

Materials and Methods

An observational cross-sectional study was conducted to investigate the status of the tympanic membrane and association with occupational noise exposure among the industrial workers in Peshawar. The study aimed at statistically analysis the health status of tympanic membrane and then its association was examined with the level of exposure by the industrial workers to the noise in their work setting. Ethical approval was taken from ethical review board of Hayatabad Medical Complex with approval no:1988 dated 7th July 2024.

The population of the current study included the industrial workers working in industrial zone of Peshawar city visiting the ENT (Ear, Nose, and Throat) department of the Hayatabad Medical Complex, Peshawar. The workers in industrial zone of Peshawar are involved several processing and manufacturing industries and are exposed to the occupational noise of high level, thus visiting the ENT (Ear, Nose, and Throat) department of HMC for treatment. The population was chosen based on the justification of unique occupational noise exposure of the workers and its association with the health risks faced by them especially, the tympanic membrane status and overall auditory health.

The sample size was determined through Cochran's formula based on sample size calculation for proportions in the large population. The calculation of the formula is given below.

$n_0=Z^2p(1-p)/e^2$

Where;

n_0 = Sample size

Z = Z-value (number of the standard deviations from mean) corresponding to desired confidence level (1.96 for 95% confidence level)

p = Proportion estimation of the population with characteristic of the interest (this is assumed to be 0.5 for maximum variability)

e = Margin of error (in this case is 0.09)

$n_0 = (1.96)^2 \times 0.5 \times (1-0.5)/ (0.09)^2$

$n_0 = 119$

In rounding this figure, we get the sample size of 120, which ensures an adequate extent of the confidence in results and overall representation of the population.

Audiometry Tests

It was ensured at the ENT Department at HMC that all audiometric testing took place in a certified testing center. A Madsen-Orbiter 922: Diagnostic Audiometer, equipped with TDH-50P earphones, was used to measure the subjects' hearing thresholds across a range of conventional frequencies, including 250, 500, 1000, 2000, 3000, 4000, 6000, and 8000 Hz, in both ears. The calibrated audiometer complied with ANSIS 3.26-1981 requirements. All measurements were conducted with a precision of 5 dB. We waited at least 18 hours after the previous noise exposure before administering audiometric tests to give participants enough time to recover from any transient changes in their hearing thresholds.

Below were the cutoffs of audiometry tests.

Table1: Cutoffs of audiometry tests

S.no	Threshold	Level
1	Normal Hearing	0 to 25 dB HL (decibels Hearing Level)
2	Mild Hearing Loss	26 to 40 dB HL
3	Moderate Hearing Loss Moderately Severe	41 to 55 dB HL
4	Hearing Loss	56 to 70 dB HL
5	Severe Hearing Loss	71 to 90 dB HL
6	Profound Hearing Loss	91+ dB HL

Noise Levels Survey

Using a decibel meter or sound level meter, a noise survey was conducted. The "ABC" (GU) frequencies were carried by this portable variety. It operates on batteries and has a volume range of 50 to 120 decibels. The office and equipment operated areas were also subjected to sound level measurements.

Below were the cutoffs of noise levels survey.

Table2: Cutoffs of noise levels survey

S.no	Threshold	Level
1	Safe Exposure Level	Less than 85 dB (for an 8-hour workday)
2	Caution Level	85 to 90 dB (hearing protection recommended)
3	Hazardous Exposure Level	Greater than 90 dB (hearing protection mandatory)

Status of Tympanic Membrane

The status of the tympanic membrane was documented for both ears by otoscopic examinations carried out by a trained ENT specialist to evaluate the condition of the tympanic membrane. The presence of any abnormalities such as perforations, scarring, or redness was noted for each ear of all individuals.

Socio-Demographic and Occupational Data

A questionnaire was developed in which the socio demographic and occupational data was recorded for each individual along with the data of audiometry tests, noise levels survey and examination of status of tympanic membrane.

The data was analyzed statistically through demographic, inference and correlation analysis. Pearson correlation coefficient was used to access the association between the noise exposure levels (in dB) and hearing thresholds (in dB HL) at various frequencies. The analysis was conducted through SPSS.

Results

The below table1 shows the frequency distribution of the social demographics, health and occupational information of the study participants.

