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## *Feeding Practices, Food Variety, and Dietary Diversity – Indicators of Nutritional Status among Historically Disadvantaged Agri-business Families, South Africa*

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### ABSTRACT

**Background:** In the South African context, little is known about the nutritional status of historically disadvantaged smallholder food producers and their family members. Food Variety Scores (FVS) and Dietary Diversity Scores (DDS) are some of the indicators of nutritional status. This study sought to evaluate the nutritional status of children of historically disadvantaged agri-business smallholders at Alfred Nzo District. **Methods:** This study's purposeful sample comprised of 263 agri-business households that generated annual turnover of US \$11 811 – \$39 370, and 327 children aged 5-14 years. A 3-day 24h dietary recall method was administered to collect information using questionnaires to assess the households' socio-economic status and the caregivers' nutritional practices. Descriptive, correlational, and non-parametric statistical analyses were performed. **Results:** The majority of caregivers' households had a monthly non-farm income of US \$78.82 - \$118.11 (32.3%), and food expenditure of US \$55.20 - \$70.87 (23.2%). The households' nutritional practices appeared weak. Half of the caregivers' households (50.2%) could not afford to provide breakfast for their children every day before they go to school or church. The mean FVS was low at  $23.43 \pm 7.89$ , while the mean DDS was debatably high at  $7.82 \pm 4.53$ . The households' non-farm income was positively and highly correlated ( $r = 0.55$ ) to food expenditure ( $P < 0.01$ ). In turn, food expenditure had a significant influence on FVS ( $P < 0.01$ ) and DDS ( $P < 0.05$ ). **Conclusion:** Households of historically disadvantaged agri-business smallholders had rather poor nutritional status. Staple food production-based security programs are required to improve nutrition.

**Keywords:** Feeding practice; FVS; DDS; Nutritional status

### Introduction

Food security, as defined by Food and Agriculture Organization (FAO) is the condition in which all people at all times have physical and economic access to sufficient, safe, and nutritious food to meet their dietary needs and food preferences for an active and healthy life

(FAO, 2012). This internationally accepted definition of food security was the cornerstone in the formulation of South Africa's post-apartheid Integrated Food Security Strategy (IFSS) (Integrated Food Security Strategy for South Africa, 2015). Subsequently, this country has had

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numerous food security programs in which the historically disadvantaged black smallholder farmers were empowered and made self-sufficient to produce massive amounts of their mainly staple food; maize. However, in view of the FAO's definition of food security, self-sufficiency in production of the staple food does not necessarily render one food secure (Pingali, 2015). Indeed, many studies conducted on food security and many government interventions tend to either disregard or put little emphasis on the nutrition dimension of food security concept (Dirwayi, 2010, Ndhleve *et al.*, 2012, Tregurtha, 2009).

Meanwhile, in other parts of the world, nutrition-sensitive interventions are applauded in the contemporary literature of food security (Herforth and Ahmed, 2015, Institute of Food Research 2015, Pingali, 2015). Nutrition-sensitive research also covers food security indicators such as food variety, dietary diversity, and nutrient intake (Labadarios *et al.*, 2011, Oldewage-Theron and Kruger, 2008). Other studies go a step further to include food absorption which gives a more accurate measure of food utilization and state of food insecurity (Yeldah, 2011).

Studies on the food security and nutritional status of historically disadvantaged smallholder agri-business farmers are scarce in South Africa. It is presumed that by virtue of being food producers, they are food secure and have elevated nutritional status. However, adequate food availability or food production neither leads to one's food security automatically, nor results in one's higher nutritional status. Furthermore, food insecurity does not only affect the poor, as it is commonly perceived, but also affects well-off families. Nutritional knowledge, attitudes, and practices of such rich people may be key determinants of what food items to produce or economically access as well as what food security and nutritional status to acquire.

Against the above background, this study sought to evaluate the nutritional status of historically disadvantaged smallholder agri-business farmer families in Alfred Nzo District of South Africa through their food variety, dietary diversity, and

feeding practices. Each family respondent is referred to as a caregiver in this study, because of his/her role in influencing the family's feeding practices and nutritional status.

