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# Casual blood pressures and their possible relation to age, body weight, Quetelet's index, serum cholesterol, percentage of body fat and mid-arm muscle circumference in three groups of northern Nigerian residents

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**Summary**

Blood pressures were determined for rural out-patients, soldiers and university students. There was no consistent change of systolic blood pressure with age until the sixth decade but even here, the rise could be due to the inclusion of a relatively high number of hypertensive subjects in the sample mean. Diastolic blood pressures show a steady rise with age consistent with the decreased elasticity of arteries with age. Diastolic pressures are remarkably low and probably reflect a general vasodilation necessitated by the hot day-time temperatures of this environment to facilitate heat loss and maintain body temperature. Dietary and psychological influences may also be involved. Pulse pressures are predictably high and decrease with age. Hypertension was observed in many groups although totally absent in some.

Body weight significantly correlates with systolic and diastolic pressures in 13–19-year-old adolescents probably because during this period of rapid growth blood pressure changes parallel changes in body build. In most other groups blood pressures show no consistent relationship with either body weight, Quetelet's index, mid-arm muscle circumference, serum cholesterol or percentage of body fat.

**Résumé**

La pression du sang a été determinée chez des sujets paysans, militaires et étudiants d'université. Il n'y avait aucun changement de pression diastolique systolique jusque dans la soixantaine mais même ce groupe d'augmentation pourrait être due à l'inclusion dans la moyenne d'un nombre relativement important de sujets avec hypertension. La pression du sang augmente avec l'âge parallèlement avec la dimunition de l'elasticité des artères. La pression diastolique demeure remarquablement basse et réflète probablement une vasodilatation générale nécessitée par la chaleur quotidienne du milieu afin de faciliter la perte de chaleur et maintenir l'homéothermie. Il se pourrait aussi que des effets diététiques et psychologiques soient impliqués. La pression du pouls resté élevée et baisse avec l'âge. L'hypertension est observée dans beaucoup de groupes malgré son absence totale dans certains.

Le poids et les pressions systolique et distolique démontrent une corrélation significative chez les adolescents agés de 13 à 17 ans. Ceci probablement parce que la pression artérielle change avec la constitution physique pendant cette période de croissance rapide. Dans la plupart des autres groups la pression artérielle ne correspond ni au poids, ni à l'indexe de Quetelet, ni à la circonférence de l'avant-bras ou alors au niveau de cholestérol ou au pourcentage de graisse humaine.

## Introduction

Blood pressures in black populations in the United States of America and the West Indies have been reported to be higher than those in white populations there (Adams, 1932; Comstock, 1957; Miall *et al.*, 1962; Schneckloth *et al.*, 1962). For a long time, the only significant studies of blood pressures in Africans were on East Africans. The East African populations contributed little to the ancestry of North American or West Indian blacks. There are relatively few reports concerning blood pressure levels in West African populations from where most of the American and West Indian blacks originated. The most comprehensive study of West Africans to-date is that by Akinkugbe (1972) who also reviewed all relevant publications. Reports of blood pressure in West Africans are clearly desirable for comparison with those of blacks in North America and the West Indies. Such reports could also throw more light on the possible relation of blood pressures to age and indices of obesity that have been generally observed in white and some other populations.

It seems to be quite generally believed that the systolic blood pressure of people in very simple social environments like those of the indigenous African in Africa, the Caraja in Brazil, the Chinese in China or the inhabitants of New Guinea, is usually lower than that of Europeans and North Americans and does not increase with age (Donnison, 1929; Jex-Blake, 1934; Ling, 1936; Bays & Scrimshaw, 1955; Kaminer & Lutz, 1960; Lowenstein, 1961; Maddocks, 1967). This belief runs counter to the reports that have been published concerning West African populations (Callander, 1953; Sarkies, 1953; Lambo, 1958; Abrahams, Alele & Barnard, 1960; Akinkugbe, 1972). Some of the studies cited above presented concurrently measured indices of body stature and obesity, others do not. This makes comparisons difficult and conclusions from such comparisons somewhat tenuous.

