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Contribution of Agripreneurship to Dietary Diversity Among Farming Households in the Limpopo Province: Implications for Food Security

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ABSTRACT

Among other Southern African countries, South Africa continues to face persistent food insecurity driven by high population growth, high unemployment, climate change, rising food prices, and low levels of agripreneurship. The study assessed the contribution of agripreneurship to household dietary diversity in Limpopo Province. The data were collected from 200 randomly selected farming households and analysed using Stata. The results revealed an average agripreneurship score of 3.04, indicating a medium level of agripreneurship among the farming households. Furthermore, 71% of farming households had a high dietary diversity score, indicating that they were food-secure. The ordered logistic regression results revealed that agripreneurship positively and significantly influenced dietary diversity, demonstrating that it plays a critical role in enhancing household food security among farming households in Limpopo. The study recommends strengthening agripreneurship through training courses, extension services and farm diversification to improve dietary diversity and food security at the household level.

Keywords: Agripreneurship, Dietary Diversity, Ordered Logistic Regression, Food Security, Limpopo Province.

1. INTRODUCTION

The continent of Africa is characterised by the world's largest and fastest population growth. The United Nations (UN) estimated that the African population will grow to 2.5 billion by

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2050 (Stanley, 2023). As a result, food security across the continent will be affected. The Food and Agriculture Organisation (FAO), the International Fund for Agricultural Development (IFAD), the United Nations Children‘s Fund (UNICEF), the World Food Programme (WFP) and the World Health Organisation (WHO) (2024) reported that approximately 828 million people worldwide experienced hunger in 2021. Africa was the worst-affected region, with approximately 278 million people affected by hunger. According to Statistics South Africa (Stats SA), four million households experienced moderate to severe food insecurity, whereas 1.5 million households experienced severe food insecurity in 2023 (Stats SA, 2023).

Among other southern African countries, South Africa still suffers from food insecurity, particularly in rural provinces like Limpopo. This is caused by high population growth and unemployment rates, climate change, volatile food and input prices, poor infrastructure, and a lack of production and marketing skills (Van Wyk & Dlamini, 2018; Ngubane *et al.,* 2023; Stats SA, 2023). Low levels of agricultural entrepreneurship, driven by funding shortages, poor infrastructure, and high input costs, also contribute to food insecurity in rural areas (Jack, 2020). These conditions often lead to low dietary diversity, which is an indicator of food security and overall nutrient intake (Swindale & Bilinsky, 2006).

Dietary diversity refers to the range of food types consumed by individuals or households over a specified timeframe and is closely associated with nutrient sufficiency and overall health status (Swindale & Bilinsky, 2006). Increased dietary diversity correlates with enhanced intake of macro- and micronutrients, reduced multination risks, and improved health resilience (Eric *et al.,* 2021). In rural areas, low dietary diversity is often due to subsistence production systems that typically focus on staple crops, with limited production or access to foods rich in nutrients such as fruits, vegetables, dairy, and animal protein (Oyet *et al.,* 2025). This lack of food diversity contributes to undernutrition, micronutrient deficiencies, and diet-related non-communicable diseases (Deshpande *et al.,* 2024). Addressing dietary diversity requires interventions that go beyond subsistence farming, underscoring the importance of agricultural commercialisation and innovation. In this context, agripreneurship, which involves the application of an entrepreneurial mindset to agriculture, emerges as a critical tool for enhancing dietary diversity and, hence, food security.

Agripreneurship is derived from two words, namely, “agri” and "preneurship,” where agri refers to agriculture and preneurship stems from entrepreneurship (Basir & Musa, 2022). Aleke *et al.* (2011) define an agripreneur as an individual involved in agricultural cash-generating

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activities. Thus, this article defines an agripreneur as an individual farmer involved in agricultural activities for market- and profit-oriented purposes. Agripreneurs are considered essential to agricultural development and growth because they serve as catalysts for the transition from conventional to modern farming. Agripreneurship stimulates self-efficacy among smallholder farmers and reduces the risks associated with the supply of agri-products from rural to urban areas (Swetha *et al.,* 2025). It encompasses participation in value-adding activities such as agro-processing, product diversification, enhanced marketing strategies, and the adoption of advanced technologies to increase productivity and profitability (Mmbengwa *et al.,* 2020; Adeyanju *et al.,* 2023).

In rural areas, agricultural entrepreneurship is frequently seen as a solution to youth unemployment (Choudhury & Easwaran, 2019). It inspires youth in rural areas to start their own agribusiness rather than to relocate to urban areas to seek employment (Kazungu & Kumburu, 2023). An investment in agriculture and the empowerment of aspiring youth and adult entrepreneurs in the sector can serve as powerful tools to unlock South Africa's economic potential and contribute to socioeconomic development and growth. Encouraging domestic youth and communities to produce excess food and start their own agricultural businesses could save South Africa’s reliance on imported products, contribute to job creation, increase food security and reduce crime (Swetha *et al.,* 2025).