### Materials and Methods

*Study design and population:* Participatory action research was used to gain in-depth understanding of the determinants of nutritional status including feeding practices, food variety, and dietary diversity.

This study targeted at investigating historically disadvantaged smallholder agri-business owners/managers of Alfred Nzo District in South Africa. The inclusion criterion was participants' individual or collective annual turnover of US \$11811 and US \$39370. So, all owners/managers who met this criterion were purposefully selected from a farmer database that was made available by local agricultural extension officers. The selection process led to a purposeful sample of 263 smallholder farmers. Each of these representative respondents due to their influence in the children's feeding behavior, are referred to as a caregiver in the study.

*Research instruments:* Questionnaires were used to assess the caregivers' socio-economic status, feeding practices, food variety, and dietary diversity. A 24h dietary recall questionnaire was also administered twice; once in weekdays and once in weekends. Food models and the internationally acclaimed Food finder III nutritional software of the Medical Research Council of South Africa were used to improve the accuracy of recorded food quantities. Data from the 24h dietary recall questionnaire was then used to calculate FVS and Dietary Diversity Score (DDS). The former was calculated as the sum of food items consumed by a child over a period of time, while the latter was calculated as the sum of different food groups consumed by a child over a period of time. Consequently, the following nine food groups were investigated in this study: cereal, roots, and tubers; fleshy foods; dairy foods; legumes and nuts; eggs; vitamin-A rich vegetables and fruits; other fruits and juices; other vegetables; as well as fats and oils.

Regarding the feeding practices, investigation on the consumption patterns of vitamin A-rich fruits was limited to ripe mango/mango juice and apricot/apricot juice. Similar investigation on animal protein sources was confined to organ meat (liver, kidney, and heart), flesh meat (beef, mutton, pork, and chicken), and fish (fresh fish, canned fish, prawns, mussels, crayfish, crabs, and oysters). Feeding practices were assessed on the basis of responses that caregivers gave to questions that are pertaining, among other issues, to breakfast, number and diversity of meals, consumption of vitamin A and C-rich foods, and protein sources. Further information on participants' feeding practices was obtained through a 3-day 24h dietary recall method.

Various measurements were carried out to promote the validity and reliability of data. These included conduction of extensive literature review, use of legitimate and a multiple of research instruments, as well as selection of a research sample representative of the research population so that the results can be generalized.

*Data analysis:* Data were statistically analyzed using SPSS version 20. Descriptive statistics were used to establish central tendencies and tests for statistical significance were carried out using analysis of variance (ANOVA). Non-parametric Mann-Whitney test and Kruskal-Wallis test were conducted to elucidate the outcomes of the parametric tests. A bivariate correlation analysis was also conducted to describe relationships between variables.

*Ethical considerations:* Written consents were obtained from the caregivers to conduct the study and their right for anonymity, confidentiality, and fair treatment was respected. This study also upheld scientific integrity.

## Results

*Demographic information:* The overwhelming majority of the caregivers (n = 250, 94.95%) participating in this study, were women (**Table 1**). Their marital status was so that most were 'married' (n = 125, 47.5%), followed by those who were 'never married' (n = 82, 31.2%) and 'widowed' (n = 56, 21.3%).

Most of the caregivers (n = 54, 20.5%) fell in the age group of 36–40 years, followed by those who were within 46–50 years (n = 36, 13.7%). The number of those who reached 60 years and so were eligible for government's old age social grants was estimated at 55 (20.8%).

With respect to education, majority of caregivers had academic qualifications (n = 66, 25.1%), while, 41 individuals (15.6%) had no formal education and the Bachelor's degree/Diploma was the highest level of education acquired (n = 25, 9.5%).

When asked to indicate the number of people who permanently reside in their respective households, most caregivers registered a size of 4–6 persons (n = 109, 41.4%), followed by 7–9 people (n = 68, 25.9%). Only 59 (22.4%) households accommodated 1–3 members and just 27 (10.3%) of them had more than 10 persons.

