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A meta-analysis of influence of yoga activities on reaction time as a component of skill related fitness

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Meta-analysis

Abstract

Introduction: Yoga practices are known to have beneficial effect on cognitive functions. Reaction is a purposeful voluntary response to external stimuli. Reaction time is a component of skill related fitness. Humans gives response to different external environmental stimuli with different speed. Majority of daily work is done in response to visual and auditory stimuli. Yoga practices may improve reaction time.

Objectives: To study influence of yoga practices on auditory reaction time and visual reaction time.

Methods: Researchers used the Preferred Reporting Items for Systematic Reviews and Meta- Analyses (PRISMA) guidelines for reporting systematic reviews and meta-analysis. Researchers searched articles on PubMed, Google scholar and by manual search. Searched articles were screened for relevancy. By use of inclusion and exclusion criteria potential articles were selected.

Results: Out of 287articles, finally 5 studies included in current meta-analysis. Yoga activities has effect on visual reaction time (VRT): SMD = 3.06, 95% CI = –0.66–6.78, P < 0.01 and auditory reaction time (ART): SMD = 2.86, 95% CI = –0.37–6.09.

Conclusion: Yogic activities can provide beneficial effect on reaction time. Improved reaction time is important for reactive activity like sports. Yoga can be useful as a part of training in skill related work. There is wide scope for further studies to evaluate beneficial effects of yoga activities.

Keywords

- yoga activities
- auditory reaction time
- visual reaction time
- fitness
- effect

Contribution

A – the preparation of the research project
B – the assembly of data for the research undertaken
C – the conducting of statistical analysis
D – interpretation of results
E – manuscript preparation
F – literature review
G – revising the manuscript

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Conflict of interest

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Introduction

Yoga activities are known to have beneficial effect on cognitive functions.[1,2] Components of yoga are asanas, pranayama, and meditation.[3] Pranayama are said to affect the higher functions of central nervous system like learning, memory, planning and perception.[3] Studies shows that yoga breathing techniques have beneficial effect on visual and auditory information processing tasks.[1,4,5]

Reaction time is defined as interval of time between presentation of stimulus and appearance of appropriate voluntary response in a subject.6 Humans gives responses to so many external environmental stimuli of different types in day-to-day life. There are various sensory modalities and humans gives responses to different stimuli with different speed. Out of this, response to visual stimuli and response to auditory stimuli are important one in daily life.

Better Reaction time is important for performance in sportsman, skilled professionals, and surgeons.[7,8]

Overall, comparatively fewer studies have focused for influence of yoga on reaction time. And, comparatively a smaller number of meta-analysis available. So, what is the influence of various yogic activities on reaction time, to what extent it affects reaction time and what is importance of yogic activities for reaction time is not known clearly. To, analyse this, this is meta-analysis to evaluate influence of yoga activities on auditory reaction time and visual reaction time.

Materials and methods

In the meta-analysis, researchers used the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines for reporting systematic reviews and meta-analysis (Figure 1).[9] As it is meta-analysis, institutional review board approval was not required.

Search strategy

Relevant studies were identified by a literature search with language restriction of 'English' language in electronic database of Google Scholar and PubMed Central. Advance search with application of filter in PubMed Central and in Google scholar. Words used in search strategy are: effect, yoga, auditory reaction time and visual reaction time. Literature search was also done directly online in google search. Reference list of filtered studies were also searched to get relevant articles.

Studies selection criteria

Studies filtered in primary search assessed for following inclusion and exclusion criteria:
Inclusion criteria:

- Studies including yogic activities.
- Studies measing auditory and visual reaction time.
- Studies includes pre and post yoga effect reaction time.

Exclusion criteria:

- Not satisfying inclusion criteria.
- Articles not relevant to reaction time.
- Free full text article not available of studies.
- Type of articles as letters and review articles.