Despite the important role of agripreneurship in rural development, the existing literature has primarily examined its contributions from an economic and agripreneurship development perspective (Saghaian *et al.,* 2022; Zwane & Osuigwe, 2024; Maesela *et al.,* 2024). Only a few studies have explored its contributions to food security (Sinyolo & Mudhara, 2017; Kazungu & Kumburu, 2023). The empirical evidence on the impact of agripreneurship on dietary diversity remains limited. To address this gap, the present study aims to quantify the contribution of agripreneurship to dietary diversity. Specifically, the study seeks to assess the contribution of agripreneurship competencies to the dietary diversity among farming households in Limpopo Province.

2. RESEARCH METHODOLOGY

2.1. Study Area

The study areas incorporated the Sekhukhune, Capricorn and Waterberg districts of the Limpopo Province, South Africa. Among the other provinces, Limpopo benefits

economically from its agricultural sector. The agricultural sector contributes raw materials locally and to the international markets. The province is the largest fruit producer in South Africa. Limpopo contributed about 7.2% to the Gross Domestic Product (GDP) in 2021, and the agricultural sector contributed approximately 3.3% to the provincial GDP (Department of Trade, Industry and Competition, 2022).

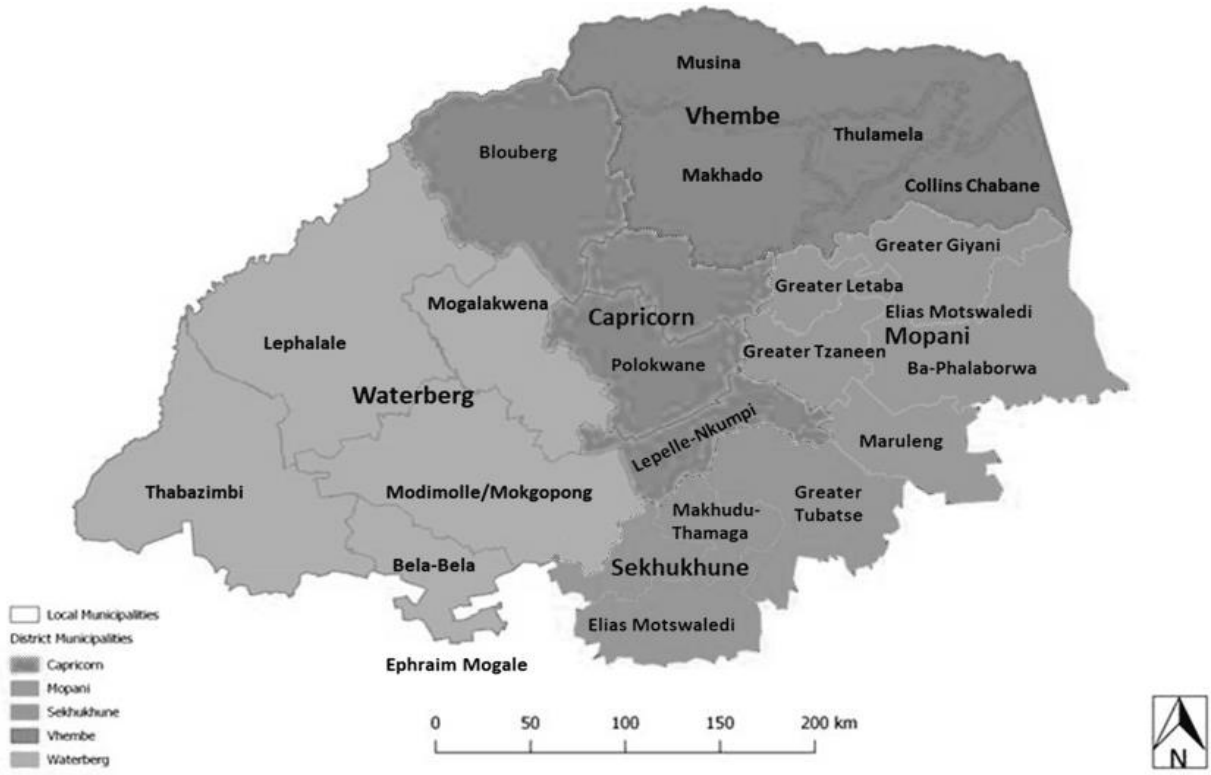

FIGURE 1: Map of Limpopo Province (Source: Serote *et al.*, 2021)

These districts were selected because they represent areas with high agricultural activities, diverse farming systems and different levels of food security. Additionally, budget constraints and interruptions caused by the COVID-19 pandemic restricted data collection to these specific districts.

