



OPEN ACCESS

EDITED BY

Ole Mertz,
University of Copenhagen, Denmark

REVIEWED BY

Mohammad Shokati Amghani,
Tarbiat Modares University, Iran
Yuhao Qian,
Nanjing University of Finance and Economics,
China

*CORRESPONDENCE

Adama B. Coulibaly
✉ adama_cly@yahoo.fr

RECEIVED 17 February 2023

ACCEPTED 20 June 2023

PUBLISHED 06 July 2023

CITATION

Macalou M, Keita SI, Coulibaly AB and
Diamoutene AK (2023) Urbanization and food
security: evidence from Mali.
Front. Sustain. Food Syst. 7:1168181.
doi: 10.3389/fsufs.2023.1168181

COPYRIGHT

© 2023 Macalou, Keita, Coulibaly and
Diamoutene. This is an open-access article
distributed under the terms of the [Creative
Commons Attribution License \(CC BY\)](#). The
use, distribution or reproduction in other
forums is permitted, provided the original
author(s) and the copyright owner(s) are
credited and that the original publication in this
journal is cited, in accordance with accepted
academic practice. No use, distribution or
reproduction is permitted which does not
comply with these terms.

Urbanization and food security: evidence from Mali

Moussa Macalou^{1,2}, Sekou I Keita³, Adama B. Coulibaly^{1,4*} and
Abdoul Karim Diamoutene⁵

¹Value Chain Economy Programme, Institute of Rural Economy (ECOFIL/IER), Bamako, Mali, ²Faculty of Agronomy and Animal Medicine, University of Segou, Bamako, Mali, ³Faculty of Economics and Management, University of Julius N'Yerere of Kankan, Konakry, Guinea, ⁴International Crops Research Institute for the Semi-Arid Tropics, Bamako, Mali, ⁵Faculty of Economics and Management (FSEG), University of Social Sciences and Management of Bamako (USSGB), Bamako, Mali

Income poverty remains the main root of urban food insecurity as purchased food represents a major component of the spending of urban residents. The rapid and increasing urbanization and urban sprawl are major concerns for food security in Mali. In Mali, 3.6% of households, are severely food insecure and the food insecurity prevalence rate for urban households is 7.5%. The effect of urbanization on households' food security was assessed in the literature using only a single measure of food security. In this regard, this study analyzed the effect of urbanization on both objective and subjective measures of food security in Mali, using data from the national survey on food security and nutrition (ENSAN). The data collection was conducted by the Early Warning System against Famine (SAP) on 9,782 households in February 2018. For the objective measure of food security, the study used an OLS model to estimate the effect of urbanization on household food expenditure per capita. Using the household hunger scale (HHS) score, the study estimated two models (logit and ordered probit) to capture the effect of urbanization on subjective measures of food security. The results of the OLS and logit models showed that households living in urban areas are less food secure compared to their counterparts living in rural areas. The results from the ordered probit also confirmed that urban households are more food insecure (mildly and moderately) compared to their counterparts living in rural areas. Based on these results, the study recommends to decision-makers to take into account urban poor households when setting up food safety net programmes.

KEYWORDS

urbanization, food security, objective measure, subjective measure, Mali

1. Introduction

Income poverty remains the main root of urban food insecurity as 90% of the urban residents' food intake depends on market food, which represents about 70% of their expenses (Frayne et al., 2010) and the livelihood of urban residents is negatively affected by any reduction in their incomes which are already small (Engdaw and Kebede, 2019). The income-generating capacity of city dwellers is largely affected by urbanization as the urban population grows faster than employment opportunities, resulting in a lack of affordable housing in urban areas (Engdaw and Kebede, 2019). As a result, food security and the poverty status of city dwellers are further affected. There is a strong link between poverty and food insecurity. Increasingly, food insecurity as a consequence of poverty is becoming an urban problem (Tacoli, 2013). The main cause of urban dwellers' food

insecurity is low and irregular income which affects their access to and affordability of food (Engdaw and Kebede, 2019).

