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CONTRIBUTION OF DIETARY PATTERNS AND DIETARY DIVERSITY TO THE NUTRITIONAL STATUS OF CHILDREN UNDER FIVE YEARS IN NELSON MANDELA BAY METRO, SOUTH AFRICA

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ABSTRACT

Food insecurity and malnutrition is a major problem in the sub-Saharan African region. The study aimed to determine the contribution of dietary patterns and dietary diversity on child nutritional status of children aged 0 to 60 months. A cross-sectional design was applied using a quantitative approach. A convenience sample (n=184) of children aged 0 to 60 months were included from the Dora Nginza Hospital (situated in Port Elizabeth in South Africa) and data was collected between May and July 2018. Primary caregivers provided informed consent for themselves and their children for participation. The researcher and trained assistants collected data using structured questionnaires which aimed at gathering information on socio-economic factors, health status, dietary patterns, and diversity. Child anthropometric measurements were performed on children following the World Health Organisation (WHO) standardised methods. Slightly more males (52.7%, n = 97) than females were included. The mean age of the children included was 20.21 months (SD = 17.1). Most were of African ethnicity (58.7%, n = 108). A total of 25.6% (n = 47) of the children were stunted, 19.8% (n = 25) were underweight for their age, 6.7% (n = 7) were classified as either moderate acute malnourished (3.9%) or (n =7) or severely acute malnourished (2.8%, n = 5), and 7.2% (n = 13) were overweight or obese. There was low or inadequate consumption of meat, dairy products, fruit and vegetables and the most consumed foods were soft porridge, margarine, potatoes, white bread and chips. About 91% of the children met the minimum dietary diversity score (>4 dietary diversity). The child's dietary diversity score had a significantly positive relationship with weight for height, weight for age and mid-upper arm circumference, showing improved nutritional status when a more varied diet is eaten. Therefore, these findings confirm the importance of dietary diversity and dietary patterns to nutritional status of children under 60 months of age.

Key words: anthropometry, underweight, overweight, malnutrition, caregivers, nutritional status, consumption, stunting, cross-sectional

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INTRODUCTION

Malnutrition is a global phenomenon that is prevalent and is affecting both adults and children alike [1]. It is also prevalent in South Africa, where under and overnutrition co-exist within one city, community and even within one household [2, 3]. The generality of malnutrition, presenting as under- and overnutrition as well as micronutrient deficiencies are clearly seen in South Africa and specifically in the Eastern Cape [2-4]. The Eastern Cape is an area where the double burden of malnutrition has a widespread presence [4, 5]. Malnutrition is characterised by the coexistence of undernutrition together with overweight, obesity or nutrition-related non-communicable diseases (NCD) within individuals, households and populations across the life course [6]. Mkhize and Sibanda [7] conducted a review on selected studies concerning the factors that affect the nutritional status of children in South Africa. The results of the review showed that the nutritional status of children is affected by several factors which includes household food insecurity, low household income, illiterate caregivers, unemployment, inadequate dietary intake, low birth weight, consumption of monotonous diets, poor caregiver's nutritional knowledge, poor access to water and sanitation, poor weaning practices, age of the caregiver, and demographic characteristics of a child (age and gender). Other researchers have also reported on the above factors as contributing to the nutritional status of the children [8, 9]. Similarly, Motsa, Ibisomi and Odimegwu [10] reported that mother's country of residence, highest level of education attained and marital status; child's sex, birth weight and preceding birth interval were the significant predictors of infant mortality in Southern Africa.

In South Africa, malnutrition is characterised by both being underweight (which includes stunting and wasting) and overweight [11]. Malnutrition is regarded as hidden hunger because of its nature as it exists as lack of vitamins and minerals in the human body and is directly associated with dietary nutrition dietary consumption patterns. Food consumption and dietary diversity in low-income households were improved after the introduction of the child support grant; however, the nutritional status of children has shown minimal improvement [12, 13]. Although social grants have shown success in reducing food insecurity, the effect on severe malnutrition is insufficient.

