www.abiosci.com

ISSN: 2348-1927

RESEARCH ARTICLE

Annals of Biological Sciences
2015, 3 (1):25-29

Effect of long term exposure to wood smoke on blood pressure among women in Samaru, Zaria

N. Y. Francis* and I. Suleiman

Department of Human Physiology, Faculty of Medicine, Ahmadu Bello University, Zaria, Kaduna, Nigeria
(Received: 05/03/15) *(Accepted:21/03/15)*

ABSTRACT

The study is aimed at examining the effect of long term exposure to wood smoke on blood pressure among women in Samaru, Zaria. The survey research design was adopted for the study. The sample of the study comprised of 40 women in the study area. The study is designed to involve all the women in community market Ahmadu Bello University, Zaria who use fire wood as a means of daily commercial cooking activities and women in community market Ahmadu Bello University who are not exposed to fire wood smoke. Data collected included age, height, weight and level of education in view of socio economic factors. Wood smoke is a complex mixture of substance produced during the burning of wood. The major emissions from wood stoves are carbon monoxide, organic gases (containing carbon or derived from living organism), particulate matter and nitrogen oxide. Wood smoke contains many organic compounds known to cause cancers (such as benzopyrenes, dibeenzanthracenes and dibenzocarbazole) and other toxic compounds (such as aldehydes, phenols or cresols). The findings of the study showed that women exposed to wood smoke had higher mean values of systolic blood pressure than control group (mm Hg), (119.75 ±3.41) and (112.60 ±2.43), respe ctively. They also had higher diastolic blood pressure (mm Hg), (86.50 ±2.93) compared with control (81.00 ±2.57) , and mean arterial blood pressure (mm Hg), (91.53 ±2.41) as compared with control (97.58 ±2.94). In conclusion , this study observed an increase in systolic, diastolic and mean arterial blood pressures in the exposed women compared to control group but not significantly differ. Hence, the findings of the study show that long term exposure to wood smoke may causes an increase in blood pressure and is a potential predisposing factor to hypertension.

Keywords: Systolic blood pressure, diastolic blood pressure, means arterial blood pressure, wood smoke.

INTRODUCTION

The use of wood as a source of fuel in our societies is a very common practice. Although wood usage is as old as man himself, wood is still very common in use. This is due to easy accessibility and economic hardship which made many people to resort to the cheap, affordable and readily available source of fuel especially in the rural areas. Wood is used in its traditional forms as household heating and cooking fuels in developing countries, and in its modern forms as power-plant fuel, principally in developed countries [1]. Throughout human history, the largest exposures to particle air pollution probably occurred in households through use of wood and other forms of biomass as sources of cooking, drying, and space-heating energy. Even today, such uses probably account for the majority of human exposure to inhalable Particulate matter worldwide because of the continued high dependence on such household fuels [2]. Because household use dominates total fuel demand in many developing countries, particularly in rural areas where half of humanity still lives, it is likely that biomass remains the main source of energy for most of humanity [3].

Many health problems could arise as a result of exposure to wood smoke. It has been discovered that too long exposure to wood smoke could predispose one to cardiovascular disease, coronary heart disease, cerebro-vascular disease, venous thrombo-embolism etc., and the increase in cases of the aforementioned diseases in our societies could be attributed to exposure to wood smoke for a long period of time. Continuous exposure to wood smoke causes oxidative stress to heart, pancreatic cells and organs involved in maintaining cardiovascular parameters [4].

The mechanisms proposed to explain the adverse health effects of PM exposure include particle-induced oxidative stress, inflammation and genotoxicity. Several *in-vitro* studies of cultured cells have previously shown that wood smoke PM increased the expression and production of pro-inflammatory cytokines, oxidatively damaged DNA and oxidative stress [4].

MATERIALS AND METHODS

1.1 Research Design

The research design used for the study was survey design. This is because it gives easy way to assess the effect of exposure to wood smoke on blood glucose level and some cardiovascular parameters among women in Samaru, Zaria. It is believed that survey design is most common and effective in examining existing issues as this study topic entails.

1.2 Population of Study

The targeted populations of study were the women inSamaru area of Zaria, Kaduna State of Nigeria. The population of the study includes all women who were 18 years and older and have been exposed to wood smoke for at least a period of ten years consistently as the exposed group and women who had never or abstained from wood smoke exposure for a period of ten years in the past as the control group. The target population was 50 women. The sample size was determined using the formula Yamane (1967) [5].

$$N = \frac{N}{1+ N*(e)2}$$

Where
n = the sample size
N = the population size
e = the acceptable sampling error
95% confidence level and p = 0.05 were used.

