

Integrating poultry and nutrition education to improve dietary diversity among rural Kenyan women

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Abstract

Background: Malnutrition among women of reproductive age (WRA) in Kenya reflects a dual burden: persistent undernutrition alongside increasing rates of overweight and obesity, with widespread micronutrient deficiencies. Dietary diversity, a proxy for nutrient adequacy, remains low—particularly in rural and peri-urban areas—exacerbated by socioeconomic and educational disparities.

Objective: To assess the impact of poultry interventions, with and without integrated nutrition education, on dietary diversity among WRA in smallholder households in Kakamega and Bomet Counties, Kenya.

Methods: A cluster-randomized implementation study was conducted among poultry-keeping households across selected villages in Kakamega and Bomet. Villages were randomly assigned to one of three groups: (1) Poultry Only, (2) Poultry plus Nutrition Education, and (3) Control. A total of 324 households (108 per group) were enrolled. The Minimum Dietary Diversity for Women (MDD-W) was assessed at baseline (August–September 2023) and at endline (December 2024) using 24-hour dietary recall and descriptive statistical analysis.

Results: Significant improvements in dietary diversity were observed in both intervention groups. In Bomet, MDD-W achievement increased from 9% to 61% in the Poultry Only group and from 41% to 78% in the Poultry + Nutrition Education group. In Kakamega, MDD-W improved from 41% to 78% in the Poultry Only group and from 44% to 97% in the Poultry + Nutrition group. The control group in Kakamega also improved (from 41% to 79%), while the control group in Bomet showed no significant change. Higher educational attainment in Kakamega may have contributed to the greater gains observed.

Conclusion: Both poultry provision and nutrition education independently improved women's dietary diversity, with the combined intervention demonstrating the greatest impact. Educational disparities influenced intervention outcomes, highlighting the need for locally tailored, nutrition-sensitive agricultural strategies to effectively address malnutrition among WRA in rural settings.

Keywords: Dietary diversity, nutrition-sensitive agriculture, women of reproductive age, poultry intervention, nutrition education

Introduction

The nutritional status of women of reproductive age (WRA) in Kenya remains a major public health concern, with far-reaching implications for both maternal and child health. This demographic is affected by the dual burden of malnutrition—facing both undernutrition and a rising prevalence of overweight and obesity. These trends are largely driven by dietary transitions, urbanisation, and lifestyle changes. According to the Kenya Demographic and Health Survey, approximately 9% of women aged 15–49 are underweight, while 33% are either overweight or obese—an increase from 25% in the 2018–2020 period (Jepkoech 2020). This coexistence of nutritional deficiencies and excesses illustrates the complex and evolving dietary landscape in Kenya.

Beyond macronutrient imbalances, micronutrient deficiencies are also widespread among WRA. Research indicates that iron deficiency affects 48% of

women, zinc deficiency 52%, and vitamin A deficiency 40%—with serious health consequences including anaemia, compromised immunity, poor pregnancy outcomes, and elevated maternal and neonatal mortality rates (Benson et al. 2021). Dietary diversity, commonly used as a proxy indicator of micronutrient adequacy, remains suboptimal among many Kenyan women, particularly in rural and peri-urban settings. For instance, a study in Laikipia County reported a mean dietary diversity score (DDS) of 6.84 ± 1.46 , where diets were predominantly cereal-based and included minimal consumption of animal-source foods. Notably, 15% of pregnant women failed to meet the Minimum Dietary Diversity for Women (MDD-W), indicating inadequate intake of key nutrients (Kiboi et al. 2017).

Similar patterns have been observed elsewhere. In Nakuru County, an assessment revealed a mean DDS of 3.78 ± 0.99 , with over 75% of women consuming fewer than five food groups—falling below the MDD-

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W threshold (Gitagia et al. 2019). These figures highlight a persistent gap in both the availability of and knowledge about diverse diets among women. Socioeconomic factors—including education level, income, and household food security—are significant determinants of dietary practices. Women with higher education and formal employment are more likely to consume nutritionally diverse diets, whereas women in low-income environments, such as informal urban settlements, often face limited access to diverse foods, inadequate nutrition education, and poor sanitation, all of which increase the risk of malnutrition (Tambe et al. 2023).

