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Determinants of rural household dietary diversity: The case of Amatole and Nyandeni districts, South Africa

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Abstract

The emerging interest in household dietary diversity against dietary quantity presents an opportunity to estimate household food security. Using household cross-sectional survey data from rural communities in the Eastern Cape province of South Africa (N=181), the paper estimated determinants of rural household dietary diversity. Regression results suggest a positive influence of participation in irrigation schemes, gender, education, income, access to home gardens and ownership of small-livestock in attainment of high dietary diversity. Government policies and intervention programmes targeting the above variables may improve rural household dietary diversity and household food security.

Keywords: Household dietary diversity, Food security

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1. Introduction

Dietary diversity refers to an increase in the variety of foods across and within food groups (WHO/FAO, 1996) capable of ensuring adequate intake of essential nutrients that can promote good health (Ruel, 2002). Since no single food can contain all nutrients, Labadarios et al., (2011) noted that the more food groups included in daily diet the greater the likelihood of meeting nutrient requirements. With that background, Kennedy et al., (2009) argued that, a diet which is sufficiently diverse may reflect nutrient adequacy. Thus far, dietary diversity can be viewed as a proxy measure of food security (Hoddinott, 2002).

Food security on the other hand entails three important aspects (availability, access and utilization) in the relationship between man and food, critical to ensure that nutrition plays its optimum role in human health (Ajani, 2010). Interestingly, dietary diversity has been positively linked with these three pillars of food security (Bernal et al., 2003; Styen et al., 2006; Hillbruner and Egan, 2008). Eating a large variety of foods, across and within major food groups has therefore been recommended in most dietary guidelines (Jeanene et al., 2006), since it is associated with a number of improved outcomes such as nutrient adequacy, anthropometric indices and improved haemoglobin concentrations (Swindale and Bilinsky, 2005).

Understanding household dietary diversity may therefore be an alternative easy pathway to estimate household food security (Thorne-Lyman et al., 2009; Vakili et al., 2013). Also, the dietary diversity pathway may be more related to food security (Hoddinott, 2002; Styen et al., 2006; Hillbruner and Egan, 2008; Ajani, 2010), than the current focus on dietary quantity - dietary energy (Rashid et al., 2006). This paper therefore focused on dietary diversity with the implicit objective of understanding rural households` food groups and potential factors that may influence rural households` dietary diversity. The paper is arranged as follows: section 1 presents the introduction while section 2 presents the problem statement and objectives, section 3 and 4 summaries the related literature and the methodology. In section 5 the paper presents results and section 6 draws some conclusions and policy insights.

2. Problem statement

Ruel (2002) noted that lack of dietary diversity is a challenge for rural communities in developing countries. Their diets are by default defined on starchy staples with inadequate animal products, fresh fruits and vegetables (Ruel et al., 2004). Unfortunately maternal malnutrition is acknowledged as a major predisposing factor for morbidity and mortality in African women (Lartey, 2004), notably caused by inadequate food intake, poor diet quality and frequent infections (Ajani, 2010). Several authors therefore argue that, quality of diets is directly correlated to dietary diversity and inversely related to malnutrition (Azadbakht et al., 2005; Styen et al., 2006).

As rightly suggested by Rashid et al., (2006) a large number of studies seem to be focusing on determinants of dietary energy consumption (or dietary quantity), at the expense of dietary quality and diversity. Need therefore arises to also focus on determinants of dietary diversity and dietary quality given the fact that a diverse diet normally rare in rural communities from developing countries is critically

important for infants and young children in terms of supply of micronutrients and energy for physical and mental growth (Torlesse et al., 2003; Pan-American Health Organization and WHO, 2003; Ruel et al., 2004).

2.1. Objectives

- To investigate food groups consumed by rural households
- To estimate correlates of rural household dietary diversity

3. Literature review

In this section the paper explores related literature, specifically focusing on the emerging interest in household dietary diversity, its measurement and potential correlates.

