TRIBAL HOUSING CONDITIONS AND INDOOR AIR POLLUTION: PREPARATION OF LOW RISK FUEL INDEX WITH USE OF CENSUS 2011 DATA

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Abstract : Indoor air pollution caused by the solid cooking fuel is one of the most predominant health threats globally and India in particular. Tribes are economically, socially and environmentally vulnerable and ethnic group of society got severally affected by indoor pollution. Improper, inadequate housing conditions of tribal households till relay on unprocessed bio-fuel as their primary source of cooking and the accessibility of low risk fuel is a challenge for them. They were not only weaker in using low risk fuel but also in housing conditions and other household amenities. In India, those states provide good housing conditions were also good in using low risk fuel and vies versa. This paper focuses the relation between the housing conditions of the tribes with respect to cooking fuel consumed by them in different states of India with the help of secondary source of information computed from the census of India 2011. The result shows a strong positive effect between living condition and the use of low risk fuels by the tribes. The use of low risk fuel is a millennium development goal and housing is a basic necessity, it is necessary to probe more in this area for the sustainable development of the nation.

Index Terms - Indoor air pollution, Tribes, Unprocessed bio fuels, Low risk cooking materials, High risk cooking materials, Housing conditions.

I. INTRODUCTION

Indoor air pollution caused by the unprocessed solid cooking fuel is one of the most predominant health threats globally sceptically in India. Women, children, elderly people are vulnerable group in both rural and particularly in tribes. The tribes are excluded from the main stream of the society (Chandrima Chatterjee and Gunjan Sheoran, 2007) with respect to socio, economic and environmental aspects. Tribal people are living in vulnerable environment got seriously affected by the indoor air pollution caused by unprocessed cooking fuel. Improper, inadequate and poor socio-economic conditions of tribal households till relay on unprocessed bio fuel as their primary source of cooking and the accessibility of clean fuel is a challenge for them. In India as per the 2011 census, 90.6 percentages of the tribal households have been relay on high risk cooking fuel as their primary source of cooking.

Globally, the unprocessed solid bio cooking fuels used for cooking and heating purposes are considered as the largest source of indoor air pollution. (Kirk R Smith et al. 2005). Economically developed countries, such as the USA, UK, Italy, Denmark, and others were depending on cleaner cooking fuels, where as in India bulk of the cooking energy needs were derived from unprocessed solid bio fuels, such as firewood and cattle dung cake (Meena Sehgal et al.2010). India has got the largest burden of disease due to the use of solid biomass as household fuels and 28% of deaths occur out of total deaths due to indoor air pollution in developing countries (ICMR 2001).

The tribes are affected mostly by indoor air pollution problem. Indian states provide good housing conditions were also good in using clean fuel and vies versa. In addition it is difficult to find the real income of households in majority of economic analysis. It is essential to take housing as an economic variable instead of income. There is parallel relationship between housing condition and income. A crucial question proposed that is there any positive association between tribal housing condition and burning up of clean fuel? In this backdrop, this paper is addressing issue of the housing condition and clean fuel accessibility owing to achieving millennium development goal. It is necessary to probe whether tribes are equally access the better housing conditions and clean fuel than other.

II. MATERIALS AND METHODS

In order to realise the focus of paper, the major source of information computed from census of India 2011. Clean fuel is a millennium development goal and the housing is basic necessity, it is necessary to probe more in this contest for the sustainable development of the nation. Trichotomy approach was adopted in the analysis. The states are categories three type namely good, moderate and poor states based on the percentage use up of low risk cooking material. Those states with less than 25 cumulative percentage of the tribal population depends on low risk material (clean fuel) as primary cooking fuel, states are considered as poor states, states consuming 25.1 to 75 percent of low risk material as moderate states and states with tribal population depending more than 75 cumulative percent on low risk material categorised as good states. States like Rajasthan, Bihar, Tripura, Jharkhand, Odisha, Chhattisgarh and Madhya Pradesh are coming under poor states, likewise Jammu & Kashmir, Uttar Pradesh, Arunachal Pradesh, Nagaland, Manipur, Meghalaya, Assam, West Bengal, Gujarat, Maharashtra, Andhra Pradesh, Karnataka and Kerala were coming under moderate states and state such as Tamil Nadu, Himachal Pradesh, Uttarakhand, Sikkim, Mizoram and Goa are coming under good states with respect to low risk material used as primary source cooking. Union Territories are not taking into account against state comparison and states like Punjab and Haryana were excluded throughout the analysis due to non availability of tribal populations.

