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FOOD PRICE, FOOD SECURITY AND DIETARY DIVERSITY: A COMPARATIVE STUDY OF URBAN CAMEROON AND GHANA

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Abstract: This paper contributes to the urban food security literature by presenting the results of 600 household surveys conducted in Ghana and Cameroon. In this, we show how dietary diversity, which is a well-developed proxy for food security, is similar in both countries but varies significantly based on household demographic characteristics. In particular, smaller, better-off and more educated households were likely to have higher levels of dietary diversity and were less likely to respond to rising food prices by reducing diets or shifting buying patterns. In addition, households that live in 'primary' cities that are large and well integrated into global markets also enjoyed higher levels of dietary diversity. This research contributes to debates around whether or not food security is enhanced by being integrated into global markets or whether it is better served through national or regional food systems. The evidence uncovered here suggests that for well-off households, integration into global markets is probably preferable as such households enjoy more diverse diets.

Keywords: food security; food price; market integration and globalisation; rural development

INTRODUCTION

There is a growing interest in urban food insecurity in sub-Saharan Africa (SSA). Partly, this is because of the fact that the region is rapidly urbanising (Crush, Frayne, & Pendleton, 2012; Crush & Frayne, 2011). In addition, situations such as the 2007/2008 food price crisis, which led to riots in many African cities, show that urban food insecurity can lead

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to political volatility (Legwegoh, Fraser, KC, & Antwi-Agyei, 2015; Sneyd, Legwegoh, & Fraser, 2013). Working on this topic, researchers have hypothesised that urban food insecurity may be caused by the fact that poor urban consumers are net food buyers who depend on markets for supplies, and this makes them particularly vulnerable to food price increases and fluctuations (Legwegoh *et al.,* 2015; Ruel, Garrett, Hawkes, & Cohen, 2010). This is because food purchases account for 1/2–2/3 of total monthly expenditures for many families in such regions (Mason, Jayne, Chapoto, & Donovan, 2011). In West African cities, these issues are even more pressing because many households have become dependent on imported rice from Asia over the past three decades (Moseley, Carney, & Becker, 2010).

Taken together, some scholars speculate that this dependency means that urban consumers who depend on international markets were particularly impacted by global food price hikes in 2007–2008, and this directly led to the outbreak of food riots witnessed in that year (Moseley *et al.,* 2010). Such concerns have heightened attention to the vulnerability of urban consumers and reignited discussions around the need to invest in local agricultural systems to curb import dependence and shield local consumers from global food price fluctuations (Moseley *et al.,* 2010). Others recommend that governments implement food policies and programs that enhance food affordability, especially among low-income households (Mason *et al.,* 2011).

However, questions remain, and there are no simple correlations between import dependence, poverty and such social phenomena as the occurrence of food of riots (Sneyd *et al.,* 2013). A key barrier that prevents developing better policy, therefore, is a lack of well-established and empirical evidence that exposes the causal links between rising food prices and indicators of household food insecurity. Wiggins and Keats (2009), for example, express concern that there are only limited qualitative and quantitative studies that explore the social impact of food price crisis, including peoples' experiences, reactions and coping strategies. Indeed, much of the work that exists on this topic is based on computer simulation models, and this leads Headey (2013) to caution that policy makers should blend household data with computer models as the key way through which to design policy interventions.

In response to these challenges, some argue that using dietary recall surveys to assess the frequency that different households consume different types of food—called dietary diversity surveys—represents a useful tool that helps capture how households may react to changing food prices (Headey & Ecker, 2013; Headey, 2013). More specifically, preliminary evidence shows that reducing dietary diversity is a common way that many households use to cope with higher staple food prices (Leroy *et al.,* 2015; Martin-Prevel *et al.,* 2012). Often times, household dietary diversity is captured using an index called the 'Household Dietary Diversity Score' (HDDS), which is a common measure of dietary diversity. It has been validated in different countries as proxy measures of household per capita energy intake and used as a tool for monitoring household economic access to food (Kennedy *et al.,* 2010). Supporting the use of the HDDS as a tool for evaluating food insecurity are a number of studies that show how there is a well-established link between dietary diversity and micronutrient adequacy of diets measured at the individual level (Kennedy *et al.,* 2010; Clausen, Charlton, Gobotswana, & Holmboe-Ottesen, 2005; Headey & Ecker, 2013). Furthermore, dietary diversity assessments such as the household dietary diversity score have been shown to be a useful tool to compare food insecurity across geographical regions (although the relationship between dietary diversity scores and nutrient deficiencies varies according

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to countries and contexts) (Arimond *et al.,* 2010; Headey & Ecker, 2013; Legwegoh & Riley, 2014).

This paper aims to contribute to the current urban food security literature by exploring peoples' experiences with food price rises, specifically through the lens of dietary diversity. In this, we have adopted a comparative approach looking at two countries: Cameroon and Ghana. Within each country, we collected data from three distinct types of cities including capital cities that are well integrated into global commodity markets, secondary cities that are smaller and serve regional economies, and tertiary cities that are more rurally situated, are economically the most peripheral, but have the best access to peri-urban agriculture.More specifically, the overall objective of this paper is to compare household dietary diversity levels in these three types of cities for both Ghana and Cameroon. In doing so, we attempt to find answers to the following questions:

(1) How do people react to food price changes in urban Cameroon and Ghana?
(2) What are the levels of household dietary diversity in these urban areas and are there similarities and differences within and between these two countries?
(3) What factors shape dietary diversity in different types of urban settings?

