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Gender Variations in Time Perception: A Cross-Sectional Comparative Study

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Abstract

Background: Lipomas arising from the retropharyngeal or prevertebral spaces are uncommon benign tumours that may remain asymptomatic until their gradual enlargement produces compressive symptoms. Clinical manifestations may include dysphagia, nasal regurgitation, voice changes, snoring, and, in severe cases, airway obstruction. Their submucosal location and smooth overlying mucosa may make clinical diagnosis challenging.

Case Presentation: An 80-year-old woman presented with a six-month history of foreign-body sensation in the throat, predominantly solid-food dysphagia, recurrent nasal regurgitation, habitual snoring, and symptoms suggestive of sleep-disordered breathing. Clinical examination revealed a smooth, left-sided bulge involving the posterior pharyngeal wall, with intact overlying mucosa. Contrast-enhanced computed tomography performed on 26 May 2025 revealed a fat-attenuation lesion measuring 1.5 × 2.7 × 4.0 cm, with an attenuation value of approximately −114 HU, located in the left prevertebral space and extending from the skull base to the inferior margin of C2. The lesion produced anterior displacement and narrowing of the airway. A level 2 sleep study demonstrated an apnoea-hypopnoea index (AHI) of 30 events/hour. On 5 June 2025, complete en bloc excision was performed using an endoscopic transoral approach. The encapsulated specimen measured 4 × 2 × 1 cm. Histopathological examination (HP-245/25) revealed lobules of mature adipose tissue separated by fibrous septa, confirming the diagnosis of a lipoma.

Conclusion: The postoperative recovery was uneventful, with complete wound healing at one-month follow-up and considerable improvement in swallowing and airway-related symptoms. At one-year follow-up, the patient remained free from dysphagia, recurrent symptoms of obstructive sleep apnoea, or clinical evidence of tumour recurrence. Repeat sleep assessment demonstrated a marked reduction in the AHI from 30 to 5 events/hour. This case highlights the importance of considering prevertebral lipoma in the differential diagnosis of posterior pharyngeal wall masses. Endoscopic transoral excision can provide a minimally invasive and effective surgical option for appropriately selected patients with medially accessible lesions, with favourable anatomical and functional outcomes.

Keywords: Case report; prevertebral lipoma; retropharyngeal space; posterior pharyngeal wall; dysphagia; obstructive sleep apnoea; endoscopic transoral excision.

Introduction

Time perception is an essential aspect of human cognition that enables individuals to estimate, process, and respond to the passage of time. It plays an important role in everyday activities, including decision-making, attention, memory, learning, and behavioural regulation. Unlike other sensory experiences, the perception of time is subjective and may vary considerably between individuals, even when they are exposed to identical time intervals. Psychological and neurobiological mechanisms, including attention, memory, emotional state, and internal timing processes, contribute to individual variations in temporal perception

[1,2].

Time perception involves different cognitive processes, including prospective and retrospective estimation. Prospective time perception occurs when an individual is aware that they will be required to estimate a particular time interval, whereas retrospective time perception involves estimating duration without prior awareness that the interval will be assessed. These processes are influenced by attention, information processing, and memory, which may affect the accuracy of perceived duration [1,3]. Variations in these mechanisms may contribute to differences in how individuals experience and estimate time.

Gender-related differences in cognitive functioning have been explored across several domains, including attention, memory, sensory processing, and temporal judgement. Previous research has suggested that males and females may differ in certain aspects of time estimation and temporal processing. A meta-analysis by Block et al. reported a small but statistically significant overall sex difference in duration judgements, with the magnitude of the difference varying according to the experimental method used [4]. Similarly, experimental studies have identified differences between males and females in the perception of short time intervals and temporal order [5,6]. However, these findings are not entirely consistent, indicating that gender differences in time perception may depend on the duration assessed, cognitive demands, and experimental conditions [3,4].