2.2. Study Design, Data Collection and Sampling Procedure

The study adopted a cross-sectional design to collect quantitative data from farming households in Limpopo Province. The study identified 200 farming households, stratified and randomised, targeting beneficiaries of the Land Restitution Programme. The Capricorn district comprised 23 Communal Property Associations (CPAs) with approximately 9,053 members. The Waterberg district comprised 41 CPAs with about 9,418 members, and the Sekhukhune district

comprised 31 CPAs with about 5,093 members. Using stratified sampling, two groups of CPAs in the Capricorn district and one CPA group in the Waterberg and Sekhukhune districts were selected. Fifty farming households were randomly selected from each group, which amounted to 200 respondents. The purpose of the study was to investigate the programme's usefulness to the beneficiaries' livelihoods. The sample was calculated using the Yamane (1967) formula; however, only 200 farming households were interviewed due to budget constraints and COVID-19 restrictions, resulting in a sample of 393.

The formula is expressed as $n = \frac{N}{1+N(e)^2}$ Equ. (1)

Where n is the sample size, N is the population size, and e is the acceptable margin of error.

$$n = \frac{9053+9418+5093}{1+23564(0.05)^2}$$

$$= \frac{23564}{1+23564(0,05)^2}$$

$$= 393$$

The database of farming households was obtained from the Department of Agriculture, Land Reform and Rural Development (DALRRD). A pre-tested semi-structured questionnaire was utilised to gather the primary data, which commenced in 2021 and ended in 2022. The data collection process was disrupted by the COVID-19 pandemic and national lockdowns, leading to an overlap. The two experienced enumerators who speak the home language were recruited to collect data. Personal Protective Equipment (PPE) was provided to the enumerators, and the COVID-19 rules and regulations were observed.

The questionnaire collected information on demographic and household characteristics, as well as support services. The interview questions were closed-ended. Concerning the Protection of Personal Information Act (POPIA, 2013), household demographic information was obtained solely to enable a comprehensive analysis of the study's findings, to achieve the research objective, and to support detailed descriptions of the study participants. Questions about the food consumed the day before the interview were also asked, along with the agripreneurship competencies and skills of household farmers.

2.3. Conceptual Framework

The conceptual framework (Figure 2) shows that agripreneurship plays an important role in improving dietary diversity and food security among the farming households in Limpopo Province. It is assumed that agripreneurship competencies, such as market and profit

orientation, customer orientation, financial management, negotiation, networking skills, and many others, enable farming households to increase production efficiency, reduce product losses, and access high-value output and input markets. The success of agribusiness would lead to increased household income, allowing families to purchase a wider variety of foods and thus improve their dietary intake. This improvement directly impacts household food security by ensuring access to sufficient and nutritious food.

