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Systematic Review

Prevalence of household food security in Kenya: a systematic review and meta-analysis

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ABSTRACT

Food is both a basic need and a human right. As such, food security is a critical factor in individual and social health. This study aimed at assessing the pooled prevalence of household food security in Kenya. Relevant studies were systematically searched through manual and electronic searches. We searched databases including; Scopus, Embase, Science Direct, Web of Science, PubMed, Google Scholar and Cochrane Library. The Preferred reporting items for systematic reviews and meta-analyses protocol (PRISMA-P) guideline was followed. Heterogeneity of the primary studies was examined using the Cochrane Q test statistics and I^2 test. A random-effect model was used to estimate the pooled prevalence of household food security. The prevalence was determined at a 95% confidence interval with its corresponding odds at a p value of less than 0.05. A total of 15 studies were included. The pooled prevalence of household food security was 22.33% (95% CI: 16.60%-28.06%). Households in an urban setting had a lower (19.28%) food security (95% CI: 12.55%-26.01%) as compared to those in rural settings (25.27%) (95% CI: 16.60%-28.06%). Additionally, those studies conducted post the Sustainable development goals (SDGs) had a higher (24.20%) household food security prevalence (95% CI: 11.49%-36.91%) as compared to those conducted before (21.16%) (95% CI: 14.11%-28.21%). Household food security remains a major concern in the country, particularly in the urban setting. Policymakers and the Government (national and county levels) at large should upscale and accelerate efforts to improve the household food security situation.

Keywords: Food Security, Household, Kenya, Meta-analysis, Prevalence, Systematic review

INTRODUCTION

Adequate quantity and quality food is required for optimal health, growth and development of human beings. Therefore, food security is essential to every individual at all times.[1,2] Due to its importance in human survival and development, the issue of food security has continued to be an important agenda globally.[2,3] According to Food and Agriculture Organization (FAO), food security occurs when people at all times have physical, social and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for a healthy and active life.[4] The four critical dimensions of food security are food availability, access to food, utilization and stability.[3,5]

Food security is a fundamental aspect of human societies and is considered one of the critical factors of individual

and social health. Food insecurity which occurs when there is uncertain or limited access to nutritionally adequate food for an active and healthy life remains a major challenge for many nations particularly in developing countries.[2,5] Of note, food insecurity is associated with a low-quality diet and inadequate nutrient intake which compromises the health and well-being of an individual.[6-8] Despite remarkable progress in economic growth and development in developing countries over the last decades, food security remains a major concern in the countries. Kenya and other Sub-Saharan Africa countries are intensely affected.[2,9,10] Due to the problem, malnutrition remains high in the continent which further impedes its development.[11]

Food is both a basic need and a human right. As such, the constitution of Kenya promulgated in 2010, identifies food security as a right for every citizen of the Republic of Kenya. Article 43 (1c) states that every person has the right to be free from hunger and to have adequate food of acceptable quality.[12] Based on that premise, the government of Kenya has initiated various projects geared toward the enhancement of food security among its citizens. Despite the initiatives' food insecurity remains ubiquitous.

Due to the detrimental effect of food insecurity, research that determines the prevalence of food security/insecurity is critical in the development of more targeted intervention programs. The research should focus on the prevalence, risk factors and the identification of the vulnerable groups in society.[13] Over time, the country has largely relied on national surveys in its planning and decision making. For the highest impact and to ensure food security at all levels, it's important that the government considers the sub-national studies during the planning and the enactment of national policies. In that regard, this paper seeks to pool the prevalence of food security by considering all studies reporting on the prevalence of food security in Kenya. Additionally, these sub-national studies could provide useful information regarding food security status at an individual, household and community level.[14] Moreover, the pursuit of the sustainable development goals to achieve zero hunger, good health and well-being requires continued monitoring of food security status and its related factors.

Furthermore, food security has many dimensions at global, regional, national, local, household and individual level with varying determinants at the different levels. Considering the complexity of food security, its assessment and finding comparable indicators applicable to various contexts remain challenging.[9,15-17] For example, some studies have relied on individual's 24-hour recall of food consumption, the Household Hunger Scale (HHS), the Household Food Security Scale Module (HFSSM), the Household Food Insecurity Access Scale (HFIAS), and the Household Consumption and Expenditure Surveys (HCES) among other methods in the assessment of food security [18-20]. Therefore, for greater accuracy and reliability, it is vital to combine food security indicators that measure the different dimensions.[21]

The main objective of this paper is to estimate the overall prevalence of food security in Kenya through a systematic review and meta-analysis of all available studies in the country published and unpublished until December 2020. The paper further aims at determining the prevalence of food security in the country based on the different methods of food security assessment and based on the different groups of the population.