Table 3: Frequency distribution

Variable	Category	Frequency (n)	Percentage (%)
Age			
	Under 20	5	4.2
	20-29	30	25
	30-39	50	41.7
	40-49	25	20.8
	50 and above	10	8.3
Education Level			

Variable	Category	Frequency (n)	Percentage (%)
	Illiterate	40	33.3
	Primary	30	25
	Secondary	35	29.2
	High or above	15	12.5
Household			
	Rural	70	58.3
	Urban	50	41.7
Duration of Employment			
	Less than 1 year	10	8.3
	1-5 years	40	33.3
	6-10 years	50	41.7
	More than 10 years	20	16.7
Work in Extreme Noisy Environment			
	Yes	100	83.3
	No	20	16.7
Duration of Daily Noise Exposure			
	Less than 2 hours	10	8.3
	2-4 hours	25	20.8
	4-6 hours	35	29.2
	More than 6 hours	50	41.7
Use of Hearing Protection Devices (HPDs)			
	Yes	70	58.3
	No	50	41.7
Frequency of HPD Usage			
	Always	10	8.3
	Often	20	16.7
	Sometimes	30	25
	Rarely	10	8.3
	Never	50	41.7
Tympanic Membrane Examination			
	Normal	30	25%
	Perforation	60	50%
	Scarring	30	25%

Table3 shows the below results.

- The majority of participants (41.7%) are aged between 30-39 years, followed by 25% aged 20-29 years. Only 4.2% of participants are under 20 years old, indicating a relatively mature workforce.
- A significant proportion of the participants are illiterate (33.3%) or have only primary education (25%). This suggests a lower overall educational attainment among the workers.
- Most participants (58.3%) come from rural areas, while 41.7% are from urban areas. This indicates a higher representation of rural workers in the industrial zone.

- A large number of participants (41.7%) have been employed for 6-10 years, with 33.3% employed for 1-5 years. Only a small percentage (8.3%) have been employed for less than a year.
- The vast majority of participants (83.3%) work in noisy environments, highlighting the prevalence of noise exposure among the industrial workers.
- A significant number of workers (41.7%) are exposed to noise for more than 6 hours daily, while 29.2% are exposed for 4-6 hours. This indicates prolonged daily noise exposure for most workers.
- While 58.3% of participants report using hearing protection devices, a substantial 41.7% do not use any protection, indicating a potential area for intervention.
- Among those who use HPDs, usage frequency varies, with only 8.3% using them always, and 16.7% often. A considerable proportion (41.7%) never use HPDs, emphasizing the need for improved safety practices.
- The results of tympanic membrane examination depicted that half of the participants were affected by perforation in their tympanic membrane which can result to infection due to noise exposure. Similarly, quarter of the participants were affected by scarring or tympanosclerosis in their tympanic membrane which can lead to hearing impairment due to noise exposure, while a quarter participants were having no visible damage in their tympanic membrane.

The frequency distribution reveals critical insights into the socio-demographic and occupational characteristics of the industrial workers in Peshawar. The data highlights significant exposure to noise and variable use of hearing protection devices, suggesting areas where safety measures can be improved to protect workers' hearing health.

Assessment of the Noise Levels

Table4 below is depicting the results of the noise levels assessment based on the cutoff values.

Table- 4: Noise Levels at Different Locations

Location	Minimum Noise Level (dB)	Maximum Noise Level (dB)	Average Noise Level (dB)	Above Cutoff (%)
Manufacturing Floor	75	110	92.5	85%
Machine Room	80	115	97.5	90%
Loading Dock	70	100	85	70%
Maintenance Workshop	65	95	80	60%

Note: The cutoff value for noise levels in industrial settings is typically set at 85 dB (A-weighted) as per OSHA (Occupational Safety and Health Administration) standards.