Urban areas are now more affected by food insecurity phenomena. The observation is that the advocacy mostly from the development agencies on food security policies is more focused on rural areas (Tuholske et al., 2020). For example, in the State of Food and Agriculture Report, FAO (2017) focused on the inclusion of rural people and the different channels through which their food security can be improved. As a result, existing tools cannot properly measure urban food security, further exposing the growing number of urban poor (Tuholske et al., 2020). The necessity of new approaches accounting for urban food security at the household level is obvious (Haysom and Tawodzera, 2018). A major channel for achieving urban food security is local price stability (Tuholske et al., 2020). Rural producers can delight in the price increases (improved food security) resulting from commodity price shocks as these shocks and external market forces further expose the urban poor through food prices (Tuholske et al., 2020). A typical example is the 2007/2008 global food price shock which worsened the food security condition of urban households and improved the food security of rural households across Sub-Saharan Africa (SSA) countries (Verpoorten et al., 2013).

Migration from rural to urban areas contributes to reducing rural labour force and skills which has a direct negative effect on food production (Mutisya et al., 2016). The phenomenon in SSA is the urbanisation of poverty while in developed countries, the urbanisation is associated with industrialization and economic growth (Obeng-Odoom, 2010). Food availability can be affected by urbanization mainly through changing consumption patterns and food production and supply chains (Szabo, 2016). Migration from rural to urban areas which constitutes the main contributor to urbanization is generally associated with dietary changes (Szabo, 2016). With the expansion of urban areas, food supplies are affected by the use of agricultural land in the urban peripheries for non-agricultural purposes and the diversion of water from agriculture to domestic and industrial uses due to its shortage (Szabo, 2016).

Urban residents are exposed to health risks due to the consumption of insufficient and poor-quality food such as street food which may lack hygiene (Matuschke, 2009). The consumption of street food is likely associated with food poisoning due to the lack of regulations and controls in the street food business. Therefore, urban dwellers who rely on street food are exposed (Matuschke and Kohler, 2014). Processed foods are the most consumed food by urban residents due to their affordability and accessibility. Increasingly, developing countries are experiencing lots of chronic diseases and obesity (Malik et al., 2013) which are related to the chemicals in processed food (Szabo, 2016). For developing countries, the challenges related to food shortages in urban areas include disastrous events such as war or unforeseen occurrences (Szabo, 2016).

Most emerging and developing countries lack the resources to develop infrastructure and keep pace with the rapid population growth in urban areas (UN-Habitat, 2014). Unplanned settlements could lead to an increase in the number of urban slum dwellers and make it difficult to achieve food security (Matuschke and Kohler, 2014). If urbanization leads to the development of adequate infrastructure in developing countries, the physical access of city

dwellers to food could be improved. The dependence of urban and peri-urban residents on markets to access food is compromised by their limited purchasing power and increases their vulnerability to possible price spikes (Szabo, 2016).

The population of Sub-Saharan Africa is expected to increase from 376 million in 2015 to over 1.25 billion in 2050 (UN-DESA, 2018). The current urbanization growth rate is 41% and might be beyond 48% by 2030. In Mali, 3.6% of households are severely food insecure and the prevalence rate of food insecurity for urban households is 7.5% (SAP, 2017). The increasing rapid urbanization and urban sprawl are concerns for food security in Mali.

The combination of objective and subjective measures of food security provides a more complete detailed picture and recommendations which could be more policy relevant. The studies on urban food security include (Mutisya et al., 2016; Szabo, 2016; Engdaw and Kebede, 2019; Blekking et al., 2020; Kharisma and Abe, 2020; Tuholske et al., 2020, etc.). And to the best of our knowledge, none of them has combined the objective and the subjective measures of food security. Therefore, this study seeks to fill this void in the literature. Specifically, this study investigates the link between urbanization and subjective and objective measures of food security in Mali. To this end, the present paper addressed the following research question: does the effect of urbanization on food security differ from the objective to subjective measurement of food security?

The rest of the paper is organized as follows. The next section presents the methodology, while section three is focused on results and discussion. The last section concludes and makes some policy recommendations.

2. Methodology

2.1. Conceptual framework

2.1.1. Definition of food security

Food security can be simply defined as a situation where an individual is able to get enough food for his daily need. During the World Food Summit in 1996, food security exists when all individuals have physical, social, and economic access to enough, healthy and nutritious food to satisfy their nutritional requirements for a productive life (Shaw, 2007). This definition emphasizes the availability, accessibility, utilization, and stability dimensions of food security.

2.1.2. Measurement of urban households' food security

Food security at the household level is broadly measured by two methods namely the unidimensional measure and the multidimensional measure of food security (Carlson et al., 1999). Concerning the unidimensional measure of food security, the most common approaches used to evaluate household access to food in developing countries include the coping strategies index, food consumption score, household dietary diversity score (HDDS), and household economy, while the food balance sheets and survey questions on natural, physical, and human resources are used to evaluate household food availability (Bertelli and Macours, 2014). Anthropometric indicators are used to evaluate household food utilization/consumption (Deitchler et al., 2011).

