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Assessment of the influence of food security, eating pattern and physical activity on nutritional status among lactating women in Bujumbura, Burundi

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EAST AFRICAN NUTRITIONAL SCIENCES INSTITUTE

(EANSI)

Masters in Food Sciences and Nutrition

ASSESSMENT OF THE INFLUENCE OF FOOD SECURITY, EATING PATTERN AND PHYSICAL ACTIVITY ON NUTRITIONAL STATUS AMONG LACTATING WOMEN IN BUJUMBURA, BURUNDI

By

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THESIS

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Under the direction of: Prof. Dr. NAHIMANA Hilaire (director)

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Assessment of the influence of food security, eating pattern and physical activity on nutritional status among lactating women in Bujumbura, Burundi

Identification of members of jury

i. Pr. Dr. Ir NIYUKURI Jonathan: President of the Jury

ii. Ir. MUVUNYI Robert: Secretary of the Jury

iii. Dr. NAHIMANA Hilaire: Member of the Jury

Dedication

This book is dedicated to:

My lovely husband to be, Abeli Sadock Nfukamo

My family, both of Mr. and Mrs. Pastor Leonard Mkwandu Mnyani and of Mr. and Mrs. Pastor Sadock Nfukamo Ntaliligwa

All lactating women, nutritional and health workers in Bujumbura, Burundi

For their committed support towards the accomplishment of this work

Acknowledgement

I would like to give first thanks to ALMIGHTY GOD who is my all-time supporter in all matters of life and study.

I would also like to provide my gratitude to the members of jury who contribute in improving the quality of this work so it can be more and easily understood by the community.

I also provide my acknowledgements to different people who supported me in accomplishment of this work. Firstly, to my beloved husband to be, Abeli Sadock Nfukamo for all of his effort, energy, time and sacrifices. He was always there in supporting me at school. Secondly, to my parents, Mr. and Mrs. pastor Leonard Mkwandu Mnyani, Mr. and Mrs. Pastor Sadock Ntaliligwa Nfukamo for their heartily and indeed support, prayers and encouragement.

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Abstract

Lactating women have increased nutritional requirements to maintain maternal health and support optimal infant growth. This study assessed the influence of food security, eating patterns and dietary diversity, daily physical activity on nutritional status among lactating women in Bujumbura. A one-month cross-sectional study using consecutive sampling was used. Data were collected using structured questionnaires on socio-demographic and obstetric characteristics, dietary diversity assessed by the Minimum Dietary Diversity for Women (MDD-W), food security classified according to WHO/FAO guidelines, physical activity measured in MET-minutes/week, and anthropometric measurements. Among 384 participants, 53.3% were aged 20-30 years, 92.7% were married, 64.8% were unemployed, and 72.7% had attained at least secondary education. Most women were 1-4 months postpartum (44.8%) and had fewer than three children (61.8%). Achieving minimum dietary diversity was protective against underweight (AOR = 0.274; 95% CI: 0.077-0.971; p = 0.045) and associated with overweight (AOR = 2.734; 95% CI: 1.053-7.097; p = 0.039). Low physical activity was associated with obesity (AOR = 19.774; 95% CI: 1.741-4.539; p = 0.016) and underweight (AOR = 7.8; 95% CI: 1.484-4.007; p = 0.015), while high physical activity was positively associated with dietary diversity (AOR = 8.918; 95% CI: 2.869-27.719; p = 0.001). Food security alone showed no significant association with nutritional status. Dietary diversity and physical activity were stronger determinants of nutritional outcomes than food security alone, highlighting the need for interventions promoting diverse diets and active lifestyles alongside food access programs.

Keywords: Lactating women, Food security, Dietary diversity, Physical activity, Nutritional status

Résumé

Les femmes allaitantes ont des besoins nutritionnels accrus pour préserver leur santé et assurer une croissance optimale de leur nourrisson. Cette étude a évalué l'influence de la sécurité alimentaire, des habitudes alimentaires, de la diversité du régime alimentaire et de l'activité physique quotidienne sur l'état nutritionnel des femmes allaitantes à Bujumbura. Une étude transversale d'un mois, utilisant un échantillonnage consécutif, a été menée. Les données ont été recueillies à l'aide de questionnaires structurés portant sur les caractéristiques sociodémographiques et obstétricales, la diversité alimentaire évaluée par le biais des Apports Minimaux de Diversité Alimentaire pour les Femmes (AMDF), la sécurité alimentaire classée selon les recommandations de l'OMS/FAO, l'activité physique mesurée en MET-minutes/semaine et les mesures anthropométriques. Parmi les 384 participantes, 53,3 % étaient âgées de 20 à 30 ans, 92,7 % étaient mariées, 64,8 % étaient sans emploi et 72,7 % avaient au moins un niveau d'études secondaires. La plupart des femmes étaient en post-partum de 1 à 4 mois (44,8 %) et avaient moins de trois enfants (61,8 %). L'atteinte d'une diversité alimentaire minimale avait un effet protecteur contre l'insuffisance pondérale (AOR = 0,274; IC à 95 % : 0,077–0,971 ; p = 0,045) et était associée au surpoids (AOR = 2,734 ; IC à 95 % : 1,053–7,097 ; p = 0,039). Une faible activité physique était associée à l'obésité (AOR = 19,774 ; IC à 95 % : 1,741–4,539 ; p = 0,016) et à l'insuffisance pondérale (AOR = 7,8 ; IC à 95 % : 1,484–4,007 ; p = 0,015), tandis qu'une activité physique élevée était positivement associée à la diversité alimentaire (AOR = 8,918 ; IC à 95 % : 2,869–27,719 ; p = 0,001). La sécurité alimentaire, à elle seule, n'a montré aucune association significative avec l'état nutritionnel. La diversité alimentaire et l'activité physique se sont révélées être des déterminants plus importants des résultats nutritionnels que la sécurité alimentaire seule, soulignant la nécessité d'interventions promouvant des régimes alimentaires diversifiés et des modes de vie actifs parallèlement aux programmes d'accès à l'alimentation.

Mots-clés : Femmes allaitantes, Sécurité alimentaire, Diversité alimentaire, Activité physique, État nutritionnel.

Condensé en français (F)

Contexte

L'alimentation adéquate, l'activité physique et une alimentation de qualité et diversifiée pendant l'allaitement sont essentielles à la santé maternelle et infantile. Sur le plan physiologique, les besoins nutritionnels augmentent considérablement pendant la grossesse et l'allaitement, tant en calories qu'en nutriments essentiels. Or, la malnutrition maternelle et infantile constitue un grave problème de santé publique à l'échelle mondiale, responsable de 51,06 % de la mortalité infantile en 2021 (Ritchie, 2024). Malgré les efforts déployés ces trente dernières années, la faim et la malnutrition restent un problème courant chez les enfants et les femmes au Burundi (Ishimwe, 2021). Le pays enregistre le taux le plus élevé de malnutrition chronique (54 %) (UNICEF, 2019), les femmes et les enfants étant les plus vulnérables à ce risque (Niragira *et al*., 2020). Mare *et al.*, (2025) ont rapporté une prévalence de 9,5 % (insuffisance pondérale, IMC < 18,5 kg/m²) et (surpoids/obésité) chez les femmes âgées de 15 à 49 ans. Leur prévalence d'anémie aurait augmenté, passant de 19 % en 2010, à 39 % en 2017, pour atteindre 39,8 % en 2024 (UNICEF, 2025). La prévalence du retard de croissance chez les enfants de moins de cinq ans reste élevée, à 56 %, 57 %, 54,2 %, 52,2 %, 55,8 % et 52,8 % respectivement en 2017, 2018, 2019, 2020, 2022 et 2024, avec une forte baisse chez les enfants âgés de 6 à 23 mois ayant une diversité alimentaire minimale, à 19 %, 57,3 %, 17,5 %, 7,7 %, 20,6 % et 28,6 % respectivement en 2017, 2018, 2019, 2020, 2022 et 2024 (UNICEF, 2025). De plus, l'anémie touchait les enfants âgés de 6 à 59 mois, avec une proportion de 45 % en 2010, 61 % en 2017 et une baisse à 59,1 % en 2024 (UNICEF, 2025). Le PAM (2023) a indiqué que plus de 65 % des Burundais souffrent d'insécurité alimentaire et que l'alimentation des mères allaitantes est peu diversifiée (souvent riche en amidon) (UNICEF, 2023). Ces données suggèrent qu'une grande partie des mères burundaises commencent l'allaitement en étant déjà dénutries, ce qui peut nuire à leur santé et à la qualité de leur lait maternel. Bien que l'insécurité alimentaire et la monotonie alimentaire soient endémiques dans le pays, elles sont insuffisamment étudiées et les facteurs de risque tels que les habitudes alimentaires, l'activité physique et la sécurité alimentaire des mères pendant l'allaitement, une période de la vie caractérisée par des besoins nutritionnels élevés, ne sont pas suffisamment évalués. Les inégalités géographiques persistantes en matière d'insécurité alimentaire constituent un obstacle majeur à la réalisation des objectifs du Plan national de développement (PND) 2018-

2027 du Burundi et du deuxième objectif de développement durable (Faim Zéro) de la Déclaration et des Nations Unies sur le développement durable (DND) d'ici à 2030 (Pérez -Escamilla, 2017). Par exemple, les crédits alloués aux initiatives liées à la nutrition, en proportion du budget total de l'État pour 2023-2024, étaient très faibles: 0,32 % du budget total en 2023-2024 (UNICEF, 2023) et 1,3 % en 2024-2025 (UNICEF, 2025). Ceci souligne la nécessité de mieux appréhender les besoins sanitaires locaux afin d'allouer les ressources de manière appropriée. Cette étude visait donc à évaluer les interactions entre la sécurité alimentaire, les habitudes alimentaires, l'activité physique et l'état nutritionnel des femmes allaitantes à Bujumbura. Comprendre ces relations est essentiel pour développer des interventions ciblées visant à améliorer la santé des femmes dans ce contexte urbain.

Objectifs

Objectif général

Étudier l'interaction entre la sécurité alimentaire, les habitudes et la diversité alimentaires, l'activité physique et l'état nutritionnel chez les femmes allaitantes à Bujumbura.

Objectifs spécifiques

i. Évaluer le niveau de sécurité alimentaire des ménages parmi les femmes allaitantes à Bujumbura.

ii. Examiner les habitudes alimentaires et leur diversité chez les femmes allaitantes dans la zone d'étude

iii. Évaluer le niveau d'activité physique quotidienne des femmes allaitantes en fonction de leurs tâches quotidiennes à Bujumbura

Lacune de recherche

Malgré les bénéfices avérés des programmes de nutrition multisectoriels au Burundi, aucune étude n'a, à ce jour, évalué de manière systématique l'interaction entre la sécurité alimentaire des ménages, les habitudes et la diversité alimentaires, l'activité physique et l'état nutritionnel des mères allaitantes. La plupart des études se sont concentrées sur les résultats des programmes ou

sur des indicateurs au niveau des ménages, notamment en ce qui concerne la sécurité alimentaire et l'état nutritionnel, en particulier des enfants, sans aborder la situation des femmes allaitantes. La présente étude vise à combler cette lacune.

Méthodologie

Zone d'étude

L'étude a été menée à Bujumbura, ville située à 3°23′S 29°22′E sur la rive nord-est du lac Tanganyika, au Burundi. Bujumbura est un pôle économique du pays, dont les industries sont axées sur la transformation et la fabrication de produits tels que le textile, le cuir et les produits agricoles. Son tissu urbain présente souvent une grande diversité de statuts socio-économiques et de problèmes nutritionnels.

Conception de l'étude

L'étude a adopté un plan d'analyse transversal, collectant les données à un seul moment donné.

Population étudiée .

L'étude a porté sur des femmes allaitantes âgées de 18 à 49 ans résidant à Bujumbura, au Burundi, en période post-partum et ayant des nourrissons âgés de 0 à 12 mois et plus. Les participantes ont été recrutées à l'hôpital Roikhaled, qui dessert la majeure partie de la population urbaine, garantissant ainsi la représentation de femmes issues de milieux socio-économiques et démographiques divers. Seules les femmes allaitantes âgées de 18 à 49 ans, allaitant actuellement quel que soit leur nombre d'enfants, et ayant des nourrissons âgés de 0 à 12 mois ont été incluses. Les femmes gravement malades ou hospitalisées, celles qui ont refusé de participer aux volets quantitatif et qualitatif de l'étude, ainsi que celles qui ne résidaient pas à Bujumbura ou y résidaient depuis moins de six mois ont été exclues.

Procédures d'échantillonnage

Les participantes à l'étude ont été recrutées à l'aide d'une technique d'échantillonnage consécutif, selon laquelle toutes les femmes allaitantes éligibles qui se sont rendues à l'hôpital Roikhaled chaque jour pendant la période de collecte de données d'un mois (30 jours) ont été inscrites séquentiellement.

Détermination de la taille de l'échantillon

La taille de l'échantillon a été calculée à l'aide de la formule de Cochran pour les études de

$$n_0 = \frac{Z^2 \cdot p \cdot (1-p)}{e^2}$$

prévalence (Cochran, 1977) :

Où:

Z = 1,96 (niveau de confiance de 95 %)

p = 0,5, prévalence estimée chez les femmes en âge de procréer au Burundi

e = 0,05, marge d'erreur

$$\mathrm{n} = \frac{1.96^2 \times 0.5(1-0.5)}{0.05^2}$$

$$\mathrm{n} = \frac{3.8416 \times 0.11 \times 0.89}{0.0025}$$

$$\mathrm{n} = 384$$

Ensuite, un échantillon de 384 femmes allaitantes a été utilisé dans l'étude.

