

Troisième article : **A systematic literature review on how food and nutrition research in Bénin and how these research integrate equity lens**

Par : R. A. O. Bouraima, N. Fanou Fogny, J. Harris and A. E. Assogbadjo

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Types de contributions et aspects généraux

Le Bulletin de la Recherche Agronomique du Bénin (BRAB) accepte des articles scientifiques, des articles de synthèse, des résumés de thèse de doctorat, des analyses bibliographiques, des notes et des fiches techniques, des revues de livres, des actes de conférences, d'ateliers et de séminaires, des articles originaux de recherche et de synthèse, puis des études de cas sur des aspects agronomiques et des sciences apparentées produits par des scientifiques béninois ou étrangers. La responsabilité du contenu des articles incombe entièrement à l'auteur et aux co-auteurs. Le BRAB publie par an -i- quatre (04) numéros à raison d'un numéro par trimestre, et -ii- aussi des numéros spéciaux mis en ligne sur le site web : <https://brab.bj/>. Pour les auteurs, une contribution de cinquante mille (50.000) Francs CFA, tout frais compris, est demandée par article soumis et accepté pour publication. L'article publié est disponible en accès libre sur la plateforme avec notification à l'auteur correspondant.

Soumission de manuscrits

Les manuscrits doivent être soumis en ligne sur la plateforme <https://brab.bj/> accompagnés d'une lettre de soumission au comité de rédaction et de publication du BRAB. Dans la lettre de soumission les auteurs doivent proposer l'auteur de correspondance ainsi que les noms et adresses (y compris les e-mails) de trois (03) experts de leur discipline ou domaine scientifique pour l'évaluation du manuscrit. Certes, le choix des évaluateurs revient au comité éditorial du Bulletin de la Recherche Agronomique du Bénin. Les manuscrits doivent être écrits en français ou en anglais, tapé/saisi sous Winword ou Word ou Word docx avec la police Arial taille 10 en interligne simple sur du papier A4 (21,0 cm x 29,7 cm). L'auteur doit fournir des fichiers électroniques des illustrations (tableaux, figures et photos) en dehors du texte. Les figures doivent être réalisées avec un logiciel pour les graphiques. Les données ayant servi à élaborer les figures seront également fournies. Les photos doivent être suffisamment contrastées. Les articles sont soumis par le comité de rédaction à des évaluateurs, spécialistes du domaine. L'auteur reçoit automatiquement un accusé de réception.

Processus d'évaluation

Dès la réception du manuscrit, le secrétariat scientifique de la revue vérifie la conformité aux indications aux auteurs puis envoie un courriel à l'auteur correspondant où il lui est mentionné la suite réservée à son manuscrit. Ensuite, est déclenché le processus de l'évaluation aveugle par l'envoi aux trois (03) évaluateurs retenus par le secrétariat scientifique. Au cours de la troisième semaine, l'auteur reçoit la décision de rejet ou d'acceptation de son manuscrit sous réserve de la prise en compte des observations faites par les évaluateurs. Les auteurs ont deux (02) semaines pour retourner la nouvelle version de leur manuscrit accompagnées d'une deuxième lettre de soumission comportant un tableau synoptique dans lequel ils justifient la prise en compte ou non des observations critiques constructives des évaluateurs dudit manuscrit. Toutefois, les manuscrits ayant reçu des observations majeures sont retournés aux évaluateurs pour la vérification des observations apportées. Au bout de deux (02) semaines, ils reçoivent le proof de leur article pour une relecture en 72 heures et procède au règlement des frais de publication avant la parution de l'article sur la plateforme.

Sanction du plagiat et de l'autoplégat dans tout article soumis au BRAB pour publication

De nombreuses définitions sont données au plagiat selon les diverses sources de documentations telles que « -i- Acte de faire passer pour siens les textes ou les idées d'autrui. -ii- Consiste à copier les autres en reprenant les idées ou les résultats d'un autre chercheur sans le citer et à les publier en son nom propre. -iii- Copie frauduleuse d'une œuvre existante en partie ou dans sa totalité afin de se l'approprier sans accord préalable de l'auteur. -iv- Vol de la création originale. -v- Violation de la propriété intellectuelle d'autrui. » (<https://integrite.umontreal.ca/reglements/definitions-generales/>). Le Plagiat et l'Autoplégat sont à bannir dans les écrits scientifiques. Par conséquent, tout manuscrit soumis pour sa publication dans le BRAB doit être préalablement soumis à une analyse de plagiat, en s'appuyant sur quelques plateformes de détection de plagiat. Le **plagiat constaté dans tout article sera sanctionné par un retour du manuscrit accompagné du rapport de vérification du plagiat par un logiciel antiplégat à l'auteur de correspondance pour sa correction avec un taux de tolérance de plagiat ou de similitude inférieur ou égal à sept pour cent (07%).**

Respect de certaines normes d'édition et règles de présentation et d'écriture

Pour qu'un manuscrit soit accepté par le comité de rédaction, il doit respecter certaines normes d'édition et règles de présentation et d'écriture. Ne pas oublier que les trois (3) **qualités fondamentales d'un article scientifique** sont la **précision** (supprimer les adjectifs et adverbes creux), la **clarté** (phrases courtes, mots simples, répétition des mots à éviter, phrases actives, ordre logique) et la **brièveté** (supprimer les expressions creuses). **Le temps des verbes doit être respecté**. En effet, tout ce qui est expérimental et non vérifié est rédigé au passé (passé composé et imparfait) de l'indicatif, notamment les parties *Méthodologie (Matériels et méthodes)* et *Résultats*. Tandis que tout ce qui est admis donc vérifié est rédigé au présent de l'indicatif, notamment les parties *Introduction*, avec la citation de résultats vérifiés, *Discussion* et *Conclusion*. Toutefois, en cas de doute, rédigez au passé. Pour en savoir plus sur la méthodologie de rédaction d'un article, prière consulter le document suivant : **Assogbadjo A. E., Aïhou K., Youssao A. K. I., Fovet-Rabot C., Mensah G. A., 2011. L'écriture scientifique au Bénin. Guide contextualisé de formation. Cotonou, INRAB, 60 p. ISBN : 978-99919-857-9-4 – INRAB 2011. Dépôt légal n° 5372 du 26 septembre 2011, 3^{ème} trimestre 2011. Bibliothèque Nationale (BN) du Bénin.**

Titre

Dans le titre se retrouve l'information principale de l'article et l'objet principal de la recherche. Le titre doit contenir 6 à 10 mots (22 mots au maximum) en position forte, décrivant le contenu de l'article, assez informatifs, descriptifs, précis et concis. Un bon titre doit donner le meilleur aperçu possible de l'article en un minimum de mots. Il comporte les mots de l'index *Medicus*. Le titre est un message-réponse aux 5 W [what (quoi ?), who (qui ?), why (pourquoi ?), when (quand ?), where (où ?)] & 1 H [how (comment ?)]. Il est recommandé d'utiliser des sous-titres courts et expressifs pour subdiviser les sections longues du texte mais écrits en minuscules, sauf la première lettre et non soulignés. Toutefois, il faut éviter de multiplier les sous-titres. Le titre doit être traduit dans la seconde langue donc écrit dans les deux langues français et anglais.

Auteur et Co-auteurs

Les initiales des prénoms en majuscules séparées par des points et le nom avec 1^{ère} lettre écrite en majuscule de tous les auteurs (auteur & co-auteurs), sont écrits sous le titre de l'article. Immédiatement, suivent les titres académiques (Pr., Dr, MSc., MPhil. et/ou Ir.), les prénoms écrits en minuscules et le nom écrit en majuscule, puis les adresses complètes (structure, BP, e-mail, Tél. et pays) de tous les auteurs. Il ne faut retenir que les noms des membres de l'équipe ayant effectivement participé au programme de recherche et à la rédaction de l'article.

Résumé

Un bref résumé dans la langue de l'article est précédé d'un résumé détaillé dans la seconde langue (français ou anglais selon le cas) et le titre sera traduit dans cette seconde langue. Le résumé est une compression en volume plus réduit de l'ensemble des idées développées dans un document, etc. Il contient l'essentiel en un seul paragraphe de 200 à 350 mots. Le résumé contient une **Introduction** (contexte, Objectif, etc.) rédigée avec 20% des mots, la **Méthodologie** (type d'étude, échantillonnage, variables et outils statistiques) rédigée avec 20% des mots, les **Résultats obtenus et leur courte discussion** (résultats importants et nouveaux pour la science), rédigée avec 50% des mots et une **Conclusion** (implications de l'étude en termes de généralisation et de perspectives de recherches) rédigée avec 10% des mots.

Mots-clés

Les 3 à 5 mots et/ou groupes de mots clés les plus descriptifs de l'article suivent chaque résumé et comportent le pays (la région), la problématique ou l'espèce étudiée, la discipline ou le domaine spécifique, la méthodologie, les résultats et les perspectives de recherche. Il est conseillé de choisir d'autres mots/groupes de mots autres que ceux contenus dans le titre.

Texte

Le texte doit être rédigé dans un langage simple et compréhensible. L'article est structuré selon la discipline scientifique et la thématique en utilisant l'un des plans suivants avec les Remerciements (si nécessaire) et Références bibliographiques : *IMReD* (Introduction, Matériel et Méthodes, Résultats, Discussion/Résultats et Discussion, Conclusion) ; *ILPIA* (Introduction, Littérature, Problème, Implication, Avenir) ; *OPERA* (Observation, Problème, Expérimentation, Résultats, Action) ; *SOSRA* (Situation, Observation, Sentiments, opinion, Réflexion, Action) ; *ESPRIT/SPRIT* [Entrée en matière

(introduction), Situation du problème, Problème précis, Résolution, Information appliquée ou détaillée, Terminaison (conclusion)] ; *APPROACH* (Annonce, Problématique (permutable avec Présentation), Présentation, Réactions, Opinions, Actions, Conclusions, Horizons) ; etc.

Introduction

L'introduction c'est pour persuader le lecteur de l'importance du thème et de la justification des objectifs de recherche. Elle motive et justifie la recherche en apportant le background nécessaire, en expliquant la rationalité de l'étude et en exposant clairement l'objectif et les approches. Elle fait le point des recherches antérieures sur le sujet avec des citations et références pertinentes. Elle pose clairement la problématique avec des citations scientifiques les plus récentes et les plus pertinentes, l'hypothèse de travail, l'approche générale suivie, le principe méthodologique choisi. L'introduction annonce le(s) objectif(s) du travail ou les principaux résultats. Elle doit avoir la forme d'un entonnoir (du général au spécifique).