3.1. Emerging interest in household dietary diversity

The emerging interest in dietary diversity according to Ruel (2002) stems from issues of nutrient deficiency and the potential importance of increasing food and food group variety to address nutrient adequacy. Ruel (2002, p. 3) defines dietary diversity as "The number of different foods or food groups consumed over a given reference period". Based on the assumption that no single food can contain all nutrients, dietary diversity has been conjectured to have a greater practical potential of meeting nutrient requirements (Labadarios et al., 2011). This could be an indicator of nutrient adequacy (Swindale and Bilinsky, 2005; Kennedy, 2009) and an outcome measure of food security (Hoddinott, 2002) for the main pillars of food security (availability, access, and utilisation) are also positively reflected in dietary diversity (Styen et al., 2006; Hillbruner and Egan, 2008; Ajani, 2010). It could therefore be concluded that, household dietary diversity holds promise as a food security indicator, although not frequently supported by peer-reviewed literature (Thorne-Lyman et al., 2009).

3.2. Measurement of dietary diversity

Dietary diversity is usually measured by summing the number of foods or more often by counting the number of food groups consumed over a reference period (Ruel, 2002; Vakili et al., 2013). At household level, Vakili et al., (2013) suggested that, dietary diversity can be used as proxy measure of food access while at individual level as a reflection of dietary quality. The reference period usually ranges from one to three days, but seven days is also often used (FAO, 2011), and periods of up to 15 days have been reported (Drewnowski et al., 1997; Administrative Committee on Coordination/Subcommittee on Nutrition, 2005).

Several researchers in Africa used either food group counts [Ethiopia (Arimond and Ruel, 2002) and Niger (Tarini et al., 1999)] or number of individual foods consumed [Kenya (Onyango et al., 1998) and in Ghana and Malawi (Ferguson, 1993)]. Literature also indicates that a combination of both single food counts and a

group count can be used in measuring dietary diversity (Hatløy et al., 2000; Ogle et al., 2001; Hoddinott and Yohannes, 2002).

3.3. Determinants of dietary diversity

Given the importance of dietary diversity and its possible link to food security this section summaries some of the major determinants of dietary diversity as highlighted in literature. Several studies suggest a positive association between income and dietary diversity (Theil and Finke, 1983; Pollack, 2001; Regmi, 2001; Ruel, 2002; Rashid et al., 2006). In Germany Thiele and Weiss (2003) noted that household size, age, sex composition, employment status and level of education were the major determinants of food diversity.

3.4. Literature insights

Literature suggests that there is a growing interest in understanding households and individual dietary diversity mainly because of its relevance in meeting nutrient requirements (Labadarios et al., 2011) and nutrient adequacy (Swindale and Bilinsky, 2005; Kennedy et al., 2009). Because of its simplicity in measurement and its reflection on key food security pillars, dietary diversity could be used as a practical proxy measure of household or individual food security (Thorne-Lyman et al., 2009; Vakili et al., 2013). With that background, several socio-economic factors (income, education, age) may therefore condition individuals` dietary diversity (Thiele and Weiss, 2003; Thorne-Lyman et al., 2009) worth understating for policy guidance and intervention targeting towards addressing food security.

4. Methodology

This section presents the methodology that was used in this study. The study used cross-sectional survey data from Amatole and Nyandeni districts, in the Eastern Cape province of South Africa. The two districts were purposively selected to accommodate variations in household characteristics and agro-ecological settings. A total of 100 respondents were randomly selected from Amatole district and 81 from Nyandeni.

Through targeting the respondents` dietary history, a 24-hour dietary recall was conducted to obtain food groups information from respondents` food intake. The respondents were asked to recall all foods eaten and beverages taken in the previous twenty-four hours prior to the interview. A scale of twelve food groups was used in assessing the dietary diversity of the respondents as summarised in Table 1.

The dietary diversity scores for the respondents were therefore estimated using information collected from the 24-hour dietary recall (FAO, 2007). A single point was awarded to each of the food groups consumed over the reference period giving a maximum sum total dietary diversity score of 12 points for each individual in the event that his/her responses are positive to all food groups.