Three studies were compared: UNICEF [3, 11], South African Demography and Health Survey (SADHS) [12] and older statistics from UNICEF. When comparing the three studies, the prevalence of stunting ranged from 15.% to 27%, for wasting ranged from 3% to 6% and overweight ranged from 7.7% to 13% [3,11,12]. These studies included data from different periods and even included different age groups, but consistently, throughout all three surveys, the rising trend in stunting and overweight was noted, while wasting was decreasing [3,12].

Lesiapeto *et al.* [14] conducted a study in rural districts of Eastern Cape and KwaZulu Natal to determine factors associated with children's anthropometric status. They reported several factors associated with stunting, underweight and overweight including child of male gender, the mother's perception that child was not growing well, household receiving no food handouts, mother not making important household decisions, low maternal education, any current breastfeeding (children under 24 months), gastrointestinal symptoms and the household not having a regular source of income. These are typical circumstances that prevail in low socioeconomic status households.

In the Eastern Cape, South African National Health Assessment Nutrition Examination Survet-1 the prevalence of stunting was 33.7% in children, while SAM (severe acute malnutrition) and MAM (moderate acute malnutrition) were relatively low at 0.4% and 1.5%, respectively [3]. Over nutrition, however, has increased with 20% of children being overweight. According to these statistics, it is clear that stunting and overweight are also increasing rapidly in the Eastern Cape [3]. The existence of malnutrition is a concern for the country due to its contribution to mortality in children under five years of age. Malnutrition diseases have decreased during the past decades after the government had implemented various food security interventions for combating malnourishment [13]. Therefore, the study aimed to determine the contribution of dietary patterns and dietary diversity on malnutrition in children aged 0 to 60 in the Eastern Cape.

METHODS

Study design

The study followed a cross-sectional design using a quantitative approach.

Study setting

The study setting is Dora Nginza Hospital (DNH), which is a 220-bed Provincial public hospital, located on Spondo Street in Zwide township of Gqeberha in Nelson Mandela Bay (NMB) in the Eastern Cape in South Africa. It is a tertiary hospital and forms part of the Port Elizabeth Hospital Complex. The DHN was used as a sampling frame. The population size of this area is 1,195,603 with 384,794 children under the age of five years [4]. Most of the surveyed participants were coming from NMB.

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Sample calculation and sampling procedure

The estimated sample size was 184 caregiver-child pairs using the Cochran equation [$n = Z^2 \times p\,(1-p)/e^2$], with stunting prevalence of 9% in NMB health district of the Eastern Cape [12], a 95% confidence level and 5% precision and a 10% non-response rate. A calculated sample (n = 184) of a caregiver and children 0 to 60 months were included. The study sample was obtained through convenient sampling, while ensuring that a representative group of children with different forms of malnutrition was included. Children who met the inclusion criteria of 0-60 months old and had an accompanying caregiver who gave consent for their child and themselves to participate were recruited. A child who had any health condition that may prevent him/ her from being able to be weighed or measured or who is comatose or too ill to participate was excluded from the study.

Data collection procedures

The study was granted ethical clearance by the Health Research Ethics Committee of Stellenbosch University (Ethics approval: S17/10/192). Recruitment was done by the researcher at the Paediatric Outpatient Department Clinic of DHN where the primary caregivers were given information about the study. Primary caregivers provided written informed consent for themselves and their children respectively for participation.

The researcher and a trained research assistant completed the data collection using a questionnaire. The variables measured for the study were socio-economic and health status, child dietary patterns, dietary diversity and anthropometry (weight, height, mid-upper arm circumference (MUAC)). Socio-economic and health variables were captured through questionnaire-interviews as demographic questions. Dietary patterns were captured through a food frequency questionnaire (FFQ). Dietary diversity was determined using a 24-hour recall and child diet diversity score (CDDS) sheet.

Anthropometric measurements were obtained as per standardised practice described in preceding studies [15, 16, 17]. The weight, length/ height for children and MUAC (for children older than six months) were obtained. The anthropometric information was obtained to provide descriptive data regarding the nutritional status of participants and also to be able to investigate a variety of possible contributing factors to the nutritional status of the child (determined by anthropometric measurements).