METHODOLOGY

Regional Context and Research Design

The World Bank classifies both Cameroon and Ghana as lower middle-income countries. Cameroon has a slightly smaller population and higher rates of poverty than Ghana; however, urbanisation rates are similar in both Countries. Cameroon's total population is estimated at 22.77 million as of 2014 with an estimated 53.8 per cent of the population living in urban areas and an annual urbanisation rate of 3.6 per cent between 2010 and 2015. An estimated 37.5 per cent of the population lives below the national poverty line, while the urban poverty rate in Cameroon is 12.2 per cent (World Bank, 2016).

Ghana's population is estimated at 26.79 million with an estimated 53.4 per cent of the population living in urban areas and an annual urbanisation rate of 3.4 per cent between 2010 and 2014. An estimated 24.2 per cent of Ghana's population lives below the national poverty line, while the urban poverty rate is 10.6 per cent (World Bank, 2016). Furthermore, both country's consumers have faced volatile domestic food prices (Figure 1), and this has had a significant impact on consumer food intake as well as people's ability to save, invest or spend on other essentials of life (Food and Agriculture Organization, 2013).

Despite these obvious similarities, there are significant differences between the countries in terms of food prices and food security. For instance, the FAO's Domestic Food Price Level Index, which measures the price of food in the country relative to the price of the generic consumption basket, indicates that while the cost of food has been declining in Ghana, in Cameroon it has been on the rise (Figure 2). In addition, although both countries experienced significant food price volatility in recent years, there was no indications of violent food-price related protests in Ghana, while Cameroon experienced some of the worst food riots in the world when food and fuel price rose in 2007–2008 (Sneyd *et al.,* 2013).

As noted in the introduction, this study uses data collected in three different cities from both Cameroon and Ghana, to explore the relationship between household dietary diversity

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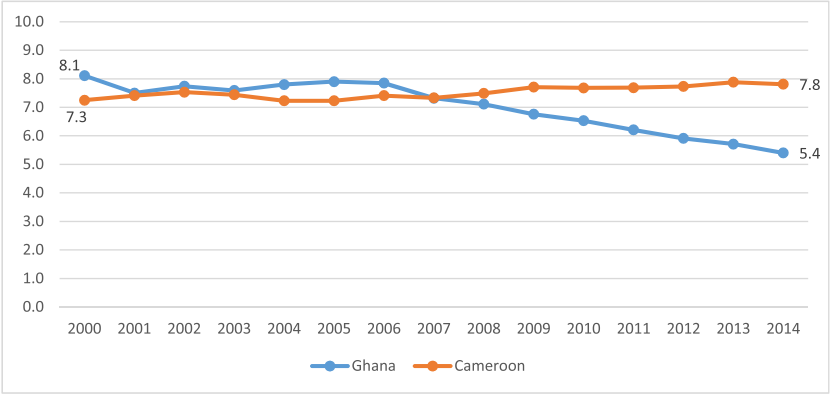

Figure 1. Domestic Food Price Level Index for Cameroon and Ghana (2000–2014). [Colour figure can be viewed at wileyonlinelibrary.com]

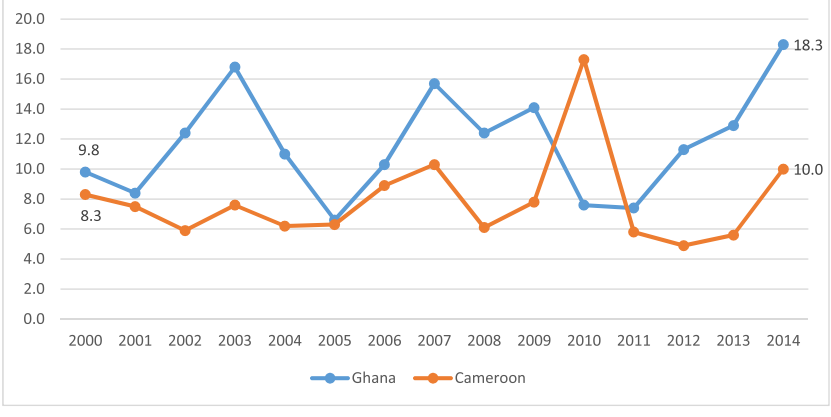

Figure 2. Domestic Food Price Volatility Index for Cameroon and Ghana (2000–2014). [Colour figure can be viewed at wileyonlinelibrary.com]

and other indicators of food security with price volatility. Thus, our data provide the opportunity to both observe trends in each country while also providing the basis for a comparative study that may reveal trends generalisable to the region. Without attempting to review the extensive literature on the importance of comparative urban studies (see for example: Riley & Legwegoh, 2014; Robinson, 2015), we draw on the essence of the comparative approaches within urban geography by paying close attention to the geographical context of these six cities as we explore our data.