Matériels et méthodes

Il faut présenter si possible selon la discipline le **milieu d'étude** ou **cadre de l'étude** et indiquer le lien entre le milieu physique et le thème. **La méthodologie d'étude** permet de baliser la discussion sur les résultats en renseignant sur la validité des réponses apportées par l'étude aux questions formulées en introduction. Il faut énoncer les méthodes sans grands détails et faire un extrait des principales utilisées. L'importance est de décrire les protocoles expérimentaux et le matériel utilisé, et de préciser la taille de l'échantillon, le dispositif expérimental, les logiciels utilisés et les analyses statistiques effectuées. Il faut donner toutes les informations permettant d'évaluer, voire de répéter l'essai, les calculs et les observations. Pour le matériel, seront indiquées toutes les caractéristiques scientifiques comme le genre, l'espèce, la variété, la classe des sols, etc., ainsi que la provenance, les quantités, le mode de préparation, etc. Pour les méthodes, on indiquera le nom des dispositifs expérimentaux et des analyses statistiques si elles sont bien connues. Les techniques peu répandues ou nouvelles doivent être décrites ou bien on en précisera les références bibliographiques. Toute modification par rapport aux protocoles courants sera naturellement indiquée.

Résultats

Le texte, les tableaux et les figures doivent être complémentaires et non répétitifs. Les tableaux présenteront un ensemble de valeurs numériques, les figures illustrent une tendance et le texte met en évidence les données les plus significatives, les valeurs optimales, moyennes ou négatives, les corrélations, etc. On fera mention, si nécessaire, des sources d'erreur. La règle fondamentale ou règle cardinale du témoignage scientifique suivie dans la présentation des résultats est de donner tous les faits se rapportant à la question de recherche concordant ou non avec le point de vue du scientifique et d'indiquer les relations imprévues pouvant faire de l'article un sujet plus original que l'hypothèse initiale. Il ne faut jamais entremêler des descriptions méthodologiques ou des interprétations avec les résultats. Il faut indiquer toujours le niveau de signification statistique de tout résultat. Tous les aspects de l'interprétation doivent être présents. Pour l'interprétation des résultats il faut tirer les conclusions propres après l'analyse des résultats. Les résultats négatifs sont aussi intéressants en recherche que les résultats positifs. Il faut confirmer ou infirmer ici les hypothèses de recherches.

Discussion

C'est l'établissement d'un pont entre l'interprétation des résultats et les travaux antérieurs. C'est la recherche de biais. C'est l'intégration des nouvelles connaissances tant théoriques que pratiques dans le domaine étudié et la différence de celles déjà existantes. Il faut éviter le piège de mettre trop en évidence les travaux antérieurs par rapport aux résultats propres. Les résultats obtenus doivent être interprétés en fonction des éléments indiqués en introduction (hypothèses posées, résultats des recherches antérieures, objectifs). Il faut discuter ses propres résultats et les comparer à des résultats de la littérature scientifique. En d'autres termes c'est de faire les relations avec les travaux antérieurs. Il est nécessaire de dégager les implications théoriques et pratiques, puis d'identifier les besoins futurs de recherche. Au besoin, résultats et discussion peuvent aller de pair.

Résultats et Discussion

En optant pour **résultats et discussions** alors les deux vont de pair au fur et à mesure. Ainsi, il faut la discussion après la présentation et l'interprétation de chaque résultat. Tous les aspects de l'interprétation, du commentaire et de la discussion des résultats doivent être présents. Avec l'expérience, on y parvient assez aisément.

Conclusion

Il faut une bonne et concise conclusion étendant les implications de l'étude et/ou les suggestions. Une conclusion fait ressortir de manière précise et succincte les faits saillants et les principaux résultats de l'article sans citation bibliographique. La conclusion fait la synthèse de l'interprétation scientifique et de l'apport original dans le champ scientifique concerné. Elle fait l'état des limites et des faiblesses de l'étude (et non celles de l'instrumentation mentionnées dans la section de méthodologie). Elle suggère d'autres avenues et études permettant d'étendre les résultats ou d'avoir des applications intéressantes ou d'obtenir de meilleurs résultats.

Remerciements

Il s'agit de remercier ceux qui ont financé l'étude, collecté les données sur le terrain et facilité la bonne conduite des travaux de recherche ainsi que d'éventuels lecteurs critiques du manuscrit.

Conflits d'intérêt

Un des aspects cruciaux de l'éthique de la recherche qui nécessite la divulgation transparente des conflits d'intérêt, permet de maintenir l'intégrité de la recherche scientifique et assure la crédibilité des conclusions publiées. Par conséquent, il est plus qu'essentiel pour tout chercheur de divulguer honnêtement toute situation pouvant être perçue comme un conflit d'intérêt afin de préserver la rigueur scientifique et la confiance du public. Par exemple, il s'agit de mentionner si éventuellement le travail a des situations conflictuelles avec d'autres en cours et connues des auteurs.

Contribution des auteurs

Dans cette rubrique est renseignée la contribution substantielle de chaque auteur dans le processus d'élaboration de l'article. Il s'agit de la part de travail de chacun des auteurs depuis la conception du travail, la mobilisation des ressources, la collecte et l'analyse des données, la rédaction du manuscrit, etc.

Références bibliographiques

La norme Harvard et la norme Vancouver sont les deux normes internationales qui existent et régulièrement mises à jour. Il ne faut pas mélanger les normes de présentation des références bibliographiques. En ce qui concerne le Bulletin de la Recherche Agronomique du Bénin (BRAB), c'est la norme Harvard qui a été choisie. Les auteurs sont responsables de l'orthographe des noms cités dans les références bibliographiques. Dans le texte, les publications doivent être citées de la manière suivante : Sinsin (2020) ou Sinsin et Assogbadjo (2020) ou Sinsin *et al.* (2007). Sachez que « *et al.* » est mis pour *et alteri* qui signifie et autres. Il faut s'assurer que les références mentionnées dans le texte sont toutes reportées par ordre alphabétique dans la liste des références bibliographiques. Somme toute dans le BRAB, selon les ouvrages ou publications, les références sont présentées dans la liste des références bibliographiques de la manière suivante :

Pour les revues scientifiques :

- ✓ **Pour un seul auteur** : Yakubu, A., 2013: Characterisation of the local Muscovy duck in Nigeria and its potential for egg and meat production. *World's Poultry Science Journal*, 69(4): 931-938. DOI: <https://doi.org/10.1017/S0043933913000937>
- ✓ **Pour deux auteurs** : Tomasz, K., Juliusz, M. K., 2004: Comparison of physical and qualitative traits of meat of two Polish conservative flocks of ducks. *Arch. Tierz., Dummerstorf*, 47(4): 367-375.
- ✓ **A partir de trois auteurs** : Vissoh, P. V., R. C. Tossou, H. Dedehouanou, H. Guibert, O. C. Codjia, S. D. Vodouhe, E. K. Agbossou, 2012 : Perceptions et stratégies d'adaptation aux changements climatiques : le cas des communes d'Adjohoun et de Dangbo au Sud-Est Bénin. *Les Cahiers d'Outre-Mer N° 260*, 479-492.

Pour les organismes et institutions :

- ✓ FAO, 2017. L'État de la sécurité alimentaire et de la nutrition dans le monde 2017 : Renforcer la résilience pour favoriser la paix et la sécurité alimentaire. Rome, FAO. 144 p.
- ✓ INSAE (Institut National de la Statistique et de l'Analyse Economique), 2015 : Quatrième Recensement Général de la Population et de l'Habitation (RGPH-4) : Résultats définitifs.

Direction des Etudes Démographiques, Institut National de la Statistique et de l'Analyse Economique, Cotonou, Bénin, 33 p.

Pour les contributions dans les livres :

- ✓ Whithon, B.A., Potts, M., 1982: Marine littoral: 515-542. *In*: Carr, N.G., Whithon, B.A., (eds), The biology of cyanobacteria. Oxford, Blackwell.
- ✓ Annerose, D., Cornaire, B., 1994 : Approche physiologique de l'adaptation à la sécheresse des espèces cultivées pour l'amélioration de la production en zones sèches: 137-150. *In* : Reyniers, F.N., Netoyo L. (eds.). Bilan hydrique agricole et sécheresse en Afrique tropicale. Ed. John Libbey Eurotext. Paris.

Pour les livres :

- ✓ Zryd, J.P., 1988: Cultures des cellules, tissus et organes végétaux. Fondements théoriques et utilisations pratiques. Presses Polytechniques Romandes, Lausanne, Suisse.
- ✓ Stuart, S.N., R.J. Adams, M.D. Jenkins, 1990: Biodiversity in sub-Saharan Africa and its islands. IUCN–The World Conservation Union, Gland, Switzerland.

Pour les communications :

- ✓ Vierada Silva, J.B., A.W. Naylor, P.J. Kramer, 1974: Some ultrastructural and enzymatic effects of water stress in cotton (*Gossypium hirsutum* L.) leaves. Proceedings of Nat. Acad. Sc. USA, 3243-3247.
- ✓ Lamachere, J.M., 1991 : Aptitude du ruissellement et de l'infiltration d'un sol sableux fin après sarclage. Actes de l'Atelier sur Soil water balance in the Sudano-Sahelian Zone. Niamey, Niger, IAHS n° 199, 109-119.

Pour les abstracts :

- ✓ Takaiwa, F., Tnifuji, S., 1979: RNA synthesis in embryo axes of germination pea seeds. Plant Cell Physiology abstracts, 1980, 4533.

Thèse ou mémoire :

- ✓ Valero, M., 1987: Système de reproduction et fonctionnement des populations chez deux espèces de légumineuses du genre *Lathyrus*. PhD. Université des Sciences et Techniques, Lille, France, 310 p.

Pour les sites web : <http://www.iucnredlist.org>, consulté le 06/07/2007 à 18 h.

Equations et formules

Les équations sont centrées, sur une seule ligne si possible. Si on s'y réfère dans le texte, un numéro d'identification est placé, entre crochets, à la fin de la ligne. Les fractions seront présentées sous la forme « 7/25 » ou « (a+b)/c ».

Unités et conversion

Seules les unités de mesure, les symboles et équations usuels du système international (SI) comme expliqués au chapitre 23 du Mémento de l'Agronome, seront acceptés.

Abréviations

Les abréviations internationales sont acceptées (OMS, DDT, etc.). Le développé des sigles des organisations devra être complet à la première citation avec le sigle en majuscule et entre parenthèses (FAO, RFA, IITA). Eviter les sigles reconnus localement et inconnus de la communauté scientifique. Citer complètement les organismes locaux.

Nomenclature de pesticides, des noms d'espèces végétales et animales

Les noms commerciaux seront écrits en lettres capitales, mais la première fois, ils doivent être suivis par le(s) nom (s) communs(s) des matières actives, tel que acceptés par « International Organization for Standardization (ISO) ». En l'absence du nom ISO, le nom chimique complet devra être donné. Dans la page de la première mention, la société d'origine peut être indiquée par une note en bas de la page, p.e. PALUDRINE (Proguanil). Les noms d'espèces animales et végétales seront indiqués en latin (genre, espèce) en italique, complètement à la première occurrence, puis en abrégé (exemple :

Oryza sativa = *O. sativa*). Les auteurs des noms scientifiques seront cités seulement la première fois que l'on écrira ce nom scientifique dans le texte.