METHODS

This systematic review and meta-analysis were undertaken to estimate the pooled prevalence of household food security in Kenya. A thorough search for any existing review or meta-analysis on the topic of interest was conducted to avoid duplication.

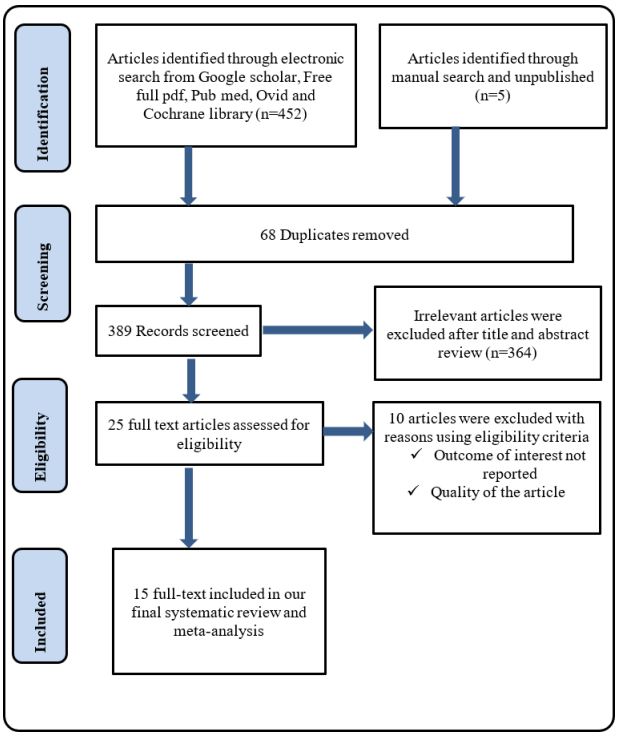

Figure 1: PRISMA flow diagram of the studies included in the household food security in Kenya.

The result of the search confirmed that there was no review or meta-analysis conducted in relation to the topic of interest. The studies were retrieved through manual and electronic searches. International databases such as Google Scholar, Scopus, Embase, Science Direct, Web of Science, free full pdf, PubMed, Ovid, Cochrane Library and Kenya databases were systematically searched. The keywords used during the search were "Prevalence", "Households", "Food Security" and "Kenya". The search was done in combination and separately using "AND" or "OR" and included all articles published until December 31, 2020. The search was conducted from the beginning

of August 2020 until the end of December 2020. The Preferred protocol (PRISMA) guideline for reporting items for systematic and meta-analysis was followed in our review.[22]

Eligibility criteria

Inclusion criteria

Included both published and unpublished observational studies (cross-sectional, case-control, and cohort) on household food security conducted only in Kenya.

Exclusion criteria

Studies that were not done in Kenya, used other languages apart from English and papers that were not fully accessible. Studies that were not fully accessed were excluded because the quality of the articles in the absence of the full text could not be determined. Studies that did not report on the specific outcome for household food security and according to the settled criteria and poor quality articles were also excluded from the study review.

Publication condition

Articles included in peer-reviewed journals.

Study design

We included observational study designs (i.e., cross-sectional, case-control, and cohort). Both published and unpublished papers were considered.

Language

All articles that were published in English.

Publication and publication year

We included all articles published until December 2020.

Outcome measurement

The main outcome of this study was the prevalence of food security among households.

Data abstraction

Three independent authors searched the reports, studies and articles. Moreover, all relevant data was extracted using the standard data extraction method using Microsoft Excel. Data extraction characteristics included: the names of authors, year of study, year of publication, the location where the study was conducted, the prevalence of household food security, sampling technique and sample size. Finally, the three authors checked the data extraction process.

Quality assessment

The review adopted Newcastle-Ottawa scale as a quality assessment tool for each of the studies.[23] The tool used has three distinct sections. The first section is focused primarily on the quality of the methodology employed and rated from five stars. The second section is dedicated to how the studies can be compared with other studies and the last section encompasses the statistical analysis and the outcome of each original study. Each paper was thoroughly evaluated by three independent authors. A discussion was used to tackle any disagreement between the reviewers. Finally, the database search results were compiled.

