

## DUAL-TASK INTERFERENCE AND AUDITORY REACTION TIME IN ZUMBA PERFORMERS

Asmita Singh<sup>1</sup>, Atul Jain Singhai<sup>1</sup>, Vesti Randa<sup>2</sup>, Manjula Mehta<sup>3</sup>

<sup>1</sup>Senior Resident, Department of Physiology, JNMCH, AMU, Aligarh, Uttar Pradesh, India

<sup>2</sup>Associate Professor, Department of Physiology, MGMMC, Indore, Madhya Pradesh, India

<sup>3</sup>Assistant Professor, Department of Physiology, MGMMC, Indore, Madhya Pradesh, India

Received : 05/03/2026

Received in revised form : 22/04/2026

Accepted : 11/05/2026

**Keywords:**

Dual-task interference, auditory reaction time, Zumba, cognition, motor coordination.

Corresponding Author:

**Dr. Asmita Singh**

Email: singhasmita421@gmail.com

DOI: 10.47009/jamp.2026.8.3.128

Source of Support: Nil,

Conflict of Interest: None declared

*Int J Acad Med Pharm*  
2026; 8 (3); 696-698



### ABSTRACT

**Background:** Dual-task paradigms impose increased demands on attentional and executive control systems, often leading to performance deterioration. Zumba, a structured aerobic dance form, requires continuous integration of cognitive and motor processes. The objective is to evaluate the effect of dual-task interference on auditory reaction time (ART) among trained Zumba performers. **Materials and Methods:** A cross-sectional observational study was conducted on 40 trained Zumba performers aged 18–40 years. ART was assessed using a digital reaction time apparatus under single-task and dual-task conditions. The dual-task involved simultaneous auditory response and cognitive counting. Data were analyzed using paired t-test. **Result:** The mean ART significantly increased from  $182.4 \pm 21.6$  ms under single-task conditions to  $231.7 \pm 25.3$  ms under dual-task conditions ( $t = 12.84$ ,  $p < 0.001$ ). **Conclusion:** Dual-tasking significantly prolongs auditory reaction time, indicating cognitive-motor interference even in trained individuals.

## INTRODUCTION

Dual-task performance refers to the simultaneous execution of two tasks that compete for shared neural and cognitive resources. When the cumulative demand exceeds available attentional capacity, performance in one or both tasks deteriorates—a phenomenon known as dual-task interference.<sup>[1-3]</sup>

Zumba is a popular aerobic dance program that integrates rhythmic auditory cues with coordinated motor responses. It requires sustained attention, motor planning, timing, and rapid sensory processing. Such activities heavily engage cortical and subcortical networks responsible for sensorimotor integration.<sup>[4-6]</sup>

Reaction time, particularly auditory reaction time (ART), is a sensitive and objective indicator of central processing speed, attentional allocation, and neuromuscular coordination. While dual-task interference has been extensively studied in general populations, there is limited literature exploring its impact in trained performers such as dancers.<sup>[7-9]</sup>

This study aims to assess the influence of dual-task conditions on ART in Zumba performers, thereby contributing to understanding cognitive-motor interactions in trained individuals.

## MATERIALS AND METHODS

**Study Design:** Cross-sectional observational study.

**Study Setting:** Department of Physiology, in collaboration with trained Zumba centers.

### Sample Size

Total participants:  $n = 40$

### Inclusion Criteria

- Age between 18–40 years
- Minimum 3 months of regular Zumba training
- Apparently healthy individuals

### Exclusion Criteria

- Neurological or musculoskeletal disorders
- Hearing impairment
- Use of medications affecting CNS function

### Study Procedure

Auditory reaction time was recorded using a digital reaction time apparatus under two conditions:

#### 1. Single-task Condition

- Participants responded to an auditory stimulus as quickly as possible.

#### 2. Dual-task Condition

- Participants responded to the auditory stimulus while simultaneously performing a cognitive task (serial counting).

Each participant performed five trials per condition, and the mean value was recorded to reduce variability.

### Statistical Analysis

- Data expressed as Mean  $\pm$  Standard Deviation (SD)
- Normality assessed prior to analysis
- Paired t-test used for comparison between conditions
- Statistical significance set at  $p < 0.05$ .

