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Role of kitchen gardening in enhancing household nutrition security among rural families

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Abstract
Ask any extension officer working in rural Malawi which single intervention delivers the most visible household-level nutrition change for the least investment, and kitchen gardening is likely to come up quickly, yet the evidence base quantifying that change with any rigor remains thinner than the intervention's popularity would suggest. This research followed 180 rural households across three districts around Lilongwe over a twelve-month period, comparing 90 households that established a kitchen garden with 90 matched households that did not, to assess the effect of kitchen gardening on household dietary diversity, vegetable consumption frequency, and household income allocated to vegetable purchase. Households with kitchen gardens recorded a Household Dietary Diversity Score rising from a baseline of 4.2 to 7.1 after twelve months, compared with a change from 4.1 to only 4.4 among households without gardens over the same period. Kitchen garden households also reported a 42% reduction in weekly expenditure on purchased vegetables, redirecting an estimated equivalent value toward other household needs. Vegetable consumption frequency rose from an average of three days per week to six days per week among garden households, with leafy green vegetables showing the largest gain in both variety and frequency. These findings support kitchen gardening as a measurably effective, low-cost household-level intervention for improving dietary diversity and food security in rural farming communities, and argue for its continued and expanded promotion within nutrition-sensitive agriculture programming in this region.

Keywords: Kitchen gardening, household nutrition security, dietary diversity, rural households, vegetable consumption, food security, home gardens, nutrition-sensitive agriculture, household income, diet diversification

Introduction
Rural households across much of Malawi grow the staple grain that anchors their diet with reasonable reliability, but the vegetables and other diversifying foods that round out a nutritionally adequate diet often depend on market purchase, seasonal availability, or opportunistic foraging, all of which introduce cost and unpredictability that staple grain production does not carry to the same degree [1, 2]. Kitchen gardening, small-scale vegetable cultivation within or adjacent to the homestead, has long been promoted as a partial answer to this gap, offering households a direct production pathway to dietary diversity that does not depend on market access or purchasing power in the same way [3].

Evidence supporting kitchen gardening's nutritional impact exists across multiple countries and contexts, but much of it relies on cross-sectional comparison between garden-owning and non-owning households rather than a matched, longitudinal design tracking the same households before and after garden establishment, which leaves open the possibility that households already inclined toward better dietary practices are simply more likely to establish gardens in the first place, rather than the garden itself driving the dietary change observed [4, 5].

Household Dietary Diversity Score has become a widely used, validated proxy for household-level food access and nutritional adequacy, correlating reasonably well with more detailed individual dietary intake assessment while requiring far less data collection burden, making it a practical tool for evaluating intervention impact at the scale this research aimed to work at [6, 7]. Whether kitchen gardening's dietary diversity benefit operates mainly

through direct vegetable production, through the income saved from reduced market purchase being redirected toward other food groups, or through some combination of both pathways, is a distinction with practical relevance for how nutrition-sensitive agriculture programmes design and message kitchen gardening interventions [8].

This research set out to track a matched sample of kitchen garden and non-garden households longitudinally over a full twelve-month period, capturing both a pre-intervention baseline and a post-intervention endpoint, to establish a more rigorous estimate of kitchen gardening's effect on household dietary diversity, vegetable consumption frequency, and vegetable purchase expenditure than cross-sectional comparison alone can provide.

Objectives were to compare change in Household Dietary Diversity Score, vegetable consumption frequency, and weekly vegetable purchase expenditure between kitchen garden and matched non-garden households over twelve months, and to characterize which food groups contributed most to any dietary diversity gain observed among garden-owning households.

Materials and Methods

Theoretical Framework

This research draws on the conceptual pathway linking agricultural production to household nutrition outcomes through three main channels: direct production for own consumption, income generation or saving that can be redirected toward food purchase, and, less directly, changes in household time allocation and intra-household decision-making around food. Kitchen gardening was expected to operate primarily through the first two channels, direct vegetable availability for consumption and income saved from reduced market purchase, both of which this research's data collection was designed to capture explicitly rather than treating the pathway as a single undifferentiated intervention effect.

Instrument Development and Validation

Household Dietary Diversity Score was assessed using the standard twelve food-group recall instrument, adapted with minor wording adjustments for local food terminology and validated through a pilot round with twenty households not included in the main research sample, after which two questions were reworded for clarity based on pilot feedback. Vegetable consumption frequency and expenditure were captured through a structured seven-day recall questionnaire, administered by trained enumerators at baseline and at the twelve-month endpoint.

Field Experimental Design

A total of 180 households across three districts surrounding Lilongwe, Malawi, were selected, with 90 households enrolled in a kitchen gardening support programme providing seed, basic tools, and technical training, and 90 comparison households matched on household size, baseline income category, and baseline Household Dietary Diversity Score but not receiving the gardening intervention. Matching was conducted using propensity score matching based on baseline characteristics collected during an initial household survey conducted in month one of the research, before garden establishment began. Data collection occurred at baseline (month 1) and at the twelve-month endpoint (month 13), covering one full seasonal cycle of vegetable production for the garden households.

