“Association Between Headache and Body Mass Index: A Cross-Sectional Study”

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UNDERTAKING

PLAGIARISM CERTIFICATE

ETHICAL CLEARANCE CERTIFICATE

List of Abbreviations

Abbreviation	Full Form
BMI	Body Mass Index
WHO	World Health Organization
TTH	Tension-Type Headache
VAS	Visual Analogue Scale
SD	Standard Deviation
DAL	Daily Activity Limitation
TACs	Trigeminal Autonomic Cephalalgias
SSLC	Secondary School Leaving Certificate
PUC	Pre-University Course
χ^2	Chi-Square Test
CNS	Central Nervous System
QOL	Quality of Life
MOH	Medication Overuse Headache
H/A	Headache (commonly used shorthand in clinical notes)
MIG	Migraine
ICHD	International Classification of Headache Disorders
Hz	Hertz (used in context of pulsating/throbbing headache)
OPD	Outpatient Department
CI	Confidence Interval
SE	Standard Error
RCT	Randomized Controlled Trial (referred in literature comparisons)

ABSTRACT

Background: Headache is one of the most common neurological complaints, significantly impacting quality of life. Emerging evidence suggests a possible link between body mass index (BMI) and the frequency and severity of primary headache disorders, especially migraine and tension-type headaches (TTH).

Objective: [redacted]

Methods: [redacted]

Results: [redacted]

Conclusion: [redacted]

[redacted]

Keywords: Headache, Body Mass Index, Migraine, Tension-Type Headache, Obesity, Cross-Sectional Study, Risk Factors

TABLE OF CONTENTS

SL. NO.	TOPIC	Page No
1	INTRODUCTION	
2	AIMS AND OBJECTIVES	
3	REVIEW OF LITERATURE	
4	MATERIALS AND METHODS	
5	RESULTS	
6	DISCUSSION	
7	CONCLUSION	
8	SUMMARY	
9	BIBLIOGRAPHY	
11	ANNEXURE I – CONSENT FORM	
12	ANNEXURE II – PROFORMA	
13	ANNEXURE III – MASTER CHART	

LIST OF TABLES

Table No	Description	Page No
1	ICHD-3 Classification of Headache Disorders	
2	Body Mass Index (BMI) Classification – WHO vs. Asia-Pacific Standards and Associated Health Risks	
3	Timeline and Percentage Allocation of Research Activities	
4	Distribution of patients by gender	
5	Distribution of patients by Economic background	
6	Distribution of patients by Education	
7	Distribution of patients by Location	
8	Distribution of patients by Type of pain	
9	Distribution of patients by Diurnal variation	
10	Distribution of patients by Visual analysis scale	
11	Distribution of patients by Migraine	
12	Distribution of patients by Tension Headache	
13	Distribution of patients by Other primary headaches	
14	Association between Migraine and BMI level	
15	Association between Tension Headache and BMI level	
16	Association between Other primary headaches and BMI level	

LIST OF GRAPHS

Graph No	Description	Page No
1	Distribution of patients by gender	
2	Distribution of patients by Economic background	
3	Distribution of patients by Education	
4	Distribution of patients by Location	
5	Distribution of patients by Type of pain	
6	Distribution of patients by Diurnal variation	
7	Distribution of patients by Visual analysis scale	
8	Distribution of patients by Migraine	
9	Distribution of patients by Tension Headache	
10	Distribution of patients by Other primary headaches	
11	Association between Migraine and BMI level	
12	Association between Tension Headache and BMI level	
13	Association between Other primary headaches and BMI level	

LIST OF FIGURES

Graph No	Description	Page No
1	Types of Headache and Their Typical Pain Locations	
2	Obesity – Effects on the Body	
3	Body Mass Index (BMI) Classification – Visual Representation	
4	Pathophysiological Mechanisms Linking Obesity to Insulin Resistance	
5	Interrelationship Between Obesity, Migraine, and Diabetes – Shared Risk Factors and Biomarkers	

INTRODUCTION

Headache ranks among the most frequently reported neurological complaints worldwide, affecting people of all ages, genders, and socioeconomic backgrounds. [redacted]

[redacted]Additionally, obesity has been associated with a higher frequency of chronic daily headaches and may reduce the responsiveness to conventional headache treatments.[redacted]

[redacted]A better understanding of this relationship is essential for improving early diagnosis, guiding effective treatment, and designing preventive interventions that address modifiable risk factors like obesity.[redacted]

Global Prevalence of Headache Disorders

Headache disorders are among the most widespread and disabling neurological conditions experienced by populations worldwide.

The burden is especially heavy among individuals aged 15 to 49 years, an age group critical to economic productivity and social participation.

These conditions are increasingly reported in both developed and developing countries, reflecting changing lifestyle patterns, increased stress, and possibly the overuse of analgesics.

Moreover, addressing the burden of headaches globally is essential not only to improve individual patient outcomes but also to enhance societal productivity and reduce the overall economic impact associated with these disabling conditions.[13]

Prevalence of Headache in India

In the Indian context, headache disorders represent a major public health issue, often underrecognized despite their high occurrence.

Furthermore, many people rely on over-the-counter analgesics, which increases the risk of medication-overuse headaches—a growing concern in India.

Nevertheless, there is limited data correlating BMI and headache characteristics within Indian cohorts, which highlights the need for region-specific research to guide effective clinical and public health interventions.[16]

AIMS AND OBJECTIVE

Aim:

[redacted]

Objective of the study:

[redacted]

REVIEW OF LITERATURE

'Epidemiology of Headache'

Headache is a highly prevalent neurological symptom with substantial global and regional health implications. [redacted] The lifetime prevalence of headache in adults has been reported to be more than 90% in some surveys, with women being more frequently affected than men due to hormonal, genetic, and psychosocial influences.[34]

[redacted]

Despite the high prevalence, headaches often go underreported and undertreated, especially in rural settings, due to a lack of awareness and limited access to specialist care.

‘Classification of Headache’

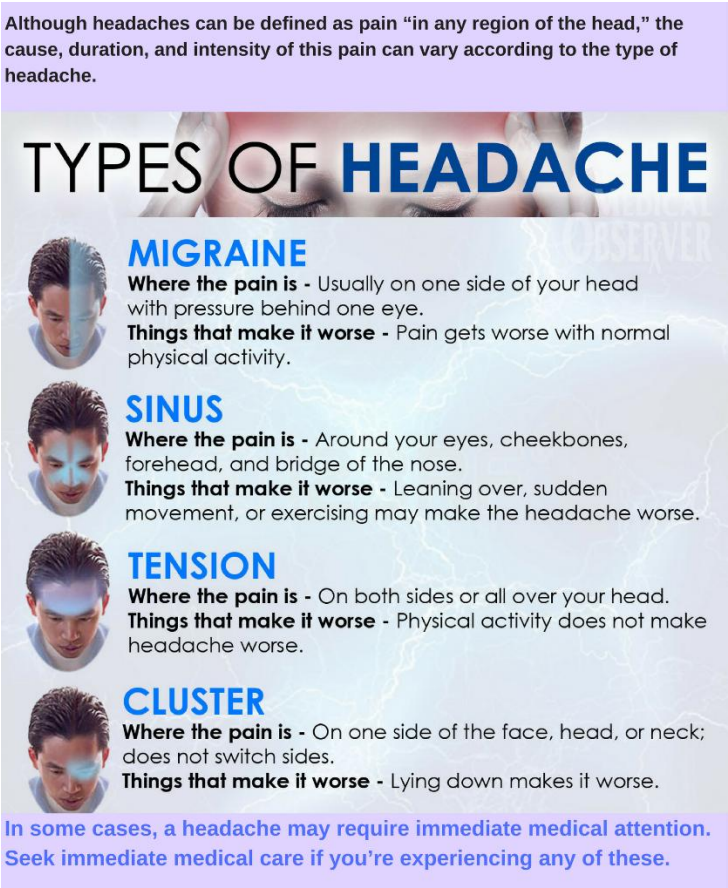


Fig 1: Types of Headache and Their Typical Pain Locations [68]

[redacted]

1. Primary Headache Disorders

[redacted]

- **Migraine**

  [redacted]

  [redacted]

  [redacted]

- **Tension-Type Headache (TTH)**

  [redacted]

- **'Trigeminal Autonomic Cephalalgias'**

  - 'Cluster headache'

    [redacted]

- **Other primary headache disorders**

  - Primary cough headache

    [redacted]

2. Secondary Headache Disorders

These headaches are symptoms of an underlying medical condition and resolve when the primary cause is treated. [redacted]

3. Painful Cranial Neuropathies, Other Facial Pains, and Other Headaches [42]

This category includes:

- ‘Occipital neuralgia’

- Persistent idiopathic facial pain

For researchers, ICHD-3 provides a uniform language and structured definitions for headache phenotypes, which is vital for epidemiological and interventional studies.[45]

Table 1 ICHD-3 Classification of Headache Disorders

Main Category	Subtypes	Examples
1. Primary Headache Disorders	- Migraine (with/without aura) - Tension-Type Headache (episodic/chronic) - Trigeminal Autonomic Cephalalgias (TACs) - Other primary headaches (cough, exertional)	Migraine, Tension-Type Headache, Cluster Headache
2. Secondary Headache Disorders	- Trauma/Injury - Vascular Disorders - Non-vascular Intracranial Disorders - Substance Use/Withdrawal - Infection - Homeostasis Disorders - Psychiatric Disorders	Post-traumatic headache, SAH, Medication-overuse headache
3. Painful Cranial Neuropathies and Other Facial Pains	- Trigeminal Neuralgia - Occipital Neuralgia - Persistent Idiopathic Facial Pain - Burning Mouth Syndrome	Trigeminal Neuralgia, Glossopharyngeal Neuralgia

