

Fatigue in India: A Cross-Sectional Study of Prevalence and Severity

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Abstract: ***Objective:** To assess the prevalence and severity of physical fatigue in India across different regions, genders, and age groups. **Methods:** This cross-sectional study collected data from 30,899 individuals aged 18–99 [youth (18–25 years), young adults (26–40 years), middle-aged adults (41–65 years), and the elderly (66–99 years)] using five physical fatigue questions from the 10-item Fatigue Assessment Scale, administered verbally. Variations in fatigue severity by region, age, and gender were analyzed. **Results:** Among the 28,291 eligible participants, the Southern region contributed the largest proportion (46.60%) of fatigue. Fatigue severity increased with age, with elderly individuals showing the highest prevalence of severe fatigue (25.83%). The Eastern region recorded the highest prevalence (14.18%) of severe fatigue. Men reported higher rates of mild fatigue than women (34.25% vs. 27.63%). These patterns indicate significant demographic differences in fatigue severity across the population ($p < 0.0001$). **Discussion:** Fatigue severity varies with age, region, and gender. Micronutrients like L-carnitine, vitamin B12, and folic acid may help manage fatigue, but further research is needed to confirm their effectiveness.*

Keywords: Fatigue, India, Fatigue assessment scale, Fatigue Severity

1. Introduction

Fatigue is a symptom that is not easily alleviated by conventional methods of restoring energy, such as resting and sleeping, and often interferes with routine activities. There is no uniform definition of fatigue, and individuals describe fatigue in various ways, ranging from a general lack of energy to profound physical weakness, often accompanied by tiredness, daytime sleepiness, and exhaustion [1]. It can negatively affect an individual's performance at work as well as social and family relationships [2]. Fatigue imposes a substantial economic burden, primarily through reduced productivity and loss of employment. Additionally, the need for informal care from family and friends further increases the financial strain on households [3].

The perception of fatigue differs by gender; men commonly describe it as tiredness, whereas women are more likely to associate it with emotional states, such as anxiety or depression. This highlights the importance of including both genders in the study to ensure a comprehensive understanding of fatigue experiences [2], [3].

The etiology of fatigue is multifactorial. It may result from underlying medical conditions (secondary fatigue) or imbalances in sleep, exercise, or diet that can be alleviated with rest (physiological fatigue). Secondary fatigue is often linked to edema, goiter, lymphadenopathy, poor muscle tone, neurological abnormalities, and cardiac murmur. Fatigue that persists for more than 6 months despite

adequate rest is called chronic fatigue and is frequently associated with diabetes, chronic kidney disease, congestive heart failure, sleep apnea, medications (e.g., sedative-hypnotics and antidepressants), substance abuse, depression, or anxiety [2].

A correlation between pain intensity and chronic fatigue has also been observed across various conditions in which pain is a dominant symptom, such as individuals with rheumatoid arthritis, osteoarthritis, low back pain, fibromyalgia, headaches, and cancer. Pain intensity scores in these individuals significantly correlate with fatigue measurement scores. About 50% of individuals with chronic pain mention fatigue to be the most challenging symptom [4]. Studies also indicate that about 50% of people with complaints of fatigue are diagnosed with one or more conditions, such as thyroid dysfunction, infections, diabetes mellitus, anemia, and cancer [5].

Effective fatigue management requires a multifaceted approach that addresses both underlying causes and symptom relief. Addressing the root cause, along with regular monitoring, patient counseling, and regular follow-ups, plays a crucial role in managing fatigue. Additionally, psychoeducational interventions and behavioral therapy may contribute to improved overall well-being [6]. Among the most effective strategies for fatigue management is gradual physical activity combined with cognitive behavioral therapy [7].