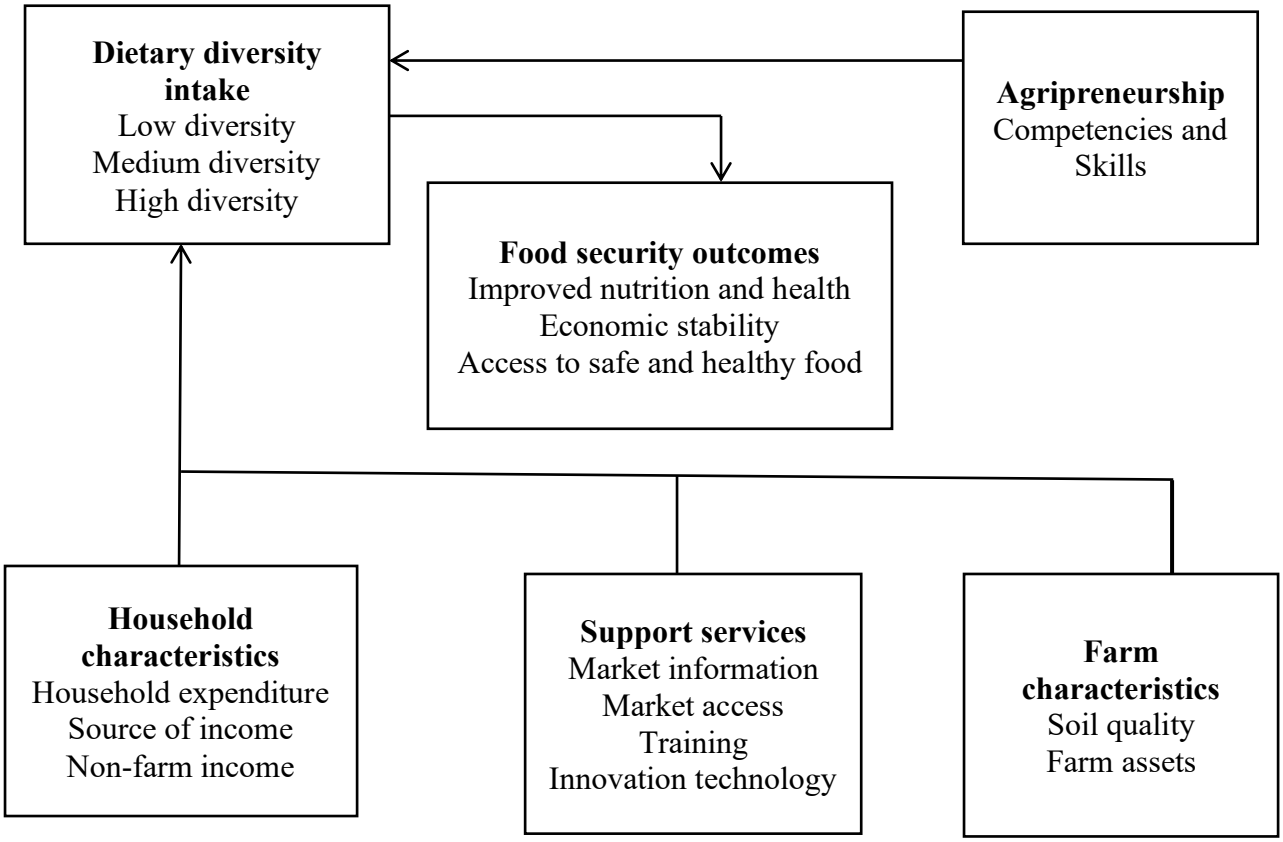

FIGURE 2: Conceptual Framework Linking Dietary Diversity, Food Security and Agripreneurship

The framework shows the interrelationships among agripreneurship, dietary diversity intake, household characteristics, support services, and farm characteristics, which, in turn, result in food security outcomes. Dietary diversity intake concerns household food consumption and is calculated by summing the total amount of food consumed by households over the previous 24 hours at a preferred time (FAO, 2010). The present study assumes that dietary diversity among farming households is influenced by agripreneurship, which is a strong indicator of household security. The studies conducted by Sinyolo and Mudhara (2017) and Kazungu and Kumburu (2023) reported a positive correlation between agripreneurship and household food security.

Several studies have highlighted the statistical relationships among household dietary diversity, food security, and various household characteristics. For example, Akinboade *et al.* (2016), Awoke *et al.* (2022), Kolliesuah et al. (2023), and Tacconi et al. (2023) reported that factors such as household expenditure, source of income, and non-farm income significantly influence dietary diversity and food security. Similarly, Maesela *et al.* (2025) and Nkegbe *et al.* (2016) established a strong correlation between household dietary diversity, food security, and farm-related characteristics, including soil quality, irrigation systems, and farm assets. Moreover, access to support services such as market information, agricultural training and innovation technologies has been shown to play a crucial role in improving household dietary and food security (Tambi, 2019; Hlatshwayo *et al.,* 2023; Maesela *et al.,* 2025). These factors collectively underscore the multifaceted nature of food security and highlight the importance of household and farm characteristics, as well as institutional support, in enhancing dietary diversity and reducing food insecurity among rural farming households.

2.4. Analytical technique

2.4.1. Dietary Diversity Score

The Dietary diversity score (DDS) was used as the food security measurement tool, following the studies by Awoke et al. (2022), Nengovhela et al. (2022), Sambo et al. (2022), and Sibhatu *et al*. (2022). The DDS is part of the FANTA second project, which was implemented in 2006 as an indicator of household food accessibility (FANTA, 2004). The DDS method is very easy to use and understand by both the respondents and enumerators. It provides information on household consumption of different foods rather than on individual household members. Data on DDS are preferably collected from household members who usually prepare the food, but this is not limited to them. The person is expected to recall all the food groups consumed in the household on the previous day.

The point given to each food group is 1 if it was consumed in the previous day or 24 hours, and 0 if not. The diversity score ranged from 0 to 14 in this study. The DDS is calculated as follows:

$$S = Sum\,(1 + 2 + 3 + 4 + 5 + 6 + 7 + 8 + 9 + 10 + 11 + 12 + 13 + 14) \quad \text{Equ. (2)}$$

The sum of DDS was then categorised into three as follows:

$DDS_{0\text{-}4\ points}$ = low dietary diversity

$DDS_{5\text{-}8\ points}$ = medium dietary diversity

$DDS_{9\text{-}14\ points}$ = high dietary diversity.

2.4.2. Ordered logistic model

The ordered logistic model was used to examine the contribution of agripreneurship to the household dietary diversity. An ordered logistic model is considered appropriate for this study because the dependent variable, dietary diversity, is ordinal. The model estimates the probability that households fall into low, medium, or high dietary diversity categories. Although the results derived from the binary models are discrete, the models do not fit this study because they cannot manage the nature of ordinal dependent variables. Ordered logistics and probit models provide the same outcomes, although the logit model estimates the logistic distribution of disturbance terms and the probit model estimates a normal distribution (Greene, 2002). The ordered logistic model was used to analyse the ordinal variable. Assuming cumulative probability, V is a dependent variable, U is a group, and ($v \leq i$) denotes the probability that V falls in the group U or below. The cumulative probability is equivalent to the sum of probabilities in the U group.

$$(v \leq i) = (i) = Br(v = 1) + Br(v = 2) + \cdots Br(v = i) \quad \text{Equ. (3)}$$

The group U and ordinal-dependent V have cumulative probabilities U: Br(v = 1), Br($v \leq 2$)… Br ($v \leq u$) and the last cumulative probability utilises the rest of the scale; thus, Br ($v \leq u$) = 1, since the last cumulative probability reflects the scale of the ordinal dependent variable. The probabilities meet.