*Income:* Some of the caregivers' households had multiple sources of income. For example, a few caregivers were employed somewhere else outside their family agri-businesses (n = 34, 12.9%). Of these employed caregivers, most were employed on permanent basis (n = 14, 41.2%), while 32.4% and 26.5% were employed on temporary basis and fixed-term contract, respectively. The majority of participants (n = 143, 55.4%) declared having no employed family members with whom they permanently live. The rest caregivers (n = 115, 44.6%) reported having from 1 to 3 employed family members.

The non-farm income of households originated from employed caregivers and their family members with whom they permanently live. Most of the caregivers' households (n = 85, 32.3%) earned US \$78.82 and US \$118.11, followed by those who earned from US \$39.37 to US \$78.74 (n = 55, 21.9%). Furthermore, 51 (19.8%) caregivers' households earned more than US \$196.85 per month (**Table 2**).

Farming activities of the agri-business smallholders were not intense, often characterized by low yields and productivity due to use of out dated farming methods and poor infrastructure base. The majority of smallholders (n = 236, 89.7%) co-owned and/or co-managed their agri-

business units in groups with average size of four people. The average annual farm income payable to each agri-business smallholder was US \$2 903. However, in their homesteads the agribusiness smallholders kept some livestock and grew crops which were mainly used for home consumption.

The households' monthly expenditure on food was from US \$55.20 and US \$70.87 (n = 61, 23.2%); 19 (7.2%) caregivers' households spent \$39.45 or less a month, while 13 (4.9%) individuals spent US \$157.48 or more (**Table 2**).

*Breakfast eating patterns:* The caregivers were asked to quantify frequencies of providing breakfast for their children. To this end, about half of the caregivers (n = 132, 50.2%) provided breakfast 'every day of the week'. This group of caregivers was followed by those who provided breakfast 'four to six times a week' (n = 82, 31.2%), while 23 of participants (8.7%) indicated that they 'never' provided breakfast for their children before they go to school (**Table 3**). The results from the 24h dietary recall method showed that the government's school nutrition programme of the Department of Education provides 'late' breakfast from 11 to 12 a.m. for all school children. This nutrition programme appeared helpful, particularly to children from households (n = 131; 49.8%) who could not provide breakfast.

*Meals:* When asked if they 'can afford' providing their children with 'three meals a day and a snack', most caregivers (n = 159; 60.5%) conceded that they 'cannot afford' (**Table 3**). In line with this response, most caregivers admitted that provision of such number of meals a day is 'difficult' (n = 138, 52.5%), while the rest (n = 125, 47.5%) said it is 'not difficult' (**Table 3**). The most cited sources of 'difficulties' in providing children with 'three meals a day and a snack in between' were high cost of food and drought.

More than half of the caregivers (n = 139, 52.9%) said that it was 'difficult' to provide their children with different types of foods (**Table 3**), largely due to high food costs and unavailability of some foodstuffs in the local shops.

*Consumption of Vitamin A and C-rich foods:* The majority of caregivers (n = 203, 77.2%)

reported that their children did not consume any of the fruits mentioned above over the previous 24h. However, only 29 caregivers (11.0%) reported consumption of ripe mango/mango juice and 26 of them (9.9%) indicated consumption of apricot fruit/juice. The rest of caregivers (n = 5, 1.9%) did not respond to the question.

With respect to consumption patterns on vitamin A-rich vegetables and fruits (carrots, pumpkin, and squash), most caregivers indicated that their children had consumed carrots (n = 169, 64.3%) or pumpkin/squash fruit (n = 51, 19.4%) during the last 24h. The rest of participants (n = 43, 16.3%) said that their children had consumed none of the above mentioned vegetables.

Regarding the consumption frequency of vitamin C-rich citrus, only a small number of participants (n = 9, 3.4%) indicated every-day consumption of citrus. Most caregivers reported consumption of 'once per week' (n = 96, 36.5%), while 42 (16.0%) of them indicated a consumption of 'twice per week'. Noticeably, a large number of caregivers (n = 45, 17.1%) responded to this question with 'never', followed by 29 participants (11.0%) who responded with 'thrice per week'. The rest either responded with 'do not know' (n = 22, 8.4%) or 'did not respond' to the question (n = 20, 7.6%).

