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Hypertension and overweight/obesity in Ghanaians and Nigerians living inWest Africa and industrialized countries: a systematic review

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Abstract

Context: There is a growing prevalence of cardiovascular disease (CVD) risk factors in West Africa and among its migrants to industrialized countries. Despite this, no study has reviewed CVD risk factor prevalence among West Africans in Africa and industrialized countries.

Objective: To appraise studies on the prevalence of two CVD risk factors (hypertension and overweight/obesity) among two major West African populations (Ghanaians and Nigerians) in Africa and industrialized countries.

Methods: A comprehensive literature search from 1996 to July 2012 was undertaken to identify quantitative studies on hypertension and overweight/obesity among adult Ghanaians and Nigerians in West Africa and industrialized countries.

Results: Twenty studies were included with 10 conducted in Ghana, six conducted in Nigeria and four in industrialized countries. Studies in Ghana and Nigeria reported a hypertension prevalence of 19.3–54.6% with minimal differences between rural, urban, semi-urban, and mixed populations. Of the hypertensive patients, 14–73% were aware of their condition, 3–86% were on treatment, and 2–13% had controlled blood pressures. Overweight/obesity prevalence in Ghana and Nigeria ranged from 20 to 62% and 4 to 49%, respectively. The four studies in industrialized countries reported a hypertension prevalence of 8.4–55% and overweight/obesity prevalence of 65.7–90%.

Conclusion: Hypertension and overweight/obesity are highly prevalent conditions in West Africa and in its migrants residing in industrialized countries. Urgent measures are needed to prevent CVD risk factors and halt the clinical sequelae.

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Conflicts of interest

There are no conflicts of interest.

Keywords

African immigrants; Ghana; hypertension; immigrants; industrialized countries; migrants; Nigeria; obesity; overweight

INTRODUCTION

Cardiovascular disease (CVD) has become the leading cause of death globally [1,2] with a high prevalence of major risk factors for CVD, including tobacco use, alcohol use, hypertension (HTN), high cholesterol, obesity, physical inactivity, and unhealthy diets. CVD is an emerging public health problem in West Africa and especially in Ghana and Nigeria where rapid epidemiological transitions have occurred [3]. These countries were selected for this systematic review because they are both English-speaking West African countries whose inhabitants exhibit similar sociodemographic characteristics, political/historical backgrounds, and have been relatively well studied.

In West Africa, HTN and overweight/obesity have emerged as important regional risk factors for CVD [4,5]. Among 79 cases of sudden cardiac deaths in Ile-Ife, Nigeria, hypertensive CVD was the cause of death in 83.5%, of which only 30.3% were previously diagnosed [6]. Similarly, a case-fatality rate of 43% was reported in 445 Nigerian hypertensive cases that presented to an urban tertiary hospital, suggesting that HTN is a major cause of morbidity [7]. HTN is also a leading cause of renal failure and heart failure in Ghana [8] and in the Greater Accra Region, HTN became the second leading cause of outpatient morbidity in 2007 [9].

Once considered a problem of wealthy nations, the WHO estimates that overweight and obesity have increased dramatically in sub-Saharan Africa (SSA) [10] and the obesity prevalence is trending upward in West Africa [11]. Obesity is also the most prevalent nutrition-related disorder in developed and developing countries [12]. These trends are worrisome as HTN and overweight/obesity are associated with increased morbidity and mortality, and pose a large disease burden for numerous noncommunicable diseases [13–15]. Further, the concurrent prevalence of obesity and malnutrition in West African countries result in an even greater disease burden and pose unique challenges for these settings [16].

Rates of CVD and risk factors among some ethnic groups increase following migration to countries where CVD rates are high, which indicates a substantial environmental influence [17]. There are growing West African populations in industrialized regions [18]. An estimated two to three million people from SSA reside in the European Union [19] and 1.1 million reside in the United States [20]. Although limited, available data suggest that African immigrants in these regions bear a disproportionate burden of CVD and CVD risk factors [21–25].

The purpose of this systematic review, therefore, was to critically appraise existing studies on the prevalence of two major CVD risk factors: HTN and overweight/obesity in two West African populations (Ghanaians and Nigerians) residing in Africa and in industrialized countries.