III. ANALYSIS AND DISCUSSION

The data computed and analysed with the help of the raw data available from the 2011 census of India. For the sake of analysis about cooking fuel used by tribal India were categorised into high risk cooking materials user and low risk cooking materials user. High risk materials or unprocessed fuels are bio-fuels used for cooking i.e. firewood, cow dung cake, crop residues, charcoal, coal and lignite. And the low risk materials or clean fuels are cooking materials which are comparatively less pollutants i.e. kerosene, biogas, LPG, PNG and electricity. These were the major cooking fuels used in India. Mean, Standard Deviation, Range and Index Mean were the statistical tools used for the analysis.

The rural poor in general and the vulnerable section in particular were facing different kinds of problems in India. Tribal are facing host nitty-gritty problems such as required and quality of drinking water, poor shelter, lack of drinking water, lack of education, improper medical facility, improper road, improper sanitation, improper lighting facilities and lack of awareness of clean fuel consumption.

Housing as condition as an economic variable liveable condition of the houses, structure, ownership patterns, size and number of rooms in the tribal houses, had taken into account for the study and household amenities like basic necessities of a household like drinking water facilities, lighting facilities, sanitation and drainage facilities were considered for the research. Keeping all these as economic variables accessing the standard of living of tribes with respect to the comparatively cleaner fuel or the low risk cooking material (LRM) used in India, thus the accessibility of low risk materials to the tribes.

Table – 1: Percentage wise details of tribal total housing conditions, residential housing and residence-cum-other use housing condition

Cumulative Proportion of using LRM	States	Statistics	Percentage of LRM	Housing Conditions (%)			Condition of residential houses			Condition of houses residence-cum-other use		
				Good	Liveable	Dilapidated	Good	Liveable	Dilapidated	Good	Liveable	Dilapidated
Poor state (25 % <)	Chhattisgarh, Odisha, Jharkhand, Madhya Pradesh, Bihar, Rajasthan, Tripura	Mean SD Range Idx. mean N	4.33 1.37 2.20-6.20 0.04 7	36.03 10.60 19.1-52.7 0.34 7	58.11 9.314 42.2-72.3 0.69 7	5.84 1.74 3.3-8.6 0.71 7	34.81 10.51 18.7-52.2 0.33 7	55.26 9.25 41.1-70.3 0.64 7	5.64 1.71 3.3-8.4 0.71 7	1.23 0.90 0.4-2.6 0.27 7	2.87 1.85 1.1-5.8 0.30 7	0.19 0.11 0-0.30 0.81 7
Moderate states (25.1 -75%)	West Bengal, Kerala Assam, Jammu & Kashmir, Meghalaya, Manipur, Gujarat, Andhra Pradesh, Nagaland, Karnataka, Uttar Pradesh, Maharashtra, Arunachal Pradesh	Mean SD Range Idx. mean N	15.30 5.22 7.00-24.10 0.25 13	44.05 9.58 27.5-57.8 0.51 13	49.27 7.83 36.5-61.5 0.47 13	6.69 4.41 1.5-16.3 0.65 13	42.95 9.61 26.8-57.4 0.50 13	47.32 7.0 36.1-59.3 0.45 13	6.54 4.40 1.5-16.3 0.66 13	1.10 1.23 0.1-4.5 0.23 13	1.93 2.60 0.2-9.0 0.18 13	0.16 0.30 0-1.10 0.85 13
Good states (> 75.1 %)	Uttarakhand, Himachal Pradesh, Tamil Nadu, Sikkim, Goa, Mizoram	Mean SD Range Idx. mean N	40.67 7.49 33.00-54.00 0.74 6	62.02 5.61 54.7-68.6 0.87 6	34.85 4.59 29.0-40.1 0.13 6	3.15 1.18 1.9-5.2 0.88 6	60.82 5.78 53.0-67.8 0.87 6	33.90 4.80 27.6-39.5 0.15 6	3.12 1.19 1.8-5.2 0.90 6	1.22 0.55 0.5-1.8 0.27 6	0.92 0.66 0.4-2.1 0.05 6	0.05 0.08 0.0-.20 0.95 6
Total		Mean SD Rang Idx. mean N	18.20 14.29 2.20-54.00 0.30 26	46.04 12.99 19.1-68.6 0.55 26	48.32 11.19 29.0-72.3 0.45 26	5.65 3.52 1.5-16.3 0.72 26	44.88 12.99 18.7-67.8 0.54 26	46.36 10.44 27.6-70.3 0.43 26	5.51 3.49 1.5-16.3 0.73 26	1.16 0.99 0.1-4.5 0.25 26	1.95 2.16 0.2-9.0 0.18 26	0.14 0.22 0-1.10 0.86 26
		ANOVA	F=83.31***	F=13.60***	F=14.97***	F=2.31^{NS}	F=13.54***	F=14.03***	F=2.16^{NS}	F=.05^{NS}	F=1.37^{NS}	F=.69^{NS}

Source: Data computed from the census 2011

States – Haryana & Punjab and Union Territories were excluded.