*Consumption of protein-rich foods:* The caregivers were asked if their children had consumed any of the protein-rich foods, including organ meat, flesh meat, and fish over the past 24h. With respect to consumption of 'organ meat', most of the caregivers responded that their children had consumed liver (n = 123, 46.8%), followed by those who mentioned consumption of heart (n = 12, 4.5%) and kidney (n = 6, 2.3%). The rest indicated that their children did not consume any of the above mentioned 'organ meat' (n = 122, 46.4%).

Regarding 'flesh meat', the majority of caregivers reported consumption of 'chicken' (n = 160, 60.8%), while consumption of 'mutton' (n = 11, 4.2%), 'pork' (n = 5, 1.9%), and 'beef' (n = 4, 1.5%) was restricted to very few households. A sizeable number (n = 83, 31.6%) of participants said

that their children had consumed 'none of the flesh meat' listed above. Respecting 'fish', only the consumption of 'canned fish' (n = 161, 61.2%) and 'fresh fish' (n = 13, 4.9%) were registered by the caregivers. The rest (n = 89, 33.8%) reported no consumption of any 'fish' over the past 24h.

*Food variety and dietary diversity:* Having discussed the caregivers' feeding practices, further investigations were extended to food variety and dietary diversity using a 3-day 24h dietary recall method. The average FVS for the 263 investigated households was low at 23.43 (**Table 4**) (Mahoney *et al.*, 2005). Most of the caregivers' households (n = 215; 81.7%) had a low FVS, followed by those with a medium FVS (n = 48; 18.3%). None of the households had a high FVS category.

Regarding dietary diversity, most of the caregivers' households (n = 88; 33.5%) consumed foods from eight food groups, followed by those (n = 71; 27.0%) who consumed foods from all nine food groups. Participants who consumed only from three food groups had the lowest frequency (n = 5; 1.9%). The mean of DDS was 7.82, which is a high DDS. The majority of caregivers' households (n = 184; 70%) had high DDS, followed by those with medium (37.2%) and low DDS (8.2%).

**Table 5** presents a summary of the top 20 most consumed food items by the caregivers' children during the 3-day 24h dietary recall. Noticeably, the carbohydrates-rich food items from the 'cereal, roots, and tubers' group dominated the top 10 most consumed foods. Only canned fish and chickens from the 'flesh' group as well as fresh milk and sour milk from the 'dairy products' group appeared in the list of top 20 most consumed foods items. Only carrots and spinach from the 'vitamin A-rich vegetables and fruits' group, as well as cabbage and onion from the 'other vegetables' group appeared in **Table 5**, while sunflower oil represented the 'fats and oils' group. Food groups which their food items were not included in the questions consisted of 'eggs', 'legumes and nuts', and 'other fruits and juices'.

This study also found that consumed quantities of food items varied widely within and between households, largely due to the varying socio-economic status of the caregivers' households. Consumed quantities of food items from other food groups were rather low (e.g., dairy products, vegetables, and flesh foods). This again was a function of socio-economic properties of the caregivers' households.

**Table 1.** Demographic characteristics

Characteristics	n	%
Gender		
Male	13	5.1
Female	250	94.9
Role in family		
Father	4	1.6
Mother	141	53.8
Grand father	12	4.5
Grand mother	97	36.7
Other	9	3.4
Educational qualifications		
No education	41	15.6
Adult basic education and training (ABET)	60	22.8
Grade 1-7	31	11.8
Grade 8-11	66	25.1
Grade 12 / N3	40	15.2
Bachelor's degree / Diploma	25	9.5

Table 2. Economic characteristics

Characteristics	n	%
Households' monthly non-farm income		
US \$39.37-\$78.74	55	20.9
US \$78.82-\$118.11	85	32.3
US \$118.19-\$157.48	26	9.9
US \$157.56-\$196.85	41	15.6
> US \$196.85	51	19.4
No response	5	1.9
Households' monthly food expenditure		
≤ US \$39.45	19	7.2
US \$39.49-\$55.12	38	14.4
US \$55.20-\$70.87	61	23.2
US \$70.94-\$86.61	39	14.8
US \$86.69-\$94.49	17	6.5
US \$94.57-\$110.24	32	12.2
US \$110.31-\$125.98	11	4.2
US \$141.82-\$157.48	33	12.5
> US \$157.48	13	4.9

