



Study Effect of Camphor fumes on the Pulmonary Functions

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Abstract

Effect of occupational exposure to camphor fumes on the pulmonary function was studied using one hundred (100) selected Igbo women working in camphor industry in Aba, Abia State, Sought East Nigeria, exposed to camphor fumes for over 15 years (test subjects). They were compared with age, body weight and height matched control who were mostly house wives and civil servants not exposed to any known fumes or air pollutants and with no history of chest infections or spinal cord injury. Lung function indices investigated to include Forced Vital Capacity (FVC), Forced Expiratory Volume per second (FEV₁), ratio of FEV₁/FVC expressed as percentage (FEV₁%) and Peak Expiratory Flow Rate (PEFR). The study which lasted for 4 months, was carried out using a Vitalograph Spirometer and Peak Expiratory Flow Meter. Results obtained showed statistically significant reduction in lung function indices (FVC, FEV₁ and PEFR) for workers exposed to camphor fumes (test) compared to the control subjects (P < 0.001). However, FEV₁% in the Test group was 89.1% compared with the control (98.0%). Although both groups appeared normal and within normal values with no statistical difference but in some lung diseases like pulmonary fibrosis and other similar lung conditions, FEV₁% may appear normal, yet there is derangement in pulmonary functions. This is not the case in this present study which showed restrictive pattern of lung defect as shown by the significant statistical results. The result of mean values of anthropometric parameters which included age, height, body weight and body mass index obtained showed that the test and control subjects were statistically not significant when compared (P > 0.05). It was not possible to determine the effects of environmental factors like carbon dioxide (CO₂) carbon monoxide (CO) and other gaseous fumes emitted during the processing period. It is therefore concluded that camphor fumes contributed significantly to the disorder observed in this study.

1 Introduction

Smokes and fumes inhalation are reported to have deleterious effect on the pulmonary functions. These smokes and fumes come from cigarette sticks, heated oil, wood combustion, dust, sand mining and gases. They are usually inhaled during the process of heating, mining and manufacturing. Patrick and Femi Pearce (1976)¹ reported that anthropometric parameters like age, height, weight and race are important factors that affect pulmonary functions. Atmospheric pollutants like asbestos, sand

mining, granite, wood dust have been reported to affect pulmonary function in occupationally exposed workers²⁻⁵.

The present study investigated the effect of occupational exposure to camphor fumes on lung functions. Camphor industrial workers in Aba, Abia State, Sought East Nigeria, were studied (test subjects) and compared with age-, weight- and height matched control who were mainly house wives and civil servants not exposed to camphor fumes or any other air pollutants (control subjects). Camphor is a terpenoid substance prepared from wood of Camphor Laurel (*Cinnamomum*

camphora) and other evergreen trees in Asia and other Pacific Countries. Its production involves heating of turpentine oil to a very high temperature using wood and charcoal. The oil vapourizes, freezing at temperature of 175-205 degree Centigrade into a solid camphor materials, packaged into camphor balls and other camphor derivatives and marketed. Its medical and other uses date back to centuries. It is used as ointments, rubs and peppermints. It is also used as antipruritic agent. In industries, it is used for culinary spices, insect repellants and flea killing substance. It is also used as embalmment fluid and preservative. It contains linalool, cineole, nerolidol, satrole and barneol. In Aba, Abia State, Sought East Nigeria, many camphor industries are abound with many people earning their livings from there. Many of the workers have worked there for over 15 years and are exposed everyday to the risk of inhaling unquantified doses of camphor fumes. Although there are reports on the harmful effects of exposure to particulate fumes/smokes of cigarettes^{6,7}, sand mining and asbestos⁸, Wood dust⁵, there are paucity of report on the occupational exposure to camphor fumes on the pulmonary function indices of the exposed camphor workers. All the workers that participated in this study denied being aware of potential harmful effect of exposure to camphor fumes and other environmental pollutants associated with heated chaircoal and wood used during the camphor manufacturing period.

2 Materials and Methods

2.1 Materials

Vitalograph spirometer, weighing scale, non stretchable meter rule, a pair of scissors, Peak Flow Meter, a wooden back chair, a nose clip and a disposable mouth piece.

2.2 Experimental protocol

One hundred (100) Igbo women, aged between 30-47 years, weighing 50-90kg(1,4-1.7mheight), working in camphor industry in Ariari market in Aba, Abia State, Sought East ,Nigeria, exposed to camphor fumes for over 15 years were studied. They constitute the test subjects. The study lasted for 4months. The subjects were educated on the significance of the study and their informed consent was obtained. Inclusion criteria were observed strictly. The subjects were well seated on a back chair. Using vitalograph and Peak Flow meter, they were instructed to forcefully inhale air and exhale it with the nose clipped with nose clip while sitting on a chair quietly with the lips firmly held around the disposable mouth piece such that no air leakage occurs.

Each subject was made to perform the procedure three times with minimum interval of five minutes between each exercise. Lung function indices recorded include FVC, FEV₁. FEV₁% and PEFR. The test and control subjects were subjected to these procedures. Other measurements and readings taken were

weight (kg), height (m), body mass index (BMI, kg/m²) calculated.