Tableaux, figures et illustrations

Chaque tableau (avec les colonnes et lignes rendues visibles donc quadrillées) ou figure doit avoir un titre. Les titres des tableaux seront écrits en haut de chaque tableau et ceux des figures/photographies seront écrits en bas des illustrations. Les légendes seront écrites directement sous les tableaux et autres illustrations. En ce qui concerne les illustrations (tableaux, figures et photos) seules les versions électroniques bien lisibles et claires, puis mises en extension jpeg avec haute résolution seront acceptées. Seules les illustrations dessinées à l'ordinateur et/ou scannées, puis les photographies en extension jpeg et de bonne qualité donc de haute résolution sont acceptées.

Les places des tableaux et figures dans le texte seront indiquées dans un cadre sur la marge. Les tableaux sont numérotés, appelés et commentés dans un ordre chronologique dans le texte. Ils présentent des données synthétiques. Les tableaux de données de base ne conviennent pas. Les figures doivent montrer à la lecture visuelle suffisamment d'informations compréhensibles sans recours au texte. Les figures sont en Excel, Havard, Lotus ou autre logiciel pour graphique sans grisés et sans relief. Il faudra fournir les données correspondant aux figures afin de pouvoir les reconstruire si c'est nécessaire.

A systematic literature review on food and nutrition research in Benin and how research integrate equity lens for healthier food choices

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Key findings

- Food environment research in the Benin has been largely focused on cultivated food environments, informal markets and wild food environments.
- There is a rise in research on rural home gardens and domestication of wild fruits and vegetables to address the challenges of food availability and food accessibility.
- Most food environment studies in Benin focus on quantitative data with lack of deep investigation on experiences and perception at individual levels.
- Most food and nutrition research conducted in Benin do not explicitly frame their analyses through an equity and social inclusion perspective
- Food environment in Benin reflect structural inequalities linked to poverty, geography, gender, and socioeconomic status and very few studies examine how disparities shape food and nutrition outcomes in Benin.

Abstract

The food environment represents the external and personal domains that shape dietary behaviours, food consumption, food purchase patterns, and nutritional status of individuals. In response to the increasing incidence of obesity, non-communicable diseases with a triple burden of malnutrition, research interests are growing to study the role of the food environment and find innovative solutions and mechanisms supporting healthy food choices. Failure to solve these challenges may result in long-term economic and social consequences, especially in regions most in need, as current policy interventions are insufficient and community-driven solutions are needed to bridge these gaps and ensure food security and nutrition for all. This scoping review aims to synthesize findings from studies examining the food environment in Benin to provide a comprehensive assessment. To examine and synthesize existing literature, the study employs a scoping review methodology. It involves a targeted keyword search strategy, selecting relevant articles from Web of Science and Scopus databases from 2000 to 2022. Overall, 84 studies, both quantitative and qualitative published were included. Data extraction and quality appraisal was conducted independently by authors, before the study findings were collated and summarized through a narrative data synthesis.

Keywords: food access, inequalities, diets, fruits, vegetables

Une revue systématique de la littérature sur les recherches en alimentation et nutrition au Bénin : intégration d'une approche d'équité sociale pour promouvoir des choix alimentaires sains

Résultats clés

- Les recherches sur les environnements alimentaires au Bénin se sont largement concentrées sur les environnements alimentaires cultivés, les marchés informels et les environnements alimentaires sauvages.
- Une augmentation des recherches portant sur les jardins de case et la domestication des fruits et légumes sauvages est observée comme stratégies visant à répondre aux défis liés à la disponibilité et à l'accessibilité des aliments.
- La plupart des études sur les environnements alimentaires menées au Bénin reposent principalement sur des données quantitatives, avec une faible exploration approfondie des expériences, des perceptions et des réalités vécues au niveau individuel.
- La majorité des recherches en alimentation et nutrition au Bénin n'intègrent pas les aspects d'équité et d'inclusion sociale dans les analyses.
- Les environnements alimentaires au Bénin reflètent des inégalités structurelles liées à la pauvreté, à la localisation géographique, au genre et au statut socioéconomique et très peu d'études analysent la manière dont ces disparités influencent l'accès à l'alimentation, les comportements alimentaires et les résultats nutritionnels au sein des différentes populations au Bénin.

Résumé

L'environnement alimentaire représente l'ensemble des facteurs individuels et externes qui façonnent les comportements alimentaires, la consommation alimentaire, les habitudes d'achat alimentaires ainsi que l'état nutritionnel des individus. Face aux défis du triple fardeau de la malnutrition avec l'augmentation du taux d'obésité, des maladies non transmissibles, les recherches scientifiques se multiplient afin d'étudier les comportements alimentaires de la population et des communautés et d'identifier les solutions et mécanismes innovants qui favorisent des choix alimentaires sains. L'incapacité à résoudre ces défis peut entraîner des conséquences économiques et sociales à long terme, en particulier dans les régions les plus vulnérables, car les interventions politiques actuelles demeurent insuffisantes et des solutions portées par les communautés sont nécessaires pour combler ces lacunes et garantir la sécurité alimentaire et nutritionnelle pour tous. Cette revue vise à synthétiser les résultats des études portant sur l'environnement alimentaire au Bénin afin de fournir une évaluation globale de la situation. Pour cela, l'étude a examiné et synthétisé la littérature existante en utilisant une méthodologie de revue systématique. Celle-ci repose sur une stratégie de recherche ciblée par mots-clés, permettant de sélectionner des articles pertinents issus des bases de données Web of Science et Scopus entre 2000 et 2022. Au total, 84 études, à la fois quantitatives et qualitatives, ont été incluses. L'extraction des données et l'évaluation de la qualité ont été réalisées indépendamment par les auteurs, avant que les résultats des études ne soient regroupés et synthétisés à travers une analyse narrative des données.

Mots clés : Accès à l'alimentation, inégalités sociales, régimes alimentaires, fruits, légumes

1. Introduction

Today, different forms of malnutrition—including overweight, obesity, and micronutrient deficiencies—are expanding at alarming rates (FAO, 2021). Malnutrition is a multifaceted and important public health and development issue, especially in low- and middle-income areas and across different communities (Van De Poel *et al.*, 2007) influenced by a range of personal, socioeconomic, environmental, and health-related factors. In addition, food safety and food quality concerns, added to socio-economic and environmental factors, directly impact consumer dietary behaviours, which shift, such as reduced intake of healthy foods and increased consumption of processed and unsafe foods, driving the double burden of malnutrition (Liguori *et al.*, 2022), both undernutrition and diet-related non-communicable diseases. So, malnutrition in all its forms requires food systems that are equitable, empowering, sustainable, healthy, and nutritious.

The food environment serves as the interface between consumers and the broader food system, which circumscribes the food acquisition choices available to consumers (Turner *et al.*, 2018). Low-quality diets are a leading risk factor in the global burden of disease, therefore identifying constraints in the food environment that limit access to healthy diets is of key importance. Though market food environments are most prominently featured in research, broader typologies have included wild and cultivated, institutional, and kin and community-based food environments (Downs *et al.*, 2020).

Furthermore, qualitative research exploring health, and wellbeing remains limited. Little is currently known about how marginalized communities perceive their food environments and about the attitudes. Additional research is therefore needed to better understand the relative influence of income and other determinants of food security on household. Therefore, more research is needed to explore how different population groups perceive their food environments, food acquisition processes and social dynamics underlying food choices that shape household food choice, decision-making and dietary practices (Beck *et al.*, 2019). In Benin, food and nutrition research has insufficiently emphasized food environment importance in shaping healthier household food choices, especially how food environment types and dimensions (external) interact with personal (internal) factors and other determinants of food security to shape food production, food consumption and food access in different communities in Benin.

As part of the Fruit and Vegetables for Sustainable Healthy Diets (FRESH) Initiative, a CGIAR initiative partnered with the World Vegetable Center, this scoping review aims to assess food environments, food environment dimensions, and individual-level factors studied in the literature, along with the methods used. It focuses on FRESH countries: Tanzania, Philippines, Sri Lanka, and Benin. Research questions for this review include: which food environment types and dimensions, and individual factors have been studied in Benin, the Philippines, Sri Lanka, and Tanzania? Which contexts of the four focus countries have been studied in the food environment literature (urban, rural, school, etc.), and when linking with consumers, which populations have been studied? What are the key findings related to food environment characteristics, including food environment-related barriers and enablers to improved dietary intake, especially fruits and vegetables, and equity in food access across different populations in the four focus countries? What food environment-related interventions have been implemented in the four focus countries to improve dietary intake, especially related to fruits and vegetables? What study designs, methods, tools, and metrics have been used to assess food environments in the four focus countries, and from which academic disciplines?

This country profile provides an overview of Benin's food environment based on a scoping review of published literature. This scoping review comprehensively assesses research on Benin food environment including the various types of food environment and food environment dimensions studied, as well as the methods employed to investigate them. The review also identifies individual-level factors that intersect with the food environment and drive food choices and nutrition in Benin. Lastly, it examines food environment-related interventions, highlighting key findings, barriers, and enablers and also linkages between food environment, diets, health and equity aspects in various studies in Benin. Findings are expected to contribute to public health efforts and the development of effective strategies aimed at improving food access and the dietary practices in poor and marginalized families in Benin. The research addressed the following key questions:

1. Which food environment types and dimensions, and individual factors have been studied in Benin, the Philippines, Sri Lanka, and Tanzania?
2. Which contexts of the four focus countries have been studied in the food environment literature (urban, rural, school, etc.), and when linking with consumers, which populations have been studied?
3. What are the key findings related to food environment characteristics, including food environment-related barriers and enablers to improved dietary intake, especially fruits and vegetables, and equity in food access across different populations in the four focus countries?
4. What food environment-related interventions have been implemented in the four focus countries to improve dietary intake, especially related to fruits and vegetables?
5. What study designs, methods, tools, and metrics have been used to assess food environments in the four focus countries, and from which academic disciplines?

By exploring these research issues, this review aimed to synthesize findings from descriptive studies relying solely on food environment data, as well as studies that examine and test the linkages between food environment, diets, health, etc. in FRESH focus countries. Therefore, it is not a requirement in the search terms or eligibility criteria for diet, health, equity, or environmental outcomes to have been measured, though articles should all be in the context of people's access to food.

2. Methodological Approach Adopted for the Systematic Literature Review

2.1. Search for publications

The review protocol followed a PRISMA 2020 inspired framework (Tugwell and Tovey, 2021) to ensure transparency and reproducibility. The review applied explicit eligibility criteria, a documented search strategy, structured study selection, and standardized data extraction procedures. Systematic searches were conducted in December 2022 in Web of Science and Scopus databases using search terms guided by a comprehensive food environment framework. Publications in English and French were included, with additional studies considered when an English abstract was available. Search strings combined terms related to studies were eligible if they focused on food environment, diets and health in Benin context, reported empirical or reproducible analytical results, addressed at least one core thematic area, and were published between 2000 and 2022.