More specifically, we began with the initial observation that food security is influenced by multiple factors including market trends, the agricultural background of populations and the nature of the urban economies (Bopda & Awono, 2010). Further, it is important to take into consideration rural–urban connectivity including the fluid daily flows of people and food, as well as understanding the ways that some urban settlements permit the practice of agriculture within urban boundaries (Bopda & Awono, 2010; Chagomoka *et al.,* 2015). Drawing on these factors, we classified cities in Cameroon and Ghana along a continuum from the following: (i) 'primary cities' that are the most urbanised areas, that

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include large capital cities that are relatively well integrated into the global economy and possess limited amounts of agricultural production within their boundaries; (ii) 'secondary cities' that are influenced by global food price trends but maintain a robust urban and peri-urban agricultural system given the availability of undeveloped land; and (iii) 'tertiary cities' further in the hinterlands, where it takes significantly longer for imported goods (and hence import prices) to be transported, and that are largely serviced by fluid rural–urban supply chains but are well supported by urban and peri-urban agriculture.

Using this classification system, in Cameroon, we identified Douala, the economic capital and major port city in Cameroon and in Ghana, Accra, the capital city, to represent the first category. Buea and its satellite towns (Cameroon) and Kumasi (Ghana) were selected to represent the second category, which we labelled 'secondary cities'. Finally, Bamenda (Cameroon) and Techiman (Ghana) were selected for the third category as they are found in an economic hinterland (see Figure 3). In terms of the sizes of these cities, Cameroon's 2005 census notes that Douala had 1 906 962 inhabitants, Buea had 90 090 and Bamenda had 269 530. Based on Ghana's 2010 census, Accra had 2 070 463 inhabitants, while Kumasi had 2 035 064, and Techiman had 67, 241 inhabitants.

Survey Design

One survey was constructed to collect data in all six cities. The survey covered several themes including household demographics (e.g. ethnicity, household size, gender, age, marital status, education levels, as well as indicators of household expenses such as

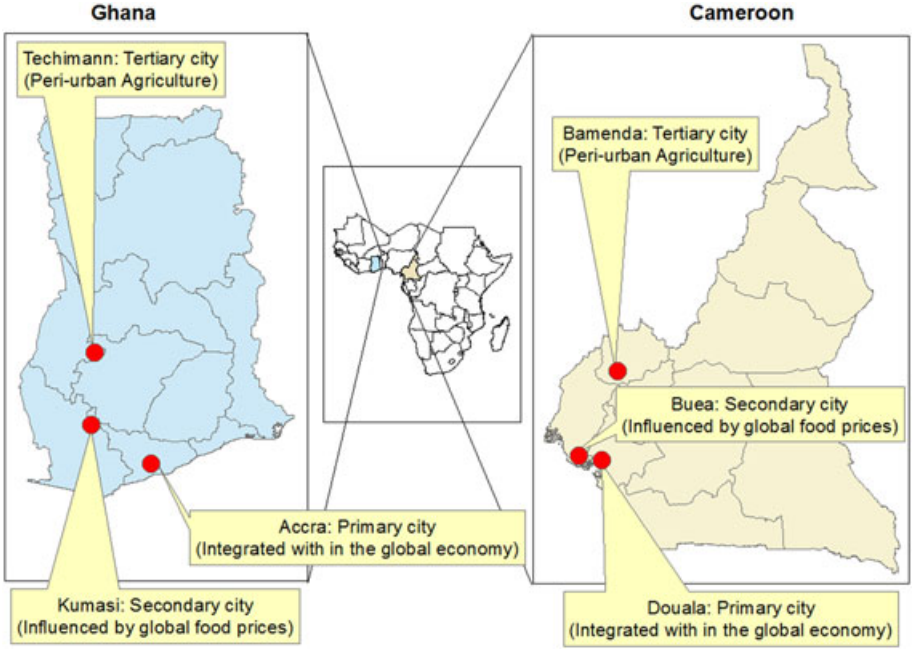

Figure 3. Map of Cameroon and Ghana showing three study sites in each country: Primary cities integrated with in the global economy (Douala and Accra), Secondary cities that are influenced by global food prices (Buea and Kumasi) and Tertiary cities that are peri-urban (Bamenda and Techiman). [Colour figure can be viewed at wileyonlinelibrary.com]

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expenditure on food, clothing etc., relative wealth such as occupation, work status and opinion on current level of living standard and position compared to average household within the same community). To assess dietary diversity, we used the Household Dietary Diversity Scale (HDDS) questionnaire (Ruel, 2003; Swindale & Bilinsky, 2006). The HDDS was developed by the USAID-funded Food and Nutrition Technical Assistance (FANTA) project and provides a count of the number of different food groups consumed by a household over a specific reference period of time (e.g. 24 h/48 h/7 days (Swindale & Bilinsky, 2006)). The HDDS is useful as an increase in the average number of different food groups consumed provided a quantifiable measure of improved food access. The HDDS can also provide insights on household nutritional security based on the quality of diets, as represented by the food groups that a household consumes. For more information on the construction of the HDDS, Swindale and Bilinsky (2006) provide full details including the questionnaire and instructions on how to use this tool. For our study, this dietary diversity questionnaire required individuals to state whether or not they, or anyone else in their household, had eaten any food items recorded in the 12 food groups listed below in the past 24 h. The resultant household dietary diversity score is the total number of food groups consumed by household members:

(1) Cereals (bread, rice noodles, biscuits or foods made from millet, sorghum, maize, rice, wheat)
(2) Tuber or roots (potatoes, yams, cassava)
(3) Vegetables
(4) Fruits
(5) Meat (beef, pork, lamb, goat, rabbit, game, chicken, duck, other birds, offal)
(6) Eggs
(7) Fish/shellfish
(8) Pulses/legumes/nuts (beans, peas, lentils or other nuts)
(9) Milk (and milk products)
(10) Oil/fat (foods made with oil, fat or butter)
(11) Sugar/honey
(12) Condiments, coffee and tea

Finally, households were asked whether they had experienced food price increases over the last 12 months, and if so, they were further asked to elaborate on how they had reacted to the food price rise (e.g. did they continue buying the same quantity of the same ingredients; buy smaller quantities, stop buying expensive food and whether they switched to alternative foods).

