

## **Auditory and visual reaction time and peripheral field of vision in helmet users**

Abbupillai Adhilakshmi<sup>1</sup>, Udhy Kumar Priyadarshini Karthiga<sup>2</sup>, Nitin Ashok John<sup>3</sup>

### **Abstract**

**Background:** The incidence of fatal accidents are more in two wheeler drivers compared to four wheeler drivers. Head injury is of serious concern when recovery and prognosis of the patients are warranted, helmets are being used for safety purposes by moped, scooters and motorcycle drivers. Although, helmets are designed with cushioning effect to prevent head injuries but there are evidences of increase risk of neck injuries and reduced peripheral vision and hearing in helmet users. A complete full coverage helmets provide about less than 3 percent restrictions in horizontal peripheral visual field compared to rider without helmet. The standard company patented ergonomically designed helmets which does not affect the peripheral vision neither auditory reaction time. **Objective:** This pilot study aimed to evaluate the peripheral field of vision and auditory and visual reaction time in a hypertensive, diabetic and healthy male and female in order to have a better insight of protective characteristics of helmet in health and disease. **Method:** This pilot study carried out on age matched male of one healthy, one hypertensive and one diabetic and female subject of one healthy, one hypertensive and one diabetics. The field of vision was assessed by Lister's perimeter whereas auditory and visual reaction time was recorded with response analyser. **Result :** Gender difference was not noted in peripheral field of vision but mild difference was found in auditory reaction time for high frequency and visual reaction time for both red and green colour in healthy control. But lateral and downward peripheral visual field was found reduced whereas auditory and visual reaction time was found increased in both hypertensive and diabetic subject in both sexes. **Conclusion:** Peripheral vision, auditory reaction time and visual reaction time in hypertensive and diabetics may lead to vulnerable accident. Helmet use has proven to reduce extent of injury in motorcyclist and other two wheeler drivers.

**Key Words:** Helmets, Two Wheelers, Drivers, Hypertension, Diabetic.

J Bangladesh Soc Physiol. 2016, December; 11(2): 43-46  
For Authors Affiliation, see end of text.

<http://www.banglajol.info/index.php/JBSP>

---

### **Introduction**

**T**he stringent guidelines by Road Traffic Office regarding safety helmet usage have brought down the fatality risk in motorcycle crashes. The availability and accessibility of cheap and non-standard helmets in the market mars safety of the helmet user.

Received 20 June 2016; Accepted 5th August 2016

Government should subsidize the cost of standard helmets and enforce regulations banning the import of non-standard helmets in the market. Few amongst the hundred rider were found wearing standard patent company helmet. More than hundred vehicle drivers were interviewed and most of them complained about narrowing of

peripheral visual field and visibility. In addition, they are unable to hear properly and feel more comfortable while driving without helmet.<sup>1,2,3,4</sup> Whether use of non standard local brand helmet is cause of discomfort or reduced peripheral vision was a query to be answered. Hypertension and diabetes are well recognized conditions for impaired cognition function.<sup>5,6,7</sup> Whether it is the health of the drivers interfering with driving performance was needed to be ascertained.<sup>3,4</sup> Thus to find out these information, this pilot study was designed to analyze the peripheral field of vision and auditory and visual reaction time in a subject of each of healthy control, diabetic and hypertensive male and female drivers using standard patent company helmet. .

### Methods

The pilot study was carried out in department of Physiology of Indira Gandhi Medical College and Research Institute, Government of Puducherry Institution. Random selection was done to identify an age matched healthy control, hypertensive and

diabetic's male and female; and all of them were using standard patent company helmet while driving two wheelers. One individual in each category was investigated in our pilot study. After obtaining informed consent the and informing them the details of purpose and manner of evaluation, the field of vision was recorded with Listers Perimeter and auditory and visual reaction time with a response analyzer which was having display accuracy of 0.001 millisecond.<sup>3,4,7</sup>

### Results

There was no gender difference in peripheral field of vision (Table-I) but mild difference in auditory reaction time for high frequency and visual reaction time for both red and green colour in healthy control (Table-II). But lateral and downward peripheral visual field was found reduced (Table-I) whereas auditory and visual reaction time was found increased in both hypertensive and diabetic subject in both sexes compared to corresponding healthy control (Table-II).