Collecte de données

Un questionnaire structuré prétesté a été administré afin de recueillir des informations sur les caractéristiques sociodémographiques, les antécédents obstétricaux et les pratiques d'alimentation. La sécurité alimentaire des ménages a été évaluée selon les directives FAO/USAID HFIAS (Coates *et al.*, 2007). L'outil Diversité alimentaire minimale pour les femmes (FAO et FHI 360, 2016) a été utilisé pour évaluer la diversité alimentaire minimale. Le Questionnaire mondial sur l'activité physique (GPAQ) de l'OMS a été utilisé pour évaluer l'activité physique (OMS, 2020). Des mesures anthropométriques ont été utilisées pour évaluer l'état nutritionnel des femmes allaitantes participantes. L'IMC a ensuite été calculé.

$$\text{IMC} = \frac{\text{masse (kg)}}{\text{taille}^2\ \text{(m)}}$$

Les participants ont ensuite été classés selon les seuils de l'OMS : insuffisance pondérale (<18,5 kg/m²), poids normal (18,5-24,9 kg/m²), surpoids (25-29,9 kg/m²) et obésité (≥30 kg/m²).

Analyse des données

Les données ont été nettoyées et vérifiées quant à leur cohérence et leur exhaustivité, codées et saisies dans SPSS version 20. Des statistiques descriptives (pourcentages) ont été utilisées pour résumer les caractéristiques sociodémographiques, la diversité alimentaire, l'activité physique et les catégories d'état nutritionnel.

La diversité alimentaire a été évaluée à l'aide de l'échelle MDD-W et classée comme adéquate (> 5 groupes alimentaires) ou inadéquate (<5). La sécurité alimentaire a été évaluée selon les recommandations de l'OMS/FAO et l'activité physique a été mesurée en MET-minutes/semaine. L'état nutritionnel a été déterminé à l'aide de l'IMC et des seuils de l'OMS. Les associations entre les variables prédictives et l'état nutritionnel, la sécurité alimentaire, la diversité alimentaire et l'activité physique ont été analysées par régression logistique multinomiale.

Résultats et discussion

Informations démographiques

Parmi les 384 femmes allaitantes, la plupart étaient âgées de 20 à 30 ans (53,3 %), mariées (92,7 %), sans emploi (64,8 %), avaient au moins un niveau d'études secondaires (72,7 %), étaient en post-partum de 1 à 4 mois (44,8 %) et avaient moins de trois enfants (61,8 %). Des structures d'âge similaires et des taux de mariage élevés chez les femmes allaitantes ont été observés en Éthiopie, reflétant les périodes de pic de fécondité et d'allaitement où les naissances ont principalement lieu au sein du mariage (Seid & Cherie, 2022 ; Gizachew *et al.*, 2024). Des études menées au Népal et dans le sud de l'Éthiopie ont également fait état d'un taux de chômage élevé chez les femmes allaitantes, ce qui indique un accès rare à l'emploi formel malgré leur niveau d'instruction (Singh *et al.*, 2020 ; Gizachew *et al.*, 2024). Bien que de nombreuses femmes aient au moins un niveau

d'études secondaires, des études montrent que l'éducation seule ne garantit pas la sécurité alimentaire ni la diversité alimentaire en raison de l'insécurité alimentaire des ménages, du coût, de la disponibilité et de l'accès aux aliments (Zegeye *et el*., 2025 ; Seid et Chérie, 2022).

Sécurité alimentaire chez les femmes allaitantes

L'insécurité alimentaire était très répandue dans cette étude, touchant 84,2 % des femmes allaitantes. Ce constat est similaire à celui d'autres études menées en Afrique de l'Est, où elle persiste dans les populations urbaines en raison des contraintes économiques et de la fluctuation des prix alimentaires (Leroy *et al*., 2021). Une revue systématique a montré ses effets disproportionnés sur les femmes vivant dans des contextes à faibles ressources, entraînant souvent une réduction de la qualité de l'alimentation et une diminution du nombre de repas (Carvajal- Aldaz *et al.*, 2022). Cette prévalence est supérieure aux estimations nationales de 65 % (PAM, 2023), ce qui suggère que les femmes allaitantes vivant dans des zones urbaines denses comme Bujumbura sont confrontées à un stress économique accru, à l'instar des observations faites au Kenya où l'insécurité alimentaire est un facteur prédictif d'insuffisance pondérale et de surpoids (Keino *et al*., 2014). Une régression logistique multinomiale a montré que l'implication dans une petite entreprise et le niveau d'éducation étaient des déterminants significatifs, l'enseignement primaire ou secondaire réduisant l'insécurité alimentaire par rapport à l'enseignement supérieur. Cela suggère que des études supérieures ne garantissent pas toujours un revenu stable (Smith & Haddad, 2015 ; Rapport mondial sur la nutrition, 2023). L'âge, la situation matrimoniale et la parité n'étaient pas des déterminants significatifs de la sécurité alimentaire (Assenga & Kayunze, 2020). Face à la hausse des prix alimentaires, les femmes allaitantes adoptent diverses stratégies d'adaptation, reflétant des mesures à la fois proactives et contraignantes, afin de maintenir l'accès à l'alimentation au sein de leur foyer. Cela comprenait le lancement d'activités économiques, la réduction du nombre de repas, l'achat de nourriture au même prix ou l'achat uniquement d'aliments abordables. Tsegaye *et al*. (2018) ont rapporté que les ménages combinent des stratégies génératrices de revenus avec des modifications alimentaires pour gérer l'insécurité alimentaire.

Habitudes alimentaires et diversité du régime alimentaire chez les femmes allaitantes

Malgré une insécurité alimentaire généralisée, 53,3 % des femmes allaitantes de Bujumbura consommaient trois repas par jour, bien que 61,2 % d'entre elles aient déclaré manger tard et 35,8%

ne mangeaient que lorsqu'elles avaient faim. La consommation d'aliments d'origine animale était faible (3,2 %), tandis que les aliments de base d'origine végétale, tels que les légumineuses (41,3 %) et les légumes (39,2 %), prédominaient, ce qui concorde avec les rapports nationaux indiquant une consommation limitée de produits animaux en raison de leur coût (PAM, 2023). Ces habitudes alimentaires reflètent celles d'autres milieux urbains en situation d'insécurité alimentaire, où le recours à des aliments végétaux peu coûteux offre une certaine variété, mais peut manquer de nutriments biodisponibles (Islam *et al.*, 2023 ; Weil *et al.*, 2023). Il est à noter que 75,2 % des femmes atteignaient les recommandations minimales de diversité alimentaire pour les femmes (RMA-F), ce qui suggère une consommation d'aliments variés à court terme, conformément aux conclusions des évaluations du programme *de Tubaramure* (Leroy *et al*., 2021). La régression logistique multinomiale n'a révélé aucune association significative entre les variables sociodémographiques et la diversité alimentaire, soulignant l'influence de facteurs plus larges tels que le revenu du ménage, l'accès au marché, l'agrobiodiversité et la saisonnalité (Assenga & Kayunze , 2020).

Activité physique quotidienne chez les femmes qui allaitent

L'activité physique variait de modérée (≥ 600 MET-min/semaine) à élevée (≥ 3 000 MET-min/semaine), avec 43 % des participantes dans chaque catégorie et seulement 13,9 % en dessous de la normale (< 600 MET-min/semaine). Malgré ces niveaux, les données nationales indiquent que 40 % des Burundaises ne respectent pas les recommandations de l'OMS en matière d'activité physique (Fédération mondiale de l'obésité, 2025). Les activités non structurées, telles que la marche et les tâches ménagères, contribuaient de manière significative à l'activité physique globale, même si l'exercice physique structuré offre des bienfaits supplémentaires pour la santé (Bizimana *et al.*, 2016). Ces tendances concordent avec les recommandations de l'OMS pour les femmes en post-partum, qui soulignent le rôle des mouvements quotidiens réguliers dans la dépense énergétique (OMS, 2020).

État nutritionnel des femmes allaitantes

Les données révèlent un double fardeau de malnutrition : 9,1 % de la population est en insuffisance pondérale, 35,8 % en surpoids, 6,1 % obèse et 49,1 % a un poids normal. La prévalence du surpoids dans cet échantillon urbain dépasse les estimations nationales (10,5 %) et reflète les

tendances observées dans d'autres populations urbaines d'Afrique subsaharienne en transition nutritionnelle (Atsu, 2024 ; Rapport mondial sur la nutrition, 2023). Cette coexistence du surpoids et de l'insécurité alimentaire illustre le paradoxe insécurité alimentaire-obésité : des budgets limités incitent à privilégier les aliments bon marché et riches en énergie, un schéma corroboré par des données provenant du Kenya (Carvajal- Aldaz *et al.*, 2022). Keino *et al.* (2014) ont rapporté qu'un accès limité à la nourriture peut prédisposer les femmes à la fois à la malnutrition et au surpoids en raison d'une alimentation irrégulière et d'une dépendance aux calories bon marché.

Sécurité alimentaire, diversité alimentaire et activité physique quotidienne

La sécurité alimentaire n'était pas significativement associée à la diversité alimentaire (AOR = 0,794 ; p = 0,640). Ceci confirme que les ménages bénéficiant de la sécurité alimentaire peuvent néanmoins adopter des régimes alimentaires monotones en raison de pratiques culturelles, de préférences alimentaires ou de priorités économiques (Chakona, 2023). Ainsi, l'accès à l'alimentation ne garantit pas automatiquement la qualité de l'alimentation chez les femmes allaitantes. Une activité physique élevée était fortement associée à l'obtention d'une diversité alimentaire (AOR = 8,918 ; IC à 95 % [2,869-7,719] ; p = 0,001). Cela suggère que les femmes plus actives physiquement adoptent potentiellement des comportements alimentaires plus sains et bénéficient d'un meilleur statut fonctionnel et socio-économique global. Des associations similaires ont été observées chez les femmes en post-partum dans les pays à revenu faible et intermédiaire, où un mode de vie actif était associé à de meilleures pratiques alimentaires (Zegeye *et al.*, 2025).

Sécurité alimentaire, diversité alimentaire, activité physique quotidienne et état nutritionnel

Chez les femmes allaitantes, la sécurité alimentaire n'était pas significativement associée à l'insuffisance pondérale, au surpoids ou à l'obésité. Cela suggère que l'accès à l'alimentation au sein du ménage ne suffit pas à lui seul à refléter l'état nutritionnel maternel, ce qui concorde avec les résultats obtenus au Kenya, où la sécurité alimentaire perdait sa signification après prise en compte des facteurs alimentaires et comportementaux (Keino *et al.*, 2024). La diversité alimentaire avait un effet protecteur : les femmes bénéficiant d'une diversité alimentaire minimale présentaient un risque moindre d'insuffisance pondérale (AOR = 0,274 ; IC à 95 % : 0,077-0,971 ; p = 0,045).

De même, une étude menée à Dessie Town, en Éthiopie, a montré qu'une diversité alimentaire insuffisante était associée de manière indépendante à la malnutrition maternelle (AOR = 3,8 ; IC à 95 % : 2,08-77,03) (Seid & Cherie, 2022). Une faible activité physique augmente les risques d'insuffisance pondérale (AOR = 7,8 ; IC à 95 % : 1,484-4,007 ; p = 0,015), reflétant une mauvaise santé, de la fatigue ou un apport énergétique insuffisant, comme observé chez les adultes taïwanais (Lee *et al.*, 2023). Concernant le surpoids, si la diversité alimentaire est associée à des risques plus élevés (AOR = 2,734 ; IC à 95 % : 1,053-3,097 ; p = 0,039), l'activité physique n'est pas significative. Ceci concorde avec les données récentes d'Afrique subsaharienne indiquant que les régimes alimentaires diversifiés en milieu urbain incluent souvent des aliments transformés et riches en énergie, contribuant à l'augmentation du poids corporel chez les femmes en âge de procréer (Zegeye *et al*., 2025). L'obésité était fortement associée à une faible activité physique (AOR = 19,774 ; IC à 95 % : 1,741-4,539 ; p = 0,016), démontrant que la sédentarité pendant la période post-partum augmente considérablement le risque d'obésité chez les femmes (Mosha *et al*., 2021).

Conclusion et recommandation

L'état nutritionnel des femmes allaitantes à Bujumbura est influencé par de multiples facteurs, la qualité de l'alimentation et l'activité physique se révélant être de meilleurs indicateurs de l'état nutritionnel que la seule sécurité alimentaire du ménage. La plupart des participantes étaient âgées de 20 à 30 ans (53,3%), mariées (92,7%), sans emploi (64,8%), avaient au moins un niveau d'études secondaires (72,7%), étaient en post-partum de 1 à 4 mois (44,8%) et avaient moins de trois enfants (61,8 %). Le niveau de sécurité alimentaire dans cette étude était faible (15,8%), bien que non significatif. En revanche, l'atteinte d'une diversité alimentaire minimale était légèrement élevée (75,2%) et significativement associée à une probabilité plus faible d'insuffisance pondérale et à une probabilité plus élevée de surpoids.