In addition to diagnosing and managing the underlying condition, focusing on nutritional support is equally important; vitamins and minerals are essential for optimal cellular function, oxygen transport, metabolism, neuronal activity, and DNA synthesis [5]-[8]. Deficiencies in nutrients, such as vitamin B complex, vitamin C, sodium, zinc, iron, and magnesium, have been linked to physical fatigue. Moreover, vitamin and mineral supplementation also influences cognitive and psychological processes, including physical and mental fatigue [8]-[10]. Deficiency of L-carnitine, a micronutrient derived from the methylation of lysine, is also associated with fatigue, muscle weakness, and low energy levels [7].

A bidirectional relationship exists between nutrition and fatigue—poor nutrition can lead to weight loss and deficiencies that contribute to fatigue, while fatigue itself may result in inadequate food intake due to reduced energy for meal preparation [10]. Appropriate supplementation with vitamins and minerals can play a beneficial role in managing fatigue [7].

Given the subjective nature of fatigue, its diagnosis and severity are often assessed using self-reported questionnaires [11]. One of the widely used tools to assess fatigue severity is the Fatigue Assessment Scale, a 10-item fatigue measure that uses statements to refer to how one usually feels. It is a valuable tool known for its psychometric qualities, simplicity, and ease of use, and remains reliable and valid despite gender-based differences in the way fatigue is described [12].

Though comprehensive data are limited, fatigue prevalence appears to be increasing in all age groups [5], [13]-[15]. Results from a 2019 cross-sectional questionnaire-based survey, adopted from the Brief Fatigue Inventory, in corporate workers aged 24-40 years in four major cities in India (Delhi-Gurgaon, Bangalore, Pune, and Kolkata) indicated that about 80% of respondents had moderate-to-severe fatigue [13]. A 2023 study estimated that 70.66% of middle-aged individuals in Ahmedabad, India, reported experiencing fatigue [14]. According to the available data from a meta-analysis using a random-effects model to produce point estimates and 95% confidence intervals of prevalence with subgroup analysis, general fatigue (fatigue for <6 months) affects about 20.4% of adults and 11.7% of minors, while chronic fatigue (fatigue for >6 months) affects 10.1% of adults and 1.5% of minors [5]. However, there is a dearth of data on the prevalence and severity of fatigue across different age groups, genders, and regions of India. Therefore, this study was conducted to bridge this gap by assessing physical fatigue levels using the Fatigue Assessment Scale.

2. Methodology

This pan-India, cross-sectional, observational study was conducted to assess the prevalence and severity of physical fatigue among individuals of different age groups and genders from different geographical regions of India. This survey involved minimal risk to participants and did not collect any personally identifiable information. Thus, ethics committee approval was not needed. The study was

conducted in compliance with the ethical principles of the Declaration of Helsinki.

The study collected data from a total of 30,899 individuals. The participants included in the study were from the Central region (Madhya Pradesh), Southern region (Kerala, Karnataka, Andhra Pradesh, Tamil Nadu, and Telangana), Eastern region (Bihar, Jharkhand, West Bengal, and Orissa), Western region (Maharashtra, Goa, and Gujarat), North Eastern region (Assam and Manipur), and Northern region of India (Chandigarh, Delhi, Haryana, Uttarakhand, Uttar Pradesh, Punjab, Rajasthan, and Jammu and Kashmir).

Adult men and women aged 18 to 99 years (both ages inclusive) and capable of understanding and responding to the questions verbally were included in this analysis. Participants were recruited through fatigue awareness health camps in both rural and urban areas to ensure representation from diverse socioeconomic and occupational backgrounds. Trained field investigators explained the purpose of the survey in the local language, obtained verbal consent, and then delivered the survey. Of the 30,899 participants, 2,608 participants were excluded due to missing data and/or failure to meet the age criterion. Eligible participants were divided into the following age groups for analysis: youth (18-25 years), young adults (26-40 years), middle-aged adults (41-65 years), and the elderly (66-99 years).

Data from 28,291 participants were collected from September 7, 2022, to January 28, 2023, by verbally asking the first five questions (for physical fatigue) of the 10-item Fatigue Assessment Scale for maximum response rate, as demonstrated in Table 1. We did not include the questions 6 to 10 related to mental fatigue in our study.