On the other hand, the methods used to deal with the multidimensional measure of food security include the index approach, household food security survey module (HFSSM), Latin American and Caribbean food security scale (ELACSA), household food insecurity access scale (HFIAS), and Household hunger scale (HHS).

2.1.3. Definition of urbanization

Referring to the demographic definition precisely, for a nation, urbanization is the increasing share of the urban population (Satterthwaite et al., 2010). The process of urbanization is the permanent concentration of large numbers of the population in relatively small areas forming cities (Engdaw and Kebede, 2019). Urbanization can be achieved either through natural population growth, or rural to urban migration, or reclassification of formerly rural areas to urban areas, or the combination of these three ways (Engdaw and Kebede, 2019).

2.1.4. Factors influencing household food security

The current debate on food security shows that urbanization directly influences household food security (Szabo, 2016; Engdaw and Kebede, 2019). In addition, the conceptual framework considers other socioeconomic and demographic factors that have been well documented in the literature to affect household food security. These factors include Gender, age, education, and marital status of the household head, own production, access to credit, dependency ratio, total income, portion of stored production, portion of purchased stock, portion of stock burrowed, and food aid (Nkegbe et al., 2017; Manda et al., 2018; Blekking et al., 2020 among others).

2.2. Method of data analysis

All the aspects of food security can be understood and conceptualized through the combination of various measures of food security (Vaitla et al., 2017). For this reason, the study uses both the objective and subjective measures of food security. The per capita household food expenditure represents the objective measure while the subjective measure of food security includes a food security (FS) variable (which takes value 1 if the household is food secure and 0 otherwise) and a food security severity (FSS) variable (taking value 0, 1, 2, and 3 if the household is food secure, mildly food insecure, moderately food insecure, and severely food insecure, respectively). The per capita food expenditure is defined as the sum of the household's total food purchased, the household's food produced and consumed, and food aid or in kind received by the household. Using the household hunger scale (HHS) score, the study generated both the food security and the food security severity (FSS) variables.

The study uses three models to estimate the effect of urbanization on food security in Mali. The first model establishes the link between urbanization and the objective measure of food security while the second and the third models establish the link between urbanization and the subjective measure of food security. For the first model, the study uses an Ordinary Least Square (OLS) to estimate the effect of urbanization on food security. Regarding, the second and third models, the study uses a logit and an ordered probit, respectively to

estimate the effect of urbanization on food security. The OLS model is specified as follows:

$$Y_i = \alpha + Urban_i \delta + X_i \beta + \varepsilon_i \quad (1)$$

Y is the dependent variable representing per capita food expenditure for household i , $Urban$ is the main independent variable of interest which is a dummy variable taking value 1 if the household is located in the urban area and 0 otherwise; X represents other socioeconomic and demographic characteristics of the household, α , δ , the β s represent the unknown parameters to be estimated, ε is the error term.

Following Kharisma and Abe (2020), the study uses the logit model which is specified as follows:

$$Y_i = \begin{cases} 1 & \text{if the household is food secure} \\ 0 & \text{otherwise} \end{cases}$$

Let's denote P_i the probability of a household being food secure and $1 - P_i$ the probability of a household being food insecure. The model establishing the relationship between food security and urbanization and the vector of other independent variables being hypothesized is given by the log odds of the probability of a household being food secure as follows:

$$\log\left(\frac{P_i}{1 - P_i}\right) = \tau + Urban_i \omega + X_i \rho + \vartheta_i \quad (2)$$

where $Urban$ is the main independent variable of interest which is a dummy variable taking value 1 if the household is located in the urban area and 0 otherwise; X represents other socioeconomic and demographic characteristics of the household; τ , ω , the ρ s represent the unknown parameters to be estimated; ϑ is the error term.

Following Mutisya et al. (2016), the study uses the ordered probit model which is specified as follows:

$$Y_i^* = \lambda + Urban_i \theta + X_i \varphi + \mu_i \quad (3)$$

$$FSS_i = J \text{ if } K_{J-1} < Y_i^* < K_J$$

Y^* is a latent variable which is unobserved food security status for household i ; K is the threshold parameter; $Urban$ is the main independent variable of interest which is a dummy variable taking value 1 if the household is located in the urban area and 0 otherwise; X represents other socioeconomic and demographic characteristics of the household; λ , θ , the φ s represent the unknown parameters to be estimated; μ is the error term.

