Afr. J. Biomed. Res. (2000): Vol 3; 117 - 121

AJBR

Original article

SOME FACTORS WHICH MAY AFFECT BLOOD PRESSURE IN NIGERIAN CEMENT FACTORY WORKERS.

V.I. IYAWE[1], M.I.E. EBOMOYI[1], J.C CHIWUZIE[2] AND W. ALAKIJA[2]

[1]Department of Physiology and [2]Department of Community Health, Faculty of Medicine, University of Benin, and University of Benin Teaching Hospital, Benin City, Nigeria.

Objective: *To investigate the influence of age, nature of job and duration of employment on the blood pressure of the workers of a cement factory in Nigeria.*

Design: *BP was measured using the standard sphygmomanometer and stethoscope. Workers were classified based on age, type of job, and the number of years they have worked in the factory.*

Setting: *The factory is located in a village and has an ill-equipped clinic run by a nurse.*

Participants: *All the workers present in the factory for the three days of the study participated.*

Results: *Blood pressure increased with age. Increases in blood pressure were not influenced by "cement related jobs" in the factory. The administrative staff had the highest number of "hypertensives". Newly employed workers were found to have higher mean systolic and diastolic pressures than others.*

Conclusion: *Pollution in the cement factory may not influence blood pressure directly, but inactivity and the psychological stress associated with working in a potentially hazardous environment are factors to consider.*

Keywords: Cement and blood Pressure.

Blood pressure (BP) has been reported to be higher in the urban area African population than in their rural counterparts (Akinkugbe and Ojo, 1969; Pobee et. al, 1977; Oviasu and Okupa, 1979). It is also higher in persons engaged in occupations involving little physical activity than those who were more active (Oviasu and Okupa, 1979; Miall, 1959; Idahosa, 1987). The association between weight and BP is well documented (Ashley and Kannel, 1974; Etta and Watson, 1976).

High blood pressure is considered to be result of environmental influences acting over time on the genetically predisposed individual (Pickering, 1967). The role played by physical activity, job related factors (industrial noise, pollution and so on) and environmental factors such as diet and socio – economic activity on BP need to be clearly defined. Hence Pobee (1989) in his abstract on "Epidemiology of Hypertension: Unfinished and Hidden Agenda in Black Africa" contended that the question of occupational factors/socio – economic conditions in the genesis of hypertension has not been settled.

The cement factory environment is full of noise, dust particles of different sizes and quantity and chemical polutants. The effects of these deleterious elements may depend on the section of the factory and thus the degree of exposure of the workers. For example, it has been found that lung function of cement factory workers is affected, with time, depending on the section of the factory in which the individual worked (Alakija et. al., 1990). It is however, not known whether BP is also affected in individuals engaged in different jobs in the same cement factory environment. The present study therefore examines the influence of age, nature of job at the factory and duration of employment on BP in a group of cement factory workers.

MATERIALS AND METHODS.

The study took place at the Okpella cement factory, Okpella, Edo State in Nigeria on the West Coast of Africa. A total of 447 workers (432 males and 15 females) aged between 20 and 59 years were examined. This represented 85% of the total workforce. All workers reside at Okpella, which is in the rural part of Nigeria. Although Okpella is a village, it has electricity and pipe-borne water. The cement factory is one of two big industries in Okpella, but the major employer of labour. A large number of the factory workers are engaged in small scale farming on part – time basis also.

Workers were divided into groups based on age, nature of job done at the factory (job category) and duration of employment. The age groups in year were 20-24, 25-29, 30-34, 35-39, 40-44, 50-54 and 54-59. The following were the job categories: A- Workers at the Quarry; B- Mill operators and feeders C- Truck and lorry loaders; D- Maintenance staff- fitters, welders, plant technicians and engineers; E- Administrative staff- managers, accountant, laboratory and nursing staff, clerk and messengers; F- Surrounding of mill, cleaners, drivers, hawkers and security staff. The period of employment in the factory in years were: {1-5, 6-10, 11-15 and 16-20).

BP was measured once, using the conventional mercury sphygmomanometer (with a cuff size of 12 x 22 cm) and stethoscope. All measurements were taken on the left arm after the subject had

been seated for 5 minutes. In all cases the systolic BP was recorded at the first appearance of Korotkoff sound while diastolic BP was recorded at the point where korotkoff sound became abruptly muffled. BP was expressed as:

Mean systolic BP + S.D. mmHg.