Obesity and Its Classification (BMI Criteria – WHO/Asia-Pacific)

Definition and Global Significance of Obesity

Obesity refers to the excessive accumulation of fat within the body to a degree that may adversely affect an individual's health. [redacted]

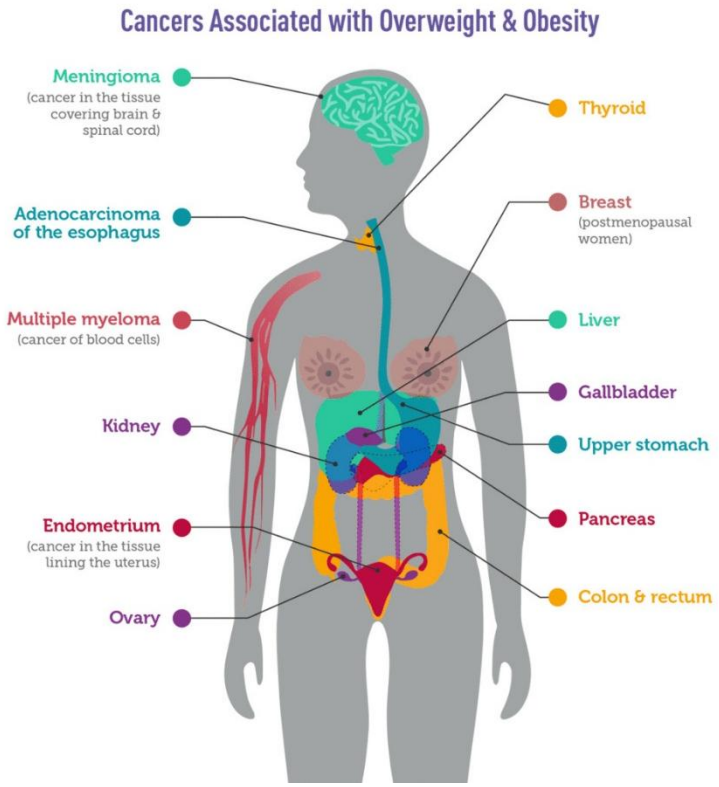


Fig 2 Obesity – Effects on the Body [69]

International and Regional BMI Standards

While the World Health Organization (WHO) has proposed global BMI thresholds to define overweight and obesity, scientific evidence has shown that populations from Asia face heightened health risks linked to excess weight at lower BMI values compared to Western populations. [redacted]

Table 2: Body Mass Index (BMI) Classification – WHO vs. Asia-Pacific Standards and Associated Health Risks

BMI (kg/m²)	WHO International Standard	Asia-Pacific Standard	Associated Health Risk
< 18.5	Underweight	Underweight	Increased risk of nutritional deficiency
18.5 – 24.9	Normal weight	Normal weight	Minimal risk
25.0 – 29.9	Overweight	Overweight (At risk)	Elevated risk of heart disease
30.0 – 34.9	Obesity Class I	Obese I	Moderate risk
35.0 – 39.9	Obesity Class II	Obese II	High risk
≥ 40.0	Obesity Class III (Severe)	Obese III (Severe)	Very high risk

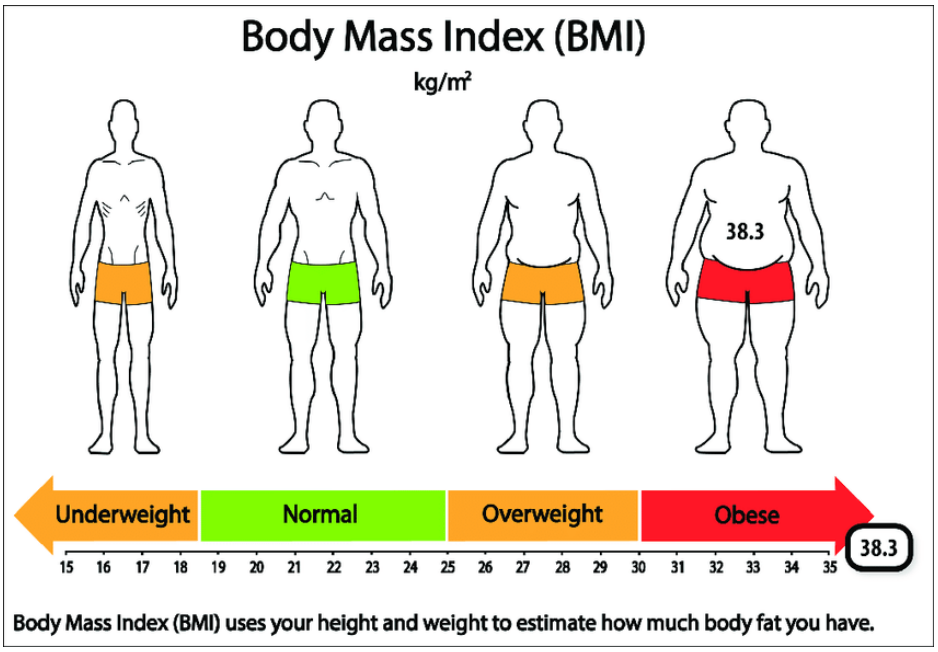


FIG 3 Body Mass Index (BMI) Classification – Visual Representation [70]

Important Notes:

- The Asia-Pacific BMI classification adopts lower thresholds for overweight and obesity to better reflect the increased metabolic risks faced by Asian populations.

[redacted]

Mechanisms Underlying Obesity

Obesity develops when the balance between energy consumed and energy expended remains persistently positive, resulting in fat accumulation. [redacted]

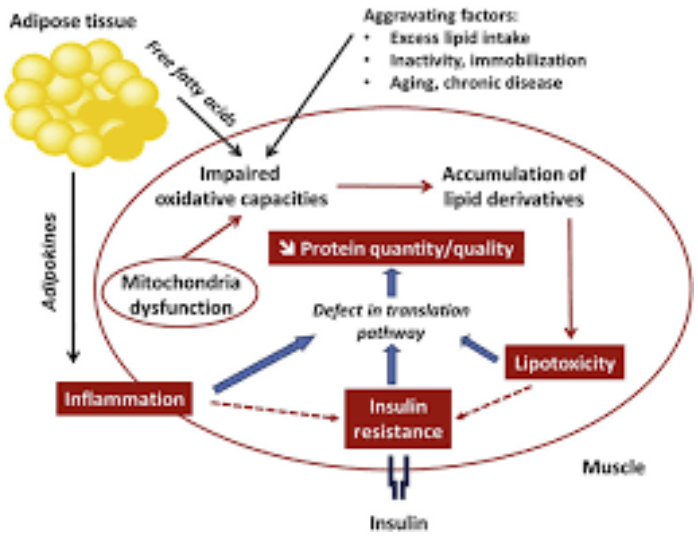


Fig 4 Pathophysiological Mechanisms Linking Obesity to Insulin Resistance [71]

Key Biological Processes:

[redacted]**Disrupted Energy Regulation:** [redacted]

- **Role of Fat Tissue:**
- **Development of Insulin Resistance:** Chronic inflammation and lipid overload reduce insulin sensitivity, paving the way for metabolic syndrome and diabetes.

Genetic and Epigenetic Influences:

Environmental Contributors:

Obesity's Connection to Headache Disorders

Recent research increasingly points to obesity as an important risk factor for certain headache types, including migraine and chronic daily headaches.[55]

Proposed Links Between Obesity and Headaches:

Inflammation:

Hormonal Changes:

[redacted]**Increased Attack Frequency and Severity:** [redacted]

[redacted]**Medication Overuse:** [redacted]

- **Associated Disorders:** Conditions linked to obesity, such as sleep apnoea and depression, may worsen headache disorders or complicate their management.

Clinical Relevance:

[redacted]

Broader Neurological Consequences of Obesity

Beyond headache disorders, obesity impacts neurological health through a variety of mechanisms, increasing susceptibility to multiple neurological conditions.[56]

[redacted]**Stroke Risk:** [redacted]

- **Cognitive Impairment:** Research indicates that obesity in midlife increases the risk of cognitive decline and dementia, possibly through insulin resistance, vascular damage, and chronic inflammation.

[redacted]**Sleep apnoea and Neurological Effects:** [redacted]

[redacted]**Peripheral Nerve Damage:** [redacted]

[redacted]

Scientific Evidence Linking BMI and Headache

A substantial body of evidence supports the relationship between increased BMI and the risk, frequency, and severity of headache disorders, particularly migraines.[57]

[redacted]**Population Studies:** [redacted]

[redacted]**Meta-analyses:** [redacted]

[redacted]**Biological Mechanisms:** [redacted]

- **Therapeutic Outcomes:** Weight reduction strategies, including lifestyle interventions and surgery, have demonstrated effectiveness in decreasing migraine frequency and severity, supporting a causal connection.

