Original Article

Income and Nutritional Outcomes in Kenyan Smallholder Poultry Systems: Evidence from Bomet and Kakamega Counties

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Abstract

Background: In sub-Saharan Africa, smallholder's households often rely on poultry production as an important source of livelihood, with poultry sometimes described as a "living ATM". However, access to high-yielding poultry genetics does not necessarily translate into improved household nutrition when families sell eggs to meet household expenses. This study examines the trade-off between income generation and nutrition outcomes in smallholder poultry production in Kenya.

Objective: To assess the effects of geographic setting, socio-economic constraints, and avian genetics on egg utilization patterns among smallholder households in Bomet and Kakamega counties.

Methods: A cross-sectional analytical study was conducted with 189 smallholder households in Bomet (n = 148) and Kakamega (n = 41) counties. A multimodal data collection strategy, using ODK digital entry with pictorial support, was employed to collect the data. The income-nutrition trade-off was evaluated using independent samples t-tests, a one-way ANOVA, and multiple linear regressions.

Results: The mean consumption priority score was 1.31 on a scale of 1-3, indicating a strong orientation towards commercialization. There was significant regional variation in egg consumption: households in Bomet consumed only 16% of their eggs, compared with 51% among households in Kakamega Egg utilization was more strongly affected by contextual factors than by bird strain. Income was negatively correlated with consumption ($r = -0.610$, $p < .001$). The strongest predictors of consumption identified by multivariate regression were county ($\beta = 0.222$, $p < .001$) and egg income ($\beta = -0.000047$, $p < .001$), whereas bird strain was not a statistically significant predictor ($\beta = 0.016$, $p = 0.582$). The model accounted for 45.8% of the variance in consumption (adjusted $R^2 = 0.458$).

Conclusions: Egg utilization patterns are largely influenced by geographic and behavioral factors rather than by poultry genetics alone. Interventions aimed at improving household egg consumption should address economic constraints and provide targeted extension services to support egg retention for household consumption. [*Ethiop. J. Health Dev.* 2026; 40(2)]

Keywords: Smallholder Poultry, Income-Nutrition Trade-off, Egg Utilization, Kenya, Multivariate Analysis.

Introduction

Poultry production is not only a livelihood strategy for smallholder households in Sub-Saharan Africa (SSA) to alleviate poverty, but also a means of improving food security (1). In rural settings, poultry assets are often considered a "living ATM" because they provide an immediate source of cash to meet current non-food needs, such as medical expenses and school fees.(2). Although the introduction of new chicken strains with high production potential under tropical conditions, such as KALRO and Kuroiler, has greatly increased household poultry production capacity, these genetic improvements have not necessarily translated into increased household egg consumption. (3).

The nutritional status of women of reproductive age (WRA) in Kenya continues to be a major public health concern, with a complex "dual burden" of malnutrition. This phenomenon occurs when under-nutrition and the increasing prevalence of overweight and obesity, with the prevalence of this dual burden reaching 33% in 2020 (4). In addition to macronutrient deficiencies, micronutrient deficiencies are also common. One study reported that 40% of females in the study population were Vitamin A-deficient, 48% iron-deficient, and 52% zinc-deficient. (5). These deficiencies can have serious health consequences, including anaemia, impaired immunity, and pregnancy complications.

Despite the availability of diverse agricultural products in many areas of Kenya, dietary diversity remains low, indicating low nutrient intake. As reported by Metet et al. (2025), the Dietary Diversity scores in Nakuru were as low as 3.78, with more than three-quarters of women in the study area having scores below the Minimum Dietary Diversity for Women (MDD-W) threshold (6). These dietary practices are closely linked to socioeconomic factors such as education and income. However, even in agricultural regions, consumption of animal-source foods remains very low. Furthermore, growing evidence suggests that maternal nutrition is associated with psychological wellbeing; low maternal nutritional status has been significantly associated with prenatal depression (7). In recent years, evidence has shown that while poultry is an important source of animal protein globally, it is primarily used to generate income in rural African households (8).

In general, there is a trade-off between the short-term cash flow from selling eggs and the potential long-term nutritional benefits of consuming them within the household (9). Recent studies have shown that higher agricultural production does not necessarily lead to greater dietary diversity, due to factors such as market conditions, household economic constraints, and social norms that influence utilization. This income-nutrition trade-off may be particularly pronounced in areas with strong commercial influences, where households may

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prioritize income generation over the consumption of nutrient-rich foods.(9).

Although some studies have documented income-nutrition trade-offs in dairy and vegetable production systems, limited empirical evidence exists on how this trade-off operates in smallholder poultry systems, particularly in the context of newly introduced dual-purpose chicken breeds. Moreover, the relative contributions of the genetic factors (biological interventions) and socio-economic factors to household egg utilization are not well understood. This study aims to address these gaps by comparing two contrasting counties in Kenya and examining the extent to which variation in household egg consumption is explained by poultry genetics and contextual factors.