L'activité physique, modérée à élevée (43% pour chaque niveau), était significativement corrélée à l'état nutritionnel. Une faible activité physique était associée à la fois à l'insuffisance pondérale et à l'obésité. Par ailleurs, une activité physique élevée était positivement corrélée à la diversité alimentaire. En définitive, la coexistence de l'insuffisance pondérale, du surpoids et de l'obésité au

sein de cette population met en évidence un double fardeau de malnutrition, soulignant la nécessité d'interventions ciblant les deux extrémités du spectre nutritionnel.

Pour améliorer la nutrition maternelle chez les femmes allaitantes à Bujumbura, les interventions devraient viser à améliorer la qualité de l'alimentation et à promouvoir l'activité physique. Les programmes nutritionnels devraient encourager la diversification alimentaire, notamment une consommation accrue de fruits, de légumes, de légumineuses et d'aliments d'origine animale, et être intégrés aux soins post-partum de routine.

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List of abbreviations

MET; Metabolic Equivalent of Task

AORs; Adjusted Odds Ratios

NHANES; The National Health and Nutritional Examination Survey

GPAQ; Global Physical Activity Questionnaire

MDD-W; Minimum Dietary Diversity for Women

HFIAS; Household Food Insecurity Access Scale

WHO; World Health Organization

FAO; Food and Agriculture Organization

WFP; World Food Programme

MINAGRI; Ministry Of Agriculture And Animal Resources

UNICEF; United Nations Children's Fund

Foreword

This thesis is submitted in partial fulfillment of the requirements for the Master's Degree in Food Science and Nutrition, with a specialization in Food security and climatic change at East African Nutritional Sciences Institute, University of Burundi.

The research titled "**Assessment of the influence of food security, eating pattern and physical activity on nutritional status among lactating women in Bujumbura, Burundi "** was driven by the growing nutritional issue concerns particularly to lactating women living in Bujumbura and how food security, eating patterns and physical activity can affect this group of people which is very important for the development of good nutritional status of children who are the coming generation of the country

Lactating women are vulnerable group since they gave high nutritional needs to compensate the needs of their body and their baby too and at the same time, they are in risky of being affected much by food insecurity, poor eating patterns and high physical activity which cannot be in balance with diets taken

I sincerely appreciate my academic supervisor for his guidance, my husband to be for his unwavering support, my family for their encouragement and all individuals and institutions that gave their help for the completion of this research work

I pray that the nutritional status of lactating women will be improved as all institutions dealing with this group plan and implementing measures to give the solution of what is discovered by this research work

Assessment of the influence of food security, eating pattern and physical activity on nutritional status among lactating women in Bujumbura, Burundi

Chapter I. Introduction

I.1. Background of information

Burundi is one of the East African countries with estimated 12.3 million people (UNICEF, 2021) and an annual population growth of over 2.23%. Burundi fertility rate is high at 4.67 to 4.7 children per women (UNFPA, 2025). It's a landlocked country in East Africa faced persistent political instability, economic hardship, and climate-related problem, which collectively affect its agricultural production and food systems (UNICEF, 2021). Despite the scarcity of arable land and unpredictable climate, 84% of people in Burundi and its economy depend on agriculture (Cintile, 2025).

Food security influences the existence of affordable price of food throughout the country. It is featured by three pillars of the level of food security which are food availability, food accessibility and food stability or consistency (Pereira *et al*, 2022). Households experiencing food insecurity always side on cheaper food, nutrient-poor foods, energy-dense that are significant compromiser of their nutritional status (FAO, 2021). Moreover, food insecurity has been associated with decreased physical activity to people, further increasing the health risks (Lohman *et al*., 2022). Socioeconomic factors, including individual income levels and educational status, significantly influence physical activity and food choices by an individual. Women from lower socioeconomic family often faced with a limited access to safe and healthy foods and safe spaces for physical activities, leading to suboptimal dietary patterns and reduced physical activity (Facina *et al*., 2023).

Understanding the relationship between food security, eating patterns, physical activity, and nutritional status is essential for developing targeted measures to improve lactating women health outcomes. This focused concern is justified because lactating women have special needs compared to other groups of people. During lactation, their bodies require even more energy and nutrients than during pregnancy. In Burundi, where many families struggle with food insecurity and malnutrition (UNICEF, 2023), paying attention to lactating mothers is very important. So, this study aims to investigate these factors among lactating women in Bujumbura, providing insights to inform policies and programs that promote healthy and lifestyles in Bujumbura.

I.2 Problem statement

Food sufficiency, physical activities and dietary quality and diversity during the lactation period are essential for maternal and child health. Physiologically, the nutritional demand increases during pregnancy and lactation, highly in both calorie and essential nutrients. However, maternal and child undernutrition is a severe public health problem globally accounted for 51.06% of all child deaths in 2021 (Ritchie, 2024). Despite efforts made over the last three decades, yet hunger and malnutrition are a common problem among children and women in Burundi (Ishimwe, 2021). The country reported highest rates of chronic malnutrition 54% (UNICEF, 2019) with women and children being most vulnerable to the risk of hunger and malnutrition (Niragira *et al*., 2020). Mare *et al.,* (2025) reported a prevalence of 9.5% (underweight, BMI < 18.5 kg/m²) and (overweight/obese) among women aged 15-49. Their anemia prevalence reported to be incremented from 19% in 2010, 39% in 2017, to 39.8% in 2024 (UNICEF, 2025). The prevalence of stunting among children under five remains above, 56%, 57%, 54.2%, 52.2%, 55.8% and 52.8% in 2017, 2018, 2019, 2020, 2022, and 2024 respectively with sharp fall on children aged 6 to 23 months having a minimum dietary diversity, 19%, 57.3%, 17.5%, 7.7%, 20.6%, 28.6% in 2017, 2018, 2019, 2020, 2022 and 2024 respectively (UNICEF, 2025). In addition, anemia affected children aged 6 to 59 months with the proportion of 45% in 2010, 61% in 2017 and dropped to 59.1% in 2024 (UNICEF, 2025). WFP (2023) reported that over 65% of Burundians are food insecure with low dietary diversity among lactating mother (often includes a large portion of starchy foods) (UNICEF, 2023). These suggest that a large proportion of Burundian mothers begin lactation already nutritionally compromised, which can impair both their health and breast-milk quality. Although food insecurity and dietary monotony are endemic in the country, they are insufficiently examined and assessed for risk factors like eating pattern, physical activities and food security in mothers during lactation, a life stage of high nutritional demand. The existing geographic inequalities in food insecurity is considered as a major challenge in achieving the goal of Burundi's National Development Plan (NDP 2018-2027) and the UNSD second goal of Sustainable Development (Zero Hunger) by 2030 (Pe´rez-Escamilla, 2017). For example, the budget allocations for nutrition related initiatives as a proportion of the total state budget on 2023-2024 was very low, 0.32% of total budget in 2023/2024 (UNICEF, 2023) and 1.3% of total budget in 2024/2025 (UNICEF, 2025) reflecting the need for better understand on the local health needs for the allocation of resources accordingly. Thus, this study aimed to assess the interplay between

food security, eating patterns, physical activity, and nutritional status among lactating women in Bujumbura. Understanding these relationships is crucial for developing targeted interventions to improve women health outcomes in this urban setting.

I.3 Justification of study

Undernutrition during the critical periods of pregnancy and lactation remains a major global public health concern. In 2021, an approximately 4.7 million under five children died worldwide with approximately 2.4 million of those deaths (51%) were attributable to child and maternal malnutrition, reflecting the consequences of inadequate maternal nutrition (Ritchie, 2024). In Burundi, these global trends are often contributed by chronic food insecurity and limited access to diverse diets observed to most of maternal and children. Burundi has one of the highest stunting rates globally. According to Global Nutrition Report (2023), 50.9% of children under five were classified as stunted in 2022 far above the Sub-Saharan Africa average of 30.7%. The 2023 national nutrition analysis documents an extremely high prevalence of chronic undernutrition with stunting at 55.9% among children 0-59 months (MINEAGRIE *et al*., 2023). Chronic childhood malnutrition in turn reflects the nutritional environment of their mothers, many of whom remain under poor nutrition profiles throughout pregnancy and lactation. Among women of reproductive age, 15-49 years, anemia prevalence is reported round 38.5% in national summaries, indicating a severe micronutrient public-health problem (Global Nutrition Report, 2023).

Food insecurity is associated with these nutritional deficits. In October 2023, over 65% of Burundians were food insecure, with particularly low dietary diversity observed among lactating women whose diets are heavily reliant on starchy staples and lack adequate vegetables, animal-source proteins and fruits (WFP, 2023). Furthermore, the Burundians national reporting for 2023 indicates that 41.2% of households experienced food insecurity overall, of which 32.3% were classified as moderately food insecure and 8.9% as severely food insecure (MINEAGRIE *et al*., 2023). This represented an upward trend from earlier years as national analyses show the proportion of food-insecure households increased from 27.8% in 2008 to 44.6% in 2018 (FAOSTAT, 2021). Female-headed households reported about 50% food insecurity compared with 39% for male-headed households. Most of them who depended on petty agricultural wage labor showed insecurity rates around 68.4%, compared to those relying on food aid report about 57.5% (MINEAGRIE *et al*., 2023).

Eating patterns and dietary diversity data documented monotonous, staple-based diets for both women of reproductive age and young children. Recent analyses report that Burundian women consume on average approximately 4 of the 10 MDD-W food groups, which is below the FAO/WHO minimum dietary diversity threshold of greater than 5 groups (Emera *et al*., 2025). Programmatic summaries indicate that fewer than half of women meet the MDD-W cutoff, with WFP monitoring suggesting only about 30-35% of women achieved adequate dietary diversity in 2022–2023 (WFP, 2023). Diets consumed are dominated by cereals, roots/tubers and legumes, and consumption of animal-source foods (meat, fish, dairy, eggs), fruits, and vitamin-A rich vegetables remains low.

Moreover, women in Burundi are involved in over activities. Women often engage in agricultural labor over several hours and household chores daily with unmatched increased caloric intake especially during pregnancy and lactation (Global Nutrition Report, 2023). Yet, despite the clear expected interaction between food security, eating pattern and diversity, and physical activities, no Burundian study has examined how these factors affect the nutritional status of lactating mothers.

I.4 Objectives

I.4.1 General objective

To investigate the interplay between food security, eating patterns and diversity, physical activity and nutritional status among lactating women in Bujumbura.

I.4.2 Specific objectives

iv. To assess the level of household food security among lactating women in Bujumbura.

v. To examine the dietary patterns and diversity among lactating women in the study area

vi. To evaluate the daily physical activity level among lactating women in relation to their daily routine task in Bujumbura

I.5 Hypothesis

I.5.1 Null hypothesis (H_0)

There is no significant association between food security, eating patterns, physical activities, and the nutritional status of lactating women in Bujumbura, Burundi.

I.5.2 Alternative hypothesis (H_1)

There is a significant association between food security, eating patterns, physical activities, and the nutritional status of lactating women in Bujumbura, Burundi.

I.6 Research questions

i. What are the current common eating patterns and diversity of lactating women in Bujumbura?

ii. What is the current food security status among lactating women in Bujumbura?

iii. What is the nutritional status of lactating women in Bujumbura?

iv. How does food security, eating patterns and diversity, physical activity correlate with nutritional status among lactating women in Bujumbura?

I.7 Scope of the study

This study was confined to food security, eating patterns and dietary diversity, daily physical activity, and nutritional status among lactating women in Bujumbura, Burundi. The study focused on lactating women residing in selected areas of Bujumbura urban and examined variables related to food access, dietary practices, physical activity, and nutritional status during the study period. Geographically and conceptually, the study was limited to the specified study area and variables outlined in the research objectives.

I.8 Research gap

Despite the documented benefits of multisectoral nutrition programs in Burundi, no research to date has systematically evaluated the interplay between household food security, dietary pattern and diversity, physical activity, and maternal nutritional status during lactation. Most studies focused on program outputs or household-level indicators particularly for food security and nutritional status especially to children without with nothing on lactating women. This study aimed to address that gap, offering evidence critical for designing interventions tailored to the unique nutritional needs of this group.

Chapter II: Literature review

II.1 Lactating mother and nutrition overview

Lactating Mother needs a well balance diet to produce breast milk with complete nutrition for the healthy growth of an infant (Victora *et al*., 2016). Breast milk is necessary food for the growth and development of infant. WHO (2017) recommends exclusive breastfeeding up to six months of a child's age, and continued breastfeeding, along with complementary feeding, up to two years of age. The quantity and quality of breast milk from lactating mother largely depends on the nutritional quality and adequacy of taken diet. It is essential that the diet of a lactating mother should be rich in both calorie and nutrients content for better breastfeeding (Torheim & Arimond, 2013).

II.2 Household food security and nutritional status

Food security is very important in ensuring good nutritional status. Together with dietary diversity, they are two important determinants of undernutrition. FAO defines food security as the situation when all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preference for an active and healthy life (FAO, 2003). The household members are considered to be food secured when they do not have to live in or with fear of starvation. Food insecurity remains as an existed challenge in Burundi. Approximately 41.2% of the Burundian population faces chronic food insecurity, with more than half of households lacking dietary adequacy (Global Nutrition Report, 2023). Food insecurity was substantially higher in rural areas (about 44%) than in urban areas (about 18%) (MINEAGRIE *et al*., 2023). Other study by WFP (2023) reported over 65% of Burundians are food insecure with majority depending in subsistence agriculture. Community-level interventions targeting women and children, such as WFP's *Tubaramure* program, have demonstrated positive impacts of nutrition to lactating mothers. The program impacted a notable improvement in food security (between 4.5% to 7.3%) and increased maternal dietary diversity by about 0.4 food groups mainly in legume food (Leroy *et al*., 2020). Yet, the program focused more broadly on household outcomes rather than isolating lactating women's nutrition, leaving a critical evidence gap.

