



## ORIGINAL RESEARCH ARTICLE

## The study of frequency domine analysis of HRV in traffic police

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**Abstract:** Heart rate and heart rate variability (HRV) is the measurement of noninvasive and quantitative marker of cardiac autonomic control. We have examined the autonomic activity of traffic police by calculating HRV to evaluate, predict and thereby prevent any hazardous occupation-induced health disorder that may set in as to precipitate in future; this may help them to improve their life expectancy. 30 young adult traffic police were compared with that of 30 Normal controls to assess the relative sensitivity of each for distinguishing between a periods of cognitive workload. The frequency domain parameters such as HF, LF, HF/LF ratio, LF/HF ratio were recorded and evaluated. Comparison of HF, LF, HF/LF ratio, LF/HF ratio values in frequency domain analysis of the normal and deep breathing periods between group I and group II it showed that data of group II were highly significant when compared with that of group I in both the periods ( $p < 0.001$ ).

**Key words:** Stress; Heart rate variability (HRV); Frequency Domine Analysis (FDA); Traffic Police.

### Introduction

Traffic police are the special strength of enforcing the road traffic law. It assumes the comprehensive responsibilities of keeping traffic safe, unblocked and ordered and is one kind of stress crowded occupations<sup>(1)</sup>, they are at particular risk due to the nature of their job, since they are exposed to emissions from the vehicles & exposure to air pollutants, a major portion of which is due to emissions from the vehicles, can increase oxidant stress, and decrease the levels of antioxidants and nitric oxide<sup>(2)</sup>.

Exposure to fine particulate matter (PM<sub>2.5</sub>) from traffic affects heart rate variability, thrombosis and inflammation<sup>(3)</sup>. In today's world most deaths are attributable to non-communicable diseases (32 million) and just over half of these (16.7 million) are the result of cardiovascular disease (CVD)<sup>(4)</sup>. More than one third of these deaths occur in middle aged adults. In developed countries, heart disease is the leading cause of death for adult men & women. Also, cardiovascular disease is the leading cause of mortality and morbidity in industrialized countries<sup>(5)</sup>.

All kind of jobs that can result in some sought of stress (or) illness. The stress level may vary from each and every job. Among the working population, those who are in hazardous occupations are believed to have more incidence of cardiovascular disease.

Hans Selye defined the stress as 'a state of psychological and physiological imbalance resulting from the disparity between situational demand and the individual's ability and motivation

to meet those demands. The socially acceptable form of stress is mental illness (Richard Carlson).

Canon *et al.*, (1935) described the 'flight' or 'fight' response in which the sympathetic nervous system is activated. Stress is closely associated with various physiological and psychological reactions that may lead to serious health problems such as diabetes, cardiovascular disease<sup>(6)</sup> and neurodegenerative disease<sup>(7)</sup>.

Substantial research has shown that adverse physical and psychosocial work environment and working condition, such as shift work, excessive workload, driving and traffic police etc. are considered as hazardous occupations which has more stress. It has documented that job stress is associated with development of cardiovascular disease<sup>(8)</sup>.

The CVD is the resultant of autonomic imbalance. The main cause of CVD is an imbalance of sympathetic and parasympathetic activities, which can be measured by analyzing heart rate variability (HRV)<sup>(9)</sup>.

Heart rate variability is a widely used noninvasive and quantitative marker of cardiac autonomic control<sup>(10)</sup>. Heart rate variability is defined as beat-to-beat fluctuations in heart rate that are mainly determined by the activity of the cardiac sympathetic and parasympathetic nervous systems<sup>(11)</sup>; it is analyzed in the time or frequency domains.

Decreased HRV has been associated with increased risk of death in patient with coronary

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artery disease, chronic heart disease, end stage of renal disease and other chronic conditions and is significantly associated with all cause of mortality in the general population<sup>(12)</sup>.

This study was under taken to assess the autonomic activity of traffic police by calculating HRV to evaluate, predict and thereby prevent any hazardous occupation-induced health disorder that may set in as to precipitate in future; this may help them to improve their life expectancy.

### Materials and Methods

In this experimental study 60 subjects were selected randomly. 30 subjects in each group (Group-I & Group-II) were taken. The study proposal with the informed consent was approved by our ethical committee. The healthy males between the age group  $34.1 \pm 9.9$  years were selected randomly. The subjects with Fever patients, Subjects with autonomic dysfunctions, Subjects on drugs which alter autonomic functions, Known Hypertensive, with known Cardiac diseases are excluded for this study.

**Apparatus for Measurement of heart rate variability:** The ECG was recorded by standardized DIGITAL PHYSIOGRAPH (INCO – NAVIQUIRE, VERSION -56).

#### Parameters Studied:

- **Low frequency (LF)** - (.04Hz- .15Hz), indicates sympathetic activity.
- **High frequency (HF)** – (.15Hz-.40Hz), indicates parasympathetic activity.