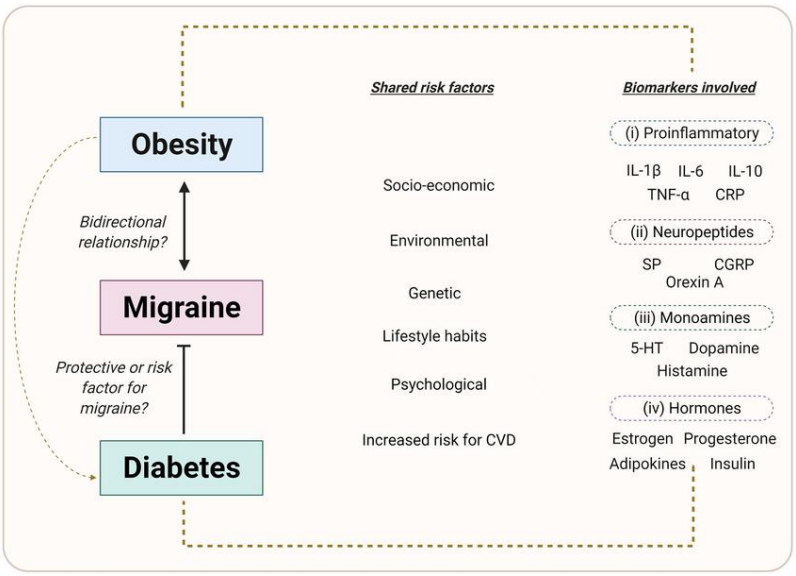


Fig 5 Interrelationship Between Obesity, Migraine, and Diabetes – Shared Risk Factors and Biomarkers [72]

Limitations and Existing Gaps

[redacted]

These findings highlight the need to incorporate BMI assessment into headache evaluation and treatment plans, advocating for comprehensive strategies that address both neurological symptoms and metabolic health simultaneously.[58]

Gaps in Current Literature

Extensive research establishes a clear association between elevated BMI and an increased risk, frequency, and severity of headache disorders, particularly migraine and chronic daily headaches. [redacted]

However, considerable variation exists in study methodologies, populations, and headache diagnostic criteria, leading to some conflicting results.[59]

Identified Gaps in Literature

[redacted] **Scarcity of Longitudinal Research:** [redacted]

[redacted] **Variation in Headache Definitions:** [redacted]

[redacted] **Limited Research in Low- and Middle-Income Countries:** [redacted]

[redacted] **Insufficient Control for Confounders:** [redacted]

[redacted] **Unclear Biological Mechanisms** [redacted]

[redacted] **Effectiveness of Weight Loss Interventions:** [redacted]

Addressing these shortcomings is crucial for developing targeted preventive and therapeutic interventions that integrate metabolic health with headache management.[60]

Research Studies

[redacted] **(2021)** conducted a systematic review to evaluate the association between migraine and obesity. [redacted]

Despite promising findings, the authors acknowledged limitations including heterogeneity among studies and called for more longitudinal research to clarify causality and improve management strategies for patients suffering from both migraine and obesity.[8]

(2021) highlighted that excess adipose tissue drives a state of chronic low-grade inflammation through adipokines and cytokines, which may sensitize trigeminal nociceptive pathways implicated in migraine pathophysiology. The review serves to inform clinicians about the importance of addressing obesity in patients presenting with migraine or IIH to improve clinical outcomes.[17]

[redacted] **(2020)** conducted a global analysis based on the Global Burden of Disease 2019 (GBD2019) data to evaluate the impact of migraine on disability worldwide. [redacted] The study provides essential data to inform policymakers, clinicians, and researchers in designing targeted interventions to address this significant neurological disorder.[2]

[redacted] **(2020)** found that obesity, particularly central adiposity (fat accumulation around the abdomen), was significantly associated with increased migraine prevalence. [redacted] This study adds to the growing evidence

linking metabolic health with neurological disorders and supports targeted interventions focusing on weight management and fat distribution to potentially reduce migraine burden.[18]

[redacted] analysis revealed significant progress in reducing communicable diseases but highlighted a rising burden from non-communicable diseases, including neurological disorders such as migraine. [redacted] Their findings provide critical evidence to guide policymakers, healthcare providers, and researchers in designing effective strategies to reduce global health disparities and improve population health outcomes.[1]

[redacted] **(2018)** observed that higher BMI was associated with increased migraine frequency and intensity, suggesting that obesity may worsen migraine clinical features. [redacted] contributed valuable evidence supporting the link between obesity and migraine in the Chinese

adult population, underscoring the need for further longitudinal and interventional studies.[19]

[redacted] **(2017)** emphasized the urgent need for effective public health interventions and policies aimed at preventing and managing obesity to reduce its growing burden. [redacted] This comprehensive assessment provides vital evidence to inform global health priorities and strategies addressing the obesity epidemic.

[redacted]**. (2018)** found that overall obesity prevalence remained high, with a slight increase in severe obesity among both children and adults. [redacted] concluded that continued surveillance and multifaceted strategies are essential to curb the obesity epidemic in the U.S.[21]

[redacted] **(2015)** analysed the relationship was particularly strong for chronic migraine, where frequent headache attacks are more disabling. [redacted]

This work underscores the importance of addressing obesity in patients with migraine to potentially reduce disease burden and improve quality of life.[9]

. (2014) conducted a systematic review to examine the epidemiological relationship between obesity and headache disorders, focusing primarily on migraine and tension-type headache.

[redacted]The review supports considering obesity as a significant modifiable risk factor in headache management and prevention strategies.[7]

[redacted]**. (2013)** conducted a randomized pilot trial to investigate ictal adiponectin levels in individuals with episodic migraine. [redacted]The study contributes to understanding the biological factors connecting obesity, metabolism, and headache disorders.[22]

[redacted] **(2013)** critically compares the Body Adiposity Index (BAI) to the Body Mass Index (BMI) and other anthropometric measures in predicting cardiometabolic risk factors. [redacted] The findings showed that while BAI moderately correlated with cardiometabolic risk factors, BMI, waist circumference, and waist-to-hip ratio consistently demonstrated stronger and more reliable associations with adverse health outcomes.

[redacted] The study's strength lies in its comprehensive comparison and validation across multiple metabolic parameters.[23]

[redacted] **(2012)** conducted a large-scale population-based survey in China to examine the association between body mass index (BMI) and migraine prevalence among Chinese adults. [redacted] Overall, this study provided valuable epidemiological evidence supporting the role of obesity as a modifiable risk factor for migraine in the Chinese adult population.[24]

[redacted] **(2011)** provided a comprehensive review exploring the complex biological mechanisms underlying obesity, emphasizing its multifactorial nature involving genetic, environmental, and physiological factors. [redacted]

This work serves as a foundational reference for understanding the biological complexity of obesity in clinical and research settings.[12]

(2010) investigated the relationship between lifestyle factors and recurrent headaches among adolescents in a large population-based study known as the HUNT study in Norway.

[redacted] contributed valuable evidence supporting lifestyle interventions as a modifiable factor in reducing headache burden among adolescents, with implications for public health strategies targeting this vulnerable population.[25]

[redacted] **(2009)** conducted a large prospective cohort study examining the relationship between body mass index (BMI) and migraine characteristics among women. [redacted] concluded that addressing obesity may reduce migraine frequency and improve quality of life in affected women.[26]

[redacted] **(2004)** addresses the appropriateness of standard BMI cut-offs for Asian populations, responding to emerging evidence that Asians may face elevated risks of obesity-related diseases at lower BMI levels compared to Western populations. [redacted]

The findings have been influential in shaping national guidelines across many Asian countries, including India, China, and Japan, ensuring more accurate identification of individuals at risk and better targeting of preventive health services.[27]

[redacted] **(1995**) report on physical status and anthropometry is a foundational document that outlines standardized methods for assessing human body measurements and their [redacted]

The report emphasizes the importance of using anthropometric measurements as accessible, non-invasive tools for diagnosing undernutrition, overweight, and obesity.

Its recommendations continue to influence global strategies aimed at improving health outcomes related to nutrition and body composition.[28]

(1983) height and weight tables were developed to provide standardized benchmarks for assessing ideal body weight in adults aged 25–29.

[redacted]

[redacted] Unlike previous weight norms that relied on simple height-weight ratios, this edition took into account frame size to increase precision and accommodate body composition variability.

[redacted]

[redacted]They also served as a catalyst for broader epidemiological research into obesity-related morbidity and mortality.[29]

1960 [redacted] The report aimed to quantify the impact of increased body mass on female

health outcomes, providing data crucial to both clinical and insurance-based risk stratification.

[redacted]

It laid the foundation for future research into gender-specific health risks and remains a landmark in the historical epidemiology of weight and mortality.[30]

1959 [redacted] published revised height-and-weight standards to establish more accurate "ideal weight" guidelines for adult men and women. [redacted]

These results informed subsequent underwriting rules, prompting insurers to adjust their policies and promote the use of individualized weight profiles instead of a one-size-fits-all model.

These weight standards remained influential well into the 1980s.

This pioneering effort aggregated experience data from approximately 2 million insured lives—spanning both males and females—from 1885 to 1909.

[redacted] To achieve this, conditions affecting life expectancy—such as medical impairments, habitual behaviours, anthropometric measures, and occupational hazards—were meticulously documented.

The study introduced a classification framework for life insurance applicants based on physical characteristics (e.g., height, weight), medical history (e.g., tuberculosis, syphilis), and lifestyle factors (e.g., alcohol use, occupation). [redacted]

Conversely, among overweight categories, increased weight was linked to higher mortality, prompting life insurance companies to refine underwriting criteria and adjust premium rates accordingly.

