Role of Oxidative Stress in Migraine

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ABSTRACT

Introduction: Migraine is the most common neurological condition seen in primary care. Globally it affects 2% of population (out of which 1.5% are female and 0.5% are male). Migraine is type of a headache that is typically localized to one side of the head. Oxidative stress is a significant factor in the development of migraines. It occurs when there is an imbalance between the production of reactive oxygen species (ROS) and the body's antioxidant defense mechanisms, resulting in cellular damage. Reduced superoxide dismutase (SOD) activity in migraine patients suggests weakened antioxidant responses, while elevated malondialdehyde (MDA) levels indicate increased lipid peroxidation. Together, these changes highlight oxidative stress as a critical factor in migraine pathogenesis. This study is an attempt to contribute towards studies that are trying to establish exact cause for prevalence of migraine.

Objective: The objective of the study were to compare the biochemical parameters SOD & MDA.

Methodology: This was a case control study and ethical approval was taken from Bahria University Health Sciences Karachi (BUHSCK). Migraine patients between age 20-40 years were included in cases and healthy participants were included in controls. The calculated sample size of 246 subjects were divided into two groups, out which 123 were cases and 123 were controls. Venous blood sample was taken for measuring SOD & MDA. The obtained results were statistically analyzed by SPSS version 23. Descriptive statistics were presented in terms of frequency with percentages and mean with standard deviation and Median with Interquartile range (IQR). Independent sample t-test was used to compare the mean of baseline characteristics of controls and migraine patients. Mann Whitney U test was used to compare the median of skewed and not normally distributed parameters between two study groups. P-values less than 0.05 were considered statistically significant.

Result: The mean comparison of baseline characteristics between controls and migraine patients, in control group mean Age (years) was 33.6±4.7, mean BMI (kg/m2) was 27.7±5.1, mean SBP was 122.2±9, mean DBP was 81.8±4.4, mean Temperature was 98.1±0.2, whereas in migraine patients mean Age (years) was 33.2±4.6, mean BMI (kg/m2) was 28.4±4.8, mean SBP was 121.5±10, mean DBP was 81.9±4.7, mean Temperature was 98±0.1, Independent sample t-test showed significant mean difference in temperature between controls and migraine patients (p=0.027), all other characteristics were found statistically insignificant (p>0.05). The cast, gender and house environment among controls and migraine patients, in control group cast Balochi were (18.7%), Muhajir were (2.4%), Pathan were (19.5%), Punjabi were (37.4%), Sindhi were (11.4%), and Siraiki were (10.6%), for gender male were (19.5%), female were (80.5%), for house environment resident in house were (13%),bungalow were (5.7%), and apartment were (81.3%), whereas in migraine patients, Balochi were (17.1%), Muhajir were (5.7%), Pathan were (18.7%), Punjabi were (32.5%), Sindhi were (14.6%), Siraiki were (11.4%),male were (14.6%), female were (85.4%), resident in house were (8.1%),bungalow were (8.9%), and apartment were (82.9%). Pearson Chi Square test did not give any significant association of these cast, gender and house environment with migraine (p>0.05). The observed characteristics of migraine patients, in migraine triggers cases of Caffeine/ screen were (0.8%), Less sleep were (2.4%), Less sleep/screen were (17.1%), Physical activity were (0.8%), Physical activity/ less sleep were (35%), Physical activity/screen/ Less sleep were (17.9%),only Screen were (0.8%), and none were (25.2%), all were found with negative family history of migraine (100%), caffeine intake were (40.7%),

physically active were (74.8%),with co morbidity were (16.3%), self-medicated were (57.7%), all were uses medicines Inderal/ topiramate (100%), with Adequate fluid consumption were (100%), cases with Moderate intensity of migraine were (21.1%), cases with Severe intensity of migraine were (78.9%), in symptoms of headache Nausea were (31.7%), Nausea/photophobia/ phonophobia were (29%), Nausea/vomiting were (0.8%), Nausea/vomiting/photophobia/phonophobia were (0.8%), Phonophobia were (0.8%), Photophobia were (24.6%), Photophobia/phonophobia were (0.8%), and None were (2.4%), in characteristics of headache Unilateral were (46.3%),Unilateral/pulsating were (18.7%),Unilateral/pulsating/throbbing were (2.4%),Unilateral/throbbing were (16.3%), and Unilateral/throbbing/pulsating were (16.3%), mean sleep hours were reported 7.6 (SD=±1.5) per night and mean HIT-6 scale of migraine patients was 69.5 (SD=±9.9). The association of diet intakes with migraine, in control group Samples with milk intake Yes were (67.5%), Occasionally milk intake were (4.9%), fish intake Yes were (52.8%), Occasionally fish intake were (9.8%), and fuzzy drinks intake Yes were (42.3%), Occasionally fuzzy drink intake were (26.8%), whereas among migraine patients milk intake Yes were (65%), Occasionally milk intake were (0.8%), fish intake Yes were (62.6%),Occasionally fish intake were (7.3%), and fuzzy drinks intake Yes were (33.3%),Occasionally fuzzy drink intake were (32.5%), Pearson Chi Square test did not showed any significant association of milk, fish and fuzzy intake drink between controls and migraine ($p>0.05$). The comparison results of SOD and MDA between controls and migraine patients, showed in control group samples median for SOD (nm/ml) was 41(IQR=29), and median for MDA (U/mL) was 2(IQR=1), whereas in migraine patients median for SOD (nm/ml) was 10(IQR=4), and median for MDA (U/mL) was 4(IQR=1). Mann Whitney U test gave significant difference in SOD, and MDA between controls and migraine patients ($p<0.01$).

Conclusion: Our study concludes that migraine patients exhibit with reduced superoxide dismutase (SOD) levels and elevated malondialdehyde (MDA), indicating a role for oxidative stress in migraine pathogenesis. These novel insights will aid healthcare professionals in refining the management approaches, allowing for targeted treatments that address underlying oxidative stress in migraine patients.

Keywords: Migraine, BMI, MDA, SOD.

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REFERENCES

1. Gross, Elena C., *et al*. "Mitochondrial Function and Oxidative Stress Markers in Higher-Frequency Episodic Migraine." Scientific Reports, vol. 11, no. 1, Feb. 2021, p. 4543, https://doi.org/10.1038/s41598-021-84102-2.
2. Neri, Monica, *et al*. "A Meta-Analysis of Biomarkers Related to Oxidative Stress and Nitric Oxide Pathway in Migraine." Cephalalgia, vol. 35, no. 10, SAGE Publishing, Jan. 2015, pp. 931–37, https://doi.org/10.1177/0333102414564888.
3. Wang, Ying, *et al*. "Superoxide Dismutases: Dual Roles in Controlling ROS Damage and Regulating ROS Signaling." The Journal of Cell Biology, vol. 217, no. 6, Apr. 2018, pp. 1915–28, https://doi.org/10.1083/jcb.201708007.
4. Yigit, Mehmet, *et al*. "Oxidative/Antioxidative Status, Lymphocyte DNA Damage, and Urotensin-2 Receptor Level in Patients with Migraine Attacks." Neuropsychiatric Disease and Treatment, vol. Volume 14, Jan. 2018, pp. 367–74, https://doi.org/10.2147/ndt.s156710. Accessed 15 May 2020.