Sampling

Data collection took place in both Cameroon and Ghana in May and June of 2014. A total of 600 participants from six cities in Cameroon and Ghana were randomly selected; 100 for each city in Cameroon, while in Ghana there were 103 participants in Kumasi, 96 in Accra and 101 in Techiman. In each city, participants were randomly selected from four neighbourhoods that were themselves randomly selected from a list of neighbourhoods in each city. When conducting the survey, the head of the household was asked to respond to the questions in the survey or to appoint another member of the household knowledgeable of dietary patterns and household socio-economic status to answer the

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questions. Sample size may be considered not large enough to draw the conclusion at the national level. However, our sample size is relatively good enough to do the comparative analysis between three similar sets of cities in two western African countries.

Preparation of Variables

Although the majority of the data were collected in a manner that could be analysed directly, several variables needed to be converted into indices. Specifically, we calculated a weighted education index (WEI) by adding the weighted educational attainment scores of all household members. In order to do this, each household member was scored according to the following: no education = 0.00, 1–5 years of schooling = 0.25, 6–8 years of schooling = 0.50, 9–12 years of schooling = 0.75 and postsecondary = 1.00 (see details in KC, 2005; KC *et al.,* 2016b and Legwegoh *et al.,* 2015).

Another variable that needed to be transformed pertained to economic wealth. To determine a wealth rank, we combined two questions. The first question asked households to evaluate their standard of living on a scale from 1 to 10 (where 1 is very poor and 10 is very wealthy). The second question asked people, on a scale of 1 to 3, how they believed their living standard compared with that found in the average home in their city (1 = below average, 2 = average, and three = above average). The results of these two questions were recoded, and the final wealth ranking calculated for all participants is outlined in Table 1. To verify the score, we conducted a qualitative comparison between the score (wealth rank), as well as the profession of the respondents and other household members, and found a close match between the two.

Analytic Process

Data were analysed in SPSS version 22 (IBM, 2013) and STATA version 14 (Stata, 2014). In terms of our statistical and econometric analysis, our basic approach had three steps.

Table 1. Developing a wealth ranking

Survey questions				Wealth ranking	
On a scale from 1 to 10, where would you place the current living standards of your household? Where 1 is 'very poor' and 10 is 'very wealthy'		How do you think your living standard compares with that found in the average home in your city?			
Actual score	Adjusted score	Actual score	Adjusted score	Total score (sum of two adjusted scores)	Income level
1–3	1	Far below average and below average	1	2 and 3	Low income
4–6	2	Average	2	4 and 5	Middle income
7–10	3	Above average and far above average	3	6	Upper middle income

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First, we summarised the data using descriptive summary statistics. Second, we used a one-way ANOVA to test for differences in dietary diversity across two countries and among the six cities, as well as between households with different socio-demographic characteristics. Third, we explored the determinants of dietary diversity using a linear modelling approach that has been established in similar studies (e.g. see: Pant *et al.*, 2014 and KC, Haque, Legwegoh, & Fraser, 2016a; KC *et al.,* 2016b). To do this, we assumed that different levels of dietary diversity may be linked to a range of factors such as household size, education level, household wealth/income, food commodity price trend and dietary behaviour. In this way, we used our data to test the following specific hypotheses:

- That larger households would have lower dietary diversity.
- That households with higher education would have higher dietary diversity.
- That households who reported to have had noticed higher food prices in the past year would have lower dietary diversity.
- That wealthier households would have more diversity.
- That households in tertiary cities would have higher diversity and be less impacted by price rises given their proximity to rural markets and their lack of integration to global supply chains.
- Finally, we explored whether dietary diversity might have also been impacted by the food consumption behaviour of the inhabitants. For example, participants might have changed their dietary habits, switching to alternative products or consuming less amounts of specific food items because of food price rise and vice versa.

Using this approach, a total of six linear models were developed:

- A single model that included all 600 survey respondents from both the Cameroon and Ghana dataset.
- Two models, one for each of Cameroon and Ghana that allowed us to explore differences between each country (N = 300 each).
- Three models, one for each of the three 'types of cities' we surveyed including: (i) the 'primary city model' (Douala and Accra—N = 196); (ii) the 'secondary city model' (Buea and Kumasi—N = 203); and (iii) the 'tertiary city model' (Bamenda and Techiman—N = 201).

In each of these six models, dietary diversity score was used as the dependent variable, and the WEI, total household expenditure and family size are the explaining variables. The wealth rank, whether the respondent reported to having noticed a price increase in the past year and whether respondents reporting to having increased or decreased purchasing in response to price changes were all used as dummy variables. Finally, as there are three wealth ranks in all the models, we used the low-income group as the reference category against which the other wealth groups are compared.