*** One percent level of significance, ** Five percent level of significance, *Ten percent level of significance, ^{NS} Not Significance

Housing is one of the basic requirements of the human beings along with food and clothing, houses provides shelter from whether and also from the wild animals. Especially for tribe who were largely living inside or near to the forest good dwelling condition is essential. Dwelling is not only matters a material living standard but also a sense of personal security and good health. Good childhood development requires good dwellings and good indoor environment. May be children from poor family are living in unhealthy houses. A house must be safe and healthy because the first indoor environment a child came to experience is the indoor environment of the house (WHO).

The table - 1 shows the relation between the conditions of houses of tribal households in different states of India with respect to cooking fuel consumption. It is evident from the table that six states like Himachal Pradesh, Uttarakhand, Sikkim, Mizoram, Goa and Tamil Nadu are using comparatively cleaner fuels and they are also good in the housing conditions. Averages of 62.02 percent were living in good housing conditions in these states, ranging from 54.7 to 68.6 with SD value 5.6 and average of only 3.15 were living in dilapidated houses which ranges from 1.9 to 5.2. The states like Bihar, Rajasthan, Tripura, Jharkhand, Odisha, Chhattisgarh, Madhya Pradesh were poor in clean cooking fuel consumption are also poor in providing good housing conditions with an average of 36.03 and standard deviation of 10.60. These states are ranging from 19.1 to 52.7. These states except Tripura were identified as most backward states in India and had included in the Empowered Action Group States (EWA) by the government of India, eight states in India namely Bihar, Jharkhand, Uttar Pradesh, Uttarakhand, Madhya Pradesh, Chhattisgarh, Orissa and Rajasthan are included in the list of EWA (Ministry of health and family welfare 2011). Average index man for these states is 0.34 where as average index mean for good houses in moderate states is 0.51, these states ranging from 27.5 to 57.8 with mean and standard deviation of 44.05 and 9.58. Over all an average of only 46.04 tribal households was enjoying good housing conditions in India.

Index of tribal housing condition is explained in the table, positive indexes were calculated for the good and liveable houses and negative index values were calculated in case of the dilapidated houses. This system has been followed throughout while computing the condition of total houses as well as condition of residential houses and condition of houses residence-cum-other use houses. In case of structure of the tribal houses permanent, semi – permanent houses and houses in serviceable conditions were calculated using positive index and temporary houses and houses in non – serviceable conditions are calculated with the help of negative index.

The good and liveable housing conditions were calculated with a positive index mean and negative index mean for the dilapidated houses. That is

Positive index = $\dfrac{\text{(Actual value – Minimum value)}}{\text{(Maximum value – Minimum Value)}}$

Negative index = $\dfrac{\text{(Maximum value – Actual value)}}{\text{(Maximum value – Minimum Value)}}$

It is clearly evident from the table that the positive indexes shows an increasing trend from the poor states to the moderate states and then to the good states. The state coming under poor category shows only positive index of 0.3 were as it increased to 0.51 among the moderate states and the positive index reached to 0.81 in case of the states under good category. It is observing one percent level of significance among the groups in case of good and liveable houses. There is positive association between clean fuel consumption with Index value, good & condition of housing whereas inverse relationship with liveable and dilapidated house.

Housing is not just used for shelter alone; it is used both as residence houses and residence cum other uses. Most of the tribal houses were utilised for residential purpose alone but a very few percent utilises there dwellings as a medium of livelihood and as residence. Among residence cum other uses houses itself an average of 0.14 were having dilapidated houses. That is an average of 0.19 houses were dilapidated within the poor states and an average of 0.16 within the moderate states and an average of 0 .05 within the good states. In case of the residential houses while observing, the good houses the condition of the houses increases from poor states to the good states, like an average of 34.81 among poor state, an average of 42.95 among moderate states and an average of 60.82 among the good state.

Structures of the tribal house hold were another important factor which determines the housing conditions of the tribes. Structures of the house means whether the houses were permanent, semi-permanent, temporary, serviceable and non-serviceable and about averages of 0.93 houses were not classified into any of these groups. Table-2 is dealing with this kind of information. From the data it is evident that an average of 38.6 was living in permanent houses. Within the permanent houses averages of 64.90 were from good states, ranging from 43.1 to 81.3 with 13.02 as standard deviation and 0.78 as index mean and 35.48 from moderate states with a standard deviation of 19.51, these stats were ranging from 7.80 to 67.30, with an index mean of 0.38 and only an average of 21.84 were belongs to the poor states, ranging from 6.3

to 42.4. And the data shows one percent level of significance between and within the groups. Semi-permanent and temporary houses were highly constituted in the poor states with averages of 56.40 and 21.33, followed by the moderate states with averages of 43.67 and 19.55 respectively and these averages reduces in case of good states to 24.85 and 9.47 respectively. There is no significant difference between and within the groups, in case of the non–serviceable houses. Non-serviceable houses were high in the moderate states, that is an average of 12.40, were as in poor states it is average of 8.49 and the good states were good in these situations also with only an average of 5.03 non–serviceable houses.

