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A comparative study on emotional reactivity and cognitive functioning between frequent and infrequent earphone users

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Abstract

Background: The growing use of earphones in daily life has raised concerns regarding their possible impact on cognitive functioning and emotional reactivity among young adults.

Objective: To compare emotional reactivity and cognitive functioning between frequent and infrequent earphone users.

Methodology: A cross-sectional study was conducted among 200 participants aged 18-30 years from various educational institutions in Lucknow. Data were collected using a socio-demographic profile sheet, the Perth Emotional Reactivity Scale (PERS), and the Cognitive Assessment Questionnaire (CAQ). Statistical analysis was performed using SPSS-20, applying frequency, percentage, mean, and correlation analyses.

Results: Most participants (72.6%) were aged 20-25 years, and 51.7% were female. The frequency of earphone use showed weak, non-significant correlations with emotional and cognitive variables. However, strong positive correlations were found among cognitive factors such as forgetfulness, distractibility, and false triggering.

Conclusion: Frequent earphone usage did not significantly affect emotional reactivity or cognitive functioning. Duration, listening volume, and content type may have a greater influence.

Keywords: Earphone users, emotional reactivity, cognitive functioning, PERS, CAQ

Introduction

The widespread use of earphones in daily life has transformed the way individuals engage with their environments, communicate, and consume media. As personal audio devices become increasingly ubiquitous, questions have emerged regarding their influence on cognitive functioning and emotional reactivity. This introduction aims to examine the cognitive effects of earphone use, highlighting relevant research, theoretical frameworks, and potential implications for mental health and well-being [1].

Innovation is becoming an essential part of an advanced daily lifestyle and, overall, it also has a negative side effect (such as increased social separation or a lack of close, personal connections with others). As young adults spend more time using portable technologies, they are dedicating less energy to interacting with parents, siblings, and friends. Even if these activities occur in the presence of others, the individual's focus seems to be on these devices. One such device is the earphone [2].

Earphones/headphones have become increasingly popular over time. However, not everyone is aware that prolonged use of this equipment can cause permanent harm to the ear, both short-term and long term. Physical characteristics such as frequency and intensity, as well as other non-occupational noise at high sound levels, determine the impact on hearing health and contribute to a public health issue that affects the majority of the world's population. Sound exposure over an extended period will harm the ear and will not recover quickly [3]. Headphones, like other loud noises, cause damage to the ears, leading in noise-induced hearing loss. However, the headphones do not have to be exceedingly loud to do harm to your ears; even listening to headphones at a moderate volume can cause hearing loss over time. That is because your ears are injured not only by the strength of the noise, but also by the duration of exposure.

If one can hear the sound that is being sent to a person's ear while using headphones/earphones, it implies that the sound is excessively loud and, over a period of time, it would lead to irreversible hearing loss [4].

The Ministry of Labor, Government of India, recommends a maximum safe level of 90 decibels (8 hours per day, 5 days per week) under the Factory Act. A noise level of 86db is similar to city traffic, and the damage is seen after 6.5 hours of use, but 101db is equivalent to a hand drill, and the damage appears after 12 minutes of use. According to the World Health Organization, around 1.1 billion young people worldwide are at risk of hearing loss as a result of exposure from the inappropriate use of portable audio devices. The use of personal audio devices exposes nearly half of all adolescents and young adults (12-36 years old) to harmful sound levels. And at pubs, discos, and clubs, over 40% of them are subjected to potentially dangerous noise levels. Since the introduction and quick spread of Personal Audio Devices (PADs), recreational noise-induced hearing loss has become a significant global public health concern. According to studies, most PADs have output levels that are higher than acceptable (80 dB), which poses a health risk since users who use them for more than an hour a day may develop noise-induced hearing loss [5].

According to neuroscientific theory, processing sound and controlling thought and emotion are functions of the limbic system, prefrontal areas, and auditory cortex. According to functional MRI research, listening to music stimulates parts of the brain linked to memory, reward, and emotional control. Thus, prolonged earphone exposure to auditory stimuli may result in brain changes that impact emotional states and cognitive functioning [6].