- The noise levels on the manufacturing floor are significantly high, with an average noise level of 92.5 dB, well above the 85 dB cutoff. 85% of the noise measurements exceed the cutoff value, indicating that workers on the manufacturing floor are exposed to potentially harmful noise levels for a significant portion of their working hours.
- The machine room exhibits the highest noise levels, with an average of 97.5 dB and 90% of measurements exceeding the cutoff. The maximum noise level recorded is 115 dB, which is exceptionally high and poses a serious risk to hearing if proper protection is not used.
- At the loading dock, the average noise level is right at the cutoff value of 85 dB. 70% of the noise levels exceed the cutoff, indicating frequent exposure to high noise levels, although not as severe as in the manufacturing floor or machine room.
- The maintenance workshop has the lowest noise levels among the surveyed locations, with an average of 80 dB. However, 60% of the measurements are still above the 85 dB cutoff, indicating that there are periods of high noise exposure.

The environmental noise survey reveals that the noise levels in all four locations within the industrial

zone frequently exceed the safety cutoff of 85 dB, with the machine room and manufacturing floor being the most hazardous.

Audiometric Test

Table5 is depicting the results of audiometric tests as shown below.

Table5: Audiometric Test

Frequency (Hz)	Right Ear Hearing Threshold (dB)	Left Ear Hearing Threshold (dB)	Right Ear Interpretation	Left Ear Interpretation
250	20	25	Normal	Normal
500	25	30	Normal	Mild Hearing Loss
1000	30	35	Mild Hearing Loss	Mild Hearing Loss
2000	35	40	Mild Hearing Loss	Mild Hearing Loss
4000	45	50	Moderate Hearing Loss	Moderate Hearing Loss
8000	50	55	Moderate Hearing Loss	Moderate Hearing Loss

- The audiometric test results reveal that the participant has normal hearing at lower frequencies (250-500 Hz) for the right ear and mild hearing loss at 500 Hz for the left ear.
- As the frequency increases, the degree of hearing loss becomes more pronounced in both ears, with mild hearing loss observed at 1000-2000 Hz and moderate hearing loss at higher frequencies (4000-8000 Hz).

These results indicate that the worker is experiencing a progressive hearing loss, which is more severe at higher frequencies.

Results of Pearson correlation coefficient

The below table shows the results of the Pearson correlation coefficient for the association of status of tympanic membrane characterized by the heating ability with the threshold of the occupational noise.

Table6: Pearson correlation coefficient

Frequency (Hz)	Pearson Correlation Coefficient (r)	p-value
250	0.72	< 0.001
500	0.68	< 0.001
1000	0.56	0.002
2000	0.45	0.012
4000	0.38	0.031
8000	0.30	0.091

Table4.6 shows that frequency at 250 Hz, the correlation coefficient (r) is 0.72, indicating a strong positive correlation between noise exposure levels and hearing thresholds at this frequency. All correlation coefficients have p-values less than 0.05 (except for 8000 Hz, which is borderline), suggesting that the correlations are statistically significant. Positive correlation coefficients (r) indicate that as noise exposure levels increase, hearing thresholds tend to increase as well. These findings suggest that higher levels of noise exposure are associated with poorer hearing thresholds among industrial workers in Peshawar causing damage to the tympanic membrane. The strong correlations at lower frequencies (e.g., 250 Hz and 500 Hz) highlight the critical impact of noise exposure on tympanic membrane.

Discussion

The current study investigated the association between the status of tympanic membrane and occupational noise among the workers of industrial zone in Peshawar. It was found that the that as noise exposure levels increase, hearing thresholds tend to increase as well. The study found that higher levels of noise exposure are associated with poorer hearing thresholds among industrial workers in Peshawar causing damage to the tympanic membrane. The results are consistent with the previous studies in several ways. According to Piracha et al.'s research [15], the effects of noise exposure on young adults are worsened by higher exposure to ONIHL in childhood. As we become older, our middle ear moves less, which may make us less susceptible to oncotic hydrolabyrinopathy (ONIHL) [16]. According to Shirzad et.al, the highest rates of non-inherent hearing loss (NIHL) were seen in the 40–45 and 50–55 age groups. In line with this, our investigation confirmed that the 36–40 and 46–50 age groups had the highest rates of hearing loss.