Study quality

Reviewers assessed studies independently for inclusion and exclusion criteria mentioned in study selection criteria. Reviewers analysed selected studies with following headings: Name of first author with initials, year of publication, age, gender, type of yoga activity, brief detail of yoga activity and measurement of auditory and visual reaction time. During detail reading of studies queries for inclusion and exclusion of studies was sort out and finally decided by discussion.

Data extraction

We extracted auditory and visual reaction time with standard deviation before and after sessions of yoga activities in individual articles. Data were verified by reviewers and any discrepancies were addressed by discussion and resolved by consensus.

Data analysis

Free online meta-analysis calculator[10,20] was used for analysis of all data and to construct forest plot.

The standardized mean differences (SMD) for the auditory and visual reaction time before and after yoga sessions of yoga activity were calculated. The principal summary measure was done with a 95% confidence interval with SMDs.

The Tau2, Chi2 and I2 test was used to measure the Statistical heterogeneity across studies.[11–15] Because of variability in included studies regarding types of yoga activities and among study population, a considerable degree of heterogeneity was expected. So random effects model was used for comparison.[11,16]

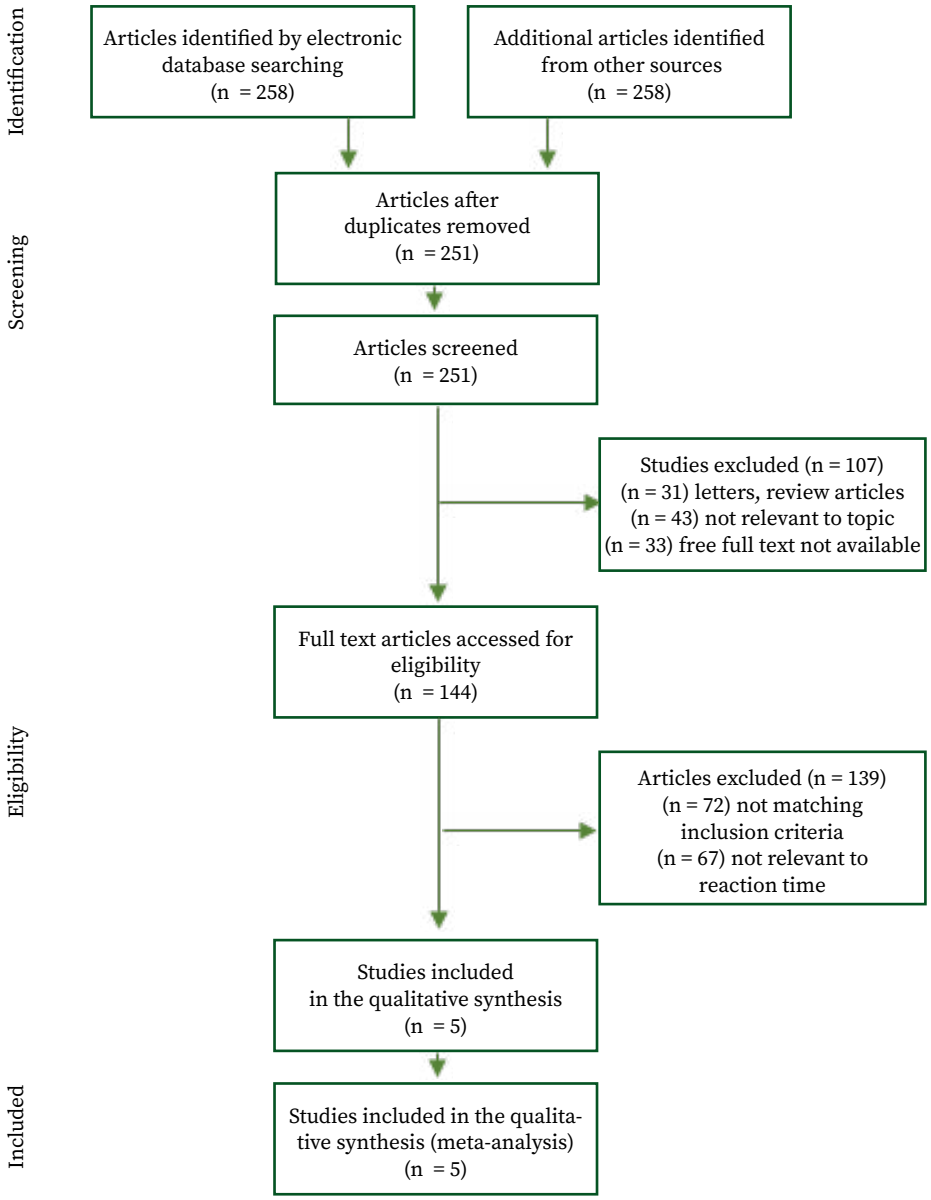

Figure 1. Flow chart article search and study selection

Results

Literature search is detailed in Figure 1.[9] Brief description of each included study is detailed in Table 1.

Figure 2 shows visual reaction time measurement for individual studies and Figure 3 shows auditory reaction time measurement for individual studies. Analysis was performed with random effect model. visual reaction time (VRT): Tau2 = 8.8092, Chi2 = 340.45, df = 4, P < 0.01, I2 = 99% and auditory reaction time (ART): Tau2 = 6.6253, Chi2 = 294.28, df = 4, P < 0.01, I2 = 99%.