Inclusion criteria are:

- Subjects are non smokers
- Subjects are those willing to participate fully and freely
- Subjects had no past medical history of respiratory infections before the study was carried out
- Subjects are all females and Igbo by tribe

Exclusion criteria include:

- Subjects with past history of chest infections, heart surgery and spinal cord injury
- Subjects with physical disability affecting the spine particularly
- Subjects with thoracic cage abnormality
- Subjects unwilling to fully and freely participate till the end of the study

2.3 Statistical analysis:

SPSS model 14 statistical soft ware was used for data entry and analysis. Chi square was used to compare percentages or ratios. Coefficient of correlation r was used to determine the significance between relationships. Unpaired student t test was used to compare two mean values. P< 0.05 is taken to be significant.

Table 1 showed that the mean values of industrial workers exposed to camphor fumes were for FVC=158±0.46L/m as against control=2.49±0.12L/m. This showed significant difference between the test and control subjects (P<0.001). The FEV₁ for the test and control groups are 1.41±0.41 and 2.44L/m, respectively. This also showed significant difference between them (P<0.001). FEV₁% for the test and control groups were 95.15±5.18% and 98.59±0.58%, respectively. This was not statistically significant, (P>0.05). PEFR for the test was 3.80+1.30L/s and control was 5.90±0.41L/s. This was statistically significant (P<0.001).

Table 1: showing mean values of lung function indices for the control and the test subjects

Parameters	Control (n=100)	Test (n=100)	P-Values
FVC (L/m)	2.49±0.12	1.58±0.46	**
FEV ₁ (L/m)	2.44±0.10	1.41±9.41	**
FEV ₁ %	98.59±0.58	95.18±5.18	NS
PEFR(L/S)	5.90±0.41	3.80±1.30	**

**=P<0.001 when compared with the control; NS=not statistically significant

Table 2 showed mean values of anthropometric parameters for the control and the test groups. There was no statistical significant difference between the anthropometric parameters of the control and the test groups ($P>0.05$).

Table 2: Showing mean values of anthropometric parameters for control and test subjects

Parameters	Control (n=100)	Test (n=100)	P Values
Age (years)	38.14±4.87	37.91±4.81	NS
Height (m)	1.62±0.06	1.62±0.08	NS
Weight (kg)	64.33±8.12	63.90±8.93	NS
Body mass index (kg/m)	24.69±3.35	24.17±3.02	NS

NS=Not statistically significant

4 Discussions

Deleterious effects of exposure to smokes and fumes of cigarettes and various heated substances on the lung functions have been reported. Osim *et al* (1992)⁴ reported derangement of lung functions in sand miners and workers exposed to asbestos. Okwari *et al* (2005)⁵ reported decrease in lung function indices in workers exposed to wood dust. Tredaniel *et al* (1994)⁶, Wells,(1994)⁷ reported that cigarette smoke has deleterious effect on the lung functions.

Maduka *et al* (2009)⁸ also reported that occupational exposure to local powdered tobacco(snuff) has deleterious effect on pulmonary function. In this study, effect of occupational exposure to camphor fumes on the camphor industrial workers was studied using one hundred selected Igbo women. Results obtained showed reduction in the pulmonary function indices (FVC, FEV₁and PEFR) of the industrial workers exposed to camphor fumes compared with the control. FVC for the test group was 1.58± 0.46L/m as against control group 2.49±0.12L/m, FEV₁ for the test subjects was 1.41±0.41L/m, FEV₁ for the control =2.44±0.10L/m, PEFR for the test and control groups were 3.80±1.30L/s and 5.90±9.41L/s, respectively. FVC, FEV₁ and PEFR for the test subjects were statistically reduced significantly when compared with control subjects,($P<0.001$).FEV₁% for the test and control were 95.18±5.18% and 98.59±0.58%, respectively.

This was not statistically significant when compared. The results obtained in this study showed that the pattern of impaired pulmonary function indices in camphor industrial exposed workers was that of restrictive lung function defect. This finding agreed with those of Osim *et al*(1992)⁴, Okwari *et al* (2005)⁵ and Maduka *et al*(2009)⁸ who worked on sand mining and asbestos, wood dust and tobacco (snuff)related occupational exposures respectively.

Obstructive lung defect was however absent in this study as shown by the normal values of FEV₁% in both the test and control groups. Since anthropometric parameters like age, sex, height, race and body weight have been shown to influence lung function indices (FVC, FEV₁ and PEFR) as reported by Patrick and Femi Pearce (1976)¹, Johannsen and Erasinus (1968)⁹, Aderele and Oduwole (1983)¹⁰, Jaja and Fagbenro (1995)¹¹ these factors were taken into consideration in this study and all were statistically not significant when both the test and control were compared($P>0.05$).

5 Conclusion

It is therefore concluded that camphor fumes caused significant restrictive pattern of lung function defect in camphor Indus trial workers exposed to camphor fumes.

6 Competing interests

Authors have agreed and declared that no competing interests exist.

7 Author's contributions

MFO and NAA carried out literature review and experimental, EAS, ADN and AEA were responsible for statistical work, calculations and typesetting of data and gained workers concepts. All authors read and approved the final manuscript.

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