Hence, a total of 40 respondents were used for the research as the sample size which was selected from a total population of 50 women. The Forty (40) women volunteered to participate in the study. The women were grouped according to the type of domestic fuel used: wood (N = 20) and non-wood fuel (N =20) group. Non-wood fuel comprised liquefied petroleum gas, electricity and kerosene. All the women who used non-wood fuels had been exposed to biomass fuel at some time, but were currently using mixed sources of fuel. Exclusion criteria included all smokers, pregnant women and women with family history of hypertension and diabetes any respiratory disorder, pulmonary arterial hypertension, diabetes mellitus, and those who underwent recent surgery.

1.3 Sample and Sampling technique

The sample for the study is made up of a total of 40 women from Samaru area (Ahmadu Bello University Community Market) of Zaria, Kaduna State of Nigeria. A volunteer sampling technique was used to select the women who constituted the respondents and subjects for the study. The women were selected from the market which use wood frequently as source of fuel and also from locations in the market where wood is rarely used as source of fuel.

1.4 Data Collection

Questionnaire and scientific instrument were used for data collection. The questionnaire was divided into four parts. Section A, B, C and D. Section A comprises socio-demographic data of the respondents, section B family history, section C habits and physical activities and section D some structured questions revealing issue concerning health condition and health care accessibility of the respondents.

1.5 Data Administration

The research was carried out at the locations selected as sample for the study and the questionnaires were administered to the designated sample of women personally. This was to avoid loss of the questionnaires. Hence, the wait and take method was used by the researcher to request the respondent to provide information at the point of visit. After which, body weight, height, blood samples for fasting blood glucose level and blood pressure readings were taken using the procedures stated below.

i Blood pressure

The women were seated, relaxed and with arms well supported. The resting blood pressure [systolic blood pressure (SBP) and diastolic blood pressure (DBP)] were measured by manual auscultation using a sphygmomanometer. The armlet or cuff was wrapped snugly around their arm. The pulsation of the brachial artery was felt then the diaphragm of stethoscope was placed over the region of pulsation. The pressure was rapidly ran up to about 200mmHg and then allow to fall until the first tapping sound was heard. This was immediately noted as the systolic pressure. The pressure was allowed to fall slowly until it got to a point where the sound disappeared. This was taken as the diastolic pressure and mean arterial blood pressure (MABP) was calculated using the formula MABP = DBP + $\frac{1}{3}$ (SBP-DBP).

1.6 Ethical Consideration and Consent

An ethical permit from Ahmadu Bello University Teaching Hospital (ABUTH) Scientific and Health Research Ethics Committee was obtained for the research and also consent forms were issued out to the respondents during the research. This was to make sure that the respondents approved their participation in the research.

1.7 Statistical Analysis

The data obtained was expressed as Mean ± Standard error of mean (SEM) and analyzed by using the student t-test. Probability of P< 0.05 was considered statistically significant. Statistical package for social science (SPSS) software version 20.0 for Windows computing programme was used for the statistical analysis.

RESULTS

Figure 1 shows the mean difference of systolic blood pressure (mm Hg) of women exposed to wood smoke and control group, (119.75 ± 3.41) as compared to control (112.60 ± 2.43). This result is no significantly differ (p > 0.05).