Table 3. Households' general feeding patterns

Characteristics	n	%
Frequency of provision of breakfast		
Every day	132	50.2
Four to six times per week	82	31.2
One to three times per week	26	9.9
Never	23	8.7
Affordability of providing three meals a day, and a snack in between		
Can afford	104	39.5
Cannot afford	159	60.5
Is it difficult to provide different meals a day?		
Yes	139	52.9
No	124	47.1

Table 4. Food variety scores within food groups

Food Group	Mean ± SD	Range
Cereals, roots, and tubers	5.05 ± 0.89	3-7
Fleshy foods	3.22 ± 1.08	1-5
Dairy products	1.97 ± 1.14	0-6
Legumes and nuts	1.00 ± 0.58	0-3
Eggs	0.38 ± 0.49	0-1
Vitamin A-rich vegetables and fruits	3.06 ± 1.20	0-5
Other fruits and juices	2.85 ± 1.93	0-8
Other vegetables	4.03 ± 2.48	0-11
Fats and oils	1.86 ± 0.86	0-4

Table 5. Top 20 most consumed foods

Rank	Food item	Mean food intake (g/person/day)
1	Maize meal soft porridge	99.23 ± 74.56
2	Instant tea	182.14 ± 131.38
3	White sugar	19.99 ± 7.05
4	Maize meal stiff pap	123.49 ± 72.79
5	Brown bread/rolls	27.58 ± 30.81
6	Amarhewu	176.78 ± 174.66
7	Crumbed maize meal (uphuthu)	107.67 ± 105.07
8	Fresh milk	21.85 ± 26.34
9	Potatoes	21.38 ± 14.34
10	Samp	156.63 ± 139.91
11	Rice	64.86 ± 36.03
12	Amasi	128.57 ± 118.77
13	Carrot	14.28 ± 10.94
14	Baked bread, homemade	49.16 ± 50.43
15	Cabbage	10.64 ± 12.47
16	Spinach	10.17 ± 14.89
17	Onion	8.78 ± 11.74
18	Sunflower oil	23.85 ± 32.99
19	Canned fish	13.66 ± 17.56
20	Chicken	33.81 <i>t</i> -test ± 39.95

## Discussion

In a normal society, men and women are raised to play specific roles in future at home and in society. Generally, men are meant or conditioned to be problem solvers who ought to be manly and show less emotions in their behavior. On the other hand, women have inherent emotional coping strategies necessary for taking care of children and the sick (Min *et al.*, 2011, Veasey *et al.*, 2015). In accordance with these gender norms, it is therefore not surprising that the majority of caregivers in this study were women who played roles of mothers and grandmothers. The age of caregivers did not seem to have an effect on their households' feeding practices, FVS, and DDS. This suggests that the government old age monthly grant of US \$118.11 which is paid to people of over 60 years did not have any significant effect on the households' nutritional status. However, the same could not be said for caregivers' level of education, since it had a significant influence on FVS ( $P \leq 0.05$ ) than on DDS ( $P \geq 0.05$ ). Further analysis of the results

showed that caregivers' level of education had significant effect ( $P \leq 0.05$ ) on their households' monthly non-farm income and expenditure on food. The monthly non-farm income was positively strongly correlated to food expenditure ( $r = 0.55$ ,  $P < 0.01$ ). In turn, food expenditure had a significant influence on FVS ( $r = 0.67$ ;  $P < 0.01$ ) and DDS ( $r = 0.32$ ;  $P < 0.01$ ).

The studied population's expenditure patterns on food are similar to those reported in a survey conducted at Alfred Nzo District (Mekary *et al.*, 2013). It was reported in the mentioned survey that most of the monthly expenditure was used to acquire non-durable goods like food, while very little was expended to buy either durable or semi-durable goods. For example, in 2013 from the total household income of US \$810 million, US \$720 million was used in household expenditure. This elevated household expenditure shows poverty in the district, since high expenditure on non-durable goods does not contribute to wealth creation.

