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Prevalence of Environmental-related Headaches

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ABSTRACT

Headaches can affect people of all ages, races, and socioeconomic backgrounds; however, women are more prone to suffer from them than men. According to the Global Burden of Disease (GBD) study, headache disorders are one of the most important geographical public health problems that affect all countries and global areas. Some headaches are debilitating and can lower a person's quality of life. With a 48.9% incidence rate in the general population, headache disorders are one of the most common nervous system diseases, with headache being their most prevalent symptom. A syndrome is an identifiable grouping of physical signs and symptoms that may have several etiological causes. Some diseases, such as migraine and 'cluster headaches', sick building syndrome (SBS), might be linked to the syndrome of environment-related headaches. In this article, we want to ascertain the incidence of headaches caused by the environment including various headache-causing factors. For Some occupations, headaches may create serious obstacles. Hence, when evaluating patients with headaches, occupational health specialists should take these factors into account. An essential factor in determining the efficacy of learning in the architecture studio is Indoor Environmental Quality (IEQ). Weather conditions have a significant impact on how comfortable indoor environments are. Over a variety of lag structures, there was a strong correlation between higher air pollution levels and migraine risk. Our contribution to this article is to study, thoroughly identify, and synthesise material in order to assess particular aspects that are observable events and relationships that are sets of occurrences and to present readers with a state of comprehension of the article.

Keywords: Cluster Headaches; Environmental-related Headaches; Headache; Migraine; Occupational Health.

1. INTRODUCTION

Headache is a nearly universal human experience and one of the most common symptoms seen in medicine and neurology [1,2]. People with migraines frequently mention environmental causes for their headaches, such as changes in barometric pressure, bright sunlight, flickering lights, air quality, and odours [3,4]. Numerous environmental elements might trigger migraines and other forms of headaches, which will be covered in more detail in this article. The Global Burden of Disease (GBD) research has identified headache problems as one of the major global public health concerns [1]. In 2019 edition of GBD showed migraine as the second leading cause of disability and the first among women under the age of 50 [5].

This study emphasises certain aspects of taking environmental headaches into account when creating a healthy learning environment. The article focuses on studying the many aspects that will emphasise the relevance and present situation of Environmental-related Headaches. High-altitude headaches and headaches caused by airline travel are two secondary disorders caused by atmospheric pressure. A migraine trigger is a situation that briefly enhances the likelihood of a migraine headache occurring, and many migraine sufferers attribute at least some of their migraine episodes to environmental conditions. Rarely do headaches occur when exposed to chilly surroundings. Although the exact mechanism is unknown, it has been hypothesised to be vascular, with acute cold exposure leading to fast vessel constriction and activation of vessel wall nociceptors. One of the less well-known uncommon headache syndromes is a headache due to external compression, which is thought to come from persistent activation of cutaneous nerves caused by pressure applied to the scalp or forehead. Lighting, temperature, relative humidity, and the presence of contaminants and gases are among the Indoor Environmental Parameters (IEPs) that make up Indoor Environmental Quality (IEQ). Another study that involved 92 VDT users who kept a log of their postural and visual symptoms over the course of five consecutive workdays discovered that screen readability had a substantial impact on ocular discomfort and that vertical head movement had an impact on headaches [6]. Even though headaches rarely indicate anything serious, they can occasionally be a sign of a significant neurological disorder. Headaches can infrequently develop during or after scuba diving.

The main objective of these recommendations is to enhance the quality of studies on headache prevalence and burden. We think that these guidelines will not only help with the planning and execution of new research but will also help with the review of already published studies.

2. CLINICAL TRAITS, RELATED CONCEPT AND ASSOCIATED CONDITIONS

2.1. Barometric pressure-related headache

These headaches are a consequence of barotrauma and/or variations in barometric pressure. This includes migraine-related headaches, headaches from flying, headaches from diving, and headaches from space travel. The force the atmosphere applies to an area per unit of time is known as barometric pressure. 1013 mb is the average barometric pressure. On sunny days, barometric pressure may be high, whereas, on windy days, it may be low.[7]

Changes in barometric pressure might be one of the aggravating reasons for migraine headaches. Many people attribute their migraines to weather fluctuations including rain. High barometric pressure and lower mean daily wind speeds were linked to an increase in headache occurrence, according to a prospective headache diary-based research by Zebenholzer et al. on 238 migraine patients with or without aura for 90 days. [8].