METHODS

Search strategy for identification of studies

Searches were undertaken using the PUBMED electronic database to identify population-based quantitative studies on HTN and overweight/obesity in adult Ghanaians and Nigerians in Africa, Europe, and North America using relevant diagnostic criteria [26–28]. Articles were included in this review if they were published in English between 1996 and June 2012. To enhance the comprehensiveness of the search, both subject headings and free text searches were implemented. Subsequently, reference lists of relevant identified articles were examined to retrieve other studies that were not indexed by PUBMED. The keywords and medical subject headings (MeSHs) used in the development of the search strategy included Ghana, Nigeria, African immigrants, HTN, high blood pressure (BP), overweight, obesity, risk factors, prevalence, and BMI. All MeSH words and keywords were truncated and exploded to capture as many articles as possible.

Study selection and data extraction

The titles and abstracts of the articles were screened and retrieved from the multiple sources described above. Articles were included if they reported on original prevalence (crude or adjusted), and contained epidemiological data on HTN and overweight/obesity. The full texts of potentially relevant articles were examined on the inclusion criteria and for methodological soundness. No pooled analysis was performed due to the heterogeneity of study populations. Figure 1 [29] is the flow chart of study selection and extraction.

RESULTS

Description of studies

Twenty (20) independent studies were included in this review, with 10 studies [30–38] conducted in Ghana, six studies [39–44] conducted in Nigeria, and four studies [45–48] conducted in industrialized countries. No epidemiological studies on HTN and overweight/obesity in Ghanaian or Nigerian immigrants in North America were reported. The majority of studies conducted in Africa were population-based and cross-sectional studies. All the four studies conducted in industrialized countries were cross-sectional. Sample sizes of the studies ranged from 85 to 4733 in Africa and 45 to 1471 in industrialized countries.

Hypertension in Ghanaians and Nigerians residing in Africa

HTN was defined using Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure (JNC −7) criteria [26] of SBP at least 140 mmHg and/or DBP at least 90 mmHg or as individuals being on antihypertensive medication. Notably, some studies also considered individuals who self-reported a prior diagnosis of HTN as hypertensive participants [30–32]. Three studies [34,36,37] restricted their diagnosis of HTN to only one BP measurement. Mean age of participants ranged from 31.6 to 46.8 years in both countries.

Studies in Ghana and Nigeria reported a crude prevalence of HTN between 19.3 and 54.6% (Table 1) [30–32, 33–43,44,49]. The study by Kunutsor and Powles [37], which reported the

lowest crude prevalence rate in a rural Ghanaian population, and the study by Duda *et al.* [36], which reported the highest crude prevalence among urban Ghanaian women, both only obtained one BP measurement and neither reported adjusted prevalence rates. Notably, only two studies [31,32] adjusted the HTN prevalence rates to the world standard population. Studies in Nigeria reported a crude HTN prevalence between 20.8 [42] and 36.6% [39], whereas their counterparts in Ghana reported a crude prevalence between 19.3 [37] and 54.6% [36]. Minimal differences in HTN prevalence rates were noted between rural, urban, semi-urban, and mixed populations in both countries. In two of the four rural populations, the HTN prevalence was 25% or higher [30,34]. In all six urban populations, the HTN prevalence was 27% or higher. Where reported, there were sex differences in HTN prevalence rates, although no clear pattern was noted (see Table 1). Six [34,35,41–43,49] of the 11 studies that analyzed rates by sex reported a higher HTN prevalence in men compared with women.

Detailed analyses of the awareness, treatment, and control of HTN were available for only eight studies conducted in Africa. Of the hypertensive patients, 14–73% were aware of their condition, 3–86% were on treatment, and 2–13% had controlled BPs less than 140/90 mmHg according to the JNC-7 criteria [26]. The highest awareness, treatment, and control rates were observed among urban civil servants in Accra, Ghana [31] and semi-urban participants in Sekondi-Takoradi, Ghana [38] with awareness, treatment, and control rates of 54.1, 31.3, and 12.7 and 73, 59, and 5%, respectively. The worst was observed in a mixed population-based sample of semi-urban and rural participants in the Ashanti region, Ghana where detection, treatment, and control rates were significantly higher in semi-urban (25.7, 14.3, and 3.4%) than in rural villages (16.4, 6.9, and 1.7%) [35]. Generally, women had higher awareness, treatment, and control rates than men [31,35,42,49]. Differences in study populations hinder further analysis of other trends in awareness, treatment, and control.

