



## A comparative study on some cardiovascular indices among morticians exposed to formaldehyde in Benin City, Nigeria

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### Abstract

**Background:** Some cardiovascular indices among morticians exposed to formaldehyde in a Teaching hospital and General hospital were studied.

**Materials and Methods:** Thirty subjects were studied and divided into three groups A, B, and C with 10 subjects in each group. Group A served as control with nil exposure to formaldehyde while groups B and C served as the test groups. Subjects in group B were morticians working in the Teaching hospital while subjects in group C were morticians working in the General hospital. Anthropometric measurements were taken and some cardiovascular indices were measured which included pulse rate, systolic blood pressure, diastolic blood pressure, pulse pressure, and mean arterial pressure. Statistical analysis was done using Graph Pad Prism version 8.0.1. Results were presented as Mean  $\pm$  SEM. Analysis of Variance was used to compare the means of test and control values while post hoc test was done using Tukey's multiple comparisons test and a P-value of less than 0.05 was considered as statistically significant.

**Results:** Results revealed significant increase in pulse rate, systolic blood pressure, diastolic blood pressure, pulse pressure, and mean arterial pressure among morticians of the Teaching hospital and General hospital when compared to the control and those of the General hospital morticians were higher compared to the Teaching hospital morticians.

**Conclusion:** It was therefore concluded that exposure to formaldehyde has deleterious effects on the cardiovascular health of morticians hence, there is an urgent need to seek ways of reducing the atmospheric levels of formaldehyde in our mortuaries in order to protect the cardiovascular health of the morticians.

Keywords: morticians, formaldehyde, Teaching hospital, General hospital, cardiovascular

### Introduction

Occupational exposure to formaldehyde has been reported to be high in workplaces such as histopathology laboratories and mortuaries where it is continuously utilized for the fixation of tissues and embalment of dead bodies.<sup>1</sup> Formaldehyde as a chemical fixative prevents tissues from undergoing post-mortem changes which usually occurs after death and this is achieved through its inherent properties that helps to fix and preserve tissues thereby helping to retain the form they held while the individual was

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still alive.<sup>2</sup> The property of formaldehyde in delaying the decomposition of cadavers makes it useful for embalming of bodies in the mortuaries as well as for the purpose of study during anatomy dissections in medical schools. Morticians who work in the mortuaries utilize formaldehyde continuously for the preservation of dead bodies

thereby making them prone to high exposure to formaldehyde fumes owing to their occupation. The health hazards of formaldehyde has been reported by several authors<sup>3-10</sup> and also several organizations have established standards which defined the limit to which an individual can be exposed to formaldehyde in order to protect occupationally exposed individuals from any possible harmful health effect of formaldehyde which could be acute or chronic. Occupational Safety and Health Administration (USA-OSHA) suggested a Time Weighted Average Concentration of 0.75ppm and Short Term Exposure Limit of 2ppm as legal standards,<sup>11</sup> while the American Conference of Governmental Industrial Hygienist (USA-ACGIH) suggested a ceiling limit of 0.3ppm as recommended standard.<sup>12</sup> The National Institute for Occupational Safety and Health (USA-NIOSH) suggested a ceiling limit of 0.1ppm and Time Weighted Average Concentration of 0.016ppm as recommended standard,<sup>13,14</sup> while the Japan Society for Occupational Health suggested a ceiling limit of 0.5ppm,<sup>15</sup> Also in Japan, the Ministry of Health, Labour and Welfare set limit values for environmental exposure to formaldehyde at 0.08ppm as an average for general workplaces and 0.25ppm for specific workplaces like formaldehyde factories and gross anatomy laboratories.<sup>16</sup> In a previous study, the present authors investigated the atmospheric levels of formaldehyde in some selected hospital mortuaries in Benin City, Nigeria which included a Teaching Hospital, General Hospital, and a busy Private Hospital mortuary<sup>17</sup> where it was observed that the atmospheric level of formaldehyde in the Teaching hospital mortuary was significantly lower compared to the General hospital and Private hospital mortuaries. This present study seeks to investigate the cardiovascular health of morticians in the Teaching hospital mortuary as compared to morticians in the General hospital mortuary.

## Materials and methods

Morticians exposed to formaldehyde in the Teaching hospital and General hospital in Benin City, Nigeria were recruited for this study. Subjects were apparently healthy, non-smokers, had no history of cardiopulmonary disease, and had not undergone any recent abdominal or chest surgery. Informed consent was obtained from the subjects who participated in the study while ethical approval was obtained from the College Research Ethics Committee, University of Benin as well as from the Edo State Hospital Management Board before commencement of the work. Subjects were divided into three groups A, B, and C with ten subjects in each group. Group A served as control (non-morticians) while groups B and C served as the test groups respectively. Group B consisted of morticians working in the Teaching hospital while group C consisted of morticians working in the General hospital. Their anthropometric parameters were measured as well as some indices of cardiovascular function which included pulse rate, systolic blood pressure, diastolic blood pressure, pulse pressure, and mean arterial pressure. Statistical analysis was done using Graph pad prism version 8.0.1. Results were presented as Mean  $\pm$  SEM. Analysis of Variance was used to compare the means of test and control values while post hoc test was done using Tukey's multiple comparisons test and a p-value of less than 0.05 was considered as statistically significant.