Mean diastolic BP ± S.D.

For the purpose of this study, workers with BP above 135/85 mmHg were regarded as having "elevated BP". The workers with "elevated BP" were further classified into two groups. Those with BP between 135/85 and `39/89 mmHg were regarded as "high normal" or "borderline hypertensives" and those with BP of 140/90 mmHg and above were regarded as "hypertensives".

A standard questionnaire was used to obtain the following from each subject: name, age, sex, previous job/position, present job/position, smoking habit, drug usage, previous illness or surgical operation, nature of job in the factory and the date of employment. Height and weight were measured routinely for all subjects without shoes.

Data were analysed by parametric statistics using students t-test and presented as means ± standard deviation (mean ± S.D). P-values less than 0.5 taken as statistically significant.

Table 1.
Mean BP + S.D. in relation to age groups of subjects.

Age Group (Years)	Number of Workers	Mean Systolic BP + S.D. mmHg Mean Diastolic BP ± S.D.
20-24	20	119.5 + 10.5 76.1 ± 8.6
25-29	99	122.6 + 14.7 75.6 ± 11.1
30-34	95	123.0 + 14.0 78.9 ± 10.7
35-39	103	123.4 + 16.5 79.4 ± 8.9
40-44	56	120.0 + 15.1 76.6 ± 10.7
45-49	50	125.0 + 18.0 80.0 ± 10.9
50-54	20	136.0 + 17.1 85.0 ± 8.4
55-59	4	140.1 + 17.0 88.5 ± 10.8

RESULTS

Of the 447 workers examined, 367 were found to have normal BP while the remaining 80 (17.9%) had "elevated BP". Out of these 80 workers, 32 were "high normal" or "borderline hypertensives" and 54 were "hypertensives". In other words, 12.1% of the total workforce were "hypertensives" ($p<0.05$). Also, out of the 80 workers with "elevated BP", 35 (43.8% were cigarette smokers ($p<0.05$).

Table 2.
Mean BP ± S.D. in relation to job category for all workers.

Job Category	Number of Workers	Mean Age (Years)	Mean Systolic BP + S.D. mmHg Mean Diastolic BP ± S.D.
A	51	38	123.0 + 15.6 79.2 ± 8.6
B	26	33	123.4 + 14.8 79.8 ± 8.1
C	20	39	122.0 + 16.0 76.6 ± 10.6
D	27	37	120.3 + 17.3 75.9 ± 9.7
E	170	36	125.0 + 15.5 79.5 ± 11.1
F	153	35	123.0 + 15.1 78.0 ± 10.7

The 367 workers with normal BP had a mean age of 36.4 ± 1 years and mean systolic and diastolic BP of 117.8 ± 0.53mmHg and 74.2 ± 0.43mmHg respectively. The

workers with "elevated BP" were aged between 25 and 59 years with a mean age of 39.3 ± 3.2 years. Their mean systolic and diastolic BP were 145.0 ± 1.7mmHg and 96.0 ± 1mmHg respectively.

The 35 smokers had a mean BP of 145.3 + 0.2/98.8 ± 1.4.

Age and Blood Pressure.

Mean age for all workers was 35.6 ± 0.4 years and mean BP for all workers was 125.5 + 17.3/80. ± 11.0mmHg. BP increased with age as shown in Table 1. For example, the age group 20-24 years had mean BP of 119.5 ± 10.5 /76.1 ± 8.6mmHg, age group 35-39 years had mean BP of 123.4 + 16.5 /79.4 ± 8.9and age group 55-59 yrs had mean BP of 140.1 ± 17.0/88.5 ± 10.8mmHg.

Nature of Job and BP

Table 2 shows that the nature done by the workers did not significantly influence the BP of the general workforce. The same observation was also made among those with elevated BP (Table 3). They all had fairly similar BP although the workers in job category C (loaders) had the lowest systolic and diastolic (135 +5.2 /91 ± 1.4mmHg).