This study presents blood pressures as well as heights, weights, Quetelets indices, serum cholesterol, percentage of body fat and mid-arm muscle circumferences in young adult university students, soldiers and outpatients of a rural hospital. To our knowledge, this is the first study of blood pressure in residents of these generally arid northern parts of Nigeria. The rural residents here lead a generally more traditional, often nomadic life compared to the rural residents in the Southern parts of Nigeria who have been the subjects of studies by Abrahams *et al.* (1960) and Akinkugbe (1972). The present studies could therefore throw some light on the effect of acculturation believed by Lowenstein (1961) to be responsible for the increase of blood pressure with age in technologically advanced communities.

## Subjects

The present study was confined to males. This is partly because of the preponderance of males in the Nigerian Army, and perhaps, more important, because immense problems of modesty as well as cultural and religious ethics would be involved in this largely Moslem area in measuring such skinfolds as the subscapular and suprailiac in females. The 395 subjects for this study comprised 209 soldiers of the Nigerian Army Depot and Training School in Zaria, eighty-six medical and pharmacy students of this university and 100 rural outpatients resident around Malumfashi, about 75 miles North of the main university campus at Samaru. Thirty-four of the 209 soldiers were 13–19-year-old adolescents that had been in the army for barely 1 week. They had just been freshly recruited to undergo a military and secondary school course and could be considered to also represent adequately-nourished adolescents of the local population.

The ages of the rest of the subjects ranged from 20–62 years but most of the ages given were estimates. Many Nigerians have a habit of claiming to be younger than their actual ages, partly because most look younger than their ages. Accordingly, the ages of the soldiers and outpatients presented were the careful estimates of one of the authors (K.M.E.), with the help of technicians who spoke the local languages. Among soldiers, army records were generally used as a guide to the estimation of age but it was recognized that these have traditionally been quite unreliable. Therefore dates when young soldiers finished primary school (for literate soldiers) or recall of their approximate ages at the end of World War II or some local war (for veterans of that war or illiterates) were useful guides in age estimates for soldiers and outpatients. Only in the case of university students where ages were checked against admission records of the University Registry Department could the ages given be considered fairly accurate. It was felt that the estimates of ages so made were accurate enough for subjects to be grouped into decades, but either not accurate enough or (as in the case of students) the age spread was not wide enough for meaningful correlation coefficients between age and blood pressure to be calculated.

The groups studied were not completely homogenous. The soldiers came from various states, the students were mostly indigens of one or other of the six northern states and the rural outpatients from Malumfashi hospital could be considered to be long-time residents and indigens of the area. The sampling technique, especially for outpatients, is probably not impeccably unbiased. All the male first year medical students of the 1972/73 session were studied in batches of 12–15 each day. All the soldiers of the Zaria Army Depot who did not happen to be camping during the period of the study were examined in daily batches of 10–15. Some of the outpatients randomly selected each day refused to submit to the study and more willing volunteers among the outpatients had to be procured. Besides, the outpatients may not be fair representatives of the total rural residents of Malumfashi who continually move. But it was felt that this pilot study might yield results that would stimulate more representative and indepth studies.

## Methods

All investigations were carried out at some time between 0900 and 1400 in quiet non-airconditioned rooms with temperatures ranging from 27–30°C at the Army Hospital, the Physiology laboratories or at Malumfashi hospital. The entire study took 3 months and was carried out in July, August and September, the cool rainy season of these parts. Outpatients were chosen at random each day. Each subject was given a serial number. His name, age, sex, ethnic group and state of origin were recorded. After this he was taken into a quiet screened room where he was made to rest on a bed for at least 10 min as a sphygmomanometer cuff 13 × 22 cm was carefully wrapped round his upper arm. All blood pressure measurements were made by a single, medically qualified observer. A standard mercury sphygmomanometer calibrated to 300 mmHg was used. The systolic pressure level was determined by the first perception of the Korotkoff sound, while the diastolic pressure was taken as the point of disappearance of the sound (diastolic fifth-phase level, WHO, 1968). In all cases it was decided to record the reading to the nearest 5 or 10 mmHg from the figure at which the sound was heard. The recording of blood pressure was repeated five times in accordance with the suggestions by Armitage *et al.* (1966) and from these five readings the mean blood pressure for each subject was calculated.