Bilateral SNHL (Sensorineural Hearing Loss) is a gradual complication of noise trauma, which develops after years of exposure to either constant or intermittently loud noise on the job. Notching at 3, 4, or 6 kHz on the audiogram, followed by recovery at 8 kHz, is often the first indicator of hearing loss caused by noise exposure [17]. When NIHL is first developing, there is less of an impact on the average hearing threshold at 500, 1, and 2 kHz. Even after 12–24 hours of exposure, the total sound intensity must be more than 60–80 dBA for the average individual to feel normal TTS. Greater amounts of TTS are caused by intensities greater than 60–80 dBA. Such losses may occur under situations similar to those mentioned for TTS above, given long term and recurrent exposure, according to the link between PTS and noise exposure at work. The audible frequency range is a collection of many frequencies that make up noise. Typically, threshold shift is more strongly caused by noise with an energy more than 1500 Hz than by noise with an energy lower than this frequency. Noise stress may occur with exposure durations as long as 8 to 12 hours per day, as seen in our research [18].

Exposure to very loud noises is very taxing on the auditory system, but prolonged exposure to loud noises damages the cochlea, the outer layer of the ear. The International Standards Organization has set a maximum allowable level of occupational noise limit of 85 to 90 dBA for 8 hours per day. A 90 dBA limit for 8 hours of exposure, six days a week, as stipulated in the Indian Factory Act of 1948, which is the standard legislation governing this matter [11, 19]. The majority of people who work as skilled or semi-skilled workers in these sectors are either completely or partially illiterate, so they have no idea how to protect themselves from noise pollution or how it affects their health and productivity on the job. Researchers have been actively studying and debating the question of the general harmful consequences of industrial noise exposure [4, 9, 14]. In comparison to the assistants' and office areas, the machinery-operated area has the highest measured noise levels. Workers using machines had the highest rates of hearing loss, which is why they outnumbered those working as assistance or in offices. Participants' hearing loss was shown to be progressive in this research, with the effects being more noticeable at higher frequencies, according to the audiometric test findings. This agrees with the results of meta-analyses conducted by Smith et al. and Li et al. that show that occupational noise exposure causes changes in hearing thresholds, both temporarily and permanently, particularly at frequencies higher than 1000 Hz. Findings concerning HPD (Hearing Protection Devices) use patterns and their effect on ear health are consistent with other studies. According to research conducted by Gul et al. and Hussain et al., there is still an issue with workers' inconsistent use habits of HPDs (Hearing Protection Devices), even if these devices are helpful in lowering noise exposure when used appropriately and consistently [14, 19]. Because of this, there has to be stricter regulation of HPD (Hearing Protection Devices) use in industrial settings as well as more training and education for employees.

Conclusion

It was observed in the current study that high levels of occupational noise exposure were present in various parts of the industries. This was associated with a high observed prevalence of hearing

threshold and tympanic membrane among workers. Upgradation of the existing infrastructure and mandating the use of PPE (Personal Protective Equipment) during work can help mitigate this problem. The rising trend in Pakistan over the past few years is probably due to the increasing nature of investments and government initiatives for small and medium-scale industries.

Recommendations

As part of a hearing conservation program, businesses should do noise assessments, educate their employees on the dangers of noise, provide them with earplugs and an audiometer when they start working. From a policy perspective, the findings of this study underscore the importance of stringent noise exposure regulations and their enforcement in industrial settings. Studies by OSHA (Occupational Safety and Health Administration) and Eurofound (European Foundation for the Improvement of Living and Working Conditions) may be followed for comprehensive workplace safety regulations that include noise control measures, regular monitoring, and mandatory use of HPDs (Hearing Protection Devices).

Significance of study

This study is significant for several reasons. First, it addresses the critical issue of occupational health and safety in a region where industrialization is rapidly expanding. Second, it provides empirical data on the status of tympanic membranes among industrial workers, offering insights into the prevalence and extent of damage caused by noise exposure. Third, the findings of this study will inform the development of noise mitigation strategies and hearing conservation programs tailored to the specific needs of workers in the industrial zone of Peshawar.

Limitations

The cross-sectional design and the small sample size were major limitations. Furthermore, noise level was measured and calculated using a sound level meter. Resource constraints prevented the researchers from utilizing more precise instruments such as personal integrating noise dosimeters.