2.2. Inclusion and Exclusion of Publications

Initially, all publications containing at least one food environment-related keyword in their title or abstract were identified and screened, while literature reviews were excluded. Studies conducted outside the FRESH focus countries (Benin) without clear relevance or transferability to the Beninese context were excluded, as well as opinion papers lacking empirical evidence, inaccessible full-text articles, duplicate records, and studies unrelated to food environments. Research from all disciplines addressing food environments was considered. Following the initial screening, studies that did not explicitly address any dimension of the food environment were excluded. To be eligible for inclusion in the systematic review, a publication had to contain at least one food environment-related term and provide evidence relevant to food access. Articles published in either English or French were considered. The primary criterion for study selection was the extent to which the publication examined at least one component of the food environment from a food access perspective, including factors influencing the availability, affordability, accessibility, or acquisition of food by individuals or households. This approach ensured that the review captured the broad range of determinants shaping food access within the Beninese food environment.

2.2.1. Inclusion criteria

The inclusion criteria are the following:

- Met at least one search term in each of the 4 themes (including within the 2000-2022 date range);
- Researched at least one element of food environments;
- English and French languages;
- Research reporting on FRESH focus countries, here Benin;
- Research studying food environments from the perspective of food access;
- Studied agricultural practices aimed at improving crop characteristics, including productivity when they directly impacted the access, affordability, or consumption of the target population. We do not include studies that increase food availability or affordability at the macro level without implications for individuals or households;
- Discussed plants for use as medicine only if they refer to food/dietary intake, interpreting food as medicine. We exclude studies that study the use of plants in the preparation of medicines such as tablets/pills/ointments, etc. Additionally, studies focused on testing a plant species' effectiveness in treating illness (e.g., through trials or lab experiments) are not included unless they relate to food access.

2.2.2. Exclusion criteria

The exclusion criteria are the following:

- Did not meet all of the inclusion criteria;
- Did not describe or assess food environments from the perspective of food access (e.g. agricultural literature that is focused on producers and increasing yields or agricultural markets, articles that discuss other supply chain activities with no assessment of food environment dimensions/domains, etc.);
- Studied agricultural practices aimed at improving crop characteristics, including productivity, unless they directly impacted accessibility, affordability or consumption -by the target population;
- Studied agricultural practices that aimed at reducing barriers to crop productivity from pest and viruses;
- Conducted genetic analysis, chemical laboratory testing and field evaluation of invasive species; diagnosis of plant diseases and pests. Similarly for animal diseases, we exclude studies based in laboratory settings with no explicit link to food environment;
- Evaluated soil quality and characteristics with no explicit link to food environment;
- Were conference abstracts, opinions, editorials, commentaries, global systematic reviews;
- Assessed dietary intake and/or associations between dietary intake and disease, but did not describe or assess any food environment determinants;
- Assessed the nutritional composition of specific food items, but not in the context of food environments;
- Studies reporting on focal county populations living elsewhere (e.g. migrant populations from Tanzania living in the USA);
- Global studies that do not focus specifically on the FRESH focus countries.

2.3. Data collection

Following the application of the inclusion and exclusion criteria, full texts of eligible publications were retrieved and reviewed in detail. A standardized data extraction framework was developed to ensure consistency across studies. Information from each publication was systematically recorded in a database and included bibliographic details (author(s), year of publication, and study location), study objectives, methodological approach, population characteristics, and key findings. Particular attention was given to identifying the food environment dimensions addressed in each study, the food sources or acquisition channels examined, and the indicators used to assess food access. Data were also extracted on the types of foods investigated, the settings in which food acquisition occurred, and the socioeconomic or environmental factors influencing access to food.

Where relevant, information on dietary outcomes, nutrition-related behaviours, and health implications associated with food environments were documented. To guide the identification and classification of relevant studies, an extended search framework was developed based on major food environment domains and food access determinants. The framework incorporated terms related to food environments, food acquisition sources, food environment dimensions, individual-level factors, food groups, and the geographical context of the review. In Table 1 is presented the complete list of search terms and keywords used to identify publications relevant to the Bénin food environment context.

Table 1. Extended search strategy and keywords used for the identification of studies on food environments and food access in Benin.

Theme		Framework Box Number	Terms
Food Environment and individual-level factors	Overarching food environment terms	1	"food environment*" OR "food desert*" OR "food swamp*" OR "obesogenic environment*" OR "nutrition* environment*" OR "neighborhood environment*" OR "neighbourhood environment" OR "retail* environment*"
	(OR) Formal and informal market types	1.1	"Supermarket*" OR "superstore*" OR "hypermarket*" OR "food mart*" OR "food outlet*" OR "corner shop*" OR "foodscape*" OR "traditional market*" OR "wet market*" OR "open-air market*" OR "open-air market*" OR "fruit* vegetable* market*" OR "fruit* and vegetable* market*" OR "vegetable market*" OR "fruit market*" OR "food vendor*" OR "street vendor*" OR "food retailer*" OR "food establishment*" OR "grocer*" OR "food chain store*" OR "chain food store*" OR "retail food market*" OR "food retail market*" OR "food shop" OR "fruit* vegetable* shop*" OR "fruit* and vegetable* shop*" OR "vegetable shop*" OR "fruit shop*" OR "green\$grocer*" OR "convenience store*" OR "superstore*" OR "superstore*" OR "food retail store*" OR "traditional store*" OR "food store*" OR "discount store*" OR "fast food store*" OR "dairy product* store*" OR "small store*" OR "corner store*" OR "co-op*" OR "food* market" OR "food* markets" OR "restaurant*" OR "take\$away*" OR "carry-out*" OR "online retail*" OR "kiosk*" OR "mobile vendor*" OR "farmer\$s market*" OR "canteen*" OR "sales directly from houses" OR "sales directly from homes".
	(OR) Wild and cultivated types	1.2	"Wild food" OR "wild edible" OR "non-timber forest product" OR "non-wood forest product" OR "food gather*" OR "hunt*" OR "forag*" OR "own production" OR "own-production" OR "homestead farm*" OR "garden*" OR "home\$garden*" OR "orchard*" OR "cultivated plots*" OR "field*" OR "forest*" OR "jungle*" OR "neglected species" OR "underutilized species" OR "agriculture* biodiversity".
	(OR) Food aid, services, and kin & community	1.3	"food aid" OR "food assistance" OR "food transfer*" OR "food barter*" OR "food sharing" OR "community food" OR "festival*" OR "food remit*" OR "school*" OR "hospital*" OR "prison*" OR "institutional food" OR "institutional meal*" OR "workplace*"
	(OR) Food environment dimensions	2	("Cost of" NEAR/5 "diet") OR "food\$born* illness" OR "food safety" OR ("food" NEAR/3 "advertise*")
	(OR) Individual-level factors	3	"Food access" OR "afford*" OR "desire*" OR "food preference*" OR "taste preference*" OR "food attitude*" OR "food accepts*" OR "convenience" OR "perceive* avail*" OR "perceive* afford*" OR "perceive* access" OR ("perception*" NEAR/3 ("avail*" OR "afford*" OR "access*")).
(AND) Food		n/a	"Food*" OR "grain*" OR "cereal*" OR "rice*" OR "potato*" OR "vegetable*" OR "fruit*" OR "leafy green" OR "veg" OR "nut*" OR "legume*" OR "pulse*" OR "bean*" OR "egg*" OR "dairy" OR

Theme	Framework Box Number	Terms
		"dairies" OR "milk*" OR "yogurt*" OR "cheese*" OR "fish*" OR "seafood*" OR "meat*" OR "sugar-sweetened beverages*" OR "high fat" OR "high sugar" OR "high salt" OR "diet*" OR "eat" OR "eating" OR "nutr*" OR "snack*" OR "greens" OR "arugula" OR "broccoli*" OR "cassava green*" OR "collard*" OR "endive*" OR "kale*" OR "lettuce*" OR "spinach" OR "chard" OR "purslane" OR "carrot*" OR "pumpkin*" OR "squash*" OR "sweet potato*" OR "artichoke*" OR "asparagus*" OR "beet*" OR "bitter melon*" OR "Brussels sprouts*" OR "cabbage*" OR "celery" OR "corn" OR "cucumber*" OR "eggplant*" OR "fennel" OR "leek*" OR "gourd*" OR "mushroom*" OR "okra*" OR "onion*" OR "pepper*" OR "radish*" OR "zucchini*" OR "apple*" OR "avocado*" OR "banana*" OR "baobab fruit*" OR "blackberry*" OR "blueberry*" OR "cashew fruit*" OR "cherr*" OR "cranberry*" OR "durian" OR "elderberry*" OR "figs" OR "gooseberry*" OR "grapefruit*" OR "grape*" OR "guava*" OR "melon*" OR "jackfruit*" OR "kiwi*" OR "litchi*" OR "nectarin*" OR "orang*" OR "peach*" OR "pear*" OR "pineapple*" OR "plum*" OR "pomegranate*" OR "pomelo*" OR "prune*" OR "rambutan*" OR "raspberry*" OR "soursop" OR "guanabana" OR "star fruit*" OR "strawberry" OR "tangerine*" OR "apricot*" OR "cantaloupe*" OR "mango*" OR "papaya*" OR "passion*" OR "persimmon*".
(AND) Context/Setting	n/a	Benin* OR Tanzania* OR "Sri Lanka*" OR Philippines OR Filipino.
(AND) Year	n/a	2000 - 2022

Searching Topic (TS), It searches for Title (TI), Abstract (AB), Author Keywords and Keyword Plus.

2.4. Framework to Guide Research Questions and Search Strategy

The framework (Figure 1) adopted for this scoping review builds on previous frameworks developed by Turner *et al.* (2020), Downs *et al.* (2020) and Bogard *et al.* (2021), which together propose a typology of food environments, as well as food environment dimensions that interact with individual-level factors to determine food acquisition, diet, health, equity, and environmental outcomes. Study selection followed the PRISMA 2020 workflow (Figure 2). During the identification stage for all countries, 12,566 records were retrieved, including 4,055 duplicates. After removing duplicates, titles and abstract screening of the remaining 8,451 records follows, 7,825 records were excluded due to irrelevance as they did not describe or assess food environments from the perspective of food access or do not focus specifically on the FRESH focus countries. A total of 626 full-text articles were assessed for eligibility leading to the exclusion of 45 studies after full-text review. The remaining full-text articles were evaluated against the inclusion criteria and separated by a focus country. Ultimately, 84 studies were included in the systematic synthesis for Benin context. Additional references were cited to provide historical background, conceptual framing, and contextual discussion.