Overweight/obesity in Ghanaians and Nigerians residing in Africa

All studies except one [43] in this review utilized international criteria for BMI classification [28,50], with normal weight defined as a BMI of 18.5–24.9 kg/m^2, overweight 25–29.9, and obesity as at least 30 kg/m^2. The study by Oghagbon *et al.* [43] differed by categorizing normal weight as BMI of 20–24.9 kg/m^2.

The overall prevalence of overweight and obesity ranged from 20 to 62% and 4 to 49%, respectively (see Table 2) [30,31,33–37,40–44,49,51]. Although two of the three rural studies had lower rates of overweight and obesity compared with urban and mixed population, Burket's study [34] was the exception, in which about 44% of the population was found to be overweight or obese. However, a potential selection bias of women (77%) at the market limits the generalizability of the findings. In general, urban studies reported a higher prevalence of overweight or obesity with rates as high as 62%, observed in urban women in the Women's Health Study of Accra. The lowest rate of overweight or obesity (3.9%) [43] was observed in rural Egbegba, Nigeria; however, 60.9% of this population was underweight. This difference in prevalence of overweight or obesity is also reflected in the average BMIs of urban and rural populations in Table 2. Five studies [31,34,41,49,52] did not report BMI status by sex. In all studies in which BMI status was reported by sex, women

had a higher prevalence of overweight or obesity. This sex disparity in prevalence of overweight or obesity corroborates the findings of systematic review by Abubakari and Bhopal [53]. In all urban studies [31,51], obesity was approximately four times higher in women than men with the exception of study by Duda *et al.* [36], which excluded men. The prevalence of overweight or obesity was higher in Ghanaians (range of 21.1–62.3%), compared with Nigerians (range of 3.9–49%). Given the frequent concurrence of overweight/obesity and HTN, it is no coincidence that the prevalence of overweight/obesity and HTN are high in majority of the studies that addressed both risk factors as illustrated in Fig. 2.

Hypertension and overweight/obesity in Ghanaians and Nigerians residing in industrialized countries

There were four studies conducted in industrialized countries that addressed HTN and overweight/obesity in Ghanaians and Nigerians with the results presented in Table 3 [45–48]. Two studies were conducted in the Netherlands, whereas the other two were conducted in Italy and Australia. Sample sizes ranged from 45 to 1471. The prevalence of HTN in Ghanaians and Nigerians residing in industrialized countries ranged from 8.4 to 55%. Only study by Agyemang *et al.* [48] examined the awareness, treatment, and control of HTN and reported rates of 50, 45, and 33%, respectively.

DISCUSSION

Compared with the earliest epidemiological studies in Ghana and Nigeria, which revealed a low prevalence of CVD and associated risk factors [54], this systematic review found a high prevalence of HTN and overweight/obesity in the two countries, as foretold by Pobee *et al.* [55] in 1979. Also, this review shows that HTN and overweight/obesity are significant problems even in the poorest rural populations [30,34,40,42]. In a relatively young sample with a mean age of 31 years, a crude HTN prevalence of 30.6% [40] was observed. This finding is particularly concerning, considering the fact that an HTN prevalence of 33.5% has been reported in the United States in adults at least 20 years of age [21], but Ghana and Nigeria are more resource-limited settings. Further, rates of HTN in West African samples, regardless of setting and sample, are comparable to, or higher than the estimated global prevalence rate of 26.4% [56]. These findings should dispel the myth that HTN is only a problem for the wealthy and elderly.

Although Ghanaians have the highest prevalence of fruit and vegetable consumption in comparison to 52 other countries internationally [50], the prevalence of overweight/obesity is high in this review. The prevalence of overweight/obesity in urban women across studies is alarming. Although lower than the prevalence of 80% in African–American women [57], it still has profound public health implications in developing countries, where resources are scarce and malnutrition remains a public health concern [16]. This may be attributed to low physical activity, as epidemiological studies have shown that Ghanaians and Nigerians do not engage in regular physical activity [33,42,52], or to other dietary factors, as Ghanaians and Nigerians consume dietary salt exceeding recommended limits [37]. Several clinical trials have established that interventions to increase physical activity and reduce dietary

sodium [58–60] lower BP, and may reduce CVD risk. However, to enhance the effectiveness of these interventions in Ghana and Nigeria, tailoring to the specific population social, economic and cultural context must be considered.