[redacted]

Today, the Medico-Actuarial Mortality Investigation remains a landmark in demographic and anthropometric research, reinforcing the importance of large-scale, empirically grounded health risk analysis.[16]

Rationale for the Study

Headache disorders—including migraine and tension-type headaches—are among the most common neurological conditions worldwide, leading to significant disability and socioeconomic impact. [redacted]

Most existing studies are cross-sectional and originate from developed nations, limiting their applicability in the Indian setting.[61]

[redacted] Insights from this research will assist clinicians in adopting a holistic approach that emphasizes weight management alongside standard headache care.[62]

Need for the Study

[redacted]

Early recognition of obesity's role in headache disorders could promote integrative treatment strategies that combine weight management with conventional therapies, thereby reducing headache

Hypotheses

Null Hypothesis (H0):

- **Alternative Hypothesis (H1):**

Operational Definitions

Headache: ‘

Migraine: ‘

Body Mass Index (BMI): ‘

Obesity:

- **Overweight: ‘**

Headache Frequency

Headache Severity: ‘

Chronic Headache:

METHODS AND MATERIAL

Study Design

[redacted]

Study Setting

[redacted]

Study Duration

[redacted]

Table 3: Timeline and Percentage Allocation of Research Activities

Activity	Percentage of Time Allocated	Time Period
[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]

Sample Size Calculation

Using a previously reported prevalence of headache/migraine in obese individuals of [redacted]

Inclusion Criteria

[redacted]

Exclusion Criteria

[redacted]

[redacted]

Methodology

This cross-sectional study, conducted within a hospital setting, commenced only after securing approval from the institutional ethics committee. [redacted]

Data Collection

[redacted]

[redacted]

Assessment Tools

[redacted]

Anthropometric Measurements

[redacted]

BMI Classification

Participants were classified according to WHO criteria:

[redacted]

- ‘Class III obesity: ≥40.0 kg/m²’

Data Management and Quality Control

[redacted]

Statistical Analysis

Data were entered into Microsoft Excel and analysed using Epi Info software version 7. [redacted]

RESULTS

[redacted] **4 Distribution of patients by gender**

		n	%
Gender	[redacted]	[redacted]	[redacted]
	[redacted]	[redacted]	[redacted]

[redacted]

[redacted]

[redacted]The higher female representation could reflect gender-related differences in the healthcare-seeking behaviour or prevalence of headache disorders, particularly migraines, which are known to be more common among females.

Graph 1 Distribution of patients by gender

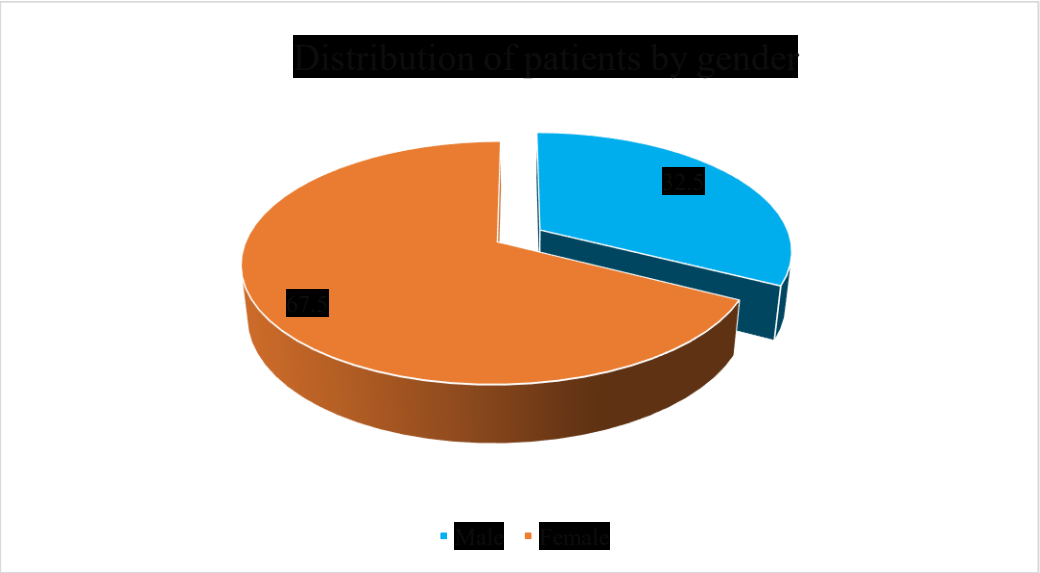
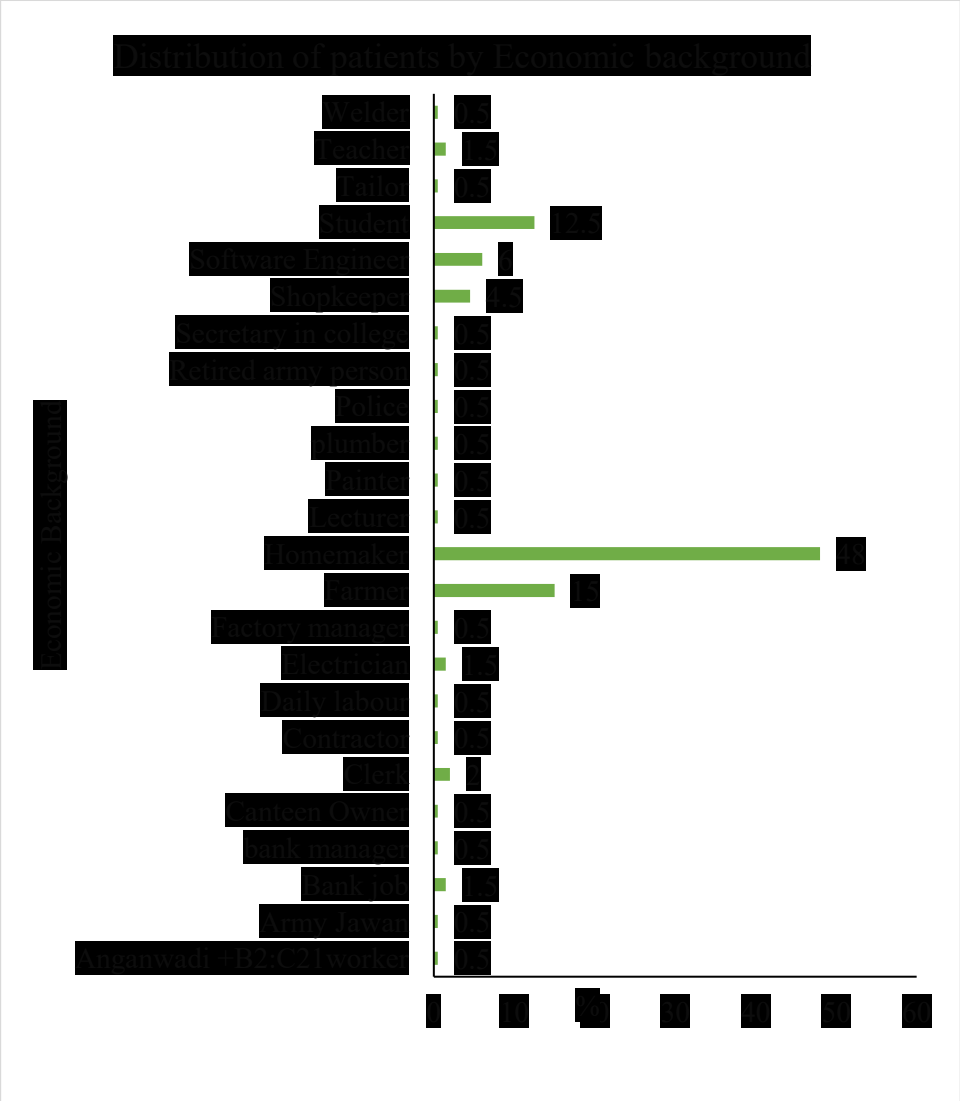


Table 5 Distribution of patients by Economic background

		n	%
Economic background	Anganwadi worker	[redacted]	[redacted]
	Army Jawan	[redacted]	[redacted]
	Bank job	[redacted]	[redacted]
	bank manager	[redacted]	[redacted]
	Canteen Owner	[redacted]	[redacted]
	Clerk	[redacted]	[redacted]
	Contractor	[redacted]	[redacted]
	Daily labour	[redacted]	[redacted]
	Electrician	[redacted]	[redacted]
	Factory manager	[redacted]	[redacted]
	Farmer	[redacted]	[redacted]
	Homemaker	[redacted]	[redacted]
	Lecturer	[redacted]	[redacted]
	Painter	[redacted]	[redacted]
	plumber	[redacted]	[redacted]
	Police	[redacted]	[redacted]
	Retired army person	[redacted]	[redacted]
	Secretary in college	[redacted]	[redacted]
	Shopkeeper	[redacted]	[redacted]
	Software Engineer	[redacted]	[redacted]
	Student	[redacted]	[redacted]
	Tailor	[redacted]	[redacted]
	Teacher	[redacted]	[redacted]
	Welder	[redacted]	[redacted]

Graph 2 Distribution of patients by Economic background



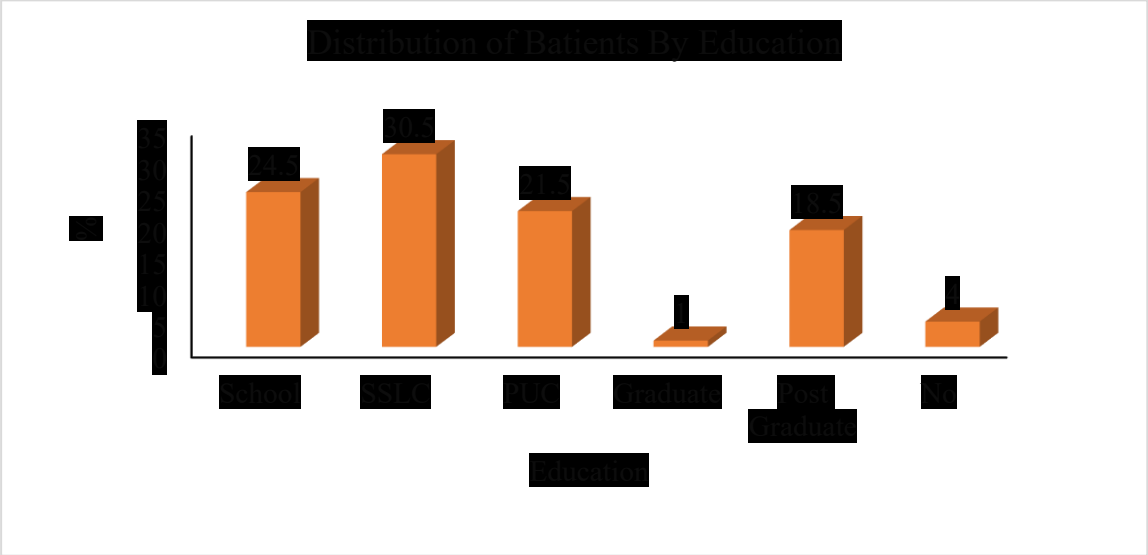
[redacted]