The probabilities meet: $(v \leq i) \leq Br(v = 2) \leq \cdots \leq (Br\ (\leq u)) = 1$ Equ….(4)

The probability rating for an observation under the group response will therefore be estimated as a linear function of explanatory variables and a collection of middle points in an ordered logit model. The probability of analysing group responses aligns with the probability that the calculated linear function, in addition to the random miscalculation, falls below the group of calculated middle points of the same response.

It is also crucial to estimate $w_1w_2\ldots\ldots w_i - 1$ and the coefficients $\beta_1, \beta 2, \ldots \beta_m$ as well as the middle points $w_1w_2\ldots\ldots w_i$ where *i* is the possible group response numbers of the ordinal dependent variable. Williams (2006) indicated that the middle points and the coefficient are estimated using maximum likelihood. Table 1 describes the variables used in the study.

TABLE 1: Description of Variables Used in Ordered Logistic Regression

Variable names	Variable descriptions	Unit of measurement	Expected sign
Dependent variables			
Dietary diversity score	1 = low dietary diversity 2 = medium dietary diversity 3 = high dietary diversity	Ordinal	+
Independent variables			
Household characteristics			
Household expenditure	Money spent on food	Rand per month	+
Source of income	1 if social grant; 0 otherwise	Binary	+/-
Non-farm business	1 if the household has a non-farm business; 0 otherwise	Binary	+
Farm characteristics			
Agripreneurship	Agripreneurship index	Continuous	+
Soil quality	1 if soil quality is good; 0 otherwise	Binary	+
Productive assets	1 if the household has productive assets;0 otherwise	Binary	+
Irrigation	1 if the household has an irrigation system	Binary	+
Support services			
Market information	1 if the household has access to market information; 0 otherwise	Binary	+
Market access	1 if the household has access to the market; 0 otherwise	Binary	+
Training	1 if household received agricultural training; 0 otherwise	Binary	+
Innovation technology	1 if the household adopted innovative technologies; 0 otherwise	Binary	+

3. RESULTS AND DISCUSSION

3.1. Summary Statistics of Agripreneurship Competencies

Table 2 presents the means of agripreneurship competencies from the farm entrepreneurship index, created using principal component analysis (Maesela *et al.,* 2024). The study used a five-point Likert scale, where 0.01-1.00 indicates strongly disagree, 1.01-2.00 indicates disagree, 2.01-3.00 indicates neutral, 3.01-4.00 indicates agree, and 4.01-5.00 indicates strongly agree, following the study by Ghanney and Wotordzor (2024). The competencies with a mean score between 3.01 and 5.00 indicate that households agreed or strongly agreed they possessed those competencies. The competencies with mean scores between 0.01 and 2.00 indicate that households disagreed or strongly disagreed with having those competencies, whereas those with mean scores between 2.01 and 3.00 indicate that households were neutral about them. Additionally, the mean was categorised into three: a mean score less than 2.5 was classified as a low level of agripreneurship, between 2.5 and 3.5 as a medium level of agripreneurship, and above 3.5 as a high level of agripreneurship, following the study by Lodesso and Kebede (2017). The results showed an average of 3.04, indicating that most farming households fall at the medium level of agripreneurship. These results concur with the findings of Boye et al. (2022), who reported a medium level of agripreneurial traits, such as decision-making, innovation, and motivation, among agripreneurs.

TABLE 2: Agripreneurship Competencies and Index

Competencies	Mean	Std. Dev	Agripreneurship index
Accountable	3.73	1.27	.57
Emotional coping	3.72	1.29	.52
desirability to learn	3.63	1.57	.69
Goal setter	3.58	1.27	.60
Ability to negotiate	3.55	1.31	.62
Influential and good communication	3.51	1.38	.73
Passionate	3.33	1.55	.82
Ambitious and motivated	3.29	1.54	.75
Ability to network	3.29	1.34	.55

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Business sustainability	3.19	1.72	.76
Collaboration	3.19	1.66	.74
Adoption of advanced technology	3.09	1.57	.80
Adaptive	3.08	1.51	.76
Work long hours	3.06	1.67	.75
Problem solving	2.97	1.65	.74
Profit driven	2.94	1.68	.82
Market driven	2.79	1.56	.85
market competition	2.69	1.59	.73
Customers oriented	2.69	1.38	.62
Tough decision	2.56	1.61	.81
Ability to scan the environment	2.55	1.39	.51
Business growth visionary	2.53	1.50	.77
Opportunity searcher	2.49	1.37	.81
Finance management	2.38	1.22	.67
Market searcher	2.19	1.45	.80
Average mean			3.04
Eigen value			13
Variance (%)			52
Total variance			52

Source: Maesela *et al.* (2024)