Young adulthood represents an important developmental period characterised by continued refinement of cognitive abilities, behavioural regulation, and decision-making processes. Understanding individual differences in temporal perception during this stage may provide useful insights into cognitive functioning and everyday behavioural patterns [7,8]. Despite previous investigations into sex-related variations in time estimation, further comparative research among young adults is warranted. Therefore, the present study aims to compare time perception between young males and females and assess whether significant gender-related differences exist in the estimation of time intervals. The findings may contribute to a better understanding of individual variations in temporal processing and the potential influence of gender on subjective time perception.

Materials & Methods

Study Design

A comparative cross-sectional study was conducted to evaluate gender-related differences in time perception among young adult males and females. The study aimed to assess variations in time estimation accuracy between the two groups under standardised experimental conditions.

Study Setting

The study was conducted in the Department of Physiology, Mysore Medical College and Research Institute, Mysuru, Karnataka, India.

Study Duration

The study was carried out over a period of 12 months, from January 2025 to December 2025.

Study Population

The study population comprised young adults aged 18–25 years, including both male and female participants. Individuals fulfilling the predefined eligibility criteria were recruited from the study institution and evaluated for differences in their perception and estimation of time.

Sample Size

A total of 400 participants were included in the study. The participants were categorised into male and female groups, with unequal representation between the two groups. The gender-wise distribution was documented during data collection and subsequently considered during statistical analysis.

Sampling Technique

Convenience sampling was employed to recruit participants during the study period. Individuals who

fulfilled the inclusion criteria, were available during the data collection period, and provided informed consent were enrolled until the required sample size of 400 was achieved.

Inclusion Criteria

The study included male and female individuals aged 18–25 years who were willing to participate and provided written informed consent. Participants were required to understand the instructions and complete the time estimation assessment independently.

Exclusion Criteria

Individuals with a known history of neurological disorders or psychiatric conditions that could significantly influence cognitive functioning were excluded. Participants with significant visual or hearing impairment affecting the assessment procedure, those taking medications known to substantially influence cognitive or neurological functions, and individuals unable or unwilling to complete the assessment were also excluded.

Study Groups

The participants were divided into two groups based on gender. Group I comprised young adult males, while Group II comprised young adult females. The number of participants in each group was unequal. Both groups underwent the same assessment procedure under comparable experimental conditions to facilitate an appropriate comparison of time perception.

Study Tool

A structured data collection sheet was used to record the demographic details of the participants, including age and gender. Time perception was assessed using a time estimation task. Standardised instructions and predefined time intervals were used to ensure consistency in the assessment procedure across all participants.

Study Procedure

After obtaining written informed consent, eligible participants were enrolled in the study. Relevant demographic information was collected using a structured data collection sheet. Each participant was individually instructed regarding the time estimation task, and the assessment was conducted in a quiet environment to minimise external distractions. Participants were asked to estimate a predefined time interval without referring to external time indicators. Their responses were recorded systematically for subsequent analysis. The same assessment procedure and instructions were followed for all participants to minimise procedural variations between the male and female groups.

Assessment of Time Perception

Time perception was assessed using the time estimation method. Participants were instructed to estimate a predetermined time interval without access to a clock, stopwatch, or other external time reference. The estimated duration provided by each participant was recorded and compared with the actual duration of the interval. The absolute estimation error was calculated as the difference between the estimated and actual durations, irrespective of the direction of deviation. A lower absolute estimation error indicated greater accuracy in time estimation, whereas a higher value represented greater deviation from the actual duration.

Statistical Analysis

The collected data were entered into Microsoft Excel and analysed using the Statistical Package for the Social Sciences (SPSS), version 25. Descriptive statistics were used to summarise the demographic and study variables. Continuous variables were expressed as mean and standard deviation or median and interquartile range, depending on their distribution, while categorical variables were presented as frequencies and percentages. Normality was assessed before selecting appropriate statistical tests. The independent Student's t-test was used to compare normally distributed continuous variables between the two groups, whereas the Mann–Whitney U test was applied for non-normally distributed variables. A p-value of less than 0.05 was considered statistically significant.

Ethical Considerations

The study was initiated after obtaining approval from the Institutional Ethics Committee of Mysore Medical College and Research Institute, Mysuru, in 2025. Written informed consent was obtained from all

participants before enrolment. Participation was voluntary, and confidentiality and anonymity of the collected information were maintained throughout the study. The study was conducted in accordance with established ethical principles for biomedical research involving human participants.

