



EPIDEMIOLOGICAL STUDIES ON HEALTH STATUS OF COAL MINE WORKERS – A CASE STUDY

Rathnam Kadamanda *1, S Jithender Kumar Naik *2, Laxmaiah Chiraboina*3

1. Research Scholar, Department of Environmental Science, University college of Sciences, Osmania University, Hyderabad, Telangana, India – 500007.
2. Senior Professor, Department of Zoology, University college of Sciences, Osmania University, Hyderabad, Telangana, India – 500007.
3. Research Scholar, Department of Zoology, University college of Sciences, Osmania University, Hyderabad, Telangana, India – 500007.

Abstract:

Introduction: The expansion of industrial activity has raised people's living standards and quality of life, but it has also brought about several occupational risks. One of the oldest and most important industries in India and the rest of the globe is coal mining. The general health status of coal mine workers is currently the subject of very little literature in India.

Aim: The current study investigated the general health condition, compare with habits like alcohol, smoking and tobacco use of the coal mine area.

Material and methods: In accordance with the survey questions created in accordance with the prescribed proforma with norms of the National Family Health Survey, India, an epidemiological survey descriptive study was carried out among the 282 workers and non-workers of a coal mine located in the coal chemical complex areas of the Mancheril district, Telangana, India.

Results: Personal histories were examined in relation to drinking, smoking, and other drug and tobacco use. Out of 282, 126 (45%) are alcoholics, 22 (7%), are smokers, and 14 (4.96%) are tobacco users.

The medical condition shows that 173 (61.34%) people (68 non workers and 105 workers) have respiratory problem, 141 (47+94) have musculoskeletal system, along with 37 (eight non-workers and 29 workers) who have cardio-vascular problems, 65 (12 non-workers and 53 workers) who have neurological problems. There are negative health impacts of coal dust significantly with lung problems, cardio-vascular

problems in coal mine workers compared to non coal mine workers; especially kidney effect in coal mine workers compared to nil effects in non coal mine workers.

Conclusion: The data showed that high kidney, respiratory problems, cardio-vascular problems and other conditions call for rapid treatment.

Key words: Epidemiology, Health, habits, coal mine, workers.

INTRODUCTION:

The world's greatest known energy source, coal is increasingly used to generate electricity. Coal-fired power plants generate more than 42% of the world's electricity. (M. Nandi et al., 2022).

In addition to higher than average levels of respirable dust and quartz, underground coal mines had higher dust concentrations that frequently exceeded the PEL. The results of the survey and the results of lung histology in mining fatalities demonstrate that CWP exposures in coal mines are more frequent than previously believed (Go, L.H.T. et., al, 2022).

An increase in inflammation is often brought on by angular edges because of their propensity to penetrate lung tissue. The risk is caused by particles, including dangerous metals, that eventually enter the circulation (such as Fe, Cd, Hg, and Pb). Analyses of the link between particle form and toxicity have revealed that angular particles, like fibres, which have more roughness and sharp edges, are more poisonous than spherical particles (Liu, T. and Liu, S.H. 2020).

It is a universal truth that a person's genetic make-up and his exposure to the environment's environmental elements determine what kind of person he is and what diseases he may contract. Globally increased industrial activity has raised people's standards of living while also increasing their vulnerability to different occupational health risks (Subramanian, A. and Prakasam, T. 2013).

At greater levels of coal dust exposure, the risk of IHD mortality rose after controlling for age, smoking, and body mass index. The region of the coal rank was likewise linked to mortality risk. Cumulative exposure to coal dust and coal rank were both related with an increased risk of death from IHD. Different coal mine dust particle compositions could be the cause of the effect of coal rank (Landen, D.D. et., al. 2011).

A considerably greater incidence of cardiovascular diseases (CVD) was identified in locations with coal mining. According to toxicants present in coal and coal processing, cardiovascular illnesses have been related to both air and water pollution. Future studies should evaluate the water and air quality in coal mining towns, and environmental programmes and regulations should be implemented as necessary (Hendryx, M. and Zullig, K.J. (2009)

Peak PM_{2.5} levels above the interquartile range were linked to a 16% higher chance of gestational diabetes mellitus (95%CI 1.09, 1.22;). Contrarily, a 7% increase in the risk of gestational diabetes mellitus was linked to an interquartile range rise in average PM_{2.5} (Melody, S.M. 2020).