Briefly, an electronic pan-type beam scale (the Seca354) was used to weigh infants younger than two years of age. This is accurate to 0.01 kilogram. This has shown accuracy to 0.1 kilogram. For infants, the weights were taken to the nearest gram and for adults, to the nearest 100grams. The weight measurement was done twice, and the mean was obtained. If the weights differed more than 0.001 kilograms (infants) and 0.1 kilogram (older children and adults), the weights were retaken [15, 16, 17]. For infants younger than two years, a Perspex length board with a solid headboard and a movable footboard, with 1milimeter increments, was used to measure height to the nearest 0.1centimeter twice and the mean recorded. In adults and children older than two years of age, a Seca stadiometer (model 217) was used, and the measurements were taken to the nearest 0.1centimeter [10, 11]. MUAC was measured following standard procedures [15, 16].

Data analysis

The socio-demographic and dietary patterns quantitative data was entered into an Excel spreadsheet. The CDDS was also reworked to a score out of seven which was identified by the WHO as being the minimum dietary diversity for children [18]. A score of less than four out of seven was considered low dietary diversity, while a score of more than four out of seven was considered adequate dietary diversity [18].

The weight and height of the caregivers were converted to BMI for interpretation. The children's anthropometry was classified according to WAZ, HAZ and WHZ after analysis using the WHO AnthroPlus Version v1.0.4 to calculate z-scores. WAZ < -2 is described as underweight-for-age. Height-for-age describes linear growth and a HAZ < -2 is described as stunting. Weight-for-height describes the weight in relation to the height/length of the child and is considered acute malnutrition. WHZ < -2 is described as MAM and WHZ < -3 is described as SAM.

Statistical Package for Social Sciences (SPSS for Windows, Version 25, IBM SPSS Inc., Chicago IL. USA) was used to analyse quantitative data. The nutritional status of the children was categorised by using appropriate cut-offs for classification. Bivariate analysis was done to determine the correlations between the variables. Relationship between socio-demographic, dietary patterns, dietary diversity, food insecurity, and anthropometry were determine using Pearson correlation was used and variables were significant if the p-value was <0.05.

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RESULTS AND DISCUSSION

Children's demographics

When children were grouped into six-month age categories, the 0 to 6 months category had the highest number of children (28.4%, n =52), as displayed in Table 1. Slightly more males (52.7%, n= 97) than females were included. The mean age of the children included was 20.21 months (SD=±17.1). Most were of African ethnicity (58.7%, n=58.7).

Dietary patterns

Breastfeeding

The current study included children (0 to 60 months), 49.3%, (n= 79) of the children who were currently breastfeeding while 50.7% (n= 81) had breastfed previously. Many of the children (87%, n= 160) were breastfed at some point or were still breastfeeding at the time of the study. There was no distinction made as to whether the child was exclusively breastfed or receiving mixed feeding. The duration of breastfeeding was less than six months for more than half (54.3%, n= 44). It was shown that 60.3% (n= 111) of children received formula milk. From these 111 children, most (45.9%, n= 51) received formula milk, while younger than one month of age and were therefore mixed fed. Most of the caregivers (93.7%, n= 104) used the bottle-feeding method.

Exclusive breastfeeding (EBF) for the first six months of life and continued breastfeeding for two years and beyond is recommended by the WHO as it protects children against morbidity and mortality [18, 19]. Initiation of breastfeeding (less than one hour after delivery) is high in this study with 87% (n= 160) who reported having breastfed their babies initially (this includes mixed feeding). However, just over half of the caregivers breastfed for less than six months and only 6% (n= 5) breastfed for two years and beyond. This indicates a high frequency of initiation of breastfeeding, but poor continuation thereof. Formula milk was introduced as early as one month. A study performed in four South African provinces demonstrated breastfeeding initiation rate (50%) but a low six-month EBF rate (12%) [20]. Recent statistics from SADHS have shown the breastfeeding initiation rate to be moderate at 44%, while exclusive breastfeeding until six months was only 4.9% [12]. Breastfeeding is key for optimal child growth and provides important nutrition for the child.