Table 1. Categories of food groups

Food groups	Points
1. Any bread, rice, noodles, biscuits, or any other foods made from millet, sorghum, maize, rice, wheat or any other locally available grain	1
2. Any potatoes, yams, manioc, cassava or any other foods made from roots or tubers	1
3. Any vegetables	1
4. Any fruits	1
5. Any beef, pork, lamb, goat, rabbit, wild game, chicken, duck, other birds, liver kidney, heart or other organ meats	1
6. Any eggs	1
7. Any fresh, dried fish or shellfish	1
8. Any foods made from beans, peas, lentils or nuts	1
9. Any cheese, yoghurt, milk or other milk products	1
10. Any foods made with oil, fat or butter	1
11. Any sugar or honey	1
12. Any other foods such as condiments, coffee or tea	1
Total Points	**12**

***Key**: If the answer is "YES" then award 1 point: If the answer is "No" award 0 points*

Effectively this created mutually exclusive dietary diversity categories as derived from the 12 food groups into; low, medium and high dietary diversity groups as summarised in Table 2.

Table 2. Categorisation of respondents with respect to dietary diversity

	Low Dietary Diversity	Medium Dietary Diversity	High Dietary Diversity
Dietary Diversity Score	0 - 3	4 - 6	7 -12
No. of respondents	53 (29.3%)	65 (35.9%)	63 (34.8%)

Based on the above categorisation, three homogeneous mutually exclusive strata were created [Stratum A: Low Dietary Diversity (LDD): n = 53; Stratum B: Medium Dietary Diversity (MDD): n = 65; Stratum C: High Dietary Diversity (HDD): n = 63] for independent analysis as shown in Table 2. The multinomial logistic regression model was used to estimate the determinants of household dietary diversity, where the three created dietary diversity categories (LDD, MDD and HDD) were taken as the dependent variable. Medium Dietary Diversity (MDD) was chosen as the baseline group with a dummy value of 1, Low Dietary Diversity (LDD) with a dummy value of 0 and High Dietary Diversity (HDD) with a dummy value of 2. A typical logistic regression model used took the following form (Gujarat, 1992):

$$\text{Logit}\,(P_i) = ln\,(P_i / 1 - P_i) = \alpha + \beta_1 X_1 + \ldots + \beta_n X_n + U_t \quad \ldots\ldots(1)$$

Where;

- $ln\,(P_i / 1 - P_i)$ = logit for dietary diversity categories
- P_i = Medium Dietary Diversity (MDD)
- $1\text{-}P_i$ = Low or High Dietary Diversity (LDD or HDD)
- β = coefficient
- X = covariates
- U_t = error term

The probability that a household is classified in one dietary diversity category compared to the other is restricted to lie between zero and one ($0 \leq P_i \leq 1$). P_i represents the probability of a household to be classified in the MDD category and $(1 - P_i)$ represents the probability of a household to be either classified in the LDD category or the HDD category. Thus far, the model was therefore used to assess the odds of: LDD versus MDD; and HDD versus MDD. By fitting the variables into the model, the model is presented as:

$$ln\,(Pi / 1 - Pi) = \beta_0 + \beta_1\,IrigS + \beta_2\,Age + \beta_3\,Gen + \beta_4\,MS + \beta_5\,Edu + \beta_6\,EmpS + \beta_7\,HHS + \beta_8\,AcsG + \beta_9\,AcsF + \beta_{10}\,Inc + \beta_{11}\,OwLV + \beta_{12}\,OwSL$$

4.1. Specification of model variables

Table 3 summarises variables specified in the multinomial logistic regression model and the expected signs.

5. Results and discussion

This section presents results initially based on descriptive findings and inferred results later. Table 4 presents a summary of the basic sample statistics. A total of 181 respondents were considered with a mean household head age of 49 years. A few of these respondents participated in irrigation schemes and a majority were classified in the medium dietary diversity (MDD) category.