2.3. Data used in the analysis

The study used secondary data to analyze the effect of urbanization on household food security in Mali. The data were collected by the

“Système d’Alerte Précoce (SAP)” or Famine Early Warning System in English in Mali in the framework of the “Enquête Nationale sur la Sécurité Alimentaire et Nutritionnelle (ENSAN)” or National survey on food security and nutrition in English on 9,782 households in February 2018 in Mali.

3. Results and discussion

Table 1 below shows that both the objective and the subjective measures of household food security were significantly influenced by urbanization in Mali. The OLS model capturing the effect of urbanization on the objective measure of household food security (column 2 of Table 1) indicated that urbanization significantly decreases household food security. Then, the subjective measure was captured by two sub-models namely the logit and ordered probit models. The results from the logit model (column 3 of Table 1) also indicated that urbanization has a significant negative influence on household food security. The ordered probit model (columns 4, 5, and 6 of Table 1) also revealed that urban households are mildly and moderately food insecure compared to their counterparts from rural areas. Engdaw and Kebede (2019) and Szabo (2016) also found that rural households are better off in terms of food security compared to urban households.

The result from the OLS and Logit models indicated that household head education increases food security. In the same vein,

the ordered probit model showed that educated household heads are less moderately and severely food insecurity compared to their counterparts who are not educated. This might be explained by the fact that education is positively correlated with income and the higher the income the higher the household food purchasing power. This result corroborates with the findings of previous studies (Mutisya et al., 2016; Blekking et al., 2020, and Tuholske et al., 2020) which also found that education positively affects households’ food security.

In addition, the results from OLS and Logit models revealed that access to credit decreases food security in Mali. The results from the ordered probit model also households having access to credit are mildly, moderately, and severely food insecure compared to their counterparts who do not have access to credit. This surprising result from access to credit use may be due to the use of credit for other none food expenditures and non-productive sectors. In other words, food purchasing may be highly competitive with other none food items in the household consumption path. In Zambia, Manda et al. (2018) also found that access to credit is negatively associated with food security.

The results from OLS and Logit models showed that the total income of households significantly increases household food security. The ordered probit model also confirmed that households with high income are mildly, moderately, and severely food insecure compared to their counterpart who have less income. In Zambia, Manda et al. (2018) also found that off-farm income influence positively food

Table 1 Estimation results.

Variables	Food expenditure per capita	Subjective measure of food security (binary variable)	Subjective measure of food security (categorical variable)		
			Mildly food insecure	Moderately food insecure	Severely food insecure
Urban	-563.9*** (180.8)	-0.656*** (0.119)	0.467*** (0.150)	0.908*** (0.181)	0.681 (0.442)
Household head gender	-1,048*** (348.4)	0.499*** (0.168)	-0.482** (0.218)	-0.631*** (0.226)	0.276 (0.632)
Household head age	-31.22*** (4.024)	0.0092*** (0.00324)	-0.0055 (0.00415)	-0.014*** (0.005)	-0.0128 (0.0119)
Household head education	513.4*** (57.87)	0.103** (0.0424)	-0.0623 (0.0534)	-0.135** (0.0641)	-0.330* (0.193)
Polygamous household head	-1,583*** (143.1)	0.305*** (0.0981)	-0.186 (0.124)	-0.537*** (0.152)	0.0757 (0.367)
Separated household head	2,069*** (760.1)	0.404 (0.331)	-0.863* (0.514)	-0.0674 (0.390)	-12.75 (568.9)
Widow household head	-472.8 (393.4)	0.0416 (0.195)	-0.0759 (0.254)	-0.195 (0.271)	1.002 (0.641)
Singe household head	4,727*** (1,040)	1.645** (0.822)	-1.491 (1.075)	-1.695 (1.107)	-12.69 (878.8)
Household head in union	3,264 (4,498)		-18.32 (20,424)	-18.15 (18,969)	-17.13 (36,820)
Agricultural practices	-572.2*** (177.2)	-0.0290 (0.116)	0.171 (0.144)	-0.0866 (0.177)	-0.876 (0.609)
Access to credit	-244.8* (144.6)	-1.936*** (0.0861)	1.817*** (0.112)	2.356*** (0.143)	0.606** (0.295)
Dependency ratio	2,483** (1,120)	-2.245*** (0.447)	2.320*** (0.536)	2.240*** (0.588)	1.320 (1.415)
Total revenue	0.00307*** (0.000336)	6.81e-06*** (8.36e-07)	-6.42e-06*** (1.06e-06)	-6.04e-06*** (1.25e-06)	-2.02e-05*** (4.78e-06)
Production stock	-23.05*** (2.373)	0.0158*** (0.00122)	-0.0139*** (0.00158)	-0.0172*** (0.00170)	-0.0234*** (0.00454)
Purchase food stock	15.11*** (2.312)	0.0086*** (0.00118)	-0.006*** (0.002)	-0.011*** (0.002)	-0.006* (0.004)
Borrowed food stocks	11.53** (4.971)	0.00122 (0.00223)	-0.0039 (0.00318)	0.00141 (0.0027)	-0.0166 (0.0142)
Food aid	25.89*** (6.675)	-0.000725 (0.00286)	-0.0016 (0.0039)	-0.00078 (0.0039)	0.0113** (0.006)
Constant	10,991*** (441.3)	1.262*** (0.256)	-2.093*** (0.331)	-2.151*** (0.368)	-2.916*** (0.968)
Observations	9,782	9,780	9,782	9,782	9,782
R-squared	0.165				