Table 1: Questionnaire Used in the Study [12]

Question number	Question
1	I am bothered by fatigue
2	I get tired very quickly
3	I don't do much during the day
4	I have enough energy for everyday life
5	Physically, I feel exhausted

For each statement, the participants had to choose options one to five, where 1=Never, 2=Sometimes, 3=Regularly, 4=Often, and 5=Always. The minimum and maximum possible scores were 5 and 25, respectively. The total scores of each participant were recorded and tabulated. Based on these scores, participants were further categorized into three groups, mild, moderate, and severe fatigue.

Data entry was performed using Microsoft Excel, and data cleaning was conducted to remove incomplete or inconsistent responses prior to analysis. The statistical significance was determined using the Chi-square test, with a $p < 0.05$ considered to be statistically significant. All statistical analyses were performed using IBM SPSS Statistics software, version 26.0.

3. Results

Data collected from 28,291 participants, which included 11,838 (41.84%) women and 16,453 (58.16%) men, was included in the analysis.

As seen in Figure 1, participants from the Southern region of India (46.60%) contributed the largest proportion, followed by the Western (19.23%), Northern (12.58%), Eastern (11.02%), Central (9.80%), and Northeastern (0.77%) regions.

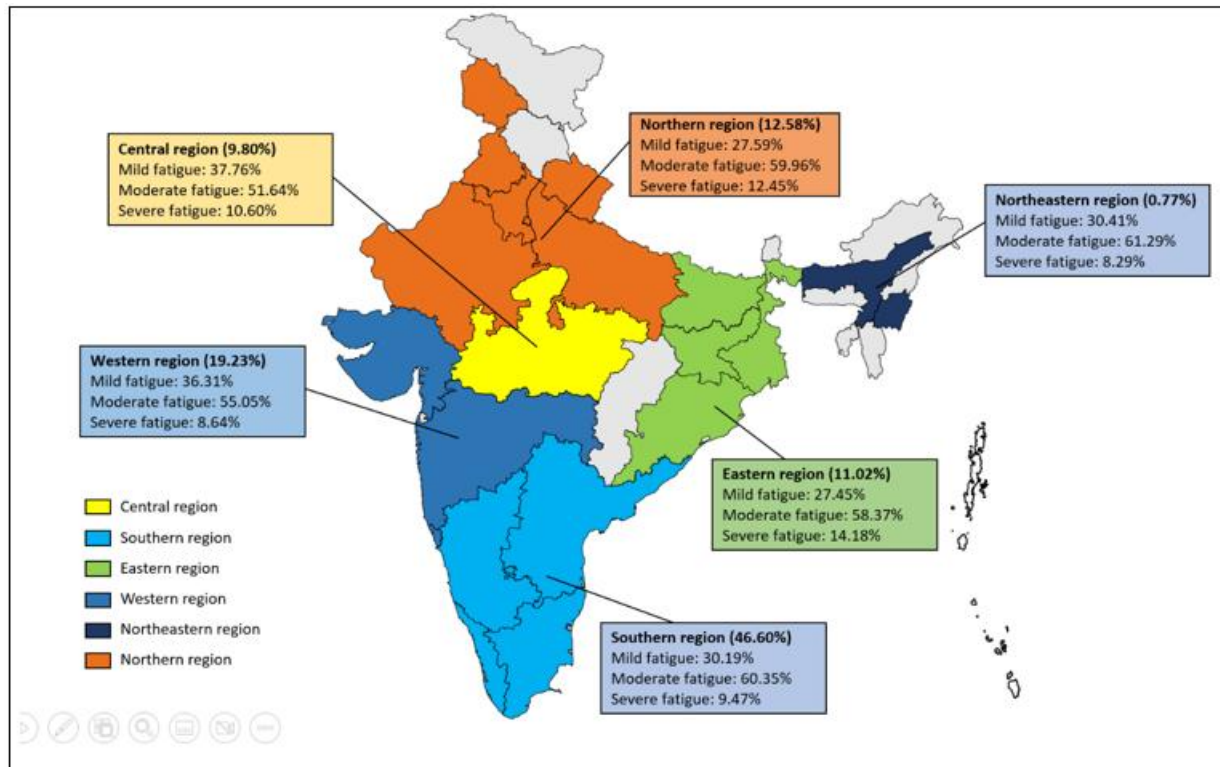


Figure 1: Regional variations in fatigue prevalence and severity [16]