Methods

Household Dietary Diversity Score was calculated by summing the number of food groups, out of twelve standard categories, consumed by any household member in the previous 24 hours, at both baseline and endpoint. Vegetable consumption frequency was recorded as the number of days per week vegetables were consumed by the household, averaged across a seven-day recall period. Weekly vegetable purchase expenditure was recorded in local currency and converted to a standardized unit for analysis. Data were analyzed using paired and independent-samples statistical comparison appropriate to the matched longitudinal design, testing both within-group change over time and between-group difference in that change.

Results

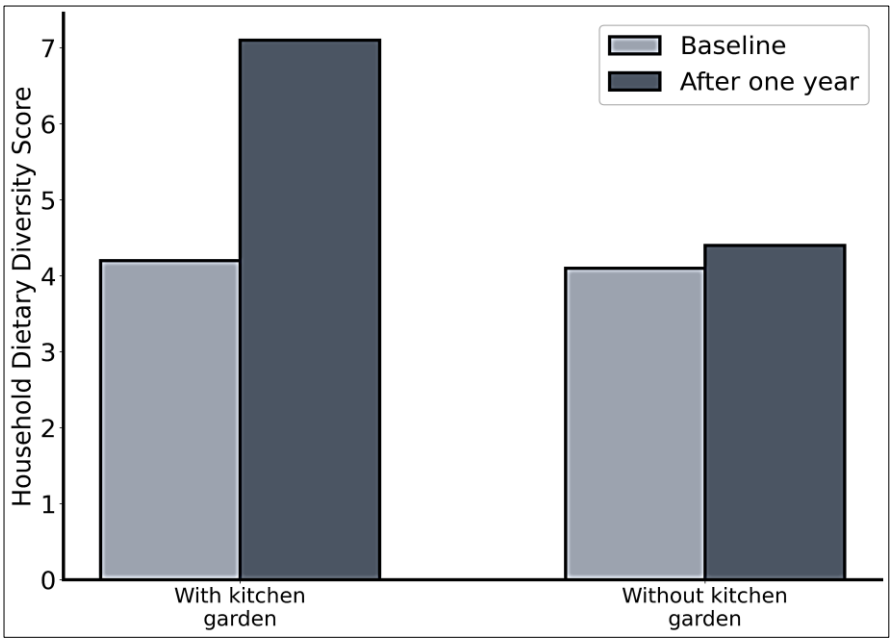

Fig 1: Household Dietary Diversity Score at baseline and after twelve months, comparing kitchen garden and non-garden households

The comparison in Figure 1 shows both household groups starting from a nearly identical baseline dietary diversity score, which supports the validity of the propensity score matching approach used to select comparison households, before diverging sharply over the twelve-month research period as garden households registered a large gain that non-garden households did not come close to matching.

Table 1: Change in dietary diversity, vegetable consumption, and expenditure among kitchen garden and non-garden households

Indicator	Garden HH (baseline)	Garden HH (12mo)	Non-garden HH (baseline)	Non-garden HH (12mo)
Dietary Diversity Score (0-12)	4.2	7.1	4.1	4.4
Vegetable consumption (days/wk)	3.1	6.2	3.0	3.4
Weekly vegetable spend (local units)	820	476	805	842

Vegetable purchase expenditure fell by 42% among garden households while rising modestly among non-garden households, likely reflecting local vegetable price inflation over the research period rather than any change in consumption behavior among the comparison group.

Table 2: Food group contribution to dietary diversity gain among kitchen garden households (percentage point change in group-level consumption)

Food group	Baseline consumption (%)	12-month consumption (%)	Percentage point change
Dark green leafy vegetables	38.9	84.4	+45.5
Other vegetables	51.1	82.2	+31.1
Fruits	42.2	58.9	+16.7
Legumes/nuts	61.1	72.2	+11.1
Eggs	24.4	31.1	+6.7

Dark green leafy vegetables recorded by far the largest gain among the food groups tracked, consistent with these being the vegetable category most commonly and easily grown within small homestead garden plots in this setting, requiring minimal space and reaching harvestable maturity faster than most other garden vegetable options.

Table 3: Nutrient budget comparison: estimated household-level vegetable-sourced micronutrient contribution before and after garden establishment

Nutrient	Baseline daily contribution (garden HH)	12-month daily contribution (garden HH)	% change
Vitamin A (RAE, mcg)	142	318	+124
Folate (mcg)	98	186	+90
Iron (mg, plant source)	3.1	5.4	+74