According to a study, abnormal BP was most common in coal miners, followed by abnormal ECG, PF, and radiographs. Coal miners' abnormal blood pressure, heart rate, pulse, and radiograph readings varied significantly depending on their age, years of exposure to the mine's dust, smoking and alcohol use, type of job, and mine size. To ensure coal miners' health, practical health promotion and safety measures should be taken (Wu, Q. et., al. 2019).

Particularly elevated risks were seen for asthma hospitalisations. A 5-year increase in the risk of respiratory hospitalisations was linked to a 6-week exposure to coal mine fire-related particulate matters (Xu, R. et., al. 2022).

MATERIALS AND METHODS:

The goal of the study was to learn more about the general health-related behaviors, drinking, smoking, and tobacco use of the population in the coal chemical complex region of Mancherial district, Telangana's mine workers and non-miners.

To determine the sample size and study's viability, a trial was conducted. The preliminary study's findings were used to determine the sample size, which came at 282. The following formula was used to complete the epidemiological survey.

Tabel 1

	CASE (NUMBER)	NON CASE(NUMBER)	TOTAL EXPOSURE (NUMBER)
EXPOSED	A	B	TOTAL EXPOSED
NON EXPOSED	C	D	TOTAL NON EXPOSED
	TOTAL CASES		TOTAL

Disease Frequency Measures

Prevalence of Disease, By Exposure Status

For Exposed: $A/(A+B)$

For Not Exposed: $C/(C+D)$

Exposure Prevalence, by Disease Status

For Cases: $A/(A+C)$

Non-cases for Fon: $B/(B+D)$

Cases: Odds of Exposure, by Disease Status

For cases: A/C

For non-cases B/D

Table 2

Measures of <u>Association</u>	
$[A/(A+C)] / [B/(B+D)]$	Ratio of Exposure Prevalences
$[A/(A+B)] / [C/(C+D)]$	Ratio of Disease Prevalence
$[A/(A+C)] - [B/(B+D)]$	Difference in Exposure Prevalence
$[A/(A+B)] - [C/(C+D)]$	Difference of Disease Prevalence
$[A/C] / [B/D] = [A*D] / [B*C]$	Exposure Odds Ratio

Logistic regression would be an appropriate statistical method given that the result is binary (case, non-case). The major problem is that this table only provides a "picture" of the current situation because it displays poll data.

A standardised questionnaire was used to gather thorough data on demographics, job history, smoking history, respiratory symptoms, blood pressure and diabetics, based on the standards spelled forth in the World Health Organization (WHO) Oral Health Assessment form (2013). Participants who met the International Labour Organization's criteria for necessity received full-format posterior-anterior chest radiographs.

RESULTS AND DISCUSSION

The following material comprises important epidemiological data that relate to coal mine dust-affected workers and non-workers, according to the results of the epidemiological investigation.

DEMOGRAPHIC CHARACTERISTICS OF THE WORKER

Table 1

S.No	Range	Control	Coal Workers
1	Age (Yrs)	43.28±11.21	44.16±8.27
2	SEX	141±0.02	141±0.02
3	B M I (kg)	27.82±2.34	28.46±1.82
4	Duration of Exposure	-	8

The data of non-workers' and coal mine workers' ages (43.28 and 44.16), sex (141 and 141), BMI (kg) (27.82 and 28.46), and duration of exposure are shown in Table 1. (nil in control and 8 in workers).

Table:2

HABIT AND HABITATION OF THE STUDY GROUP

S.No.	PARTICULARS	CONTROL	EXPOSED
1	VEGETARIAN	2	1
2	NON VEGETARIAN	140	141
3	ALCOHOLICS	54	72
4	SMOKERS	13	9
5	TEETOTALER	87	69
6	TOBACCO CONSUMER	2	12

The Habit and Habitat of the Workers are explained in Table 2 and Figure 1 as vegetarians and non-vegetarians parameters are equal between workers and non-workers. However, in the category of alcoholics, workers (72) outnumber non-workers (54), while the categories for smokers (13 controls and 9 workers) and abstainers (87 non-workers and 69 workers) are the opposite. There are similarities between tobacco consumer and alcoholics (2 non workers and 12 workers).

