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# Household socio-economic determinants of food security in Limpopo Province of South Africa: a cross sectional survey

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## Abstract

**Background** Despite the strong commitment at both national and international levels to eradicate hunger and achieve household food security, by 2030 food insecurity remains a public health problem. South Africa is amongst the countries with the highest rate of income inequality in the world and extremely high levels of absolute poverty. The Gini coefficient in South Africa is estimated at 0.68. Although South Africa may be food secure at a national level, large numbers of households within the country are food insecure. Approximately 52% of the rural households in Limpopo Province of South Africa were considered severely food insecure. It has been noted that the majority of households in South African informal settlements and rural areas were moderately or severely food insecure due to lack of access to food which was directly related to income. Rural areas have assets that can be explored to support households. The adult population above 18 years in South Africa make up 78% of the 5.9 million population with about 40% living in rural areas, this study explored household food insecurity in adults in rural environments. The current study aimed to explore the socioeconomic and dietary determinants of household food insecurity among the adult population in the Limpopo Province.

**Methods** A cross-sectional survey design was used, and data were collected using a validated pre-tested questionnaire. The participants were recruited from households in Limpopo province. Multiple linear regression was computed to explore the influence of socioeconomic and dietary practices on food insecurity.

**Results** The study included 699 randomly selected participants of which the majority earned a monthly income  $\leq$  3000 ZAR, and 31.8% experiencing hunger in the past 30 days at the time of study. The dietary practices of the participants were found to be associated with household food insecurity. The study found that large family size, being female in South Africa, low household income and low rate of regular breakfast intake were significant determinants of household food insecurity ( $p < 0.05$ ).

**Conclusion** In summary, most of the households were poor and approximately one-third were food insecure. The implementation of sustainable employment policies, and food-based approaches and targeting rural household food production could significantly reduce food insecurity in the rural area.

**Keywords** Dietary patterns, Household environment, Household food insecurity, Limpopo province, South Africa

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## Background

Household food insecurity is a major public health issue in Africa, with persistent social and health impacts. Household food insecurity is referred to as the inability to afford nutritionally adequate and safe foods, or limited ability to acquire acceptable foods in socially acceptable ways [1]. The Food and Agriculture Organization of the United Nations' (FAO) defines as: "Food security exists when all people, at all times, have physical and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life" [2, 3].

Food insecurity levels have steadily risen in Southern Africa in recent years and remain a major developmental problem in the sub-region [4]. The general household survey reports that in South Africa, food insecurity is not regarded as the ability to produce sufficient food for the nation, but as inadequate financial resources to buy food for the household [5]. South Africa as a country is food secure at the national level yet many households in rural communities still struggle with hunger and food insecurity [6, 7]. The high level of inequality and unemployment as reported by Statistics South Africa [5] may partly explain the contrasting scenarios of South Africa being food secure at national level but not at household levels. According to Drimie [8] and the World Wildlife Fund (WWF) [9], challenges affecting the South African food system include poor health conditions, a severe rate of malnutrition and long-term impacts of nutritional deficiencies in the population. Challenges of crippling poverty, high unemployment rate especially among women, corruption, and deep-rooted inequality continue to have implications on access to land, water supply, energy, food and nutritionally balanced diets.

The food security status of any population is linked to the functions of food system outcomes which are impacted by aspects such as technology, politics, economy, culture, social, and natural environment [10]. Apart from this, food systems should not only focus on farming for consumption but also need to address issues affecting the health of the population including nutrition-related chronic diseases such as cardiovascular, obesity, diabetes, and other diseases linked to the double burden of malnutrition [11]. An increase in food productivity, efficiency and profitability are of paramount importance in reducing the prevalence of hunger and improving the nutritional needs of the underprivileged population of rural communities.