Although considerable progress has been made toward HTN control in western countries, this review shows that West Africa is lagging behind. In comparison to the United States, where awareness, treatment, and control rates of 80.7, 72.5, and 50.1%, respectively, were reported in 2008 [61], the highest corresponding rates were 54.1, 31.3, and 12.7% [32] in Ghanaians. Possible reasons for the poor treatment and control rates include the high cost of medications [62], absence of national treatment guidelines [5], and misconceptions about HTN [38]. There is an urgent need to improve awareness, treatment, and control of HTN in these two countries to curb the looming epidemic of CVD.

The high prevalence of overweight/obesity in Dutch-Ghanaians (90%) in study by Agyemang *et al.* [48] reviewed deserves great attention and is comparatively higher than rates reported in the United States [57]. Saleh *et al.* [47] reported similar findings in Australian-Ghanaians where 89% of men and 92% of women were overweight or obese. Although the sample size of 45 in the latter study is small, the findings are equally disturbing. These two studies provide the closest estimate of what can be expected in the Ghanaian and Nigerian immigrants in North America. In West Africa, there is a positive social perception about overweight/obesity, as they are taken to mean signs of ‘good living’ and are associated with wealth, feminine beauty, and freedom from HIV/AIDS [63,64]. This perception could reinforce unhealthy lifestyles that lead to overweight/obesity in African immigrants. It is well known that 75% of the incidence of HTN is related directly to obesity [65]. It is, therefore, important to develop effective treatment strategies for the management of overweight/obesity in order to reduce the occurrence of obesity-related HTN.

No US-based studies were included in this review because African immigrants are often lumped into one racial/ethnic category and classified as ‘blacks’ [66,67], which may include African immigrants, and Afro-Caribbean immigrants. The lack of epidemiological data on CVD risk factors such as HTN and obesity in the recently immigrated West African population residing in the United States limits healthcare providers and policy makers’ abilities to address CVD prevention and management of CVD in this rapidly growing population.

Limitations and implications of findings for future research

The small number of high-quality, large-scale and comparable studies made this review difficult. Establishing a clear link between temporal trends and increasing prevalence of HTN and overweight/obesity was not possible, although the data suggest that the prevalence rates of HTN and overweight/obesity are high. The absence of sex and age-specific estimates limited interpretation and comparison of the data. There is an urgent need for cross-sectional studies on CVD risk factors in African immigrants to the USA and other industrialized countries. Studies should report world-standardized prevalence rates to permit comparisons between age groups, sexes, areas, and time points globally. Furthermore, studies should build on strengths of previous studies including the use of representative samples and large sample sizes. Longitudinal studies of Ghanaian and Nigerian immigrants

starting from the time of migration to industrialized nations may adequately characterize the environmental factors that may contribute to the development or progression of CVD risk factors.

In conclusion, this review has demonstrated a high prevalence of HTN and overweight/obesity in both urban and rural areas of Ghana and Nigeria. The awareness, treatment, and effective control of HTN in these two countries are unacceptably low. Improving the awareness, treatment, and control of HTN in these two West African countries is critical in reducing and preventing morbidity and mortality from CVD. Overweight and obesity are highly prevalent conditions in Ghanaians and Nigerians residing in West Africa and even greater in their counterparts residing in industrialized countries. The factors that contribute to this phenomenon need to be further explored in future studies. Ghanaians and Nigerians residing in West Africa may have a high risk of CVD due to the high prevalence and poor management of HTN and overweight/obesity and this risk may further deteriorate upon migration to industrialized countries. Future longitudinal studies will improve our understanding of the evolution of CVD risk in persons who migrate from West African countries to industrialized countries.