According to the findings, coal dust has a negative impact on coal mine workers. The findings are confirmed by earlier research because cumulative coal dust exposure was linked to an increased risk of death from heart disease (*Landen, D.D. et., al. 2011; Wu, Q. et., al.2019; Hendryx, M. and Zullig, K.J. (2009)*)

Figure 1



HABIT AND HABITATION OF THE STUDY GROUP

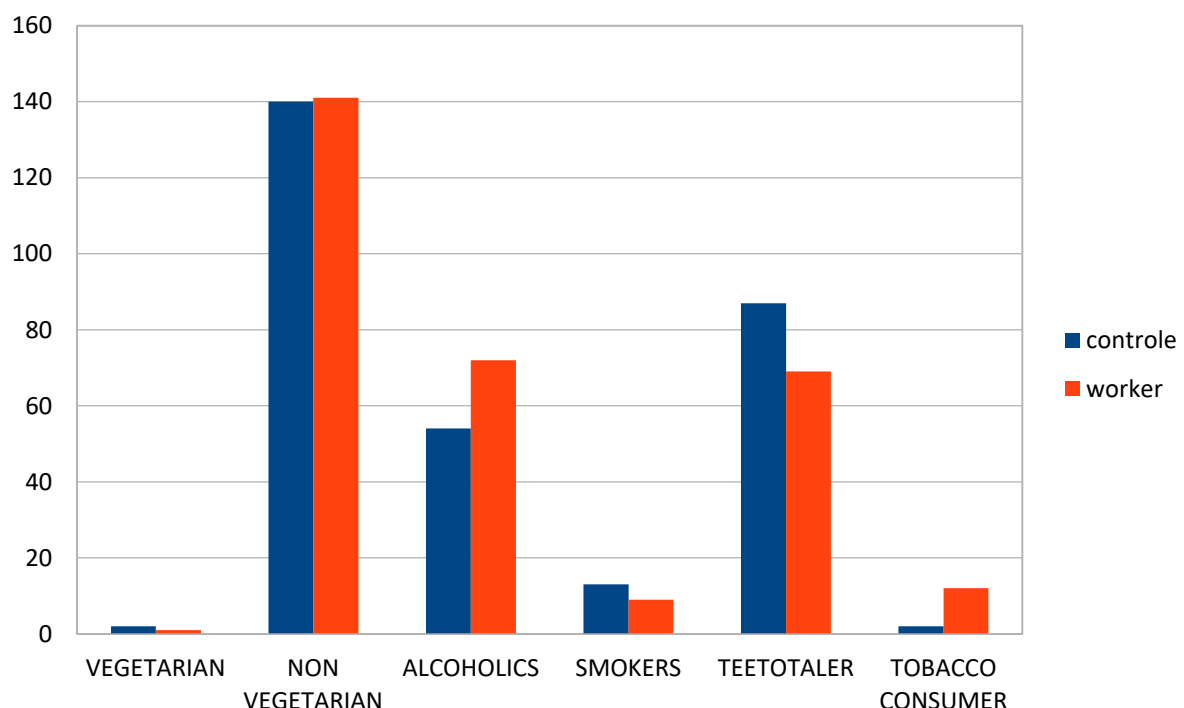
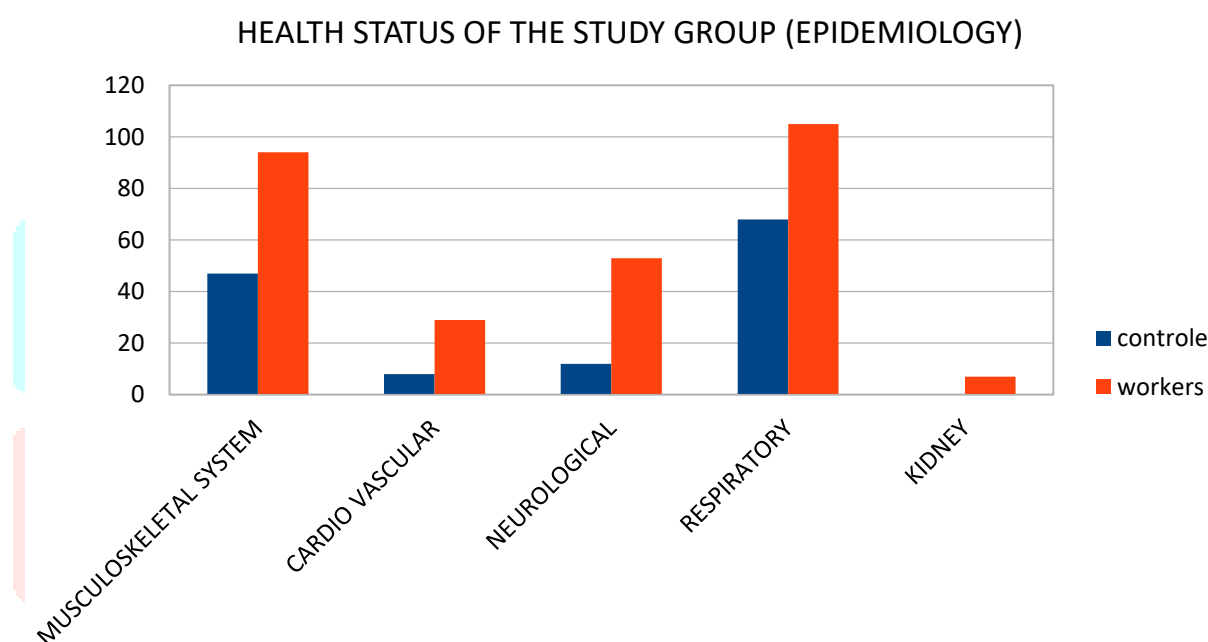