Aim and objectives

To compare emotional reactivity and cognitive functioning between frequent and infrequent earphone users.

Methodology

Study design

This was an observational cross-sectional study.

Study setting

The research effort involved individuals of 18-30 years from various colleges, universities, and workplaces in Lucknow city.

Sample size

There were 200 respondents in all, divided into two groups based on their reported earphone usage: frequent users (n = 100) and infrequent users (n = 100). This distribution allows for a balanced comparison to examine the correlation between earphone use, emotional reactivity, and cognitive function. Based on the impact of earphones on emotional reactivity and cognitive functioning, the sample size was calculated using Cochran's well-known formula at a 95% confidence level and 5% absolute precision.

Sampling technique

The study employs a purposive random sampling technique. Initially, participants are purposefully approached based on their reported earphone usage habits (high vs. low/no usage). Within this purposeful selection, randomization is introduced to avoid selection bias and ensure a balanced distribution across key demographics such as age and gender.

Methods of selection

Inclusion criteria

- Adults aged 18-30 years.

Exclusion criteria

- Individuals diagnosed with a neurological or psychological disorder.
- Individuals with hearing impairments or any condition that affects auditory processing.

Methods of measurement

a) Socio-demographic data: This self-constructed sheet is used to collect basic demographic information from participants, including their age, gender, educational background, and earphone usage patterns (e.g., average daily usage time). This tool helps in classifying participants into the high and low/no earphone usage groups and provides contextual background for data interpretation.

b) Perth emotional reactivity scale: The Perth Emotional Reactivity Scale (PERS) is a psychological assessment tool developed to measure how individuals typically respond to emotional stimuli, both positively and negatively. This self-report scale was created by researchers at the University of Western Australia, specifically aiming to distinguish between emotional reactivity across different emotional valences (positive and negative) and types of reactivity (activation, intensity, and duration). By assessing how quickly emotions are triggered, how intense they are, and how long they last, the PERS provides a nuanced understanding of emotional functioning, which is crucial in both clinical and research settings.

The PERS is divided into subscales that reflect three key aspects of emotional reactivity: activation (how easily emotions are triggered), intensity (the strength of the emotional response), and duration (how long the emotion lasts). Each of these aspects is measured separately for both positive and negative emotions. This dual-valence approach makes the PERS unique because it allows for a more detailed emotional profile; individuals may, for instance, have high reactivity to negative emotions but not to positive ones, or vice versa. This level of granularity helps psychologists better understand emotional patterns in mental health conditions such as depression, anxiety, or borderline personality disorder.

Scoring and Results

The Perth Emotional Reactivity Scale-Short Form is an 18-item self-report measure of people's trait levels of emotional reactivity [7]. The PERS-S assesses the emotional reactivity construct as it is defined by Becerra and Campitelli; that is, it measures the typical ease of activation, intensity, and duration of one's emotional responses, and does so for positive (e.g., happiness) and negative (e.g., sadness) emotions separately [8].

Two composite scores and six subscale scores can be derived by summing a participant's responses (i.e., the number they select on the 5-point answer scale) for the relevant items. For all composites and subscales, higher scores indicate higher levels of reactivity in that domain; in other words, that emotions are more easily/quickly activated, more intense, and longer in their duration. The table below describes these subscales and composite scores, and how to calculate them.

Perth Emotional Reactivity Scale (PERS) scoring table

Subscale/composite scores	How to calculate	Content measured
Subscale scores		
Negative-activation	Sum items 2, 8, 14.	The ease/speed of activation of one's negative emotions.
Negative-intensity	Sum items 6, 12, 18.	The intensity of one's negative emotions.
Negative-duration	Sum items 4, 10, 16.	The duration of one's negative emotions.
Positive-activation	Sum items 1, 7, 13.	The ease/speed of activation of one's positive emotions.
Positive-intensity	Sum items 5, 11, 17.	The intensity of one's positive emotions.
Positive-duration	Sum items 3, 9, 15.	The duration of one's positive emotions.
Composite scores		
General negative reactivity	Sum all even-numbered items.	Overall level of reactivity (ease of activation, intensity, and duration) of one's negative emotions.
General positive reactivity	Sum all odd-numbered items.	Overall level of reactivity (ease of activation, intensity, and duration) of one's positive emotions.