Table – 2: Percentage wise details of Structure of the Tribal Houses

Cumulative Proportion of using LRM	States	Statistics	Percentage of LRM	Structure of the Tribal Houses					
				Permanent	Semi-permanent	Temporary	Serviceable	Non-serviceable	Unclassifiable
Poor state (25 % <)	Chhattisgarh, Odisha, Jharkhand, Madhya Pradesh, Bihar, Rajasthan, Tripura	Mean SD Range Idx. mean N	4.33 1.37 2.20-6.20 0.04 7	21.84 12.76 6.30-42.40 0.29 7	56.40 17.57 29.90-78.90 0.69 7	21.33 10.52 9.10-34.50 0.57 7	12.83 8.09 5.20-30.10 0.45 7	8.49 10.01 0.90-23.90 0.81 7	0.41 0.21 0.20-0.80 7
Moderate states (25.1 -75%)	West Bengal, Kerala Assam, Jammu & Kashmir, Meghalaya, Manipur, Gujarat, Andhra Pradesh, Nagaland, Karnataka, Uttar Pradesh, Maharashtra, Arunachal Pradesh	Mean SD Range Idx. mean N	15.30 5.22 7.00-24.10 0.25 13	35.48 19.51 7.80-67.30 0.38 13	43.67 16.84 18.50-67.50 0.47 13	19.55 11.26 2.40-48.40 0.61 13	7.13 6.15 0.80-18.20 0.22 13	12.40 11.93 1.60-44.90 0.74 13	1.29 1.14 0.20-4.10 13
Good states (> 75.1 %)	Uttarakhand, Himachal Pradesh, Tamil Nadu, Sikkim, Goa, Mizoram	Mean SD Range Idx. mean N	40.67 7.49 33.00-54.00 0.74 6	64.90 13.02 43.10-81.30 0.78 6	24.85 12.94 12.30-48.90 0.18 6	9.47 8.11 1.30-22.50 0.83 6	4.43 6.35 0.10-17.10 0.15 6	5.03 5.76 0.60-16.10 0.90 6	0.77 0.54 0.20-1.50 6
Total		Mean SD Range Idx. mean N	18.20 14.29 2.20-54.00 0.30 26	38.60 22.48 6.30-81.30 0.43 26	42.75 19.32 12.30-78.90 0.46 26	17.70 11.06 1.30-48.40 0.85 26	8.04 7.20 0.10-30.10 0.27 26	9.65 10.41 0.60-44.90 0.80 26	0.93 0.92 0.20-4.10 26
		ANOVA	$F=83.31^{***}$	$F=11.23^{***}$	$F=6.11^{***}$	$F=2.49^{NS}$	$F=2.74^{*}$	$F=1.09^{NS}$	$F=2.47^{NS}$

Source: Data computed from the census 2011

*** One percent level of significance, ** Five percent level of significance, *Ten percent level of significance, ^{NS} Not Significance