II.3 Dietary pattern, diversity and nutrient intake

Globally, dietary pattern and diversity are the key predictor of micronutrient adequacy and maternal health. A healthy eating pattern, rich in fruits, vegetables, whole grains, and lean protein, promotes optimal health, growth, and development while preventing diseases. Conversely, poor eating choices, like skipping meals or consuming excessive processed foods, can lead to malnutrition, including stunting and wasting (Sridevi *et al*., 2025). In rural Burundi, only 16% of children achieved minimum dietary diversity (≥ 4 food groups/day), indicating that they have limited access to nutrient-rich foods (Custodio *et al*., 2019). Similar dietary monotony was observed among lactating women, who often rely heavily on starchy staples with minimal fruits, protein, or vegetables (WFP, 2023). Interventions involving bio fortified crops such as beans have shown promise. Kwizera *et al*. (2025) found that households growing bio fortified beans had a significant potential improved dietary habits and diversity among Burundian households.

II.4 Physical activity and nutritional status

Physical activities often observed to play a vital role in maternal energy balance and overall wellbeing. The level of daily physical activity can be affected by economic level, social and cultural factors of individual. Lactating women in Burundi often engage in intensive physical labor like as farmland labor and household activities which greatly are highly increasing their energy expenditure due to agricultural need and family demands. Such involvement is not translated into health benefit practices due to absence of nutritional intake adequacy (Custodio *et al*., 2019). A systematic review across sub-Saharan Africa suggested that while agricultural engagement can boost household income and dietary diversity, excessive labor without social support and enough dietary intake can negatively impact women's nutritional status (Gupta, 2025).

II.5 Integrative interventions for maternal and child nutrition

Combining food assistance with behavior change communication and community support has shown greater effectiveness in maternal nutrition programs. A systematic review in sub-Saharan Africa reported that interventions designed using behavior-change theories such as the COM-B model demonstrated significant reductions in child stunting and improvements in maternal dietary intake (PLOS Global Public Health, 2023). WFP's *Tubaramure* and the World Bank's Maternal and Child Nutrition Enhancement Project in Burundi employed such integrative approaches, including nutrition education, seed provision, food fortification, and community mobilization.

These efforts led to increased production and consumption of micronutrient-rich foods and better utilization of nutrition services during the first 1,000 days of an infant (World Bank, 2021).

II.6 Definition of key terms

A lactating woman is a woman who is actively producing and secreting milk from her breasts through the process of lactation. It's providing essential nutrition and immune protection to the children. Lactation typically begins during pregnancy and continues after childbirth, as long as the infant continues to suckle or the mother continues to express milk.

Food security is a situation where people are able to access sufficient, safe, and nutritious food at all times for an active and healthy life. Food security is closely associated with prevention of adverse health outcomes and improving nutrition status (Odoms-Young *et al*., 2024).

Physical activity can be described as any bodily movement produced by skeletal muscles that require expenditure of energy. It is an essential thing in promoting maternal and children's health and well-being. Increased sedentary behavior contribute to obesity in the general population (Dixon *et al*., 2021).

Eating patterns (dietary patterns) can be defined as the quantities, proportions, variety, or combination of different foods, drinks, and nutrients in diets, and the frequency with which they are habitually consumed. It is the repeating habits of eating including what, when, and how much someone eats. To understand these patterns is crucial because the overall diet, rather than individual foods or nutrients, can better predict general health and disease risk of an individual (Sridevi *et al*., 2025).

Dietary diversity is defined as eating a wide variety of foods from different groups (like grains, fruits, veggies, proteins, dairy) to ensure the all essential nutrients are obtained. It boosts micronutrient intake, supports healthy growth, strengthens immunity, and fosters a healthy gut microbiome, reducing risks of diet-related diseases. It can be improved by adding seasonal local foods, legumes, and whole grains, rather than relying on expensive or processed items, which are much costly.

Nutritional status refers to the condition of an individual's health in relationship to the intake, absorption, and utilization of nutrients. It describes the balance between nutrient needs and nutrient

intake. Nutritional status can be evaluated using various methods like anthropometric measurements, dietary assessments, and biochemical tests. Nutritional status is influenced by different factors such as socioeconomic factors, age and health relating behaviors (Sinai *et al*, 2021)

Body Mass Index (BMI) is a method of assessing nutritional status through measuring body weight and length of an individual. It is calculated by taking weight (kg) of an individual divide by his or her height (m) square. Below is interpretation of BMI for lactating mother according to WHO's BMI classification (Ruan *et al*., 2024; CDC, 2021);

Underweight: Below 18.5 Kg/m^2

Healthy Weight: Between 18.5 Kg/m^2 and 24.9 Kg/m^2

Overweight: Between 25.0 Kg/m^2 and 29.9 Kg/m^2

Obese: At or above 30.0 Kg/m^2

Food availability refers to the physical presence and access to sufficient quantities of nutritious and safe food, supplied through domestic production or imports, including food aid. It is a key factor in ensuring food security, alongside food access, utilization, and stability.

Food accessibility refers to the ability of individuals and households to regularly acquire enough adequate and appropriate food for a nutritious diet. This includes both the physical and economic ability to access food sources, as well as the social factors that may influence access.

Physical access refers to the ability to physically reach food sources, such as grocery stores, markets, or food banks, and the safety and convenience of doing so. It is all times aspect of being near enough to reliable food sources to acquire sufficient, safe, and nutritious food. Physical access act as one of the core dimensions (pillars) of food security, alongside economic access, availability, utilization, and stability.

Economic access refers to the ability of people to afford and obtain essential resources, goods, and services like food for a decent living, often hindered by poverty. It can be improved through financial inclusion, better policies, and economic growth, impacting overall well-being and

development. Economic access is not only about just availability, but also about affordability and the practical means to acquire what's needed.

Social access refers to the social norms, cultural practices, and other social factors that may influence food acquisition, such as gender roles, social status, and discrimination. It is all about fairness, community ties (social capital), policies, and norms that might help access for different groups, ensuring everyone, including minorities and women, acquire food for a healthy life.

Chapter III: Research methodology

III.1 Study area

The study was conducted in Bujumbura urban located on coordinate 3°23′S 29°22′E on the northeastern shore of Lake Tanganyika in Burundi (Figure 1). Bujumbura is a Burundi's largest city and near the border with the Democratic Republic of the Congo (DRC), serving as the country's primary port and a vital commercial center. Bujumbura is the economic hub of the country, having industries focused on processing and manufacturing like textiles, leather and agricultural products. Its urban settings often show diverse socio-economic status and nutritional challenges, including food insecurity and poor maternal health indicators (UNICEF, 2023). Selection of health zones on the city provides a representative sample of urban lactating women and facilitates data collection via local health facilities (UNICEF, 2023).

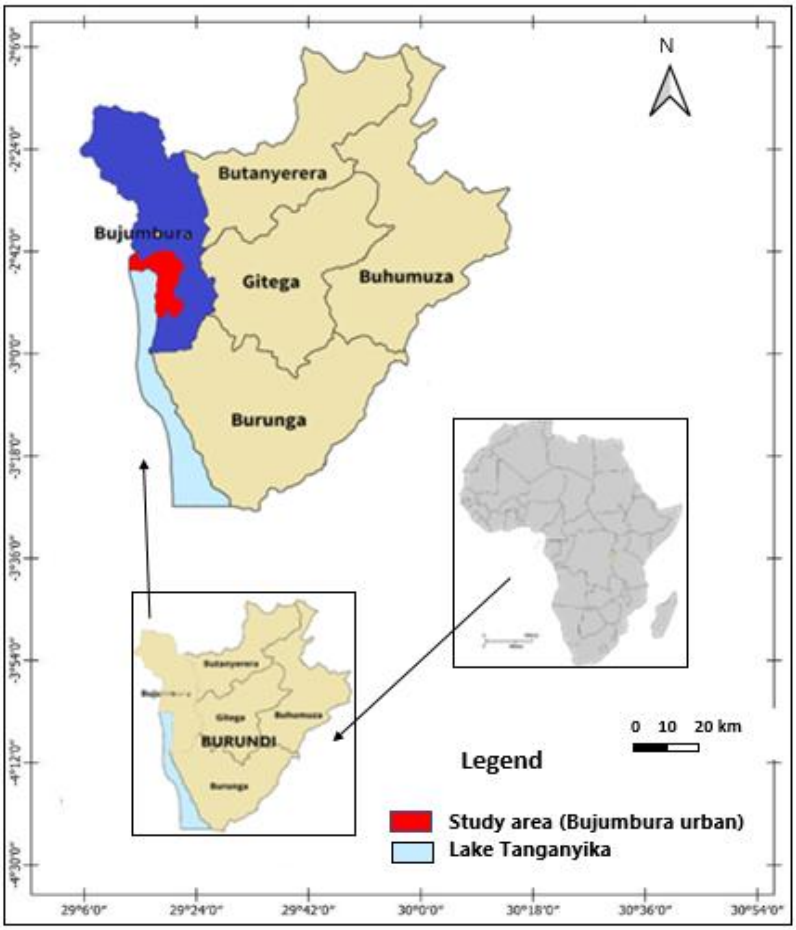


Figure 1. Map showing study area (Bujumbura urban, Burundi)

III.2 Research approach

This study employed a mixed-methods research approach, integrating both quantitative and qualitative approaches to provide a comprehensive assessment of food security, dietary diversity, daily physical activity, and nutritional status among lactating women in Bujumbura, Burundi.

The quantitative approach facilitated the systematic collection of numerical data, enabling the measurement of the prevalence of physical activity levels, as well as anthropometrically assessed nutritional outcomes. This approach allowed for statistical analysis of associations between variables and provided objective, reproducible evidence.

The qualitative approach complemented the quantitative findings by capturing contextual insights into the experiences, perceptions, and practices of lactating women regarding food access, eating patterns, and daily activity during the postpartum period. Incorporating qualitative data enriched the interpretation of quantitative results and helped to explain underlying behaviors and factors influencing nutritional status.

By integrating both approaches, the study ensured triangulation of evidence, enhancing the validity, depth, and comprehensiveness of the findings and providing a robust basis for recommendations to improve maternal nutrition and health in urban settings.

III.3 Study design

The study adopted a cross-sectional analytical design. This design was selected to allow for the collection of data at a single point in a specific time, providing a snapshot of food security, dietary diversity, daily physical activity, and nutritional status among lactating women in Bujumbura, Burundi.

A cross-sectional design is appropriate for assessing the prevalence of nutritional outcomes and exploring associations between exposure variables (food security, dietary diversity, physical activity) and outcome variables (nutritional status) in public health context (Setia, 2016). By collecting both quantitative and qualitative data concurrently, the design enabled the study to generate descriptive statistics and contextual insights within the same population.

This approach also allowed for efficient data collection in an urban setting, facilitating the identification of key factors influencing maternal nutrition. The cross-sectional design is widely

used in public health and nutrition research to provide baseline information that can inform interventions, policies, and further longitudinal studies (Setia, 2016).

III.4 Study population

The study population comprised lactating women aged 18 to 49 years residing in Bujumbura, Burundi, who were within the postpartum period and caring for infants aged 0-12 months and above. Participants were recruited from Roikhaled Hospital that serves the most of urban population, ensuring representation from women with diverse socio-economic and demographic backgrounds.

III.4.1 Inclusion criteria

Lactating women were included in the study if they were aged 18 to 49 years, currently lactating regardless of parity, and had infants aged 0-12 months and above. Participants were required to have been residing in Bujumbura for more than six months, ensuring familiarity with local food availability and lifestyle patterns. Only women who were willing and able to provide informed consent and physically capable of participating in anthropometric measurements and interviews were included, to ensure data reliability and ethical compliance.

III.4.2 Exclusion criteria

Women with seriously ill or hospitalized, which would prevent participation in interviews or physical measurements were excluded. Those who refused consent for either quantitative or qualitative components were also excluded. Additionally, women who were non-residents of Bujumbura or had lived in the city for less than six months were not included, as their exposure to local food systems and activity patterns would differ. Participants with medical conditions affecting nutrition independently of dietary intake, such as severe chronic illnesses, or with postpartum complications that could interfere with standard assessment of physical activity or dietary patterns, were also excluded to maintain the integrity of the study outcomes.

III.5 Sampling procedures

The study participants were recruited using a consecutive sampling technique, whereby all eligible lactating women who attended at Roikhaled Hospital each day during the one-month (30 days) data collection period was enrolled sequentially. This approach ensured that every woman meeting

the inclusion criteria had an opportunity to participate, enhancing the completeness and internal consistency of the sample.

Eligible participants were identified based on predefined inclusion and exclusion criteria. Upon arrival at the facility, each woman was informed about the study objectives, procedures, and ethical considerations, and informed consent was obtained prior to participation (Figure 2). Women who met any exclusion criteria, such as being seriously ill or refusing consent, were not enrolled, and recruitment proceeded with the next eligible participant.