Various studies have established synergies between food security, unemployment, poverty and inequality [12]. Statistics South Africa [5] provides a profile of households' experiences of hunger in terms of sex and population group of household head as well as

geographic location and settlement type. They report that that households of larger sizes (8 or more members) experienced higher proportions of hunger. The larger the household size, the higher are chances of hunger. Furthermore, a higher proportion of women in South Africa are unemployed; around 30% are male compared to 50% women. Borat and Goga [13] investigated the gender wage gap in South Africa using Labour Force Surveys and showed an increase in the gender wage gap over time. They investigated whether men earn more than women in any single year and whether the earnings gap increased over time and found that women who work earned far less than their male counterparts. As of 2019, 41.8 percent of households in South Africa were female-headed, which amounted to a total of 7.2 million [5]. Given that employment is one of the most important sources of earning an income and a key driver of escape from poverty and achieving food security, narrowing the poverty gap between gender is important. Census 2011 results show that 2.9 million households (20%) were involved in agriculture. Nationally, the largest percentage of agricultural households was located in Kwazulu-Natal (25%), Eastern Cape (21%) and Limpopo (16%) [5]. Therefore Limpopo has an opportunity to amplify agricultural households. The significance of these problems has been emphasised in the Sustainable Development Goals 1, 2 and 3, which aim at eradicating poverty, hunger, and promoting good health and wellbeing by 2030. This study seeks to examine food insecurity determinants taking into consideration the Sustainable Development Goals.

The South African government is also committed to promoting and protecting South Africans' right to access adequate food. To accomplish this goal, it is fundamental to eradicate hunger and achieve household food security. The 'Integrated Food Security and Nutrition Programme' under the National Department of Agriculture, Forestry and Fisheries is charged to oversee its implementation [1]. This goal aligns with the goal of food security of the Food and Agriculture of the United Nations [7]. Although there is strong commitment both at national and international levels, the number of people suffering from hunger and food insecurity still represents some of the biggest challenges for a large part of the South African population and must be treated with utmost urgency [14]. The need to identify the determinants of food security is, therefore, essential.

Studies have been conducted in low-income settings to reveal the determinants of food insecurity in households in Addis Ababa [15], South Africa [16], and rural and urban households in South Africa [17], while Herforth and Harris [18] summarised studies from Low and Middle Income Countries. Most of these studies found that education levels, household size, dependency ratios,

household income and the areas in which the households were situated, were major determinants of food insecurity. None of the studies investigated the dietary patterns as potential indicators of food insecurity. A recent study in Maphumulo in KwaZulu-Natal [19] found that education, receiving infrastructural support (irrigation), and participation in the “One Home One Garden” programme positively influenced the food security status of households, while household income and access to credit showed a negative correlation with food security. Another study examined linkages between agricultural skills and household food security in farming households of the Tugela Ferry irrigation scheme in the Msinga Local Municipality [20]. This study found that factors like household size, marital status, education levels, gender, total livestock units, household income, farming experience, credit use and competence levels in fertiliser measurement have the potential to reduce household food insecurity. The study concludes that provision of agricultural skills may improve household food security and that interventions could improve smallholder farming productivity. The current study aimed to explore the socio-economic and dietary determinants of household food insecurity among the adult population in the Limpopo Province. In addition identifying households or community assets that could be solutions. The study forms part of a larger study that investigated eating patterns, cultural perspectives, household food security, nutritional status, physical activity and health risk of population in Limpopo province. The current study reports on the household food security and households’ determinants, specifically focusing on accessibility and availability.

## Methodology

### Study design and setting

The study design was cross-sectional and aimed to explore a statistical analysis for measurement of correlation between two or more phenomena. This study was conducted in the Limpopo Province situated in the Northern part of South Africa, which has an estimated population of 5,404,868 [21]. It consists of five districts, namely Capricorn, Waterberg, Sekhukhune, Mopani and Vhembe. The target population was adults (male and female) aged 18 to 65.

### Sampling approach and recruitment

A probability method was used which involved the selection of participants or sampling units from a population using random procedures. Three districts were randomly selected and used as a cluster: Vhembe, Mopani and Waterberg. From each cluster four villages were selected as a stratum using simple random sampling. In the stratum, a systematic method was used to select households.

Individuals in the household whose ages ranged from 18 to 65 years were selected using convenience sampling. Only one member per household was recruited.

### Data collection procedures

Data were collected using a well-designed pre-tested questionnaire divided into five sections, namely sociodemographic information (age, education level, marital status, household income and family size); dietary patterns; 24-h recall; household hunger scale (HHS); and food inventory. The dietary patterns questions and 24-h recall were used to measure patterns and consumption, while food accessibility and availability in the households were assessed using a household hunger scale adapted from a WHO standardised and validated tool used in the 1999 South African National Food Consumption Survey (NFCS) [22].