This study aimed to address the following research questions: (1) To what extent do households priorities income generation over household egg consumption? (2) How do regional economic contexts influence egg utilization? (3) What is the relative influence of poultry genetics versus socio-economic factors on household egg consumption?

The purpose of this study is therefore to determine the extent to which behavioral factors and the regional context influence this trade-off. The study compares the dynamics of Bomet and Kakamega counties. Livelihoods in Bomet are primarily based on tea production, whereas Kakamega has more diversified livelihood activities, including subsistence agriculture, small-scale trade, and off-farm income sources. Ultimately, the study seeks to identify opportunities to increase dietary diversity and improve nutrition outcomes for women and their children.

Methodology

The utilization of poultry products was evaluated in two distinct socio-economic and agro-ecological contexts in Kenya using a cross-sectional analytical design. The design enabled an assessment of household practices at a single point in time. It facilitated a comparative analysis of the relationship between income and nutrition across regions experiencing different economic pressures. A multistage sampling was used to select households. Within each study region, purposive sampling was employed to ensure representation across a range of production intensities, from subsistence-oriented to commercially oriented households. While this approach limits the statistical generalizability of the findings, it enables an in-depth comparative analysis of allocation strategies across distinct household typologies.

The study locations were selected based on their agroecological and livelihood characteristics. Kakamega was characterized by diversified subsistence maize and bean farming with relatively low agricultural input use, whereas Bomet was dominated by commercially oriented tea and dairy farming. Most participants were women aged 15–49 years, reflecting their important role in managing household poultry resources and determining the utilization of eggs within households.

A cross-sectional analytical design was used. A multi-stage sampling method was used to select the study households. First, sub-locations were purposefully selected based on their agroecological characteristics and the intensity of their poultry production, representing two broad contexts: commercially oriented and diversified subsistence production. Villages are then randomly assigned to three groups within each sub-location: (1) high-yielding bird genetics only (KALRO or Kuroiler); (2) high-yielding bird genetics combined with intensive nutrition education; and (3) control villages. Within each village, households were purposively sampled to represent different levels of production intensity. A total of 148 households in Bomet County and 41 in Kakamega County were finally included in the study. The sample size was determined based on a moderate effect size (Cohen's d = 0.5) and 80% power, while accounting for resource availability.

Data was collected from August to September 2023 using a detailed, standardized survey instrument. The instrument was carefully designed to capture a wide range of household characteristics, including age, education, family size, poultry productivity indicators (egg production and mortality rates), and the allocation of poultry products for household consumption, sale, or giving away. To support inclusive participation and accurate data collection, the research team employed a multimodal approach that combined digital data collection via mobile tablets running Open Data Kit (ODK) with paper-based pictorial visual aids. These tools were particularly useful for participants with limited formal education when reporting dietary intake via 24-hour recall, as the visual aids facilitated recall without relying on text-based documentation. Data were collected during a single season (August-September 2023); thus, the findings reflect household allocation decisions during this specific period and may not capture seasonal variation in poultry production, egg consumption, or household food allocation.

Consumption Priority Scale

The consumption priority scale was developed as a 3-point ordinal scale based on the percentage of eggs retained for household consumption. The categories were defined as follows: 1 = 'Income Priority' (households selling > 66% of eggs); 2 = 'Balanced' (households retaining 34–66% of eggs); and 3 = 'Nutrition Priority' (selling < 34% of eggs). The scale was developed using data from a 24-hour dietary recall and cross-checked against a seven-day retrospective recall of egg allocation to assess classification consistency between the two recall periods. This double-recall approach was used to improve the consistency and reliability of classification in the low-literacy study setting.

Ethical Approval

This study was approved by the International Livestock Research Institute (ILRI) Institutional Research Ethics Committee (IREC) under the research activity “On-farm testing of improved chicken strains to measure productive performance and livelihood outcomes” on 31st July 2023 (Protocol No: ILRI-IREC2023-26). All

participants provided written informed consent before data collection. Participation was voluntary, and participants were informed that they could withdraw from the study at any time. Participant anonymity was protected by anonymizing the collected data. In addition, a research license from Kenya's National Commission for Science, Technology and Innovation (NACOSTI) was obtained prior to the study's commencement.

Data Analysis techniques

Data were analyzed statistically using SPSS version 24 and Python 3.8.13. The distribution of household egg-utilization patterns was summarized using descriptive frequencies. Mean differences between the two regions were evaluated using independent-samples t-tests, and differences among the three study arms were assessed using a one-way analysis of variance (ANOVA). Pearson's correlation coefficient was used to assess the relationship between egg income and household egg consumption as an indicator of the income-nutrition trade-off. A multiple linear regression model was fitted, with the proportion of eggs consumed at home as the dependent variable, to further examine the factors associated with household size, education, bird strain, and egg income. In addition to p-values, effect sizes (Cohen's d, eta-squared, and standardized beta coefficients) and their 95% confidence interval were reported. Significance was set at $p < 0.05$.