Table – 3: Number of rooms in the houses and Ownership status of tribal houses

Low risk cooking material	States	Statistics	Number of dwelling rooms				Ownership status		
			No exclusive room	One room	Two rooms	Three rooms and above	Owned	Rented	Any other type
Poor state (25 % <)	Chhattisgarh, Odisha, Jharkhand, Madhya Pradesh, Bihar, Rajasthan, Tripura	Mean SD Range Idx. mean N	3.19 1.36 1.6-5.5 0.90 7	47.86 16.78 29.9-79.4 0.51 7	17.31 8.87 2.9-28.1 7	10.37 5.10 2.1-16.5 0.31 7	95.07 0.83 94.4-96.7 0.91 7	2.94 0.54 2.3-4.0 0.03 7	2.00 0.63 1.1-2.9 7
Moderate states (25.1 - 75%)	West Bengal, Kerala Assam, Jammu & Kashmir, Meghalaya, Manipur, Gujarat, Andhra Pradesh, Nagaland, Karnataka, Uttar Pradesh, Maharashtra, Arunachal Pradesh	Mean SD Range Idx. mean N	4.75 4.80 1.6-20.0 0.81 13	35.12 15.51 14.1-57.4 0.33 13	27.98 15.28 8.8-49.9 13	16.16 8.24 6.7-29.0 0.53 13	88.84 4.75 81.4-97.1 0.72 13	8.10 4.16 1.6-15.0 0.22 13	3.03 1.75 1.2-7.8 13
Good states (75.1 % <)	Uttarakhand, Himachal Pradesh, Tamil Nadu, Sikkim, Goa, Mizoram	Mean SD Range Idx. mean N	3.02 2.86 1.0-8.7 0.90 6	25.98 12.29 18.4-50.1 0.20 6	38.42 13.84 13.6-49.4 6	18.42 5.54 9.4-23.6 0.63 6	80.63 8.79 67.5-89.7 0.45 6	16.15 9.10 6.3-30.3 0.52 6	3.18 .94 2.1-4.1 6
Total		Mean SD Range Idx. mean N	3.93 3.72 1.0-20.0 0.85 26	36.44 16.64 14.1-79.4 0.35 26	27.52 15.06 2.9-49.9 26	15.12 7.38 2.1-29.0 0.50 26	88.62 7.31 67.5-97.1 0.71 26	8.57 6.91 1.6-30.3 0.24 26	2.79 1.41 1.1-7.8 26
		ANOVA	F=.61[NS]	F=3.43**	F=3.93**	F=2.43 [NS]	F=11.74***	F=10.50***	F=1.59 [NS]

Source: Data computed from the census 2011

*** One percent level of significance, ** Five percent level of significance, *Ten percent level of significance, [NS] Not Significance

The table-3 above details the ownership pattern of the tribal houses and the size of the tribal houses with respect to the number of rooms consisted by these houses. Number of dwelling rooms is one of the indicators in accessing the economic condition of the houses. Averages of 36.44 percent of the tribes were living in one room houses and about 3.93 percent does not have an exclusive room in their houses. This data also follows a trend that the condition of the states moving from poor to good regarding cooking fuel, the size of house also increases like other conditions of the houses. That is in the poor states the size of houses were smaller than the houses in the moderate and good states. Numbers of one room houses with an average of 47.86 and no exclusive room houses with mean of 3.19 are higher in poor states.

Ownership of the houses shows an inverse relationship between the conditions of the state with respect to clean fuel. Low risk cooking material consumers are more in the rent houses than in the houses owned by them. Those tribes who are living in the native habitats that are inside forest or nearby forest are living in their own houses. The households who are coming out from the traditional habitats or moving to the urban for livelihood are depending on rent houses. Therefore, regarding tribes those households living in rent houses are having better housing and housing conditions.

Index means are also employed to assess the housing condition in different states in India positive index means are calculated for size of the houses with three rooms and above and for own houses also. Negative index means are calculated for houses with no exclusive rooms, houses only having one room and for rented houses.

Table – 4: Location and Source of Drinking water of tribal households

Low risk cooking material	States	Statistics	Sources of drinking water			Location of drinking water source		
			Modern sources	Traditional sources	Other sources	Within premises	Near premises	Away
Poor state (25 % <)	Chhattisgarh, Odisha, Jharkhand, Madhya Pradesh, Bihar, Rajasthan, Tripura	Mean	67.03	31.87	1.17	14.01	46.79	39.20
		SD	16.49	16.81	0.66	12.12	8.01	11.22
		Range	37.40-87.30	10.70-61.80	0.50-2.10	6.20-40.90	32.20-57.70	17.70-53.60
		Idx. mean	0.59	0.57		0.16	0.49	0.34
		N	7	7	7	7	7	7
Moderate states (25.1 -75%)	West Bengal, Kerala Assam, Jammu & Kashmir, Meghalaya, Manipur, Gujarat, Andhra Pradesh, Nagaland, Karnataka, Uttar Pradesh, Maharashtra, Arunachal Pradesh	Mean	64.70	33.09	2.24	28.78	42.02	29.22
		SD	20.37	19.68	1.74	11.43	6.59	7.46
		Range	26.70-90.40	8.30-69.90	0.80-7.10	13.30-47.30	28.90-52.90	18.20-45.50
		Idx. mean	0.55	0.55		0.42	0.36	0.56
		N	13	13	13	13	13	13
Good states (75.1 % <)	Uttarakhand, Himachal Pradesh, Tamil Nadu, Sikkim, Goa, Mizoram	Mean	82.42	14.77	2.82	43.98	40.97	15.05
		SD	12.79	11.03	2.12	14.88	14.05	4.80
		Range	60.40-94.90	2.70-32.70	1.40-7.00	21.10-58.70	28.90-65.90	9.90-22.40
		Idx. mean	0.80	0.82		0.72	0.33	0.87
		N	6	6	6	6	6	6
Total		Mean	69.41	28.53	2.09	28.31	43.06	28.64
		SD	18.73	18.37	1.68	16.08	9.01	11.71
		Range	26.70-94.90	2.70-69.90	0.50-7.10	6.20-58.70	28.90-65.90	9.90-53.60
		Idx. mean	0.62	0.62		0.42	0.39	0.57
		N	26	26	26	26	26	26
		ANOVA	F=2.08[NS]	F=2.46 [NS]	F=1.76[NS]	F=9.41***	F=.84 [NS]	F=14.16***