Furthermore, there is increasing recognition of the relationship between maternal nutrition and mental health. A recent study in Nairobi's informal settlements found that poor maternal nutrition, as indicated by low mid-upper arm circumference (MUAC), was significantly associated with antenatal depression—suggesting that nutritional inadequacies can negatively affect both physical and psychological well-being (Mulupi et al. 2025).

Given these multifaceted challenges, improving the nutritional status of WRA in Kenya demands integrated, context-specific interventions. Strategies that combine enhanced agricultural practices, targeted nutrition education, and improved access to nutrient-rich foods are essential to improve dietary diversity and, ultimately, health outcomes for women and their children.

Materials and Methods

Study Site: This comparative implementation study was conducted in Kakamega County (Western Kenya) and Bomet County (Rift Valley, Kenya). Both counties were purposively selected due to their dependence on smallholder agriculture, persistent maternal and child nutrition challenges, and alignment with program goals targeting improved dietary diversity and nutrition education among women of reproductive age. Kakamega County (0°05'–0°54'N, 34°20'–35°09'E) borders several counties, including Bungoma and Vihiga, and its economy is primarily driven by subsistence farming. Major agricultural activities include the cultivation of maize, beans, and sugarcane, alongside small-scale livestock rearing. Bomet County (0°29'–1°03'S, 35°05'–35°35'E), which spans approximately 2,307.4 km² and borders Kericho and Narok Counties, is known for tea production, dairy farming, maize cultivation, and poultry keeping. These regions were chosen for their nutritional vulnerability and agricultural potential and were included in a broader cluster-randomized intervention promoting nutrition-sensitive agriculture.

Study Design: The study employed a cluster-randomized design to evaluate the impact of poultry-based interventions—with and without integrated nutrition education—on dietary diversity among women of reproductive age (15–49 years) from smallholder farming households. The primary outcome, dietary diversity, was measured using the Minimum Dietary Diversity for Women (MDD-W) indicator, based on the standard classification of ten food groups. Villages participating in the On-farm Chicken Performance Testing (OCPT) program under the Tropical Poultry Genetic Solutions (TPGS) initiative were randomly assigned to one of two intervention arms: (1) Chicken Alone, which involved the provision of improved dual-purpose chickens, and (2) Chicken Plus Nutrition Education, which included both poultry distribution and a structured nutrition education package. Villages not participating in the OCPT program served as the control group and received no intervention. Baseline data collection was conducted between August 29 and September 15, 2023, while endline data were gathered in December 2024 to allow for comparative analysis of dietary outcomes.

Study Population: The study targeted women aged 15–49 years residing in poultry-producing households across the selected counties. Participants were further categorized by age group: 21.7% were youth (18–29 years), 37.9% were middle-aged adults (30–45 years), and 40.4% were older women above 45 years. Educational attainment among participants varied, with 30% having completed primary education, 50% secondary education, and 20% attaining higher education. On average, participating households comprised five members, including approximately three children. These demographic characteristics were documented and analyzed to explore their relationship with dietary diversity and nutritional practices.

Sample Size: A total of 324 households were enrolled at baseline, with equal distribution across the three study arms—108 households per group (Chicken Alone, Chicken Plus Nutrition Education, and Control). The sample size was calculated to detect statistically significant changes in MDD-W with 80% power at a 5% significance level, assuming an average of 36 households per village. This design allowed for robust comparisons between groups and minimized the risk of underpowering the analysis.

Data Collection and Analysis: Dietary data were collected using a standardized 24-hour dietary recall questionnaire administered through face-to-face interviews. Responses were recorded electronically using the Open Data Kit (ODK) platform to ensure

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accuracy and uniform data entry. The primary outcome, MDD-W, assessed dietary intake across ten predefined food groups to determine whether participants met the minimum threshold for dietary diversity. Data were analyzed using Python version 3.8.13. Descriptive statistics were employed to summarize demographic profiles and dietary diversity scores. Consistency in data collection protocols across baseline and endline helped reduce bias and strengthened the reliability of the findings, enabling more accurate causal inference regarding the intervention's impact.