Abbreviations:

BP	blood pressure
CVDs	cardiovascular diseases
HTN	hypertension
MeSH	medical subject headings
Mixed	Rural+Urban/Semi-urban+ Rural Population

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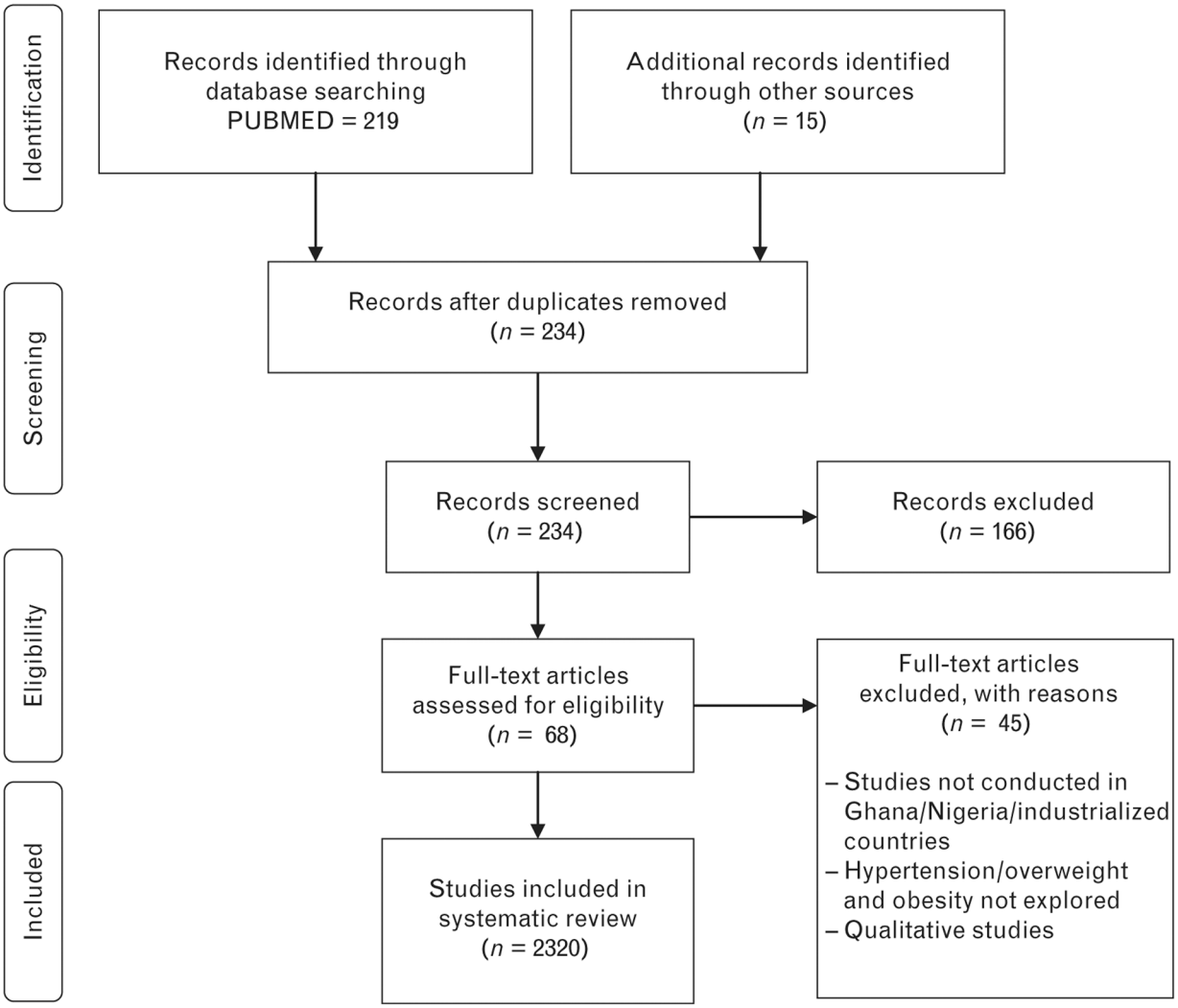

FIGURE 1.
Study selection and data extraction. Adapted from [29].