Table 3. Variables specified in the multinomial logistic model

Variable name	Variable Description	Measurement	Expected signs	
			LDD	HDD
(1) IrigS	Participation in irrigation schemes	0 = No ; 1 = Yes	-	+
(2) Age	Household head age	Years	+/-	+/-
(3) Gen	Household head gender	1 = Male ; 2 = Female	*	*
(4) MS	Household head marital status	1 = Single ; 2 = Married; 3 = Divorced; 4 = Widow; 5 = Widower	+/-	+/-
(5) Edu	Household head education	Grade 0 to Grade 12: 13 = certificate/diploma; 14 = degree and above	-	+
(6) EmpS	Household head employment status	0 = unemployed; 1 = farmer; 2 = diver; 3 = miner; 4 = other	-	+
(7) HHS	Household size	Number of members	+	-
(8) AcsG	Access to a home garden	0 = No access; 1 = Access	-	+
(9) AcsF	Access to field land	0 = No access; 1 = Access	-	+
(10)Income	Households monthly income	Amount in Rands	-	+
(11)OwLV	Ownership of Large-Livestock (Cattle, horses, donkey)	0 = No ownership; 1 = Ownership	-	+
(12)OwSL	Ownership of Small-Livestock (Avis species and Shoats)	0 = No ownership; 1 = Ownership	-	+

Key:

- **:* *variable influence could not be established a priori*
- *LDD:* *Low dietary diversity*
- *HDD:* *High dietary diversity*
- *IrigS:* *Participation in irrigation schemes status of household head*
- *AcsG:* *Access to a home garden status of the household head*
- *AcsF:* *Access to a field land status of the household head*
- *OwLV:* *Ownership of large livestock stock specifically cattle, horses and donkeys*
- *OwSL:* *Ownership of small-livestock specifically avis species and shoats*

On average respondents were educated up to grade 7 and mostly unemployed with an average household size of 6 family members. Most of them owned home gardens and field lands. Also, most households had access and ownership to small-livestock (poultry and shoats). On average households earned a monthly income of R2000 from various income sources.

5.1. Rural household food groups and beverages

This section focuses on reported food groups and beverages from the study area based on a 24-hour dietary recall. Figure 1 presents a radar summary of the reported food groups and beverages. The distribution indicates that the following food groups were common: sugars (16%), condiments (16%), oils (12%), potatoes (12%), grains (11%) and beans/peas (9%).

Table 4. Basic sample statistics

Statistics													
	Irig S	DDS	Age	Gender	Marital Status	Educ	Emplo Status	HHS	Garden	Field	Income	Livestock	small-livestock
N	181	181	181	181	181	181	181	181	181	181	181	181	181
Mean	.20	1.07	48.72	.42	1.93	6.55	.38	5.80	.76	.64	2182.32	.38	.59
Median	.00	1.00	49.00	1.00	2.00	7.00	.00	5.00	1.00	1.00	1500.00	.00	1.00
Std. Deviation	.400	.807	.591	.731	1.223	4.380	.871	3.045	.427	.483	2291.268	.487	.494
Skewness	1.521	-.122	-.797	-.842	.478	-.257	2.916	.545	-1.244	-.567	2.921	.493	-.351
Minimum	0	0	21	0	0	0	0	3	0	0	500	0	0
Maximum	1	2	90	1	5	13	6	16	1	1	12000	1	1

Key:

- *DDS: (Dietary Diversity Status) 0 = Low Dietary Diversity, 1 = Medium Dietary Diversity, 2 = High Dietary Diversity*
- *Irig S: (Participation in irrigation) 0 = non participants, 1 = Participants*
- *HHS: (Household Size)*