The caregivers' actual nutritional practices appeared weak largely due to socio-economic factors. As a result, the quality of meals consumed by the caregivers' children was not reflective of their food producing status, but their families' low income. Their meals, especially breakfast were dominated by carbohydrate-rich food items, many of which were based on homegrown and purchased maize. These maize-based food items were soft porridge, stiff pap, crumbed maize meal, maize samp, and *amarhewu*. Basically, the caregivers' families ate mostly similar carbohydrate-rich food items.

The eating behavior and the number of meals that a child can have a day are largely determined by his/her parents (Silvia Scaglioni, 2011). In this study, late or lack of breakfast provision to children before they go to school was found as a bad feeding practice. Because it is associated with reduction of short memory (Matla, 2008), reduction of metabolism, increase of cholesterol and insulin levels (Lee and Tang, 2015), depletion of energy (Toni Calasanti, 2007), and increased risk of type 2 diabetes (Eastern Cape Socio-Economic Consultative Council, 2014).

With respect to the 'fleshy food' group, canned fish followed by chicken were consumed more frequently, while mutton, beef, and pork were consumed in very few caregivers' households. It appeared that this feeding pattern was primarily driven by food costs. In the area where this study was undertaken, the average retail price of a 400g-canned fish is US \$1.18, while frozen chicken costs US \$2.91/kg. Mutton, beef, and pork cost US \$5.64/kg, US \$5.40/kg, and US \$4.90/kg, respectively.

Cheaper alternative protein sources such as dried beans and peas were consumed in fewer households as they were not included in the list of top 20 most consumed food items. Soya and lentils were not consumed. This situation provides a good ground for nutrition awareness and education that can best be performed by agricultural extension practitioners.

Vitamins are organic substances that are required in small quantities for overall health, normal cell function, growth, and development (C Gupta and C Gupta, 2015). Vitamin A, in particular, is for

maintenance of healthy teeth, bones, and soft tissues (Zhou *et al.*, 2011), while vitamin C promotes the function of immune system, wounds' healing, and acts as an antioxidant (Naidu, 2003). The low consumption of vitamin C-rich citrus was remarkable in the current study (**Table 4**). A part of this sparingly low consumption may be due to limited availability and commensurately higher price of citrus caused by the citrus post-harvest period (September) in which data collection for this study was started. On the contrary, the widespread consumption of vitamin A-rich vegetables (carrot and pump/squash fruit) was commendable. By virtue of being a dark leafy vegetable, high consumption of spinach and liver might have resulted in a good intake of vitamin A.

Regarding the above outlined discussions, it appears that home-grown and/or purchased staple foods, a few vegetables, and other food items consisted of the daily meals for the caregivers' families. The poor quality of consumed meals is traceable from weak feeding practices, low FVS, and the debatably high DDS. These results are indicative of a low nutritional status of the caregivers' families. In order to ameliorate this sub-standard situation, smallholder farmers should grow a wide variety of crops that are not necessarily staple foods. In addition, a portion of proceeds from their farming activities should be used to purchase other affordable food items that they are unable to produce. This proposal is in line with Simon's assertion (Simon, 2012) that food can be accessed physically, financially, and socio-culturally. Against the popular and largely held political view, reliance on the first element did not yield desirable results in this study. There is a need to increase the households' ability to access foods by strengthening markets and market access (Australian Agency for International Development, 2012). Such an approach would best represent the ideals of South Africa's IFSS (2002) and FAO's (2002) definition of food security concept.

### Conclusion

The quantities and variety of food produced or purchased and subsequently consumed by families



of smallholder farmers is indicative of their families' low nutritional status. Some families' inability to provide their children with breakfast and sufficient number of meals per day, and low FVS and DDS diffuse the perception that families of food producers are automatically food secure and enjoy a higher nutritional status than non-farming families.

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### Authors' contributions

Both Zwane EF and Van Niekerk JA participated in conceptualization of the study. They further presided over the literature review, the study design, analysis, and composition. The latter author also organized financial and institutional support for the study.

### Conflicts of interest

The authors of this paper have no conflicts of interest.

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