The levels of food security were grouped into three categories namely: food secure (0–1), at risk of hunger (2–3) and experiencing hunger (4–6).

The research assistants used a door–door recruitment approach, and willing participants were informed about the study and then interviewed. In each cluster area, the appropriate local language (*Xitsonga, Sepedi, Tshivenda or Isindebele*) was used. The researchers provided oversight and checked the completeness of the questionnaires.

### Data analysis

The data were analyzed using a statistical package for social sciences (SPSS) version 25. Descriptive statistics such as percentile mean, standard deviation, minimum and maximum values were analysed. The Chi square test was used to determine the relationship between independent variables (sociodemographic and dietary patterns) and the outcome variable (food insecurity). Categorical variables were dummy coded before incorporated in the multiple regression and household hunger scale scores (dependent variable) were used. Multiple linear regression was computed to explore the influence of sociodemographic and dietary practices on food insecurity. Regression analysis allows the researchers to understand the strength of relationships between the above cited dependent and independent variables. Using statistical measurements like R-squared/adjusted R-squared, regression analysis can reveal how much of the total variability in the data is explained by your model. The six independent variables used in this study were selected based on previous findings, model building procedures and contexts of the current study area. The collinearity effect was also tested using a variance inflation factor for all six independent variables. The multicollinearity effect computed for each independent variable ranged

between 1.011 and 1.131, which is less than the cut-off value ( $\geq 4$ ). The only dependent variables in the study were household food insecurity coded from 0 to 6 with increasing number representing greater food insecurity. The dependent variables were managed in the analysis as continuous endpoint. Variables were considered statistically significant if  $p$ -values were less than 0.05.

## Results

### Sociodemographic data

Among the 699 participants recruited, 79.9% were females, 59.4% had secondary levels of education and 46.2% were single. The average age of the participants was  $36.3 \pm 17.6$  years, with 79.7% between 18 and 60 years. Less than half (46.2%) of the participants were married and 70.2% lived in a household where the breadwinner earned less than or equal to 3 000 ZAR (South African Rand) per month. On average, the household family size was  $5.3 \pm 2.5$  persons, with the number of persons ranging from one to fifteen per household as depicted in Table 1.

### Dietary practices

The findings of the current study revealed that the majority (95.7%) of the participants consumed more than two meals per day, 93.1% ate breakfast with 60.1% doing so daily. In addition, 92.1% of the participants reported that they prepared food at home and 78.9% ate meals alone. The majority (93.0%) of the participants reported that they ate fruit and vegetables, but only 16.0% did so daily. Furthermore, 39.2% reported that they ate fruit as a snack, see Table 2.

Dietary patterns, accessibility, availability and consumption of food in the households were assessed using the dietary pattern questions and 24-h recall. A hunger scale and household food inventory were used to assess food availability at household level. The 24-h recall showed that the most consumed foods were mealie meal (99.4%), salt (99.4%), sugar (73.9%), tea (71.7%), bread (40.6%) and meat (33.9%).

The household food inventory revealed that most of the households had, on the day of the interview, consumed the foods listed in Table 3. The table only lists foods available in 20% or more of the households. On the whole, 10 starches were found in households with mealie meal; white meal and brown bread being the most frequently found starches. Other available starches were rice crisps, Weet-Bix (a cereal made from wheat), corn flakes (cereal made from corn), potato, sweet corn and sweet potato.

Regarding protein availability in the households, 15 protein food items were found with none of the items available in more than 20% of the households; however, fresh fish, mutton and gizzards (hearts and/or livers)

**Table 1** Sociodemographic characteristics of participants

Socio-demographic parameters of participants	Percentage (%)
Gender ( $n=697$ )	
Male	20.1
Female	79.9
Age (years) ( $n=689^a$ Mean $\pm$ SD = $36.2 \pm 17.6$ )	
< 18	8.7
18–35	47.9
36–60	31.8
60–80	9.9
80 plus	1.8
Educational level	
Never attended school	11.8
Primary education	21.2
Secondary education	59.4
Tertiary education	6.7
Short courses	0.68
Marital status	
Married	39.2
Single	46.2
Divorced	8.6
Widowed	6.0
Salary scale of the breadwinner in Rands (ZAR)	
< 1000	18.6
1000–3000	51.6
3001–4000	17.4
> 4001	8.1
Not sure	4.3
Number of family members in the household ( $n=698$ Mean $\pm$ SD = $5.3 \pm 2.5$ )	
1–2	10.8
3–6	60.7
7–15	28.5