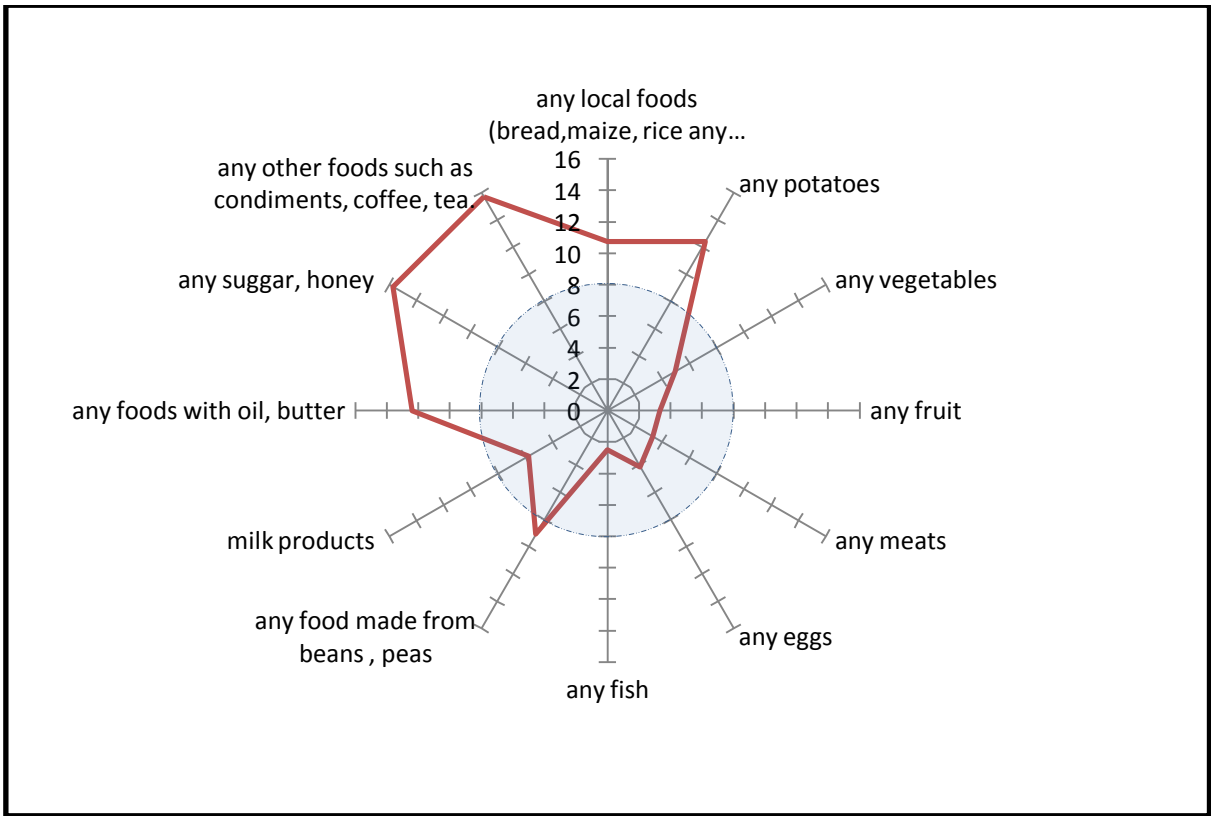

Figure 1. Reported food groups and beverages from the study area

The following food groups were also reported but not commonly shared across the study area: milk (6%), vegetables (5%), eggs (4%), meats (3%), fruits (3%) and fish (2%). The observed distribution suggests that on average, rural households` diets are mainly dominated by food groups rich in, sugars, condiments, oils, grains and potatoes at the expense of milk, meats, eggs, fish, fruits and vegetables. This may imply a low dietary diversity for the rural poor communities mainly defined by starchy staples (Ruel et al., 2004).

5.2. Determinants of rural household dietary diversity

This section presents estimated determinants of rural household dietary diversity. With reference to model fit, as presented in Table 5, a pseudo R^2 of 0.717 was obtained indicating that more of the variation was explained by the model. The final likelihood ratio test of the model against the null resulted in a significant Chi-Square (183.188: 0.000) indicating that the final model outperformed the null.

Table 5. Determinants of household dietary diversity

Predictor Variables		Determinants of Household Dietary Diversity			
		Low Dietary Diversity (LDD)		High Dietary Diversity (HDD)	
		B	Sig	B	Sig
Intercept	β_0	-2.522	.024	-7.518	.000
1) Irig S	β_1	1.841	.113	2.262	.049*
2) Age	β_2	.005	.719	.000	.998
3) Gender	β_3	.787	.079	-.270	.002**
4) Marital Status	β_4	.331	.218	.374	.246
5) Education	β_5	-.128	.040*	.156	.031*
6) Empy Status	β_6	.165	.643	.085	.830
7) HHS	β_7	-.036	.657	-.105	.264
8) Garden	β_8	-1.171	.045*	2.707	.022*
9) Field	β_9	1.051	.067	.478	.466
10) Income	β_{10}	.000	.181	.001	.010*
11) Livestock	β_{11}	.674	.274	1.324	.055
12) Small-livestock	β_{12}	-1.499	.004**	1.726	.009**
a. Base Category		Medium Dietary Diversity (MDD)			
b. N0. Of Observations		181			
c. LR Chi-Square (24)		183.188 **			
d. Pseudo R-Squared		.717			