An extraction matrix was developed in Excel by piloting the extraction of data from studies and creating field headings aligned with the study objectives. For included studies, data were extracted for each study using broadly the following fields: study country, aim/objective(s), type of food environment (wild vs. cultivated), method or measure used to measure the food environment, key food environment characteristic/s measured, and key findings concerning the food environment measurement. Out of the retrieved articles, 84 met the eligibility criteria for full-text review, synthesis and analysis of extracted information to prepare country summaries.

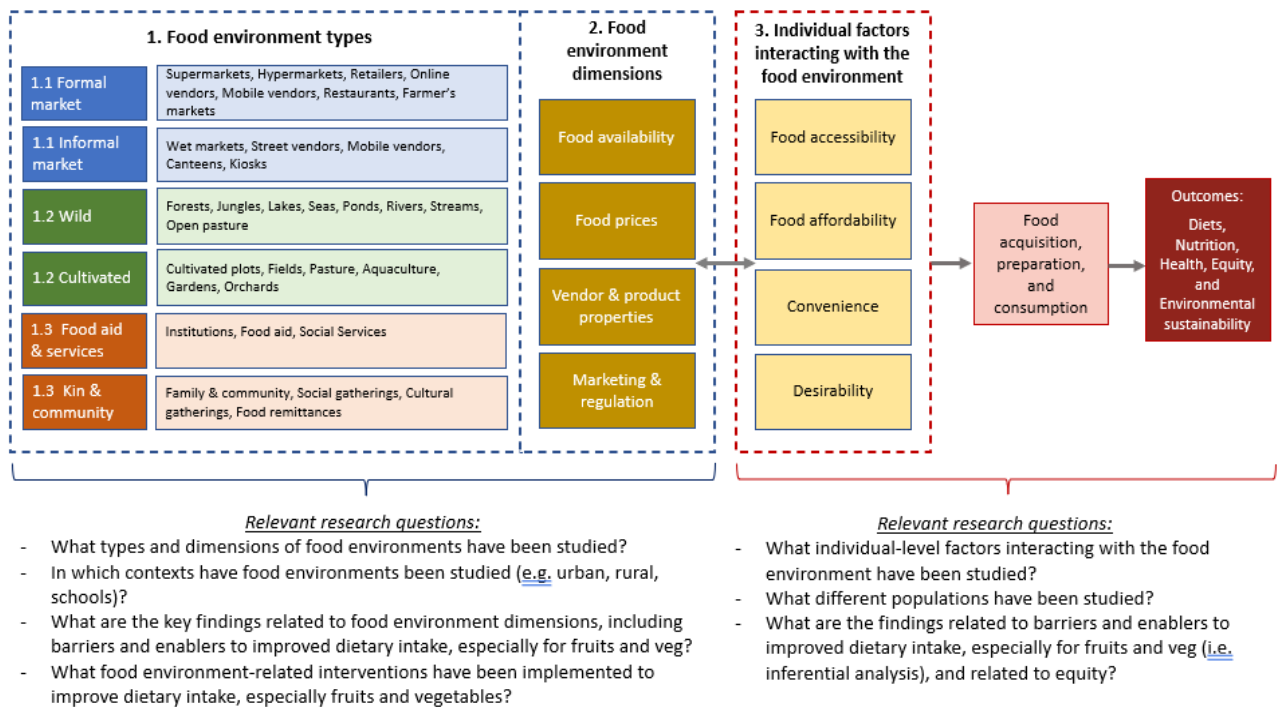


Figure 1. Framework on food environment type, dimensions, and interactions with individuals

Adapted from Turner *et al.* (2020), Downs *et al.* (2020) and Bogard *et al.* (2021)

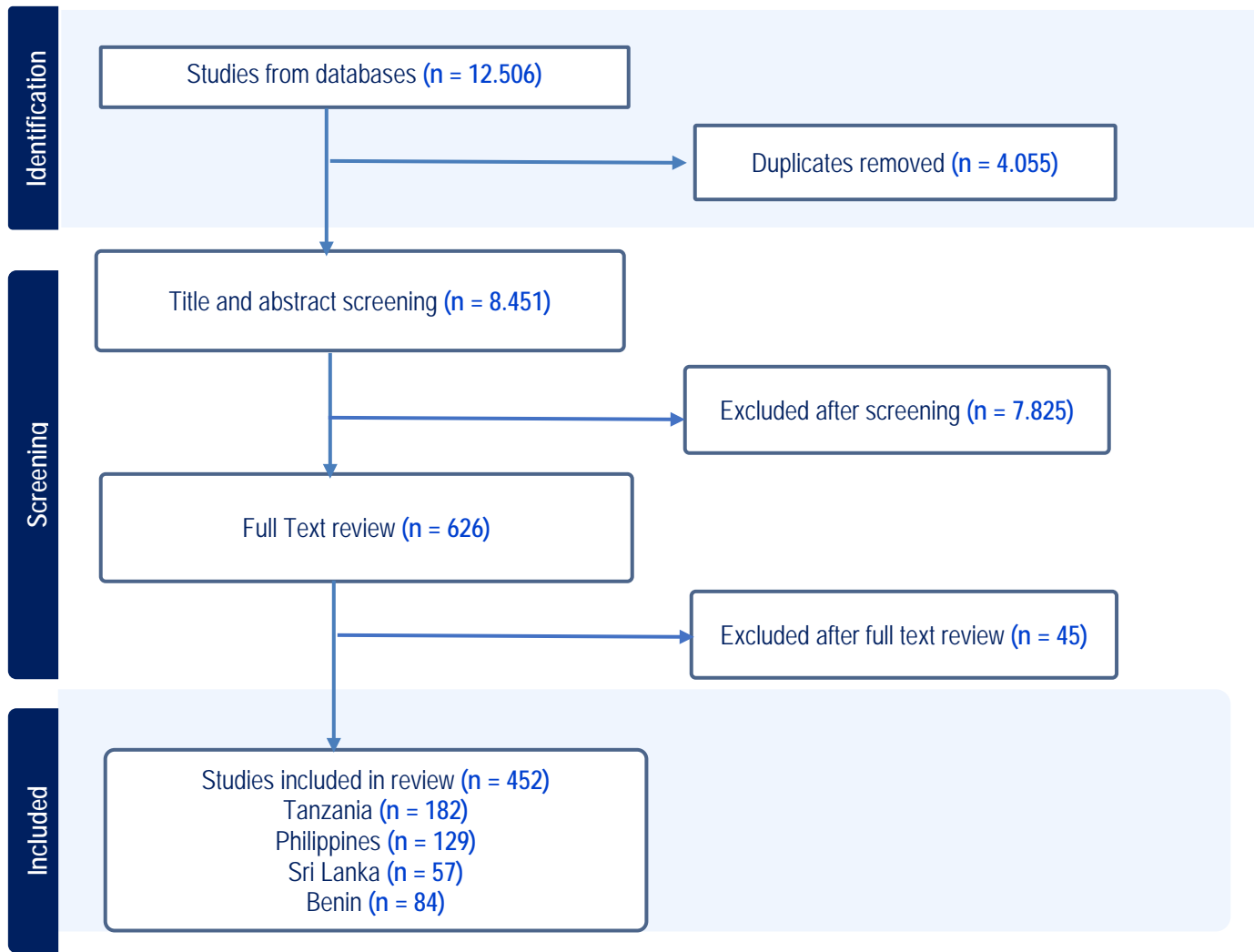


Figure 2. PRISMA 2020 flow diagram of study selection

PRISMA = Preferred Reporting Items for Systematic reviews and Meta-Analyses

3. Findings and Results from a Systematic Review

3.1. What methods, research designs, and types of data have been used to study and characterize food environments?

Out of the 84 studies, 83% collected primary data, and 6% used secondary data, while 11% used both. More than 70% of the studies reviewed employed quantitative methods, with 19% using mixed methods and only 11% employing qualitative methods. Among quantitative studies, only 15% were evaluations, of which 6% applied RCTs. Here 55% of the studies used cross-sectional data and 33% utilized longitudinal designs (Table 2). In Benin, few studies emphasized the importance of qualitative methods as essential tools for understanding complex and specific aspects of food systems that are often missed by quantitative approaches. Sodjinou, (2006) assess food composition tables commonly used in Benin by organizations and laboratories dealing with food composition data through purposive and convenience-based sampling approaches based on their relevance and access to those data. Behnassi *et al.* (2013) predominantly use qualitative strategies in their studies: purposive sampling, case study, community, participatory approaches, etc. Other papers also pointed out common uses of convenience sampling.

Assim *et al.* (2019) employed a purposive sampling process to collect 30 samples from grilled meat vendors in three urban districts in Cotonou, Benin. Locations and vendors have been selected based on accessibility and availability rather than a randomized or systematic procedures. They also consider feasibility, time, and resource constraints typical of field studies in food microbiology. Among papers which consider non-random selection, Gbedomon *et al.* (2017) applied a mixed sampling strategy through a purposive sampling to select convenient agroecological zones and households, adding to a random sampling to choose home gardens within those environmental zones that had a functioning home garden for data collection. Using mixed methodologies Lawin *et al.* (2019) combined surveys with purposive sampling of regions. Their study employed a probability-based stratified sampling approach grounded in pre-survey data, and relied on statistical formulae to ensure adequate representation of *Cola milenii* a wild food product, across the study area. Sagbo *et al.* (2022) also used probabilistic sampling, specifically a two-stage cluster sampling method stratified by urban and rural areas. Most quantitative papers pointed out common uses of cross-sectional data. In Figure 3 are shown the design features, according to studies on food environments.