The highest number of "hypertensives" occurred among the administrative staff, who also had the highest mean body weight 76.8 Kg (Table 3). 36 out of 170 administrative staff had a mean MP of 146.4+ 2.5/ 96.0 ± 1.4mmHg. A large number of those with elevated BP in each job category were smokers (Table 3).

Table 3.
Number of workers with elevated BP in each job category and their mean age, weight and BP. Table also highlights the possible effect of weight and smoking. (n = total number of workers in each job category).

Category	**Number with Elevated BP**	**% of n**	**Mean Age (Years)**	**Mean Weight (Kg)**	**Mean Systolic BP + S.D. mmHG Mean Diastolic BP ± S.D.**	**No. of Smokers**
A (n =51)	8	15.7	39	61.2	141.0 + 3.5 95.0 ± 2.2	6
B (n = 26)	4	15.4	35.8	63.2	147.5 + 2.1 95.0 ± 1.1	1
C (n = 20)	3	15.0	44.0	64.0	135.0 + 5.2 91.0± 1.4	-
D (n = 27)	3	11.1	33.0	60.2	150.0 + 3.0 93.5 ± 2.0	1
E (n = 170)	36	21.2	38.0	76.8	146.4 + 2.5 96.0 ± 1.4	18
F (n = 153)	26	17.0	37.0	68.3	143.0 + 2.5 94.0 ± 1.1	9

Duration of Employment and Bp

Mean systolic and diastolic BP was high in workers who had spent below 5 years in the factory (Table 4). Majority of the workers with the highest Bp had spent less than 10 years in the factory.

TABLE 4
Number of workers with elevated BP and their mean BP±S.D. in relation to the number of years of work in the factory.

Duration of employment (years)	Number of workers	Mean systolic + S.D. mmHg Mean diastolic ± S.D.
< 1-5	23	146 + 17.2 98 ± 7.3
6-10	40	144 + 14.0 95± 6.8
11-15	11	138 + 13.0 91 ± 2.9
16-20	6	140 + 5.8 91 ± 1.9

DISCUSSION

Blood pressure in humans is subject to movement variation. Therefore a single measurement as in this study is sometimes not a true reflection of the actual BP of the individual. Also, it is generally agreed that for hypertension in the young adult and early middle age, the groups under consideration in this study, the systolic pressure must be consistently above 140 mmHg and the diastolic pressure consistently above 90 mmHg (Wilson et al, 1991). Based on this widely accepted concept, most of the elevated BP reported in the present study would pass for borderline or mild hypertension.

It has been found that mean BP of urban subjects is generally higher than that of their rural counterparts and that in the rural labourers (individuals engaged in vigorous physical activities)BP is lower than that of rural clerks (individuals engaged in vigorous physical activities) (Akinkugbe and Ojo, 1969; Oviasu and Okupa, 1979; Pickering, 1967) the rural population studied by these worker were not exposed to the same kind of occupational hazard as seen in this study. The rural labourers studied by Oviasu and Okupa (1979) were merely engaged in the cultivation of oil palms, while the rural clerks worked in the offices of the oil palm processing company. On the other hand, the individuals in the present study worked in a cement factory, which is full of noise, dust particles of different sizes and quantities depending on the section of the factory where they worked. Although the dust particle moved easily and were distributed throughout the factory, workers in job category E (administrators) were in far lesser contact with the cement dust than those in other categories. All workers, however, lived in the same environment, drank water from the same source, eat diets very high in carbohydrates, with some protein, vitamins and minerals.
The mean BP's of the general workforce were found to be very similar and to fall within the normal limits (Table 2). The similarity in the mean BP for the different job categories may be due to the similarity in the mean ages of the workers (range 33-39 years). The observed BP is also in agreement with BP of rural oil factory workers in this age group as reported by Oviasu and Okupa (1979). However, mean BP increased with age and the BP for each age group fell within the normal range for the age.

The nature of job done at the factory did not significantly influence BP in spite of the fact that some of the workers (quarry workers, millers and loaders – A, B and C) were in closer contact with cement than other workers. Incidentally, these same workers in close contact with dust particles; chemical pollutant and noise also did the most strenous jobs in the factory. In the case of these workers, therefore, the beneficial effects of their physical activities on BP may counteract any deleterious effect associated with the pollution in the factory. The converse may also apply, in which case, the beneficial effects of their intense physical activities is annulled by the health hazards they are exposed to.