The distribution of fatigue severity across different age groups highlights a progressive increase in fatigue severity with advancing age. Figure 2 demonstrates the variations in fatigue severity with age.

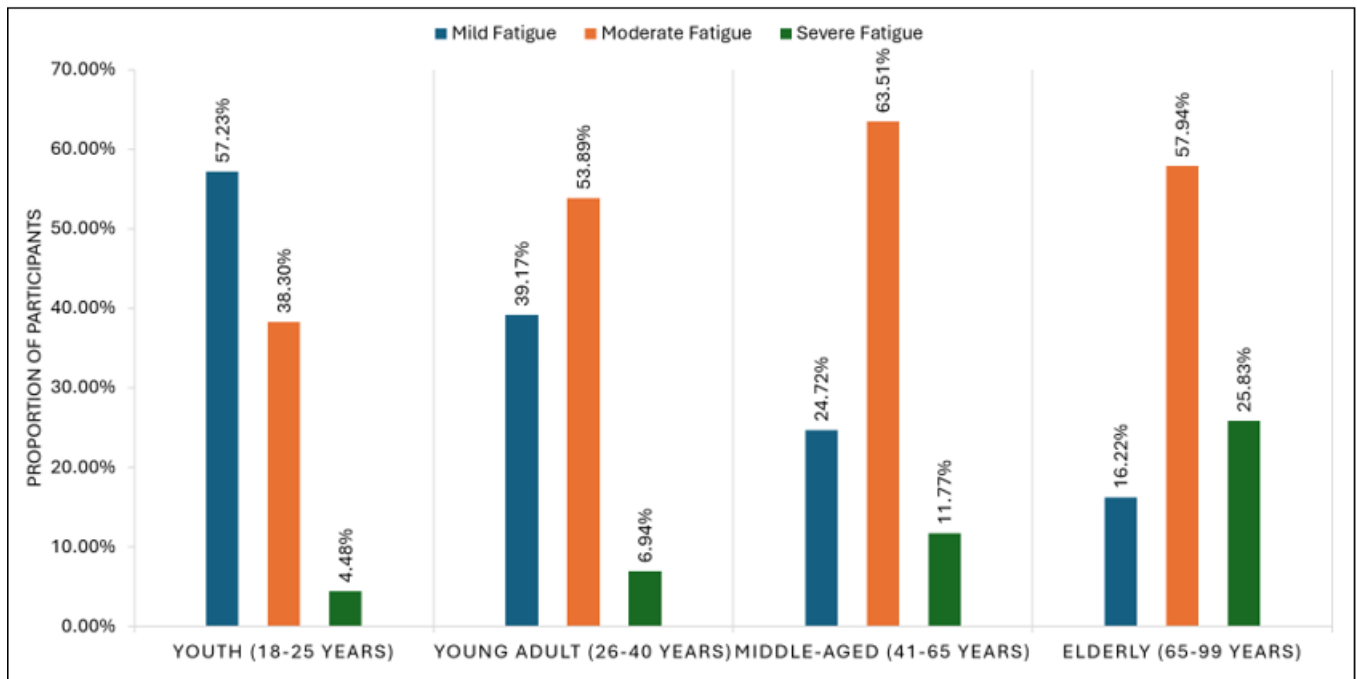


Figure 2: Fatigue severity by age group

Figure 3 indicates that middle-aged women constituted approximately 51.50% of the total female study population, while middle-aged men accounted for approximately 51.85% of the total male study population.