Source: Data computed from the census 2011

*** One percent level of significance, ** Five percent level of significance, *Ten percent level of significance, [NS] Not Significant

- Modern sources of drinking water - Tap water (from treated and un-treated sources), hand pump, tube well, borehole
  Traditional sources of drinking water - Covered well, un-covered well, spring, river, canal, tank, pond, lake

Drinking water and sanitation are the primary needs for the survival of human life, but unfortunately in India, due to the economic barriers some of the major stats are failed to provide these requirements.

Table - 4 detailing the sources from which drinking water is collected by the tribal households and the locations of the drinking water sources. The traditional sources of drinking water includes covered well, un-covered well, spring, river, canal, tank, pond and lake and the modern sources of drinking water includes tap water (from treated and un-treated sources), hand pump, tube well and borehole. Overall an average of 28.53 percent in India are still relaying on traditional sources like covered well, un-covered well, spring, river, canal, tank, pond and lake. The states in good condition are depending more on modern water sources that is, an average of 82.42 percent, ranging from 60.40 to 94.90 with standard deviation of 12.79. The states in poor condition have only an average of 67.03 percent of modern water sources, ranging from 37.40 to 87.30 with standard deviation of 16.40. The data clearly depicts that the modern source of drinking water is increasing gradually from poor states to good states. At the same time percentage of traditional sources are decreasing from poor to good states that is, from average 31.87 to 14.77 and ranges from 10.70 - 61.80 to 2.70 - 32.70. Positive index value had been calculated for modern sources and negative index value for traditional sources.

Location of drinking water source is also an important factor which determines the living condition of the tribal households. In India only an average of 28.31 percent of households have drinking water sources within the premises, out of which average of 43.98 percent are in good states, 28.78 are in moderate states and only 14.01 are in poor states. The ANOVA result shows there is significant variation among the group of states at one percent level. That is a variation of 14.30 percent between good conditioned states and poor conditioned states. Average of 43.06 percent households has water sources near to their houses; it is ranging from 28.90 to 68.90.
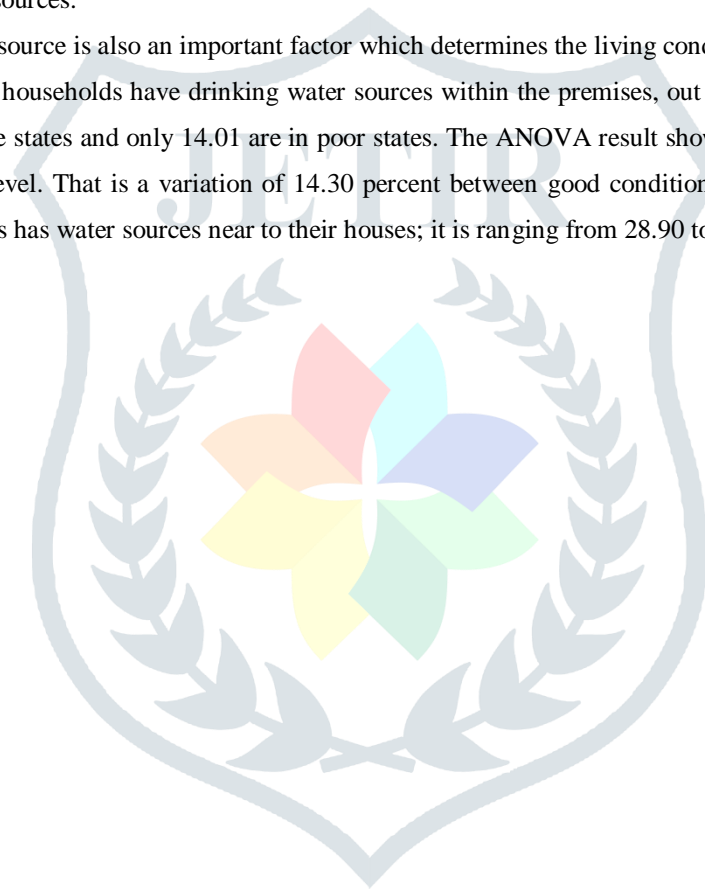
Table – 5: Sewage water disposals- Latrine, bathroom and drainage facilities of tribes

