

# Effect of Work Environment Noise on Productivity, Mental Fatigue and Blood Pressure among Indian Postal Assistants

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**Abstract**-Being a backbone of Indian economical structure, India post is serving India not only by means of delivering mails also with every banking facility to its citizens unlike other large part of world post. Literature is failing to provide any occupational health related work on these Indian postal workers. The common finding from several post offices by the authors was congested crowd within each post office premises and obvious noise which is beyond any standards during working hours. So the principle aim of this study is to investigate effect of work environment noise level on blood pressure, mental fatigue and productivity of Indian postal assistants. Generally, Indian postal workers can be classified into two groups: Postal assistants and postmen. Authors excluded postmen group from this particular study as they have to do door to door services which may alter environmental and physiological factors very frequently. Usually postal assistants need to do their assigned work behind a particular counter situated at one specific post office premises. This study results show systolic and diastolic blood pressure had strong positive correlation with post office environment noise. Though critical flicker fusion values were low in this subject group, became lower with increasing working environmental noise range. Their productivity had strong negative correlation with noise level. These postal assistants having high risk of psychological burden as well occupational stress due to daily long term exposure of work environmental noise. To prevent further burden regular work place noise monitoring and noise control processes need to be implemented soon.

**Index Terms**- Critical flicker fusion frequency, India Post, noise at work, productivity pattern.

## INTRODUCTION

More than one billion of Indian citizen from every economical classes rely on India post and that gives huge revenue to Indian finance (8). This great power behind our national revenue production needs proper evaluation of the occupation related stresses. Workers in postal section having

sedentary and moderate working hours depending on their job priorities but the health concern of them usually being neglected before this. So this study can be beneficial in a broad spectrum to Indian society. Job role of Indian postal workers are very much different from other large part of world post (1). Other than India, world post is usually engaged in delivering parcels (2). India post serving their citizens by various ways like delivering mails, financial small savings related work, providing life insurance cover, providing retail services like bill collection, sale of forms, old-age pension payments, making identity cards for proof of residence, etc. (4). All these works have separate work responsibilities with separate work pattern. According to their work pattern they can be broadly divided into two groups. One group can be tagged as Postmen who deliver parcel and provided door to door services and secondly Postal assistants who mainly serve the counter based services. This particular study is focused on the second group i.e. postal assistants group. The aim of this study is to observe the effect of work related noise on blood pressure, mental fatigue and productivity on male and female Indian postal assistants.

## METHODOLOGY

During study period three post offices (head offices) from Kolkata, India were being selected by lottery method and overall study procedure were being done in similar way to each post office. But to nullify the other possible interfering factors like temperature, subject's personal profile, work space etc, data from each post office had been assessed separately. Even after the separate assessment the overall statistical outcomes were similar in every set of data that implies towards the similar situation or status in every post office. Thus here in this

article authors mentioned about only one largest and busiest post office among those three.

This was a cross sectional study, study period was during September 2019. Twenty male and twenty female postal assistants having at least six months of same task experience were being randomly selected for the study procedure. Their single day working hours were being divided into three situations S1: 10am-11am (70dBA-80dBA), S2: 1pm-2pm (90dBA-100dBA), S3: 4pm-5pm (45dBA-55dBA). Two hours of gap had been given in between each situation to reduce the overlapping effect of previous situation. Readings of systolic blood pressure, diastolic blood pressure, critical flicker frequency, critical fusion frequency and productivity were taken with ending of every situation.

*Instruments*

Before commencement any of the experiment procedure, human ethical clearance from the Institutional Human Ethical Clearance committee and written consent from each participating subjects were taken. Postal assistants under medication support for any chronic disease were excluded from experiments.

*Measurement of physical parameters*

The height and weight of the Indian postal assistants were measured by using anthropometer (Martin’s Anthropometer) and “Crown” weighing machine (Mfg. by Raymon Surgical Co.) respectively. Body Mass Index (BMI) was calculated of all the postal assistants.