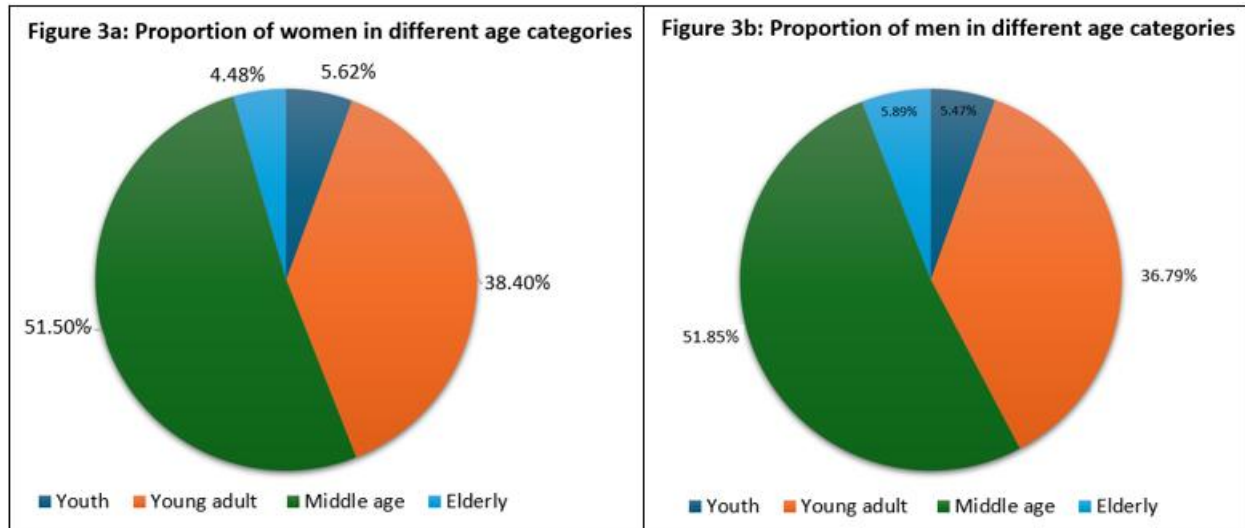


Figure 3: Proportion of men and women with fatigue in different age categories

A higher proportion of men reported mild fatigue, while moderate and severe fatigue were higher in women, as seen in Figure 4.

