Rural and Semi-Urban Differences in Salt Intake, and Its Dietary Sources, in Ashanti, West Africa

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Objectives: To provide a socioeconomic profile of rural and semi-urban settings in Ashanti, West Africa and to investigate the relationship between urbanization and sources of salt in the diet.

Setting: 12 villages (6 rural, 6 semi-urban) participating in a cluster randomized controlled trial of a health promotion in the Ashanti region of Ghana.

Participants: 1,013 adult men (*N*=385) and women (*N*=628), aged 40–75.

Method: Between June 2001 and June 2002, participants completed a detailed questionnaire on demography, occupation and education, housing, radio and television use, personal and family medical history, drug therapy, smoking, alcohol consumption, and diet.

Results: 532 subjects lived in semi-urban and 481 in rural communities. Ninety-two percent of the participants were of the Ashanti tribe and 94% spoke Twi. The semi-urban villages were closer to Kumasi, the second largest city in Ghana, had larger population (1,727 vs 1,100 people) and household sizes (14.6 vs 8.8 persons per household; $P<.001$), had fewer farmers (53% vs 81%; $P<.001$) and more traders (22% vs 7%; $P<.001$), and had more homes with electricity (81% vs 17%; $P<.001$) and piped water (28% vs 0.2%; $P<.05$). Semi–urban villagers had higher systolic blood pressure than rural villagers (129 vs 121 mm Hg difference 8 mm Hg [95% CI 5–11]; $P<.001$). Salt is almost invariably added to food in cooking (98%), and salted foods such as fish and meat are eaten in both communities. Salt is often added at the table (52%), more often in rural villages than in semi-urban settings (59% vs 45%; $P<.01$), although the total salt consumed as measured by urinary sodium was similar (99 vs 103 mmol/day). Potassium levels were higher in rural villages (58 vs 40 mmol/day difference 18 mmol/day [95% CI 11–26]; $P<.001$).

Conclusions: In this mainly farming community were clear differences in housing, population structure, and blood pressure between rural and semi-urban communities. While no significant differences were in the amount of salt consumed, the sources of salt differed between rural and semi-urban settings. Finally, rural villagers ate more potassium than semi-urban participants. (*Ethn Dis.* 2005;15:33–39)

Key Words: Rural, Dietary, Salt, Blood Pressure, Urbanization

Introduction

Noncommunicable diseases are a threat to the health of adults in Africa. Worldwide cerebrovascular disease is second only to ischemic heart disease as a cause of death and disability, and most of these diseases occur in less developed countries.[1]

Chronic diseases, such as hypertension and diabetes, are more common in urban than rural areas for people of the same ethnic origin[2–10] and consequently, as migration to urban areas increases, the proportion of the population affected by hypertension rises.[9,11] Recent estimates from the World Health Organization (WHO) highlight diseases caused by high blood pressure as reasons for the high mortality among adults in sub-Saharan Africa.[12] Although the rural-urban difference has been well documented, little descriptive information in these studies is found on what constitutes rural and urban. The lack of adequate descriptions and variations in the concepts of rurality and urbanization mean that comparing results between countries is often difficult.

Several studies in different countries have focused on hypertension within rural and urban sub-Saharan Africa.[3,5–10,13–16] In most of the studies population size was a factor used to distinguish between rural and urban settlements, but considerable variation was in population figures between different settings. The United Nations reports a similar lack of concordance between countries; they state that although many countries within Africa use a population figure of 2,000 to distinguish between rural and urban settlements, the figure varies widely between 100 in Uganda to 20,000 in Nigeria and Mauritius.[17] Other factors that have been used to describe rural areas are farming as the main occupation, distance from major cities, traditional housing, lifestyle and culture, and water collected outside the house. These factors are usually compared with urban areas selected from populations of the capital or other major cities.