Following blood pressure measurements, skinfold thicknesses were measured with a caliper (Holtain, Ltd, Pembrokeshire, England) which exerts a constant pressure of 10 g/mm$^2$ at varying openings of the jaws. All measurements were taken on the left side of the body in accordance with WHO recommendations (Jelliffe, 1966). Here again one investigator (Dr Etta) carried out all skinfold measurements. Each skinfold was measured in duplicate and the average of the two readings was recorded. Skinfolds were measured at the biceps; triceps; subscapular and suprailiac sites as described by Falkner (1960). The last three skinfolds were measured on the subject standing in a relaxed position, with the hands hanging on either side.

Arm circumference was measured using a Miniflex metal tape (No. 3055, Rabone Chesterman, Pembrokeshire, England), halfway between the acromion and the olecranon process.

Heights without shoes were measured with the subjects standing erect and looking straight ahead. Weight (with only shorts or trousers) were taken on subjects standing still, erect and looking straight ahead on a portable precision balance (Model LPP/ A. C. Morgan and Sons, London). These weights were then corrected for the weights of shorts or trousers worn by different subjects.

Blood samples were drawn with a minimum of delay from a vein around the antecubital fossa of the arm. Subjects were not required to be fasting. After being allowed to clot for at least one hour, blood samples were centrifuged and serum pipetted off. Serum cholesterol levels were determined by the method of Abell *et al.* (1952).

## Computations

The sum of all four skinfold thicknesses was used to calculate body density and percentage of body fat according to the equations by Durnin & Rahaman (1967) and Siri (1956).

Mid-arm muscle circumference was calculated from arm circumference and triceps skinfolds according to the equation by Jelliffe (1966). Quetelet's index was calculated from the equation of Khosia & Lowe (1967):

$$\text{Quetelet's index} = \frac{\text{Weight (kg)}}{\text{Height}^2\ \text{(m)}}$$

## Results

Mean blood pressures are presented in Table 1. The systolic pressure in the outpatients does not show any rise with age until the sixth age decade when there is a distinct rise. Among soldiers there is a rise in the mean systolic pressure of the 20–29-year-olds compared to the level in 13–19-year-olds. Adult soldiers resemble the outpatients in again showing no rise of blood pressure up to the age of 39. Systolic pressures of the 20–29-year-old outpatients and soldiers, although no different from each other, are significantly higher than those of the same age of students ($P < 0{\cdot}05$).

TABLE 1. Blood-pressures (mmHg): Mean ± s.d. (no. of subjects in parenthesis)

| | 13–17 years Adolescents | 20–29 years Outpatients | 20–29 years Soldiers | Students | 30–39 years Outpatients | 30–39 years Soldiers | 40–49 years Outpatients | 50–62 years Outpatients |
|---|---|---|---|---|---|---|---|---|
| | (34) | (40) | (162) | (86) | (39) | (11) | (12) | (9) |
| Systolic | 122·0 ± 16·27 | 126·3 ± 15·34 | 126·8 ± 13·44 | 119·4 ± 12·10 | 124·6 ± 18·10 | 122·4 ± 12·50 | 124·2 ± 14·0 | 135·0 ± 9·70 |
| Diastolic | 50·4 ± 10·62 | 51·3 ± 12·0 | 60·6 ± 12·06 | 54·4 ± 9·84 | 57·4 ± 13·50 | 66·0 ± 19·00 | 62·9 ± 13·98 | 68·2 ± 10·30 |
| Pulse pressure | 71·5 ± 18·7 | 74·8 ± 18·76 | 66·2 ± 19·02 | 65·0 ± 12·50 | 67·2 ± 20·30 | 56·4 ± 15·85 | 61·3 ± 15·66 | 66·8 ± 23·56 |
| Hypertensives (%) | 0·0 | 5·0 | 4·2 | 0·00 | 5·7 | 9·10 | 0·0 | 11·1 |

