ABSTRACT

Hemoglobin is the protein molecule present in red blood cells that carries O\textsubscript{2} from the lungs to the body tissues and returns CO\textsubscript{2} from the tissues back to the lungs.

The red blood cells have the ability to concentrate hemoglobin in the cell fluid up to about 34 grams in each 100 ml of cells. Anemia refers to a reduced oxygen carrying capacity of blood either due to reduced red blood cell count or decreased hemoglobin concentration. Anemia in women apart from many other causes is possibly due to the result of systemic inflammation which is probably because of the smoke of biomass fuels.

To study correlation between hemoglobin levels and use of biomass fuel (wood) for cooking by females in rural areas of Lucknow district.

The examination was done on the 44 females between 18 to 55 years of age and cooking food using biomass fuels for at least 5 years. Women who were pregnant, having history of bleeding disorders like hemophilia and Thalassaemia, history of tobacco intake, history of medications like steroids and history of hemorrhoids were excluded from the study. Examination of the blood sample for hemoglobin estimation was collected in the rural health training center (RHTC) of Era's Lucknow medical college and Hospital and hemoglobin estimation was done in the hospital lab services (HLS) Era's Lucknow medical college and hospital, which use fully analyzing method SYMEX XS 8001 for hemoglobin estimation.

The correlation between biomass fuel (wood) smoke and hemoglobin levels was strongly positive and statistically highly significant (p= 0.004).

The decrease in hemoglobin levels due to exposure to indoor air pollution resulting from the burning of biomass fuels in smoky fires for cooking have important implications for diagnosis of anemia.

KEYWORDS: Hemoglobin, Biomass fuel, Anemia, Indoor air Pollution.
growth in children, reduced birth weight & respiratory
disease (5).
In the developing countries, exposure to biomass fuel
emissions is probably one of the most important
occupational health hazards for women (6).

MATERIAL AND METHOD
This was a cross-sectional study was conducted on 44
women in rural areas (using data from rural health
training center (R.H.T.C.) of Era's Lucknow medical
college & hospital) for estimation of Haemoglobin
level at Hospital Lab Services (HLS) who were using
wood as fuel (biomass fuel) for cooking.

Inclusion Criteria
• Female subjects between 18 to 55 years of age.
• Cooking food using biomass fuels for at least 5 years.

Exclusion Criteria
• Pregnant women.
• Bleeding disorders like Hemophilia, Thalassaemia
• H/o tobacco intake.
• H/o medications (steroids)
• H/o haemorrhoid

Study Centre
Department of Physiology in collaboration with
department of Community Medicine and Hospital
Lab. Services (HLS), Era's Lucknow medical college
& hospital.

METHODOLOGY
All the subjects who were fulfill the inclusion criteria and
not falling into the domain of exclusion criteria were
invited to enroll in the study till the sample size
requirements were fulfilled. All subjects were explained
about the protocol of the study and a written informed
consent was obtained. The subjects selected for the study
were motivated to give blood sample and were explained
the benefits of examination of their blood sample.

The device used for estimation of hemoglobin works
on principle of fluorescence flow cytometry for high
quality analyzing. Venus blood sample was collected
with all aseptic precautions and stored in the EDTA
vial for examination in hospital lab. Survey was done
in the rural areas and families living in low socio-
economical status. Selections of females were done,
involving those who were using biomass fuels for
cooking since five years or more (7-9).

Statistical Analysis
• Data was analysed using statistical package for
social sciences (SPSS) Version 20.

• Chi-Square Test & Independent sample t test was
used to find the association between the type of
anaemia, and the type of Biomass fuel (wood) with haemoglobin levels.

• The confidence limit of study was 80% hence the
level P<0.05 was considered as the cut off value or statistically significant.

RESULTS
This cross-sectional study was conducted on 44
women living in rural areas (using data from rural health
training center (R.H.T.C.) of Era's Lucknow medical college & hospital) for estimation of Hemoglobin levels at Hospital Lab Services (HLS). We performed this study to find the association between hemoglobin levels and effect of biomass fuel's (wood) smoke amongst females in rural areas of Lucknow district who was using as the primary source of fuel for cooking.

Table 1: Correlation Between Hemoglobin Levels And Fuel Used (Wood) By Females For Cooking

| Hemoglobin levels(g/dL) | Female (n=44) | p value |
|-------------------------|--------------|---------|
| Severe                  | <8           | 10 (22.7)|<0.01 |
| Moderate                | 8 –10.9      | 34 (77.3)|       |
| Mild                    | 11–11.9      | -       |       |
| Normal                  | ≥12          | -       |       |

Table 1 shows the distribution of severity of anemia with hemoglobin levels. In severe anemia (10%) the level of hemoglobin was found to be <8.0 gm/dL whereas the level of hemoglobin in moderate anemia (34%) was found to be 8.0 to 10.9 g/dL. None of the women using wood as cooking fuel source suffered from mild anemia. The results were found to be highly statistically significant (p<0.01).

Fig 1: Distribution Of Females According To Severity Of Anemia
Table 2: Anthropometric Distribution Of Study Population

Table 2 shows the distribution of women using biomass fuel on the basis of their BMI in which the mean weight was found to be 50.09±7.15 kg whereas the mean height was found to be 1.54±0.042 meters and mean BMI was found to be 21.14±2.49 kg/m².

DISCUSSION

Biomass smoke contains lots of pollutants substances that may be systemic inflammation, including carbon monoxide, transitional metals, ultrafine particle, particulate matter (10).

In the present study, we study the effect of biomass fuel on Hb. Level in 44 women who used wood as fuel (biomass fuel) for cooking food. After estimating the Hb. Level of women we analyses that there are 10 women whose Hb level estimated <8g/dL and 34 women whose Hb. Level 8 – 10.9g/dL. No women found whose Hb level >11. This shows that possibility of anemia may be due to use of wood as biomass fuel. Therefore smoke produced by biomass fuel i.e. wood was found to be strongly positively correlated with the hemoglobin levels in females and its impact on their hemoglobin levels was found to be highly statistically significant (P<0.01). This result was found to be in accordance with the study conducted by D Behera, S Dash , SP Yadav 1991(6) who found carboxy hemoglobin in women exposed to different cooking fuels like biomass, kerosene and liquefied petroleum gas.

The decrease in hemoglobin levels due to exposure to indoor air pollution resulting from the burning of biomass fuels in smoky fires for cooking have important implications for diagnosis of anemia. Amongst the population most at risk for anemia, are women living in the poor rural areas of developing countries, were the use of biomass fuels for cooking is most prevalent.

CONCLUSION

Though, it is a small study, but on the basis of the conclusions drawn, further research work can be undertaken with a larger sample size to ascertain more confirmatory diagnostic criteria to assess the effect of biomass fuels smoke on the hemoglobin levels in females using it as source for cooking so that health status of women can be improved.

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