One factor that may increase hypertension in urban areas may be changes in diet, particularly an increase in salt intake.[7–9,16] Africans are more sensitive to salt than other ethnic groups,[18] with higher consumption in urban areas. Understanding patterns and sources of salt intake may help develop strategies of health promotion that aim to reduce salt intake in sub-Saharan Africa. This strategy is now one of the priorities recognized by WHO to reduce cardiovascular disease in developing countries.[12]

As part of a community-based trial of health promotion in the Ashanti re-

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gion of Ghana, we carried out a questionnaire survey of education, occupation, housing, and diet in 12 villages. Given the increase in chronic disease with urbanization, we selected six rural and six semi-urban villages. In order to facilitate comparison with other studies in Africa, we provide a detailed socioeconomic definition of rural and semi-urban communities that took part and investigate the relationship between urbanization and blood pressure, urinary sodium, and sources of salt in the diet.

METHODS

During spring 2001, 12 villages in the Ashanti region of Ghana took part in a cluster randomized, controlled trial of a health education program to reduce salt in the diet. The Ashanti region is an inland area in the south of the country surrounding Kumasi, Ghana's second-largest city. Since the health education program needed to be delivered to all members of the community, the size of the community chosen was restricted. To avoid contamination the villages had to have little direct communication with each other. The 12 villages were chosen in conjunction with local community health workers who categorized the villages as semi-urban or rural. Semi-urban villages were all within 10 miles of Kumasi, while the rural villages were between 10 and 24 miles from the city.

Between 95 and 250 subjects aged 40–75 years from each village, for a total of 1,896, were selected by stratified random sampling from a census of all inhabitants of the village. Further details of the census methods are reported elsewhere.[19] Stratification was by age and sex so that the total sample selected matched the overall population structure and no differences existed between the villages in age and sex of the chosen sample.

Prior to randomizing villages to control or intervention arms, selected participants were invited to attend a local field station, usually in the village school. For each participant a fieldworker completed a detailed questionnaire, height, weight, and blood pressure measurements, and the individual was asked to collect two 24-hour urine specimens. The baseline survey was undertaken between June 2001 and June 2002.

Each questionnaire took up to 30 minutes to complete and had been prepared in English, but where necessary it was delivered in Twi, the main indigenous language, after verifying common local expressions and translations. The questionnaire collected information on housing, occupation, education, medical history, family medical history, smoking, and alcohol use. This part of the questionnaire was adapted from that used in the Wandsworth Heart and Stroke Study,[20] which included a West African population group. The questionnaire also asked about five salty foods: koobi, momoni, kako (all salted fish), salted pig's feet, and salted beef. The respondents were asked if they ate these foods regularly. The questionnaire also asked whether respondents added salt at the table or during cooking or used stock cubes or monosodium glutamate. Each item was answered with yes or no.

Results for population characteristics have been presented as overall percentages for semi-urban and rural villages, and 95% confidence interval (CI) for the difference in percent was calculated by using village means. Bootstrapping was used for characteristics from the questionnaire, as distributions of village means were not normal. Odds ratios for dietary variables have been calculated with confidence intervals adjusted for clustering by village. Analysis was carried out with STATA.

RESULTS

Census

Although semi-urban villages are larger than rural villages (Table 1), considerable overlap was seen in total village population. Numbers of households were similar, but households were larger in semi-urban villages. A household was defined as one or more families living within a single building, which might contain several rooms, sharing a common entrance. Rural villages have more children under 16 years but fewer young adults, particularly men (only 27% of the male population of rural villages were between 16 and 39 years, compared with 40% in semi-urban villages). The population age and sex structure is described in more detail elsewhere.[19]

Access to Services

All 12 villages had churches, and all but 2 (one rural and one semi-urban) had a school. One semi-urban village had a community center and two (one rural and one semi-urban) had general clinics manned by either nurses or midwives. More rural than semi-urban villages (five vs two) had markets, and all but three (two rural and one semi-urban) had a kiosk, store, or shop selling various everyday items, eg, soap and canned food. All semi-urban villages had a drinking bar, compared to only one rural village. Five villages (three rural and two semi-urban) had communal kitchens, and nine villages (three rural and six semi-urban) had shared toilet facilities. Only four of the villages (one rural and three semi-urban) had any drainage system, albeit primitive in most cases.