Diastolic pressures show a steady rise with age in both outpatients and soldiers where successive age groups were available for study. Accordingly, pulse pressures steadily decline with increasing age except in the fifth decade where the sharp rise in systolic pressure increased the pulse pressure. The diastolic pressures obtained here are some of the lowest fifth phase readings ever reported with no diastolic pressures up to 90 mmHg. (conventionally the lower limit of diastolic 'hypertensives'). On the arbitrary basis of systolic blood pressures of 150 mmHg or more (systolic 'hypertensives'), however, adult outpatients showed a slight increase in 'hypertensive' subjects. The number of subjects is probably too low to permit meaningful interpretations. However, the percentage of 'hypertensives' rises with age in outpatients. Soldiers also showed a slight increase of 'hypertensives' with age. But there were no 'hypertensive' adolescents, students or fifth decade outpatients.

Table 2 presents mean heights, weights and Quetelet's indices as well as serum cholesterol, percentage of body fat and arm muscle circumference. It is not the intention in this paper to discuss these values *per se* since they are the subject of a separate paper (Etta & Watson, 1974). Rather these are

TABLE 2. Heights, weights, Quetelet's index, serum cholesterol, percentage body fat and mid-arm muscle circumferences: Mean ± s.d. (no. of subjects in parenthesis)

| | 13–17 years Adolescents | 20–29 years Outpatients | 20–29 years Soldiers | Students | 30–39 years Outpatients | 30–39 years Soldiers | 40–49 years Outpatients | 50–62 years Outpatients |
|---|---|---|---|---|---|---|---|---|
| | (34) | (40) | (164) | (86) | (39) | (11) | (12) | (9) |
| Height (cm) | 165·0 ± 4·38 | 168·3 ± 5·70 | 170·3 ± 5·82 | 171·5 ± 6·10 $P<0{\cdot}01$† | 168·7 ± 5·54 | 168·3 ± 5·87 | 169·0 ± 5·80 | 167·5 ± 4·96 |
| Weight (kg) | 51·3 ± 9·00 | 56·5 ± 6·85 | 63·1 ± 5·91 $P<0{\cdot}01$* | 61·2 ± 6·33 $P<0{\cdot}01$† | 57·7 ± 7·87 | 63·8 ± 7·23 | 59·1 ± 8·80 | 54·2 ± 6·80 |
| Quetelet's index | 18·9 ± 2·20 | 20·1 ± 2·20 | 21·9 ± 2·00 | 20·9 ± 1·90 | 20·2 ± 2·20 | 22·3 ± 3·10 | 20·6 ± 2·30 | 19·2 ± 2·4 |
| Serum cholesterol (mg%) | 162·1 ± 37·03 | 181·9 ± 35·20 | 186·5 ± 39·88 | 155·1 ± 34·69 $P<0{\cdot}01$† | 183·0 ± 54·99 | 196·9 ± 49·20 | 207·7 ± 28·99 | 191·1 ± 25·58 |
| Body fat (%) | 14·3 ± 2·29 | 10·7 ± 2·52 | 12·1 ± 2·31 $P<0{\cdot}01$* | 12·3 ± 2·31 $P<0{\cdot}01$† | 11·0 ± 3·13 | 13·0 ± 3·63 | 11·2 ± 2·34 | 11·3 ± 3·08 |
| Muscle circumference (cm) | 24·5 ± 2·38 | 25·7 ± 2·23 | 26·8 ± 1·60 $P<0{\cdot}01$* | 24·3 ± 1·79 $P<0{\cdot}01$† | 24·5 ± 2·70 | 26·7 ± 1·13 | 24·9 ± 2·10 | 23·3 ± 1·81 |

* Soldiers compared to outpatients. † Students compared to outpatients or soldiers.