Results

A total of 400 young adults aged 18–25 years were included. The sample comprised 180 males (45.0%) and 220 females (55.0%). Time perception was assessed using an assumed 60-second estimation task. Estimated duration and absolute estimation error were compared between the two groups.

Table 1. Distribution of study participants according to gender

Gender	Number (n)	Percentage (%)
Male	180	45.0
Female	220	55.0
Total	400	100.0

Of the 400 participants, 180 (45.0%) were males and 220 (55.0%) were females. Females constituted a slightly larger proportion of the study population. The unequal group sizes should be considered when interpreting comparisons.

Table 2. Age distribution of participants according to gender

Age group (years)	Male n (%)	Female n (%)	Total n (%)
18–19	36 (20.0)	44 (20.0)	80 (20.0)
20–21	45 (25.0)	55 (25.0)	100 (25.0)
22–23	54 (30.0)	66 (30.0)	120 (30.0)
24–25	45 (25.0)	55 (25.0)	100 (25.0)
Total	180 (100.0)	220 (100.0)	400 (100.0)

The age distribution was identical in percentage terms across the two groups in this illustrative dataset. The largest proportion belonged to the 22–23-year age group (30.0%). This comparable distribution supports a more straightforward descriptive comparison, although other potential confounding factors may remain.

Table 3. Comparison of estimated time duration between male and female participants

Gender	n	Estimated duration (seconds), Mean ± SD	p-value
Male	180	62.8 ± 8.4	
Female	220	65.1 ± 9.1	0.009*

Assuming a target interval of 60 seconds, the mean estimated duration was 62.8 ± 8.4 seconds among males and 65.1 ± 9.1 seconds among females. In this female provided a higher mean estimate. The p-value suggests a statistically significant difference.

Table 4. Comparison of absolute time estimation error between male and female participants

Gender	n	Absolute error (seconds), Mean ± SD	p-value
Male	180	7.1 ± 5.2	
Female	220	8.3 ± 5.8	0.028*

The mean absolute estimation error was 7.1 ± 5.2 seconds among males and 8.3 ± 5.8 seconds among females. A lower absolute error indicates a closer estimate of the actual interval. Thus, these values suggest greater estimation accuracy among males.

Table 5. Categorisation of participants according to absolute estimation error

Absolute error	Male n (%)	Female n (%)	Total n (%)
≤5 seconds	81 (45.0)	82 (37.3)	163 (40.8)
>5 seconds	99 (55.0)	138 (62.7)	237 (59.3)
Total	180 (100.0)	220 (100.0)	400 (100.0)

An absolute error of 5 seconds or less was observed in 45.0% of males and 37.3% of females. An error greater than 5 seconds was more frequent among females (62.7%) than males (55.0%). These are descriptive proportions; a chi-square test using actual data is required before concluding whether the

difference is statistically significant.

Table 6. Summary of time perception parameters

Parameter	Male (n=180)	Female (n=220)	Illustrative p-value
Estimated duration (seconds)	62.8 ± 8.4	65.1 ± 9.1	0.009
Absolute estimation error (seconds)	7.1 ± 5.2	8.3 ± 5.8	0.028

The females had a higher mean estimated duration and a higher mean absolute estimation error than males. The higher absolute error indicates lower accuracy relative to the assumed 60-second target.

Discussion

Time perception is an important aspect of human cognition that influences attention, memory, decision-making and behavioural responses. Although the passage of time is objectively constant, the subjective experience and estimation of time may vary between individuals depending on several cognitive, psychological and environmental factors. The present study was designed to assess gender-related differences in time perception among young adults aged 18–25 years using a time estimation task.

In the present hypothetical study involving 400 participants, females constituted 55% of the study population, while males accounted for 45%. The participants were distributed across the age groups of 18–25 years, with a comparable age distribution between males and females. Maintaining a similar age distribution across the groups is important because cognitive processing and temporal estimation may be influenced by age-related variations in attention and information processing [9].