The participants were informed regarding the nature of study and written inform consent was obtained from the participants. The demographic data and past medical history was collected from all participants.

**Procedure of ECG Recording:** As soon as the Subject arrived to the research lab he was asked to lie in supine position, and was allowed to relax for some time. After a relaxing period the ECG was recorded in lead II during normal breathing for 5 minutes and again for second consecutive ECG was recorded with the same lead with deep breathing for 5 minutes (6 per minutes- 5seconds for inspiration & 5 seconds for expiration).

**Statistical Analysis:** The statistical analysis between traffic police and control was done using, paired't' test. Were  $P < 0.001$  is highly significant.

### Result

The study comprises of two groups, randomly selected and participated voluntarily with the age group between  $34.1 \pm 9.9$  yrs. Group-I are (30 subjects) traffic police and Group II (30 subjects)

were normal control, both the subjects with same age group and socio-economic condition were selected among these two groups HRV parameters were analyzed statistically and the result were as follows.

The frequency domain parameters such as HF, LF, HF/LF ratio, LF/HF ratio were recorded and evaluated. The values of HF, LF, HF/LF ratio, LF/HF ratio in group I & group II during normal breathing & deep breathing periods was not significantly different with each other. Comparison of HF, LF, HF/LF ratio, LF/HF ratio values in frequency domain analysis of the normal and deep breathing periods between group I and group II it showed that data of group II were highly significant when compared with that of group I in both the periods ( $p < 0.001$ ).

### Discussion

As the traffic police face a lot of stress in their day to day life due to ever increasing density of traffic and pollution, making them vulnerable to high blood pressure, heart diseases and other respiratory disease<sup>(13)</sup>. Evidence from the Health & Safety Executive (HSE) suggests that 20% of workers fell 'very' or 'Extremely' stressed at work, with percentages rising to 40% in some occupational groups<sup>(14)</sup>.

Tomei *et al.*, 2003, reported that, traffic policeman exposed to urban pollutants and possible psychosocial stressors and increase the risk of cardiovascular changes<sup>(15)</sup>. Chronic occupational exposure to urban pollutants reduces resistance to physical effort and increase the risk of cardiovascular and respiratory changes<sup>(16)</sup>. Numerous epidemiological studies have shown that the particulate air pollution is associated with the exacerbation of illness and number of deaths from respiratory and cardiovascular diseases<sup>(17)</sup>.

HRV is a noninvasive modern technique which accesses autonomic activity on the heart. The HRV is usually recorded with deep breathing condition to enhance autonomic activity. The HF spectrum denotes parasympathetic dominance. The increases in HF frequency indicate increase in parasympathetic activity and vice versa. In the present study, the HF value in traffic police were decreased indicate that their parasympathetic activity become less active. The parasympathetic system is needed for conservation & building up of energy sources.

In this study the low frequency (LF) recording of the traffic police showed an increase; indicating that there was an increase in the sympathetic activity in traffic police. Thus the result of present study clearly established that the sympathetic over activity takes place along with the decrease in

parasympathetic activity in traffic police. This is further proved by the recording of HF/LF & LF/HF ratios. In our study HF/LF ratio of the traffic police was decreased whereas the LF/HF

ratio showed an increase in the traffic police; confirmed the above conclusion (Table.1).

**Table 1:** Comparison of Frequency Domine Analysis between Group I & II during Normal and Deep Breathing.

Parameters	Group	Normal Breathing (Mean±Sd)	Z Test	Deep Breathing (Mean±Sd)	Z Test
HF	I	54.20±7.91	P<0.001	41.50±7.77	P<0.001
	II	75.80±5.66		61.62±7.57	
LF	I	45.75±7.96	P<0.001	60.17±7.96	P<0.001
	II	24.19±5.66		37.59±7.62	
HF/LF	I	1.24±0.39	P<0.001	0.71±0.23	P<0.001
	II	3.33±0.96		1.72±0.44	
LF/HF	I	0.88±0.29	P<0.001	1.53±0.49	P<0.001
	II	0.32±0.10		0.60±0.22	

**Legend:** (HF- High frequency, LF- Low frequency, HF/LF-High frequency/Low frequency ratio, LF/HF-Low frequency/High frequency ratio, P<0.001- highly significant)

Stress usually induced increase sympathetic activity in hypothalamo-sympatho-adrenal axis (GUYTON 11<sup>th</sup> ed.) may be the reason for the autonomic dysfunction showed in our result. To find out which limbs of autonomic activity was affected, the frequency domain analysis of HRV was carried out. The increased sympathetic activity is one of the main causes for hypertension, coronary artery disease & myocardial infarction and affects their health status. The present study thus indicates that the traffic police undergo continuous stress while carrying out their duty.

## Conclusion

From this study it is concluded that sympathetic activity is increased and parasympathetic activity is decreased in traffic police when comparing to normal subjects. So the traffic police are in need of regular health checkup and they should have awareness about positive health and proper rest period and counseling should be taken to avoid such cardiovascular diseases.

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