Workers in categories D, E, and F whose job schedules were less tasking was also less exposed to the deleterious elements in the cement factory. It was observed, however, that categories E and F had relatively higher number of 'hypertensive' among their workforce (21.1% and 17% respectively) – Table 3. There are several possible explanations for this observation. First, these two groups contain mainly workers who were sedentary. Secondly, their mean weights were higher than those other groups. And thirdly, a significant number of those who were 'hypertensive' in the two groups

were smokers (Table 3). However, it should be emphasized that the disparity in the number of workers in each job category is a drawback and precludes coming to firm conclusion along the lines just enumerated.

Table 4 shows that those who had worked less than 10 years in the factory had some of the highest BP. That the newer workers had a large number of the 'hypertensive' in the factory may be due to one or a combination of the following factors: stress associated with working in a new environment, job insecurity, noise, time required for the individual to build up immune responses and other physiological adjustments. Also, inadequate screening during medical examination for employment may be an important factor. Some of the workers in the group might have been eliminated by thorough pre – employed medical examination.

It is concluded that the mean BP of the general Workhouse of Okpella cement factory in Nigeria falls within normal limits. The increase in BP of workers may not be related to contact with pollutants (noise, dust and chemical) in the cement factory, but due to age, inactivity and other extraneous factors like cigarette smoking and subjects' weight. The result agrees with those, which suggest a tendency for lower BP in rural dwellers than urban dwellers and higher BP for sedimentary workers than active workers (Akinkugbe and Ojo, 1969; Oviasu and Okupa, 1979; Miall, 1959; Idahosa, 1987).

The significant number of 'hypertensives' in group E is also explained by the larger number of 'administrators' or inactive workers on the staff. The effect of duration of employment on BP and the psychological influences of working in a new environment, and on that is potentially hazardous, must be investigated in other industrial environments before a firm conclusion can be drawn.

Acknowledgement

We thank the General Manager and staff of Okpella Cement Company Limited for their wonderful co-operation and support during the study.

REFERENCES

Akinkugbe, O.O., Ojo O.A. (1969): Arterial pressures in rural and urban population in Nigeria. Brit. Med. J. 2, 222-224

Alakija W., Iyawe V.I., Jarikre L.N., Chiwuzie J.C. (1990): Ventilatory function of workers at Okpella Cement Factory in Nigeria. W. Afr. J. Med. 9(3), 187-192.

Ashyley FW, Kannel W.B. (1974): Relation of weight change to changes in atherogenic tracts. The Franrriham study. J. Chron. Dis. 27, 103-114.

Etta K.M., Watson R.S. (1976): Casual BP and their possible relation to age, body weight, quetelet's index, serum cholesterol, percentage of body fat and mid-arm circumference in three African groups of Northern Nigerian residents. Afr. J. Med. Sci. 5, 525-532.

Idahosa P.E. (1987): Hypertension: An on going hazard in Nigerian workers. Am. J. Epidem. 125, 85-91.

Miall W.E (1959): Follow-up study of arterial pressure in the population of a Welsh mining valley. Brit. Med. J. 2, 1204-1210.

Oviasu V.O., Okupa F.E. (1979): Occupational factors in hypertension in the Nigerian African. J. Epidem. Comm. Health. 33. 274-278.

Pickering G. (1967): The inheritance of arterial pressure. In: Stamler J., Stanley R., Pullman T. (Editors). The Epidemiology of Hypertension. P. 18. Grune and Stratton, New York.

Pobee J.O.M., Larbi E.B., Belcher D.W., Durapa F.K., Dodu S.A (1977): Blood pressure distribution in a rural Ghanaian population. Trans. Roy. Soc. Trop. Med. Hyg. 71, 66-72.

Pobee J.O.M. (1989). June 28-July 2. Epidermiology of Hypertension – unfinished and Hidden Agenda in Black Africa. Abstract: 4th international interdisciplinary Conference on Hypertension in Blacks.

Wilson J.D., Braunwald E., Isselbalcher K.J., Petersdorf R.G., Martin J.B., Fauci A.S., Root R.K (Editors) (1991). Harrison's Principles of Internal Medicine. 12th Edition. P.1001-1002. McGraw Hill Inc.

Accepted in final form: June 2000