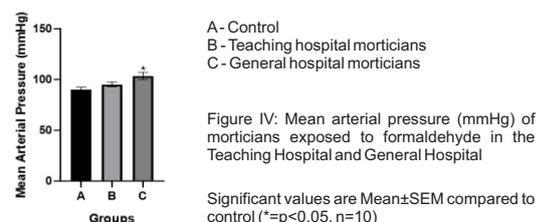
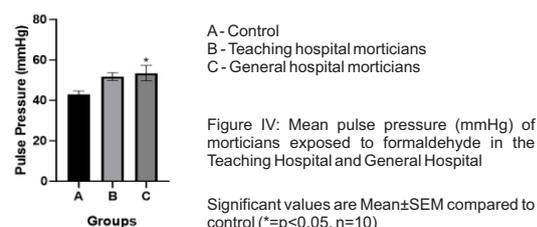
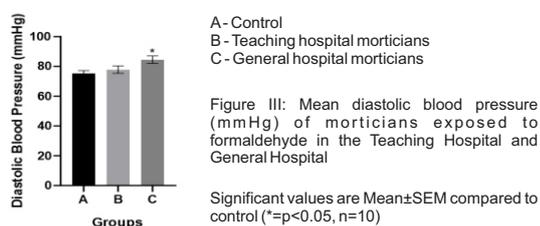
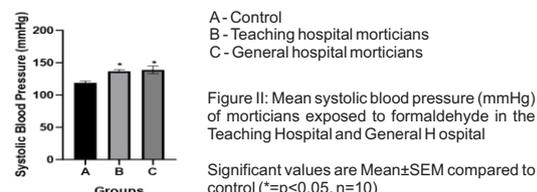
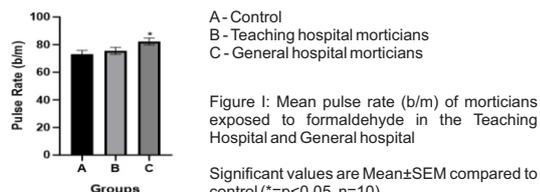
## Results

The results revealed significant increase in pulse rate, systolic blood pressure, diastolic blood pressure, pulse pressure and mean arterial pressure (figures I, II, III, IV and V) among the Teaching hospital morticians and General hospital morticians when compared to the control, and those of the General hospital morticians were higher than those of the Teaching hospital morticians.

Table 1: Anthropometric parameters of morticians exposed to formaldehyde in the Teaching hospital and General hospital

Parameters	Group A (n=10)	Group B (n=10)	Group C (n=10)	P-value
Age (yrs)	46.30 $\pm$ 1.04	46.00 $\pm$ 1.53	47.80 $\pm$ 1.77	0.6576
Weight (kg)	78.10 $\pm$ 2.04	76.10 $\pm$ 4.55	78.20 $\pm$ 4.28	0.9074
Height (m)	1.67 $\pm$ 0.03	1.68 $\pm$ 0.02	1.68 $\pm$ 0.02	0.9262
Chest Circumf (cm)	99.50 $\pm$ 2.67	97.80 $\pm$ 2.53	98.20 $\pm$ 3.69	0.9167
BMI (kg/m <sup>2</sup> )	26.91 $\pm$ 1.18	25.51 $\pm$ 1.34	26.34 $\pm$ 1.46	0.7580
BSA (m <sup>2</sup> )	1.91 $\pm$ 0.03	1.88 $\pm$ 0.05	1.89 $\pm$ 0.05	0.9422

BMI – Body Mass Index; BSA – Body Surface Area



## Discussion

In a previous study by current authors<sup>17</sup> the atmospheric levels of formaldehyde was measured across some selected hospital mortuaries in Benin City and it was reported that the atmospheric level of formaldehyde in the General hospital (4.60ppm) was significantly higher than that of the Teaching hospital (1.13ppm). This was attributed to the fact that the Teaching hospital mortuary was well ventilated and it had air extractors that were functional whereas in the General hospital mortuary the ventilation was poor and they had no air extractors. From the differences in the design and

functionality of these mortuaries it was speculated that the health of the morticians in the General hospital mortuary may be more at risk owing to poor working environment. This speculation led to this present study where some indices of cardiovascular function were measured among morticians in the Teaching hospital and General hospital. The result of this present study revealed a significant increase in pulse pressure, systolic blood pressure, diastolic blood pressure, pulse pressure, and mean arterial pressure (figures I-V) of both Teaching hospital morticians and General hospital morticians when compared to the control and those of the General hospital morticians were found to be higher than those of the Teaching hospital morticians. These findings actually suggest that the cardiovascular health of the General hospital morticians that were studied is more at risk than those of the Teaching hospital morticians. The exposure level to formaldehyde in the Teaching hospital mortuary is still above the recommended standard prescribed by some international organizations that were mentioned earlier. High level of exposure to formaldehyde above the recommended limit is not peculiar to this study alone as some other studies have equally reported high levels of formaldehyde that were above the recommended ceiling limits.<sup>18-21</sup>

A lot need to be done in the General hospital mortuary to bring the atmospheric level of formaldehyde to the desired level and also improve on the working environment while the morticians on their own part should adopt measures to reduce their personal exposure by wearing personal protective equipment like plastic gown, facemasks and face shields. They can also reduce the number of hours they spend in the mortuary.

## Conclusion

From the findings of this study we therefore conclude that measure should be taken to improve on the working environment of morticians especially those in the General hospital in order to protect their cardiovascular health.

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