Result

Educational Status of Participants (Baseline and Endline): Persistent educational disparities between Kakamega and Bomet counties were observed throughout the study. At baseline, 47% of women in Bomet County were illiterate, compared to just 12% in Kakamega. This trend remained consistent at endline. Even among women with basic literacy skills, Kakamega outperformed Bomet (35% vs. 28% at baseline). The differences were more pronounced at

higher levels of education, with 37% of women in Kakamega completing primary school compared to 17% in Bomet, and 23% attaining tertiary education versus 10% in Bomet. These sustained disparities likely influenced participants' ability to acquire nutritional knowledge and may have contributed to variations in intervention effectiveness across counties.

Minimum Dietary Diversity – Chicken Alone Group (Bomet County): Figure 1 illustrates changes in dietary diversity among women in Bomet County under the Chicken Alone treatment arm. At baseline, only 9% of participants consumed foods from five or more food groups, while 91% fell below the Minimum Dietary Diversity for Women (MDD-W) threshold. By endline, the proportion meeting MDD-W had risen significantly to 61%, while those consuming fewer than five food groups declined to 39%. This 52-percentage-point increase highlights the substantial impact of poultry provision alone on dietary quality in the region.

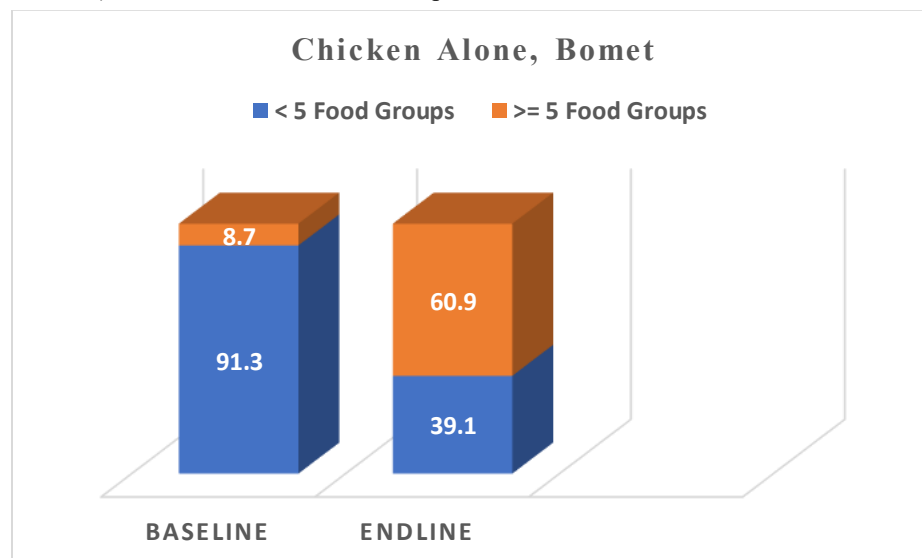


Figure 1: Women meeting minimum dietary diversity in Bomet County at baseline and endline (chicken alone arm), Kenya

Minimum Dietary Diversity – Chicken Plus Nutrition Group (Bomet County): As shown in Figure 2, dietary diversity also improved markedly among women in Bomet County who received both poultry and nutrition education. At baseline, 41% met the MDD-W threshold, increasing to 78% at endline. This 37-percentage-point gain reflects the added benefit of structured nutrition education—delivered through mobile applications and biweekly face-to-face sessions—on food choices and dietary behavior.

Minimum Dietary Diversity – Chicken Alone Group (Kakamega County): Figure 3 presents dietary diversity outcomes in Kakamega County under the Chicken Alone intervention. At baseline, 41% of women consumed from five or more food groups, while 59% fell below the MDD-W threshold. By endline, 78% of women met the minimum standard, with only 22% consuming fewer than five food groups. This 37-percentage-point increase mirrors the improvements observed in Bomet, further validating the efficacy of poultry provision in enhancing dietary diversity.