Table 3 HEALTH STATUS OF THE STUDY GROUP (EPIDEMIOLOGY)

S.No	HEALTH STATUS INDICES	CONTROL (n=141)	EXPOSED (n= 141)
1	MUSCULOSKELETAL SYSTEM	47	94
2	CARDIO VASCULAR	8	29
3	NEUROLOGICAL	12	53
4	RESPIRATORY	68	105
5	KIDNEY	0	7

FIGURE 2



According to the health status indices shown in Table 3 and Figure 3, 141 people (47 non-workers and 94 workers) in the study area have respiratory irregularities caused by CMD, along with 37 (eight non-workers and 29 workers) who have cardio-vascular problems, 65 (12 non-workers and 53 workers) who have neurological problems, and 173 (68 non-workers and 105 workers) who have neurological problems. The difference in renal condition severity between worker (7) and non-workers (both zero). The Human health has been negatively impacted by coal mines containing arsenic, fluorine, selenium, and possibly mercury on a local and regional level. The results are same as the presence of nearby Pliocene lignite deposits has been linked to Balkan endemic nephropathy (BEN), an incurable kidney disease of unknown origin. The prevailing theory is that as groundwater runs through lignites, harmful organic chemicals are leached out and consumed by the local populace, causing this health issue (Finkelman, R. B. et. al., 2002). The kidney problem is significant in coal mine workers (7) as compared to nil in non coal mine workers (0).

Table 4: The distribution of alcohol consumption habits among workers in coal mines and non-coal mines

		Alcoholic		Total	Chi-Square	Sign
		NO	YES			
COAL MINE	Count	69	72	141	12.349	.000
	% within Nature of work	48.9%	51.1%	100.0%		
NON-COAL MINE	Count	98	43	141	12.349	.000
	% within Nature of work	69.5%	30.5%	100.0%		
Total	Count	167	115	282	12.349	.000
	% within Nature of work	59.2%	40.8%	100.0%		