[redacted]

Table 6 Distribution of patients by Education

		n	%
Education	School	[redacted]	[redacted]
	SSLC	[redacted]	[redacted]
	PUC	[redacted]	[redacted]
	Graduate	[redacted]	[redacted]
	Post Graduate	[redacted]	[redacted]
	No	[redacted]	[redacted]

Graph 3 Distribution of patients by Education



[redacted]

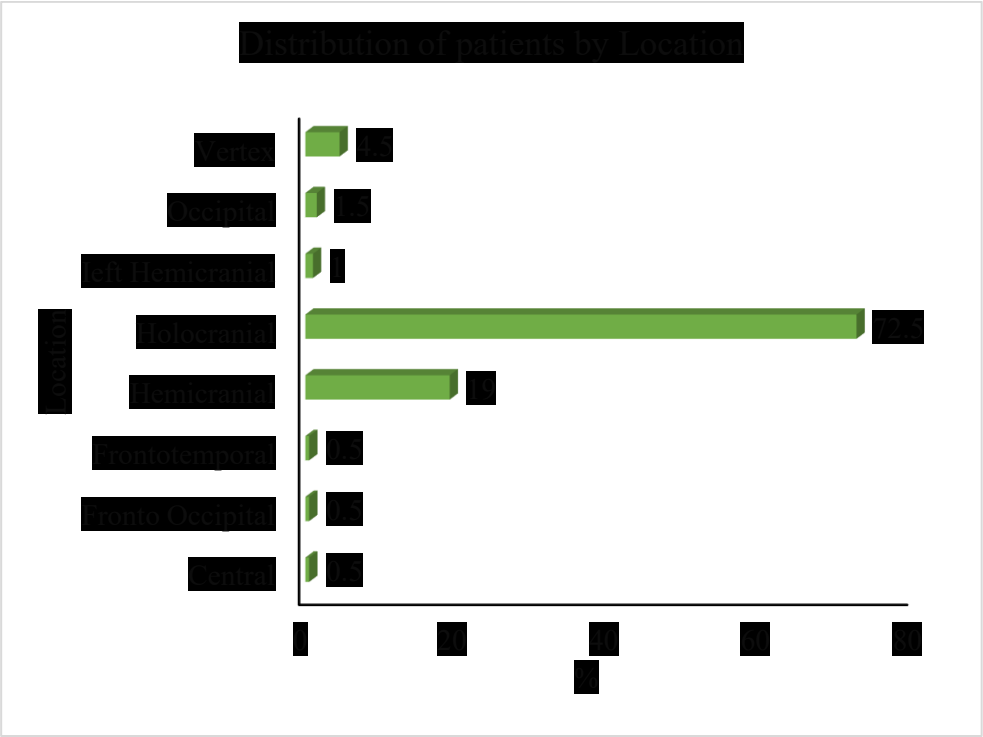
[redacted]

[redacted]

Table 7 Distribution of patients by Location

		n	%
Location	Central	[redacted]	[redacted]
	Fronto occipital	[redacted]	[redacted]
	Frontotemporal	[redacted]	[redacted]
	Hemicranial	[redacted]	[redacted]
	Holocranial	[redacted]	[redacted]
	Left hemicranial	[redacted]	[redacted]
	Occipital	[redacted]	[redacted]
	Vertex	[redacted]	[redacted]

Graph 4 Distribution of patients by Location



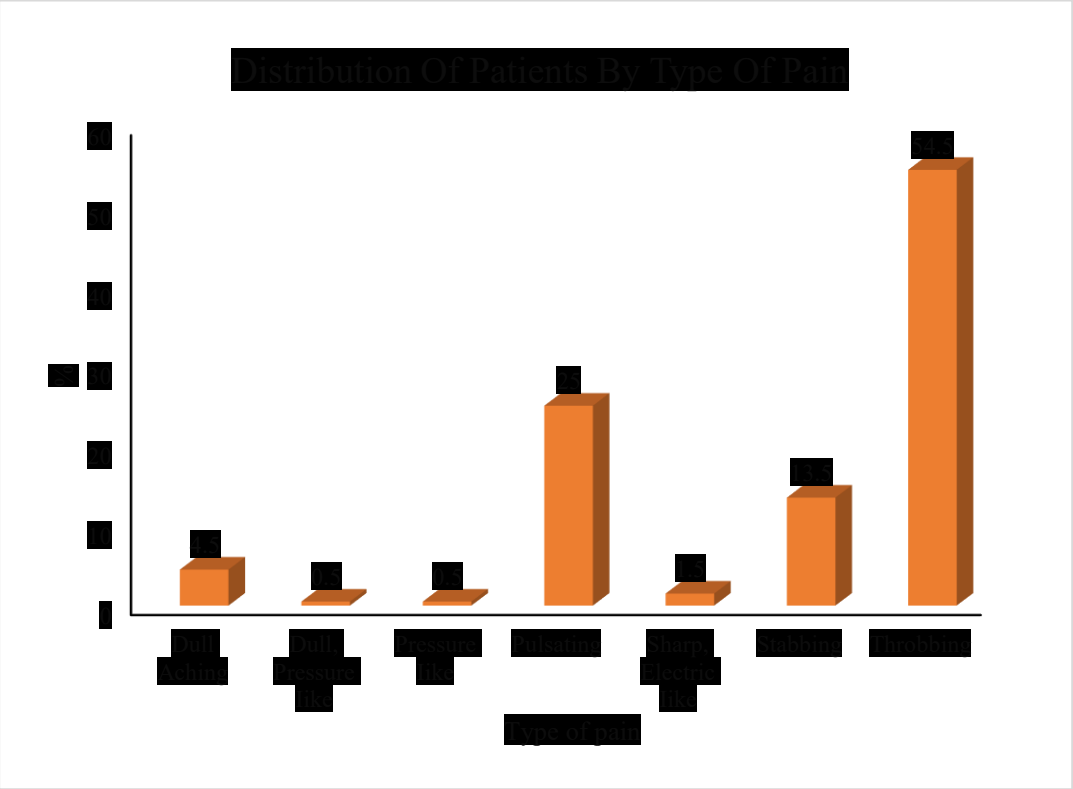
[redacted]

[redacted]

Table 8 Distribution of patients by Type of pain

		n	%
Type of pain	Dull aching	[redacted]	[redacted]
	Dull, pressure like	[redacted]	[redacted]
	Pressure like	[redacted]	[redacted]
	Pulsating	[redacted]	[redacted]
	Sharp, electric like	[redacted]	[redacted]
	Stabbing	[redacted]	[redacted]
	Throbbing	[redacted]	[redacted]

Graph 5 Distribution of patients by Type of pain


Distribution Of Patients By Type Of Pain
[redacted]
[redacted]
[redacted]

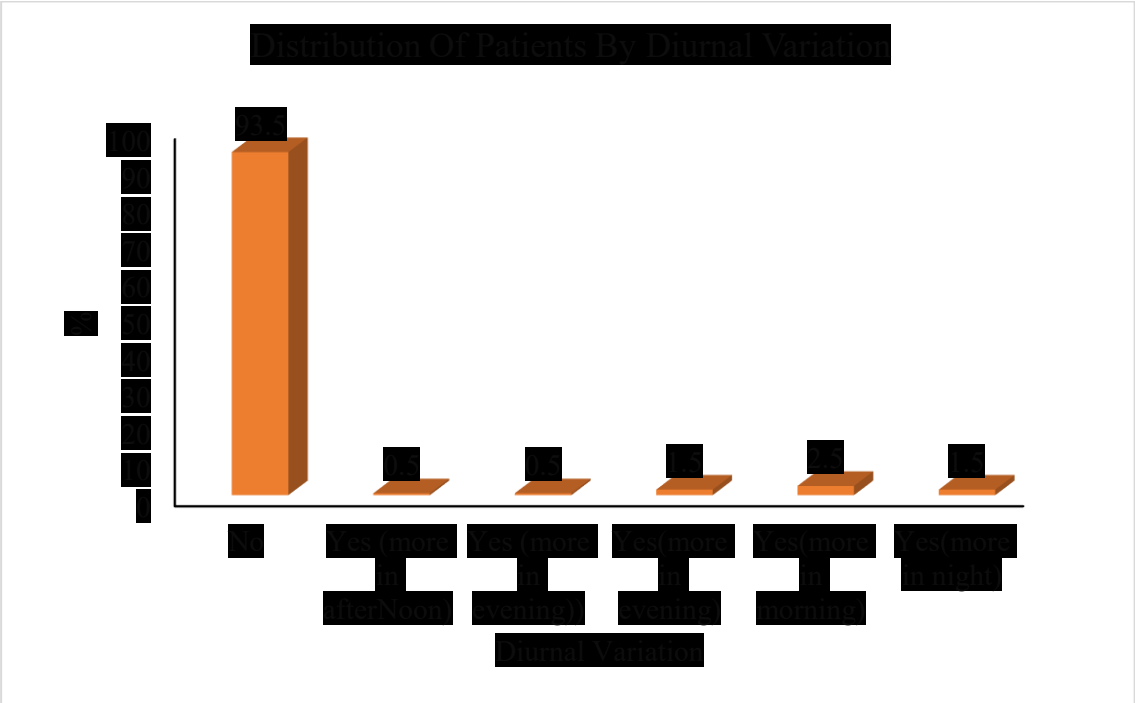
[redacted]