Effects of hypobaric hypoxia: According to another hypothesis, migraine and high-altitude headaches are actually caused by hypobaric hypoxia rather than low barometric pressure (HAH). Blood pressure, oxygen and carbon dioxide partial pressures, and blood pressure have an impact on cerebral blood flow. Ascent to high altitudes causes a steady drop in resting regional brain oxygen saturation, which causes vasodilation and an increase in cerebral blood flow [9].

Effects on the sympathetic nervous system: A rat model of neuropathic pain was studied by Sato who found that lowering atmospheric pressure (by 20 mmHg in 8 minutes in a climate-controlled room) decreased pain by sympathetic nervous system stimulation and release of adrenal medullary hormones, which results in vasoconstriction of peripheral vessels causing tissue ischemia, lower blood oxygen levels, and lower pH [10].

Effect on sinus pressure: Ascent or descent that results in a condition known as paranasal barotrauma. Barotrauma occurs when the cabin pressure drops quickly while flying, especially during ascent or descent, as a result of the paranasal sinus expanding. Cortisol levels rise in response to stress and fear, which makes it easier for triggers in the trigeminal nerve endings to be stimulated and induce pain [10].

2.2. Migraine and Weather

Numerous communities from all around the world have been investigated to better understand the connection between migraines and the weather. The two methods for determining migraine triggers are self-report and employing diary information. 38 migraine patients and 17 tension headache patients who met the International Headache Society (IHS) categorization criteria were asked about migraine triggers using a standard questionnaire [11].

The most prevalent weather-related symptoms, headache and migraine, were reported by 1064 German and 1506 Canadian participants in a cross-sectional study. Of the German participants, 19.2% thought that the weather had a "strong influence" on their health, and 35.2% thought that it had "some influence," according to the study [12]. The weather was rated as the leading headache trigger by 25% of people and as one of the top three triggers by 60% of people. About 30% of the individuals named rain, a dropping barometer, excessive humidity, strong sunshine, and low barometer reading as triggers; 25% mentioned a hot temperature [4]. Another research of six patients followed for five years revealed no relationship between their problems and the atmosphere's pressure, temperature, humidity, or ionisation levels [13]. However, because of the "biologically favourable" weather in July, headaches were less frequent. These results prompted a study in which 310 patients at the Princess Margaret Migraine Clinic in London who were seeking urgent care and who had migraines, tension headaches, or "migrainous neuralgia" were questioned about the date and time of their headache episode [14].

Migraine differs from tension-type headaches but not the other way around in terms of triggering and exacerbating causes. It's interesting to note that three of the migraine triggers (weather, scent, and smoke) are connected to the nose/sinus system, suggesting a greater role for this system in headaches than is typically thought.

2.3. Space-related headaches

Our research revealed that terrible headache frequently develops during space missions in people who do not have headache on Earth, despite the fact that headache in space is frequently not considered a serious worry.

The agony is frequently described by astronauts as "exploding" or "heavy." [15].

Hypoxia and consequently elevated intracranial pressure (ICP) can both be brought on by microgravity alone. The incidence of space headaches may be explained by certain haemodynamic alterations. During microgravity exposure, changes in cerebral blood flow and volume have been observed. The cephalad fluid shift, which happens when biological fluids are redistributed and blood volume in the upper body increases, is the most obvious change. The shift of fluids towards the brain causing cerebral oedema may result in an increase in intracranial pressure. Microgravity may be thought of as a possible cause of space headaches insofar as it is also known to cause hypoxia. Investigations using head-down-tilted bed rest (HDTBR) are used to simulate microgravity in space on Earth and enable countermeasure therapies including artificial gravity and training regimens meant to reverse microgravity-induced physiological changes [16].

During space journeys, headaches are a frequent but rarely reported ailment that is typically attributed to motion sickness in space (SMS). Space Motion Sickness (SMS) is a malady which commonly occurs shortly after attainment of sustained exposure to hypo-gravity. It is characterised by a variety of symptoms, which may proceed to nausea and eventually vomiting [17]. When moving from gravity on Earth to microgravity in space, motion sickness typically starts during the first few hours or days. The sensory conflict theory tells that the difference between the optic and vestibular systems is the reason behind the occurrence of headaches along with other symptoms of motion sickness [18]. High altitude, hypoxia, and hypercapnia headaches are linked to altered mental status, declining cognitive function, and irrational mood swings.

We conclude that a space headache is a common, lonely, and disabling condition during space travel. Among the secondary headaches associated with homeostatic disorders, they should be categorised as a separate entity.