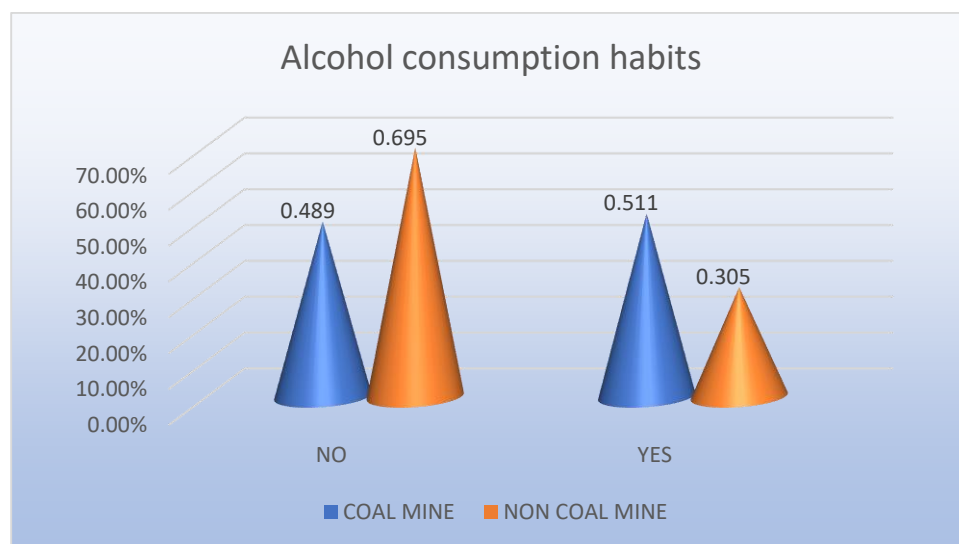


Figure 4: Alcohol consumption habits among workers in coal mines and non-coal mines

The above table shows that, the chi-square test was performed to find out association between nature of work and gender. The chi-square value is .129 and the calculated significant value is .812, which is not significant. In coal mines out of 141 (100%) workers, 69 (48.9%) do not consume alcohol. Conversely, 72 workers, or 51.1%, do consume alcohol. In non-coal mines, of the 141 (100%) workers, a larger proportion 98 (69.5%) do not consume alcohol. The remaining 43 (30.5%) workers do consume alcohol. Combining the both types of mines, there are 167 (59.2%) workers who do not consume alcohol, and 115(40.8%) workers who do consume alcohol.

It suggests that alcohol consumption is more prevalent among workers in coal mines than in non-coal mines, with coal mine workers almost evenly split on alcohol consumption. However, in non-coal mines, the majority of workers do not consume alcohol. Overall, across all workers surveyed, the majority do not consume alcohol, but a significant minority does.

Table 5: Shows information on tobacco chewing habits among workers in coal mines and non-coal mines

		Tobacco chewing		Total	Chi- Square	Significance
		NO	YES			
COAL MINE	Count	129	12	141	9.758	.003
	% within Nature of work	91.5%	8.5%	100.0%		
NON-COAL MINE	Count	140	1	141		
	% within Nature of work	99.3%	0.7%	100.0%		
Total	Count	269	13	282		
	% within Nature of work	95.4%	4.6%	100.0%		