Table 2. Study designs, methods, and types of data used in articles reviewed (n = 84)

Design feature	Number	Proportion (%)	Design feature	Number	Proportion (%)
	of studies			of studies	
Type of data used:			Study objective:		
Primary only	70	83	Evaluation	12	15
Secondary only	5	6	Conceptual	1	1
Primary and secondary	9	11	Observation	7	8
Study objective:			Inferential statistics	1	1
Descriptive	53	63	Methods used:	%	
Observational	9	11	Quantitative	59	70
			Qualitative	9	11

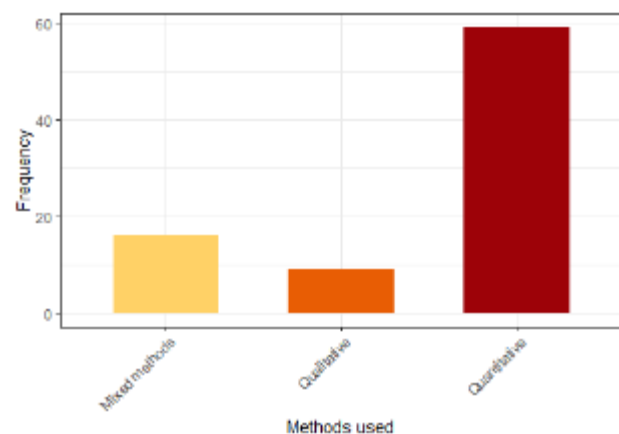
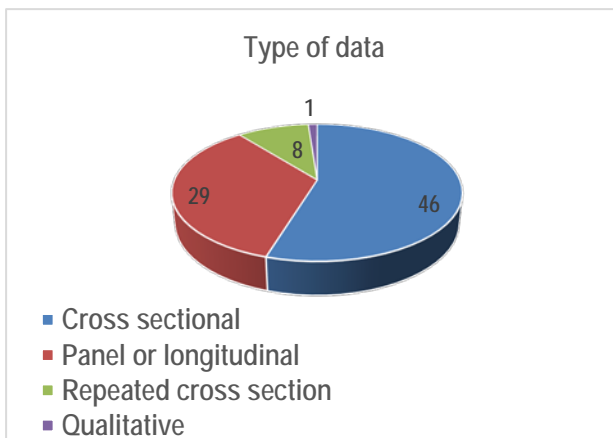


Figure 3. Design features according to studies on food environments

3.2. In what contexts have food environments been studied?

In our review, 28 studies focused on rural areas, followed by 21 in urban areas and 27 in both (Figure 4). Research in the peri-urban food environments was limited, with only 3 studies focusing on this area. However, 5 studies inadequately delineated the context when referencing markets or populations, failing to indicate whether the sampled demographic was rural, urban, peri-urban, or mixed. The rich agrobiodiversity that abounds in cultivated or wild foods in rural areas contrasts with malnutrition issues in these villages. Boedecker *et al.* (2014) found that rural populations, despite being surrounded by the extraordinary biodiversity of Wild Edible Plants naturally grown in their area surrounding the Lama Forest, face food

insecurity and malnutrition. This is due to preparation and conservation challenges, which limited their wider use, and more research is needed to understand the nutrient composition, cultural, and market value of WEPs. Also, Koukou (2022) emphasized the importance of local agrobiodiversity in meeting the nutritional needs, especially micronutrient deficiencies, of infants and young children aged 6 to 23 months. Meanwhile, Hougbenou Hounou *et al.* (2019) have identified high microbial contamination in three leafy vegetables in urban gardening at Porto-Novo, Benin, which increase health risk in consumers and call for interventions to improve the microbial quality of leafy vegetables cultivated in urban areas.

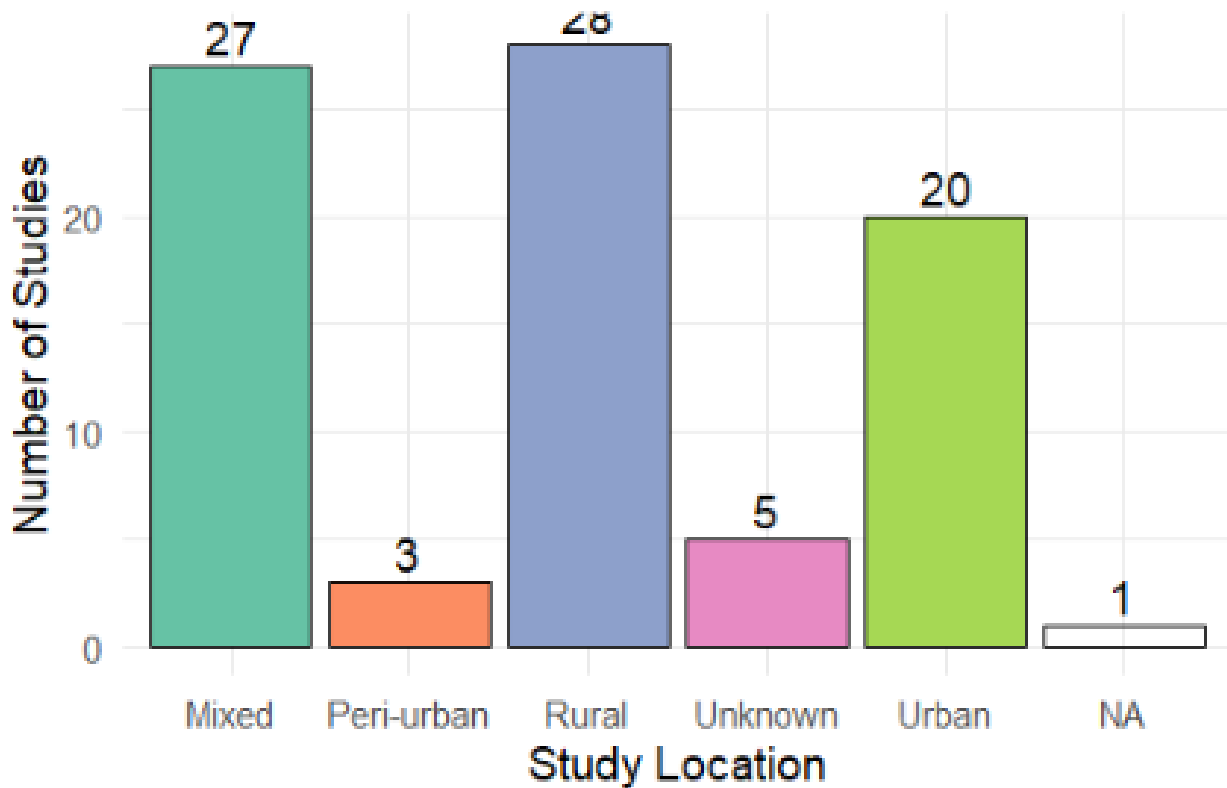


Figure 4. Context in which food environments have been studied (N = 84)

3.3. Which different populations and contexts have been studied?

The populations studied encompassed both female and male participants. Only a few studies focused exclusively on females, such as women of reproductive age from 15-49 years old, women caregivers, non-pregnant and non-lactating women (Ekué *et al.*, 2010; Alaofe *et al.*, 2019; Valenti and Alaofè, 2020; Figure 5). Additionally, some studies pointed out scholars' food environment, and the study participants included school teachers, traders/retailers, consumers of various foods and food products, and community members at the household level (Mitchikpe *et al.*, 2009; Delisle *et al.*, 2013; Sagbo *et al.*, 2022).

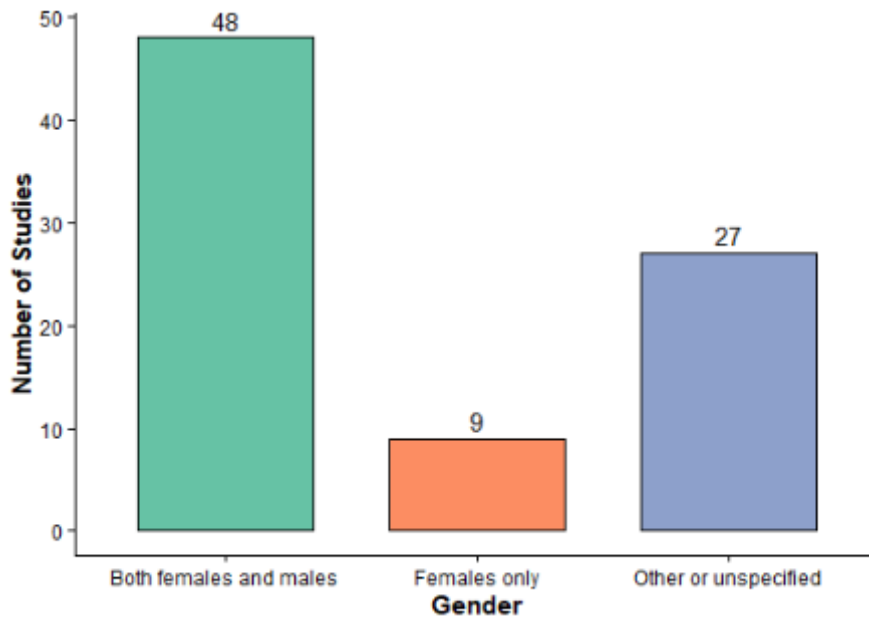


Figure 5. Different populations studied

3.4. How have studies focused on fruits and vegetables?

Few studies have focused on fruits and vegetables in food environment papers (figure 6). Thirty-one (31) out of 84 studies focused on fruits and or vegetables. The main areas of study included: 13 studies focused on food safety of commonly consumed vegetables, 1 study focused on dietary diversity of which fruits and vegetables are subgroups being measured or assessed, 7 studies focused on commonly grown and consumed fruits and or vegetables at household levels, 8 studies on assessment of nutrient content in fruits and vegetables, 8 study on the influence of vegetable consumption on health outcomes specifically on obesity.

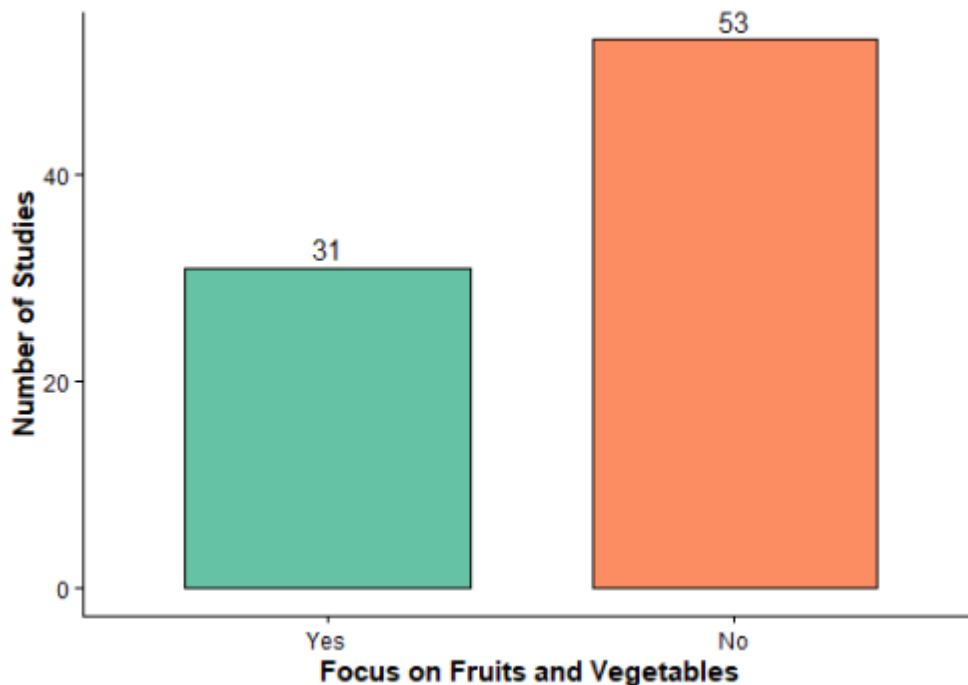


Figure 6. Studies on fruits and vegetables

3.5. What types of food environments were studied?

Cultivated food environments were the most researched in Benin (38 studies), followed by informal market food environments (35 studies), then closely by wild (30 studies), and finally with 15 studies focused on formal food environments (Figure 7). Cultivated food environments were the most researched in Benin with 39 studies, followed by informal markets with 31 studies, and then closely by wild food environment with 28 studies (Figure 7). The Food and aid services were the least studied with only 7 studies found (Figure 7). The limited attention to studying food and aid services shows the insufficient role of the public sector in improving food and nutrition security. Market gardens and cultivated plots were the most reviewed food environments within the cultivated food environment with respectively 11 and 14 studies out of 39 studies. Alaofè *et al.* (2019) stated that solar market gardens were installed in collaboration with local women's farmers' groups to improve food security and child nutrition status in Kalalé District and suggested that the production of fruits and vegetables could be a strategy to enhance their availability, diversity, and quality. Supermarkets and restaurants were the most reviewed food environments within the formal markets' food environment with respectively 4 and 3 studies out of 17 studies. Street vendors were the most reviewed food environments within the informal markets' food environment with 16 studies out of 31 studies. Forests and agroforestry were the most reviewed food environments within the wild food environment with 23 studies out of 28 studies. Achigan-Dako *et al.* (2011) indicated that the most vegetables prepared in households are collected from wild resources and only a few came from cultivation as species richness is higher in wild food environments.