2.4. Cold stimulus headaches

This includes headaches brought on by ingestion, inhalation, or the exterior application of a cold stimulus. The kinds of CSH that are triggered by various cold stimuli appear to differ. Ice water appears to produce pain sensations that are more frequent, more intense, and have a shorter latency than CSH brought on by ice cubes [19].

According to the current International Classification of Headache Diseases (ICHD-3), the term "headache due to intake or inhalation of cold stimuli" has replaced the term "ice-cream headache" (HICS). Vulnerable people feel a transient but severe frontal or temporal discomfort when a cold substance—solid, liquid, or gas—passes across the palate and/or posterior pharyngeal wall. A third of a randomly chosen population is reported to get ice cream headaches, which is a widespread complaint [20]. As cold is a triggering factor for migraine headaches, cold stimulus headaches are more common in a person who suffers from migraine. The length ranges from a few seconds to a few minutes, and they are often frontal and temporal stabbing in nature [21]. Migraineurs seem to experience more cold stimuli headaches. This can be a result of the cold causing migraine headaches. They can last anywhere between a few seconds and a few minutes, and they frequently have frontal and temporal stabbing characteristics [21]. Transcranial doppler ultrasonography has shown decreased mean cerebral blood flow velocities of the middle cerebral arteries in patients who experienced headaches after exposure to a cold stimulus, whereas no such reduction was observed in those who did not have a headache. The trigeminal-autonomic reflex is activated during lacrimal discharge during cold stimulation headaches [22]. A cold-stimulus headache might result in divers not wearing enough thermal protection.

2.5. External pressure headache

A rare form of cranial neuralgia known as external compression headache is brought on by repeated stimulation of the cutaneous nerves caused by pressure on the forehead or scalp. For instance, a headache could be brought on by wearing a tight band around the head, or sports goggles [23]. The majority of them are mild to moderate, non-pulsating headaches that largely affect the pressure point. It frequently grows over a few minutes and goes away within an hour of eliminating the trigger. If the pain-producing stimulus lasts longer in those who are vulnerable, the local discomfort may turn into more severe migraine headaches. Pressure on the cutaneous nerves of the head and forehead (perhaps including branches of the trigeminal or occipital nerves) causes this headache [24].

The COVID-19 pandemic has transformed how healthcare professionals provide treatment; in certain healthcare workers, the occurrence of "de novo" headaches is linked to the usage of filter masks and is more common; this has a higher impact on their employment, families, and personal and social lives [25].

2.6. Indoor Environment Quality (IEQ)

Inhabitants of artificially ventilated office buildings had a much higher frequency of symptoms associated with poor IEQ, according to studies conducted over the past three decades. The United States Environmental Protection Agency (EPA) [26] uses the term "sick building syndrome" (SBS) to characterise incidents in which building occupants encounter unexpected health issues that seem to be related to time spent in a structure, but no specific illness or cause can be established. Headache, exhaustion, confusion, irritation of the eyes, nose, throat, lower airways, and/or skin, as well as generalised hyperreactivity, are all symptoms of SBS. The EPA views inadequate IEQ as one of the most significant national environmental dangers given that Americans spend over 90% of their time indoors and that about 25% of US citizens are damaged by it at work or home.

In one of the few studies that examined the relationship between headache symptoms and IEQ, a small group of female office workers' headache intensity increased when the ambient temperature exceeded 73.4°F and the relative humidity was above 50% [27]. When a specifically engineered ventilation system fed outdoor air at 68°F to the residents, headache symptoms were seen to be less common and less severe., whereas mixed ventilation induced the worst symptoms. Some correlations between the symptoms of headaches, light-headedness, fatigue, and difficulty concentrating in people who live in homes with an unpleasant odour and high CO2 concentrations have been found in other investigations. Carbon monoxide levels in the room rise while the heater seems to be on while you sleep, which can affect young children and the elderly and cause chest pain in people with heart disease. Thus, naturally occurring carbon monoxide may be essential for the regulation of cerebral arterial tone and nociceptive processing, and carbon monoxide-induced headaches are similar to migraines and other types of headaches in many ways. In the office environment, fluorescent lighting and computer screen flicker are common complaints in office settings. Working at a computer produced headaches in 14.5% of chronic headache sufferers in one case-control study and made them worse in 31.3% of cases [28]. SBS symptoms can be related to poor ventilation, volatile organic compounds (VOC), dampness in buildings, and mould. For many years, indoor VOC levels have been observed and outside and inside VOC levels have been compared. Indoor concentrations for the majority of VOCs, but not all of them, are typically 2–5 times greater than outdoor concentrations, and for some compounds, the indoor/outdoor ratio (I/O ratio) is much higher. The school setting is an indoor one where children spend a significant amount of time each day. Studies on the connections between indoor VOC in schools and SBS or rhinitis in students are scarce. An early longitudinal study from elementary schools in central Sweden discovered connections between persistent SBS and the number of total VOCs present in the classrooms [29].