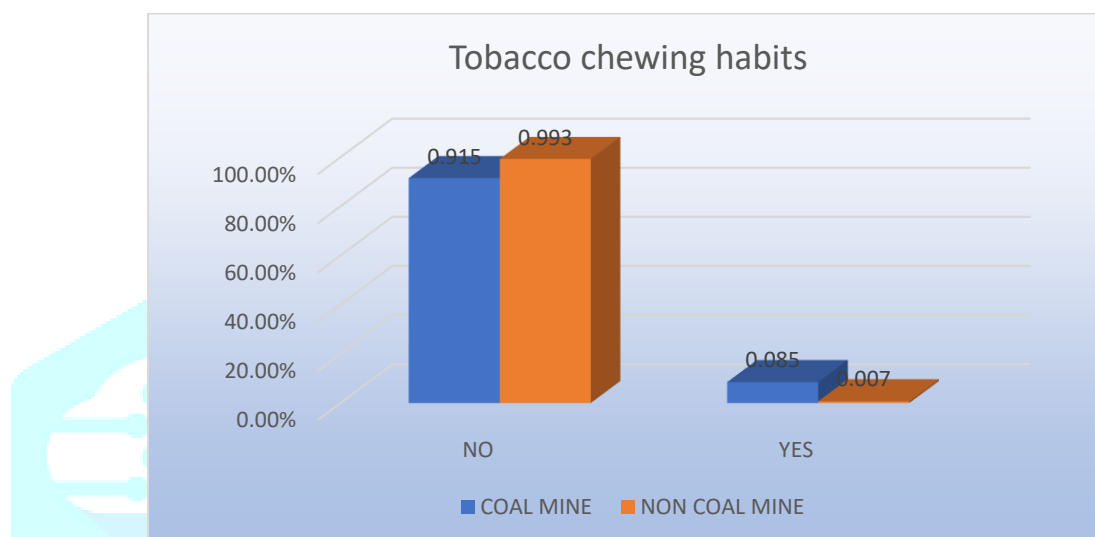


Figure 5: Tobacco chewing habits among workers in coal mines and non-coal mines

Above table shows that, the above table shows that, the chi-square test was performed to find out association between nature of work and gender. The chi-square value is .129 and the calculated significant value is .812, which is not significant.

In coal mines, out of 141(100%) workers, 129 (91.5%) do not chew tobacco. There are 12 (8.5%) workers who do chew tobacco, in non-coal mines, the number of workers not chewing tobacco is even higher relative to their coal mine counterparts. Out of 141 (100%) workers, 140 (99.3%) do not chew tobacco, Only 1(0.7%) worker in the non-coal mines chews tobacco. Looking at the both types of mines 282 (100%), 269 (95.4%) workers do not chew tobacco. There are 13 (4.6%) workers who do chew tobacco.

It indicates that tobacco chewing is not a common habit among the workers in both coal mines and non-coal mines, with a particularly low prevalence in the non-coal mines. Overall, the vast majority of the workforce in this survey do not engage in tobacco chewing.

Table 6: Shows compares Tea tootler workers from coal mines and non-coal mines.

		Tea tootler		Total	Chi-Square	Significance
		NO	YES			
COAL MINE	Count	83	58	141	20.658 ^a	.000
	% within Nature of work	58.9%	41.1%	100.0%		
NON COAL MINE	Count	45	96	141		
	% within Nature of work	31.9%	68.1%	100.0%		
Total	Count	128	154	282		
	% within Nature of work	45.4%	54.6%	100.0%		

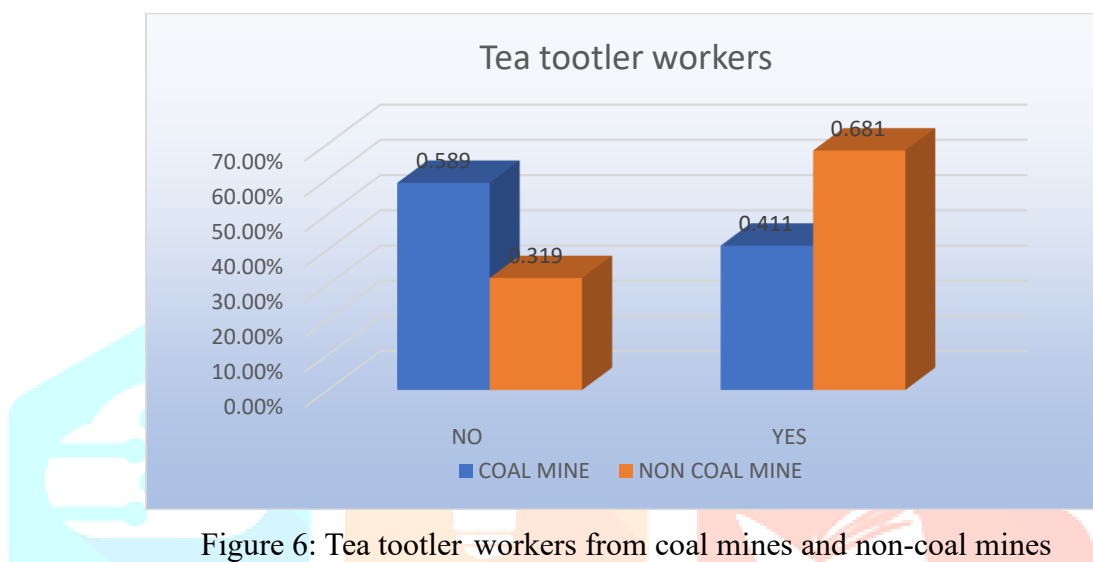


Figure 6: Tea tootler workers from coal mines and non-coal mines

From the above table and diagram shows that, the above table shows that, the chi-square test was performed to find out association between nature of work and gender. The chi-square value is .129 and the calculated significant value is .812, which is not significant.