[redacted]

Table 9 Distribution of patients by Diurnal variation

		n	%
Diurnal variation	No	[redacted]	[redacted]
	Yes (more in afternoon)	[redacted]	[redacted]
	Yes (more in evening))	[redacted]	[redacted]
	Yes (more in evening)	[redacted]	[redacted]
	Yes (more in morning)	[redacted]	[redacted]
	Yes (more in night)	[redacted]	[redacted]

Graph 6 Distribution of patients by Diurnal variation



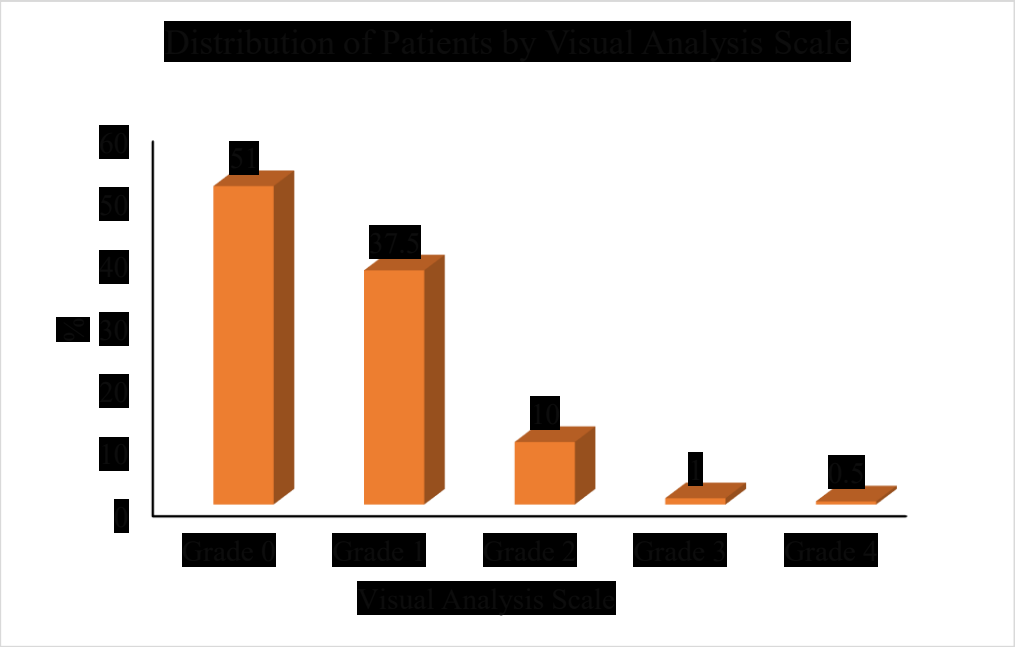
[redacted]

[redacted]

Table 10 Distribution of patients by Visual analysis scale

		n	%
Visual analysis scale	[redacted]	[redacted]	[redacted]
	[redacted]	[redacted]	[redacted]
	[redacted]	[redacted]	[redacted]
	[redacted]	[redacted]	[redacted]
	[redacted]	[redacted]	[redacted]

Graph 7 Distribution of patients by Visual analysis scale



[redacted]

[redacted]

[redacted]

Table 11 Distribution of patients by various types of factors

		n	%
Precipitating factor	[redacted]	[redacted]	[redacted]
	[redacted]	[redacted]	[redacted]
Associated symptom	[redacted]	[redacted]	[redacted]
	[redacted]	[redacted]	[redacted]
Nausea and Vomiting	[redacted]	[redacted]	[redacted]
	[redacted]	[redacted]	[redacted]
Neck pain	[redacted]	[redacted]	[redacted]
	[redacted]	[redacted]	[redacted]
Phonophobia	[redacted]	[redacted]	[redacted]
	[redacted]	[redacted]	[redacted]
Photophobia	[redacted]	[redacted]	[redacted]
	[redacted]	[redacted]	[redacted]
Dizziness	[redacted]	[redacted]	[redacted]
	[redacted]	[redacted]	[redacted]
Ptosis	[redacted]	[redacted]	[redacted]
	[redacted]	[redacted]	[redacted]
Nasal Congestion	[redacted]	[redacted]	[redacted]
	[redacted]	[redacted]	[redacted]
	[redacted]	[redacted]	[redacted]
Tearing	[redacted]	[redacted]	[redacted]
	[redacted]	[redacted]	[redacted]
worsening of pain on movement of head	[redacted]	[redacted]	[redacted]
	[redacted]	[redacted]	[redacted]
	[redacted]	[redacted]	[redacted]
Confusion	[redacted]	[redacted]	[redacted]
	[redacted]	[redacted]	[redacted]
Numbness	[redacted]	[redacted]	[redacted]
	[redacted]	[redacted]	[redacted]

Avoidance of DAL(Yes/NO)			
Tobacco chewing (Yes/No)			
Smoking			
Alcohol			
Hormonal use			
Menstrual cycle			
Use of prophylactic medication			
Coffee / Tea			
lack of sleep			
Too much sleep			
Odors			
certain foods			
stress			

Visual analysis scale			
palpitations			
weight loss			
chronic cough			
snoring			
Decline in memory			
Dental problems			
Sinus problems			
Chest pain			
Skin rash			
Excessive urination			
Anxiety			
Depression			
Hearing problem			
Joint pain			
Seizures			
Vision problems			
Loss of consciousness			

	[redacted]	[redacted]	[redacted]
TAC'S	[redacted]	[redacted]	[redacted]
	[redacted]	[redacted]	[redacted]
Other primary headaches	[redacted]	[redacted]	[redacted]
	[redacted]	[redacted]	[redacted]

In the present study of 200 participants with headache complaints, a wide range of associated symptoms and potential triggers were documented:

Triggering and Associated Features:

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

Addiction and Medication History:

Prophylactic headache medication use

Menstrual and Sleep-Related Factors:

Menstrual cycle-related headaches:

- Too much sleep: (n=3)

Environmental Triggers:

- Odors:

Stress:

Caffeine Intake:

- 2 times/day:

Once daily / occasional / nil:

Other Clinical Symptoms:

Palpitations, anxiety, seizures, snoring, sinus problems, vision decline, weight loss, memory issues: Rare or absent

- Trigeminal autonomic cephalalgias

Visual Analogue Scale (VAS) for Pain Severity:

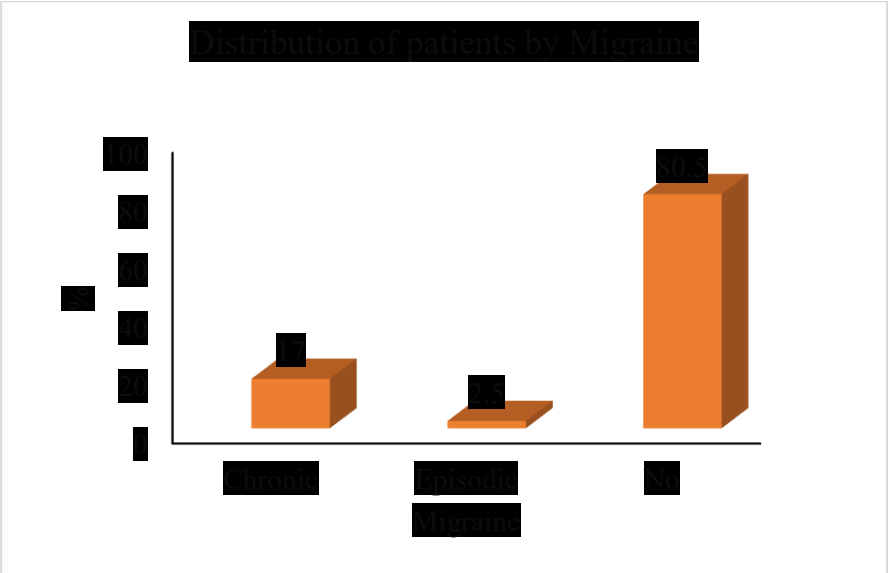
- Grade 0 (no pain):

[redacted]