c) Cognitive functioning assessment questionnaire: The Cognitive Assessment Questionnaire (CAQ) is a psychological tool designed to evaluate various aspects of an individual's cognitive functioning. It is often used in both clinical and research settings to gather information about how a person perceives, processes, and interprets data, especially in relation to their thoughts, beliefs, and cognitive patterns. Unlike performance-based cognitive tests that assess memory or attention through tasks, the CAQ is a self-report measure, meaning individuals reflect on and report their own cognitive experiences, often focusing on the content and style of thinking rather than cognitive capacity.

The CAQ typically examines areas such as cognitive distortions, automatic thoughts, rigid beliefs, and problem-solving styles. These elements are particularly relevant in Cognitive-Behavioral Therapy (CBT), where identifying and modifying maladaptive thinking patterns is a core part of treatment. For example, individuals with anxiety or depression often display frequent negative automatic thoughts or cognitive biases like catastrophizing or overgeneralization. The CAQ helps clinicians pinpoint such patterns, allowing for more targeted and effective interventions.

Scoring and result

The cognitive assessment questionnaire, originally called the Cognitive Failures Questionnaire (CFQ), was developed by Broadbent *et al*. (1982) to assess the frequency with which people experienced cognitive failures, such as absent-mindedness, in everyday life-slips and errors of perception, memory, and motor functioning. The most straightforward way to score the scale is simply to add up the ratings of the 25 individual items, yielding a score from 0-100. Scores on the scale predict episodes of absent-mindedness in both the laboratory and everyday life, including slow performance on focused attention tasks, traffic and work accidents, and forgetting to save one's data on the computer. Adding scores across the relevant items will yield subscale scores representing these dimensions of forgetfulness:

Forgetfulness (Items 1, 2, 5, 7, 17, 20, 22, and 23): "a tendency to let go from one's mind something known or planned, for example, names, intentions, appointments, and words".

Distractibility (Items 8, 9, 10, 11, 14, 19, 21, and 25): "mainly in social situations or interactions with other people, such as being absentminded or easily disturbed in one's focused attention".

False Triggering (Items 2, 3, 5, 6, 12, 18, 23, and 24): "interrupted processing of sequences of cognitive and motor actions".

d) Methods of data collection: A questionnaire and interviews were used to gather the data. To build rapport and secure the adults' complete participation, visits were undertaken to different parts of Lucknow.

Analysis

Frequency, percentage, mean, SD, T-test, and F-test were also used to determine various parameters in this study.

Statistical analysis

The SPSS-20 version of the program was used to statistically analyze the acquired data using a variety of statistical approaches.

Results

Socio-demographic details

Table 1.1 presents the socio-demographic characteristics of the study participants (N=200). The majority of respondents (72.6%) were aged between 20-25 years, while 26.9% belonged to the 25-31 years age group. In terms of gender distribution, females constituted a slightly higher proportion (51.7%) compared to males (42.8%). Most participants were postgraduates (72.1%), whereas 27.4% were undergraduates. Regarding family structure, 72.6% belonged to nuclear families, and 26.9% lived in joint families. The majority were students (78.6%), with 20.9% identifying as professionals. A larger share of respondents resided in local or urban areas (71.1%) compared to rural regions (28.4%). With respect to earphone usage patterns, 62.7% reported using earphones daily, while 36.8% used them occasionally, rarely, or not at all. Music was the most preferred content (83.6%), followed by podcasts or spoken-word content (7.5%) and other forms (8.5%). Concerning the duration of earphone use, one-third (33.3%) used them for less than an hour per day, 31.3% for one to two hours, 18.4% for two to three hours, and 16.4% for more than three hours daily. As for the volume level, 44.3% listened at a medium volume, 30.3% at a low level, 19.9% at a high level, and 5.0% at a very high volume.