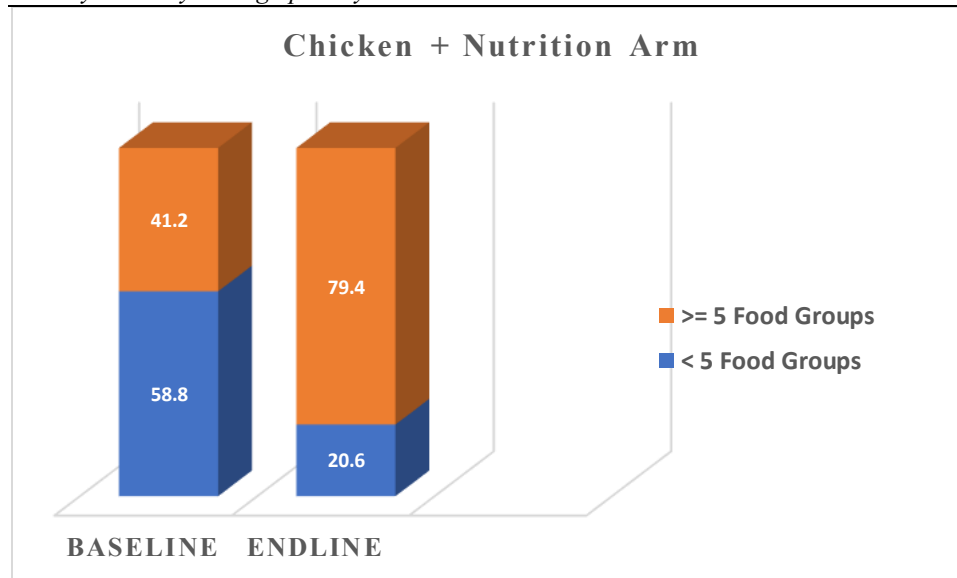


Figure 2: Women meeting minimum dietary diversity in Bomet County at baseline and endline (Chicken + nutrition arm), Kenya.

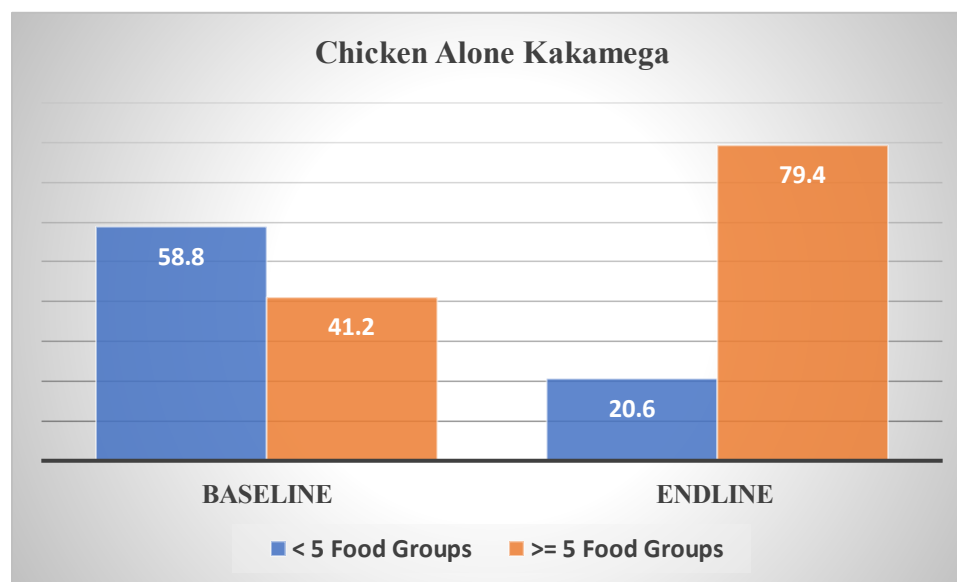


Figure 3: Women meeting minimum dietary diversity in Kakamega County at baseline and endline (Chicken alone arm), Kenya

Minimum Dietary Diversity – Chicken + Nutrition Group (Kakamega County): The most significant gains were observed in Kakamega's Chicken Plus Nutrition group (Figure 4). At baseline, 44% of women consumed at least five food groups; by endline, this figure had risen dramatically to 97%.