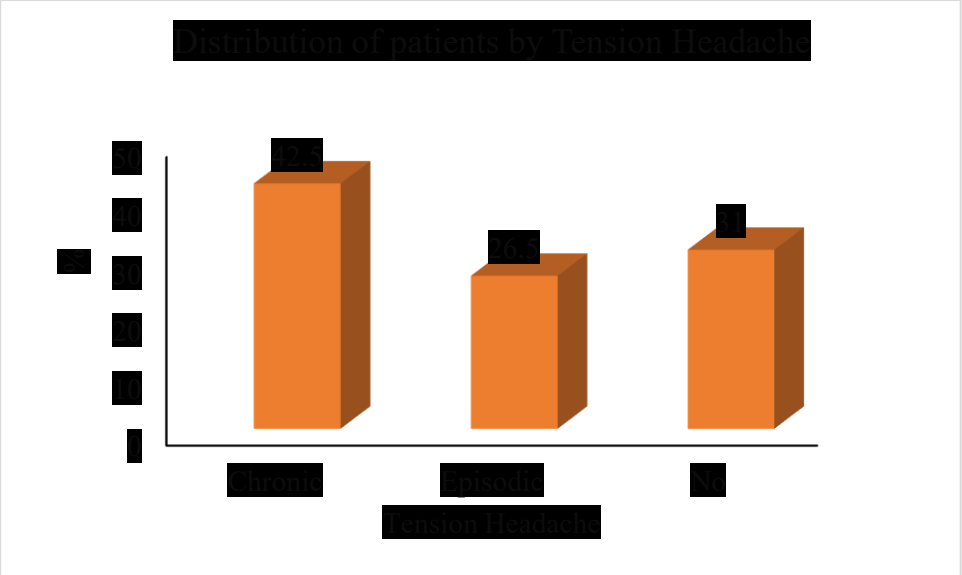
Table 12 Distribution of patients by Migraine, Tension Headache and Other primary headaches

		n	%
Migraine	[redacted]	[redacted]	[redacted]
	[redacted]	[redacted]	[redacted]
	[redacted]	[redacted]	[redacted]
Tension Headache	[redacted]	[redacted]	[redacted]
	[redacted]	[redacted]	[redacted]
	[redacted]	[redacted]	[redacted]
Other primary headaches	[redacted]	[redacted]	[redacted]
	[redacted]	[redacted]	[redacted]
	[redacted]	[redacted]	[redacted]

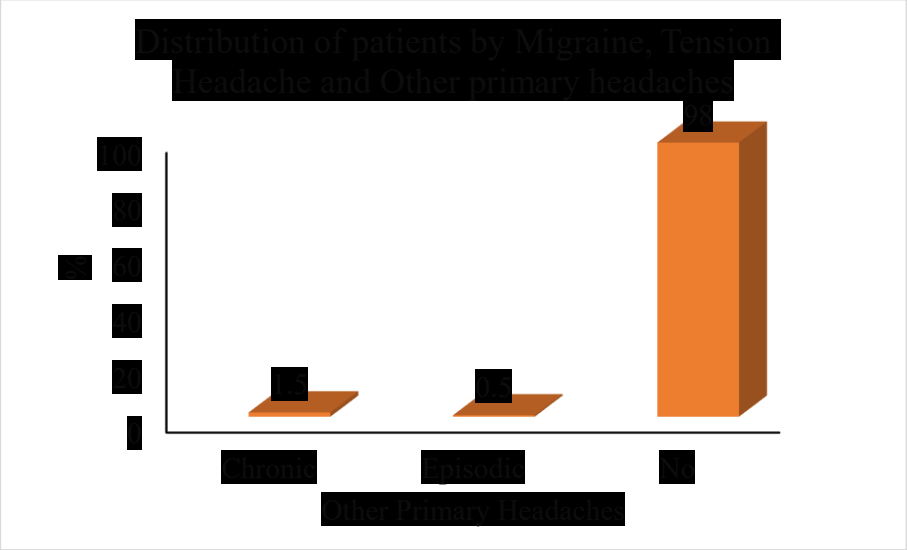
Graph 8 Distribution of patients by Migraine



Graph 9 Distribution of patients by Tension Headache



Graph 10 Distribution of patients by Other primary headaches



Migraine

Out of [redacted] participants, [redacted] reported chronic migraine, while [redacted] experienced episodic migraine. [redacted]

Tension-Type Headache (TTH)

Tension-type headache was the most frequently reported category, with [redacted] experiencing chronic TTH and [redacted] having episodic TTH. [redacted]

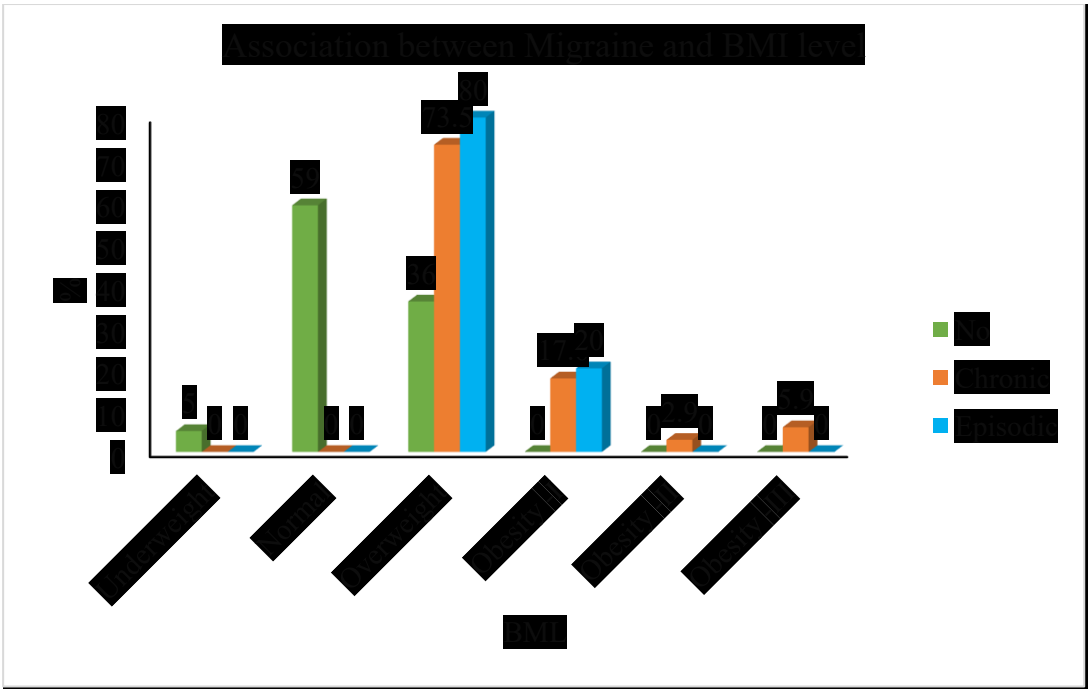
Other Primary Headaches

A small number of participants reported other primary headaches, with [redacted] experiencing chronic forms and [redacted] episodic forms. [redacted]

Table 13 Association between Migraine and BMI level

		Migraine						Chi-square
		No		Chronic		Episodic		
		n	%	n	%	n	%	
BMI	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	
	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	
	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	
	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	
	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	

Graph 11 Association between Migraine and BMI level

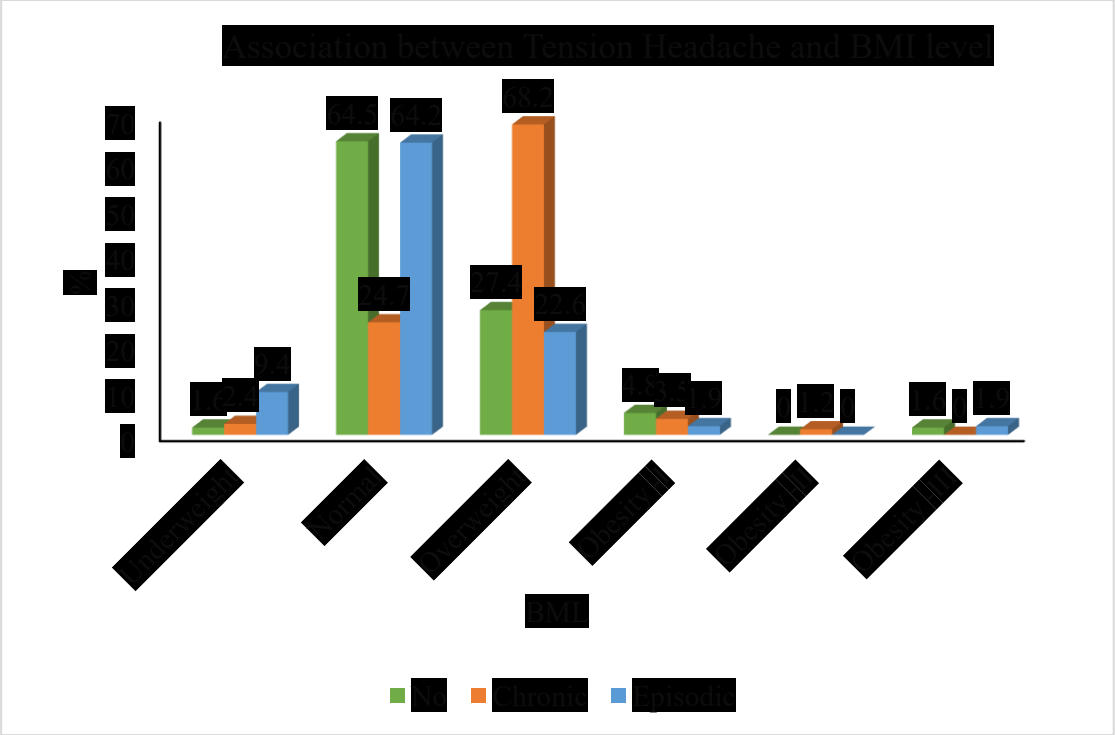

Association between Migraine and BMI level
BMI
No
Chronic
Episodic

[redacted]

Table 14 Association between Tension Headache and BMI level

		Tension Headache						Chi-square
		No		Chronic		Episodic		
		n	%	n	%	n	%	
BMI	Underweight	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
	Normal	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	
	Overweight	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	
	Obesity -I	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	
	Obesity -II	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	
	Obesity -III	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	

Graph 12 Association between Tension Headache and BMI level



A total of 200 participants were classified into BMI categories (Underweight, Normal, Overweight, Obesity Class I, II, III) and evaluated for the presence of tension-type headache (TTH) as chronic, episodic, or absent.