Our results showed that visual reaction time (VRT) decreased in after yoga activity sessions compared to before yoga activity sessions, according to random effects pooled SMD of visual reaction time (VRT) before and after yoga activity sessions was : SMD = 3.06, 95% CI = –0.66–6.78 (Figure 2). Our results also showed that auditory reaction time (ART) decreased in after yoga activity sessions compared to before yoga activity sessions, according to random effects pooled SMD of auditory reaction time (ART) before and after yoga activity sessions was: SMD = 2.86, 95% CI = –0.37–6.09 (Figure 3).

Table 1. Summary of characteristics of included studies

First Author, Year	Sample size	Age group (Year)	Gender (Male / Female)	Type of yoga activity	Brief details of yoga activity	Measurement of ART and VRT*
Mirdha M. (2022)[1]	18	18–45	Both	Shavasana, makrasan	Subjects practiced shavasan for 10 minutes and maintain makrasan pose, daily for 3 weeks	ART and VRT recorded just before yogic practice began and after 3 weeks of daily yogic practices
Naik L. (2021)[18]	108	20–50	Both	Deep relaxation technique as explained in study	Deep relaxation technique as explained in study was performed by subjects for 10 minutes	ART and VRT recorded before and after deep relaxation technique as explained in study
Gupta M. (2019)[3]	100	18–25	Both	Kapalbhati Pranayama, Anulom-Vilom Pranayama, Bhramari Pranayama and others	The pranayama training was given by yoga teacher, to all the subjects 6 days a week for 1 month for a duration of 40 minutes per session	ART and VRT recorded before and after completion of pranayama training
Jadhav S.S. (2016)[7]	60	18–20	Male	Sudarshan kriya	Sudarshan kriya was taught by trained and certified instructor	ART and VRT recorded before the practice of sudarshan kriya. After 90 days of practicing sudarshan kriya.
Joice S. (2015)[17]	40	18–23	–	Surya namaskar, Padmasana, Paschimottanasana, Padahastasana, Sarvangasana, Bhujangasana, Vajrasana, Savasana and others	Yoga training was given daily 30 minutes, 6 days a week for 12 weeks	ART and VRT recorded before and after completion of yoga practice

*ART – Auditory Reaction Time; VRT – Visual Reaction Time.