<sup>a</sup> missing values

were present in 10–17% of the households. Other food products containing proteins included burgers, peanut butter, Vienna sausages (thin parboiled sausages that contain a lot of water and are traditionally made of pork, beef or horse meat), canned fish, beef, cheese spread, chicken feet and heads, fish paste, fish fingers, polony and canned beans. Six milk and milk products were identified in the surveyed households with fat-free milk and milk blends available in more than 20% of the households. Milk, cheese, fresh milk and 2% less milk were also available in households.

Less than 10% of the surveyed households had vegetables, with only five different vegetables found in all surveyed households. These included mixed vegetables, cabbage, beetroot salad, carrots and spinach. Fifteen different fruits were available in the interviewed households; naartjies, pawpaw and oranges were present in

**Table 2** Dietary practices of surveyed participants

Dietary practices of participants	Frequency	percentage
Number of meals eaten per day ( <i>n</i> = 695)		
One	30	4.3
Two	324	46.6
Three	309	44.5
Four and more	32	4.6
Eating of breakfast		
Yes	651	93.4
No	46	6.6
Frequency of eating breakfast ( <i>n</i> = 699)		
Daily	419	60.1
2–3 times a week	225	32.3
4–6 times a week	28	4.0
Do not eat	21	3.0
Other	4	0.6
Prepare food at home ( <i>n</i> = 697)		
Yes	642	92.1
No	44	6.3
Other (at times)	11	1.6
With whom the participants ate with at home		
Alone	550	78.9
Parent	35	5.0
Sibling	61	8.8
Combination	51	7.3
Eating of fruit and vegetables		
Yes	648	93.0
No	49	7.0
Frequency of eating fruit and vegetables ( <i>n</i> = 696)		
Daily	111	16.0
2–3 times a week	468	67.2
Twice a month	89	12.8
Do not eat/other	18	4.0
Food eaten as a snack ( <i>n</i> = 697)		
Fruit	273	39.2
NikNaks	250	35.9
Chocolates/sweets	99	14.2
Peanuts	27	3.9
Other	48	6.9

more than 20% of the households. Other fruits included pears, apples, peaches, plums, mangoes, pineapples, avocados, apricots, bananas, guavas and grapes. Another 20 miscellaneous food items were also identified, namely non-dairy creamers, hard sweets, toffee/fudge sweets, vetkoek (fried fat cake made from wheat flour), tea, ice cream, butter, cheese curls, custard, coffee, scones, sugar, chocolate bar/chomps, jelly, margarine, jam, NikNaks (maize-based chips), biscuits and marmalade.