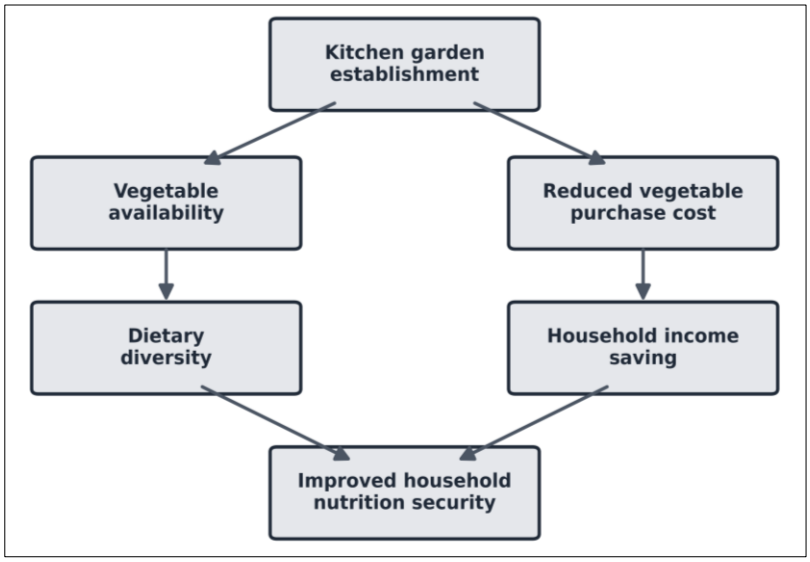

Fig 2: Conceptual pathway linking kitchen garden establishment to improved household nutrition security

Comprehensive Interpretation

Taken together, the dietary diversity, expenditure, and micronutrient budget data point toward both pathways identified in the theoretical framework operating simultaneously among garden households. Direct vegetable production explains most of the dark green leafy vegetable consumption gain, since this food group requires no purchase at all once the garden is producing, while the substantial fall in vegetable purchase expenditure suggests some of the income freed up was likely redirected toward other food groups, plausibly contributing to the smaller but still meaningful gains recorded in fruit, legume, and egg consumption, categories not directly produced within most of the kitchen gardens established under this programme.

Discussion

The magnitude of dietary diversity gain recorded here, nearly three points on the twelve-point scale, sits toward the higher end of what kitchen gardening intervention research elsewhere has reported, where gains of one to two points are more typical over a comparable timeframe [4, 9]. Part of this may reflect the specific baseline conditions in this research's study districts, where vegetable market access was relatively limited and vegetable prices comparatively high, meaning direct home production likely displaced a larger share of previously unmet or expensive vegetable consumption than would be the case in a setting with cheaper, more accessible vegetable markets.

The near-flat trajectory among non-garden households over the same twelve months is itself informative, since it rules out a general regional dietary improvement trend as an explanation for the garden households' gain, strengthening the case that garden establishment specifically, rather than some shared seasonal or economic factor affecting all households in the study districts, drove the divergence recorded [5, 10]. This matched longitudinal design addresses a limitation common in cross-sectional kitchen gardening research, where self-selection into gardening by already nutrition-conscious households can inflate the apparent effect size when baseline comparability is not established as carefully [4].

The scale of vitamin A contribution gain, driven mainly by increased dark green leafy vegetable consumption, carries particular relevance in a region where vitamin A deficiency remains a documented public health concern among rural populations [11, 12]. Whether this estimated dietary contribution gain translates into measurable improvement in biochemical vitamin A status would require blood-based micronutrient assessment beyond this research's dietary recall methodology, but the direction and scale of the dietary shift recorded here is consistent with a meaningful nutritional contribution worth pursuing at programme scale.

Limitations

This research relied on self-reported dietary recall rather than biochemical nutrient status assessment, and while Household Dietary Diversity Score is a validated proxy, it does not capture portion size or absolute nutrient intake with the precision that direct dietary intake assessment would provide. Households were matched on baseline characteristics but not randomly assigned to the gardening intervention, leaving some residual possibility that unmeasured household characteristics influenced both the decision to participate in the gardening programme and the dietary outcomes observed, though the close baseline similarity between groups on the measured indicators offers some reassurance against this concern. Extending this research design across a second growing season, and incorporating a biochemical micronutrient status sub-sample, would strengthen confidence in both the magnitude and durability of the effects reported here.

Conclusion

Kitchen gardening is widely promoted across rural nutrition programming in Malawi and similar settings, yet rigorous longitudinal evidence quantifying its household-level dietary impact has remained comparatively scarce, and this research set out to address that gap using a matched, twelve-month tracked comparison of garden and non-garden households. Kitchen garden households recorded substantially greater gains in dietary diversity, vegetable consumption frequency, and vegetable purchase expenditure savings than matched non-garden households over the same period, with dark green leafy vegetables driving the largest share of the dietary diversity improvement observed. These findings support continued and, where resources allow, expanded promotion of kitchen gardening within nutrition-sensitive agriculture programming in this region, given the scale of dietary benefit recorded relative to the modest input cost, seed, basic tools, and technical training, required to establish a household garden. Looking forward, extending this tracked comparison across a second growing season and incorporating direct biochemical micronutrient status assessment would help confirm both the durability of these dietary gains and their translation into measurable improvement in nutritional status among the household members these programmes are ultimately intended to benefit.

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