To address the research questions: (1) Household prioritization of income generation over household egg consumption was assessed using descriptive frequencies and mean consumption priority scores. (2) Regional differences in egg utilization were evaluated using independent-samples t-tests comparing Bomet and Kakamega, and (3) The relative contributions of poultry genetics and socio-economic factors were determined using multiple linear regression, with the proportion of eggs consumed at home as the dependent variable and household size, bird strain, and egg income included as explanatory variables.

Results

Socio-demographic characteristics of respondents

Table 1: Socio-demographic Characteristics of Women Respondents by County

Characteristic	Bomet (n=148)	Kakamega (n=41)	Total (N=189)
Education Level (%)			
Unable to read and write	45.0%	10.0%	37.4%
Read and write only	30.0%	25.0%	28.9%
Elementary/High school	15.0%	40.0%	20.4%
College/University	10.0%	25.0%	13.3%
Religion (%)			
Christian	70.0%	90.0%	74.4%
Muslim	0.0	25.0%	19.6%
Other	5.0%	10.0%	6.0%
Occupation (%)			
Housewife	70.0%	50.0%	65.7%
Student	5.0%	5.0%	5.0%
Government employee	5.0%	5.0%	5.0%
Merchant	10.0%	20.0%	12.2%
Other	10.0%	20.0%	12.2%

Table 1 presents the socio-demographic characteristics of women respondents in Bomet and Kakamega Counties. The two counties differed in educational attainment, religious affiliation, and occupational distribution.

Educational attainment varied considerably between the two counties. In Bomet, nearly half (45.0%) of the women were unable to read or write, compared to 10.0% in Kakamega. Conversely, Kakamega had substantially higher proportions of women with elementary or high school education (40.0% vs 15.0%) and of those with college or university education (25.0% vs 10.0%). This substantial difference in literacy and educational attainment reflects differences in the socioeconomic contexts of the study populations. Christianity was the predominant religion in both counties, with a higher proportion of respondents identifying as Christian in Kakamega (90.0%) than in Bomet (70.0%). Notably, 25.0% of respondents in Kakamega identified as Muslim, compared with none in Bomet. The remaining respondents reported other religious affiliations (5.0% in Bomet and 10.0% in Kakamega).

Occupational profiles also differed between the counties. In Bomet, the majority of women (70.0%) were housewives, compared with 50.0% in Kakamega. Kakamega had a more diverse occupational distribution, with higher proportions of merchants (20.0% vs 10.0%) and respondents engaged in other occupations (20.0% vs 10.0%). Students and government employees each accounted for 5.0% of respondents in both counties. Overall, the findings indicate differences in the sociodemographic characteristics of respondents between the two counties, with Kakamega showing higher levels of educational attainment and a more diverse occupational distribution than Bomet.

Household behavioural priorities and allocation extremes

The study's findings indicated a strong orientation towards the commercialization of poultry products, with eggs largely allocated for sale rather than household consumption. The sample mean was 1.31 (SD = 0.657, N = 176) on the standardized consumption priority scale, which ranged from 1 (high market priority) to 3 (high household consumption priority). The low mean score indicates a predominant orientation towards short-term income generation rather than long-term household food consumption**.** However, substantial variation was observed at both ends of the spectrum: 10.0% of households (N=189) sold all their eggs, while 9.5% consumed all of their eggs at home. These findings illustrate considerable heterogeneity in household egg-allocation practices, with a subset of households retaining a larger proportion of eggs for household consumption and, potentially, dietary diversity and intake of animal-source foods (Figure 1).