RESULTS AND ANALYSIS

Summary Statistics

Table 2 presents a summary of the demographic and socio-economic characteristics of the sample households, as well as their experience with food price increases and their

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Table 2. Summary Statistics

Variable	Cameroon				Ghana				Total
	Bamenda ($N=100$)	Buea ($N=100$)	Douala ($N=100$)	Total ($N=300$)	Kumasi ($N=103$)	Accra ($N=96$)	Techiman ($N=101$)	Total ($N=300$)	($N=600$)
Sex of decision maker									
Male (%)	70.00	47.00	50.00	55.67	55	31	43	57.00	56.33
Female (%)	30.00	53.00	50.00	44.33	48	65	58	43.00	43.67
Average Family size	5.47	5.15	4.39	5.00	5.51	3.75	4.67	4.67	4.84
Mean Weighted education index (WEI)	.471	.545	.471	.496	.344	.499	.314	.382	.439
Average Total expenditure (US$)	508.99	1140.23	514.55	721.26	343.49	483.23	223.15	347.69	534.47
Wealth ranking									
I (low income) (%)	34.00	13.00	38.00	28.33	70.87	20.83	64.36	52.67	40.50
II (medium income) (%)	59.00	53.00	54.00	55.33	27.18	48.96	26.73	34.00	44.67
III (high income) (%)	7.00	34.00	8.00	16.33	1.94	30.21	8.91	13.33	14.83
Notice Price increase									
Yes (%)	79.78	86.21	77.0	80.80	95.15	72.92	75.25	81.33	81.08
Purchase reaction									
Continue buying same amount									
Yes (%)	12.00	14.00	12.00	12.67	26.21	76.04	44.55	48.33	30.50
Buy smaller amount									
Yes (%)	65.00	68.00	68.00	67.00	73.79	20.83	53.47	50.00	58.50
Switched to alternative products									
Yes (%)	27.33	27.00	29.00	26.00	99.03	15.63	57.43	58.33	42.83

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purchasing reaction to these perceived increases. Overall, data show that there is a slightly higher percentage of male respondents compared to females (56.33 and 43.67 per cent, respectively). This trend also holds in Cameroon (total 55.67 per cent male over 44.33 per cent female) and Ghana (total 57.00 per cent male over 43.00 per cent female). Data show that the average family size of survey household is 4.84 people. In terms of education, the results reveal that there is a difference between Cameroon and Ghana. The mean WEI of Cameroon is 0.496 and 0.382 for Ghana. Moreover, the data demonstrate that the total average household expenditure per year on foodstuffs for all survey households is $534.47 US. Not only is the total average expenditure in Cameroon ($721.26) higher than the one in Ghana ($347.69), but all Cameroonian cities demonstrate a higher average total expenditure than cities in Ghana. Data also reveal a larger number of lower and middle wealth ranking households (40.50 per cent low wealth ranking and 44.67 per cent middle wealth ranking). However, there is a higher percentage of lower wealth ranking households in Ghana (52.67 per cent) than in Cameroon (28.33 per cent), and a lower percentage of middle wealth ranking households in Ghana (34.0 per cent) than in Cameroon (55.33 per cent). As for experiencing a price increase, results show that respondents overwhelmingly answered yes (81.08 per cent) when asked if they had observed food price rises in the past year. This holds true for every city in both Cameroon and Ghana.

When asked how they had responded to changing prices, overall 30 per cent of all respondents said that they had continued to buy the same quantities while 58 per cent said they were now buying less. Additionally, 42 per cent said that they had also switched to different, lower cost, alternatives. In general, these trends were consistent across both countries and all six cities with the exception being Accra where many more (76 per cent) people said they had continued buying the same amounts of food (see Table 2 for more details).

Comparison of the Dietary Diversity between Two Countries and among Cities and Groups

Data show that, on average, our sample household had a mean dietary diversity score of 7.26. However, data also reveal a considerable variation between Ghana and Cameroon, between the six cities and among different socio-demographic groups. More specifically, we observe the following trends:

(1) There are significant differences in dietary diversity scores ($p < 0.001$) between all three cities of Cameroon and Ghana.
(2) Within Cameroon, households in Douala had an average dietary diversity score of 7.23, Buea 7.92 and Bamenda 6.31; while in Ghana, households in Accra had an average dietary diversity score of 8.57, Kumasi 6.83 and Techiman 6.73 (Table 3).
(3) The following food groups were the most common across all participants in Cameroon; cereals, vegetables, tubers, oils and fruits whereas in Ghana most participants reported consuming vegetables, cereals, oils and fish.
(4) Trends in the different cities were largely similar to the country trends although there were variations in the relative ranking of the different food groups based on how often they were noted by participants.
(5) Households in tertiary cities of Bamenda and Techiman, compared to the other cities, are less likely to be consuming non-staples and imported foods such as eggs; cheese, yogurt and other dairy products, oil, fat and butter as well as sugar (see Table 4).