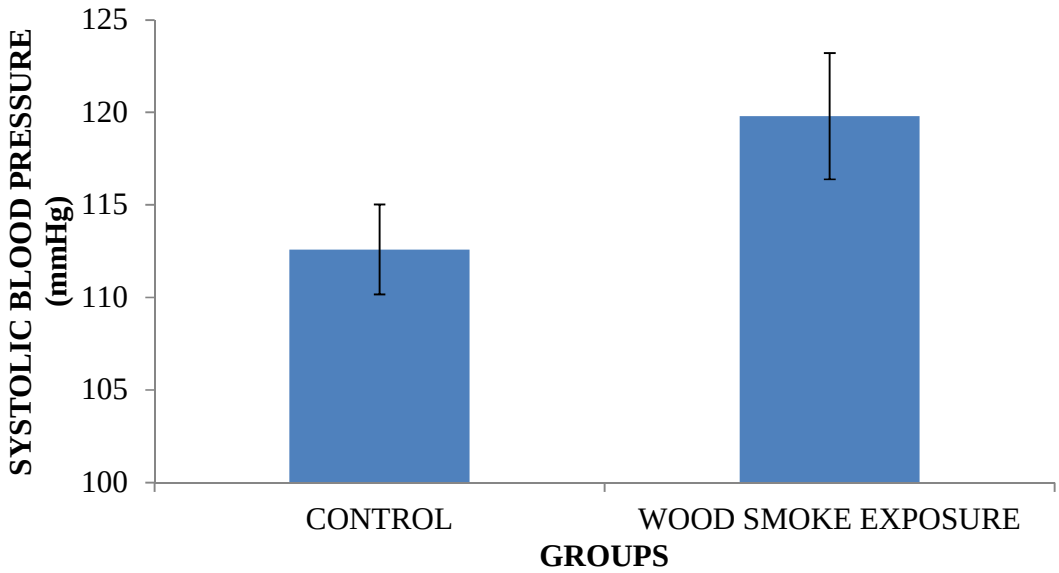

Figure 1: The systolic blood pressure of women exposed to wood smoke and control group

There is an increase in the mean of mean of diastolic blood pressure of women exposed to wood smoke (86.50 ± 2.93) as compared to control (81.5 ±2.57). This result is not significantly differ(P> 0.05) (Figure 2).

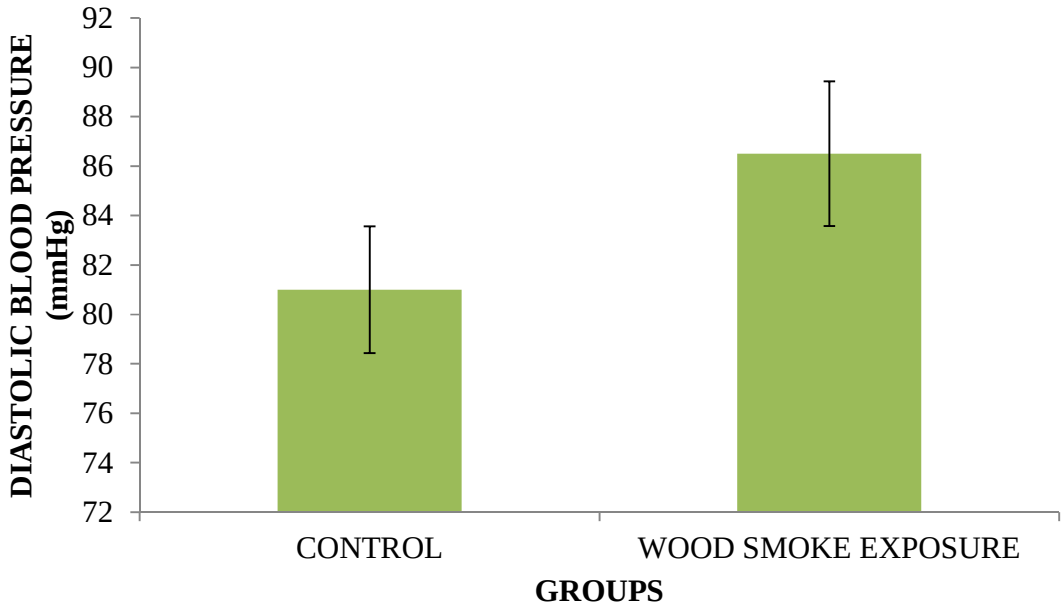

Figure 2: The diastolic blood pressure of women exposed to wood smoke and control group

Figure 3 shows the mean value difference in mean arterial blood pressure of women exposed to wood smoke (97.58 ± 2.94) and control group (91.53 ± 2.41). This result is not significantly differ (P>0.05).