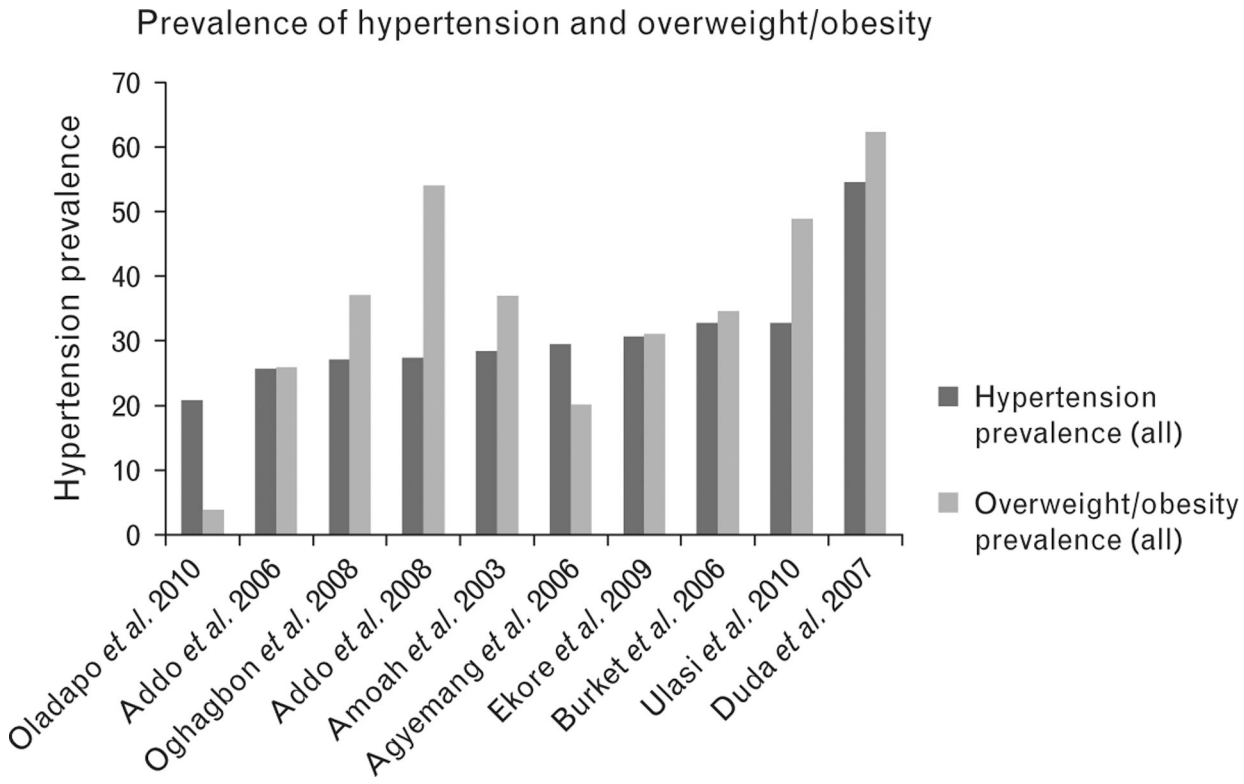

FIGURE 2.
Bar chart of studies that examined the prevalence of hypertension and overweight/obesity.

TABLE 1.

Cross-sectional studies of hypertension in [A] Ghanaians and [B] Nigerians in Africa