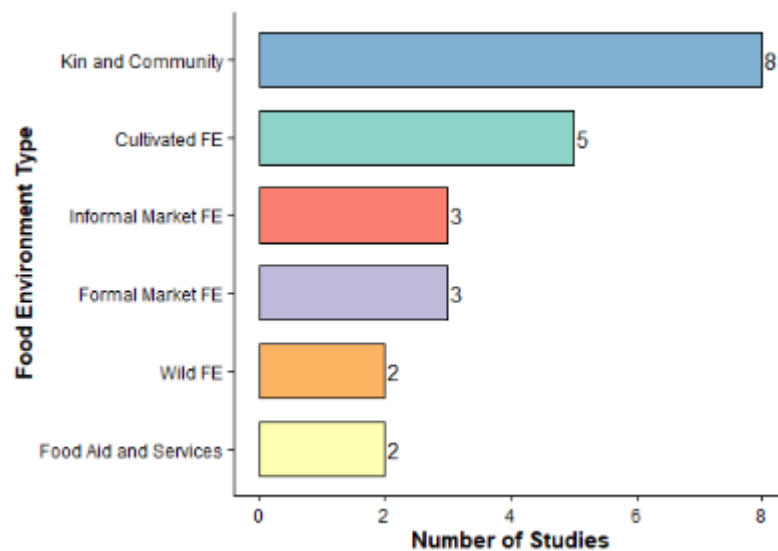


Figure 7. Type of food environments

Social and cultural gatherings and family and community were even reviewed within the kin and community food environment with 8 studies each out of 16 studies. Alaofè *et al.* (2019) found that kin and communities are important factors that influence the access and use of fruits and vegetables by local people. The paper states that kin refers to the biological relatives of a person, such as parents, siblings, spouses, children, cousins, etc., who may share the same household or live in different households within the same village or nearby villages. Kin may have similar preferences and knowledge of fruits and vegetables, as well as access rights and responsibilities for their management and conservation. Community refers to the social group of people who live in the same geographical area, such as a village or a cluster of villages. Community members may belong to different ethnic groups, religions, or socio-economic statuses, but they share a common culture, language, and environment. Assogbadjo *et al.* (2019) also mentioned that kin and community are important factors that influence the access and use of *C. millenii* by local people. The paper states that kin refers to the biological relatives of a person, such as parents, siblings, spouses, children, cousins, etc., who may share the same household or live in different households within the same village or nearby villages. Kin may have similar preferences and knowledge of *C. millenii*, as well as access rights and responsibilities for its management and conservation. Community refers to the social group of people

who live in the same geographical area, such as a village or a cluster of villages. Community members may belong to different ethnic groups, religions, or socio-economic statuses, but they share a common culture, language, and environment.

3.6. Which dimensions of the food environment have been researched?

The framework guiding our review included four dimensions of the food environment (availability, prices, vendor and product properties, marketing and/or regulation) and four individual factors (accessibility, affordability, convenience, and desirability), as adapted from Turner *et al.* (2018). We examined studies encompassing all eight dimensions of the food environment (personal and external domains). Some studies addressed multiple dimensions of the food environment. Notably, the external domain, particularly the dimension of availability had more coverage compared to the personal domain. However, the personal domain's affordability dimension had the highest number of studies. Aspects such as marketing, vendor and product properties, and convenience within the food environment are notably underexplored in existing studies (Figure 8). Food availability is the most studied dimension of food environment (30 studies), followed by food prices (23 studies). Accessibility is the most studied individual factor related to food environment (19 studies, followed by affordability (15 studies) and desirability (14 studies).

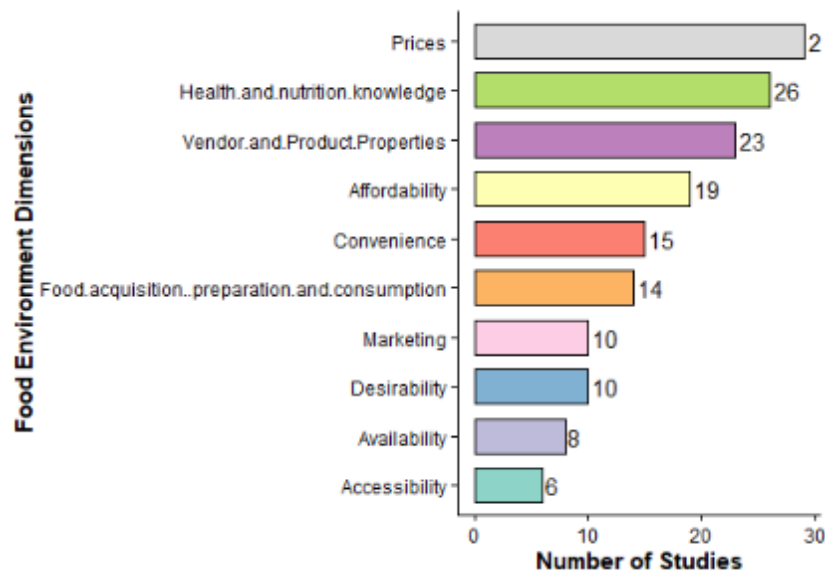


Figure 8. Food environment dimensions

3.6.1. Food Availability and accessibility

Availability dimension has been examined in many studies through field visits and interviews with local populations, surveys to assess presence plants species from wild food environment. These studies include the work of Assogbadjo *et al.* (2013), Boedecker *et al.* (2014), Hounsou-Dindin *et al.* (2022), Koukou *et al.* (2022), etc. These studies have pointed out the declining availability of wild foods due to human activities such as overharvesting for commercialization and land clearance for agriculture, limited land access and population's perceptions about wild species. Wild plants domestication and home gardens have been advocated as solutions to avoid extension of wild foods and increase their seasonality and availability. These foods are found to have the potential to enhance dietary intake, nutritional status, household food security, and the overall nutritional well-being of all household members. Availability is studied in the context of a product's diversity and abundance or not through a season or the year in the region. Some studies captured the seasonality of foods available throughout the year. For instance, N'danikou *et al.*, 2011 investigated on food availability in different seasons. The paper reports that wild edible plants are available in different seasons and habitats in the study area. In the same way, Assogbadjo *et al.* (2019) found that *C. millenii* is available in different seasons and habitats in the study area. This paper also indicates that *C. millenii* has a high diversity and abundance in different regions of Benin and that some species are available throughout the year, while others are seasonal or rare.

3.6.2. Food Desirability and Convenience

Most of the study's results showed that prices paid by consumers for foods were based on quality attributes that match consumer preferences (Assogbadjo *et al.*, 2005; Naseem *et al.*, 2013; Koukou *et al.*, 2022). Consumers are often more attracted to imported food products than domestic products. Naseem *et al.* (2013) indicated that differences between parboiled rice and raw rice relate to nutrition, convenience and that consumers are more concerned with the energy and time savings attributes found in imported rice than local rice. Also, consumers' preference for imported tomato double concentrate could be explained by its affordable price and its technical quality attributes (bright red colour, consistency) (Houessou *et al.*, 2019). Origin of foods is heavily a significant factor in consumer decisions as well. Videgla *et al.* (2016) demonstrate that consumer prefer agonli kluiklui for its specific qualities like taste, seasoning, aroma and crispness. Local people have different preferences and criteria for selecting food products. Lawin *et al.* (2019) indicates that *C. millenii* is desirable to local people who value it for its taste, nutritional, medicinal, cultural, and religious significance. However, availability, abundance, palatability, edibility, usefulness, and rarity cool also be criteria for food selection.

3.6.3. Food Prices and Affordability

Food is not often affordable in Bénin, especially those with micronutrient such as iron for children aged 6–59 months in Benin. This generates special consideration in some studies which reveal that food prices are reduced and affordable for the rural population with limited incomes using local food ingredients. For example, a complimentary nutritious food is formulated using *Adansonia digitata* fruit pulp, *Moringa oleifera* leaf powder, and *Cochlospermum tinctorium* root powder to supplement his deficiency (Affonfere *et al.*, 2021). Zannou *et al.* (2022) suggests that large-scale production of traditional fermented foods serves as healthy income sources for indigenous communities, ensure good nutrition, food safety, and help reduce poverty and hunger, indirectly implying economic benefits. Specific conditions and challenges also impact agricultural inputs and cause the decline in food availability, accessibility, diversity, and safety (Houessou *et al.*, 2021). This work highlights that the significant rise in food prices during the COVID-19 pandemic forced vulnerable groups to buy lower-quality food and reduced their ability to purchase fresh and healthy food. Honfoga *et al.* (2018) also discuss the role and impact of price on food consumption patterns in Benin which include price instability and trends, market integration of foods (imported or local foods), market analysis and the impact of processing foods. These pointed out the influences of marketing in food availability and consumption patterns. Fruits and vegetables are sold as a source of income (N'danikou, 2011; Assogbadjo, 2019). However, there are barriers to accessing food within specific populations such as schools (Van den Briel *et al.*, 2000; Ohin *et al.*, 2018; Nago *et al.*, 2010; Nago *et al.*, 2012). Nago *et al.* (2012) found that for students in private schools, the price was not considered as a constraint to the purchase of fruits and vegetables, as they can buy fruits and even expensive exotic fruits (strawberries, raspberries, grapes) in supermarkets. However, in public schools, financial means were an important constraint, which explains why public-school students reported eating more fruits when they were at home than outside. N'danikou *et al.* (2011) imply that wild edible plants are affordable to local people who do not have to pay for them or pay very little when they buy them from local markets or vendors in the village instead of in a formal market.