*Assessment of Working Environment Noise and Health Assessment of Noise Exposure*

Before doing the main methodology on subjects, noise patterns were measured for six consecutive days by using sound level meter (Lutron SL-4010). During those six days noise sources were identified. It had been noticed that based on public or customer gathering noise patterns were changing. Also the timings and patterns of customer queue were more or less similar in everyday. So after testing the working environmental noise patterns it had been observed that more or less every day these workers are facing three types of noise patterns from 10am to 5pm. These three types of noise patterns are 70dBA-80dBA, 90dBA-100dBA and 45dBA-55dBA.

Health Assessment of Noise Exposure Update Questionnaire (3) was performed among the subjects which included number of questions emphasizes on whether they exposed to loud noise, whether they engaged in noisy hobbies, whether they feel any changes in hearing ability etc.

*Assessment of Blood Pressure among Indian postal assistants*

Resting systolic blood pressure and diastolic blood pressure before starting of their working hours and after each range of noise exposure (S1, S2 and S3) were measured using Diamond dial regular blood pressure apparatus.

*Assessment of Mental Fatigue among Indian postal assistants*

Job of these postal assistants needs high and long term exposure of computer screen as well continuous noise from 10am to 5pm Monday to Saturday per week. Critical flicker fusion test was performed on postal assistants to assess the extent of mental fatigue using critical flicker fusion test apparatus. Up/ascending (Fusion) threshold-and down/ descending (Flicker) threshold-were measured following CFFT measuring procedure (1, 2, 6). Readings were taken before starting their working hours and after every noise induced situation (S1, S2 and S3).

*Assessment of Productivity*

Productivity of these subjects was measured by noting the number of financial transaction done by them per hour.

**RESULTS**

Table 1 is showing the mean (SD) values of subject profile. It demonstrated that the study sample contains 50% of males and 50% of female postal assistants, with an average age of 33.5±3.09 years and 33.7±2.71 years respectively. As per data assessment 24.8 (kg/m<sup>2</sup>) (SD= 2.01) is the mean body mass index of male postal assistants and in case of female subjects the value is 20.1 (SD= 1.09), in both the gender the mean values are in normal range.

Table 1: Demographic data of male and female subjects.

Factors	Male (n=20)		Female (n=20)	
	Mean	Std dev.	Mean	Std dev
Age(years)	33.5	3.09	33.7	2.71
Body Height (cm)	167.75	2.12	155.33	3.18

Body Weight (kg)	69.5	5.76	66.05	4.59
BMI (kg/m <sup>2</sup> )	24.8	2.01	20.1	1.09

Table 2 explained the assessment result using health assessment of noise exposure update questionnaire. Hundred percent of subjects complained of facing daily loud noise exposure at work. Though none of them used any hearing protection or visited any doctor for any ear related issues. Fifteen percent subjects complained that already they have been facing temporary reduction in normal hearing after work.

Table 2: Frequency results of health assessment of noise exposure update questionnaire

Questions or Symptoms	Frequency (%)
Are you exposed to loud noise at your current job?	
Yes	40 (100)
No	0 (0)
Do noise levels prevent conversation in normal voice level at work?	
Yes	40 (100)
No	0 (0)
Do you regularly engage in noisy hobbies?	
Yes	15 (37.5)
No	25 (62.5)
Do you currently use hearing protection?	
Yes	0 (0)
No	40 (100)
Noticed change in normal hearing	
Yes	9 (22.5)
No	31 (77.5)
Noticed ringing or temporary reduction in hearing after work	
Yes	6 (15)
No	34 (85)
Seen a doctor about ears	
Yes	0 (0)
No	40 (100)

Table 3: Detail profile of subjects

Variables	Frequency (%)
Demographic factors	
Gender	
Male	20 (50)
Female	20 (50)
Age	
<35 years	28 (70)
≥35 years	12 (30)
Mean 33.62 (SD ±2.98)	
Educational level	
Lower than higher school educational level	0
Higher school educational level	9 (22.5)
Higher than Higher school educational level	31 (77.5)
Risk behaviours	
Tobacco	
Yes	27 (67.5)
No	13 (32.5)
Loud music listening	
Yes	7 (17.5)
No	33 (82.5)
Health problems	
Hearing difficulty	
Yes	9 (22.5)
No	31 (77.5)
Headache	
Yes	40 (100)
No	0 (0)
Earache	
Yes	4 (10)
No	36 (90)
Hypertension	
es	5 (12.5)
No	35 (87.5)
Diabetes	
Yes	1 (2.5)
No	39 (97.5)
Factors related with noise exposure	
Duration of service in India post	
<5years	3 (7.5)
≥5 years	37 (92.5)
Duration of service in current section	
<1 year	32 (80)
≥1 year	8 (20)