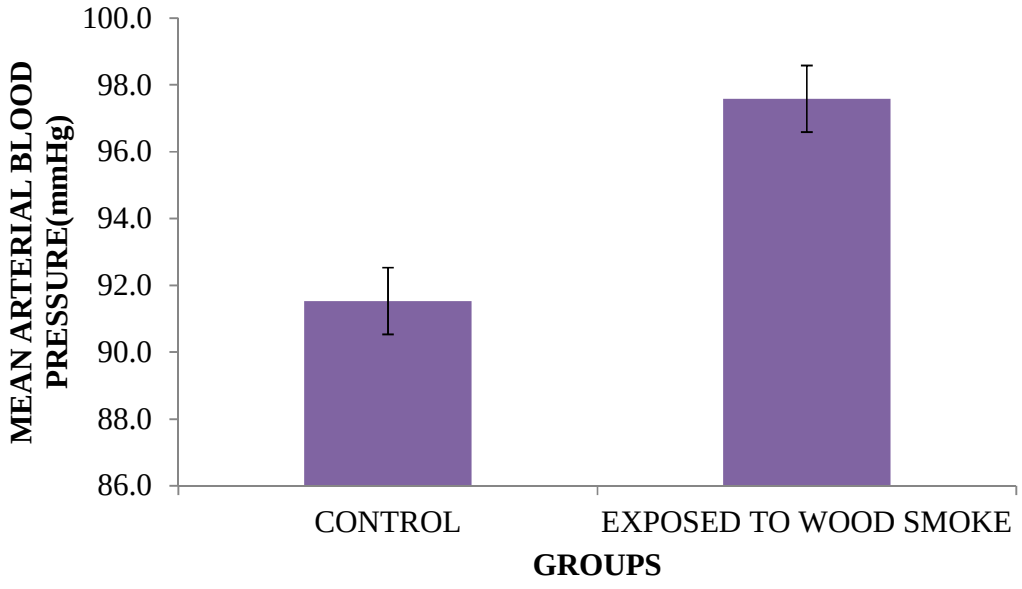

Figure 3: The mean arterial blood pressure of women exposed to wood smoke and control group

DISCUSSION

Based on the study, women who use wood fuels are of lower class, mainly cooks, causal workers with low income and educational achievements, when compared with women that used mixed fuels, who are in a higher socio-economic status with higher educational achievements and better pay, and therefore can afford more refined fuels than wood. The results of this study showed that wood fuels users had normal mean value of systolic blood pressure, but higher than the control which fell within the normal physiological range, except for diastolic blood pressure and mean arterial blood pressure. The study agrees with a study of McCracken *et al*. (2010) [6],conducted on women in Guatemala that were randomly assigned to cook with the plancha-improved stove, instead of the traditional open fire, who had lower diastolic blood pressure values. Brook *et al.* (2004) [7], states that oxidative stress and systemic inflammation are central to leading mechanistic hypothesis for effects of fine particles on cardiovascular health. The study is also in line with the study of the China Post, 2014 [8], reported that wood women in china who are to pollution from cook stove and highways face a greater risk of high blood pressure. Evidence of increased reactive oxygen species concentration in the heart and lungs of rats exposed to concentrated ambient particles supports this hypothesis. Providing a mechanistic link to blood pressure, endothelin-1, which modulates systemic vascular tone, is known to increase in response to reactive oxygen species [9].

CONCLUSION

In conclusion, this study observed non-significant increase in systolic, diastolic and mean arterial pressures in the exposed group when compared to the control group. Hence, the findings of the study show that exposure to wood smoke causes an increase in systolic, diastolic and mean arterial blood pressures.

REFERENCES

[1] United Nations Development Programme,*World energy assessment*, New York: UNDP, **2004**.
[2] K.R. Smith, *Annual Revised Energy Environment*, **1993**, 18, 529–566.
[3] L.P.Naeher, M.Brauer, M.Lipsett, J.T.Zelikoff, C.D.Simpson, J.Q.Koenig, K.R. Smith,*A Review: Inhalation toxicology*, **2007**, 19, 67-106.
[4] L. Forchhammer, P. Møller, I.S. Riddervold, J. Bønløkke, A. Massling, T. Sigsgaard, S. Loft,*Particle and Fibre Toxicology*, **2012**, 9, 7-11.
[5] T. Yamane,*Statistics: An Introductory Analysis*, 2nd Edition, New York: Harper and Row, **1967**.
[6] J.P Mccraken, K.R. Smith, M.A. Mittleman, J. Schwartz, *Environmental Health Perspectives*, **2010**, *115*(7), 996-1001.
[7] R.D. Brook, B. Franklin, W. Cascio, Y. Hong, G. Howard, M. Lipsett, R. Luepker, M. Mittleman, J. Samet, S.C. Jr. Smith, *Circulation*, **2004**, *109, 2655-2671.*
[8] The China Post,*Proceedings of the National Academy of Sciences*, **2014**
[9] B.M. Akor-Dewu,O.J. Ayo, R.A. Collins,M.M. Mabrouk,B.A. Adelaiye,L.F. Ciroma,*American International Journal of Contemporary Research*,**2012**, 2(8), 257-263.