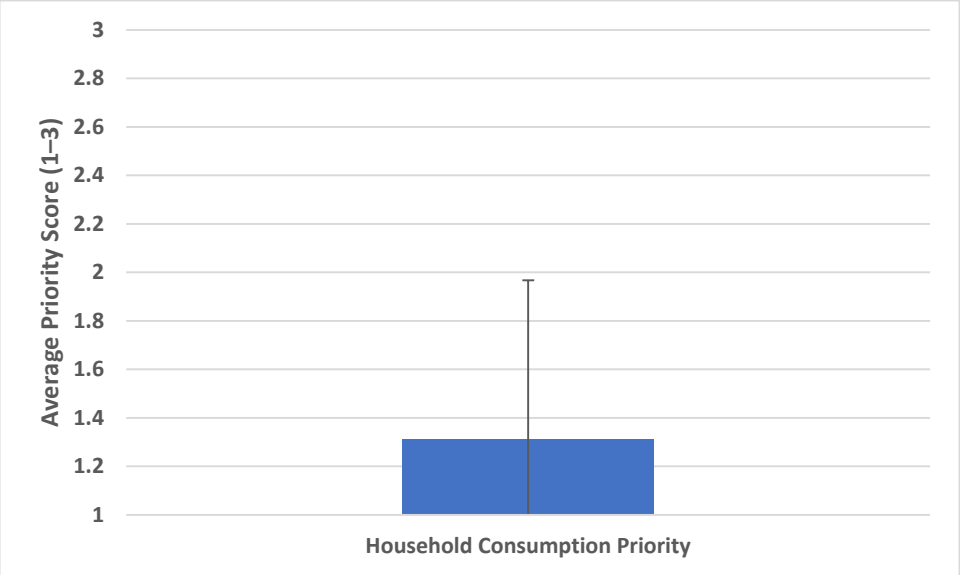

Figure 1: Distributional variance of household consumption priority allocation for poultry products (N = 176)

Polarization and the "Missing Middle"

The results of the analysis of “all-or-nothing” egg-allocation strategies further illustrate this polarization, with relatively few households falling within the intermediate range. Household egg-allocation practices were concentrated at the two ends of the consumption spectrum rather than being evenly distributed across the three categories. This pattern is reflected in the categorical breakdown of allocation strategies presented in Figure 2. The majority of households (80.1%) fell into the “Low: Income Priority” category, in which more than two-thirds of eggs were allocated for sale. Households that consumed 34–66% of their eggs at home, classified as the “Moderate: Balanced” group, represented the smallest proportion (9.1%). A further 10.8% of households fell into the “High: Nutrition Priority” category, consuming more than two-thirds of their eggs at home (i.e., selling less than 34%). This marked concentration at the two extremes suggests that household egg-allocation decisions are strongly influenced by the prevailing socioeconomic and livelihood context, with relatively few households adopting a balanced strategy between income generation and household consumption.

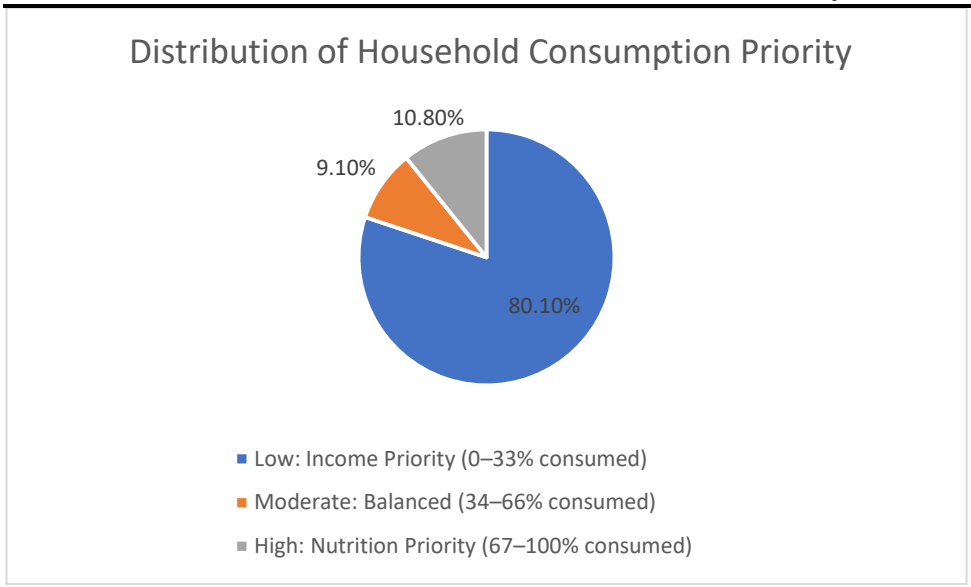

Figure 2: Categorical distribution and stratified frequency profile of household egg consumption priority brackets

Geographic Disparities and Regional Economic Context

The findings showed a statistically significant difference in household egg-allocation patterns between the two study counties, suggesting that regional economic context is associated with how households allocate eggs between consumption and sale. The mean proportion of eggs consumed at home was relatively low in Bomet (16.0%, SD = 0.203, n = 148), compared with 51.0% in Kakamega (SD = 0.409, n = 41), as shown in Figure 3. This substantial difference in household egg retention indicates marked variation in egg-utilization patterns between the two regions.

This regional disparity is further illustrated by the distribution of households across the consumption-priority categories. In Bomet, most households (89.2%) were classified as having a strong income priority, whereas only 2.9% fell within the "High: Nutrition Priority" category, indicating that a relatively small proportion retained more than two-thirds of their eggs for household consumption. In contrast, Kakamega showed a more balanced distribution across the priority categories. Although 45.9% of households were classified as having an "Income Priority", a substantial proportion (40.5%) were classified as having a "High: Nutrition Priority", indicating that these households retained most of their poultry production for household consumption.

These regional differences highlight the heterogeneity of household egg-allocation practices and suggest that smallholder households operate within different socioeconomic and livelihood contexts. The findings also indicate that households may face varying trade-offs between generating immediate income from egg sales and retaining eggs for household consumption and dietary diversity.