Table 1. Age, sex, and household size by locality. Information from the census. Overall number (%) with range of percentages for each village

	Rural Villages (*N* = 6,597)	Semi-Urban Villages (*N* = 10,368)	Difference in Percent (95% CI)
Under 16 years old	3,280 (50)	4,450 (43)	8 (4 to 12)†
16–39 years old	1,920 (30)	4,087 (40)	−10 (−15 to −4)†
40–75 years old	1,131 (18)	1,612 (16)	2 (−1 to 4)
More than75 years old	132 (2)	188 (2)	0 (−1 to 1)
Males	3,018 (46)	4,908 (47)	−2 (−4 to 1)
Mean (SD)§ number persons per household	8.8 (6.5)	14.6 (9.9)	−5.8 (−9.7 to −1.9)‡
Mean (range) number of households per village	125 (74 to 176)	118 (79 to 162)	7 (−39 to 52)
Mean (range) population of village	1,100 (564 to 1,650)	1,728 (1,205 to 1,966)	628 (172 to 1,084)*

95% confidence intervals allow for clustering by village. Age of 165 adults was unknown, and sex of 1 adult was unknown.
* $P<.05$; † $P<.01$; ‡ $P<.001$.
§ SD is calculated between households within village.

Questionnaire Survey

A total of 1,013 individuals agreed to take part in the trial, response rate 53%. Ninety-two percent of the participants were of the Ashanti tribe (Table 2), and 94% spoke Twi, with no significant differences between the rural and semi-urban villages. Seventy percent of the rural villagers lived in the villages where they were born, and even 83% of the semi-urban villagers lived where they were born ($P<.05$). More then 85% of those interviewed were Christian, with considerable variability between villages in the dominant denomination. Three percent were Muslim, and a similar number followed traditional religions. School attendance increased with age; 15% of subjects over 70 attended school compared with 86% of those under 50 years of age (Figure 1). No differences were found between semi-urban and rural villages in the proportion of subjects attending school. In all 12 villages farming was the main occupation. However, rural villages had a higher percentage than semi-urban villages (81% [95% CI 72–88] vs 53% [95% CI 39–63]). Trading was reported as a main job by 22% (95% CI 16–32) in the semi-urban villages, while only 7% (95% CI 4–11) of rural villagers were traders.

Household Characteristics

Water source varied considerably between villages; a single source of water was used by >80% of villagers in 10 villages. The most common source was

Table 2. Ethnic group, religion, and occupation by village type. Number (%) by semi-urban and rural villages and range of village percentages

	Rural Villages *N* = 481 *N* (%)	Semi-Urban Villages *N* = 532 *N* (%)	Difference in Percent (95% CI)
Ashanti tribe	426 (89)	501 (94)	−6 (−13 to 2)
First language Twi	440 (91)	510 (96)	−4 (−11 to 1)
Born in same village as interviewed	338 (70)	443 (83)	−13 (−22 to −2)*
Born elsewhere in Ashanti region	90 (19)	56 (11)	8 (0 to 15)*
Religion			
Catholic	63 (13)	216 (41)	−28 (−46 to −7)†
Protestant	338 (70)	276 (52)	18 (−2 to 37)*
Moslem	34 (7)	7 (1)	6 (0 to 14)*
Traditional	30 (6)	10 (2)	4 (0 to 12)*
Married or cohabiting	322 (67)	328 (62)	5 (−2 to 13)
Attended any school	289 (60)	307 (58)	2 (−4 to 9)
Occupation			
Farmers	389 (81)	280 (53)	28 (14 to 44)‡
Traders	34 (7)	115 (22)	−15 (−24 to −8)‡
Other manual	21 (4)	61 (11)	−7 (−13 to −1)*
Non-manual	19 (4)	37 (7)	−3 (−6 to −0)*

95% confidence intervals allow for clustering by village.
* $P<.05$; † $P<.01$; ‡$P<.001$.