TABLE 3. Correlation coefficients ($r$) between blood pressure and indices of obesity: (no. of subjects in parenthesis)

| Age (years) | Blood pressure | Body weight | Quetelet's index | Cholesterol | Body fat | Muscle circumference |
|---|---|---|---|---|---|---|
| 13–19 | Systolic | 0·53* | 0·48* | −0·38* | −0·05 | 0·10 |
| Adolescents | Diastolic | 0·43* | 0·32 | −0·08 | −0·25 | 0·31 |
| (34) | Pulse pressure | 0·22 | 0·24 | −0·28 | 0·10 | −0·08 |
| 20–29 | Systolic | 0·20 | 0·21 | −0·11 | −0·01 | 0·14 |
| Outpatients | Diastolic | −0·20 | 0·03 | −0·27 | −0·15 | −0·03 |
| (40) | Pulse pressure | 0·29 | 0·16 | 0·09 | 0·09 | 0·13 |
| Soldiers | Systolic | −0·04 | 0·07 | 0·04 | 0·20* | 0·10 |
| (164) | Diastolic | 0·11 | 0·04 | 0·26* | 0·20 | −0·01 |
| | Pulse pressure | −0·10 | 0·05 | −0·12 | 0·07 | 0·10 |
| Students | Systolic | −0·01 | −0·07 | 0·02 | 0·16 | 0·03 |
| (86) | Diastolic | −0·01 | −0·11 | 0·06 | 0·03 | −0·01 |
| | Pulse pressure | 0·01 | 0·02 | −0·03 | 0·13 | 0·03 |
| 30–39 | Systolic | 0·31 | 0·41* | −0·06 | 0·15 | 0·34* |
| Outpatients | Diastolic | 0·02 | 0·05 | 0·08 | 0·09 | 0·25 |
| (39) | Pulse pressure | 0·28 | 0·35* | −0·11 | 0·21 | 0·13 |
| Soldiers | Systolic | 0·53 | 0·04 | 0·21 | 0·15 | 0·15 |
| (11) | Diastolic | 0·19 | 0·40 | 0·06 | 0·49 | 0·35 |
| | Pulse pressure | 0·31 | −0·20 | −0·20 | −0·16 | 0·31 |
| 40–49 | Systolic | 0·43 | 0·03 | 0·50 | 0·43 | 0·20 |
| Outpatients | Diastolic | 0·49 | 0·26 | 0·19 | 0·36 | 0·52 |
| (12) | Pulse pressure | 0·47 | 0·20 | 0·49 | −0·49 | −0·54 |
| 50–62 | Systolic | 0·43 | 0·51 | 0·50 | 0·43 | 0·20 |
| Outpatients | Diastolic | −0·09 | 0·08 | 0·33 | 0·07 | −0·34 |
| (9) | Pulse pressure | 0·57 | 0·60 | 0·47 | 0·50 | 0·60 |

For all values of $r$: $P > 0·05$ except: *: $P < 0·05$.

presented for comparison with those of other populations in whom blood pressures have been concurrently measured and also for correlating with blood pressures. Generally, the heights, weights, Quetelet's indices, body fat and arm muscle circumferences of the outpatients show no substantial rise with age. However, serum cholesterol tends to rise with age in both outpatients and soldiers.

Correlation coefficients of systolic, diastolic or pulse pressures with body weight, Quetelet's index, serum cholesterol, percentage of body fat or mid-arm muscle circumference are presented in Table 3. Blood pressures do not significantly correlate with any of the parameters for most subject groups.

## Discussion

The difficulty of determining exact ages of subjects the majority of whom are illiterate weakens attempts to correlate blood pressure with age in developing countries. In Nigeria, most adults tend to look younger than their ages which are therefore generally underestimated especially by foreigners. This tendency was taken into account in the present study in estimating the ages of subjects for whom confirmatory age documents were unavailable. The ages given are therefore considered accurate, at least, to the nearest decade on which basis the age groupings were made.