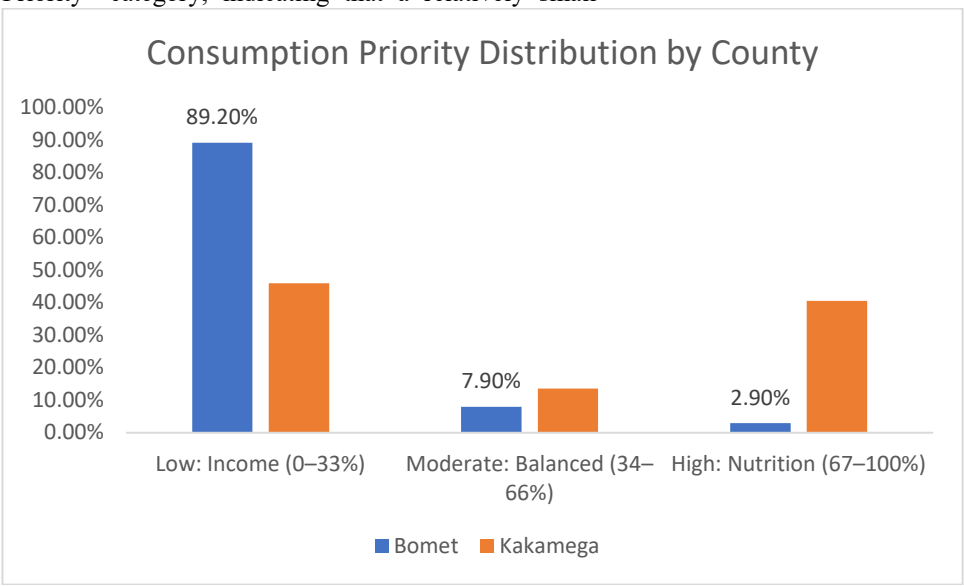

Figure 3: Regional stratification of household poultry product allocation and consumption priority brackets by county

Interaction between avian genetics and geographic context

The study compared egg utilization among households keeping two dual-purpose poultry strains, KALRO and Kuroiler, to assess whether avian genetics were associated with household egg allocation patterns. The difference between the two groups was relatively small: households keeping Kuroiler had a mean household egg-consumption rate of 26% (SD = 0.307, n = 103), compared with 21% among households keeping KALRO birds (SD = 0.290, n = 85) (Figure 4). This five-percentage-point difference was considerably smaller than the variation observed across the two geographic contexts.

When examined by county, household egg consumption differed substantially between the two strains. In Kakamega, the proportion of eggs consumed at home was 53% for KALRO and 50% for Kuroiler. In Bomet, by contrast, only 14% of KALRO eggs and 17% of Kuroiler eggs were consumed at home. Thus, the difference between counties was approximately 33–39 percentage points, depending on the strain, compared with only 3–5 percentage points between strains within counties. This pattern indicates that geographic and socioeconomic context were more strongly associated with household egg utilization than the poultry strain itself.

The interaction patterns further illustrate this contextual variation. Within each county, the difference in household egg consumption between KALRO and Kuroiler was relatively small, whereas consumption varied substantially between counties for both strains. These findings suggest that the utilization of poultry products is shaped not only by the birds' productive characteristics but also by the socioeconomic and market environments in which households operate. The findings, therefore, highlight the importance of considering regional commercial pressures and livelihood conditions when designing interventions to increase household egg retention and improve dietary diversity. Interventions focused solely on poultry genetics may have limited impact on household egg consumption unless broader economic factors influencing egg sales are also addressed.