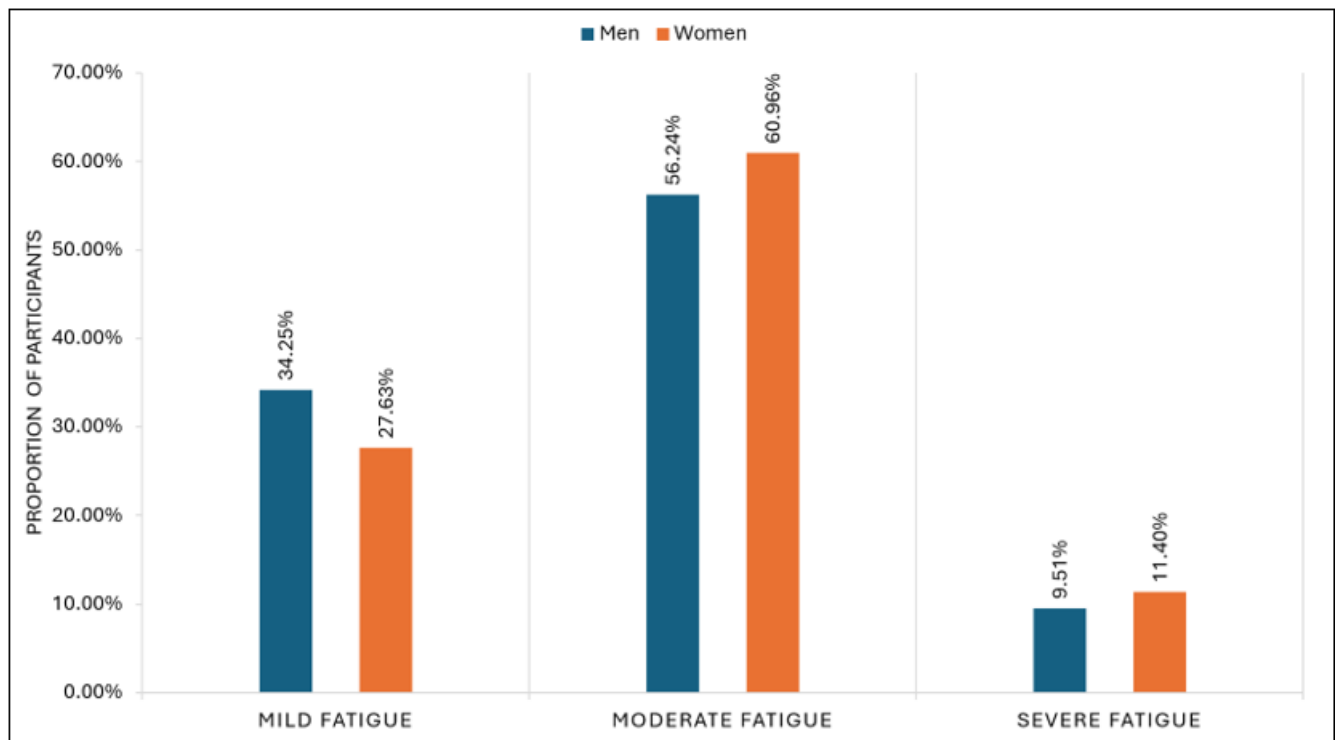


Figure 4: Fatigue severity by gender

Table 2 presents the distribution of mild, moderate, and severe fatigue among men and women across age groups and regions of India.

Table 2: Distribution of mild, moderate, and severe fatigue based on region, age categories, and gender

		Mild	%	Moderate	%	Severe	%	Chi-square	p-value
Region	Central	1047	37.76	1432	51.64	294	10.60	243.705	<0.0001
	South	3980	30.19	7957	60.35	1248	9.47		
	East	856	27.45	1820	58.37	442	14.18		
	West	1975	36.31	2994	55.05	470	8.64		
	North East	66	30.41	133	61.29	18	8.29		
	North	982	27.59	2134	59.96	443	12.45		
Age Categories	Youth	895	57.23	599	38.30	70	4.48	1611.819	<0.0001
	Young Adult	4152	39.17	5712	53.89	736	6.94		
	Middle Age	3616	24.72	9291	63.51	1722	11.77		
	Elderly	243	16.22	868	57.94	387	25.83		
Gender	Male	5635	34.25	9253	56.24	1565	9.51	146.104	<0.0001
	Female	3271	27.63	7217	60.96	1350	11.40		

The distribution of fatigue severity (mild, moderate, and severe) varied significantly by region, age group, and gender, as indicated by the highly significant Chi-square results (Chi-square: Region=243.705; Age=1611.819; Gender=146.104; all $p < 0.0001$), highlighting important demographic trends.

As seen in Table 2, the Central region demonstrated the highest percentage of mild fatigue cases (37.76%), the Northeastern region demonstrated the highest percentage of moderate fatigue cases (61.29%), and the Eastern region demonstrated the highest percentage of severe fatigue cases (14.18%). It was observed that moderate fatigue was most prevalent in all regions as compared to mild and severe fatigue.

Age-related rise in severity of fatigue was also noted, with mild fatigue being most prevalent in youths (57.23%), moderate fatigue in middle-aged individuals (63.51%), and severe fatigue in the elderly (25.83%). Severe fatigue was least prevalent in the youth category.

Gender analysis data revealed that mild fatigue was more frequently reported by men (34.25%), whereas moderate and severe fatigue were more frequently reported by women (60.96% and 11.40%, respectively).

4. Discussion

The findings of the study provide valuable information on the prevalence and severity of fatigue in individuals of various age groups and genders across different regions in India.