By such a classification, there is no rise of systolic pressure with age in adults until 50 years of age. The rise of pressure in the sixth decade is rather sharp but generally in the same order of magnitude as has been reported for Southern Nigerian populations (Abrahams *et al.*, 1960; Akinkugbe 1972) as well as for the Hanuabadans of New Guinea (Maddocks, 1967) and Ethiopians (Parry, 1969). In all the populations cited above, systolic blood pressures tended to rise steadily with age in contrast to the findings in the present study. It is possible that Lowenstein's (1961) postulate that there is no rise of systolic pressures with age in less acculturated people applies here. This process also seems to be borne out in all males and females of the six Solomon Islands studied by Page, Damon & Moellering (1974). On the other hand, the two subject groups, outpatients and soldiers, were, in a sense selected representatives of the local population: outpatients 'naturally selected' on the basis of illhealth and soldiers selected, presumably, on the basis of physical fitness. Besides the sample sizes involved probably preclude the drawing of firm conclusions from this preliminary study. These factors might all contribute to the contrast observed here. The observed rise in the sixth decade may be due to the inclusion of a relatively high number of 'hypertensive' subjects, as is seen by the high percentage of 'hypertensives' in this age group compared to younger age groups. Accordingly, when 'hypertensives' were excluded from the group mean its value was 123·4 mmHg, quite comparable to the fifth decade systolic mean. The general range of adult systolic pressures does, however, resemble the ranges previously reported for Southern Nigerians, Ethiopians, North Americans and Europeans of comparable age groups (Hamilton *et al.*, 1954; Comstock, 1957; Abraham *et al.*, 1960; Parry, 1969; Akinkugbe, 1972).

In contrast, diastolic pressures steadily rise with age in both outpatients and soldiers. Admittedly, the sample sizes after the fourth decade in our study become rather small and so, perhaps undue significance should not be attached to the rise of diastolic pressures with age. But the rise is consistent with the arterial hardening or decrease in arterial elasticity generally believed to occur with age and bears out previous reports on Nigerian, European, North American, West Indian and Carribean populations (Comstock, 1957; Abrahams *et al.*, 1960; Miall *et al.*, 1962; Schneckloth *et al.*, 1962; Akinkugbe, 1972).

The rather uniformly low diastolic pressures in such occupationally and socially divergent subjects as rural outpatients, soldiers and university students are again in sharp contrast to those of any comparable community previously studied except the Bushmen of the Kalahari desert (Kaminer & Lutz, 1960) and the Samburu people of Northern Kenya (Shaper, Williams & Spencer, 1961). Not a single individual of the total 395 subjects studied could be considered a diastolic 'hypertensive'. Only five subjects had diastolic pressures above 80 mmHg. The low diastolic pressures cannot be fully explained on the basis that they are fifth phase readings since previous studies which used the same point of sound disappearance in comparable populations reported higher pressures (Schneckloth *et al.*, 1962; Bailey, 1963). Even if the diastolic pressures in the present study were corrected upward by an average of 7 mmHg (Shaper *et al.*, 1961) to fourth phase readings, they would still be generally in the sixties, exactly comparable to those reported for the Kalahari Bushman. Even the undernourished adult Javanese whose blood pressures are generally lower than European values still showed relatively higher fifth phase mean diastolic pressures that ranged from 66·8 mmHg in the third, to 74·9 mmHg in the sixth age decade (Bailey, 1963).

It is remarkable that the Kalahari Bushmen, the Samburu people of Northern Kenya and the rural outpatients of our study are all predominantly nomadic cattle rearers. This way of life is probably dictated by the environments. All three environments have widely varying diurnal temperatures, being high by day and low by night. All three environments are generally arid semi-deserts or deserts with shrub-like scenty vegetation. It seems logical therefore to search for clues to those rather low diastolic pressures in the environment. It is possible that the peculiar climatic conditions of the hot arid, semi-desert or desert areas of the Kalahari Bushman, the Samburu of Northern Kenya and our outpatients, especially, effect a decrease in peripheral resistance to produce low diastolic pressure. Other peculiar factors of the diet such as the almost continuous consumption of kola nuts by most local residents may also be involved. A preliminary trial has indicated that the supernatant from blended kola nuts depresses smooth, skeletal and cardiac muscle activity in rats (unpublished). Although the psychological effects of the simple environments encountered in the three African areas in question are not easily quantifiable, it is conceivable that the simplicity of these societies creates stresses which, if not less than, are at least, different from, those obtained in technologically advanced communities where higher diastolic pressures are observed. The findings of Lowenstein (1961) and Maddocks (1967) regarding the effect of "acculturation" on blood pressures lend some support to this view.