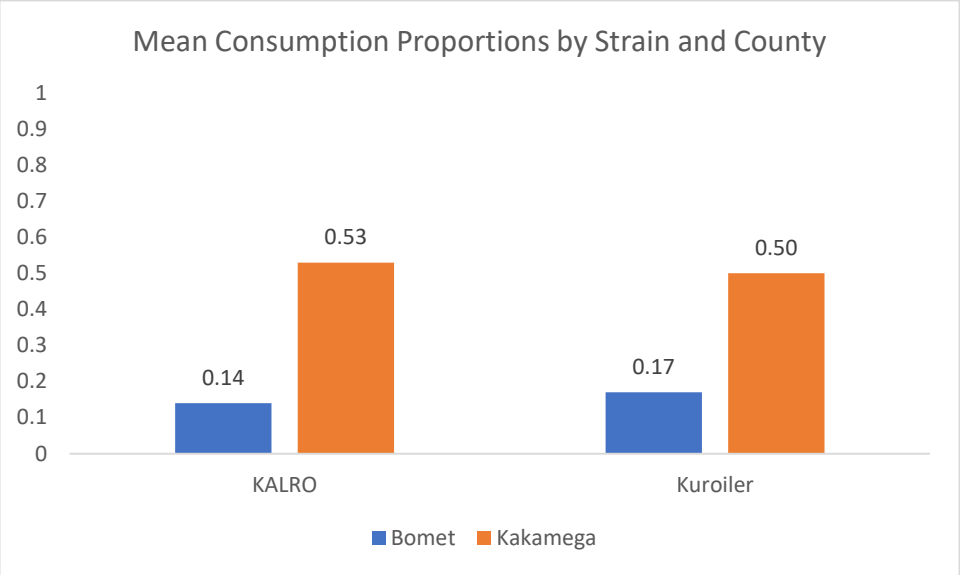

Figure 4: Mean consumption proportions by strain and county

Income-nutrition trade-off by region

Pearson correlation analysis showed a negative association between egg revenue and household egg consumption (Figure 5). In Bomet, a moderate negative correlation was observed between egg revenue and household egg consumption ($N = 148$; $r = -0.383$, $p < .001$), indicating that households with higher egg revenue tended to consume a smaller proportion of their eggs at home. This pattern is consistent with an income–nutrition trade-off in which a greater proportion of eggs is allocated for sale rather than household consumption.

A similar, although weaker, negative association was observed in Kakamega ($N = 41$; $r = -0.313$, $p = .046$). The weaker correlation may indicate greater variation in household egg-allocation practices in Kakamega. This pattern could be consistent with differences in livelihood strategies or access to alternative income sources; however, these factors would need to be examined directly to establish their contribution to the observed relationship.

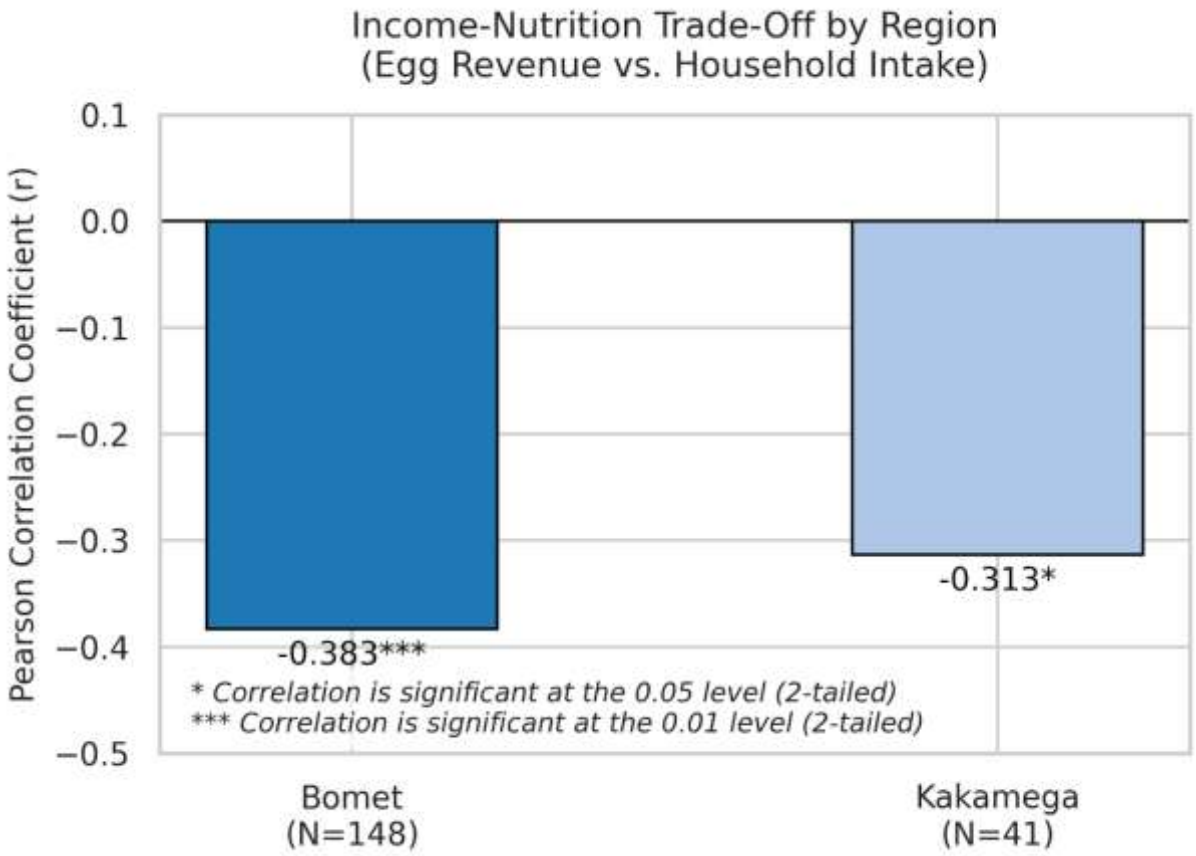

Figure 5: Income–nutrition trade-off by regions as evident by revenue vs consumption

Multivariate predictors of household egg consumption

A multiple linear regression model was then fitted, with the proportion of eggs consumed at home as the dependent variable, to further examine the relationship between egg income and household egg consumption while accounting for other relevant factors. The Independent variables included county (Bomet vs Kakamega), bird strain (KALRO vs Kuroiler), household size (average number of chickens), and egg income. The overall regression model was statistically significant with an adjusted R^2 of 0.458 ($F(4, 181) = 40.047$, $p < .001$).