Fatigue severity among different age groups

Our study found that fatigue severity increases with age. While youths experienced more mild fatigue, young adults demonstrated a shift toward moderate fatigue. Middle-aged individuals reported the highest prevalence of moderate fatigue, alongside a rise in severe fatigue. Addressing nutritional gaps and improving lifestyle interventions in this age group could be crucial in preventing further progression of fatigue. Elderly individuals exhibited the lowest prevalence of mild fatigue (16.22%) but the highest burden of severe fatigue (25.83%). This sharp increase in fatigue severity is likely attributed to age-related physiological decline, chronic health conditions, and micronutrient deficiencies, particularly in essential vitamins and minerals. This aligns with the narrative review of biochemical and

clinical evidence published by Tardy et al. (2020), indicating that the deficiencies of vitamin B complex, vitamin C, magnesium, and iron can cause fatigue [9].

Additionally, middle-aged women, including those undergoing perimenopause, commonly reported fatigue. Coslov N et al. (2024) reported that 63.3% of perimenopausal women and those in the late reproductive stage (average age 47.3 years), who described not feeling like themselves, experienced fatigue—along with symptoms such as pain, brain fog, and volatile mood—at least 50% of the time over the past 3 months [17].

Fatigue severity across different regions

The distribution of fatigue severity across different regions demonstrated that mild fatigue was most commonly reported in the Central and Western regions, while the Northern and Eastern regions had the lowest proportions. Moderate fatigue was the most prevalent category across all regions, ranging from 51.64% in the Central region to 61.29% in the Northeastern region. In contrast, severe fatigue demonstrated significant regional variability, with the highest prevalence in the Eastern and Northern regions.

Fatigue severity across genders

Fatigue severity differed between men and women across regions. In our study, men reported higher levels of mild fatigue than women in several regions. However, a higher proportion of women reported moderate and severe fatigue.

These variations indicate that fatigue is also dependent on factors such as gender and region. As the perception of fatigue differs by gender, with men describing it as tiredness and women associating it with emotional states, symptom reporting may be influenced by these differences in perception affecting the distribution of men and women across fatigue severity categories observed in this study [2], [3].

Management strategies

Given the negative impact of fatigue on health, identifying its underlying causes is essential for effective management. Factors such as illness, sleep quality, stress, obesity, and nutritional status can influence the severity of fatigue [18]. Additionally, a history of COVID-19 infection is a known risk factor for fatigue. Post-COVID fatigue is more prevalent among the elderly, women, and individuals with pre-existing comorbidities, depression, or anxiety [19]. Moreover, although fatigue is a common complaint in the

elderly, it is difficult to attribute it to one single factor [10]. Because fatigue is associated with a wide range of medical and psychological conditions, determining its exact cause is challenging.

In the absence of standard guidelines for evaluating fatigue, a range of investigations, such as complete blood count, blood glucose, liver function tests, and thyroid hormone panel, are usually done to determine its underlying cause [20].

Both pharmacological and non-pharmacological strategies can be used for the management of fatigue. Non-pharmacological management includes exercise therapy (moderate-intensity aerobic exercise, walking, and yoga); maintaining good sleep hygiene with a regular sleep-wake cycle; avoiding caffeine, nicotine, and alcohol; reducing screen time, light, and noise exposure before sleep; cognitive behavioral therapy; counseling; and psychoeducation. Pharmacotherapy is considered only if non-pharmacological measures fail to provide adequate relief [20].

Nutritional supplementation for managing fatigue

Deficiencies of vitamins and minerals have been associated with physical fatigue, although symptoms are often nonspecific and may go unnoticed [9]. When taken in adequate amounts, vitamin and mineral supplementation helps support normal physiological functions by restoring essential biochemical processes. Studies in vitamin-deficient patients have shown that supplementation with vitamins such as vitamin A [21] and vitamin D [22] can improve fatigue severity. Additionally, nutritional supplements like L-carnitine [7], coenzyme Q10 [23], and a combination of coenzyme Q10 with a reduced form of nicotinamide adenine dinucleotide [24] have been found effective in alleviating fatigue symptoms. Published data also suggests that multivitamin supplementation may help reduce fatigue [7], [9].