## RESULTS

**Table 1: Comparison of Auditory Reaction Time**

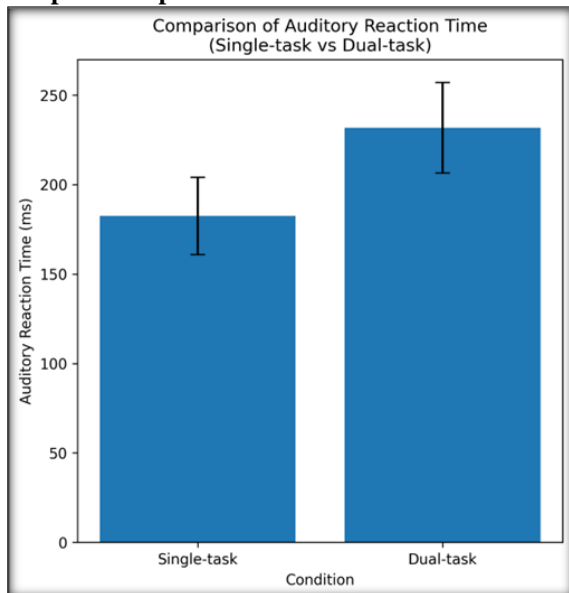
Condition	Mean (ms)	SD	t-value	p-value
Single-task	182.4	21.6		
Dual-task	231.7	25.3	12.84	<0.001*

\*Statistically significant

**Table 2: Individual Data (Sample of 10 Participants)**

Participant	Single-task (ms)	Dual-task (ms)
1	170	220
2	185	240
3	190	250
4	175	225
5	200	260
6	180	230
7	165	210
8	195	245
9	178	228
10	188	238

### Graphical Representation



### DISCUSSION

The present study demonstrates a significant prolongation of auditory reaction time under dual-task conditions in trained Zumba performers. The observed increase of approximately 49 ms highlights the presence of cognitive-motor interference.<sup>[10-12]</sup>

These findings can be explained by the capacity-sharing theory, which posits that attentional resources are limited and must be distributed across tasks. When two tasks are performed simultaneously, competition for these resources leads to delayed processing and response execution.<sup>[13]</sup>

Despite regular training and enhanced coordination in Zumba performers, dual-task conditions still resulted in significant performance decline. This suggests that even trained individuals are not immune to attentional overload.<sup>[14]</sup>

The findings are consistent with previous studies demonstrating impaired reaction time during divided attention tasks, reinforcing the role of executive control and working memory in motor performance.<sup>[15]</sup>

### CONCLUSION

Dual-tasking significantly increases auditory reaction time in Zumba performers, indicating reduced processing efficiency due to divided attention. These findings emphasize the importance of cognitive load in motor performance, even among trained individuals.

#### Limitations

- Moderate sample size
- Absence of a sedentary control group
- Lack of gender-based or experience-based subgroup analysis

### REFERENCES

1. Pashler H. Dual-task interference in simple tasks: data and theory. *Psychol Bull.* 1994.
2. Schmidt RA, Lee TD. *Motor Control and Learning*. 5th ed. Human Kinetics.
3. Kahneman D. *Attention and Effort*. Prentice-Hall; 1973.
4. Wickens CD. Multiple resources and performance prediction. *Theor Issues Ergon Sci.* 2002;3(2):159–177.
5. Abernethy B. Dual-task methodology and motor skills research: Some applications and methodological constraints. *J Hum Mov Stud.* 1988;14:101–132.
6. Beurskens R, Bock O. Age-related deficits of dual-task walking: A review. *Neural Plast.* 2012;2012:131608.
7. Leone C, Feys P, Moundjian L, D'Amico E, Zappia M, Patti F. Cognitive-motor dual-task interference: A systematic review of neural correlates. *Neurosci Biobehav Rev.* 2017;75:348–360.
8. McMorris T. *Exercise-cognition interaction: Neuroscience perspectives*. London: Academic Press; 2016.
9. Schmidt RA. A schema theory of discrete motor skill learning. *Psychol Rev.* 1975;82(4):225–260.
10. Welford AT. Choice reaction time: Basic concepts. In: Welford AT, editor. *Reaction times*. London: Academic Press; 1980. p. 73–128.

11. Luque-Casado A, Perales JC, Cárdenas D, Sanabria D. Heart rate variability and cognitive processing: The autonomic response to dual-tasking. *Front Physiol.* 2016;7:1–12.
12. Al-Yahya E, Dawes H, Smith L, Dennis A, Howells K, Cockburn J. Cognitive motor interference while walking: A systematic review and meta-analysis. *Neurosci Biobehav Rev.* 2011;35(3):715–728.
13. Plummer P, Eskes G. Measuring treatment effects on dual-task performance: A framework for research and clinical practice. *Front Hum Neurosci.* 2015;9:225.
14. Sternberg S. The discovery of processing stages: Extensions of Donders' method. *Acta Psychol (Amst).* 1969;30:276–315.
15. Posner MI. Orienting of attention. *Q J Exp Psychol.* 1980;32(1):3–25.