The sampling was conducted daily over the entire one-month period, allowing the study to capture a diverse range of lactating women with varying ages, parity, socio-economic backgrounds, and postpartum durations. By enrolling participants consecutively each day, the study ensured systematic recruitment, maximized participation, and strengthened the credibility, reliability, and internal validity of the findings.



Figure 2. Participant given descriptions by researcher and assistant researchers before being selected as part of sample in the study after attending to the health facilities

III.6 Sample size determination

Sample size was calculated using Cochran's formula for prevalence studies (Cochran, 1977):

$$n_0 = \frac{Z^2 \cdot p \cdot (1-p)}{e^2}$$

Where:

Z = 1.96 (95% confidence level)

p = 0.5, estimated prevalence among women of reproductive age in Burundi

e = 0.05, margin of error

$$\mathrm{n} = \frac{1.96^2 \times 0.5(1-0.5)}{0.05^2}$$

$$\mathrm{n} = \frac{3.8416 \times 0.11 \times 0.89}{0.0025}$$

$$\mathrm{n} = 384$$

Then, the sample size of 384 lactating women was used in the study

III.7 Data collection methods

Data for this study were collected using a combination of structured questionnaires (Appendices, section A), anthropometric measurements, and standardized assessment tools to capture information on socio-demographic characteristics, obstetric history, food security, dietary diversity, daily physical activity, and nutritional status among lactating women.

III.7.1 Socio demographic and obstetric information

A pre-tested structured questionnaire (Appendices, Section A) was administered to obtain information on socio-demographic characteristics, including age, marital status, education level and occupation. Obstetric history data collected included parity, postpartum duration, and infant feeding practices. This information was critical for understanding the background and potential determinants of dietary and nutritional outcomes among lactating women

III.7.2 Household food security

Household's food security was assessed and classified according to FAO/USAID HFIAS guidelines (Coates *et al*., 2007). This guideline highlighted 9 questions with responding options of never, rarely (1-2 times), sometimes (3-10 times) and often (>10 times). The respondent was required to tick on either option, only once per option per each question. Food security classification was done by inspection of the HFIAS responses.

Food secure: This included the household reported no real problems with food access (at most only rare worry). This means a household who responded question one either "never" or "rarely" and all remained questions as "never" (Coates *et al*., 2007) was classified as food secure.

Mildly food insecure: This included all households who sometimes (or often) worries about food or must limit food quality, but without cutting back on quantity or experiencing true hunger. This was assessed as when a household who responded either question one as "sometime" or "often" or question two as "rarely" or "sometime" or "often" or question three or four as "rarely" and all remained questions from five to nine as "never" (Coates *et al*., 2007).

Moderately food insecure: This included households who frequently sacrifices dietary quality and begins to cut back on quantity. They often eat monotonous or less-desirable foods and may sometimes reduce meal size or number, but still have not experienced the most severe coping behaviors. That is to say, a household who responded either question three or four as "sometime" or "often" or question five or six as "rarely" or "sometime" and all remained questions from seven to nine as "never" was classified as moderate food insecure (Coates *et al*., 2007).

Severely food insecure: The household who experienced at least one of the most extreme conditions (running out of food entirely, going to sleep hungry, or going a whole day and night without eating) with any affirmative response (even "rarely") to these severe hunger questions was placed in this category. This means a household who responded either question five or six as "often" or question seven or eight or nine as "rarely" or "often" or "sometime" was classified as severely food insecure (Coates *et al*., 2007).

III.7.3 Minimum dietary diversity (MDD)

The Minimum Dietary Diversity for Women (MDD-W) tool that uses a 24-hour recall to count how many of 10 standardized food groups a woman (15-49 years) consumed was used. This

enumerates a record of each group of food eaten by a respondent in the past day (FAO & FHI 360, 2016). The 10 MDD-W food groups used are:

i. Grains, roots, tubers, plantains (examples rice, maize, potato, cassava)
ii. Pulses (beans, lentils, peas)
iii. Nuts and seeds (groundnuts, pumpkin seeds)
iv. Dairy (milk, yogurt, cheese)
v. Meat, poultry, fish (beef, chicken, fish)
vi. Eggs
vii. Dark green leafy vegetables (spinach, kale)
viii. Other vitamin-A rich fruits/vegetables (carrots, mangoes, sweet potatoes)
ix. Other vegetables (tomato, onion, cabbage)
x. Other fruits (banana, orange, mango).

After listing foods consumed, each group consumed was scored 1 and one not consumed was scored 0. The MDD-W score was calculated as the sum of groups (0-10). A woman with greater than 5 food groups (out of 10) was classified as achieving minimum dietary diversity. This cutoff (greater than 5 groups) was chosen by FAO and FHI 360 (2016) based on validation studies showing that women meeting greater than 5 groups had substantially higher micronutrient adequacy than those with fewer groups

III.7.4 Daily physical activity

Physical activity was assessed by using the Global Physical Activity Questionnaire (GPAQ) from WHO (WHO, 2020), which captures multiple domains of activity and of which validates with African populations. Physical activity (PA) was quantified using MET-minutes per week, where one MET (metabolic equivalent of task) is the energy cost of resting. Energy expenditure for an activity was then calculated as:

$$\text{MET} - \text{minutes/week} = \text{MET value} \times (\text{minutes per day}) \times (\text{days per week})$$

Where

MET value was taken as constant valued 8.0 for vigorous work and vigorous recreational activities, and 4.0 for moderate work, moderate recreational activities and transport activities.

Then, the physical activity was calculated as a total MET-minutes per week and was obtained using the following formula;

$$\text{Physical activity} = \text{Summation of MET per minut per week for all activities categories}$$

Physical activity was classified according to the WHO/IPAQ criteria. Low (inactive) physical activity was defined as a total of less than 600 MET-minutes per week. Moderate (minimally active) physical activity was defined as a total of at least 600 MET-minutes per week, combined with either five days of moderate walking or activities, or three days of vigorous walking lasting more than 20 minutes per day. High (active) physical activity was defined as a total of at least 3000 MET-minutes per week (WHO, 2020).

III.7.5 Measurement of BMI

To assess the nutritional status of participating lactating women, anthropometric measurements were conducted using standardized procedures. Height was measured with a stadiometer, while weight was recorded on a calibrated digital scale following the NHANES 2021 Anthropometry Procedures Manual (CDC, 2021). Measurements were taken twice, and the average was recorded to ensure accuracy. Before measurements, each mother removed her shoes and any heavy items (example, jackets or handbags) to minimize error. During height measurement, women stood erect, feet together, looking straight ahead, with her back aligned to the vertical rod of the stadiometer (Figure 3 a & b). Weight was measured with minimal clothing, using the scale's tare function if necessary (CDC, 2021). After height and weight measuring, BMI for each participant was calculated using the standard formula:

$$\text{BMI} = \frac{\text{Weight (kg)}}{\text{Height (m)}^2}$$

Participants were then classified according to WHO cutoffs: underweight (<18.5 kg/m²), normal weight (18.5-24.9 kg/m²), overweight (25-29.9 kg/m²), and obese (≥30 kg/m²).



Figure 3. Measurement of weight and height using stadiometer with calibrated digital scale

a) Stadiometer with calibrated digital scale

b) A respondent taking a measurement under supervision of researcher and assistant researcher

III.8 Data analysis

Data were cleaned and checked for consistency, completeness, coded, and entered into SPSS version 20. Descriptive statistics (percentages) was employed to summarize socio-demographic characteristics, dietary diversity, physical activity, and nutritional status categories.

Dietary diversity was assessed using MDD-W and classified as adequate (>5 food groups) or inadequate (<5). Food security followed WHO/FAO guidelines, and physical activity was measured in MET-minutes/week and categorized as low, moderate, or high. Nutritional status was determined using BMI and WHO cut-offs.

Associations between predictors and nutritional status, food security, dietary diversity and physical activity were analyzed using multinomial logistic regression. Adjusted Odds Ratios (AORs) with 95% confidence intervals were reported, and statistical significance was set at $p < 0.05$. This approach identifies independent predictors while controlling for confounders. In multinomial logistic regression analysis, one category of the dependent variable is designated as the reference category to provide a baseline for comparison. The regression coefficients, odds ratios, and

significance tests for the other outcome categories are interpreted relative to this reference. This reference category is not assigned separate estimates or p-values, as it serves solely as the comparator against which the effects of the independent variables on the other categories are evaluated. This procedure ensures that the model produces interpretable and meaningful relative risk or odds estimates across multiple outcome categories.

Some outcomes in this study, such as nutritional status, and physical activity, have more than two categories. Using binary logistic regression would require combining categories, which loses information and masks differences between groups. Multinomial logistic regression allows the exact contribution of each factor to be accurately captured for all outcome levels, providing a more precise understanding of determinants of food security and nutrition among lactating women.

III.9 Ethical issues consideration and permission

Ethical approval for this study was obtained from the ethical review committee of Roikhaled Hospital prior to data collection. Official permission to conduct the study was also granted by the hospital administration. Written informed consent was obtained from all lactating women after clear explanation of the study objectives, procedures, potential benefits, and risks. Participation was voluntary, and respondents were informed of their right to withdraw from the study at any time without any consequences. Confidentiality and anonymity of all collected information were strictly ensured throughout the study.

Chapter IV: Results and discussion

IV.1 Demographic information of the respondents

IV.1.1 Age of lactating women

The demographic structure of the study population shows that the vast majority of lactating women in Bujumbura involved during the study were aged between 20 and 30 (53.3%) followed by an age between 31 and 40 (39.4%) years. The rest ones, were aged under 20 years (4.2%) and above 40 years (3.0%) (Table 1). The observed high percent of lactating women aged 20-30 years (53.3%) aligns with regional reproductive patterns in sub-Saharan Africa as reported by several studies. Studies in Ethiopia have documented similar age structures among lactating mothers, with the majority between 20-29 years, 74.2% (Seid & Cherie, 2022). Such age distributions reflect peak fertility and essential lactation periods in low-resource settings countries (Seid & Cherie, 2022) including Burundi.

This is a critical phase of life combining heightened nutritional requirements for lactation with ongoing personal growth and recovery from childbirth. Evidence suggests that younger lactating women, especially adolescents, are at increased risk of inadequate nutrient intake and undernutrition due to both biological demand and socio-economic barriers (Gizachew *et al*., 2024). This underscores the importance of tailored nutrition support for women in this important age group throughout lactation so as to improve their nutritional demands.

IV.1.2 Marital status of lactating women

Findings in Table 1 show that the majority (92.7%) of the lactating women in Bujumbura participated in a study were predominately married with few of them being single (3.6%) and divorced (3.6%). The high proportion of married lactating women (92.7%) align with several studies conducted in sub Saharan Africa. A study by Gizachew *et al*. (2024) on Siraro District, Southern Ethiopia reported that, 96.1% of lactating women were married and live with partner reflects social norms where childbearing predominantly occurs within marriage in sub-Saharan Africa.

Marital status affects nutritional vulnerability because women in the family often manage both food preparation and caregiving roles, yet may lack autonomy over household food choices (Seid & Cherie, 2022). Studies indicates that despite marriage being a potential source of economic

stability, it does not necessarily protect against food insecurity for women, particularly when male partners control resources of the family (Seid & Cherie, 2022). This is potentially supported by the study conducted in Uganda where marital status showed no significant (p, 0.092) relationship with food security outcome (Marsiale *et al*., 2022). This dynamic may limit dietary diversity and increase susceptibility to maternal undernutrition.

IV.1.3 Occupations of lactating women

Regarding major economic activities performed by the lactating women in Bujumbura participated in the study, the majority were unemployed accounting for 64.8% while 12.7% of were involving in small business, 11.5% were peasant and only 10.9% were employed (Table 1). With 64.8% unemployed, the study highlights economic vulnerability among lactating women in Bujumbura. Many lactating women engaged in small businesses experience irregular income, unstable working conditions, and frequent interruptions, which limit consistent participation in economic activities. As a result, these women may temporarily stop working or reduce their involvement, leading to become unemployed during the study period. This aligns with the studies conducted in Nepal and Shebedino District (Southern Ethiopia) where 64.7% (Nepal) and 92.4% (Shebedino District) of lactating women reported to be housewives or unemployed indicating rarely formal employment within the population (Singh *et al*., 2020; Gizachew *et al*., 2024).

Occupation is a critical determinant of dietary diversity and food security among women in reproductive age. Secondary data analyses on across sub-Saharan Africa found wealth and maternal employment were positively associated with minimum dietary diversity among lactating women (Zegeye *et al*., 2025). A study in Ethiopia reported that mothers engaged in less stable or informal economic activities were significantly more likely to have inadequate dietary practices, reflecting how income constraints can limit access to diverse and nutritious foods (Mulatu & Mulatu, 2025).

On other hand, Santos *et al*. (2022) found that household employment status was not significantly associated with food insecurity, indicating that having a job does not guarantee access to sufficient food if wages are low, unstable, or if other socio-economic constraints persist. These findings suggest that unemployment among lactating women may contribute to lower dietary diversity and higher food insecurity, increasing the risk of maternal nutrient deficiencies.