Strategy to raise occupant knowledge of health and Indoor Environment Quality (IEQ) in general, as well as health consequences such as headaches and migraines.

2.7. Visual stimulus in the external environment

The visual environment has a variety of known effects on humans. A poor visual environment with a high luminance ratio, irregular illuminance levels, and luminaire glare can produce headaches and migraine. Bright sunshine exposure is a frequent migraine cause. Less frequently, flickering lights like fluorescent lights, strobe lights, and varying light intensity when driving by trees are blamed. In a British study, questions about visual sensitivity were given to 1044 women, both with and without migraines [30]. More frequently than controls, women with migraines reported being sensitive to brightness, flicker, road stripes, colours, contrasting patterns, and fluorescent lights. Glare and bright illumination were cited as triggers in the paediatric population by 28.3% of children with migraine, 54.9% of subjects with tension-type headaches, and 38.8% of migraineurs [31]. Participants meeting IHS migraine criteria had their threshold tolerance to light stimulation compared to controls. Many other aspects of visual processing have been shown in an external environment such as Visual after-effects are illusions seen after prolonged viewing of visual displays, such as viewing motion in one direction (the motion after-effect, when the real motion stops, stationary patterns appear to move in the opposite direction) or oriented gratings (the tilt after-effect), when oriented gratings are replaced by vertical gratings, they appear tilted in the opposite direction. Visual after-effects are enhanced in migraine and are particularly enhanced for people with visual triggers [32].

According to the study, abnormal attentional processing may contribute to an increased brain response to common visual stimuli, which response is linked to headache, pain, and migraines. It also suggested that other neurological conditions that have symptoms similar to headache pain and visual sensitivity may be affected by this increased brain response.

2.8. Headache linked to hypoxia or hypercapnia

High-altitude headaches and headaches from acute mountain sickness are two examples of secondary headaches brought on by low oxygen pressure contributing to hypoxia. It is commonly accepted that hypoxia can cause secondary headaches, including those associated with high altitude, acute mountain sickness, or even air travel [33].

A headache that grows worse with elevation is the main symptom of AMS, which is frequently accompanied by other symptoms such as anorexia, nausea, dizziness, lethargy, disrupted sleep, or a permutation of all these symptoms. Headaches at high altitudes frequently have a pulsatile-burst nature. Altitude exposure is considered high for subjects at elevations ranging from 1500 to

3700 meters above sea level, very high at elevations ranging from 3700 to 5500 meters, and extreme above 5500 meters. Headaches are very common at heights over 4500 metres, especially during a steep ascent. People who have been pre-acclimatized have a lower risk [34].

Similarly, it has been shown that experienced mountaineers may have headaches without AMS symptoms. By boosting breathing, making more red blood cells to deliver oxygen, and raising the pressure in pulmonary capillaries, the body acclimates to higher elevations. The strenuous underwater effort, shallow or sporadic breathing, and intentional breath-holding could increase the risk of hypoxia and hypercapnia, which can cause headaches. Although occasionally the presence of arrhythmias may cause it, high-altitude syncope appears to be a vasovagal phenomenon connected to hypoxia. Primary headaches like migraine and cluster headaches (CH) may also be affected by hypoxia in significant ways [35]. Possible pathogenic mechanisms include blood-brain barrier leakage, cortical spreading depression, and hypoxia-induced nitric oxide and calcitonin gene-related peptide release.

2.9. Dive-Related Barotrauma and headaches

Scuba diving's rising popularity has opened up a new field for headache differential diagnosis. Even though headaches in divers are rare and typically not harmful, they can occasionally be a sign of serious side effects from hyperbaric treatment, such as arterial gas embolism, decompression sickness, and otic or paranasal sinus barotrauma [36].

Diving-related headaches are troubling and need to be thoroughly examined. Progressive, bilateral, throbbing headaches known as diving headaches can last for several hours. Decompression illness, arterial gas embolism, scuba tank carbon monoxide poisoning, and ruptured otic or sinus barotrauma have all been identified as sinister causes of headaches during diving. Decompression illness, external compression headache, or common headache diseases like migraine can also result in dive headache. All headaches experienced while diving should be examined by a medical professional to rule out any potentially fatal causes, such as carbon monoxide poisoning from defective equipment or decompression sickness from nitrogen gas exploding out of solution during a rapid ascent. A quick examination, oxygen therapy, and hyperbaric oxygen therapy are all necessary treatments for symptoms of disorientation, tachypnoea, myalgias, arthralgia, or hemodynamic instability.