Only 3% failed to meet the MDD-W threshold at endline, down from 56% at baseline. The 53-percentage-point increase demonstrates the powerful synergy between animal-source food provision and nutrition education.

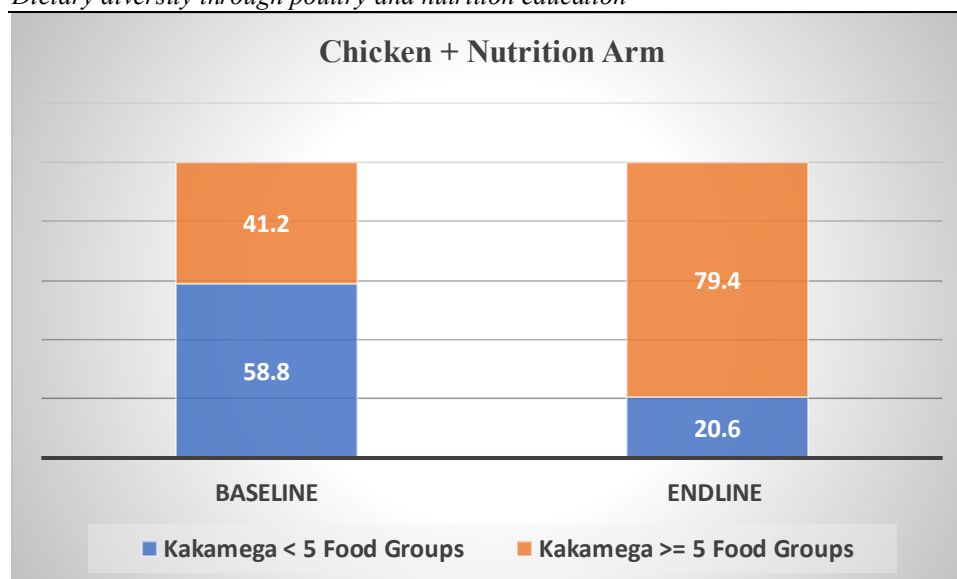


Figure 4: Women meeting minimum dietary diversity in Kakamega County at baseline and endline (Chicken + nutrition arm), Kenya

Trends in the Control Group: In Kakamega's control group, the proportion of women meeting the MDD-W threshold increased from 41% at baseline to 79% at endline. This improvement may indicate spillover effects or external influences affecting dietary behaviors. In contrast, no meaningful change was observed in Bomet's control group, where dietary diversity levels remained stagnant over the study period.

Statistical Analysis of Dietary Diversity Changes: Statistical analysis confirmed that dietary diversity significantly improved across all intervention arms, with the exception of Bomet's control group. In Bomet County, the Chicken Alone group improved from 9% to 61% ($p < 0.001$), while the Chicken Plus Nutrition group increased from 41% to 78% ($p < 0.001$). In Kakamega, the Chicken Alone group improved from 41% to 78% ($p < 0.001$), and the Chicken Plus Nutrition group experienced the largest gain, from 44% to 97% ($p < 0.001$). Even the control group in Kakamega showed a significant increase (41% to 79%, $p < 0.001$), whereas the Bomet control group recorded no statistically significant change ($p > 0.05$). These results clearly demonstrate that both poultry provision and integrated nutrition education significantly enhanced women's dietary diversity, with the combined intervention showing the most substantial impact.

Discussion

The findings from this study underscore important regional disparities in educational attainment and their potential influence on nutritional outcomes among

women in Bomet and Kakamega Counties, Kenya. The significantly higher illiteracy rate in Bomet (47%) compared to Kakamega (12%) likely impacted participants' ability to comprehend and apply nutritional education messages. Education is widely recognized as a key social determinant of health, often associated with better health-seeking behaviours and improved dietary practices (Keeley et al. 2019; Food and Affordable 2022). These disparities may have contributed to the differing levels of dietary improvement observed between the two counties.