Statistical analysis and synthesis

The extracted data was compiled using Microsoft excel and later imported to STATA version 14 for further analysis. Publication bias was checked using both Begg's and egger's tests with a p-value of less than 0.05 cut-off point for publication bias.[24,25] The results of the test did not show any publication bias (p=0.82). Additionally, the heterogeneity test was done using the Cochran Q and inverse variance (I^2) test. A forest plot was used to present the point prevalence of the primary studies with their 95% C. Moreover, a p-value of less than 0.05 was used to establish the presence of heterogeneity across the studies. Meta-regression and subgroup analysis was used to establish any potential differences between studies.

RESULTS

During our first search, 457 articles were retrieved through electronic (free full pdf, Google Scholar, Cochrane Library, Ovid and Pub Med) and supplementary searches. Of the 457 articles, 68 articles were excluded due to du

plication. From the remaining 389 articles, 364 were excluded after the abstract and title review since they were found to be irrelevant. The other 25 articles were assessed for eligibility using the inclusion criteria and 10 studies were excluded due to eligibility reasons. Finally, 15 studies were included in the final systematic review and meta-analysis.

Characteristics of the original studies

In the current systematic review and meta-analysis, a total of 15 original studies were included. With respect to the research design employed by the studies, 86.7% of the studies adopted a cross-sectional research design. One article adopted a longitudinal observational research design while another one adopted a randomized controlled trial. Additionally, the highest proportion (33.3%) of the studies used the multistage sampling technique which was followed by simple random sampling technique (20%). The sample size of the included studies ranged from 150 to 6858 and with a mean of 1070.5. Notably, all the studies were conducted between 2006 and 2019.

Table 1: Characteristics of the studies included in the systematic review and meta-analysis to estimate the pooled prevalence of food security among households in Kenya.

Authors	Setting	Study year	Publication year	Study design	Sample size	Prevalence (95% CI)
Kamal et al[26]	Urban	2013	2016	Cross-sectional	267	4.8 (2.24-7.36)
Bukania et al[27]	Rural	2012	2014	Cross-sectional	277	6.50 (3.60-9.40)
Waswa et al[28]	Rural	2012	2014	Cross-sectional	293	62.10 (56.55-67.65)
Macharia et al[29]	Rural	n/i*	2018	RCT	1110	19.50 (17.17-21.83)
Mtisya et al[30]	Urban	2006-2012	2015	Longitudinal	6858	28.14 (27.08-29.20)
Wangui et al[31]	Urban	n/i*	2019	Cross-sectional	150	14.70 (9.03-20.37)
Chege et al[32]	Urban	n/i*	2016	Cross-sectional	286	23.70 (18.77-28.63)
Shinsugi et al[33]	Rural	2012	2015	Cross-sectional	404	17.90 (14.16-21.64)
Murage et al[34]	Urban	2011-2012	2014	Cross-sectional	3210	14.90 (13.67-16.13)
Mumanyi et al[35]	Rural	2017	2019	Cross-sectional	216	2.80 (0.60-5.00)
Silvestri et al[36]	Rural	2012	2015	Cross-sectional	600	15.00 (12.14-17.86)
Owuor [37]	Urban	2015	2018	Cross-sectional	1434	29.00 (26.65-31.35)
Mutea et al[9]	Rural	2017	2019	Cross-sectional	577	32.00 (28.19-35.81)
Mwangi et al[38]	Rural	2016-2017	2020	Cross-sectional	175	39.00 (31.77-46.23)
Gwanda et al[39]	Rural	2019	2020	Cross-sectional	201	28.36 (22.13-34.59)

*not indicated.

Table 2: Descriptive summary of the 15 studies used to estimate the pooled prevalence of household food security in Kenya.

Variables	n	%
Research design		
Cross-sectional	13	86.7
Longitudinal	1	6.7
Randomized controlled trial	1	6.7
Sampling technique		
Multi-stage	5	33.3
Stratified sampling	2	13.3
Simple random sampling	3	20.0
Cluster sampling	2	13.3
Snowballing	1	6.7
Not indicated	2	13.3
Sample size		
≤385	8	53.3
>385	7	46.7
Household food security indicator		
HFIAS	11	73.3
DDS	2	13.3
Food security index	2	13.3
Year of study		
Before SDGs	9	60.0
After SDGs	6	40.0
Study settings		
Urban	7	46.7
Rural	8	53.3

In the present review, slightly above half (53.3%) of the studies were conducted in an urban setting while the rest (46.7%) were conducted in a rural setting. The majority (73.3%) of the studies used the Household Food Insecurity Scale to measure the household food security. In regards to the studies year of study, the majority (60.0%) of the studies were conducted after the sustainable development goals were formulated. The majority (73.3%) of the studies used the Household Food Insecurity Scale to measure the household food security. In regards to the studies year of study, the majority (60.0%) of the studies were conducted after the sustainable development goals were formulated.