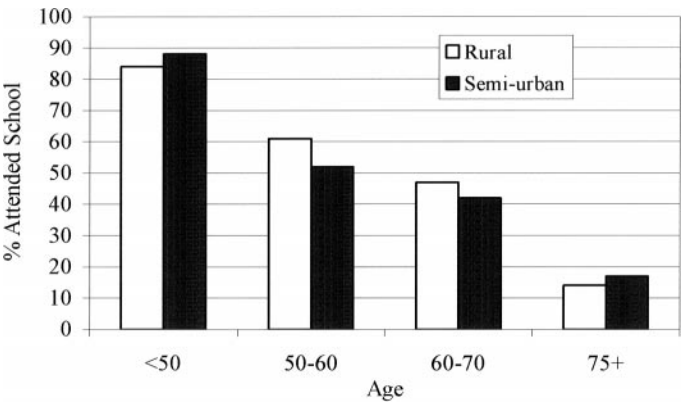

Fig 1. Proportion of participants who attended school by age group in rural and semi-urban villages

boreholes, which were used by 73% (95% CI 26–99) of rural villagers compared with 58% (95% CI 28–92) of semi-urban villagers. Piped water, either from a standpipe or piped into the home was only used by 27% of participants from semi-urban villages and 1% of rural villagers (Table 3). Eighty percent of participants reported that their homes had electricity in the semi-urban villages compared to 17% in the rural villages. Over 70% of participants said that there was a working radio in their household but there was no effect of locality (semi-urban vs rural). Working televisions were more unusual with only 12% of rural and 46% of semi-urban participants reporting that there was one in their home. There was a significantly higher rate of alcohol consumption in the semi-urban villages (44% vs 37%) while current smoking rates were similar (Table 4).

Salt was frequently added to food in cooking in both groups (98%), but salt was added at the table more often in the rural villages (59% vs 45%; $P<.01$) (Table 4). Ninety-two percent of the sample reported eating some kind of salted food, more often salted fish (koobi, momoni, kako), but the kind of salted food eaten varied considerably between villages While salted meat (pig's feet and beef) was eaten more often by semi-urban villagers, salted fish was eaten more often by rural villagers (Table 4).

Urinary potassium was higher in rural than semi-urban villages (18 mmol/day [11 to 26]; $P<.001$) but urinary sodium was similar. Systolic blood pressure was 7.7 mm Hg higher ($P<.001$), and body mass index (BMI) was 2.5 kg/m^2 higher ($P<.001$) in semi-urban villages (Table 5). Finally, a significant positive association was found between urinary sodium excretion and systolic blood pressure (regression coefficient adjusted for age, gender, BMI, and locality: 4.1 mm Hg per 100 mmol of sodium change [0.6 to 7.6]; $P=.023$).

DISCUSSION

Semi-urban villages selected for this study can be distinguished from rural villages by having larger populations, fewer farmers, more traders, fewer homeowners, larger households, and more homes with electricity and piped water. Blood pressure was higher in the semi-urban villages. Nearly all participants reported using salt during cooking and regularly eating salted foods. More

Table 3. Home ownership and occupation, electricity and water source by village type. Number (%) by semi-urban and rural villages and range of village percentages

	Rural Villages *N* = 481 *N* (%)	Semi-Urban Villages *N* = 532 *N* (%)	Difference in Percent (95% CI)
Owning their home	155 (32)	116 (22)	10 (−2 to 21)
Number of rooms in home (mean [SD])	2.0 (1.7)	2.0 (2.2)	0 (−0.5 to 0.5)
Number of people in home	4.7 (3.2)	5.1 (5.0)	−0.4 (−1.0 to 0.4)
Electricity	83 (17)	430 (81)	−64 (−79 to −36)‡
Water source			
Stream/river	88 (18)	27 (5)	13 (−9 to 56)
Well	41 (9)	43 (8)	0 (−17 to 30)
Borehole	351 (73)	305 (57)	15 (−37 to 56)
Standpipe	1 (0.2)	126 (24)	−24 (−58 to −3)*
In home	0 (0)	20 (4)	−4 (−10 to −1)*
Radio in home	359 (74)	419 (79)	−4 (−15 to 7)
Television in home	56 (12)	245 (46)	−35 (−47 to −22)‡

95% confidence intervals allow for clustering by village.
* $P<.05$; † $P<.01$; ‡ $P<.001$.