- **Underweight ([redacted]):**

  [redacted]**Chronic TTH**: [redacted]

  [redacted]**Episodic TTH**[redacted]

  [redacted]**No TTH**: 1 [redacted]

- **Normal BMI ([redacted]):**

  [redacted]**Chronic TTH**: [redacted]

  [redacted]**Episodic TTH**: [redacted]

  [redacted]**No TTH**: [redacted]

- **Overweight ([redacted]):**

  [redacted]**Chronic TTH**: [redacted]

  [redacted]**Episodic TTH**: [redacted]

  [redacted]**No TTH**: [redacted]

[redacted]**Obesity Class I–III ([redacted]) [redacted]**

  [redacted]**Chronic TTH:** [redacted]

  [redacted]**Episodic TTH**: [redacted]

  [redacted]**No TTH**: [redacted]

Statistical Significance

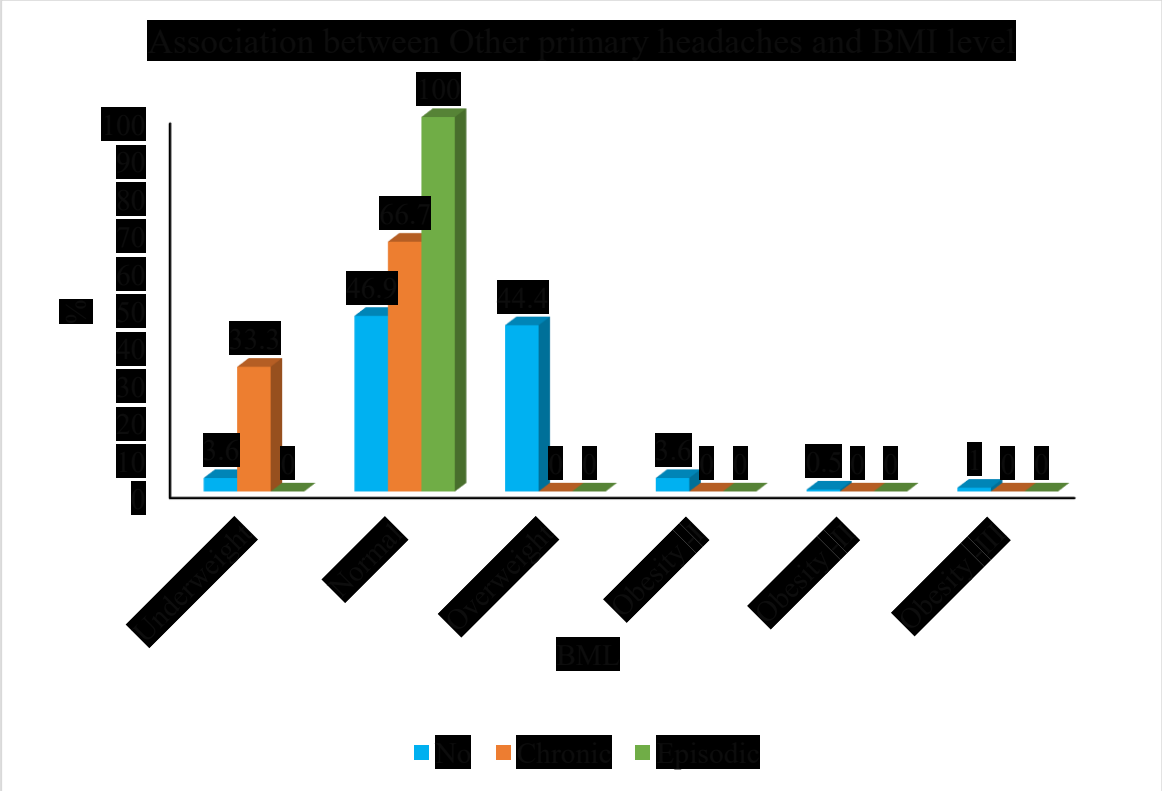
[redacted]

Table 15 Association between Other primary headaches and BMI level

		Other primary headaches						Chi-square
		No		Chronic		Episodic		
		n	%	n	%	n	%	
BMI	Underweight	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
	Normal	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	
	Overweight	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	

	Obesity -I	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	
	Obesity -II	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	
	Obesity -III	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	

Graph 13 Association between Other primary headaches and BMI level



In this study, the occurrence of other primary headaches (i.e., those excluding migraine and tension-type headache) was rare across all BMI categories:

- **Underweight ([redacted])**:
  - **Chronic headache**: 1 [redacted]

  [redacted]**No headache**: [redacted]
- **Normal BMI ([redacted])**:

[redacted]**Chronic**: 2 [redacted]

[redacted]**Episodic**: 1 [redacted]

[redacted]**No headache**: [redacted]

- **Overweight and Obesity ([redacted]):**

  [redacted]

Statistical Analysis

- The Chi-square value was [redacted], indicating no statistically significant association between BMI and other primary headaches.

Table 16 Descriptive Statistics of Study Variables

	Mean	SD	Minimum	Maximum
Age(years)	[redacted]	[redacted]	[redacted]	[redacted]
BMI	[redacted]	[redacted]	[redacted]	[redacted]
Underweight	[redacted]	[redacted]	[redacted]	[redacted]
Normal weight	[redacted]	[redacted]	[redacted]	[redacted]
Over weight	[redacted]	[redacted]	[redacted]	[redacted]
Obesity class I	[redacted]	[redacted]	[redacted]	[redacted]
Obesity class II	[redacted]	[redacted]	[redacted]	[redacted]
Obesity class III	[redacted]	[redacted]	[redacted]	[redacted]
Onset of age	[redacted]	[redacted]	[redacted]	[redacted]

Age and Headache Onset

- The mean age of participants was [redacted] years with a standard deviation (SD) of [redacted] years, ranging from [redacted] years.
- [redacted]This close alignment between current age and age of onset suggests that most headaches were chronic or persistent in nature.

Body Mass Index (BMI)

- The overall mean BMI was [redacted] kg/m², falling in the overweight category, with a range [redacted]
- BMI distribution by category:

  [redacted]**Underweight**: [redacted]

  [redacted]**Normal weight**: [redacted]

  [redacted]**Overweight**: [redacted]

  [redacted]**Obesity Class I**: [redacted]

  [redacted]**Obesity Class II**: [redacted]

  [redacted]**Obesity Class III**: [redacted]

[redacted]

DISCUSSION

This study investigates the relationship between body mass index (BMI) and primary headache disorders, analysing [redacted] participants. [redacted]A majority of participants were educated only up to SSLC or lower, and reduced health literacy has been linked to poorer nutritional habits and a higher BMI Farello et al., 2017 [4]; WHO Expert Consultation, 2004 [27].

Clinically, holocranial and hemicranial headache locations were predominant, correlating with tension-type and migraine presentations respectively. [redacted] Chai et al. (2014) [7] also

detailed how adipokines and systemic inflammation play a key role in intensifying headache symptoms among obese individuals.

[redacted]

Supporting this, Gunay et al. (2013) [53] reported that bariatric surgery significantly reduced headache burden in obese migraineurs.

[redacted]

[redacted] Ornello et al. (2015) [9] and Chai et al. (2014) [7] reported a clear relationship between increasing BMI and both chronic migraine and TTH, emphasizing the role of obesity in the chronification of headaches.

[redacted]

Tension-type headache also showed a statistically significant association with BMI ($\chi^2 = 45.991$, $p < 0.05$), with overweight individuals showing the highest prevalence of chronic TTH. [redacted]

Descriptive statistics revealed a mean BMI of 25 kg/m², indicating an overweight population. [redacted]

These observations corroborate existing global and regional literature (Gelaye et al., 2017 [3]; Ornello et al., 2015 [9]; Pavlovic et al., 2017 [6]; Chai et al., 2014 [7]), highlighting obesity as a modifiable risk factor in headache pathophysiology.

Strengths and Limitations of the Study

Strengths

- **Large and Diverse Sample Size**:
- **Comprehensive Assessment**:
- **Clear BMI Classification**:

- **Use of Statistical Correlation**: [redacted]

- **Focus on Primary Headaches**: [redacted]

Limitations

- **Cross-Sectional Design** [redacted]

- **Single-Center Study**: [redacted]

- **Self-Reported Symptoms**: [redacted]

- **Lack of Neurological Imaging**: [redacted]

- **Underrepresentation of Obesity Class II/III**: [redacted]

Exclusion of Psychological Assessments:

CONCLUSION

This cross-sectional study establishes a significant association between elevated body mass index (BMI) and the occurrence of primary headache disorders, particularly chronic migraine and chronic tension-type headaches. [redacted]

However, further longitudinal and multi-centre studies are recommended to explore causality and underlying mechanisms, and to validate these findings in broader populations.

SUMMARY

- The study was a cross-sectional analysis [redacted] participants to evaluate the correlation between headache and body mass index (BMI).

[redacted]

- Headache classification:

  [redacted]**Migraine**: [redacted]

  [redacted]**Tension-Type Headache (TTH)**: [redacted]

  [redacted]**Other primary headaches**: [redacted]

[redacted]

[redacted]

[redacted]

REFERENCES

1. GBD 2019 Diseases and Injuries Collaborators. Global burden of 369 diseases and injuries in 204 countries and territories, 1990-2019: a systematic analysis for the Global Burden of Disease Study 2019. Lancet. 2020;396(10258):1204-1222.

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ANNEXURE – I

INFORMED CONSENT FORM

CONSENT STATEMENT

ANNEXURE – II

ANNEXURE-III

MASTER CHART