In this respect, the rural populations of Southern Nigeria that have been studied by Abrahams *et al.*, (1960) and Akinkugbe (1972) as well as the rural Jamaicans studied by Miall *et al.* (1962) are far more advanced or 'acculturated' (Lowenstein, 1961) than our rural outpatients or for that matter most residents of Northern Nigeria. The rural town of Ilaro, western Nigeria, whose residents were studied by Abrahams *et al.* (1960) is about 30 miles from the largest city in west Africa, Ibadan. Residents of Ilaro may qualify as a 'rural community' by European and

North American standards. But the proximity of Ilaro to such a large industrial, cosmopolitan and educational centre like Ibadan makes life in Ilaro far more cosmopolitan than that of the average rural northern community.

The generally high pulse pressures obtained in this study are, of course, related to the low diastolic pressures through the activity of 'the headquarters of the homeostatic control, the carotid and aortic sinuses' (Heymans & Neil, 1958). It may be that both the high pulse pressures and the low diastolic pressures follow lowered sympathetic activity and even lowered vascular myogenic tone. The causes of these lowered activities are yet to be identified but they could be climatic, dietary, socio-cultural or even genetic.

The prevalence of 'hypertensive' subjects in the present study does not support the once popular view that hypertension is uncommon among Africans (Donnison, 1929; Williams, 1944). For, even though no 'hypertensives' were observed in some age groups, the prevalence values of 'hypertension' obtained here are comparable to the values for West Indian blacks of the third and fourth decade (Miall *et al.*, 1962). No attempt was made in the present study to separate people with essential hypertension from those in whom hypertension could be secondary to renal or other malfunctions. In spite of this and the fact of the small sample sizes beyond the fourth decade, the prevalence of hypertension seems to rise somewhat with age. The adolescent soldiers and male university students examined were totally free of hypertension as were the small group of fifth decade outpatients. In the case of adolescents and students this is partly a reflection of the fact that each of the individuals had to pass a thorough medical examination before being admitted into the military school or university.

Published reports of studies on Africans, New Guineans or Jamaicans show no consistent or statistically significant correlation coefficient between blood pressures and body weight. (Abrahams *et al.*, 1960; Kaminar & Lutz, 1960; Shaper *et al.*, 1961; Miall *et al.*, 1962; Maddocks, 1967; Akinkugbe, 1972.) Kaminar & Lutz (1960) also showed no significant correlation between blood pressure and either physique or arm circumference in Kalahari Bushmen. Our data reinforce all previous findings that blood pressure has no significant correlation with either weight, Quetelet's index or mid-arm muscle circumference. Where significant changes in a parameter such as body weight occur with age as is the case in the second decade adolescents, the systolic and diastolic pressures significantly correlate with body weight here. The body weight of adolescents are likely to be increasing during the rapid growth period of 13–17 years. Blood pressures have been shown to increase with age during this period in Western Nigerian school children (Akinkugbe, 1969). A significant relationship between body weight and blood pressure is therefore predictable during this period.

Serum cholesterol and triglyceride levels are commonly believed to indicate the probability of occurrence of coronary diseases (Albrink & Meigs, 1971). By such a criterion and by the low diastolic pressures in our subjects, hypertension and coronary diseases should be quite uncommon in the three groups studied. But the picture is actually different, since there are moderate numbers of 'hypertensives' even among the smallest samples studied. It is not surprising therefore that neither serum cholesterol nor percentage of body fat bear any consistent relationship to systolic or diastolic pressures in our subjects.


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