Table 4. Smoking and diet by village type. Number (%) by semi-urban and rural villages and odds ratios

	Rural Villages *N* = 481 *N* (%)	Semi-Urban Villages *N* = 532 *N* (%)	Odds Ratio (95% CI) Rural Compared to Semi-Urban
Current smoker	34 (7)	38 (7)	0.94 (0.56 to 1.56)
Former smoker	40 (8)	68 (13)	0.62 (0.42 to 0.91)‡
Alcohol drinker	176 (37)	234 (44)	0.73 (0.55 to 0.99)*
Eat			
Koobi	287 (60)	224 (42)	2.03 (1.38 to 2.99)‡
Kako	124 (26)	152 (29)	0.87 (0.40 to 1.96)
Momoni	300 (63)	290 (55)	1.39 (0.98 to 1.97)
Salted pigs' feet	76 (16)	171 (32)	0.40 (0.15 to 1.02)
Salted beef	45 (9)	124 (23)	0.34 (0.13 to 0.86)*
Add bouillon cubes§	235 (52)	256 (56)	0.85 (0.47 to 1.56)
Add MSG‖	110 (25)	71 (16)	1.72 (0.90 to 3.27)
Add salt when cooking	474 (99)	517 (97)	1.83 (0.90 to 3.72)
Add salt at table	284 (59)	240 (45)	1.75 (1.18 to 2.61)†

95% confidence intervals adjusted for clustering by village.
* $P<.05$; † $P<.01$; ‡ $P<.001$.
§ $N = 904$; ‖ $N = 882$; some respondents did not know whether these were added during cooking.

rural villagers added salt to their food at the table, but urinary sodium was not different. More semi-urban villagers drank alcohol, but current smoking rates were not different.

A comprehensive description of participants of randomized trials is important for the generalizability of results. Our villages took part in a cluster randomized trial that evaluated an intervention program to reduce blood pressure. Identifying other communities to which these results apply is important, since they may benefit from a similarly targeted strategy of health promotion.

Few studies that have reported increased hypertension in more urban areas have detailed socioeconomic characteristics of rural and urban areas. Most studies have concentrated on the extreme of urbanization, often comparing an area of a capital city with a rural area some distance away, and show an effect of urbanization in raising blood pressure.[3,5–10,13] The lack of description of the rural and urban areas makes transferring results to other countries difficult. In this study we did not include the extremes of urbanization, but we found significantly higher blood pressure and BMI in more urban villages.

The most common factor used to describe rural communities is population size. However, this study found considerable overlap in community size where rural communities had populations between 560 and 1,650, and semi-urban communities had populations between 1,200 and 2,000. This finding is partly a result of constraints of the randomized trial. Larger communities were not chosen since ensuring coverage of the health promotion program would be difficult, but rural villages were on average smaller than semi-urban villages, and very small communities would not have enough people in the age range chosen for the trial (40–75 years).

Table 5. Urinary sodium, potassium and creatinine, body mass index and systolic blood pressure by locality

	Rural Villages *N* = 481 Mean (SD)	Semi-Urban Villages *N* = 532 Mean (SD)	Difference in Means (95% CI) Rural–Semi-Urban
Urinary sodium (mmol/24 hr)	99.0 (45.0)	103.1 (45.0)	−4.1 (−16.3 to 8.0)
Urinary potassium (mmol/24 hr)	58.1 (25.5)	39.7 (17.2)	18.4 (11.3 to 25.6)
Sodium potassium ratio	1.91 (1.00)	2.83 (1.29)	−0.92 (−1.15 to −0.70)*
Creatinine	8.15 (2.50)	8.62 (2.67)	−0.47 (−1.04 to 0.09)
Sodium-creatinine ratio	12.6 (5.6)	12.5 (5.3)	0.2 (−1.6 to 1.9)
Potassium-creatinine ratio	7.38 (3.03)	4.76 (1.94)	2.61 (1.76 to 3.46)*
Systolic blood pressure (mm Hg)	121.5 (25.1)	129.2 (26.4)	−7.7 (−10.7 to −4.8)*
Body mass index (kg/m^2)	19.8 (3.2)	22.3 (4.6)	−2.5 (−3.4 to −1.6)*

95% confidence intervals allow for clustering by village.
* $P<.001$.