*Notes: ** and * indicates significance at 0.01 and 0.05 probability level respectively*

Model results indicate a positive association between being a member to an irrigation scheme and high dietary diversity. These findings suggest that with reference to the base category, households who participate in rural irrigation schemes have a higher likelihood of attaining a high dietary diversity. Irrigation schemes provide an opportunity for participants to grow a variety of cash and domestic horticultural crops which may directly improve their household food groups. Indirectly, cash crops from irrigation schemes can also improve households` food purchasing power. The association may therefore indicate positive synergies between irrigation schemes and high dietary diversity.

With reference to gender, results indicate a negative significant correlation between gender and high dietary diversity. The observed results suggest that, with regards to the base category, female headed

households have a higher probability of attaining a high dietary diversity than their male counterparts. These findings support previous studies by Rogers, (1996, p. 113) who noted that "Female headed households spent more on higher-quality, more expensive, and protein-rich foods". Since women are involved in food preparation, food selection is therefore expected to be influenced by women`s knowledge regarding nutritional benefits of different foods and their power to allocate household family budgets towards high quality foods (Quisumbing et al., 1998).

Education was positively correlated to high dietary diversity and negatively correlated to low dietary diversity. These results suggest that, with reference to the base category, the more households are educated the more they are likely to attain a high dietary diversity than a low dietary diversity. Similar comparable findings were suggested by several authors who noted that educated women assign a significantly larger proportion of their household food budget to food groups that are nutritionally rich in micronutrients (Smith and Haddad, 2000; Smith et al., 2003; Block, 2003), mainly because of greater awareness and understanding of nutritional health benefits (Smith, 2004).

Access to a home garden was positively correlated to high dietary diversity and negatively related to low dietary diversity. The observed association suggests that, rural households with access to home gardens are more likely to move from a medium dietary diversity status into a high dietary diversity status. The possible explanation could be based on the fact that, home gardens normally provide a variety of horticultural crops rich in micronutrients like vegetables, fruits and tubers. Comparable conclusions were also suggested by Bouis (2007) who argued that in theory a positive correlation normally exist between household agricultural productivity and improvement in nutrition.

Results also indicate a positive association between income and high dietary diversity. These findings suggest a higher probability of the high income groups to move from a medium dietary diversity status to a high dietary diversity status. Several authors argue that, demand for vegetables and fruits (which could mean dietary quality) increase with income (Regmi, 2001; Pollack, 2001; Thiele and Weiss, 2003) and are an expensive source of energy for low income households that prioritize fulfillment of their basic energy requirement to avoid hunger (Ruel et al., 2004).

Lastly, the paper focused on the correlation between ownership of small-livestock and dietary diversity. Results indicate a positive significant association, suggesting that households who own small-livestock are more likely to move from medium dietary diversity to high dietary diversity. Small livestock are easy to keep, easy to trade and contain several food groups (eggs, meat and goat milk) that may provide micro and macro-nutrients.

6. Conclusions

The paper estimated determinants of rural household dietary diversity using household socio-economic cross sectional survey data from 181 respondents. With reference to dietary diversity status of rural households from the study area, the paper suggests a low dietary diversity mainly defined by starchy staples (grains, condiments) at the expense of protein sources (meat, fish, eggs, vegetables). Based on empirical

results the paper concludes that key determinants that can positively condition rural households to attain high dietary diversity are: participation in irrigation schemes, gender, education, income, ownership of a home garden and small-livestock.

6.1. Policy insights

Results highlight critical roles of income, education, gender, access to irrigation schemes, ownership of home gardens and small-livestock in attainment of a high dietary diversity. Strategic policy targeting, research and investment in the above areas can play a significant role towards improving rural household dietary diversity and household food security. We therefore forward the following policy options;

- Unlocking rural income sources to improve the purchasing power (income) of rural communities.
- Rural education programmes specifically targeted for women to broaden their understanding of the nutritional health benefits of a diverse diet
- Investments in irrigation schemes
- Promotion of home gardens
- Promotion of small-livestock investments

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