			HTN prevalence (Unadjusted, adjusted†)						Hypertension			
Author name	**Population type, city**	**(*n*)**	**Sampling method**	**Study period**	**Mean age ± SD years**	**(M)**	**(F)**	**(Total)**	**Awareness % (n_A/x)***	**Treatment % (n_T/x)***	**Control % (n_c/x)***	**Control % (n_c/n_T)Δ**
[A] Ghana												
Amoah [32]	Urban (Accra)	4733	Random cluster	1998	44.3 ± 14.7	-, 27.6†	-, 29.5†	28.3 28.4†	34 (458/1337)	18 (243/1337)	3.7 (49/1337)	20.2 (49/243)
Cappuccio *et al.* [35]	Mixed (Ashanti)	1013	Stratified random	2001–2002	54.7 ± 11.3	29.9	28.0	28.7	22.0 (64/291)	11.3 (33/291)	2.8 (8/291)	24.2 (8/33)
Burket [34]	Rural (Volta region)	287	Convenience	2002	41.8	39.4	30.7	32.8	18.9	-	-	
Spencer *et al.* [38]	Semi-urban	343	Convenience	2002–2003	48	28.7	30.7	30	73 (250/343)	43 (148/343)	3.6 (12/343)	-
Addo *et al.* [30]	Rural (Accra)	362	Convenience	-	42.4 ± 18.6	24.1	25.9	25.7	32.3 (30/93)	12.9 (12/93)	2.2 (2/93)	16.7 (2/12)
Duda *et al.* [36]	Urban women (Accra)	1328	2-stage Cluster Stratified Random	2003	46.8 ± 18.0	N/A	54.6	54.6	23.7 (309/1328)	52.4 (162/309)	2.3 (7/309)	4.3 (7/162)
Agyemang [49]	Mixed (Kumasi)	1431	Random	2004	35.9 ± 0.16	Rural-27 Urban-33.4	Rural-27 Urban-28.9	29.4	34 (486/1431)	28 (401/1431)	6.2 (89/1431)	12.2 (49/401)
Addo *et al.* [31]	Urban (Accra)	1015	Random	2006	44.0 ± 10.1	31. 7	28	30.3 27.4†	54.1 (166/307)	31.3 (96/166)	12.7 (39/307)	40.4 (39/96)
Kunutsorand Powles [37]	Rural (North)	574	Random	2007	37.75 ± 14.05	-	-	19.3	-	-	-	-
[B] Nigeria												
Oladapo *et al.* [42]	Rural (Egbeba)	2000	Systematic Random	2002–2005	42.1 ± 21.6	21.1	20.5	20.8	14.2 (59/415)	2.6 (11/415)	-	-
Ekore *et al.* [40]	Urban (Ibadan)	405	Convenience	2007	31.6 ± 6.9	34.4	28.3	30.6	-	-	-	-
Adedoyin *et al.* [39]	Semi-urban (Ile-Ife)	2097	Multistage Cluster	-	44.2 ± 11.6	36.8	34.7	36.6	-	-	-	-
Oghagbon *et al.* [43]	Urban (Ilorin)	281	Convenience	-	40.34 ±9.58	29.0	22.9	27.1	-	-	-	-
Ulasi *et al.* [44]	Mixed (Enugu)	1458	Stratified random	-	43.8 ± 13.7	-	-	32.8	-	18.9 (11.5/59)	-	-

			HTN prevalence (Unadjusted, adjusted†)						Hypertension			
Author name	**Population type, city**	**(*n*)**	**Sampling method**	**Study period**	**Mean age ± SD years**	**(M)**	**(F)**	**(Total)**	**Awareness % (n_A/x)***	**Treatment % (n_T/x)***	**Control % (n_c/x)***	**Control % (n_c/n_T)Δ**
Isezuo *et al.* [41]	Mixed (Sokoto)	782	Multistage Cluster	-	38.9 ± 13.9	25.9	23.6	24.8	13.9 (27/194)	85.7 (23/27)	12.5 (2.9/23)	-

'–', Results not reported;

†, Age-adjusted to world standard population;

*, Control rate calculated with the number of hypertensive patients (x) as the denominator, and the numerator (n_A) is the number of those participants who were aware of their hypertension; n_T is the number treated with antihypertensive medication; n_C is the number who had their blood pressure controlled to 140/90mmHg;

Δ, Control rate calculated with the number treated with antihypertensive medication (n_T) as the denominator; Mixed, Rural+Urban/Semi-urban+Rural Population.

TABLE 2.

Cross-sectional studies on overweight/obesity in Ghanaians and Nigerians residing in Africa