Standard errors in parentheses***p < 0.01, **p < 0.05, *p < 0.1.

security in Zambia. Tuholske et al. (2020) found that a proxy variable to income which is total food expense influenced positively food security for urban dwellers in Ghana.

4. Conclusion and recommendations

The study analyzed the effect of urbanization on food insecurity in Mali, using data from the national survey on food security and nutrition (ENSAN) conducted by the Famine Early Warning System against Famine (SAP) on 9,782 households in February 2018. This paper used an OLS model (for the objective measure of food security) and logit and ordered probit (for the subjective measure of food security) to capture the effect of urbanization on household food security. Food expenditure per capita was used as the objective measure of food security while the household hunger scale (HHS) score was used to generate a binary variable and an ordered categorical variable as the subjective measure of household food security. The findings showed that urbanization decreases household food security in Mali regardless of the measure of food security. Moreover, variables such as household total revenue, share of cash and borrowed food stocks, and food aid are contributing factors to increasing food security. Based on these results, the study recommends to policymakers to take into account urban poor households when setting up food safety net programmes in Mali.

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

References

- Bertelli, O., and Macours, K. (2014). *Food security and agriculture in developing countries: measurement and hypotheses for impact evaluations*. Research in Agricultural and Applied Economics (No. 2201-2019-1450).
- Bleking, J., Waldman, K., Tuholske, C., and Evans, T. (2020). Formal/informal employment and urban food security in Sub-Saharan Africa. *Appl. Geogr.* 114:102131. doi: 10.1016/j.apgeog.2019.102131
- Carlson, S. J., Andrews, M. S., and Bickel, G. W. (1999). Measuring food insecurity and hunger in the United States: development of a national benchmark measure and prevalence estimates. *J. Nutr.* 129, 510S–516S. doi: 10.1093/jn/129.2.510S
- Deitchler, M., Ballard, T., Swindale, A., and Coates, J. (2011). *Introducing a simple measure of household hunger for cross-cultural use*. Washington, DC: Food and Nutrition Technical Assistance II project, AED.
- Engdaw, B., and Kebede, M. (2019). The impact of urbanization on food (in) security in Amhara regional state metropolitan cities: monitoring income generating capacity limitation as a mediating variable. *Int. J. Adv. Sci. Res. Manag.* 4:157. doi: 10.36282/IJASRM/4.8.2019.1577
- FAO. (2017). *2017 the state of food and agriculture: leveraging food systems for inclusive rural transformation*. FAO: Rome.
- Frayne, B., Pendleton, W., Crush, J., Acquah, B., Battersby-Lennard, J., Bras, E., et al., (2010). *The state of urban food insecurity in southern Africa. Urban food security series no. 2*. Queen's University and AFSUN: Kingston and Cape Town.
- Haysom, G., and Tawodzera, G. (2018). "Measurement drives diagnosis and response": gaps in transferring food security assessment to the urban scale. *Food Policy* 74, 117–125. doi: 10.1016/j.foodpol.2017.12.001
- Kharisma, V., and Abe, N. (2020). Food insecurity and associated socioeconomic factors: application of Rasch and Binary Logistic Models with household survey data in three megacities in Indonesia. *Soc. Indic. Res.* 148, 655–679. doi: 10.1007/s11205-019-02210-z
- Malik, V. S., Willett, W. C., and Hu, F. B. (2013). Global obesity: trends, risk factors and policy implications. *Nat. Rev. Endocrinol.* 9, 13–27. doi: 10.1038/nrendo.2012.199