Table 4: Changes of different factors among Indian postal assistants with changing noise intensity

Factors	N=40 (M=20 F=20)	S0 (35-40)dBA Mean ±SD	S1 (70-80)dBA Mean ±SD	S2 (90-100) dBA Mean ±SD	S3 (45-55)dBA Mean ±SD	r Value	p Value	Mean ±SD Male:Female	p-Value (95% CI)
SBP	M	121.7±1.63	129.6±2.01	136.8±2.78	122.3±1.49	0.84	<0.001	127.6±6.51	<0.05
	F	120.2±1.82	123.3±1.98	127.1±1.65	121.2±1.64	0.75	<0.001	122.95±3.2	<0.05
DBP	M	81.6±1.54	85.2±1.01	89±1.9	82.5±1.28	0.80	<0.001	84.58±3.25	<0.05
	F	80.2±1.94	83.1±1.89	86.2±2.42	81±2.1	0.68	<0.001	82.63±3.11	<0.05
Productivity	M	NA	17.85±1.59	13±2.07	26.95±2.95	-0.92	<0.001	19.27±6.25	<0.05
	F	NA	17.4±1.96	11.8±2.50	26.75±2.61	-0.93	<0.001	18.65±6.64	<0.05
Flicker Frequency	M	32.85±0.99	30.55±0.83	27.95±0.94	31.9±1.02	-0.82	<0.001	30.81±2.08	<0.05
	F	33.8±0.89	30.8±0.83	28.45±0.94	32.65±1.04	-0.86	<0.001	31.43±2.23	<0.05
Fusion Frequency	M	32.75±0.97	30.6±0.82	28±1.03	31.9±1.12	-0.80	<0.001	30.81±2.05	<0.05
	F	33.65±0.93	30.8±0.83	28.35±0.93	32.55±1.15	-0.85	<0.001	31.34±2.23	<0.05

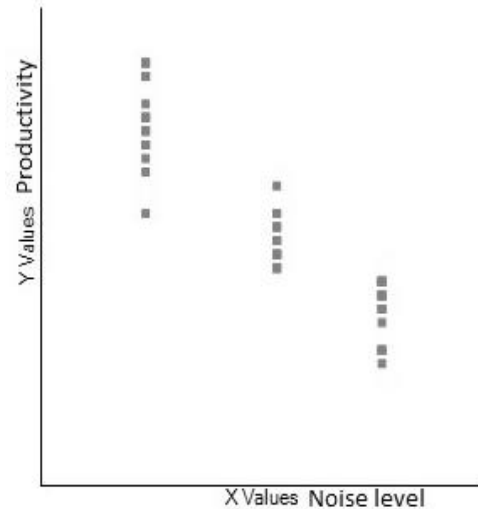
Table 3 provides a brief overview about demographic factors of subjects along with their status related to their educational level, risk behaviours, health problems and duration of present work. Minimum educational status of this subject group was higher secondary education.

Total 100% of subject population complained about headache, 22.5% complained of facing hearing difficulties, symptoms of earache had been already developed among 10% of subjects. From table 4, one can summarise that systolic and diastolic blood pressure are positively correlated th

noise level irrespective of any gender. Though Post Hoc Tukey's HSD (honestly significant difference) procedure reveals that there are no significant difference between resting (S0) situation and Situation 3 (S3) data values of systolic and diastolic blood pressure irrespective of gender variance ( $p > 0.05$ ).