**Table 3** Foods available in the households on the day of the visit

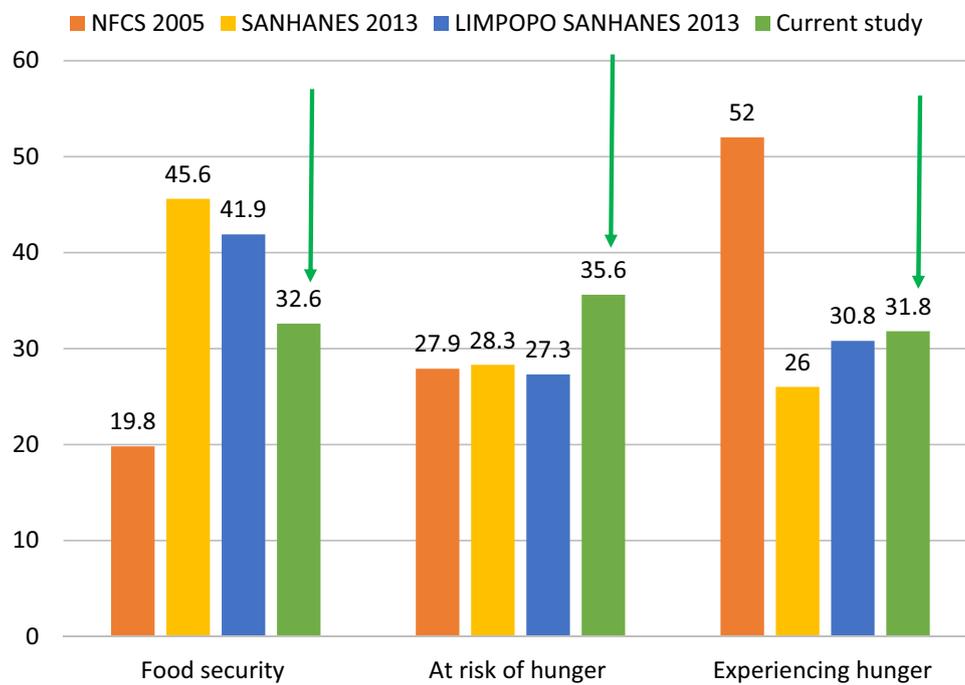
Food item	Number of households ( <i>n</i> = 699)	% Households
Starches and cereals		
Mealie meal	225	32.2
White bread	267	38.2
Brown bread	169	24.2
Milk and milk products		
Fat-free milk	402	57.5
Milk blend	146	20.9
Fruits		
Naartjie	402	57.5
Pawpaw	360	51.5
Orange	146	20.9
Other foods		
Non-dairy creamer	460	51.5

**Prevalence of hunger among participants**

The prevalence of hunger was assessed using a hunger scale, and the findings revealed that more than two-thirds of the households surveyed were food insecure and 31.8% experienced hunger. This finding is higher than the national and provincial rates of 26.0% and 30.8%, respectively. The households were asked whether any adults had gone hungry in the previous month because there was not enough food. They were also asked whether any child in the household had gone hungry in the previous month. Nearly all the households included at least one adult, and among these 82% had never experienced problems satisfying adult food needs in the previous month, 4% seldom experienced problems, 11% sometimes experienced problems, 2% often experienced problems, and 1% always experienced problems. However, 32.6% of the households in the present study were found to be food secure as depicted in Fig. 1. Figure 1 juxtaposes the findings in this study with those conducted in South Africa using similar instruments at various time points as well as highlighting ones done in the same area, namely Limpopo Province.

**Bivariate associations/correlations of sociodemographic data, dietary patterns and food security**

Female participants were more likely to be food insecure than male participants (*p* = 0.019). When considering those who experiencing hunger as illustrated in Table 4, a higher proportion of 35% (195 out of 557 females) compared to 19% (27 out of 140 males) is observed. Conversely, more men at 40.7% compared to women at 30% were food secure, when analyzing the data within the groups.



**Fig. 1** Food insecurity status comparison with previous studies [23, 26]

**Table 4** The association between sociodemographic variables and food insecurity

Socio-demographic parameters of participants	Frequency (n = 697)	Food secure	At risk of hunger	Experiencing hunger	p-value
Gender					<b>0.001</b>
Male	140	57 (25.2)	56 (22.5)	27 (12.2)	
Female	557	169 (74.8)	193 (77.5)	195 (87.8)	
Age (years) (mean ± SD = 36.2 ± 17.6)					0.367
≤ 35	390	132 (59.7)	138 (55.9)	120 (54.3)	
36–60	219	63 (28.5)	76 (30.8)	80 (36.2)	
> 60	80	26 (11.8)	33 (13.4)	21 (9.5)	
Marital status					0.175
Single	424	132 (58.4)	163 (65.5)	129 (58.1)	
Married	273	94 (41.6)	86 (34.5)	93 (41.9)	
Educational level					0.774
No college education	568	184 (81.4)	200 (80.3)	184 (82.9)	
College education	129	42 (18.6)	49 (19.7)	38 (17.1)	
Salary scale of the breadwinner in Rands (ZAR)					<b>0.000</b>
< 1000	129	21 (9.3)	45 (18.2)	63 (28.4)	
1000–3000	358	110 (48.9)	148 (59.9)	100 (45.0)	
3001–4000	121	45 (20.0)	35 (14.2)	41 (18.5)	
> 4001	56	35 (15.6)	13 (5.3)	8 (3.6)	
Not sure	30	14 (6.2)	6 (2.4)	10 (4.5)	
Number of family members in the household (n = 698 Mean ± SD = 5.3 ± 2.5)					<b>0.018</b>
1–2	75	31 (13.8)	30 (12.2)	14 (6.4)	
3–6	423	138 (61.3)	155 (63.3)	130 (59.1)	
7–15	192	56 (24.9)	60 (24.5)	76 (34.5)	

Household food insecurity was also significantly associated with large family size and low household income (Table 4).