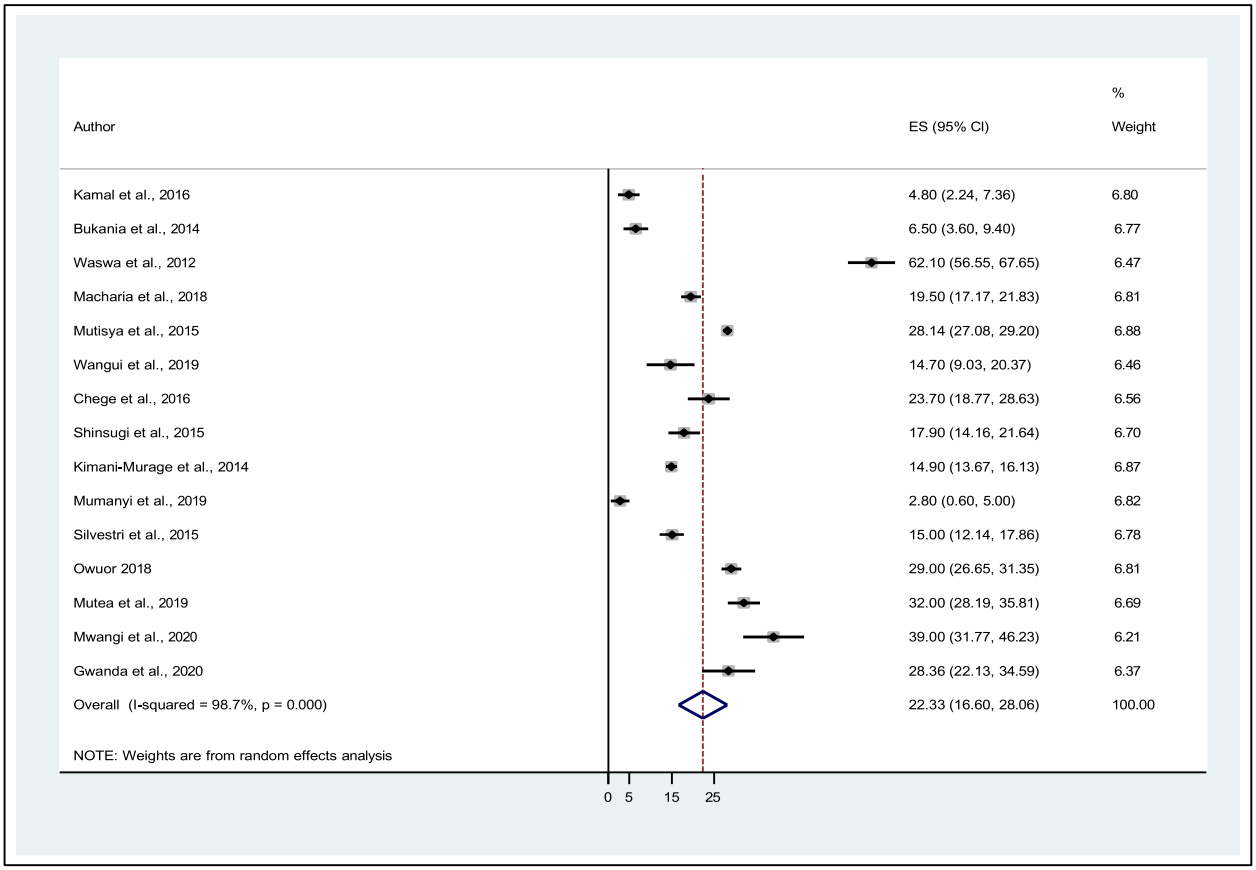

Figure 2: Forest plot of the pooled prevalence of household food security in Kenya from 2006-2020.

Meta-analysis

The results of the 15 studies revealed a pooled prevalence of household food security to be 22.33% (95% CI: 16.60%- 28.06%). The results of the pooled prevalence are shown by the forest plot in Figure 1.

As shown in the forest plot of the meta-analysis, the highest proportion of household food security (62.1%) was reported from a study conducted in a rural setting of western Kenya. The lowest proportion (2.8%) was reported in a study conducted in households in Kitui and Kilifi counties of Kenya. Based on the Cochrane-Q test and I^2 test statistics, the included studies exhibited considerable heterogeneity (I^2=96.7%; p<0.001). Due to the presence of considerable heterogeneity across the studies, a random effect analysis model was employed to estimate the pooled prevalence of household food security in Kenya (Figure 2).