The World Bank gives a more detailed distinction between urban and rural areas.[21] In rural areas livelihoods are generally from farming, forestry, and fishing, with fairly good access to land for housing and building materials. Rural areas are more independent of government but have limited access to infrastructure and services because of low population density and distance from major conurbations.

Our rural villages had a higher proportion of farmers than semi-urban villages, where a fifth of participants recorded trading as their main occupation. Infrastructure was less developed in rural villages. None of the participants had piped water supplies, and drainage and road systems were limited. Households in rural villages were also less likely to have electricity or a television set. Rural villages were farther from the regional seat of government and the Komfo Anokye Teaching Hospital, the only tertiary referral hospital in the region, both of which are in Kumasi.

Education has been linked to urbanization,[8] but among this sample of villages no difference was seen between rural and semi-urban villagers. Among those under 50 years, >80% of both semi-urban and rural villagers attended school, with no difference in age at leaving school. Less than 5% of participants were employed in a non-manual job, with no difference between semi-urban and rural areas. This finding contrasts with that of other studies, which have either included groups of non-manual workers in rural areas[15] or participants from urban areas that have a substantial proportion of non-manual workers.[8,13,15] Oviasu[15] showed an effect of occupation on blood pressure in Nigeria that was independent of urbanization.

A three-pronged approach against hypertension is needed in sub-Saharan Africa. First, primordial prevention aims to prevent the emergence or enhancement of living patterns that are known to contribute to elevated risk-factor distribution. This is more relevant for rural communities, where the need is to maintain the low level of risk factors evident in these areas. Our rural villages had lower rates of alcohol consumption than those classified as semi-urban. This difference may be explained by greater access to alcohol in semi-urban villages. While total salt consumed was similar in semi-urban and rural villages, the sources were different; more rural villages add it at the table, where it is under the control of the consumer. In semi-urban areas more processed foods, in which salt is added in manufacture, are likely to be eaten.

The average amount of money spent per person per year on health care [in sub-Saharan Africa] has been compared to the cost of a meal at McDonalds.[22]

Second, primary prevention aims to reverse and reduce elevated levels of risk factors. This type of prevention applies more to urban communities, where the need is to reverse changes that have already occurred. Without such preventive strategies intensive lifestyle education will be needed, as has been seen in developed countries.

Finally, the high-risk strategy aims to identify people with high blood pressure and to treat them with anti-hypertensive medications and reduce their risk of stroke and renal failure. This approach is hampered by lack of resources and healthcare facilities outside large conurbations and by the costs of pharmacologic interventions.

As with all developing countries, those in sub-Saharan Africa are grappling with competing priorities and scarce health resources. The average amount of money spent per person per year on health care has been compared to the cost of a meal at McDonalds.[22] Pharmacologic methods to manage hypertension can be inexpensive but are still out of reach for most people.[23] For example, out of 40 health interventions in Guinea, drug treatment was ranked most expensive at US$2,281 per year of life saved.[24] This cost highlights the need for nonpharmacologic interventions, such as reducing salt in the diet. This specific topic is now addressed by the WHO as a strategy to reduce the risk of high blood pressure in developing countries.[12]

Noncommunicable cardiovascular disease is a cause of premature death and disability in sub-Saharan Africa, and as urbanization increases, deaths from noncommunicable diseases have been estimated to exceed those from communicable causes by the year 2015. Adequate descriptions of rurality and urbanization in a particular setting are useful to generalize and apply results from epidemiologic studies.

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