IV.1.4 Education level

The educational profile of lactating women in the study shows that, 44.2% of them attained secondary education, 28.5% attained tertiary education, 20.6% attained primary education and only 6.7% attained nothing (Table 1). Although many participants had attained either secondary or tertiary education, education alone may not guarantee food security and improved nutrition during lactation. Multi-country analysis found that higher education levels were associated with greater odds of meeting minimum dietary diversity, but structural barriers such as food cost, availability, and access still constrain diet quality (Zegeye *et al*., 2025). A maternal nutritional study demonstrated that despite better education, household food insecurity remains a strong predictor of low dietary diversity (Seid & Cherie, 2022). This suggests that in Bujumbura, education may increase awareness but not necessarily translate into diverse diets or improved nutritional status without concurrent socioeconomic support.

The current study profile suggests a relatively informed population; however, the finding that 64.8% were unemployed mirrors broader global nutrition reports indicating that women's education does not always translate into economic autonomy in low-income settings (Global Nutrition Report, 2024). This pattern is consistent with demographic features of reproductive age women in sub-Saharan Africa. Semagn *et al* (2023) reported that in Kenya and Burkina Faso, about 68% of women aged 15-49 were married, and over 70% were unemployed, reminding us that marriage and limited formal employment are common among women in this age group. This mismatch between education and economic independence may increase vulnerability to food insecurity and limit access to a balanced diet for lactating women.

IV.1.5 Obstetric history

IV.1.5.1 Postpartum duration

The results in Table 1 show that the vast majority (44.8%) of the lactating women involved in a study predominately undertaken 1- 4 months period after giving birth followed by 5-12 months (24.8%), below 1 month (15.8%) and finally above 12 months (14.5%) (Table 1). The predominance of women in the early postpartum period (1-4 months) aligns with evidence that lactation places high nutrient demands in the first months after birth. Early postpartum months are critical for maternal energy and micronutrient recovery. Inadequate food intake or diversity during this time increases susceptibility to undernutrition and micronutrient depletion, particularly iron

and vitamin A. Studies highlight that, lactating women often experience the greatest nutritional depletion during early postpartum when energy and micronutrient needs are highest, yet dietary diversity may not meet these increased requirements in resource-limited contexts (Seid & Cherie, 2022).

IV.1.5.2 Parity

Based on the number of children per family among lactating women in Bujumbura participated in the study, the majority of them (61.8%) reported less than 3 children followed by 3 to 5 children (35.8%) and remained 2.4% having more than 5 children (Table 1). Most women reported fewer than three children (61.8%), which may reduce intra-household competition for food and potentially support better nutritional outcomes.

The number of children per household is an important determinant of maternal food security, as larger families may face increased competition for limited food resources, thereby heightening vulnerability to food insecurity. A study in Ethiopia found that lactating mothers from larger households with more children were significantly more likely to experience food insecurity compared to those with fewer children (Dagne *et al*., 2024). Furthermore, other studies indicate that larger family size often correlates with poorer dietary diversity and maternal nutritional status, due to increased demand on limited resources (Mulatu & Mulatu, 2025).

However, smaller family size does not automatically ensure food security. Other factors, including household income, maternal education, and employment, can manipulate the effect of family size on food security outcomes (Endeshaw, 2024). With context of current study, the predominance of women with fewer than three children may partially buffer the impact of household food scarcity, but economic vulnerability and unemployment may still limit access to diverse and sufficient foods.

Table 1. Socio-demographic characteristics of lactating women in Bujumbura (n = 384).

Categories	Percent (%)
Age of lactating women	
Under 20 years	4.2
20-30 years	53.3
31-40 years	39.4
Above 40 years	3.0
Marital status of lactating women	
Single	3.6
Married	92.7
Divorce	3.6
Education level of lactating women	
None	6.7
Primary	20.6
Secondary	44.2
Tertiary	28.5
Occupation of lactating women	
Peasant agriculture	11.5
Employed	10.9
Small business	12.7
Unemployed	64.8
Postpartum duration	
Below 1 month	15.8
1-4 months	44.8
4-12 months	24.8
Above 12 months	14.5
Parity	
Less than 3 people	61.8
3-5 people	35.8
More than 5	2.4

IV.2 Food security among lactating women

IV.2.1 Food security status among lactating women

Food insecurity was highly prevalent in the study, affecting 84.2% (26% mildly insecure, 20% moderate insecure and 38.2% severely insecure) of lactating women (Table 3), signaling significant instability in food access. Similar patterns have been documented in other East African studies where food insecurity persists even among urban populations due to economic constraints and fluctuating food prices (Leroy *et al*., 2021). Evidence from systematic reviews further confirms that food insecurity disproportionately affects women in low-resource settings, often leading to compromised dietary quality and meal reduction as coping strategies (Carvajal-Aldaz *et al*., 2022).

The high food insecurity prevalence observed here is higher than national estimates of 65% (WFP, 2023), which suggests that lactating women in dense urban areas such as Bujumbura may face heightened economic stress compared to the general population. This finding aligns with research in Kenya where household food insecurity was also identified as a predictor of both underweight and overweight among women, underscoring the multidimensional nature of food insecurity (Keino *et al*., 2014).

IV.2.2 Determinants of food security among lactating women

The multinomial logistic regression analysis indicates that education level was a significant determinant of food security among lactating women in Bujumbura, Burundi. Compared with women who had tertiary education (reference category), those with primary education were significantly less likely to experience food insecurity (AOR = 0.127, 95% CI: 0.025-0.640, p = 0.013), while women with secondary education also showed a significantly lower likelihood of food insecurity (AOR = 0.284, 95% CI: 0.093-0.870, p = 0.027) (Table 2). These findings suggest that women with basic formal education (primary or secondary education) may confer protective benefits against food insecurity in urban context, possibly through improved livelihood skills, better access to income generating opportunities, and enhanced decision-making capacities within households (Smith & Haddad, 2015). This pattern reflects the urban context of the study population, where higher educational attainment does not necessarily translate into stable income or food access (Global Nutrition Report, 2024). Women with tertiary education may face unemployment, underemployment, or higher living costs, particularly in urban settings, which can

offset the expected economic advantages of higher education. In contrast, women with primary or secondary education may engage more consistently in informal or practical income generating activities that provide regular access to food (Othman *et al*., 2022). In contrast, a study by Monroe-Lord *et al*. (2025) on older adults during the COVID-19 pandemic showed that, educational attainment did not remain a significant predictor of food security after adjusting for income and demographic covariates, suggesting that the role of education may vary depending on social, environment and economic factors.

Based on their occupation, the multinomial logistic regression results showed that women engaged in small business activities were significantly more likely to be food secure than women with no occupation (AOR = 1.020, 95% CI: 1.11-2.59, p = 0.034) (Table 2). This suggests that small business engagement may provide additional income flexibility that helps households afford food in urban environments compared to those with nothing. Evidence from Sub-Saharan African cities supports this, as different types of informal employment have been linked with food security outcomes: households predominantly engaged in informal or self-employment, including small enterprises, show distinct food security profiles, largely due to the income variability and accessibility patterns of urban labor markets (Blekking *et al*., 2020) .

Other demographic variables, including age, marital status, and parity, were not significantly associated with food security. The lack of significant associations with these variables may reflect the complex, multifactorial nature of food insecurity, where factors such as income, household size, and control of productive resources may play more predominant roles than basic socio-demographics alone (Assenga & Kayunze, 2020).

Table 2. Determinants of food security and minimum food diversity among lactating women in Bujumbura, Burundi (n=384)

Variable	**Categories**	**Food security**			**Minimum food diversity**		
		AOR	**95% CI**	**P-Value**	**AOR**	**95% CI**	**P-value**
Age	<20	0.822	0.027-24.9	0.910	0.975	0.04-23.96	0.987
	20 to 30	1.451	0.11-19.95	0.781	0.566	0.035-9.149	0.689
	31 to 40	1.542	0.12-20.45	0.743	0.827	0.051-13.34	0.894
	Above 40					*Reference*	
Marital status	Single	9.401	0.44-1.34	0.152	0.056	0.003-1.231	0.068
	Married	1.150	0.09-13.79	0.912	0.440	0.038-5.109	0.512
	Divorced					*Reference*	
Education level	None	0.398	0.063-2.51	0.327	0.673	0.134-3.377	0.630
	Primary	0.127	0.025-0.64	0.013	0.797	0.223-2.847	0.727
	Secondary	0.284	0.093-0.87	0.027	2.273	0.833-6.203	0.109
	Tertiary					*Reference*	
Occupation	Peasant agriculture	0.967	0.172-5.44	0.970	2.953	0.565-15.45	0.200
	Employed	0.688	0.160-2.95	0.615	0.387	0.114-1.307	0.126
	Small business	1.020	1.11- 2.59	0.034	0.738	0.223-2.445	0.619
	None					*Reference*	
Parity	< 3	0.663	0.054-8.09	0.747	1.208	0.099-14.72	0.882
	3 to 5	0.861	0.07-11.04	0.908	2.772	0.214-35.97	0.436
	> 5					*Reference*	

IV.2.3 Challenges faced by lactating women and their adaptive mechanism toward food insecurity

Lactating women faced with several barriers in combating against food insecurity. The most frequently cited barriers were limited income, reported by 47.9% of women, and rising of food costs, reported by 42.4% of lactating women (Figure 4). Other obstacles, such as transport or distance to markets, were reported by 1.8% of women, and the absence of good and dietary food was mentioned by 7.9% of them (Figure 4). These findings are in consistent with evidence from Tanzania, where low household income and high food prices were identified as major determinants of food insecurity, limiting the ability of households to afford both staple and diverse foods (Rashid, *et al*, 2024). Beyond economic factors, physical access to food markets also plays a role in household food security, reflecting broader patterns in the areas, where remoteness increases the cost of acquiring food and reduces access to diverse and nutritious options (FAO, 2006). The absence of diverse foods in the local environment, reported by 7.9% of women (Figure 4), further limits food security, especially for household's dependent on local markets for nutritious diets. Similar findings have been observed in peri-urban settings, where lack of availability of high-quality foods is associated with higher food insecurity (Inaç *et al*., 2024). These findings emphasize that, economic limitations are the primary determinants of food insecurity in this population, while logistical constraints play a minor role.

In response to rising food costs, lactating women adopt various coping strategies that reflect both proactive and constrained measures to maintain household food access. The majority of women, 52.7% reported starting additional economic activities, reflecting proactive efforts done by women to supplement household income. Meanwhile, 26.1% reduced the number of meals they consumed, reflecting the negative coping mechanism that may compromise both maternal and infant nutrition. Smaller percent of women attempted to buy any food at the same cost (13.3%) or buy affordable foods only (7.9%), reflecting limited flexibility in dietary adjustments due to economic crisis (Figure 4). These findings are consistent with evidence from Sub-Saharan Africa, where households combine income-generating strategies with dietary modifications to manage food insecurity (Tsegaye *et al*., 2018)

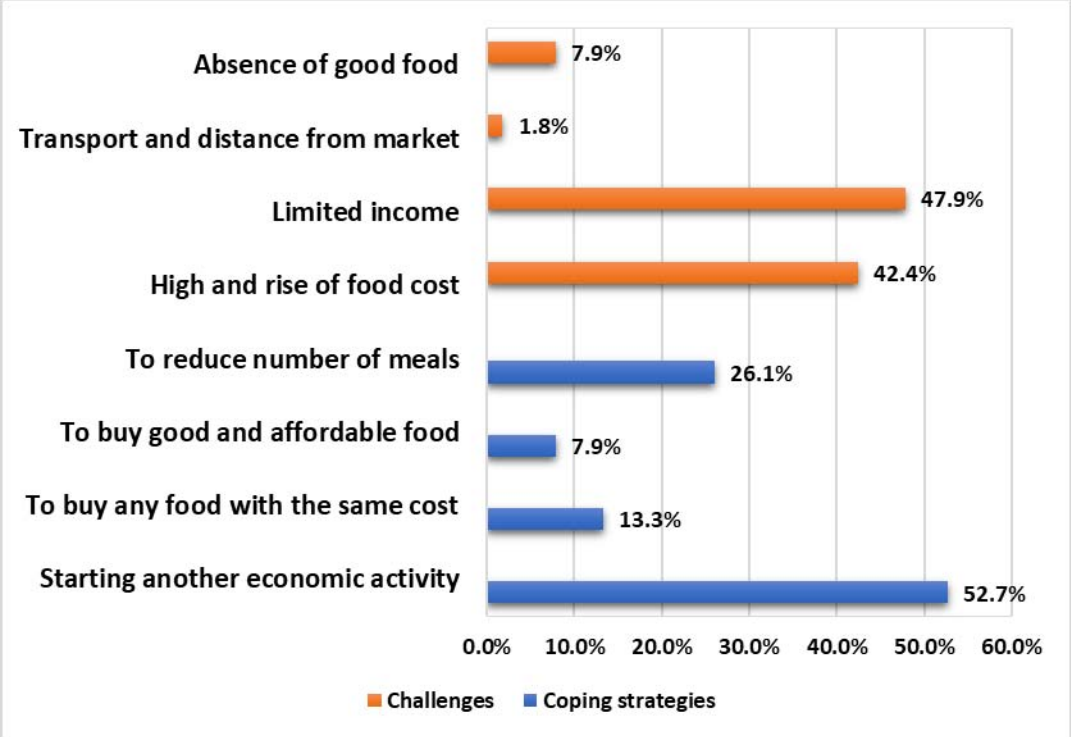


Figure 4: Challenges faced and their adaptive mechanism undertaken by lactating women against food insecurity in Bujumbura, Burundi

IV.3 Eating pattern and dietary diversity among lactating women

IV.3.1 Dietary pattern and diversity status among lactating women

Despite widespread food insecurity, 53.3% of lactating women in Bujumbura, consumed three meals daily, though irregular eating behaviors were common, with 61.2% reporting late eating and 35.8% eating only when hungry (Table 3). Their consumption of animal-source foods observed to be low (3.2%) compared to higher number of them who relied on plant-based staples such as beans (41.3%) and vegetables (39.2%) (Figure 5) for proteins and vitamins. This is consistent with national reports showing that Burundian diets remain heavily dominated by staples and legumes for protein and vitamins, with animal products consumed infrequently due to cost (WFP, 2023). This pattern resembles dietary profiles in other food-insecure urban settings, where economic constraints push households toward plant-based, low-cost meals that may be diverse but insufficient in bioavailable nutrients like iron and vitamin B12 (Islam *et al*., 2023). Similar result was observed in Burkina Faso by Weil *et al*, (2023) where urban adults relied mostly on starchy foods and other plant-based staples (rice, maize, roots/tubers) with rare consumption of animal-

based products. This reflects the early phase of nutrition transition in many urban Sub-Saharan Africa counties, where reliance on staples remains high.