Table 1.1: Socio-demographic details of the study

Characteristics	Frequency N=200	Percentage (%)
Age (in years)		
20-25	146	72.6
25-31	54	26.9
Gender		
Male	86	42.8
Female	104	51.7
Educational qualification		
Undergraduate	55	27.4
Post-graduate	145	72.1
Type of family		
Nuclear	146	72.6
Joint family	54	26.9
Occupational status		
Student	158	78.6
Professional	42	20.9
Geographical location		
Rural	57	28.4
Local	143	71.1
Earphone usage		
Daily	126	62.7
Occasionally/Rarely/Not at all	74	36.8
Content preference		
Music	168	83.6
Podcast/spoken words	15	7.5
Other	17	8.5
Duration of earphone use		
Less than 1 hour	67	33.3
1 to 2 hours	63	31.3
2 to 3 hours	37	18.4
More than 3 hours	33	16.4
Level of volume		
Low	61	30.3
Medium	89	44.3
High	40	19.9
Very high	10	5.0

Comparison of emotional reactivity and cognitive functioning between frequent and infrequent earphone users

Table 1.2 presents the correlation coefficients between frequent and infrequent earphone users and various psychological variables, namely forgetfulness, distractibility, false triggering, general negativity, and general positivity. The results indicate that earphone usage frequency shows very weak and statistically insignificant correlations with all psychological variables, suggesting minimal direct association. A strong positive correlation was observed between forgetfulness and distractibility (r = .665, *p*<0.01), as well as between forgetfulness and false triggering (r = .729, *p*<0.01)**,** indicating that individuals who reported higher levels of forgetfulness also tended to experience greater distractibility and false triggering. Similarly, distractibility was found to be positively correlated with false triggering (r = .606, *p*<0.01), demonstrating a consistent relationship among these cognitive aspects. Furthermore, a weak positive correlation existed between general negativity and general positivity (r = .160, *p*<0.05), implying that while generally independent, minor overlaps may exist between these affective tendencies. No significant correlations were found between earphone usage and either general negativity or general positivity, suggesting that the frequency of earphone use does not substantially influence the participants' emotional states.

Table 1.2: Correlation between frequent and infrequent earphone users and psychological variables

S. No.	Variables	Frequent and infrequent earphone users	Forgetfulness	Distractibility	False triggering	General negativity	General positivity
1.	Frequent and infrequent earphone users	1	.045	.137	-.007	-.061	.041
2.	Forgetfulness	.045	1	.665**	.729**	-.055	-.044
3.	Distractibility	.137	.665**	1	.606**	-.014	-.076
4.	False triggering	-.007	.729**	.606**	1	-.059	.058
5.	General negativity	-.061	-.055	-.014	-.059	1	.160*
6.	General positivity	.041	-.044	-.076	.058	.160	1

Discussion

The present study investigates the relationship between the frequency of earphone use and various aspects of emotional reactivity and cognitive functioning, namely forgetfulness, distractibility, false triggering, general negativity, and general positivity. The widespread integration of earphones into daily life has transformed patterns of communication, entertainment, and personal engagement. As the duration and frequency of earphone use increase, concerns have emerged regarding their potential psychological implications. This study aims to examine the correlation between frequent and infrequent earphone users and selected psychological variables, including emotional reactivity, stress, and attention. Understanding these associations is essential to assessing the cognitive and emotional consequences of prolonged earphone use and to inform future research on its impact on psychological well-being [10]. The first variable, "How often do you use earphones," demonstrates very weak correlations with all other variables in the matrix. Its strongest correlation is with distractibility (r = .137), suggesting that individuals who frequently use earphones may experience slightly higher levels of distractibility. However, this correlation is not statistically significant, and its magnitude is too small to draw any firm conclusions. Similarly, the correlation with forgetfulness is positive but minimal (r = .045), while false triggering is nearly zero (r =-.007). The correlations with general negativity (r =-.061) and general positivity (r = .041) are also weak and non-significant. These findings suggest that the frequency of earphone usage alone does not strongly predict either cognitive functioning or emotional reactivity.