3.2. The Level of Dietary Diversity Score Among the Farming Households

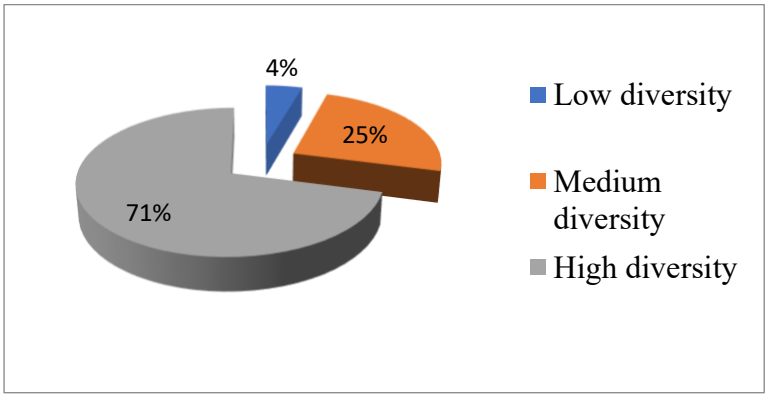

FIGURE 3: Dietary Diversity Score of Farming Households

Figure 3 presents the dietary diversity score of farming households in the study area. The results show that about 4% of farming households had low dietary diversity, 25% had medium, and about 71% had high. Although these findings are not conclusive, they imply that farming households in rural areas of Limpopo Province are food secure. A similar finding was reported by Nengovhela *et al.* (2022), who found that 80.2% of households in Limpopo have a high dietary diversity. On the contrary, Mbhatsani *et al. (*2021) reported that about 25% of households in Limpopo Province had high dietary diversity, suggesting food insecurity.

3.3. Descriptive Analysis of Farming Households in the Study Area

Table 3 presents the means for continuous variables, the percentages for binary variables, and the ANOVA test results for farming households in the study area. The ANOVA results show a low mean difference or no difference between the independent variables. The results in Table 2 reveal that the average household food expenditure increased from R2 792 per month for the low-diversity group to R3 771.46 for the high-diversity group. The majority of farming households in the low dietary diversity category (89%) relied on social grants, while a few in the high dietary diversity category (40%) did so. None of the farming households in the low-diversity group was involved in non-farm businesses, whereas about 8% and 19% of households in the medium- and high-diversity categories, respectively, were involved in non-farm businesses.

TABLE 3: Summary Statistics of Continuous and Categorical Variables Used in the Study

Variables	Means and percentages				
	All	Low diversity	Medium diversity	High diversity	Anova test
Household characteristics					
Household expenditure	3385.096	2792.325	3289.345	3771.456	0.233
Source of income	54.50	88.89	65.31	40.14	0.165
Non-farm business	15.50	0	8.16	19.01	0.026**
Farm characteristics					
Soil quality	57.50	55.56	67.35	60.56	0.003***
Assets	98.00	77.78	97.96	99.30	0.001***

Irrigation	41.21	30.28	38.78	55.56	0.244
Support services					
Market information	20.50	11.11	20.41	21.13	0.309
Market access	32.50	33.80	26.53	44.44	0.835
Training	19.00	21.83	10.20	22.22	0.231
Innovation technology	94.50	95.07	91.84	100.00	0.862

N.B: *, **, *** means statistically important at 1%, 5% and 10%

Regarding farm characteristics, fewer than 60% of farming households with low dietary diversity, and more than 60% of households in both the medium and high dietary diversity groups, reported that the quality of soil on their farms is good. Over 60% of farming households across all categories reported having farm assets, with 30% in the low-diversity group, 39% in the medium-diversity group, and 56% in the high-diversity group having irrigation systems on their farms. The results for support services show that a few farming households (less than 30%) across all categories have access to market information, whereas fewer than 50% of households across all categories have access to markets. Furthermore, fewer than 30% of farming households across all categories reported receiving agricultural-related training. Lastly, 100% of the farming households in the high-diversity group and over 90% in both the low- and medium-diversity categories reported adopting agricultural innovation technology on their farms.

3.4. The Contribution of Agripreneurship and Other Socioeconomic Factors on Dietary Diversity

Table 4 presents the marginal effects of agripreneurship and other explanatory variables on dietary diversity levels. The results show that the Chi-square probability is 1% significant and the pseudo-R2 is 20%, indicating that ordered logistic regression is well-suited to the data. The variance inflation factor (mean VIF = 1.91) indicates that there is no multicollinearity among the explanatory variables in the model. This is supported by Kim (2019), who states that multicollinearity exists when VIF is between 5 and 10, or even higher.

The ordered logistic model was used to investigate the contribution of agripreneurship to household dietary diversity. The results are discussed based on the model's marginal effects. Even though the model is appropriate for ordinal dependent variables and fits the data well, the

key assumption of the model (proportional odds) can be violated, leading to inaccurate results. The Chi-square probability and Variance inflation factors indicated that the proportional assumption is met. Although DDS helps assess food security, it has certain drawbacks. DDS displays the variety of foods that households eat, not their quantity or nutritional content. Therefore, high DDS does not necessarily indicate that households ate a nutrient-sufficient diet (Ngome *et al.,* 2019).