**Table I:** Peripheral Field of Vision in healthy Control, Diabetic and hypertensive Male and Female (n=6)

Subjects	Peripheral visual field laterally	Peripheral visual field Medially	Peripheral visual field Upward	Peripheral visual field Downward
(Male) Healthy Control	100°	60°	60°	75°
Hypertensive	90°	60°	60°	70°
Diabetics	94°	60°	60°	65°
(Female) Healthy Control	100°	60°	60°	75°
Hypertensive	96°	60°	60°	72°
Diabetics	86°	60°	60°	68°

**Table II:** Auditory and Visual Reaction Time in healthy Control, Diabetic and hypertensive Male and Female (n=6)

Subjects	Auditory Reaction Time Low	Auditory Reaction Time High	Visual Reaction Time Red	Visual Reaction Time Green
	Frequency (ms)	Frequency (ms)	Colour (ms)	Colour (ms)
(Male) Healthy Control	140	136	180	184
Hypertensive	164	160	200	220
Diabetics	172	166	190	224
(Female) Control	140	130	170	180
Hypertensive	186	190	220	240
Diabetics	180	174	196	260

### Discussion

The field of vision is the portion of space in which objects are seen when an individual is having steady fixation of gaze in one direction. The normal peripheral visual field extends 100 degrees laterally, 60 degrees medially, 60 degrees upward, and 75 degrees downward. The reaction time is the time required for response after being exposed to stimuli. The time required by an individual to respond by pressing a response switch after being exposed to low or high frequency auditory sounds is auditory reaction time or to red / green visual stimuli is visual reaction time. The normal auditory reaction time in male and female is 140 milliseconds while normal visual reaction time is 180 milliseconds for red and 185 milliseconds for green light<sup>6</sup>.

As noted in our pilot study we found that field of vision and auditory and visual reaction time has not been affected in healthy male and female control helmet users using standard patent company helmet. The hypertensive and diabetic male and females reported of marginal decrease in field of vision in lateral and inferior visual fields as compared to control while the auditory and visual reaction time (Red and Green Colour) was increased in male and female hypertensive and diabetics while the delay was further prolonged in females hypertensive and diabetics as compared to male hypertension and diabetics. Hypertensive and diabetics are known to develop cognitive dysfunctions and autonomic neuropathy<sup>6-9</sup>. The clouding thought process, along with reduce field of vision and delayed auditory and visual reaction time may pose threat of serious accidents while driving. Hence whether the safety shall prevail in the diabetics and hypertensive by helmet usage needs to be evaluated on larger population study.<sup>8,9</sup>

### Conclusion

Decreased peripheral vision, auditory reaction time and visual reaction time in hypertensive

and diabetics may lead to vulnerable accident. Helmet use has proven to reduce extent of injury in motorcyclist and other two wheeler drivers. Advancement of technology have brought superior quality ergonomically designed helmets in market but many opine that the mandatory usage enforcement of helmet use is an infringement on personal rights, and moreover it has been documented that there are increased number of vehicular accidents due to low visibility and masking of auditory sound.<sup>8,9</sup> Our concern is regarding the efficacy of helmet use and prevalence of accidental rates in hypertensive and diabetic with and without helmet use. Hence, we have decided to proceed with larger population study for analysis of field of vision, reaction time analysis, cognition status and accident prevalence rate in diabetics and hypertensive helmet users and non users.

### Author affiliation

1. Abbu Pillai Adhilakshmi, Department of Physiology, Indira Gandhi Medical College and Research Institute, Kadhirkamam, Puducherry, India.
2. Uday Kumar Priyadarshini Karthiga, Department of Physiology, Venkateshwara Institute of Medical Sciences, Puducherry, India.
- \*3. Nitin Ashok John Professor and Head, Department of Physiology, Indira Gandhi Medical College and Research Institute, Kadhirkamam, Puducherry. Email: drnitinjohn@yahoo.co.in

### \*For correspondance

### References

1. Ritter N., Vance C. The determinants of bicycle helmet use: Evidence from Germany. *Accid. Anal. Prev.* 2011; 43:95-100
2. Shaigany K, Abrol A, Svider PF, Eloy JA, Carron MA, Lin HS, Folbe AJ. Recreational motor vehicle use and facial trauma. *Laryngoscope* 2016 ; 126(1):67-72.
3. Tavakoli Kashani A, Rabievan R, Besharati MM. Modeling the effect of operator and passenger characteristics on the fatality risk of motorcycle crashes. *J Inj Violence Res* 2016 ; 8(1):35-42
4. Krumeich A., Weijts W., Reddy P., Meijer-Weitz A. The benefits of anthropological approaches for health

- promotion research and practice. *Health Educ. Res.* 2001; 16:121–130
5. Finch C.F., Owen N. Injury prevention and the promotion of physical activity: What is the nexus? *J. Sci. Med. Sport.* 2001; 4: 77–87.
  6. NA John Parekh, IPR Gajbhiye, M Wahane, Jyoti Titus. The study of auditory and visual reaction time in healthy control, patients of Diabetes Mellitus on modern allopathic regime, and healthy exercisers. *J. Ind Acad Clin Med.* 2004; 239-243.
  7. Groeneveld ON, Kappelle LJ, Biessels GJ. Potentials of incretin-based therapies in dementia and stroke in type 2 diabetes mellitus. *J Diabetes Investig* 2016; 7(1):5-16
  8. McIntosh AS, Patton DA, Rechnitzer G, Grzebieta. Injury mechanisms in fatal Australian quad bike incidents. *Traffic Inj Prev*; 2015; 29:0. [Epub ahead of print]
  9. Ryan GA: Improving head protection for cyclists, motorcyclists, and car occupants. *World J Surg* 1992; 16:398-402.