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Table 3. Comparison of the dietary diversity between two countries and among cities and groups

Variables	Mean	SD	95% conf. interval for mean	
			Lower bound	Upper bound
Country				
Cameroon	7.15	2.501	6.87	7.44
Ghana	7.36	2.357	7.09	7.62
Total	7.26	2.430	7.06	7.45
Sites***				
Primary city (integrated with global economy)	7.89	2.580	7.52	8.25
Secondary city (influence by global food price)	7.37	2.202	7.06	7.67
Tertiary city (peri-urban agriculture)	6.52	2.315	6.20	6.84
Cities of Cameroon***				
Bamenda	6.31	2.557	5.80	6.82
Buea	7.92	2.377	7.45	8.39
Douala	7.23	2.322	6.77	7.69
Cities of Ghana***				
Kumasi	6.83	1.879	6.47	7.20
Accra	8.57	2.667	8.03	9.11
Techiman	6.73	2.039	6.33	7.14
Wealth ranking***				
Low income	6.26	2.145	5.99	6.53
Middle income	7.59	2.287	7.31	7.86
Upper middle income	8.96	2.388	8.45	9.46
Education***				
'No formal schooling'	6.48	2.452	6.42	7.37
'Some primary'	6.84	1.916	6.98	8.09
'Primary completed Junior or Senior'	6.90	2.472	6.42	7.37
'Some high school'	7.54	2.668	6.98	8.09
'High school completed'	6.88	2.448	6.42	7.34
'Post-secondary qualifications not university diploma, or degree from college'	7.68	2.458	7.08	8.27
'Some university'	8.00	2.173	7.12	8.88
'University completed'	7.60	2.283	7.03	8.18
'Post-graduate MA or MSC or PhD'	8.92	2.080	8.06	9.78

Notes:
***Dietary diversity are significantly different at ($p < 0.01$).
**Dietary diversity are significantly different at ($p < 0.05$).
*Dietary diversity are significantly different at ($p < 0.1$).

Our analysis also show that dietary diversity scores were significantly different ($p < 0.001$) between different types of cities and the primary cities (e.g. the most integrated into the global economy) had a higher level of dietary diversity (7.89) than secondary cities (7.37), and tertiary cities in peri-urban areas (6.52). This indicates that the more the city is integrated into global trading systems the higher the dietary diversity.

Likewise, dietary diversity scores were significantly different ($p < 0.001$) between varying household income levels. For instance, lower income households had a dietary diversity score of 6.26; middle-income households 7.59, and upper middle-income households 8.96. This indicates that as income increases so does dietary diversity (Table 3). There was also a direct relationship between education and dietary diversity scores: a higher level of education in households is linked with a higher dietary diversity score. For example, respondents with post-graduate education had an average dietary

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Table 4. Dietary diversity composition (percentage of sample who noted consuming each food group in the last 24 h)

	Cameroon	Ghana	Douala	Buea	Bamenda	Accra	Kumasi	Techiman	Primary cities	Secondary cities	Tertiary cities
Cereals and cereal products	85.0	90.7	90.0	91.0	74.0	94.8	92.2	85.1	92.3	91.6	79.6
Potatoes yams manioc cassava or any other roots	69.0	67.7	71.0	72.0	64.0	68.8	65.0	69.3	69.9	68.5	66.7
Vegetables	74.3	96.7	61.0	82.0	80.0	99.0	95.1	96.0	79.6	88.7	88.1
Fruits	67.0	54.7	62.0	64.0	75.0	67.7	52.4	44.6	64.8	58.1	59.7
Beef pork lamb goat rabbit wild game chicken duck other bird	45.0	54.0	45.0	52.0	38.0	59.4	48.5	54.5	52.0	50.2	46.3
Eggs	45.0	42.0	51.0	51.0	33.0	56.3	44.7	25.7	53.6	47.8	29.4
Fish or shellfish	58.7	73.3	58.0	63.0	55.0	81.3	63.1	76.2	69.4	63.1	65.7
Beans peas lentils or nuts	50.3	42.0	54.0	55.0	42.0	67.7	22.3	37.6	60.7	38.4	39.8
Cheese yogurt milk or other milk products	42.0	37.3	47.0	55.0	24.0	59.4	29.1	24.8	53.1	41.9	24.4
Oil fat or butter	67.7	75.3	64.0	84.0	55.0	78.1	80.6	67.3	70.9	82.3	61.2
Sugar or honey	59.0	60.3	64.0	63.0	50.0	67.7	60.2	53.5	65.8	61.6	51.7
Other foods such as condiments coffee tea	52.3	39.7	56.0	60.0	41.0	57.3	30.1	32.7	56.6	44.8	36.8

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diversity score of 8.92, whereas respondents with no formal schooling had an average dietary diversity score of 6.48 (see Table 3 for full details). In summary, the data suggest that dietary diversity is related to the level of integration in the global economy and the rural–urban spectrum as well as wealth and education.

Linear Regression Model of Dietary Diversity Index (HDD Score) against a Set of Socio-Demographic Explaining Variables

Regression model results show that many independent variables are highly significant in terms of explaining dietary diversity and all models have R^2 values (see Table 5) that are consistent with other research that uses this type of analytic framework (e.g. see: Pant *et al.,* 2014 and KC *et al.,* 2016a, 2016b). For the overall model that used all respondents together ($N = 600$), family size was found to be significant and negatively associated with dietary diversity. This model shows that a one-unit increase in family size decreases dietary diversity scores by 0.103. This trend also holds true for the case of the Cameroon-specific model where one unit increase in family size decreases dietary diversity scores by 0.117. However, family size was not found to be significantly associated with the dietary diversity in the case of Ghana, as well as for all city-specific models.