The dietary practices of the participants were also found to be associated with household food insecurity (Table 5). A detailed analysis showed that lower number of meals eaten per day ( $p=0.000$ ) and a low rate of regular breakfast intake ( $p=0.000$ ) were determinants of household food insecurity. While, most participants ate breakfast, the frequency or number of times per week revealed that more than 50% do not eat breakfast frequently.

Multiple linear regression was computed to explore the influence of sociodemographic and dietary practices on food insecurity. Multicollinearity was verified for highly

correlated variables. The analysis revealed that being female (vs. male,  $\beta: 0.119, p=0.002$ ), and having or being part of a household size of  $\leq 6$  persons (vs.  $\geq 6$  persons,  $\beta: 0.132, p=0.001$ ) were positively correlated with food insecurity. Income level  $\leq 3\ 000$  ZAR (vs.  $\geq 3000$  ZAR,  $\beta: - 0.967, p=0.001$ ) and daily eating of breakfast (vs. sometimes,  $\beta: - 0.298, p=0.000$ ) were negatively correlated with food security (see Table 6). The model explains the 14% variance in food insecurity.

### Discussion and conclusion

The present study was conducted to identify the potential determinants of household food insecurity. For a household to be food secure, food needs to be available, accessible, and consumed, and there should be a stable food

**Table 5** The association between dietary patterns and food insecurity

Dietary practices of participants	Frequency <i>n</i> = 699	Food secure	At risk hunger	Experiencing hunger	<i>p</i> -value
Number of meals eaten per day					<b>0.000</b>
Once	30	7 (3.1)	10 (4.0)	13 (5.9)	
Twice	324	79 (35.3)	146 (58.6)	99 (44.6)	
Three times	309	120 (53.6)	86 (34.5)	103 (46.4)	
Four times and more	32	18 (8.0)	7 (2.8)	7 (3.2)	
Eating of breakfast					0.335
Yes	651	210 (92.9)	237 (95.2)	204 (91.9)	
No	46	16 (7.1)	12 (4.8)	18 (8.1)	
Frequency of eating breakfast					<b>0.000</b>
Daily	419	178 (78.8)	138 (55.4)	103 (46.4)	
2–3 times a week	225	32 (14.2)	93 (37.3)	100 (45.0)	
4–6 times a week	28	8 (3.5)	14 (5.6)	6 (2.7)	
Do not eat	25	8 (3.5)	4 (1.6)	13 (5.9)	
Prepare food at home					0.058
Yes	642	206 (91.2)	229 (92.0)	207 (93.2)	
No	44	17 (7.5)	27 (4.8)	15 (6.8)	
At times	11	3 (1.3)	8 (1.7)	0 (0.0)	
Daily eating of fruit and vegetables					0.118
Yes	648	204 (90.3)	237 (95.2)	205 (92.3)	
No	49	22 (9.7)	12 (4.8)	17 (7.7)	
Food eaten as a snack					0.196
Fruit	273	88 (38.9)	91 (36.5)	94 (42.3)	
NikNaks	25	85 (37.6)	82 (32.9)	83 (37.4)	
Chocolates/sweets	99	30 (13.3)	48 (18.5)	23 (10.4)	
Peanuts	27	5 (2.2)	13 (5.2)	9 (4.1)	
Other	48	18 (8.0)	17 (6.8)	13 (5.9)	
Participant’s eating partner at home					0.075
Alone	550	168 (74.3)	204 (81.9)	178 (80.2)	
Parent	35	14 (6.2)	10 (4.0)	11 (5.0)	
Sibling	61	19 (8.4)	18 (7.2)	24 (10.8)	
Combination	51	25 (11.1)	17 (6.8)	9 (4.1)	