Additionally, some patients with multiple sclerosis experienced mild-to-severe fatigue despite ongoing treatment for the condition. A study by Bitarafan et al. (2020) proposed a specially formulated supplement (multivitamin-mineral capsules) to evaluate its effect on fatigue in patients with multiple sclerosis [25]. On consuming two multivitamin-mineral capsules containing vitamins A, D, C, B₁, B₆, B₁₂; folic acid; calcium; magnesium; selenium; Q10; and L-carnitine daily for 3 months, a significant reduction in fatigue level was observed. Another published study indicated that a significant proportion of patients with fatigue had low vitamin D levels, and its supplementation led to improvement in fatigue severity. The study included patients who experienced fatigue, provided that any chronic medical conditions were stable at the time of participation [22]. A study by Maric et al. (2014) used a supplement of multivitamins-minerals containing vitamins A, C, D, E, K, B₁, B₂, B₃, B₆, B₁₂; folic acid; biotin; and beta-carotene for the treatment of chronic fatigue syndrome [26]. A significant reduction in fatigue levels was noted after 2 months of supplementation. Haskell et al. (2010) also assessed the effects of multivitamin-mineral supplementation containing vitamins B₁, B₂, B₅, B₆, B₁₂, C, D₃, E, K₁; biotin; folic acid;

calcium; phosphorus; chromium; copper; fluoride; iodine; iron; magnesium; manganese; molybdenum; selenium; and zinc on fatigue and cognitive function in healthy women [27]. Supplementation with a multivitamin-mineral led to improvements in cognitive performance, task accuracy, and reductions in fatigue during extended mental tasks. Additionally, mood deterioration was attenuated and homocysteine levels were significantly reduced in a subset of participants. These results suggest that multivitamin-mineral supplementation may provide cognitive and fatigue-related benefits even in healthy individuals.

Other nutritional interventions have also shown promise in fatigue management. L-carnitine, for instance, has been studied for its role in managing fatigue symptoms [7]. Matsui et al. (2018) assessed the efficacy of L-carnitine to reduce fatigue in cancer patients undergoing chemotherapy [28]. The study found that supplementation with L-carnitine 1500 mg/day reduced fatigue. Similarly, a study by An et al. (2016) assessed the effects of L-carnitine supplementation (990 mg twice daily) in patients with hypothyroidism. The study reported improvements in fatigue severity scale scores in 75% of the patients along with a reduction in physical and mental fatigue. These findings suggest that L-carnitine supplementation may be effective in alleviating fatigue symptoms [29].

This study has certain limitations. The Fatigue Assessment Scale used was not specifically validated for the Indian population, and data collection was limited to physical fatigue only. Furthermore, the use of a verbal survey may have influenced responses, as participants might have altered their answers due to a perceived lack of anonymity. In addition, recruitment was conducted at an awareness camp, which may have introduced selection bias, as patients experiencing severe fatigue might have been underrepresented due to their limited ability to attend such events.

5. Conclusion

This pan-India study highlights the wide variations in fatigue severity across various age groups, genders, and regions. Based on the study, moderate and severe fatigue were slightly more common among women than men, with the highest prevalence of severe fatigue reported in the Eastern and Northern regions. Fatigue severity showed a clear age-related trend, with more younger individuals reporting mild fatigue, while elderly individuals were more affected by severe fatigue, likely influenced by nutrient deficiencies, chronic health conditions, and physiological decline.

In conclusion, given that fatigue is commonly associated with medical conditions, aging, and modifiable factors such as poor diet and physical inactivity, a multi-pronged approach is needed for its management. Further research is also needed to investigate the underlying causes of fatigue across demographic groups and to assess the potential role of multivitamins, minerals, and L-carnitine supplementation in fatigue management.

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