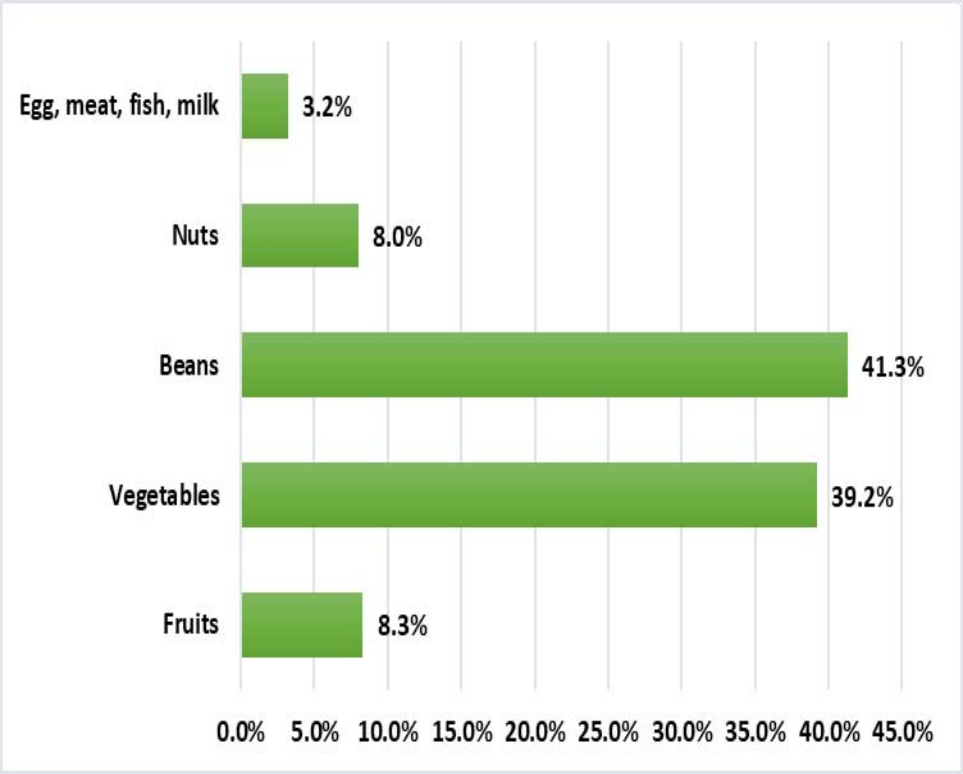


Figure 5; Common food taken with their reasons among lactating women in Bujumbura, Burundi

Interestingly, 75.2% of the women achieved the Minimum Dietary Diversity for Women (MDD-W) (Table 3), reflecting short-term Minimum Dietary Diversity attaining suggesting that, some variety in food groups consumed within a 24-hour recall. This matches findings from *Tubaramure* program evaluations, which show that dietary diversity among Burundian women can improve even under food insecurity when diverse food groups (mainly plant-based) are accessible through markets or interventions (Leroy *et al*., 2021). Comparable findings have been reported in other urban African settings, where short-term dietary diversity may appear adequate despite chronic limitations in diet quality and micronutrient intake (Leroy *et al*., 2021).

Table 3; Minimum dietary diversity for women and eating pattern of lactating women in Bujumbura, Burundi (n=384)

Variables		Percent (%)
FOOD SECURITY		
Food secure		15.8
Food insecure		84.2
MDD-W		
Attained		75.2
Not attained		24.8
Meals consumed per day		
One		4.2
Two		33.9
Three		53.3
> three		8.5
Total		100.0
Feeling of hunger		
Yes	Eat very late	61.2
	Eat when hungry	35.8
No		3.0

IV.3.2 Determinants of dietary diversity among lactating women

Multinomial logistic regression analysis showed that none of the examined socio-demographic variables were significantly associated with achieving minimum dietary diversity (Table 2). The lack of significant associations between demographic factors and dietary diversity may be due to the homogeneity of the study population, where most lactating women share similar socio-economic and cultural backgrounds. In particular, education level may not have shown an effect because even women with higher education still face similar constraints in food access and household decision-making, making dietary choices more influenced by household food availability, cultural practices, and personal preferences than formal education.

These results are consistent with findings from studies in Tanzania noted that dietary diversity is influenced by a combination of economic, environmental, and cultural factors rather than simple socio-demographic characteristics alone. Household income, market access, and production diversity have been associated with dietary diversity outcomes, while basic demographic variables often do not show consistent independent effects (Assenga & Kayunze, 2020). Further support for the importance of broader determinants comes from qualitative research showing that household cash resources, agrobiodiversity, and livelihood diversity support the ability to consume a varied diet, and that seasonality and household dynamics contribute importantly to dietary diversity outcomes (Powell *et al.*, 2017).

IV.4 Daily physical activity among lactating women

Daily physical activity levels among lactating women appeared moderate (≥ 600 MET-min/week) to high (≥ 3000 MET-min/week), with 43% each with only 13.9% of lactating women being below normal range (< 600 MET-min/week) of daily physical activity (Figure 6). The country-level data suggest that physical inactivity remains a concern in Burundi: according to global estimates, about 40% of women in Burundi do not meet WHO physical activity recommendations (World Obesity Federation, 2025). Additionally, a cross-sectional study of Burundian adults found that, non-organized physical activity (such as walking, household chores) is common and contributes significantly to health-related physical fitness, though formal (organized) activity offers additional cardiovascular and strength benefits (Bizimana, *et al*., 2016). This pattern aligns with WHO guidance noting that for pregnant and postpartum women, routine daily activities not necessarily structured exercise often makes up most of their physical activity (WHO, 2020). Taken together, the data appear consistent with Burundi-specific trends in everyday activity, and underscore the importance of recognizing non-structured, domestic forms of movement in assessing energy expenditure among lactating women.

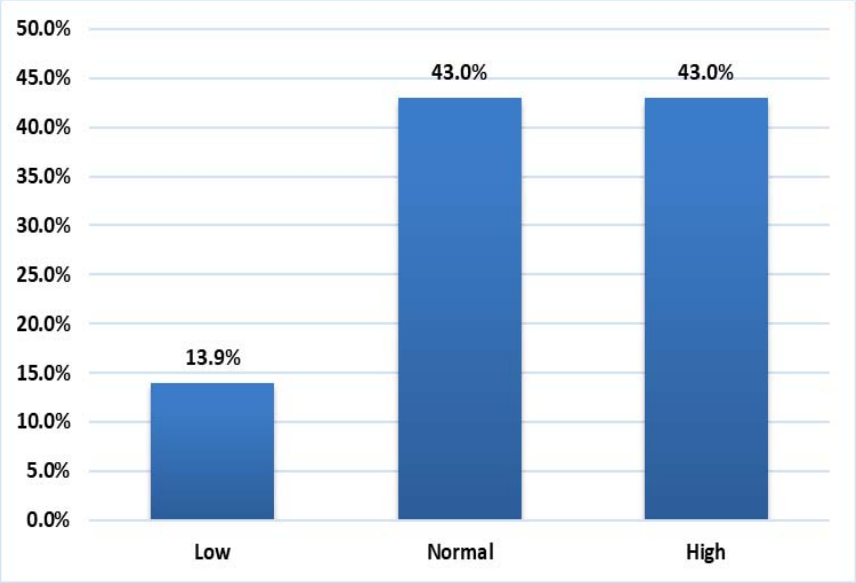


Figure 6. Daily physical activity level among lactating women in Bujumbura, Burundi

IV.5 Nutritional status among lactating women

The nutritional status data reveal a double burden of malnutrition, with 9.1% underweight, 35.8% overweight 6.1% obese and 49.1% health weight (Figure 7). The high prevalence of healthy weight despite high food insecurity and minimum dietary diversity attainment may be due to adaptation and compensatory eating patterns, where lactating women consume available staple foods in sufficient quantity to maintain body weight. Additionally, physical activity levels, metabolic differences, and occasional access to nutrient-dense foods may help preserve healthy weight even when dietary quality is limited. This pattern is consistent with regional observations showing rising overweight and obesity levels in sub-Saharan African women, particularly in urban areas undergoing nutritional transition (Atsu, 2024). Comparatively, Burundi's national obesity level for adult women is estimated at around 10.5% (Global Nutrition Report, 2024), whereas the overweight prevalence in this urban sample is considerably higher. Similar trends were documented in Tanzania, where urban women aged 20 to 49 years exhibited overweight/obesity rates was 36% (95% Cl 33.6-38.0) (Adam *et al*., 2025). The coexistence of overweight with food insecurity reflects the recognized food insecurity-obesity paradox, wherein constrained budgets encourage reliance on inexpensive, energy-dense foods (Carvajal-Aldaz *et al*., 2022). Evidence from Kenyan research further supports this paradox, showing that limited food access may

predispose women to both undernutrition and overweight due to irregular eating and dependence on cheap calories (Keino *et al*., 2014).

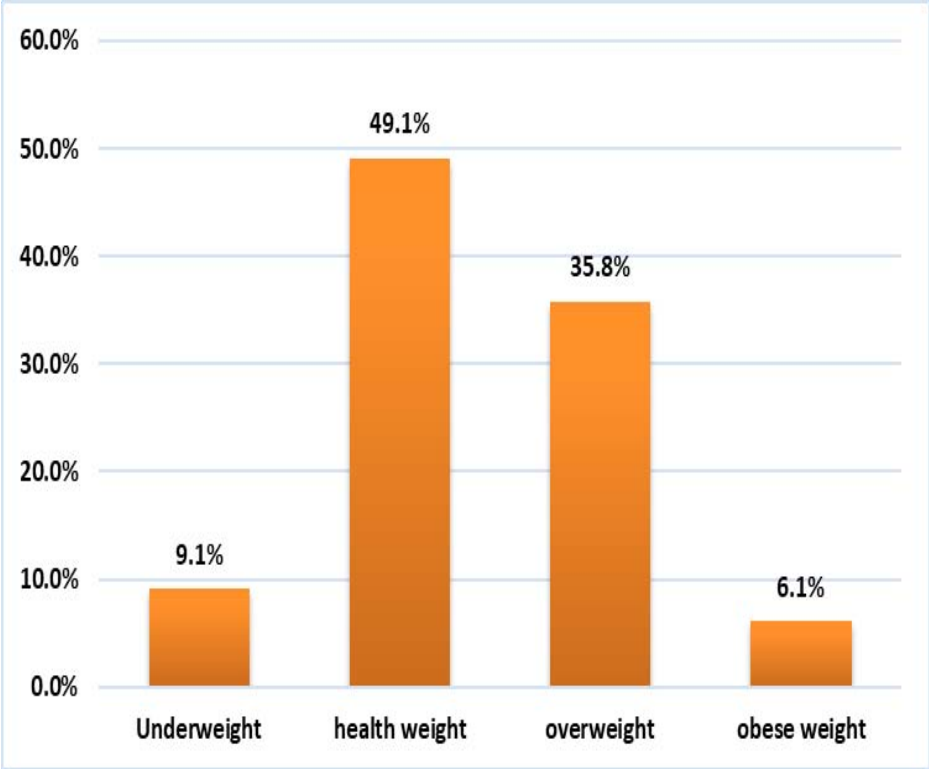


Figure 7. Nutritional status among lactating women in Bujumbura, Burundi

IV.6 Food security, dietary diversity and daily physical activity among lactating women

Food security was not significantly associated with dietary diversity (AOR = 0.794; p = 0.640) (Table 4). Despite high food insecurity and high attainment of minimum dietary diversity, food security was not significant because households may consume a variety of foods in small amounts without meeting overall food needs, and factors like limited income, household size, and inconsistent food availability have a stronger influence on true food security. This supports evidence that food secure households may still consume diets due to cultural practices, food preferences, or economic prioritization (Chakona ,2023). Thus, food access does not automatically guarantee diet quality among lactating women.

High physical activity was strongly associated with attaining dietary diversity (AOR = 8.918; 95% CI 2.869-7.719 p = 0.001) (Table 4). This suggests that women who are more physically active may also engage in healthier dietary behaviors or possess better overall functional and socio-

economic status. Similar associations have been reported among postpartum women in low- and middle-income countries, where active lifestyles were linked with improved dietary practices (Zegeye *et al*., 2025).