Subgroup analysis

Since considerable heterogeneity was observed across the studies, a subgroup analysis was conducted. The subgroup analysis was done to identify the possible source of heterogeneity and was based on sample size, research design, sampling technique, year of study and household food security indicator (Table 3).

The results of the subgroup analysis revealed that the source of heterogeneity was not due to sample size, research design, sampling technique, year of study and household food security indicator. The result of the subgroup analysis revealed that studies conducted in rural settings had a higher (25.27) household food security as compared to those conducted in urban settings (19.28%). The study also observed that those studies that had adopted a cross-sectional study design had a comparatively lower (22.37%) household food security as compared to those that had other research designs (23.87%) such as randomized controlled trials. With respect to sampling technique, those studies that adopted cluster sampling had the highest (40.72%) prevalence of food security.

In addition, the study observed that those conducted after the SDGs had the highest level (22.33%) of household food security. Of note, the studies that used the HFIAS tool to measure food security reported the highest (23.75%) food security as compared to other methods (19.30%). In regard to study sample sizes, those studies that had ≤ 385 participants recorded the largest proportion (22.55%) of household food security (Table 3).

Table 3: Subgroup and sensitivity analysis of household food security in Kenya.

Variable	n	%	Prevalence (95% C.I)	I^2	P value
Study settings					
Urban	7	46.7	19.28 (12.55-26.01)	98.7	<0.001
Rural	8	53.3	25.27 (13.78-36.76)	98.7	<0.001
Research design					
Cross-sectional	13	86.7	22.37 (14.84-31.75)	98.9	<0.001
Others	2	13.3	23.82 (19.50-28.14)	98.5	<0.001
Sampling technique					
Multi-stage	5	33.3	24.57 (9.78-41.57)	99.6	<0.001
Stratified sampling	2	13.3	23.45 (6.79-40.11)	98.0	<0.001
Simple random sampling	3	20.0	11.94 (5.80-18.07)	92.7	<0.001
Cluster sampling	2	13.3	40.72 (-1.02-82.47)	99.5	<0.001
Others	3	20.0	16.95 (9.16-31.64)	99.2	<0.001
Sample size					
≤385	8	53.3	22.55 (10.95-34.15)	98.7	<0.001
>385	7	46.7	22.33 (16.60-28.06)	98.7	<0.001
Household food security indicator					
HFIAS	11	73.3	23.75 (14.55-33.78)	98.9	<0.001
Others	4	26.7	19.30 (9.11-30.87)	98.2	<0.001
Year of study					
Before SDGs	9	60.0	21.16 (14.11-28.21)	98.7	<0.001
After SDGs	6	40.0	22.33 (16.60-28.06)	98.7	<0.001

Meta-regression

The subgroup analysis did not show the source of heterogeneity. Therefore, a meta-regression was also undertaken by considering both continuous and categorical data. Sample size, research design, sampling technique, year of study and household food security indicator were considered in the meta-regression. Notably, all the variables entered into the meta-regression equation revealed that the heterogeneity was not associated with the sample size, research design, sampling technique, year of study and household food security indicator (Table 4).

Table 4: Meta-regression for the included studies to identify source of heterogeneity for the prevalence of household food security in Kenya from 2006-2019.

Variables	Co-efficient	P value
Study settings		
Urban	-6.2330	0.566
Rural	Reference	Reference
Research design		
Cross-sectional	-3.1545	0.858
Others	Reference	Reference
Sampling technique		
Multi-stage	7.9823	0.122
Others	Reference	Reference
Sample size	0.0003	0.930
Household food security indicator		
HFIAS	17.6027	0.207
Others	Reference	Reference
Year of study	-2.8687	0.333

DISCUSSION

Food insecurity remains a major global concern. According to FAO et al, projections show that the world is not on track to achieve Zero Hunger by 2030 and, despite some progress, most indicators are also not on track to meet global nutrition targets.[40] Therefore, it is critical for countries to estimate food security situations so as to undertake the necessary corrective actions. According to this systematic review and meta-analysis, the pooled prevalence of household food security was low at 22.33%. The prevalence of household food security reported in this study is lower than that of another meta-analysis conducted in Iran which reported a household food security of 51%.[41] Moreover, other studies reported that the prevalence of household food security was 61.9% and 22.8% in Ethiopia and India respectively.[42,43] This disparity may be due to variation in socio-cultural, demographic, economic, time of the study, interventions and methodological differences of the studies across the countries.