**Table 6** Results of multiple linear regression on sociodemographic characteristics and dietary practices associated with food insecurity

Variable	Coefficient	Standard error	T	p-value
Gender (female, male)	0.119	0.284	2.693	<b>0.002</b>
Age	0.051	0.007	1.302	0.193
Number of family members in the household ( $\leq 6, \geq 6$ )	0.132	0.192	3.446	<b>0.001</b>
Income level ( $\leq 3000$ ZAR, $\geq 3000$ ZAR)	- 0.967	0.275	- 3.443	<b>0.001</b>
Number of meals eaten per day ( $\leq 2, \geq 3$ )	0.077	0.234	0.328	0.532
Eating of breakfast (yes, no)	- 0.189	0.454	- 0.416	0.678
Frequency of eating breakfast (daily, sometimes)	- 0.298	0.242	- 7.530	<b>0.000</b>
Prepare food at home (home, out of home)	- 0.086	0.374	0.230	0.818
Fruit and vegetable daily intake	0.050	0.427	0.118	0.906
R <sup>2</sup>	0.137			

supply [24]. The findings show that more than a third (35.6%) of the study participants reported to be at risk of hunger and 31.8% already experienced hunger, which was higher than the result of the national and provincial rates of 26.0% and 30.8% respectively—experiencing hunger according to South African National Health and Nutrition Examination Survey (SANHANES) 2013 [25]. However, the present findings revealed a significant decline from the 1999 and 2005 national surveys which reported that 52.3% and 52.0% respectively, of households experiencing hunger [17, 22]. This study used the same tool for measuring food security as that used in the NFCS of 2005. SANHANES 2013 and our study findings for households experiencing hunger in Limpopo province are similar; 30.8% vs 31.8%. Perhaps this reduction in number of people experiencing hunger might be an indication that intervention strategies such as grants and poverty relief strategies put in place by the South African government has indeed improved the livelihood of her people [26–28]. The South Africa Demographic Health Survey conducted in 2016 reported the percent distribution of households by the frequency of problems satisfying food needs of *de jure* adults in the previous 12 months [29].

The current findings revealed that female participants were more affected by food insecurity than males. These findings agreed with the results of a study conducted by Matheson and McIntyre [30], which reported that female household members were found to be more sensitive to food insecurity than their male counterparts. According to Herforth and Harris, the pathway from women’s empowerment to improved nutrition is influenced by a number of factors, including social norms, knowledge, skills and how decision-making power is shared within households [18]. The pathway generally consists of three interrelated components: women’s use of income for food and non-food expenditures, the ability of women to care

for themselves and their families, and women’s energy expenditure. Evidence suggests that empowering women improves nutrition for mothers, their children, and other household members.

The present findings also indicated that the rate of regular breakfast intake was low in the food insecure group, which is consistent with the findings of Chun et al. who conducted a study among Korean adults with the main aim of verifying the association between food insecurity and health behaviors [4]. Most studies in South Africa have focused on breakfast in children and adolescents [31, 32]. The study by Seedat and Pillay [32] demonstrated that most of their participants consumed breakfast; however, only a small proportion consumed it daily. In this study, breakfast was consumed, but less frequently per week probably due to food unavailability. Breakfast is an important part of the diet which contributes significantly towards daily nutrient intake and is linked to improved intake of energy, protein, iron, vitamin A and vitamin C, if consumed frequently. The consumption of breakfast leads to positive health behaviour, improved stress management, feeling energetic, and making fewer unhealthy snack choices. Skipping breakfast results in fatigue and suboptimal concentration levels, as well as an increased risk of developing obesity. Reasons for skipping meals, in general, often include being in a hurry, lack of appetite, inability to cook, fasting/religion, and not being hungry. However, in poor households with diminished purchasing power, it could be a function of not having sufficient resources to afford breakfast.

The current study also found that a lower number of meals eaten per day and having eating partner(s) at home or being parents, were determinants of household food insecurity. Reducing number of meals eaten per day could be coping strategies used by households to respond to food security as reported by an earlier study conducted in the Limpopo Province in 2016 [33].