Low risk cooking material	States	Statistics	Latrine facility		Bathroom facility		Waste water outlet	
			Having latrine	Not having latrine	Having bathroom	Not having bathroom	Have drainage	No drainage
Poor state (25 % <)	Chhattisgarh, Odisha, Jharkhand, Madhya Pradesh, Bihar, Rajasthan, Tripura	Mean SD Range Idx. mean N	17.71 20.50 7.1-63.7 0.13 7	82.29 20.50 36.3-92.9 0.13 7	5.60 1.52 3.40-7.50 0.04 7	84.59 8.61 69.90-93.80 0.11 7	16.11 8.54 10.00-35.10 0.84 7	83.89 8.54 64.90-90.00 0.11 7
Moderate states (25.1 -75%)	West Bengal, Kerala Assam, Jammu & Kashmir, Meghalaya, Manipur, Gujarat, Andhra Pradesh, Nagaland, Karnataka, Uttar Pradesh, Maharashtra, Arunachal Pradesh	Mean SD Range Idx. mean N	44.35 21.50 19.5-78.4 0.43 13	55.65 21.50 21.6-80.5 0.43 13	29.53 13.89 9.60-56.70 0.42 13	53.52 20.02 17.60-85.40 0.52 13	32.08 15.10 12.50-60.40 0.85 13	67.93 15.08 39.70-87.50 0.42 13
Good states (75.1 % <)	Uttarakhand, Himachal Pradesh, Tamil Nadu, Sikkim, Goa, Mizoram	Mean SD Range Idx. mean N	63.42 22.16 34.7-91.9 0.65 6	36.58 22.16 8.1-65.3 0.65 6	52.20 11.87 34.30-65.40 0.78 6	36.50 10.47 24.70-49.70 0.79 6	51.85 8.41 39.00-62.80 1.02 6	48.17 8.42 37.20-61.00 0.78 6
Total		Mean SD Range Idx. mean N	41.58 26.44 7.1-91.9 0.40 26	58.42 26.44 8.1-92.9 0.40 26	28.32 20.09 3.40-65.40 0.40 26	57.95 23.48 17.60-93.80 0.40 26	32.34 17.50 10.00-62.80 0.89 26	67.67 17.49 37.20-90.00 0.42 26
		ANOVA	F=7.59***	F=7.59***	F=26.75***	F=15.82***	F=13.46***	F=13.47***

Source: Data computed from the census 2011

*** One percent level of significance, ** Five percent level of significance, *Ten percent level of significance, [NS] Not Significant

Table – 5 discussing about the sanitation and sewage water disposal. An average of 58.42 of the tribal households in India did not have latrine facility, ranging from 8.1 to 92.9. It means that more than half of the population in India is lagging behind in achieving the basic requirement like latrine facility. Only an average of 41.58 percent having latrine facility, out of which 63.42 were from the good conditioned states and there is wide variation of between states in good condition and states in poor condition with the average of 17.71, ranging from 7.12 to 63.7. That is a difference of average 45.71 between the good and poor states. Bathroom facilities also represent a gradual increase from poor states average 5.60 to moderates states average 29.53 then to good states with average 52.20. That is a positive difference of 23.93 percent from poor to moderate stats and 22.67 percent from moderate to good states. ANOVA result shows that there is one percent significant difference between these groups of states. Overall average of 57.95 percent of the tribal households did not have bathroom facility ranging from 17.60 to 93.80 with standard deviation of 23.48. Positive index values are calculated for tribal houses having latrine facilities and having bathroom facilities. And for those households lagging these facilities negative index mean were calculated.