Recreational and competitive water sports participation has surged over the past ten years, with swimming becoming the fourth most popular sport in the country according to the US Census Bureau [37]. Headaches are common in both the general population and the athletic community, despite the fact that particular aetiologies should be considered in the aquatic athlete.

2.10. Infectious/environmental-related headaches

Numerous well-known infections have been shown to cause headaches. In addition to causing a headache, acute bacterial or viral rhinosinusitis can also result in maxillary tooth pain, a poor response to decongestants, abnormal transillumination tests, and a history of purulent, coloured nasal discharge [38]. This contrasts with the irritating properties of chlorine, which can raise the prevalence of non-infective rhinosinusitis in swimmers. Leptospirosis or amoebic meningoencephalitis, which can cause severe headaches, neck stiffness, rash, fevers, abnormal mentation, and other systemic symptoms, are two additional infectious causes to take into account. Other environmental factors are less frequent, such as headaches brought on by cold water immersion and marine life (e.g., stings from jellyfish) [39].

3. THE FOLLOWING CONDITIONS CAN BE ASSOCIATED WITH THE SYNDROME OF ENVIRONMENT-RELATED HEADACHES

- Migraine
- Headaches with cranial autonomic symptoms
- Sick-building syndrome
- Cluster headache
- Altitude mountain sickness
- Idiopathic intracranial hypertension
- Cervical artery dissection
- Space Motion Sickness

4. CONCLUSION

The most frequent environmental variables that can affect headache disorders include external compression, which is especially prevalent in women who wear hair ties very firmly since it puts local pressure on the headache and can produce such headaches. The pressure within the sinus cavities and the chambers and structures of the inner ear might become unbalanced as a result of changes in air pressure, which can result in headaches. Temperature changes are also considered to cause chemical and electrical changes in the brain. Another common worry is cold stimulus headache, which can be caused, for example, by breathing or ingesting cold food and result in brain freezing. As you ascend to greater altitudes, the air pressure drops and the Carbon dioxide level rises, which can cause acute high-altitude headaches. Migraines and sick-building syndrome have both been linked to the altered interior environmental quality caused by artificial heating (CO from heaters) and ventilation and air-conditioning (HVAC) systems. Headaches that are brought on by flying are also linked to variations in atmospheric pressure and barometric pressure, which can lead to a specific trauma known as barotrauma that is seen in deep-sea divers as a result of diving headaches and astronauts as a result of space headaches. Cluster headaches are brought on by the surroundings and manifest as brief, one-sided headaches. Due to changes in the environment, two circumstances are linked to increased pressure in the brain: Idiopathic intracranial hypertension is a disorder marked by an increase in brain pressure that must not be ignored since it can lead to blindness in certain people. Another issue is the dissection of artery condition, which occurs when a blood vessel supplying the brain suddenly has a split in its wall, allowing blood to enter and possibly cause a stroke. These environmental elements that cause headaches are a result that carry a heavy weight on a worldwide scale, our understanding in the relevance of these indicators and the scope of their implications is crucial in mitigating the impact of environmental factors on headaches. By taking proactive measures, individuals, communities, and policymakers can effectively address this issue. This involves implementing pollution control measures, promoting healthier indoor environments, enhancing urban planning, and raising awareness about the impact of environmental factors on headache disorders.

5. SCOPE

These suggestions are primarily intended to raise the standard of environmental headache studies. We also think that these suggestions will help with not just the design and execution of fresh studies but also the assessment of previously published studies. In cases when it is appropriate, emphasis is called on other factors that are particular to studies of the elderly. The occurrence of primary headache disorders, including migraine and headaches, and the burden caused by them are mainly addressed by these recommendations.

Although stresses brought on by secondary headaches are typically better linked to the underlying diseases, they are not meant to be unique to them. Other headaches that happen every day or month are also covered in the text because they undoubtedly worsen the general state of health. This article should be useful and authoritative for most Environmental-related headache reasons. By doing so, it enables to take anticipatory measures and enforce these factors and augment by creating a healthier and safer environment for all.

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7. CONFLICT OF INTEREST

The authors have declared that there is no conflict of interest.

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NA

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