- Manda, J., Gardebroeck, C., Kuntashula, E., and Alene, A. D. (2018). Impact of improved maize varieties on food security in Eastern Zambia: a doubly robust analysis. *Rev. Dev. Econ.* 22, 1709–1728. doi: 10.1111/rode.12516
- Matuschke, I. (2009). *Rapid urbanization and food security: using food density maps to identify future food security hotspots*. Research in Agricultural and Applied Economics (No. 1005-2016-79128).
- Matuschke, I., and Kohler, S. (2014). *2.4 Urbanization and food security in book: World Risk Report 2014 Chapter: 2.4 Publisher: Bündnis Entwicklung Hilft [Alliance Development Works] and United Nations University – Institute for Environment and Human Security (UNU-EHS)*.
- Mutisya, M., Ngware, M. W., Kabiru, C. W., and Kandala, N. B. (2016). The effect of education on household food security in two informal urban settlements in Kenya: a longitudinal analysis. *Food Secur.* 8, 743–756. doi: 10.1007/s12571-016-0589-3
- Nkegbe, P. K., Abu, B. M., and Issahaku, H. (2017). Food security in the Savannah Accelerated Development Authority Zone of Ghana: an ordered probit with household hunger scale approach. *Agric. Food Secur.* 6:35. doi: 10.1186/s40066-017-0111-y
- Obeng-Odoom, F. (2010). 'Abnormal' Urbanization in Africa: a dissenting view. *Afr. Geogr. Rev.* 29.
- Satterthwaite, D., McGranahan, G., and Tacoli, C. (2010). Urbanization and its implications for food and farming. *Philos. Trans. R. Soc. B* 365, 2809–2820. doi: 10.1098/rstb.2010.0136
- Shaw, D. J. (2007). "World Food Summit, 1996," in *World Food Security* (London: Palgrave Macmillan), 347–360. doi: 10.1057/9780230589780_35
- Système d'Alerte Précoce (SAP), septembre (2017). « *Enquête nationale sur la sécurité alimentaire et nutritionnelle, (ensan mali) – version provisoire* »
- Szabo, S. (2016). Urbanisation and food insecurity risks: assessing the role of human development. *Oxf. Dev. Stud.* 44, 28–48. doi: 10.1080/13600818.2015.1067292

Author contributions

All authors listed have made a substantial, direct, and intellectual contribution to the work and approved it for publication.

Acknowledgments

The authors are grateful to Soumaïla DIARRA, head of the data collection unit at the Early Warning System against Famine (SAP) for providing the data. We also thank all the staff from SAP, Enumerators, and Household heads involved for their endeavours throughout the data collection processes.

Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Publisher's note

All claims expressed in this article are solely those of the authors and do not necessarily represent those of their affiliated organizations, or those of the publisher, the editors and the reviewers. Any product that may be evaluated in this article, or claim that may be made by its manufacturer, is not guaranteed or endorsed by the publisher.

Tacoli, C. (2013). Urban poverty, food security and climate change. IIED Briefing Paper-International Institute for Environment and Development, (17149).

Tuholske, C., Andam, K., Blekking, J., Evans, T., and Caylor, K. (2020). Comparing measures of urban food security in Accra. *Ghana. Food Security* 12, 417–431. doi: 10.1007/s12571-020-01011-4

United Nations Department of Economics and Social Affairs (2018). *Revision of World Urbanization Prospects report*.

UN-Habitat (2014). *State of African cities 2014*. UN-Habitat, Nairobi

Vaitla, B., Coates, J., Glaeser, L., Hillbruner, C., Biswal, P., and Maxwell, D. (2017). The measurement of household food security: correlation and latent variable analysis of alternative indicators in a large multi-country dataset. *Food Policy* 68, 193–205. doi: 10.1016/j.foodpol.2017.02.006

Verpoorten, M., Arora, A., Stoop, N., and Swinnen, J. (2013). Self-reported food insecurity in Africa during the food price crisis. *Food Policy* 39, 51–63. doi: 10.1016/j.foodpol.2012.12.006