Table 4: Multivariate regression results for household egg consumption

Predictor Variable	B (Unstd.)	95% CI	β (Std.)	p-value
(Constant)	0.372	[0.313, 0.432]	—	< .001
County (Kakamega)	0.222	[0.140, 0.304]	0.348	< .001
Egg income	-0.000	[-0.000059, -0.000035]	-0.504	< .001
Household size	-0.016	[-0.024, -0.009]	-0.273	< .001
Bird strain (Kuroiler)	0.016	[-0.041, 0.073]	0.03	0.582

Note: Dependent variable = consumption_prop. Model: Adjusted $R^2 = 0.458$, $F(4, 181) = 40.047$, $p < .001$.
County coded as 0 = Bomet, 1 = Kakamega. Bird strain coded as 0 = KALRO, 1 = Kuroiler.

Household egg consumption was significantly associated with county, egg income, and household size. County was a significant predictor of the proportion of eggs consumed at home (β = 0.222, 95% CI: 0.140–0.304, p < .001), with households in Kakamega consuming a significantly higher proportion of their eggs than households in Bomet. Egg income was also a significant predictor (β = −0.000047, 95% CI: −0.000059 to −0.000035, p < .001), with higher egg revenue associated with a lower proportion of eggs consumed at home. This finding is consistent with the observed income–nutrition trade-off.

Household size was negatively associated with household egg consumption (β = −0.016, 95% CI: −0.024 to −0.009, p < .001), indicating that larger households consumed a smaller proportion of their eggs at home, holding the other variables in the model constant.

In contrast, bird strain was not a statistically significant predictor of household egg consumption (β = 0.016, 95% CI: −0.041 to 0.073, p = .582). This finding indicates that among the variables included in the model, geographic context and economic factors were more strongly associated with household egg-allocation patterns than bird strain was. Overall, the results suggest that genetic improvement in poultry alone may not be sufficient to increase household egg consumption unless the socioeconomic factors associated with egg commercialization are addressed.

Discussion

The results highlight an important challenge in nutrition-sensitive agriculture: increased agricultural productivity does not necessarily translate into improved household nutrition. In Bomet, where poultry may serve as an important source of income, eggs appear to function primarily as a marketable household asset, enabling households to generate cash to meet immediate financial needs (10). This pattern is reflected in the negative association between egg income and household egg consumption: households that generate higher egg income tend to consume a smaller proportion of their eggs at home. Thus, increased commercialization of poultry products may create a trade-off between income from egg sales and the direct nutritional benefits of household egg consumption.

The substantial regional differences observed in this study suggest that the income–nutrition trade-off is not uniform across contexts and may vary with local socioeconomic and livelihood conditions. The higher proportion of household egg consumption observed in Kakamega may be associated with differences in livelihood diversification, market conditions, household resources, or social and cultural factors (11)

However, these potential explanations were not directly measured in the present study and therefore require further investigation.

The Kakamega findings may nevertheless provide useful context for understanding the factors influencing household decisions about the retention and sale of eggs. Differences in market structures, livelihood opportunities, and community norms may affect how households balance the need for immediate income with the nutritional value of animal-source foods. Identifying these contextual factors could help inform interventions to improve household access to nutrient-dense foods without undermining the income-generating role of poultry production.

The relatively small difference in household egg consumption between the two poultry strains, together with the non-significant effect of bird strain in the multivariate model, suggests that genetic differences between KALRO and Kuroiler were less strongly associated with household egg-allocation patterns than county and egg income. This finding is important because improvements in poultry productivity may not necessarily increase household egg consumption when eggs are primarily allocated for sale. Therefore, strategies aimed at improving nutrition through poultry production may need to consider both the birds' productive characteristics and the socioeconomic conditions that influence how poultry products are utilized.

The multimodal approach used in this study, combining digital data collection with paper-based pictorial supports, facilitated data collection in a setting that included participants with varying levels of formal education. However, this approach should not be interpreted as evidence that behavioural education reduced the production–consumption gap, because the present analysis does not directly estimate the effect of nutrition education on household egg consumption. Where nutrition education was part of the study design, its specific effect should be assessed separately using an appropriate comparison of intervention and control groups.