First author, year	Population type, area	(*n*)	Sampling method	Study period	Mean age ± SD/ mean age (95% Cl) All	BMI (kg/m^2)											
						%Normal (18.5–24.9)			% Overweight (25.0–29.9)			%Obese ≥30.0			Mean ±SD		
						M	F	All	M	F	All	M	F	All	M	F	All
[A] Ghana																	
Amoah [51]	Urban (Accra)	4733	Random cluster	1998	44.3 ± 14.7	68.5	46.1	54.9	17.5	27.1	23.4	4.6	20.2	14.1 13.6 †	22.6 ± 0.1	25.6 ± 0.1	24.4 ± 0.1
Cappuccio *et al.* [35]	Mixed (Ashanti)	1013	Stratified random	2001–2002	54.7 ± 11.3	-	-	-	-	-	-	-	-	-	20.2 ± 3.1	21.1 ± 4.6	21.1 ± 4.2
Burket [34]	Rural (Volta)	287	Convenience	2002	41.8	-	-	-	-	-	25.5	-	-	9.1	-	-	24.0
Biritwum *et al.* [33]	Mixed	4231	Random	2003	-	69	60.9	64.6	13.7	17.3	15.6	2.8	7.9	5.5	-	-	-
Addo *et al.* [30]	Rural (Accra)	362	Convenience	-	42.4 ± 18.6	-	-	74	-	-	15.7	-	-	10.2	21.5 ± 2.8	23.9 ± 5.4	23.2 ± 4.9
Duda *et al.* [36]	Urban	1328	2-stage Cluster Stratified Random	2003	46.8 ± 18.0	N/A	29.9	29.9	N/A	27.7	27.7	-	34.6	34.6	N/A	-	-
Agyemang [49]	Mixed (Kumasi)	1431	Random	2004	35.9 ± 0.2	85.9	75.1	79.9	12.3	13.3	12.9	1.9	11.6	7.2	22.0	24.0	23.1 ± 0.04
Addo *et al.* [31]	Urban (Accra)	1015	Random	2006	44.0 ± 10.1	52	27	42.2	34	34	34	9.9	35.5	20	24.7 ± 4.3	28.2 ± 5.8	26.1 ± 5.8
Kunutsorand Powles [37]	Rural (North)	574	Random	2007	37.8 ± 14.1	-	-	-	-	-	-	-	-	-	21.1 ± 2.3	22.2 ± 3.4	21.8 ± 3.1
[B] Nigeria																	
Oladapo *et al.* [42]	Rural (Egbeba)	2000	Systematic Random	2002–2005	42.1 ± 21.6	32.4	37.4	35.2	1.9	1.8	1.9	1.5	2.4	2.0	22.8 ± 7.9	25.6 ± 11.3	-
Ekore *et al.* [40]	Urban (Ibadan)	405	Convenience	2007	31.6 ± 6.9	-	-	-	-	-	22.5	-	-	8.6	-	-	23.7 ±4.3
Oghagbon *et al.* [43]	Urban (Ilorin)	281	Convenience	-	40.3 ± 9.6	71 **	38.6	62.9	21.9	30	23.9	7.1	31.4	13.21	24.3 ± 4.9	24.6 ± 4.5	24.4 ± 4.8
Ulasi *et al.* [44]	Mixed (Enugu)	1458	Stratified random	-	43.8 ± 13.7	-	-	-	-	-	31.6	-	-	17.3	-	-	23.7 ± 4.3
Isezuo *et al.* [41]	Mixed	782	Multistage Cluster	-	38.9 ± 13.9	-	-	-	-	-	-	2.0	5.9	4.3	22.8 ± 3.6	23.2 ± 4.0	23.0 ± 3.8

CI, confidence interval. '-' Results not reported;

† , Adjusted to world standard population; N/A, not applicable; -, not reported;

** Normal BMI classified as 20–24.9 kg/m^2; Mixed, Rural+Urban/Semi-urban+Rural Population.

TABLE 3.

Studies addressing hypertension and overweight/obesity in [A] Ghanaians and [B] Nigerians in industrialized countries

Author name, design	Population type	(*n*)	Design	CVD risk factor	Results
Agyemang *et al.* [45] Netherlands, Ghana	Dutch-Ghanaians, rural & urban Ghanaians	1471	Cross-sectional	Overweight/obesity	Overweight/Obesity prevalence: 69.1% (M), 79.5% (F) in Dutch-Ghanaians which was significantly higher than urban Ghanaians: 22.0% (M), 50.0% (F) and rural Ghanaians: 10.3% (M), 19.0% (F)
Dominguez *et al.* [46] Italy	African immigrants (Ghanaians, Nigerians, Ivorians)	83	Cross-sectional	HTN, CVD risk profiles	HTN prevalence: 8.4%, HTN treatment: 0%. Obesity prevalence: 2.2% and significant correlations b/n duration in Italy and weight (P<0.001), BMI (P<0.0001), SBP (P<0.01), & DBP (P<0.05)
Saleh *et al.* [47] Australia	Ghanaian immigrants	45	Cross-sectional	HTN, overweight/obesity	HTN prevalence: 40% (M), 17% (F), HTN awareness 29%, Overweight/obesity prevalence: 71% (M), 65.7% (F), 63% participants had one or more metabolic risk factors.
Agyemang *et al.* [48] Netherlands	Ghanaian immigrants	221	Cross-sectional	HTN, overweight, obesity, diabetes, smoking, physical activity	HTN prevalence: 55%, HTN awareness: 50%, HTN treatment: 45%, HTN control: 33%, overweight/obesity prevalence: 90%

CVD, cardiovascular disease; HTN, hypertension.