Sewage water disposal is another important problem faced by the tribal households. Most of these houses in India did not have proper drainage facilities to dispose the waste water and stagnant waste water is the major cause of water born and water based diseases. Lack of proper drainage facilities is the major cause of stagnant waste water. Still in India, an average of 67.67 percent does not have waste water outlets to dispose waste water from the house. Out of which 83.89 percent is from poor states, 67.93 percent from moderate states and 48.17 percent from good states. That is a difference of 15.96 from poor to moderate and 19.76 from moderate to good. ANOVA estimates one percent level of significant difference between these groups. It shows that good states in the utilisation of clean cooking fuel are also good in sewage water disposal through proper drainage facilities.
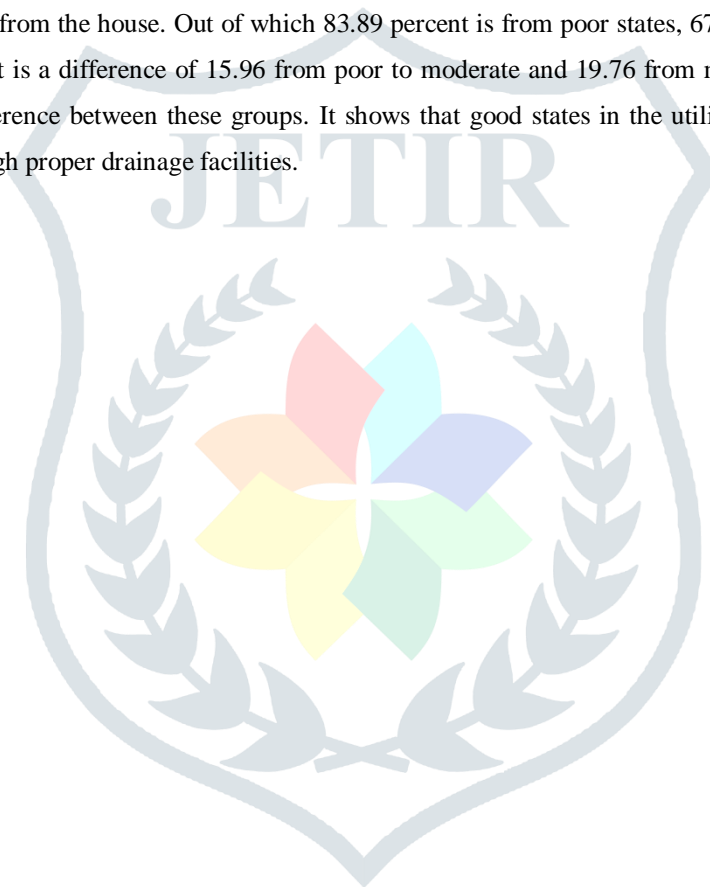
Table – 6: Main source of lighting of tribal households

Low risk cooking material	States	Statistics	Main source of lighting					
			Electricity	Kerosene	Solar	Other oil	Other source	No lighting
Poor state (25 % <)	Chhattisgarh, Odisha, Jharkhand, Madhya Pradesh, Bihar, Rajasthan, Tripura	Mean SD Range Idx. mean N	36.26 18.03 11.50-56.80 0.27 7	61.30 18.51 40.10-86.90 0.33 7	1.46 1.18 0.60-3.80 0.31 7	0.27 0.14 0.10-.50 0.61 7	0.16 0.08 0.10-.30 7	0.51 0.43 0.10-1.20 0.97 7
Moderate states (25.1 -75%)	West Bengal, Kerala Assam, Jammu & Kashmir, Meghalaya, Manipur, Gujarat, Andhra Pradesh, Nagaland, Karnataka, Uttar Pradesh, Maharashtra, Arunachal Pradesh	Mean SD Range Idx. mean N	60.88 18.75 28.00-83.60 0.59 13	33.60 20.08 12.30-69.30 0.65 13	1.68 1.42 0.30-4.00 0.35 13	0.33 0.14 0.20-.70 0.53 13	1.17 1.71 0.10-5.50 13	2.34 3.94 0.10-14.20 0.85 13
Good states (75.1 % <)	Uttarakhand, Himachal Pradesh, Tamil Nadu, Sikkim, Goa, Mizoram	Mean SD Range Idx. mean N	88.70 5.11 83.70-94.50 0.95 6	9.48 4.57 4.10-13.60 0.95 6	0.93 0.615 0.30-1.90 0.17 6	0.20 0.13 0.00-.30 0.73 6	0.13 0.08 0.10-.30 6	0.57 0.33 0.20-1.00 0.97 6
Total		Mean SD Range Idx. mean N	60.67 24.65 11.50-94.50 0.59 26	35.49 25.12 4.10-86.90 0.63 26	1.45 1.21 0.30-4.00 0.30 26	0.29 0.14 0.00-.70 0.60 26	0.66 1.30 0.10-5.50 26	1.44 2.90 0.10-14.20 0.91 26
		ANOVA	F=16.23***	F=14.40***	F=0.76^{NS}	F=1.87^{NS}	F=2.23^{NS}	F=1.29^{NS}

Source: Data computed from the census 2011

*** One percent level of significance, ** Five percent level of significance, *Ten percent level of significance, ^{NS} Not Significant

IV. CONCLUSION

The study derives a conclusion from the analysis that a strong positive relation between living condition and the use of clean fuels by the tribes. Even though housing is a basic necessity and some of the states in our nation are far behind to achieve this goal and those states were poor in housing were also poor in providing clean fuel also. The use of unprocessed bio fuel generates indoor air pollution and it leads the health of the tribal poor into worse. That is the good houses and use of clean fuel not only develop the material living standard but also develops the physical and mental health conditions. Good quality of shelter and its indoor environment must require for the well development of the future generation and these were the urgent necessities for the sustainable development of the nation.

V. AKNOLOGEMENT

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