The subgroup analysis of this study revealed that those households in the urban areas had a lower (19.28%) food security prevalence as compared to those in rural areas (25.27%). This is in agreement with other studies conducted by Tomayko et al and Das et al which found that the prevalence of food insecurity was significantly higher in urban areas.[44,45]

The possible reason is that the rapidly growing urban population is increasingly stressing the food security situation due to the rise in food prices as the demand for

food goes high. Additionally, those households in rural areas may have a farm on which they can grow food and they may not need money to access it unlike those in urban areas.

This systematic review and meta-analysis indicated that those studies that adopted a cross-sectional research design had lower food security than those that adopted other designs such as longitudinal and randomized controlled trials. This could be explained by the fact that cross-sectional studies reflect the situation at a single point in time whereas longitudinal studies could reflect seasonal changes.

According to Caruana et al, cross-sectional studies provide no information with regard to the influence of time on the variables measured. Furthermore, those in randomized trials could have received some interventions that enhanced their food security status.[46] Besides, this study observed that the sampling technique also influenced the level of household food security. Those studies that adopted cluster and stratified random sampling had the lowest food security. This may be explained by the geographical differences of the participants which may have been considered during the sampling.

Furthermore, in this meta-analysis, we noticed that those studies that measured the food security status using the HFIAS had higher food security as compared to those that used other methods. This indicates that methodological differences in food security assessment should be a key consideration. Of note, considering the complexity of food security, its assessment and finding comparable indicators applicable to various contexts remain challenging.[9,15-17] This study also reported that those studies that had a lower sample size had a slightly higher level of food security as compared to those with larger sample sizes. The differences could be due to sampling factors such as chance effects. A larger sample size is more representative of the general population and therefore better for generalization.

The findings from the current review also revealed that those studies conducted post the launch of the sustainable development goals had better food security as compared to those conducted before. The probable explanation is that post-SDGs, more food security awareness and interventions may have been initiated by the government and other stakeholders.

The creation of awareness and interventions may be geared toward the achievement of the zero-hunger goal by the year 2030. Notably, Pérez-Escamilla indicates that improved food security governance based on sound, equitable, and sustainable food systems is essential for countries to meet the SDGs.[47]

Strength and limitations of the study

Some of the studies used in the meta-analysis had small sample sizes. The small sample sizes could have some effect on the estimated prevalence of food security in the country. Secondly, the meta-analysis did not get representation from all the counties in the country, which may affect representation. The majority of the studies included in this review were cross-sectional in nature and therefore the outcome variable could be affected by other confounding variables. Searching articles from multiple databases and the use of a rigorous data abstraction and analysis process were the strengths of the review. Additionally, the study adhered to the international standardized guidelines on the conduct and reporting of systematic reviews.

CONCLUSION

This systematic review and meta-analysis indicate that the pooled prevalence of household food security in Kenya is low. Therefore, we strongly recommend that efforts to optimize household food security in the country should be strengthened and upscaled by the government and other pertinent stakeholders. Since the highest food insecurity was observed in the urban settings, more emphasis should therefore be put on households in the urban areas. In addition, to meet the SDG goal of zero hunger, it is important that countries track all the dimensions of food security and promote food systems stability. Furthermore, and to allow for evidence-based programming, more studies on the determinants of household food security in the country are recommended.

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REFERENCES

1. Hassen K, Zinab B, Belachew T. Gender and education as predictors of food insecurity among coffee farming households of the Jimma zone, Southwest of Ethiopia. BMC Nutrition. 2016;2(1):75.
2. FAO, IFAD, UNICEF, WFP and WHO. The State of Food Security and Nutrition in the World 2018.Building climate resilience for food security and nutrition. Rome, FAO. 2018.
3. Leroy JL, Ruel M, Frongillo EA, Harris J, Ballard TJ. Measuring the Food Access Dimension of Food Security: A Critical Review and Mapping of Indicators. Food and Nutrition Bulletin. 2015;36(2):167-95.
4. FAO. Rome Declaration on World Food Security and World Food Summit Plan of Action. Available at: http://www.fao.org/3/w3613e/w3613e00.htm. Accessed on 10 January 2022.
5. FAO. An Introduction to the Basic Concepts of Food Security. Available at:

www.fao.org/docrep/013/Al936e/Al936e00.Pdf. Accessed on 10 January 2022.
6. Fischer NC, Shamah-Levy T, Mundo-Rosas V, Méndez-Gómez-Humarán I, Pérez-Escamilla R. Household food insecurity is associated with anemia in adult Mexican women of reproductive age. The Journal of Nutrition. 2014;144(12):2066-72.
7. Niclasen B, Molcho M, Arnfjord S, Schnohr C. Conceptualizing and contextualizing food insecurity among Greenlandic children. International Journal of Circumpolar Health. 2013;72(1):19928.
8. Melchior M, Chastang JF, Falissard B, Galéra C, Tremblay RE, Côté SM et al. Food Insecurity and Children's Mental Health: A Prospective Birth Cohort Study. Plos one. 2012;7(12):e52615.
9. Mutea E, Bottazzi P, Jacobi J, Kiteme B, Speranza CI, Rist S. Livelihoods and Food Security Among Rural Households in the North-Western Mount Kenya Region. Frontiers in Sustainable Food Systems. 2019;3.
10. Rukuni M. Africa: Addressing Growing Threats to Food Security. The Journal of Nutrition. 2002;132(11):3443S-8S.
11. FAO. The state of food insecurity in the world 2010. Addressing food insecurity in protracted crises. Food and Agricultural Organization (FAO); Rome. 2010.
12. Government of Kenya (GOK). Constitution of Kenya, 2010. GOK. 2010.
13. Dong KR, Tang AM, Stopka TJ, Beckwith CG, Must A. Food acquisition methods and correlates of food insecurity in adults on probation in Rhode Island. PLoS ONE. 2018;13(6).
14. Hendriks SL, van der Merwe C, Ngidi MS, Manyamba C, Mbele M, McIntyre AM et al. What are we measuring? Comparison of household food security indicators in the Eastern Cape Province, South Africa. Ecology of Food and Nutrition. 2016;55(2):141-62.
15. Castetbon K. Measuring Food Insecurity. Sustainable Nutrition in a Changing World. 2017;35-41.
16. Smith MD, Kassa W, Winters P. Assessing food insecurity in Latin America and the Caribbean using FAO's Food Insecurity Experience Scale. Food Policy. 2017;71(C):48-61.
17. Smith MD, Rabbitt MP, Coleman- Jensen A. Who are the World's Food Insecure? New Evidence from the Food and Agriculture Organization's Food Insecurity Experience Scale. World Development. 2017;93(C):402-12.
18. Faber M, Schwabe C, Drimie S. Dietary diversity in relation to other household food security indicators. International Journal of Food Safety, Nutrition and Public Health. 2009;2(1):1.
19. Deitcher M, Ballard T, Swindale A, Coates J. Validation of a Measure of Household Hunger for Cross-Cultural Use. 2010;76.
20. Maxwell D, Coates J, Vaitla B. How Do Different Indicators of Household Food Security Compare? Empirical Evidence from Tigray. 2013;26.
21. Maxwell DG. Measuring food insecurity: The frequency and severity of "coping strategies." Food Policy. 1996;21(3):291-303.
22. Moher D, Liberati A, Tetzlaff J, Altman DG, Prisma Group. Preferred reporting items for systematic reviews and meta-analyses: The PRISMA statement. Annals of Internal Medicine. 2009;151(4):264-9.
23. Newcastle-Ottawa Scale customized for cross-sectional studies. Available at: https://journals.plos.org/plosone/article/file?type=supplementary&id=info:doi/10.1371/journal.pone.0147601.s001. Accessed on 10 January 2022.
24. Begg CB, Mazumdar M. Operating characteristics of a rank correlation test for publication bias. Biometrics. 1994;50(4):1088-01.
25. Egge M, Smith GD, Schneider M, Minder C. Bias in meta-analysis detected by a simple, graphical test. BMJ. 1997;315(7109):629-34.
26. Kamal SP, Bhoopathy SV, Worth H, Seale H, Richmond RL. Nutrition among men and household food security in an internally displaced persons camp in Kenya. Public Health Nutrition, 2016;19(4):723-31.
27. Bukania ZN, Mwangi M, Karanja RM, Mutisya R, Kombe Y, Kaduka LU et al. Food Insecurity and Not Dietary Diversity Is a Predictor of Nutrition Status in Children within Semiarid Agro-Ecological Zones in Eastern Kenya. Journal of Nutrition and Metabolism. 2014;e907153.
28. Waswa LM, Jordan, I, Herrmann J, Krawinkel MB, Keding GB. Household Food Security and Dietary Diversity in Different Agro-ecological Zones in Western Kenya. 2012;1.
29. Macharia TN, Ochola S, Mutua MK, Kimani-Murage EW. Association between household food security and infant feeding practices in urban informal settlements in Nairobi, Kenya. Journal of Developmental Origins of Health and Disease. 2018;9(1):20-9.
30. Mutisya M, Kandala N, Ngware MW, Kabiru CW. Household food (in)security and nutritional status of urban poor children aged 6 to 23 months in Kenya. BMC Public Health. 2015;15.
31. Wangui M, Mbeche R, Ateka J, Wanda D. Determinants of Household Food Security in Nairobi, Kenya. JKUAT Annual Scientific Conference Proceedings. 2018;290-300.
32. Chege PW, Ndungu ZW, Gitonga BM. Food security and nutritional status of children under-five in households affected by HIV and AIDS in Kiandutu informal settlement, Kiambu County, Kenya. Journal of Health, Population, and Nutrition. 2016;35.
33. Shinsugi C, Matsumura M, Karama M, Tanaka J, Changoma M, Kaneko S. Factors associated with stunting among children according to the level of food insecurity in the household: A cross-sectional