IV.7 Food security, dietary diversity, daily physical activity and nutritional status among lactating women

IV.7.1 Underweight and food security, dietary diversity, and physical activity

The findings show that, food security was not significantly associated with underweight among lactating women in Bujumbura (AOR = 0.432; p = 0.459) (Table 4). Food security was not significantly associated with nutritional status because even with limited or unstable food access, many lactating women may still consume enough overall calories to maintain a healthy weight, often by prioritizing energy-dense foods or distributing available food within the household to meet their needs. This suggests that household food security status alone may not adequately capture individual maternal nutritional risk during the lactation period. Similar findings have been reported in Kenya, where food security lost statistical significance in multivariable models once dietary and behavioral factors were controlled for underweight prediction (Keino *et al*., 2024). This highlights that intra-household food allocation and diet quality may be more critical determinants of maternal undernutrition than household food access alone.

In contrast, dietary diversity showed a significant protective effect against underweight, with lactating women who attained minimum dietary diversity having significantly lower odds of being underweight (AOR = 0.274; 95%CI 0.077- 0.971 p = 0.045) (Table 4). This finding is consistent with evidence from Dessie Town, Ethiopia, where inadequate dietary diversity was independently associated with maternal undernutrition (AOR = 3.8, 95%, 95%CI 2.08-77.03) among lactating women in Ethiopia (Seid & Cherie, 2022). Adequate dietary diversity ensures sufficient intake of both macro and micronutrients, which is essential for meeting the increased nutritional demands of the postpartum period.

Low physical activity was significantly associated with higher odds of underweight (AOR = 7.8; 95%CI 1.484 - 4.007 p = 0.015) (Table 4). This association may reflect underlying poor health status, fatigue, or insufficient energy intake, all of which can reduce functional capacity and contribute to weight loss during lactation. Comparable findings in Taiwanese adults found that participants engaging in regular leisure-time physical activity had significantly lower odds of being

underweight (AOR = 0.732; 95% CI = 0.611- 0.876) compared with those who did not engage in regular physical activity after controlling for sociodemographic factors (Lee *et al*., 2023).

IV.7.2 Overweight and food security, dietary diversity, and physical activity

Food security showed a borderline but non-significant association with overweight (AOR = 2.504; p = 0.052) (Table 4). This suggests that while food secure women may have increased access to food, this does not necessarily translate into excessive weight gain once other factors are controlled. Similar observations have been reported in USA, where food security alone was not a consistent predictor of overweight among women (Jones & Frongillo, 2007).

Dietary diversity was significantly associated with higher odds of overweight (AOR = 2.734; 95%CI 1.053-3.097 p = 0.039) (Table 4). This finding aligns with emerging evidence from sub-Saharan Africa indicating that diversified diets in urban areas often include energy-dense and processed foods, contributing to increased body weight among women of reproductive age (Zegeye *et al*., 2025). This reflects an ongoing nutrition transition, particularly in urban environments such as Bujumbura.

Physical activity level was not significantly associated with overweight (Table 4), suggesting that dietary factors may play a more prominent role than activity alone in influencing excess weight during the postpartum period.

Table 4. Multinomial logical regression for food security, dietary diversity, daily physical activity and nutritional status among lactating women (n=384)

		AOR	**95% CI**	**P-value**
Underweight	Food secure	0.432	0.047-3.988	0.459
	Food insecure			*Reference*
	Attained diversity	0.274	0.077-0.971	0.045
	Not attained diversity			*Reference*
	Low activity	7.8	1.484-4.007	0.015
	Moderate activity	1.257	0.265-5.977	0.773
	High activity			*Reference*
Overweight	Food secure	2.504	0.992-6.315	0.052
	Food insecure			*Reference*
	Attained diversity	2.734	1.053-3.097	0.039
	Not attained diversity			*Reference*
	Low activity	1.455	0.445-4.758	0.535
	Moderate activity	0.944	0.438-2.033	0.883
	High activity			*Reference*
Obese weight	Food secure	2.342	0.397-13.826	0.348
	Food insecure			*Reference*
	Attained diversity	6.155	0.694-54.762	0.103
	Not attained diversity			*Reference*
	Low activity	19.774	1.741-4.539	0.016
	Moderate activity	8.71	0.970-8.179	0.053
	High activity			*Reference*
Food diversity	Food secure	0.794	0.303-2.083	0.640
	Food insecure			*Reference*
Low physical activity	Food secure	0.531	0.106-2.663	0.441
	Food insecure			*Reference*
	Attained diversity	1.877	0.549-6.416	0.315
	Not attained diversity			*Reference*
High physical activity	Food secure	1.281	0.435-3.770	0.653
	Food insecure			*Reference*
	Attained diversity	8.918	2.869-7.719	0.001
	Not attained diversity			*Reference*

IV.7.3 Obesity and food security, dietary diversity, and physical activity

Food security and dietary diversity were not significantly associated with obesity. Food security and dietary diversity were not significantly because lactating women may attain adequate or excess energy intake from a limited variety of calorie-dense foods, even in food limited households, making obesity more dependent on energy consumption patterns than on the number or diversity of foods available. However, low physical activity was strongly and significantly associated with obesity compared to high physical activity (AOR = 19.774; 95%CI 1.741-4.539 p = 0.016) (Table 4). This finding is consistent with study conducted in Dar es salaam, Tanzania demonstrating that sedentary behavior during the postpartum period substantially increases the risk of obesity among women (Mosha *et al*., 2021).

Moderate physical activity showed an insignificant borderline association with obesity (p = 0.053), suggesting a response relationship where higher activity levels may protect against excessive weight gain. These findings underscore the importance of promoting safe and appropriate physical activity during the postpartum period.

V. Conclusion and recommendations

V.1 Conclusion

This study assessed food security, dietary diversity, daily physical activity, and nutritional status among lactating women in Bujumbura, Burundi. The findings indicate that maternal nutrition is influenced by multiple factors, with dietary quality and physical activity emerging as stronger predictors of nutritional outcomes than household food security alone. Most participants, 53.3% were aged 20-30 years, 92.7% were married, 64.8% were unemployed, and 72.7% had attained at least secondary education. This mismatch between education and economic empowerment may limit women's ability to access a variety of nutrient-rich foods, highlighting the complexity of maternal nutrition beyond mere food availability.

Obstetric characteristics revealed that most women were 1-4 months postpartum (44.8%) and had fewer than three children (61.8%). While these factors affect energy requirements and maternal nutritional needs, they were not independently associated with food security. Food security status in this study was low (15.8%) although not significantly associated with underweight, overweight, or dietary diversity, emphasizing that having enough food does not necessarily guarantee a varied or nutritionally adequate diet. In contrast, attaining minimum dietary diversity was slightly high (75.2%) and significantly associated with lower odds of underweight and higher odds of overweight, indicating that the quality and composition of the diet play critical roles in maternal nutritional status.

Physical activity ranged from moderate to high with 43% each and demonstrated a significant relationship with nutritional outcomes. Low physical activity was associated with both underweight and obesity, reflecting its dual impact on maternal weight status. Moreover, high physical activity was positively associated with dietary diversity, suggesting that more active women may have better access to or higher consumption of diverse foods. Overall, the coexistence of underweight, overweight, and obesity in this population highlights a double burden of malnutrition, underscoring the need for interventions that address both ends of the nutritional spectrum.

V.2 Recommendations

To improve maternal nutrition among lactating women in Bujumbura, interventions should focus on enhancing diet quality and promoting physical activity. Nutrition programs should encourage dietary diversification, including increased consumption of fruits, vegetables, legumes, and animal-source foods, and should be integrated into routine postpartum care. Counselling on nutrient requirements and balanced diet planning can further help mothers meet their energy and micronutrient needs.

Physical activity initiatives should provide guidance on safe and appropriate exercises for lactating women, aiming to balance energy intake and expenditure to prevent both undernutrition and overweight. Economic and social support mechanisms, such as income-generating activities for women and community-based support systems, are also essential to improve access to diverse foods, particularly for unemployed mothers.

At the policy level, maternal nutrition interventions should be incorporated into public health programs, emphasizing both food quality and lifestyle behaviours alongside traditional food security measures. Public awareness campaigns can educate communities about the importance of dietary diversity and active lifestyles during lactation. Finally, further research, including longitudinal study and comparative study between urban and rural, is recommended to assess causal relationships between dietary diversity, physical activity, and maternal nutritional outcomes, as well as to explore barriers to achieving a varied diet even in food-secure households.

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Annex: Section A; Questionnaire

I'm Mkwandu, Victoria L, a Master's student from University of Burundi under EANSI in Mutanga campus. I am conducting the research on the topic "Food Security, Dietary Patterns, Physical Activity, and Nutritional Status among Lactating Women in Bujumbura, Burundi "**.**

Kindly answers the following questions to support this research which will contribute to the development and implementation of good policy and programmes in our country. All information will be treated confidentially.

Part A. Demographic information (Please put a tick to the collect answers)

1. Age (in years): ☐ under 20 ☐ 20-30 ☐ 31-40 ☐ above 40

2. Marital status: ☐ Single ☐ Married ☐ Divorced ☐ Widowed

3. Education level: ☐ None ☐ Primary ☐ Secondary ☐ Tertiary

4. Occupation: ☐ Peasant ☐ Employed ☐ Small business ☐ None

5. Parity (Number of children): ☐ Less than 3 people ☐ 3-5 people ☐ more than 5

6. Postpartum duration: ☐ below 1 month ☐ 1 to 4 months ☐ 4-12 month ☐ above 12 months

Part B. Food security (Please put a tick to the collect answers)

7. In the past 4 weeks, how often did the following occur in your household? (HFIAS – FAO/FANTA) (Tick one option per row)

S/N	Question	Never	Rarely (1–2 times)	Sometimes (3–10 times)	Often (>10 times)
i	Worry that food would run out	☐	☐	☐	☐
ii	Unable to eat preferred foods	☐	☐	☐	☐
iii	Ate limited variety of food	☐	☐	☐	☐
iv	Ate food you did not want	☐	☐	☐	☐
v	Ate smaller meals	☐	☐	☐	☐
vi	Ate fewer meals in a day	☐	☐	☐	☐
vii	No food in household	☐	☐	☐	☐
viii	Slept hungry	☐	☐	☐	☐
ix	Went a whole day without eating	☐	☐	☐	☐

8. Where do you get support to get food? ☐ My activities ☐ Supporters such as husband

9. How do you cope with the rise of cost of the food?

☐ Starting another economic activity ☐ To buy any food with the same cost

☐ To buy good and affordable food ☐ To reduce number of meals

10 What is the main challenges for you to get enough food?

☐ High and rise of food cost ☐ Limited income ☐Transport and distance from market

☐ Absence of good food

Part C: dietary pattern and diversity

Recall period: Last 24 hours (MDD-W – FAO).

11. Did you eat the following food groups yesterday (Yes/No)? (Tick Yes if eaten even once in the past 24 hours)

S/N	Food Group	Yes	No
1	Grains, roots, tubers, or plantains	☐	☐
2	Pulses (beans, peas, lentils)	☐	☐
3	Nuts and seeds	☐	☐
4	Dairy (milk, yogurt, cheese)	☐	☐
5	Meat, poultry, fish	☐	☐
6	Eggs	☐	☐
7	Dark green leafy vegetables	☐	☐
8	Vitamin A-rich fruits/vegetables	☐	☐
9	Other vegetables	☐	☐
10	Other fruits	☐	☐

Scoring:

Each "Yes" = 1 point

Total score: ___ out of 10 (Minimum dietary diversity met if score ≥ 5)

12. How many meals do you mostly have per day? ☐one ☐two ☐three ☐more than three

13. What common in your meal? ☐Fruits ☐vegetables ☐beans ☐nuts ☐egg, meat, fish, milk

14. Do you experience some feeling of hunger? ☐Yes ☐ No

15. If yes why? ☐ I eat very late each meal ☐ I eat when I am hungry

16. Is potatoes and related food, ugali and rice very common in your meals? ☐Yes ☐ No

17. If yes why? ☐ very available ☐ very accessible ☐ easy and quick to prepare ☐I like them

Part D: physical activity

Recall period: typical week (GPAQ – WHO)

Domain 1: Work-related activity

18. How many days do you do vigorous activity (e.g., carrying heavy loads, digging)?

___ days/week; Hours per day: ___ h ___ min

19. How many days do you do moderate activity (e.g., fetching water, cooking)? ___ days/week; Hours per day: ___ h ___ min

Domain 2: Travel

20. Days walked/cycled more than or equal to10 minutes: ___ days. Time per day: ___ h ___ min

Domain 3: Recreational Activities

21. Days of vigorous leisure activity (e.g., sports, running): ___ days. Time per day: ___ h ___ min

22. Days of moderate leisure activity (e.g., gardening): ___ days. Time per day: ___ h ___ min

Sedentary Behavior

23. Time sitting or reclining during a typical day: ___ hours ___ minutes

Part E: health & nutrition status

24. Are you currently taking micronutrient supplements? ☐ Yes ☐ No

25. Duration of exclusive breastfeeding: ___ months

26. Any chronic illness (HIV, TB, diabetes, etc.)? ☐ Yes ☐ No

27. If yes, specify: _____

Part F: anthropometry (to be filled by data collector)

1. Height: _____ cm

2. Weight: _____ kg

3. BMI _____

Section B; Pictures of activities performed during data collection including questionnaire filling checking