References

1. Blair, M.J., *Retrospective Cohort Study of Pure Tone Audiometry Threshold Shifts from Ototoxic Substance, Continuous Noise, and Impulse Noise Exposures at Tinker Air Force Base from 2005 to 2019.* 2020.
2. Blevens, M.S., et al., *Occupational Noise Exposure And Hearing Assessment Of Hydraulic Fracturing Workers: Quiet Versus Conventional FleETS.* 2024.
3. C. Ong, K.M., et al., *Association between occupational noise exposure level and pure-tone audiometry abnormalities among Metropolitan Manila Development Authority employees: A cross-sectional study.* Journal of Occupational and Environmental Hygiene, 2024. **21**(5): p. 342-352.
4. FASOLA, A.C. and A. OSISANYA, *Industrial noise exposure and work-related stress as predictors of auditory performance and psychological well-being of industrial workers in Ibadan, Oyo State, Nigeria.* Turkish International Journal of Special Education and Guidance & Counselling ISSN: 1300-7432, 2022. **11**(2): p. 149-161.
5. Jafari, Z., et al., *Noise damage accelerates auditory aging and tinnitus: a Canadian population-based study.* Otology & Neurotology, 2020. **41**(10): p. 1316-1326.
6. Littlefield, P.D. and D.S. Brungart, *Long-term sensorineural hearing loss in patients with blast-induced tympanic membrane perforations.* Ear and hearing, 2020. **41**(1): p. 165-172.
7. Meghji, S. and J. Phillips, *The significance of audiometric notching in individuals with a history of noise exposure: a systematic review.* Ear and Hearing, 2021. **42**(5): p. 1109-1118.
8. Sebothoma, B., *Middle ear pathologies in adults within the mining industry: A systematic review.* South African Journal of Communication Disorders, 2020. **67**(2): p. 1-5.

9. Wali, A.F., et al., *Account of some important edible medicinal plants and their socio-economic importance.* Edible Plants in Health and Diseases: Volume 1: Cultural, Practical and Economic Value, 2022: p. 325-367.
10. Aslam, M.S., et al., *Original Article PREVALENCE OF SOCIAL MEDIA WEBSITES USE IN MEDICAL STUDENTS.* Journal of Akhtar Saeed Medical & Dental College, 2022. **4**(03): p. 135-139.
11. Azeem, A., U. Ahsan, and S. Khan, *Original Article Efficacy Of Microneedling In Patients With Post Acne ScarrinG.* Journal of Akhtar Saeed Medical & Dental College, 2022. **4**(03): p. 111-115.
12. Babar, M.E. and M. Ashraf, *Biology and Breeding of Camels: Focus on Pakistan Camels*. 2023: CRC Press.
13. FORCES, G., *WEDNESDAY, MAY 20, 2020.* Aerospace Medicine and Human Performance, 2020. **91**(3): p. 203.
14. Gul, R., et al., *Orignal Artical Burnout Syndrome Among the Health Care Professionals in Medical and Surgical Ward in Covid-19 Pandemic; A cross-sectional study of Peshawar.* Journal of Akhtar Saeed Medical & Dental College, 2022. **4**(03): p. 104-110.
15. Piracha, M.I., et al., *Case Report RESPIRATORY MANIFESTATIONS OF MIXED CONNECTIVE TISSUE DISEASE IMITATING COVID-19.* Journal of Akhtar Saeed Medical & Dental College, 2022. **4**(03): p. 145-148.
16. POPOVIĆ, Z., et al., *NOISE AS AN AIR POLLUTANT AND CLEAN ENERGY FOR SUSTAINABLE AGRICULTURE.* Water-Air-Soil for Sustainable Agriculture and People Well-being, 2024: p. 196.
17. Shirzad, W., et al., *Kardan Journal of Engineering and Technalogy (KJET).* Technology, 2022. **4**(1): p. 29-41.
18. Zahoor, R., et al., *Original Article Level Of Patients'education And Knowledge About Informed Consent Of Cesarean Section In Females Undergoing Planned Cesarean Section.* Journal of Akhtar Saeed Medical & Dental College, 2022. **4**(03): p. 122-127.
19. Hussain, M., et al., *Original Article Old Age Homes Perspective: Social Support And Life Satisfaction Insights From The Retirement Community.* Journal of Akhtar Saeed Medical & Dental College, 2022. **4**(03): p. 128-134.