study in a rural community of Southeastern Kenya. BMC Public Health. 2015;15:441.
34. Kimani-Murage EW, Schofield L, Wekesah F, Mohamed S, Mberu B, Ettarh R et al. Vulnerability to food insecurity in urban slums: Experiences from Nairobi, Kenya. Journal of Urban Health: Bulletin of the New York Academy of Medicine. 2014;91(6):1098-113.
35. Momanyi D.K, Owino WO, Makokha A, Evang E, Tsige H, Krawinkel M. Gaps in food security, food consumption and malnutrition in households residing along the baobab belt in Kenya. Nutrition & Food Science. 2019;49(6):1099-112.
36. Silvestri S, Sabine D, Patti K, Wiebke F, Maren R, Ianetta M et al. Households and food security: Lessons from food secure households in East Africa. Agriculture & Food Security. 2015;4(1):23.
37. Owuor S. The State of Household Food Security in Nairobi, Kenya. Hungry Cities Partnership. 2018;51.
38. Mwangi V, Owuor S, Kiteme B, Giger M, Jacobi J, Kirui O. Linking Household Food Security and Food Value Chains in North West Mt. Kenya. Sustainability. 2020;12(12):4999.
39. Gwada RO, Ouko KO, Mayaka ZO, Dembele B. Determinants of Food Security Among Small-Scale Soybean Households in Butere Sub-County, Kenya. Contemporary Agriculture. 2020;69(3-4):90-101.
40. FAO, IFAD, UNICEF, WFP and WHO. The State of Food Security and Nutrition in the World 2020. Transforming food systems for affordable healthy diets. Rome, FAO. 2020.
41. Behzadifar M, Behzadifar M, Abdi S, Malekzadeh R, Salmani M, Ghoreishinia G et al. Prevalence of Food Insecurity in Iran: A Systematic Review and Meta-analysis. Archives of Iranian Medicine. 2016;19(4):288-94.
42. Shone M, Demissie T, Yohannes B, Yohannis M. Household food insecurity and associated factors in West Abaya district, Southern Ethiopia, 2015. Agriculture & Food Security. 2017;6(1):2.
43. Chinnakali P, Upadhyay RP, Shokeen D, Singh K, Kaur M, Singh AK et al. Prevalence of Household-level Food Insecurity and Its Determinants in an Urban Resettlement Colony in North India. Journal of Health, Population, and Nutrition. 2014;32(2):227-36.
44. Tomayko EJ, Mosso KL, Cronin KA, Carmichael L, Kim K, Parker T et al. Household food insecurity and dietary patterns in rural and urban American Indian families with young children. BMC Public Health. 2017;17(1):611.
45. Das S, Rasul MG, Hossain MS, Khan AR, Alam MA, Ahmed T et al. Acute food insecurity and short-term coping strategies of urban and rural households of Bangladesh during the lockdown period of COVID-19 pandemic of 2020: Report of a cross-sectional survey. BMJ Open. 2020;10(12):e043365.
46. Caruana EJ, Roman M, Hernández-Sánchez J, Solli P. Longitudinal studies. Journal of Thoracic Disease. 2015;7(11):E537-40.
47. Pérez-Escamilla R. Food Security and the 2015–2030 Sustainable Development Goals: From Human to Planetary Health. Current Developments in Nutrition. 2017;1(7).

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