3.6.4. Food Vendors and Products Properties

Improving vendor practices, regulating their product safety, hygiene, visual quality, and enhancing fruit availability could significantly boost healthy eating among students and encourage adolescents from consuming fruits and vegetables sold in or around schools. Nago *et al.* (2012) discuss vendors in school settings and point out the lack of formal food policy in schools, which allows vendors to operate without any regulation, and this impacts adolescents' consumption habits. Many students preferred eating fruits and vegetables only at home for more safety, as they perceive fruits and vegetables sold by vendors at school or on the streets as unhygienic, even if cleaned, and fear microbes, worms, and unclean preparation. Exploring the vendors' practices and the product properties of boiled hypocotyls in Benin, Ohin *et al.* (2018) argue that vendors would need branding, hygiene training, attractive packaging, and consumer education.

3.6.5. Marketing and/or Regulation

Food vending businesses lead consumer choices, but marketing efforts are necessary. So, researchers touched on several marketing-related aspects that affect how fruits and vegetables are perceived and consumed by adolescents and adults. For example, unhealthy foods (like biscuits and sweets) were more attractive to students because they were nicely packaged and well presented, unlike fruits and vegetables (Nago *et al.*, 2012). This reflects the power of packaging and visual appeal, a core concept in marketing and align with Probst *et al.* (2012) who revealed that vendors prioritize visual quality and emphasized the need to address appearance concerns of organic produce, which should meet expectations for colour, freshness, and cleanliness to compete with conventionally grown vegetables. Some studies also assessed the effects of marketing on the willingness-to-pay and preferences of both vendors and consumers. Although marketing alone won't be enough to drive systemic change in vegetable production, concentrating marketing efforts and additional awareness campaigns aligned with consumer values and education could help make fruits and vegetables more "marketable".

3.6.6. Food Acquisition and Preparation

Fruits and vegetables can be consumed in different forms and dishes, such as soups, sauces, salads, snacks, drinks, or condiments. Alaofe *et al.* (2019) describes two ways of getting access to fruits and vegetables as a food source and various methods and techniques to process and prepare them, such as boiling, frying, roasting, pounding, grinding, soaking, fermenting, drying, or smoking. Lawin *et al.* (2019) describes how population utilize wild edible plants as food sources and states that local people have the knowledge and skills to identify, harvest, process, and prepare the edible parts of the plants. Zannou *et al.* (2022) presented nutrient enrichments in fermented food and beverages and raw materials used for their preparation using indigenous processing techniques.

3.6.7. Health and nutrition knowledge

To improve food safety and access health risk assessment for the Beninese consumer, many studies discuss nutritional quality and hydrocarbons contamination (Assim *et al.*, 2019; Ohin *et al.*, 2018; Moussé *et al.*, 2020; Hougbenou Hounouglou *et al.*, 2019; Iko Afé *et al.*, 2020). The presence of potential pathogenic yeast in milk products calls for further investigation to assess product quality, including nutritional quality and safety (Sessou *et al.*, 2019). Some food resources are not consumed much and are neglected or underutilized. Koukou *et al.* (2022) pointed out the lack of knowledge about the nutritional potential of wild food species in the diet of rural populations. The adolescents' nutrition and health knowledge were the most discussed personal determinant after their preferences. Globally, participants from the 4 schools had a good knowledge of the benefits of eating fruits and vegetables (Nago *et al.*, 2010). These guide several studies on the levels of food contamination and prevalence of food transmitted pathogens in African countries (Manani *et al.*, 2006; Kombat *et al.*, 2013; Kpodekon *et al.*, 2013; Ndahi *et al.*, 2014) and the prevalence data varies greatly across studies.

4. Analysis and Equity Dimensions in Food Environment Research in Bénin

The review identifies current and future research needs in the African food environment, particularly, research priorities on food environments in Benin. We have indicated a large number of studies that used primary data which may indicate a lack of publicly available secondary data on food environments in Benin. While most studies were based on quantitative data, analyses presented were primarily descriptive and/or observational in nature and these largely used non-rigorous designs, such as cross-sectional evaluations. As few studies use qualitative approach, researchers did not deeply investigate on food environments to understand experiences and perceptions at individual levels. There was a limited representation of peri-urban contexts compared to other contexts. This may be problematic given that these areas are transitional zones between rural and urban settings which experience constant population change, as well as shifts from traditional social, environmental, and economic characteristics, all of which have implications for food environments and diets.

According to equity dimensions in food environment research in Bénin, 28% of the reviewed studies implicitly or explicitly address dimensions related to social disparities, socioeconomic inequalities, territorial inequalities, gender inequities, nutritional vulnerabilities, marginalization, unequal food access, health inequities, or differentiated exposure to food and environmental risks within food and nutrition systems in

Bénin. Boedecker *et al.* (2014), Koukou *et al.* (2022) and Segnon & Achigan-Dako (2014) highlighted rural inequalities through the unequal access to diversified diets, children and women nutritional disparities, geographical disparities, the marginalization of forest communities and the differentiated access to food resources especially wild edible plants to women's diets. Nago *et al.* (2012), Honfoga *et al.* (2018), Affonfere *et al.* (2021) also stated socioeconomic inequalities in Food Access, price instability and economic vulnerabilities. Alaofe *et al.* (2019), Valenti and Alaofè (2020) show how gendered dietary inequalities, women's food access influence consumption of fruits and vegetables among women's groups. Further, Ouendo *et al.* (2005), Deleuze Ntandou Bouzitou *et al.* (2005) discuss poverty in primary health care, inequity in health access, social exclusion in poor urban areas. In addition, De Caluwé *et al.* (2009), Heubach *et al.* (2013) and Lawin *et al.* (2019) assess ethnic disparities, unequal valuation of food species due to ethnic and cultural differences in food practices especially about traditional food resources, sociocultural inequalities. Finally, Koumolou *et al.* (2013), Hounouglou *et al.* (2019), Ingenbleek *et al.* (2020) also showed health and environmental vulnerabilities, unequal food safety risks due to some people communities' exposure to chemicals and food contamination, microbial contamination of leafy vegetables in sub-Saharan Africa using case studies from Benin. However, despite documenting disparities in food access, nutritional vulnerability, affordability, gendered food practices, and environmental exposure, very few studies explicitly conceptualize these findings within a social equity or nutrition equity framework.

While a single, all-encompassing systematic Literature review dedicated strictly to the "equity lens" of Benin's nutrition research does not exist, broad thematic reviews—such as those by the CGIAR and the FAO—highlight distinct trends on how food and nutrition studies in Benin integrate equity, gender, and socio-economic disparities (Amoussa Hounkpatin *et al.*, 2020; FAO *et al.*, 2023; Norris *et al.*, 2023; Mitchodigni-Houndolo *et al.*, 2024; Totin *et al.*, 2026).

- **Current State of Nutrition Research in Benin:** Food and nutrition research in Benin predominantly focus on the following three interconnected areas (Amoussa Hounkpatin *et al.*, 2020; FAO *et al.*, 2023; Norris *et al.*, 2023; Mitchodigni-Houndolo *et al.*, 2024; Totin *et al.*, 2026):
 - ✓ **The Double Burden of Malnutrition:** Examining the paradox of persistent childhood stunting (32-36%) and micronutrient deficiencies (like anaemia), alongside rising rates of urban adult obesity.
 - ✓ **Food Environments and Dietary Diversity:** Documenting the transition from natural food environments to build ones, showing that nutritious foods are often unaffordable or unavailable to low-income populations, particularly in northern Benin.
 - ✓ **Value Chain and Agricultural Studies:** Analyzing how production (e.g. vegetables like jute mallow, okra, African eggplant) connects to human health, economic livelihoods, and food security.
 - ✓ **Integration of the Equity Lens:** Research literature in Benin addresses equity primarily through a gender and socio-economic framework rather than universal structural inequality as following (Amoussa Hounkpatin *et al.*, 2020; FAO *et al.*, 2023; Norris *et al.*, 2023; Mitchodigni-Houndolo *et al.*, 2024; Totin *et al.*, 2026):
 - ✓ **Gender Roles and Agency:** A significant portion of research evaluates how women's empowerment (e.g. their decision-making power and income) directly influences household food security. Studies show that while women are the primary food providers and processors, they often face resource deprivation.
 - ✓ **Intervention Successes:** Research specifically highlights that gender-transformative interventions (e.g. women-focused micro-irrigation programs in northern Benin) effectively increase vegetable intake, reduce anaemia, and increase household dietary diversity.
 - ✓ **Urban vs. Rural Disparities:** Literature routinely disaggregates data across agroecological and socio-economic axes, identifying that children in rural regions and low-income households are significantly more vulnerable to stunting and food insecurity than their urban/wealthy counterparts.

Concerning gaps and future directions, Amoussa Hounkpatin *et al.* (2020), Norris *et al.*, (2023), Mitchodigni-Houndolo *et al.* (2024) and Totin *et al.* (2026) mentioned that despite the inclusion of gender and location-based metrics, systematic reviews identify that the overarching equity lens in Beninese nutrition research often falls short. Many studies remain "gender-sensitive" rather than "gender-transformative", often overlooking marginalized groups such as the disabled, ethnic minorities, and adolescents.

5. Conclusion

Cultivated food environments are the most studied food environment type. Within cultivated food environments, food availability and prices influence consumption patterns. The review also reveals that perceptions about food safety strongly influence food choices among consumers. Marketing of unhealthy snacks and fast food are particularly targeted to students and adolescents through school canteens, mobile vendors around schools and the mass media influence. Meanwhile, food labels and nutritional quality of foods may not have much influence compared to visual attributes of products. Adolescents perceive eating fruits and vegetables at home being healthier and safe as fruits and vegetables qualities around or at school is questionable. Added to media influence as an indirect marketing channel, shaping perceptions and influencing behaviours, strategies like branded school stalls, attractive fruit packaging, informative posters, social media content, and family engagement with adolescents may be utilized to increase awareness on fruits and vegetables consumption. There is mixed evidence with regards to the extent of microbiological and heavy metal contamination in meats and vegetables, and urban markets pose higher risk. There is also low evidence on the contribution of home gardens to diet quality: greater plant species diversity is not associated with diet diversity, but enhancing home gardening through domestication of wild food products, training and other inputs can improve intake of certain micronutrients and promote neglected foods. Moving forward, there is a need for more food environment studies in Benin to test interventions that may enhance diets in the context of the double burden of malnutrition, in both urban and rural contexts. Qualitative research that incorporates deep and more comprehensive food environment investigations will also provide an important evidence base to inform and adapt policies and programs to increase fruits and vegetable consumption in Benin.

6. Statement and Declarations

6.1. Conflict of interest

The authors declare that they have no conflict of interest.

6.2. Ethics, consent to participate, and consent to publish

The methods for this research were considered by the World Vegetable Centre Institutional Review Board. Participants provided appropriate informed consent to participate.

6.3. Author contributions

All authors contributed to the study.

Raoudath A. O. BOURAIMA: Conceptualization, data curation, formal analysis, investigation, methodology, project administration, visualization, writing – original draft, writing – review and editing.

Nadia FANOU FOGNY: Conceptualization, design, methodology, supervision, writing – review and editing.

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