3.4.1. Agripreneurship Contribution to Household Dietary Diversity

The model results in Table 4 showed that agripreneurship reduced the probability of farming households falling into the low and medium dietary diversity categories by 2.8% and 6.7%, respectively, and increased their probability of falling into the high dietary diversity group by 9.5%. The level of agripreneurship among the farming households in the study area is positively associated with improved dietary diversity scores, thereby indicating a positive implication for households' food security. These results emphasise that farming households with agripreneurship competencies and skills (for instance, market and profit orientation, negotiation, networking, and financial skills) are more likely to succeed in their agribusinesses and stand a good chance of improving their dietary and nutritional intake at home.

The benefits of agripreneurship regarding household food security manifest in various ways. The agribusinesses could maximise profits, thereby improving purchasing power and providing sufficient resources to meet diverse daily dietary needs. Households could also produce excess food for both agribusiness and family consumption, thereby meeting some of the household's dietary needs. Various studies attest to the beneficial role of agripreneurship in household food security (Kazungu & Kumburu, 2023; Sinyolo & Mudhara, 2017). Kazungu and Kumburu (2023) indicated that agripreneurship is very important by ensuring food affordability, accessibility and availability. Sinyolo and Mudhara (2017) reported that motivated farmers who are willing to invest in their farms, maximise farm production, and earn improved farm income through market participation have the advantage of diversifying their household diets.

3.4.2. Additional Factors Affecting Household Dietary Diversity in Limpopo Province

3.4.2.1. Household Characteristics

Variables related to household characteristics, such as household expenditure, source of income, and non-farm business, influenced farming household dietary diversity. The marginal

effects results revealed that for every additional rand spent on food (*household expenditure*), the chance of households experiencing a low- or medium-diverse diet decreased by 39% and 82%, respectively, while the chance of experiencing a high-diverse diet increased by 21%. As anticipated, farming households with enough money would be able to spend more on various food items to meet their different daily diets than households with insufficient money. On the contrary, Kolliesuah *et al. (*2023) stated that a unit change in household expenditure is associated with a decrease in dietary diversity. On the other hand, the findings concurred with those of the study conducted by Nkegbe *et al.* (2016), indicating that household food expenditure is negatively associated with severe hunger.

The results regarding household characteristics showed that farming households that rely on the social grant as their main source of income have an increased chance of 8.1% to experience medium dietary diversity and a reduced chance of 6.4% to experience high dietary diversity. These groups of households were more likely to encounter medium dietary diversity, hence moderate food security. The same results were reported by Hlatshwayo *et al.* (2023), who found that social grants positively impact household dietary diversity. Social grants are inadequate to cover all household food expenditure; hence, households surviving on grants have low to middle purchasing power to diversify their diets and meet their daily nutritional requirements. The study by Mazenda and Mushayanyama (2021) supports the latter's claim that social grants are insufficient to cover household dietary needs. On the contrary, Akinboade *et al.* (2016) indicated that social grants are sufficient to meet household dietary needs.

Farming households owning n*on-farm businesses* reduced the likelihood of encountering low and medium dietary diversity by 6.2% and 15%, respectively, and increased the likelihood of encountering high dietary diversity by 21%. Non-farm business is negatively correlated with low and medium dietary diversity and positively correlated with high dietary diversity. Non-farm businesses offer households a stable additional source of income, reducing dependence on farming products. Farming households earning income from various sources are expected to have sufficient capital resources to diversify their diets. Just as farm diversification increases household consumption expenditure and improves dietary variety; non-farm businesses do the same. Similarly, Tacconi *et al.* (2023) revealed the positive relationship between non-farm activities and dietary diversity. Moreover, Awoke *et al.* (2022) asserted that households that can diversify their livelihoods are more likely to enjoy improved food security.

TABLE 4: Ordered Logistic Regression Marginal Effects

Variables	Low diversity		Medium diversity		High diversity	
	dy/dx	Std. Err	dy/dx	Std. Err.	dy/dx	Std. Err.
Agripreneurship	-0.028	0.012**	-0.067	0.022***	0.095	0.031***
Household expenditure	-0.390	0.036*	-0.820	0.686**	0.210	0.000**
Source of income	0.033	0.021	0.081	0.045*	-0.115	0.064*
Non-farm business	-0.062	0.033*	-0.151	0.067**	0.212	0.095**
Soil quality	-0.151	0.072**	-0.367	0.154**	0.518	0.209**
Assets	-0.249	0.081***	-0.608	0.153***	0.858	0.189***
Irrigation	0.084	0.065	0.204	0.154	-0.288	0.214
Market information	0.088	0.0364**	0.215	0.064***	-0.303	0.088***
Market access	-0.033	0.031	-0.079	0.072	0.113	0.102
Training	-0.054	0.031*	-0.130	0.067*	0.184	0.094*
Innovation technology	-0.005	0.034	-0.013	0.082	0.018	0.116
LR $chi^2(11)$ = 48.71	Prob > chi^2 = 0.000	N = 165	Pseudo R^2 = 0.1952	Log likelihood = -100.427	Mean VIF = 1.91	