Feeding practices

The study findings showed that children's appetite changed with growth in age. Of those who had appetite changes (34.8%, n= 64), the most frequent reason

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provided by the caregiver was the health status of the child (67.1%, n= 43). Most children (95.4%, n= 131) ate breakfast daily. Out of the 138 children who were introduced to complimentary food, 42.8% (n= 59) were introduced after six months of age, while 57.2% (n= 79) were introduced to complementary food before six months of age. The food given most frequently to children was infant cereal (55%, n= 76). More than half (54.3%, n= 100) of the participants gave their children tea or coffee to drink and 92% (n= 92) of those who gave tea or coffee added sugar to the beverage (Table 2). A study in Limpopo province reported the composition of meals for children under five years to be relatively good (>90%) and included a starchy food, vegetable, protein-rich food and fat source [8]. Their study showed that less than 20% of caregivers reported giving children vegetables daily (10.6% to 15.4%), while between 31.9% and 48.7% gave vegetables three to five times per week. Just over half of caregivers (46.8% to 59.0%) gave children fruit less than three times per week.

Food consumption patterns

Only children older than six months were included as this is the recommended age to introduce complimentary food; therefore, n=132. Table 3 presents the food consumption patterns in food groups.

Cereals, starches and dairy products

The most frequently consumed cereal was soft porridge which was eaten by 75% (n= 99) of the children, followed by potatoes and white bread which were each eaten by more than half of the children (54.5%, n= 72). Daily *samp* intake was low only 2.3% (n= 3) of children who consumed it. Dairy was not consumed with cereals, and only half of the children consumed a dairy product daily, with yoghurt being the predominant item (50.1%, n= 67), while sour milk [amasi] (9.8%, n= 13) and cheese (9.1%, n= 12) were least consumed. Only 38.6% (n= 51) of children drank milk daily. Other researchers have reported soft maize meal as the most common cereal fed to children [8, 9, 20 and 21]. Sayed and Schonfeldt [21] report that maize porridge is a common first food for infants, but there is also a high reliance on commercial infant cereal. Maize is a food item almost available in most households all the time [22].

The results of this study showed that infant cereal was most frequently given as the first solid food consumed as complimentary food. The FFQ results from the current study showed that over three-quarter of the children consumed soft porridge more than four times per week. A review including 14 studies also identified maize meal porridge, as well as commercial infant cereal, as the most popular type of complementary food [20]. A South African cohort study regarding

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complementary feeding in children aged 6 to 12 months found that the most frequently consumed food groups by children were grain, roots and tubers [20]. Grain, specifically porridge, is a suitable staple for children as it is affordable, available and nutrient-dense, especially when it is fortified [21]. However, when grains are consumed with a diet lacking in protein-rich foods, a deficiency in energy, iron and zinc could be present [21].

Animal and plant protein

Animal protein consumption was poor for most children. The most consumed animal product daily was chicken, which was eaten by 24.2% (n= 32) of the children, followed by eggs (22.7%, n=30). Processed meat (polony and viennas) was also consumed regularly by over a quarter of the children. Pork (2.3%, n= 3) and lamb (1.5%, n=2) were the least consumed meat products. Daily plant protein intake was poor with peanut butter being most consumed daily (55%, n= 41.7). Soya was eaten daily by only 9.1% (n= 12) of the children and 6.8% (n= 9) of the children ate beans or lentils as shown in Table 3.

The FFQ results of this study showed that the intake of animal products was suboptimal. The most frequently eaten animal proteins were chicken (24.2%, n= 32) and processed meat (23.5%, n= 31). Yet less than a quarter ate these four or more times a week. Just over half of the children ate chicken and almost a third ate processed meat up to three times a week. The Paediatric Food Based Dietary Guidelines (PFBDG) [23] recommends a daily intake of chicken, fish, egg or meat for optimal growth and development of children from 6 months of age. In this study, only a fifth of children 6 to 12 months of age had a daily meat or egg portion and only half of the children 12 to 36 months ate a daily portion of meat or an egg. Meat intake has shown improvement in the growth of children, micronutrient status and cognitive performance [19, 20]. A previous South African cohort study showed a low meat intake among children at six months which increased by twelve months [21]. Over 70% of children had a daily intake of some animal protein by one year of age. Chakona [9] reported that eggs, meat, and legumes and nuts were infrequently eaten and were mentioned by less than 5% of women, in their study in the Eastern Cape. Meat is an expensive commodity in South Africa with lamb and beef almost beyond many households reach. Pork and chicken are cheaper. However, many families do not eat pork for religious or cultural taboos [8, 9, 20, 21].