Mean productivity of male postal assistants ( $19.27 \pm 6.25$ ) and female postal assistants ( $18.65 \pm 6.64$ ) showing strong negative correlation with noise level. Mean flicker and fusion frequencies among male Indian postal assistants ( $30.81 \pm 2.08$  and  $30.81 \pm 2.05$ ) are negatively correlated with noise level. Mean flicker and fusion frequencies assessment of female subjects ( $31.43 \pm 2.23$  and  $31.34 \pm 2.23$ ) are also showing negative correlation with noise level.

Image 1 depicts the productivity pattern with the changes of noise level of male postal assistants. By this image it can be clearly visible that with increasing of noise level (x values) rate of productivity decreases (y values). Image 2 is showing the productivity pattern of female subjects with increasing in noise level. Though the result interpretation was similar with the male findings but in case of female subjects productivity is lesser than the male subjects in similar noise patterns ( $p < 0.05$ )

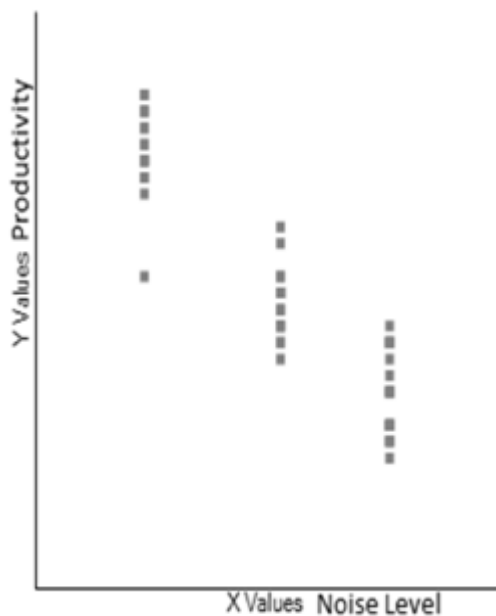


**Productivity Vs. Noise Level (Male, n=20)**

Image 2

DISCUSSION

This study is informing about the health and productivity conditions of Indian postal assistants under their work environment noise exposure. The result of this study demonstrates that the production efficiency of subjects was significantly reduced with higher intensity of work environment noise. This might be due to starting of headache, loss of concentration from work among subjects with increment of environmental noise. While performing the Health Assessment of Noise Exposure Update questionnaire, sources of work place noise had been identified. Daily common sources of noise are postal franking machine, printing machine, stamp tool, high speed wall mounted fans, customer queue, chaos between customers, co-workers, chaos among kids coming with customers, road side vehicle honking etc. Resting blood pressure is significantly affected with increasing of noise level, though they have mainly 7 hours of sitting task with a half an hour recess time per day. In near future, this may generate the problem of hypertension or other health related issues among them. Occurrence of faster mental fatigue was also significantly associated with noise exposure. Strong negative correlation was found between flicker-fusion frequencies with noise exposure. These workers are having lower resting critical flicker-fusion frequency value than control group presented during the study done by Gangopadhyay et al



**Productivity Vs. Noise Level (Female, n=20)**

Image 1

during 2013, this could be because of advancement of digitalization, daily prolong exposure of computer and mobile devices. Along with this, these postal assistants are continuously exposed to computer screen for at least six hours per day along with continuous monetary management to fulfil their job role. This may caused a development of faster mental fatigue among them. In addition, daily work environment noise exposure is causing even faster mental fatigue which also causes reduction in productivity. During this study none of the postal assistant being found using hearing protectors for reducing environmental noise at work, this might be because of the poor awareness about self protective measure among them. The prevalence of hearing difficulties among these postal assistants (22.5%) is near about similar with other studies done on heavy factory workers of different countries (7). These workers should aware about occupational health and safety regulations. To reduce public chaos, 'For Better Service Kindly Maintain Silence' or 'Do Not Make Unnecessary Noise' boards in local languages or in imagery form can be arranged. By allotment of proper sitting arrangements, comfort of customers can be increased to avoid unnecessary chaos. Background classical music can be helpful in reducing stress (5). By arranging the sound of classical music in the background, anxiety of customers and workers can be regulated which might prevent the generation of noise. Regular work place noise monitoring and noise control processes need to be implemented on an urgent basis. Further work is under process to see the effect of interpersonal relationship between co-workers and customers on postal worker's occupational health.

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