When we tested to see if there were differences in dietary diversity between those who had and those who had not perceived food price rises in the past year, we uncovered a number of significant differences. Specifically, our results show that those who believed that there was a price increase had lower dietary diversity than those who did not perceive price increases. This trend holds for country specific models as well as the primary and secondary city models, but not for the tertiary city model (e.g. the cities that were most rural and least well integrated into global food markets).

The data presented in Table 5 also show that average dietary diversity scores are different depending on how households responded to past price rises. For instance, households that did not adapt to price rises and bought the same items and quantities, as well as those who reported switching to alternative products, both had significantly higher levels of dietary diversity. This trend was reflected in the overall model as well as in the Cameroonian model and the model dealing with tertiary cities (i.e. Bamenda and Techiman). However, this was not significant in Ghana, primary cities (i.e. Douala and Accra) or secondary cities (i.e. Buea and Kumasi). Similarly, the dietary diversity level of those who switched to alternative products was higher than those who did not switch to alternative products. This trend is also significant ($p < 0.01$) in tertiary cities (i.e. Bamenda and Techiman) as the dietary diversity level of those who switched to alternative products was higher than those who did not switch to alternative products. The level of dietary diversity and those who bought the same items but in smaller quantities was not significant except for in cities marked by peri-urban agriculture (i.e. Bamenda and Techiman). The dietary diversity score of those who bought the same items but in smaller quantities was higher than those who did not.

DISCUSSION

Broadly speaking, the aim of this paper was to compare the relation between household dietary diversity with household dynamics and reactions to food price rises in a range of

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Table 5. Variability of dietary diversity index (HDD score) is modelled against set of explaining variables through linier regression model

Variables	All sites	Cameroon	Ghana	Douala + Accra (Primary cities)	Buea + Kumasi (Secondary cities)	Bamenda + Techimann (Tertiary cities)
Weighted education index	0.212 (0.553)	0.686 (0.824)	0.264 (0.812)	0.331 (1.084)	−0.990 (0.846)	0.574 (1.011)
Total expenditure (US$)	5.66e − 05 (5.22e − 05)	5.72e − 05 (5.44e − 05)	0.000261 (0.000522)	0.000221 (0.000328)	3.09e − 05 (4.85e − 05)	0.000137 (0.000245)
Notice food price increase in last 12 months (1 = Yes, 0 = No)	−0.692*** (0.241)	−0.726** (0.354)	−0.565* (0.332)	−0.485 (0.434)	0.304 (0.513)	−1.371*** (0.367)
Purchase Reaction						
(1 = Continue buying same things and quantity 0 = Otherwise)	0.820** (0.332)	1.187** (0.538)	−1.244 (1.016)	0.596 (0.703)	−0.00144 (0.545)	1.758*** (0.540)
(1 = Buy same things but smaller amount 0 = Otherwise)	0.461 (0.311)	0.367 (0.412)	−1.214 (1.011)	−0.0745 (0.684)	−0.183 (0.497)	1.505*** (0.495)
(1 = Switch alternative products 0 = Otherwise)	0.534** (0.208)	0.459 (0.387)	0.194 (0.306)	0.440 (0.520)	−0.0453 (0.389)	1.354*** (0.337)
Wealth rank						
(1 = Medium income 0 = Otherwise)	1.268*** (0.218)	1.273*** (0.326)	1.311*** (0.318)	1.128*** (0.416)	1.142*** (0.380)	1.314*** (0.346)
(1 = High income 0 = Otherwise)	2.587*** (0.321)	2.640*** (0.458)	2.429*** (0.467)	1.993*** (0.557)	3.005*** (0.559)	1.974*** (0.651)
Family size	−0.103** (0.0477)	−0.117* (0.0667)	−0.0744 (0.0768)	−0.0738 (0.127)	−0.0986 (0.0732)	−0.0622 (0.0725)
Constant	6.481*** (0.509)	6.263*** (0.729)	8.297*** (1.089)	7.006*** (1.153)	7.166*** (0.890)	4.926*** (0.803)
Observations	576	276	300	196	190	190
R-squared	0.181	0.194	0.189	0.143	0.228	0.234

Standard errors in parentheses
***$p < 0.01$
**$p < 0.05$
*$p < 0.1$

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settings across Western Africa. By exploring how household dietary diversity varies across two countries and three different kinds of cities, as well as between households with different demographic characteristics, we conclude that there is a relatively homogenous and consistent picture emerging from our data. In particular, our data suggest that better off households that have higher levels of education and who live in primary cities eat both a more diverse diet and are less likely to have to change in their diet or reduce their consumption patterns in the face of a price rise. To situate this primary observation within the relevant food security literature, we would like to return to the initial three questions that inspired this paper in the first place:

(1) How do people react to food price changes in urban Cameroon and Ghana?
(2) What are the levels of household dietary diversity in these urban areas and are there similarities and differences within and between these two countries?
(3) What factors shape dietary diversity in different types of urban setting?