Minimum Dietary Diversity and Intervention Outcomes: In Bomet County, the chicken-alone intervention led to a notable increase in the proportion of women achieving the Minimum Dietary Diversity for Women (MDD-W), rising from 9% at baseline to 61% at endline—a 52-percentage-point gain. Similarly, in Kakamega County, dietary diversity improved from 41% to 78% in the same treatment arm. These outcomes align with previous research suggesting that poultry ownership can enhance household food security and dietary diversity, particularly in rural agricultural settings (McDermott et al. 2015; Magnusson et al. 2022).

Even more substantial improvements were seen in the groups that received the combined Chicken Plus Nutrition intervention. In Bomet, dietary diversity increased from 41% to 78%, while in Kakamega it rose from 44% to 97%, marking a 53-percentage-point gain. These results suggest a synergistic effect when animal-source food interventions are integrated with structured nutrition education. This supports literature

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emphasizing the importance of multi-sectoral approaches to combat malnutrition (Yazdanpanah et al. 2023; Korir et al. 2024).

The incorporation of mobile app-based and biweekly face-to-face nutrition sessions likely improved women's understanding and confidence in preparing and consuming a wider variety of foods. These findings are consistent with other studies that highlight the role of information and communication technology (ICT) in expanding the effectiveness of nutrition programming (Mancone et al. 2024). Education likely served as a key enabler, particularly in Kakamega, where higher educational attainment may have facilitated better comprehension and application of nutrition messages.

Control Group Patterns: Dietary patterns in the control groups provide additional context for the intervention's effectiveness. In Kakamega, the control group exhibited a significant increase in the proportion of women meeting MDD-W (from 41% to 79%), possibly due to spillover effects or other confounding factors such as access to infrastructure or informal education. By contrast, Bomet's control group showed no significant change, reinforcing the importance of targeted interventions in lower-resource contexts (Ojo et al. 2021).

These results also highlight the influence of baseline conditions—such as education, infrastructure, and socio-economic status—on intervention success. As Fox (2019) suggests, identical programs can yield varying results depending on the existing local capacity. The significant dietary improvements observed across intervention groups, confirmed through p-value analysis ($p < 0.001$), demonstrate that the changes were not due to chance but rather a direct result of the interventions.

Particularly noteworthy are the outcomes from the Chicken Plus Nutrition group in Kakamega, where dietary diversity rose from 44% to 97% ($p < 0.001$). This underscores the added value of combining livestock provision with nutrition education. In Bomet, where literacy levels were lower, the same intervention still produced significant dietary improvements (41% to 78%, $p < 0.001$), suggesting that behaviour change strategies—when properly designed—can be effective even in low-literacy contexts. The lack of progress in Bomet's control group further reinforces the conclusion that intervention, rather than external factors, was the primary driver of improvement.

Overall, these results align with growing evidence that nutrition-sensitive agricultural programs are most effective when designed to be multi-sectoral and

tailored to local socio-educational conditions (Yazdanpanah et al. 2023; McDermott et al. 2015).

Conclusion

This study confirms that interventions integrating livestock support and nutrition education significantly enhance women's dietary diversity in rural, smallholder contexts. The impact is especially pronounced in settings where educational attainment is higher, facilitating better understanding and application of nutrition knowledge. These findings advocate for integrated, context-sensitive, nutrition-sensitive agriculture programs that are responsive to regional disparities in education and infrastructure.

Recommendations

The findings of this study support the integration of nutrition education with livestock-based interventions as an effective strategy to improve dietary diversity among women of reproductive age. Programs that combine poultry provision with structured, multi-platform nutrition education—such as mobile applications and face-to-face sessions—are more effective in promoting lasting dietary changes than asset provision alone. To ensure equitable outcomes across regions with varying literacy levels, future interventions should employ context-sensitive communication methods, including visual aids, audio materials, and community facilitators, particularly in low-literacy areas like Bomet. The observed differences in outcomes between counties also underscore the need for broader investments in education and rural infrastructure, including adult literacy initiatives and community learning platforms, to reinforce behaviour change. Additionally, improvements in Kakamega's control group point to the value of informal knowledge diffusion, highlighting the importance of considering social networks and community dynamics during program planning and evaluation. Continuous monitoring and follow-up are essential to sustaining dietary gains and informing scalable, context-specific models for nutrition-sensitive agricultural development.

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