Forgetfulness, however, shows strong and statistically significant correlations with both distractibility (r = .665**) and false triggering (r = .729**). These positive relationships indicate that individuals who report being more forgetful are also more likely to become easily distracted and emotionally reactive, as shown by false triggering. This clustering suggests a common cognitive-emotional pattern, possibly reflecting underlying executive function issues such as poor attention control or working memory. On the other hand, forgetfulness is only weakly and negatively correlated with general negativity (r =-.055) and general positivity (r =-.044), suggesting that being forgetful does not necessarily make one feel more negative or less positive in general.

Similarly, distractibility is significantly and positively associated with false triggering (r = .606**), which supports the idea that attentional difficulties are closely linked with increased emotional reactivity. This further reinforces the connection between cognitive lapses and emotional sensitivity. However, like forgetfulness, distractibility is not significantly associated with general mood states. Its correlations with general negativity (r =-.014) and general positivity (r =-.076) are both weak and non-significant, indicating that being easily distracted does not strongly influence a person’s overall emotional outlook.

False triggering also exhibits significant correlations with the two core cognitive variables forgetfulness and distractibility but not with either general negativity or general positivity. The correlation with general negativity (r =-.059) is negative but very weak, while the correlation with general positivity (r = .058) is weakly positive. These findings suggest that false triggering, as a specific form of emotional reactivity (such as being easily startled or emotionally provoked), may function somewhat independently of broader mood traits like general positivity or negativity. An interesting result emerges from the relationship between general negativity and general positivity. These two variables show a small but statistically significant positive correlation (r = .160*). Although it might be expected that these constructs would be negatively related (i.e., more negativity corresponds to less positivity), the positive correlation could indicate that some individuals experience high levels of both emotions simultaneously perhaps as emotional complexity or mood variability. This small yet significant association could reflect a dual emotional profile in certain individuals who experience intense highs and lows.

Finally, general negativity and general positivity each show weak relationships with the cognitive and emotional reactivity variables. General negativity has slightly negative correlations with forgetfulness (r =-.055), distractibility (r =-.014), and false triggering (r =-.059), none of which are statistically significant. General positivity shows similarly weak correlations with these variables:-.044 with forgetfulness,-.076 with distractibility, and .058 with false triggering.

These results suggest that general affective states (positivity and negativity) are not closely tied to momentary cognitive lapses or specific forms of emotional reactivity in this sample.

In summary, the matrix highlights strong interconnections among the cognitive and emotional reactivity variables, particularly forgetfulness, distractibility, and false triggering. These findings suggest that individuals experiencing one of these symptoms are likely to experience the others, possibly pointing to a shared underlying cognitive-emotional process. However, general affective states and the frequency of earphone use do not show significant relationships with these variables. This implies that while earphone use is not a major standalone factor in cognitive or emotional functioning, attentional and memory issues play a more central role in influencing emotional reactivity [11].

Conclusion

A direct comparison between daily users (frequent) and occasional or non-users (infrequent) revealed no significant differences in emotional reactivity, neither in general negative nor positive emotional responses (p-values .395 and .565 respectively). Cognitive functioning metrics forgetfulness, distractibility, and false triggering, also showed no significant variation between these groups. These results indicate that the frequency of earphone use per se does not directly correspond to emotional or cognitive impairments. Instead, other factors such as the duration of individual use episodes, volume, and content type may play more substantial roles. Correlational analyses further revealed that earphone use frequency is weakly related to cognitive and emotional variables, reinforcing the idea that it is not the frequency but the qualitative aspects (duration, volume, content) that matter. The strong relationships between cognitive variables imply a common underlying factor perhaps cognitive load or auditory distraction affecting these domains.

Ethical consideration

Prior to administering the surveys, the study participants gave their informed permission.

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Nil.

Conflicts of interest

No conflicts of interest exist.

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