The majority of households included in the study had a monthly income of less than or equal to 3000 ZAR. These results clearly indicate that the majority of the participants lived in poor households and lived below the poverty line of approximately one United States Dollar (15 ZAR) per person per day according to the World Bank. This poses an increased risk of poverty and limits the purchasing power of the household, thus leading to food inaccessibility as reported in this study. These findings are consistent with a previous study where it was reported that on average, a household in the Limpopo Province had an income of 2953 ZAR per month [7]. Low household income was found to be significantly associated with household food insecurity in the study area. Household income is a significant determinant of access to food, which in turn is a major determinant of the nutritional status of the household members [34–37].

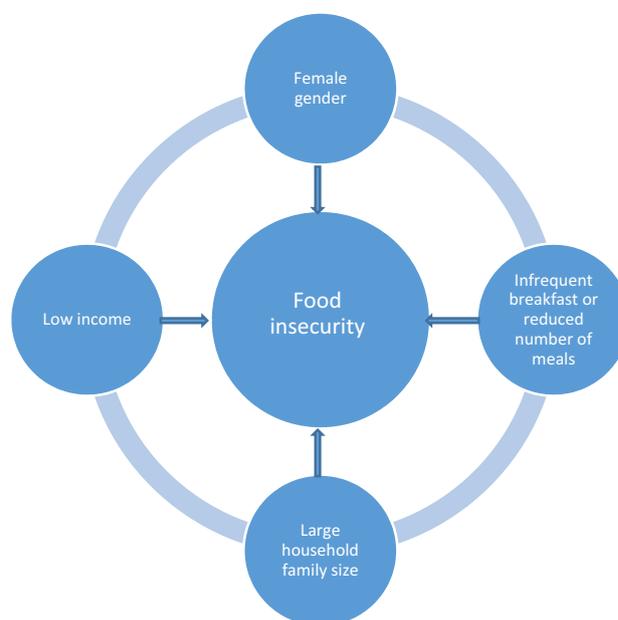
The average family size per household was five persons. A larger household size implies more people to feed which might easily lead to food insecurity. The current findings established an association between household size and food insecurity, similarly to previous findings in South Africa and Ethiopia, which reported that larger household size tends to be food insecure compared to smaller household size [15, 17]. The determinants which were significantly linked to food insecurity are depicted in Fig. 2.

These determinants were related to the status of women in the society. Women in this study are mostly unemployed, earn less money and have or live with large families. This is in line with the high rural women unemployment rates reported by Statistics South Africa [5].

The limitations of the current study recognized the possibility of misclassification of individuals as food insecure when food security survey tools are used to assess food security in households where some household members are food insecure. In addition, the data was self-reported which means that social prestige may have affected the extent to which participants might have responded to food-related behaviours. There were also more female participants than males.

### Conclusion

The findings revealed that more than one-third of all households surveyed were poor, with 31.7% already experiencing hunger. Being female with a low household income, eating a small number of meals per day, with a low rate of regular breakfast intake, and having an eating partner at home or being parents, were found to be risk factors of household food insecurity. Recommendations based on the key findings of the study include policy strengthening of sustainable development activities for reduction of unemployment, creating employment



**Fig. 2** Determinants of food insecurity with a significant association

opportunities at local and promoting income-generating activities for women to ensure that households can have improved ability to purchase food. These measures can improve household food security and advance livelihoods.

### Abbreviations

FAO	Food and Agriculture Organisation
HHS	Household Hunger Scale
NCFS	National Food Consumption Survey
SANHANES	South African National Health and Nutrition Examination Survey
SPSS	Statistical package for social sciences
WWF	World Wildlife Fund
ZAR	South African rand

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### Author contributions

XG conceptualised the study. TA, NS, HV, TC, LF, MM and XG collected and analyzed the data, wrote the draft and approved final versions. All authors read and approved the final manuscript.

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### Data availability

The data used to support the findings of this study are available from the corresponding author, upon request.

### Declarations

#### Ethics approval and consent to participate

The research proposal was approved by the Ethics committee of the University of Venda (SHS/08/NUT/003) before data collection commenced. Permissions and consents were obtained from local authorities and the participants, respectively.

**Consent for publication**

Participants were informed that data will be shared widely while kept anonymous.

**Competing interests**

The authors declare that there are no financial competing interest regarding the publication of this paper.

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