Fruit and vegetables

Daily fruit intake by children is relatively low compared with the PFBDG, with just over a third who consumed fruit daily. Banana and fruit juice were most consumed

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with 38.6% (n= 51) of children who consumed either of these daily (Figure 1). An apple was eaten daily by almost a third of the children (38%, n= 38). Guava (2.3%, n= 3) and pawpaw (1.5%, n= 2) were the least consumed fruit. See Figure 1.

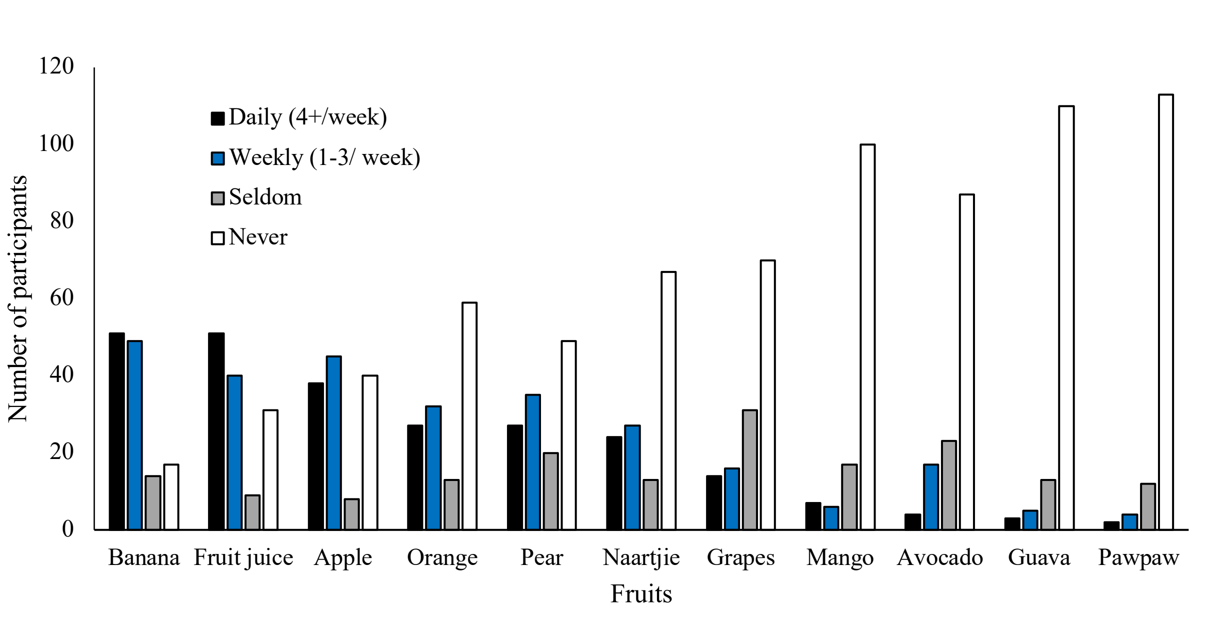

Figure 1: Fruit consumption patterns (n = 132). Source: Research data

Vegetable intake was even poorer than fruit intake with less than a quarter of children who consumed vegetables daily (24.2%, n= 32). The orange vegetables (pumpkin and carrot) were the most consumed. (Figure 2). Green leafy vegetable (spinach) consumption was also low with only 11.4% (n= 15) of children who ate spinach daily. Beetroot was least consumed and eaten by only 6% (n= 8) of children.