N.B: *, **, *** means statistically important at 1%, 5% and 10%

3.4.2.2. Farm Characteristics

Farming households with good soil quality on their farms had a lower chance (15% and 36%) of falling into the low-to-medium diet diversity category and a higher chance (52%) of experiencing high diet diversity. With high-quality soil and other necessary inputs, such as seeds and tractors, the production of crops and vegetables, including maize, beans, spinach, and more, will improve. Households will produce saleable products and improve their household income distribution. They will further have excess produce to feed their families. Additionally, buying power will increase. Good-quality soil would also result in improved nutrient intake within households. According to the FAO (2015), healthy soil is the ultimate

defence of food security. Farming households with *productive assets* on their farms were less likely to fall into the low- and medium-diversity categories by 25% and 61%, respectively. The same households are 86% more likely to fall into the high-diversity category. This finding indicates that productive farm assets play a crucial role in household food security. Assets could be machinery and equipment, cash and inventory. Possessing these assets will help farming households improve their production or earn extra cash by hiring them out to other farmers, thereby increasing their household food availability. This result concurs with the findings of Maesela et al. (2025), who revealed that asset ownership increases households' likelihood of falling into the high dietary diversity category.

3.4.2.3. Support Services

The results on support services revealed that farming households with access to *market information* have an increased likelihood of 8.8% to experience low dietary diversity, a 22% greater likelihood to experience medium dietary diversity, and a 30% decreased likelihood to experience high dietary diversity. Although access to market information is expected to improve dietary diversity and household food security, this is not the case in this study. Possible explanations for these findings include that farming households may have received the necessary information but were unable to use it effectively, or that the information was irrelevant to their needs. These results concur with those of Hlatshwayo et al. (2023), who reported a negative relationship between dietary diversity and market information, and differ from those of Maesela et al. (2025), who reported a positive relationship between high dietary diversity and market information. The *training* variable reduced the probability of farming households falling into the low dietary diversity category by 5.4%, the medium dietary diversity category by 13%, and increased the probability of falling into the high dietary diversity category by 18%. This highlights that farming households that received agricultural extension-related services, such as training, are more likely to have high dietary diversity. Training plays a significant role in food security (Tambi, 2019). It serves as an instrument to empower farming households and foster sustainable growth. Farming households with agricultural knowledge and skills would make informed decisions on their farms. With relevant agricultural training, concepts such as record keeping, the use of advanced technologies, farmers' association membership, and market and product orientation will be better understood. Agricultural production and income will improve, thereby improving food security. The findings differ from those of Hlatshwayo et al. (2023), who found that agricultural

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extension-related services are detrimental to dietary diversity.

4. CONCLUSION AND RECOMMENDATIONS

The study investigated the contribution of agripreneurship to the dietary diversity of farming households in Limpopo Province. The findings revealed an average entrepreneurship score of 3.04, indicating a medium level of agripreneurial engagement among farming households. Additionally, 71% of households had high dietary diversity scores, suggesting that agripreneurship positively contributed to households' dietary diversity, with implications for household food security. Factors such as household expenditure, non-farm businesses, soil quality, farm assets, and agricultural training increased the likelihood that farming households would attain high dietary diversity and be food secure. Conversely, sources of income and market information were associated with a higher probability of households falling into the medium to low dietary diversity categories.

The study highlights that agripreneurship is a strategic pathway for enhancing household food security, particularly in rural areas. Since access to market information and training significantly influences dietary diversity, the study recommends investment in extension services to build and strengthen agripreneurship competencies among the farming households. Extension officers should be supported and encouraged to deliver informal training tailored to the local needs of the farming households. The extension officers can also arrange formal training that promotes practical skills and innovative farming practices. To achieve this, there is a need for collaboration among the different stakeholders involved in agriculture and government to secure funding and training, and to adopt advanced teaching strategies that effectively engage farming households. The training should be accompanied by adequate relevant resources, depending on the needs of the farming households.

Furthermore, the empirical results revealed that non-farm businesses have the potential to improve household dietary diversity and overall nutrition. Therefore, it is recommended that farming households be persuaded to diversify their income streams either by diversifying their farms or by engaging in non-farm cash-generating activities. This diversification will boost household purchasing power, reduce their dependence on the social grant, and ensure long-term food security.

5. STUDY LIMITATION

The study's limitation is that the data were collected from three districts in the Limpopo Province. This implies that the data do not encompass the province. Additionally, the study used the dietary diversity score only as an implication of food security in rural areas of Limpopo. This indicator focuses on one pillar of food security. Thus, more research is needed to cover all the districts of Limpopo and to use a range of food security indicators.

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