How do people react to food price changes in urban Cameroon and Ghana?
Our results suggest that when faced with food price rises, households reported adopting a number of different strategies. Overall, our results suggest that the majority of households adapt by purchasing smaller amounts of the same foodstuff while the second most common strategy is switching to alternative products. However, across our entire sample, approximately one third of people suggested that they continued buying the same amounts of food when faced with a price rise. This is more common in Ghana than it is in Cameron, and more common in Accra that has been well integrated into global economic trading systems and where participants had higher incomes than in smaller tertiary cities. Therefore, overall, it is possible to infer from this that better off families who live in cities more integrated into global economic systems may be better buffered against food price rises than less well-off families who live in more peripheral urban centres. This makes sense in so far as these relatively well-off households would have access to imported food from other markets and would have sufficient income to allow their demand for food to be relatively inelastic. Such observations are consistent with the literature (e.g. see: Anderson, 2010). Whereas much of this literature focuses on rural issues, results from this paper may be seen as preliminary evidence as to the potential food security benefits of being well integrated into global trade networks for urban residents (a review of these arguments see: Fraser *et al.,* 2016).

What are the levels of household dietary diversity in these urban areas and are there similarities and differences within and between these two countries?
The analysis presented here provides contributions to the literature cited in the introduction that draws a strong correlation between various measures of food security and dietary diversity. In particular, we note that there are no significant differences in dietary diversity between Cameroon and Ghana suggesting that country level analyses are not relevant for this type of inquiry. We do, however, find significant differences in dietary diversity between households that live in primary cities such as international ports or capitals where households enjoyed the highest levels of diversity in their diets. As we move along an urban continuum outwards to less well-integrated cities, we see dietary diversity declining. At the same time, it is worth noting that the dietary composition of HDDS in primary cities often tends to include non-staples and processed foods in the tertiary cities such as so-called 'junk foods' like sugary beverages. While more research is needed to confirm that

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this is an accurate snapshot of daily dietary patterns in these cities, this result does reinforce the fact that diets across the developing world are in transition and many people are eating higher calorie diets and that this is linked with rising public health problems such as obesity and type II diabetes. Thus, our data build the case that that many cities in the developing world face a 'double burden' of under-nutrition along with chronic health problems linked with diets high in simple sugars and fats (Delisle, Agueh, Sodjinou, & Ntandou-bouzitou, 2013; Steyn & Mchiza, 2014).

What factors shape dietary diversity in different types of urban settings?
Finally, and unsurprisingly, we identify richer households and households with higher levels of education as having greater diversity in their diets. We note that larger households tend to have lower diversity in their diets. The links between dietary diversity and food security have been observed in a number of diverse settings, including rural Asia (KC *et al.,* 2016a, 2016b, Legwegoh & Riley, 2014). Hence, this paper can be seen as adding weight to the growing body of work that demonstrates how households who enjoy diverse diets also enjoy greater food security. As noted earlier in the paper, there is well-established literature on the association between dietary diversity and household socio-demographic data which make dietary diversity a good proxy for food insecurity (Headey & Ecker, 2013). These findings are related to other studies, for example, Legwegoh and Riley (2014) in the comparative study between urban Gaborone and Blantyre illustrate how access to the informal food economy/markets in Blantyre yields positive outcomes in terms of household dietary scores. Further, as several studies have shown, income remains a recurrent determinant of dietary diversity as people diversify their diets to include more non-staples to their daily meals and to make it more palatable (see for example: Oldewage-Theron & Kruger, 2011; Legwegoh & Hovorka, 2013; Thorne-Lyman *et al.,* 2010). Finally, case studies by Jayawardena *et al.* (2013) in Sri Lanka and Savy, M., *et al.* (2005) in Burkina Faso have also illustrated that higher education level is associated with increased dietary scores.

Interestingly, our results do not suggest that households who live in areas less exposed to global commodity shocks and have better access to local food systems are any better off than households who live in primary cities where households are presumably more exposed to market shocks. Our data, therefore, provide a modest contribution to the food sovereignty and food resilience literature (see: Clancy & Ruhf, 2010; Slusser & Mazur, 2015; King, 2008) in that our paper has not revealed any evidence that cities with more direct access to the rural countryside derive any benefits in terms of dietary diversity as found (e.g. see, Satterthwaite & Cecilia Tacoli, 2003). According to our data, the primary driver of dietary diversity, and the associated food security implications of dietary diversity, remains related to household characteristics such as access to markets, income and education levels. While one would assume that smaller cities should have better HDDS through food remittances, we do not find this in our study. Overall, our data raise a number of important questions that warrant further investigation but also highlight the fact that integration into global economy could be compensating for lack of rural urban linkages or availability of land for urban/peri-urban agriculture.

CONCLUSION

In conclusion, the primary contribution of this paper is to provide evidence that suggests that richer and better educated households who live in areas well-integrated into global

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economic systems are less affected by price rises and enjoy higher levels of dietary diversity than their poorer counterparts who live in less well-integrated cities. However, these benefits are income dependent, and across our study, poorer, larger and less educated households who live in more remote areas are worse off in terms of dietary diversity and most likely to reduce purchasing during price hikes. This suggests that policies aimed at keeping food prices low and protecting marginal households may be more effective at maintaining food security during price hikes than policies geared at protecting or promoting regional–local food systems. Further, while acknowledging the differences found between Cameroon and Ghana, we found similarities between trends in the different types of cities as well as differences across the cities within each country. This highlights the importance of looking at site (city/region) specific determinants of food insecurity within each country rather than focusing on overall or aggregated national level data or policies.

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