In coal mines out of 141 (100%) workers, 83 (58.9%) are not tea tootlers (they may consume alcohol), The remaining 58 (41.1%) workers are tea tootlers, In non-coal mines, out of 141 (100%) workers, a smaller number, 45 (31.9%), are not tea tootlers, A majority of 96 (68.1%) workers are tea tootlers, which is of the non-coal mine workforce. When combining the mine types, out of the total 282(100%) workers, 128 (45.4%) are not tea tootlers, and 154 (54.6%) are tea tootlers. It suggests that a higher proportion of workers in non-coal mines abstain from alcohol compared to those in coal mines. Overall, among the total surveyed population, tea tootlers make up a slight majority.

Table 11: Shows the details the frequency of a specific activity or behaviour performed weekly by workers in

coal mines and non-coal mines.

		Weekly		Total	Chi-Square	Significance
		NO	Yes			
COAL MINE	Count	138	3	141	18.063	.000
	% within Nature of work	97.9%	2.1%	100.0%		
NON-COAL MINE	Count	117	24	141		
	% within Nature of work	83.0%	17.0%	100.0%		
Total	Count	255	27	282		
	% within Nature of work	90.4%	9.6%	100.0%		

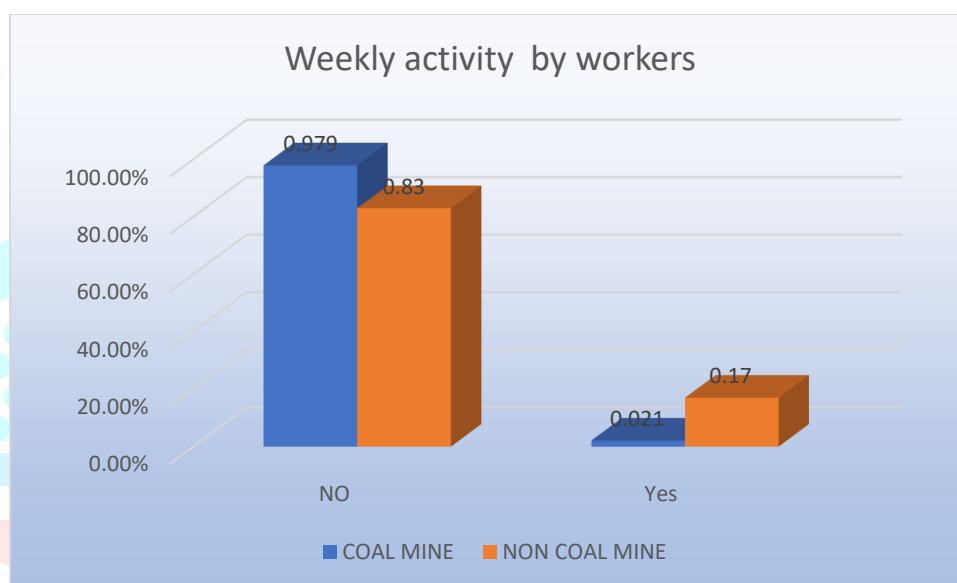


Figure: A specific activity or behaviour performed weekly by workers in coal mines and non-coal mines.

From the above table shows that, the above table shows that, the chi-square test was performed to find out association between nature of work and gender. The chi-square value is .129 and the calculated significant value is .812, which is not significant.

In coal mines, out of 141(100%) workers, 138(97.9%) do not perform the activity weekly, a small number, 3 (2.1%) workers, do perform the activity weekly, in non-coal mines, the number of workers not performing the activity weekly is 117(83.0%), which is of the non-coal mine workforce. A higher proportion compared to coal mines, 24 (17.0%) workers do perform the activity weekly. Looking at the both types of mines, 255 (90.4%) workers do not perform the activity weekly, there are 27 (9.6%) workers who do perform the activity weekly. It suggests that the weekly activity or behaviour in question is not commonly performed by the majority of workers in either type of mine. However, it is more common in non-coal mines than in coal mines.