The mean estimated duration was higher among females (65.1 ± 9.1 seconds) compared with males (62.8 ± 8.4 seconds), assuming a target interval of 60 seconds. The difference was statistically significant in the illustrative analysis ($p = 0.009$). This finding suggests that female participants tended to report a longer duration than male participants during the estimation task. Block et al. reported a small but statistically significant overall sex difference in duration judgements in their meta-analysis, although the findings varied according to whether prospective or retrospective estimation methods were used [8]. Their findings suggest that the method of assessment plays an important role when interpreting gender-related differences in time perception.

The absolute estimation error was also higher among females (8.3 ± 5.8 seconds) than males (7.1 ± 5.2 seconds), with an illustrative p-value of 0.028. Since absolute estimation error represents the magnitude of deviation from the actual duration, a lower value indicates greater estimation accuracy. Therefore, the hypothetical findings suggest that male participants demonstrated relatively greater accuracy in estimating the predefined time interval. However, previous studies have reported variations in the direction of gender differences. Hanson and Buckworth observed lower prospective time estimation ratios among women than men during self-paced running, suggesting that women perceived time as passing more slowly in that particular experimental setting [10]. Such differences highlight the influence of experimental conditions and physiological factors on time perception.

The categorisation of participants according to absolute estimation error showed that 45% of males and 37.3% of females had an estimation error of five seconds or less. Conversely, a higher proportion of females (62.7%) had an estimation error greater than five seconds compared with males (55%). These descriptive findings further illustrate the differences in estimation accuracy observed in the hypothetical dataset. However, the statistical significance of this categorical comparison must be established using an appropriate test applied to the actual study data.

Time perception is a complex cognitive function involving several neural networks, including the prefrontal cortex, basal ganglia, cerebellum and supplementary motor areas. Attention and working memory play

important roles in estimating time intervals, particularly when external time cues are unavailable. Block and Zakay explained that prospective duration judgements are strongly influenced by attention allocated to temporal information, whereas retrospective judgements depend more on memory processes [11]. Similarly, Block and Gruber highlighted the relationship between time perception, attention and memory, emphasising that different cognitive mechanisms contribute to subjective duration estimation [12].

The internal clock model provides a theoretical explanation for variations in subjective time estimation. Allman et al. described the internal clock as a mechanism involving clock speed, temporal memory and attentional time-sharing, which may be influenced by emotional and cognitive factors [13]. More recent neurobiological perspectives have also demonstrated that prospective and retrospective timing involve distinct computational processes supported by neural activity dynamics [14]. These mechanisms may contribute to individual differences in estimating elapsed time.

Previous research examining sex- and gender-related differences in temporal perception has reported mixed findings. Block et al. demonstrated that the magnitude of sex differences depended on the duration judgement paradigm, with different patterns observed in prospective and retrospective estimation [8]. Klapproth also examined prospective and retrospective duration estimation and reported differences in the variability of temporal judgements between the two paradigms [15]. Rammsayer and Lustnauer reported differences between men and women in the discrimination of brief auditory durations, although their findings involved a different temporal assessment method [16]. Collectively, these studies suggest that gender-related differences in time perception cannot be generalised across all temporal tasks.

Strength & Limitation: The study has certain limitations. Convenience sampling may limit the generalisability of the findings to the wider young adult population. The unequal number of male and female participants may also influence the precision of group comparisons. Despite these limitations, the study provides an opportunity to examine gender-related variations in time estimation among young adults using a standardised assessment procedure. Further studies involving larger and more representative populations, multiple time intervals and different methods of temporal assessment may provide a more comprehensive understanding of the factors influencing subjective time perception.

Conclusion

The present study highlights the possibility of gender-related variations in time perception among young adults. Based on the hypothetical findings, female participants demonstrated a higher mean estimated duration and greater absolute estimation error compared with male participants, suggesting relatively higher time estimation accuracy among males. However, time perception is a complex cognitive process influenced by attention, memory, emotional state and individual variations. Further studies involving larger populations and different time estimation tasks are required to establish the consistency and significance of gender-related differences in temporal perception.

Declaration

Conflict of interest: The authors declare that they have no competing interests.

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Reference

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