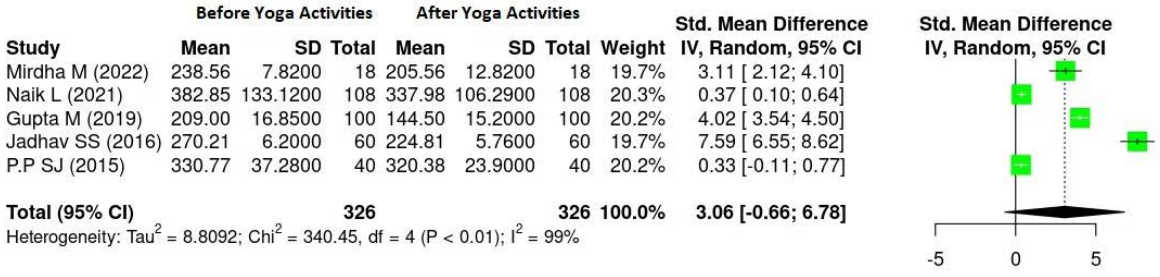

Figure 2. Forest plot of influence of yoga activity on visual reaction time

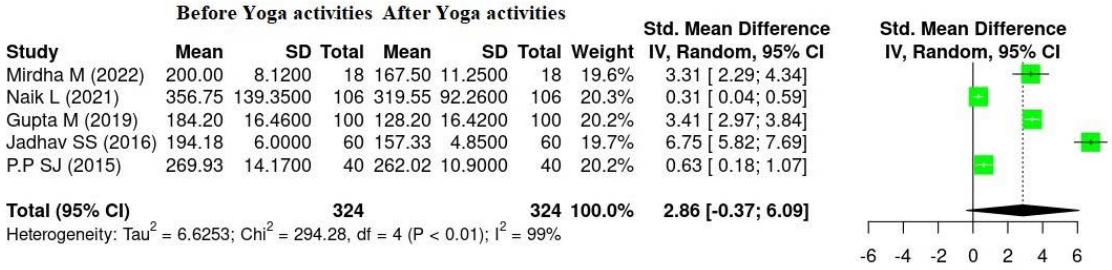

Figure 3. Forest plot of influence of yoga activity on audiatory reaction time

Discussion

This meta-analysis was conducted to evaluate effect of yoga practices on visual reaction time and auditory reaction time. The meta-analysis examined whether yoga activities decrease auditory and visual reaction time. Findings of the study suggests that reaction time decreased after yoga activity sessions compared to before yoga activity.

More faster processing at level of brain and body, faster will be decision making and bodily voluntary movements to external stimuli which ultimately lead to faster reaction time.[18,19] Findings of this study parallel with past studies.[21,22] Increased concentration, relaxation, organization, and focus have been observed after yoga practice.[23] Reason for decrease in reaction time may be due to faster rate of information processing, improved arousal and improved concentration.[23] Reaction time is a component of skill related fitness.[24] Improvement in auditory reaction time and visual reaction time is important in activities and professions which requires faster responses such as sports, surgeries, mechanical equipment operations.[21] It may be useful in training of this people.[21]

Participants in studies were from different age group. Participants in the studies were from both genders. Thus, findings of study can be applied to large population. Yogic practices mentioned in studies were simple to perform and a person can do at their home also. Studies in meta-analysis has not focused on single yoga activity. Participants have performed various yoga activities. So, it is difficult to filter effect of individual yogic activity. In the studies overall analysis of various yogic activities is done and nearly all age group is covered in selected studies, so findings provide overall effect of various yogic activities.

Limitation

In search strategy of articles, we selected articles in English language and freely available articles which may have skipped some useful articles. In this study effect of yoga activities on auditory and visual reaction time is focused. Selected studies measured auditory and visual reaction time before and after yoga sessions. While other aspects of yoga activities like separate effect of single yoga activity, time duration of yoga activities and any specific activity which requires guidance from instructor are not separately analyzed. Selection of articles done by electronic data base. So, studies of electronic data base which are not screened is likely to be missed. This increase bias in selection process.

Recommendations for future

For more specific evaluation, studies in future should focus on individual yoga activities.

Conclusion

The present meta-analysis study focused on influence of yogic activities on visual reaction time and auditory reaction time. Overall findings of study suggests that yogic practices decrease reaction time. Properly designed RCTs are required to examine this effect in more detail.

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