Table 12: The crosstab presents data regarding the occurrence of viral infections among workers in coal mines and non-coal mines

		Any Viral Infection		Total	Chi-Square	Sign
		No	Yes			
COAL MINE	Count	64	77	141	71.954	.000
	% within Nature of work	45.4%	54.6%	100.0%		
NON-COAL MINE	Count	130	11	141		
	% within Nature of work	92.2%	7.8%	100.0%		
Total	Count	194	88	282		
	% within Nature of work	68.8%	31.2%	100.0%		

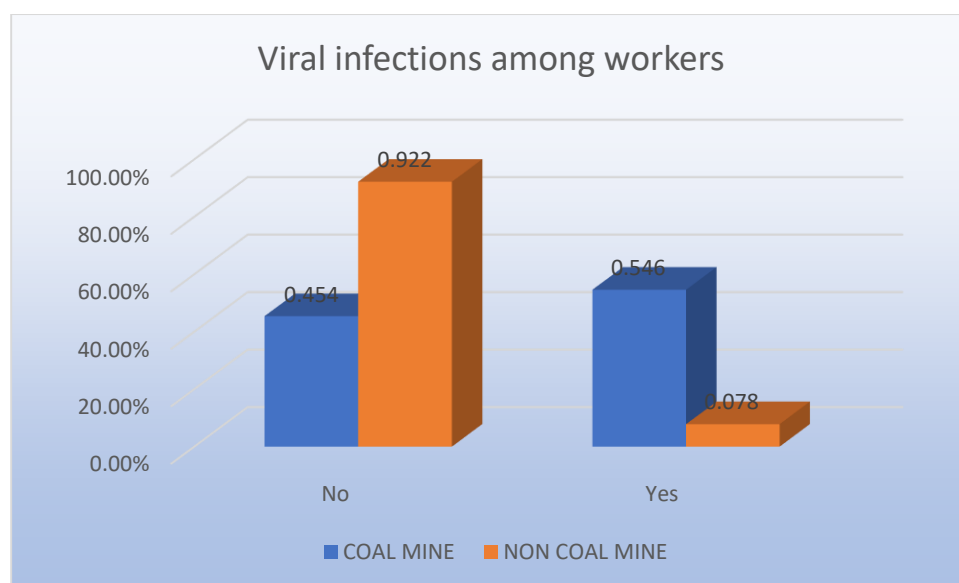


Figure: the occurrence of viral infections among workers in coal mines and non-coal mines.

The above table shows that, the above table shows that, the chi-square test was performed to find out association between nature of work and gender. The chi-square value is .129 and the calculated significant value is .812, which is not significant.

In coal mines, out of 141(100%) workers, 64 (45.4%) have not had a viral infection, in contrast, a larger number, 77 (54.6%) workers, have had a viral infection, in non-coal mines, the situation is quite different. Out of 141(100%) workers, a large majority, 130 (92.2%), have not had a viral infection, only 11(7.8%) workers have had a viral infection. When combining both mine types, out of the total 282(100%) workers, 194(68.8%) have not had a viral infection, representing of the overall workforce. However, 88 (31.2%) workers have experienced a viral infection, which constitutes of the total workforce.

It indicates that viral infections are significantly more common among coal mine workers than non-coal mine workers. Overall, a majority of the total workforce has not experienced a viral infection, but a considerable number (nearly one-third) have.

CONCLUSION

The poor general health status of coal mine workers has been made clear by this study. The research showed that high rates of CMD, alcohol consumption, smoking, and cigarette use cause greater rates of blood pressure disease and lung injury in the community, necessitating rapid care. This study has paved the way for additional investigation and intervention in a population where more than 83 mining regions in 9 Indian states (the ministry of coal) are actively using labour to produce coal.

The normal general health examinations that are performed on a regular basis at the mines must be included. On mine premises, general health education materials, alcohol- and smoking-related posters, as well as information about the benefits of quitting smoking, must be posted. To give employees individualised care and support, CMD cessation counselling facilities must be built.

To prevent those who do not already have the habit from being persuaded to adopt it, strict restrictions must be implemented prohibiting the consumption of alcohol and smoking in mines. The current general healthcare services offered by my government, which focus mostly on treatment, should be more proactive in their approach. To improve these particular occupational subjects' health state, ongoing study and treatments are required.

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