The multivariate regression results further support the observed association between income and household egg consumption. After accounting for household size and bird strain, county and egg income remained significant predictors of the proportion of eggs consumed at home. The model explained 45.8% of the variance in household egg consumption (adjusted R^2 = 0.458). Bird strain was not a statistically significant predictor (p = .582), indicating that, within this model and study population, variation in household egg consumption was more strongly associated with geographic context and egg income than with poultry strain. These findings are consistent with previous research showing that greater market integration can influence how agricultural products are allocated between household consumption and sale (12). These findings should, however, be interpreted with consideration of potential confounding and unmeasured factors. Differences in market access between Bomet

and Kakamega, including proximity to urban centers, market infrastructure, and prevailing egg prices, could independently influence decisions to sell or consume eggs. In addition, data were collected during a single season (August–September 2023), and seasonal variation in egg production, food availability, and market prices may affect household allocation decisions. Cultural norms and food preferences, including food taboos, may also influence the intra-household distribution and consumption of animal-source foods, but these factors were not explicitly measured in the present study. Future research should incorporate longitudinal designs, more detailed measures of market access and prices, and direct assessment of social and cultural factors to better understand the pathways linking poultry production, commercialization, and household nutrition.

Conclusion and Recommendations

The study concludes that geographic and socioeconomic contexts are strongly associated with household egg-utilization patterns in smallholder poultry systems. Although high-yielding poultry strains such as KALRO and Kuroiler can increase poultry productivity, the findings indicate that genetic improvement alone may not necessarily be translated into higher household egg consumption. The substantially lower proportion of eggs consumed at home in Bomet, together with the significant negative association between egg income and household egg consumption, suggests that commercialization and household economic conditions are important considerations for improving the nutritional benefits of poultry production.

Development programmes should therefore consider county-specific socioeconomic and market contexts when designing interventions. In areas where commercial pressures are strong, interventions could extend beyond production training to include social and behaviour change communication, nutrition education, and livelihood or income-diversification strategies that may reduce the need to allocate a large proportion of eggs for sale. In regions where household egg utilization is more balanced, peer-learning approaches could be explored to identify and share locally relevant practices. Extension services should also promote inclusive service delivery through multimodal approaches, including digital and paper-based communication, to address literacy differences and facilitate access to information on nutrition and poultry management among household decision-makers.

The multivariate regression analysis further showed that county and egg income were significant predictors of household egg consumption, whereas bird strain was not ($p = .582$). The full regression model explained 45.8% of the variance in household egg consumption (adjusted $R^2 = 0.458$), indicating that the variables included accounted for a substantial proportion of the observed variation. These findings suggest that improving poultry genetics alone may not be sufficient to increase household egg consumption if socioeconomic and market factors that influence egg allocation are not addressed.

Overall, the findings underscore the importance of integrating nutrition-sensitive agricultural extension with approaches that address household economic conditions and market incentives. Such integrated approaches may help households balance the income-generating benefits of poultry production with the nutritional benefits of retaining eggs for household consumption, particularly in settings characterized by strong commercial orientation such as Bomet nutrition.

Recommendations:

1. **Country-specific Interventions**: Economic interventions are needed in areas with high –levels of commercialization, such as Bomet, to help reduce the need to sell eggs. Counties such as Kakamega, where egg utilization is more balanced, can provide opportunities for peer learning and the sharing of best practices.

2. Social and Behavioral Change Communication (SBCC): Extension services should integrate SBCC messages that highlight the long-term health benefits of retaining eggs for women and children, especially the first 1,000 days of a child's life.

3. Inclusive service delivery: Multimodal training approaches (paper-based and digital) should be scaled up to address literacy challenges and ensure that women involved in household nutrition decision-making can access and benefit from relevant information. The use of pictorial aids and ODK-based data collection in this study was effective and could be adapted to similar low–literacy settings.

4. **Future investigations:** Longitudinal studies should be conducted to better establish the temporal and causal relationships between poultry interventions and egg-utilization patterns. Objective nutritional status indicators (e.g., anthropometric measures and biomarkers) should also be included in future studies to complement self-reported dietary information. In addition, qualitative research could be conducted to investigate the sociocultural factors that shape intra-household allocation decisions.

Limitations

This study has several limitations that should be acknowledged. The cross-sectional design does not allow causal inference; the observed associations may reflect household characteristics rather than direct effects. Regional comparisons may be limited by differences in sample sizes between the two counties, namely Bomet (n=148) and Kakamega (n=41). Data were collected over a single season (August–September 2023); therefore, seasonal variations in production and consumption were not captured. Self-reported dietary intake may also be subject to recall bias, even with pictorial aids. Other factors, including unmeasured variables such as market access, household wealth, and cultural norms, may influence both income and consumption decisions.

Nevertheless, the findings suggest that increased genetic quality of poultry alone may not be sufficient to improve household nutrition unless food systems are better structured to address the social and economic factors driving commercialization. To transition from poultry production to a system that supports both economic outcomes and human health, inclusive, context-specific interventions that address both production and consumption should be scaled up.

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