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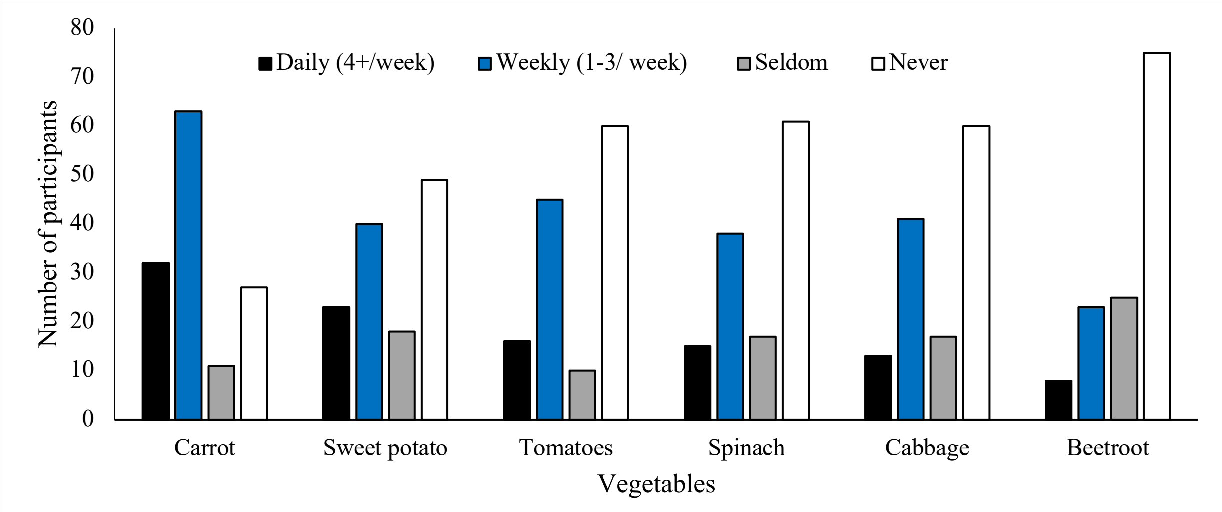

Figure 2: Vegetable consumption patterns (n=132). Source: Research data

At age 12 to 36 months, over a quarter of children consumed vegetables, and just over a tenth of children consumed fruit or vegetables that are rich in vitamin A. Seasonal variety of fruits and vegetables could also influence its affordability and availability during certain times. A recent cohort study showed that fruit and vegetable intake was also poor, especially of children younger than one year old [22]. Green leafy vegetables are especially valuable due to the higher composition of iron compared to other vegetables. Orange fruits and vegetables are higher in vitamin A than other fruits and vegetables. Chakona [9] observed that vegetables were only consumed by 17% of the children, while only 11% women reported the consumption of fruits by children. WHO asserts that daily consumption of fruit and vegetables is an important component of a healthy diet. According to Bourne [23], children under five years should receive vitamin A-rich fruits and vegetables (which are often also rich in other nutrients) daily to address needs in vitamin A and other nutrients. Affordability also influences access to especially fruits and vegetables. Vegetables are less expensive because household can also produce them in their backyards.

Miscellaneous foods

Margarine was eaten daily by almost two-thirds of the children (59.1%, n = 78) as a complement with other foods. Chips-potato potato were the most frequently consumed as a snack food which was eaten by 53% (n = 70) of the children. Biscuits (41.7%, n = 55) and sweets (37.1%, n = 49) were also eaten daily by over a third of the children. Jam was also a popular condiment that was used daily by

19.7% (n = 26) of the children and ice cream was eaten least frequently by 3.8% (n = 5) of children daily.

To summarise dietary patterns, the results of this study showed that starches were eaten most frequently, especially maizemeal and white roots (white tubers). Dark green leafy vegetables were eaten by only two-fifths of children, while over half ate other vegetables and fruit. Meat was eaten by just over half of the participants and less than three-quarters ate dairy products.

Dietary patterns were further interpreted using three South African paediatric food-based dietary guidelines for children between the ages of one toto seven months [23].

1) Animal protein (meat, chicken, fish or egg) should be eaten every day or as often as possible. Only about a fifth of the children aged 6 to 12 months (21.7%, n= 5) consumed animal protein daily, while about half of the children aged 12 to 36 months (52.1%, n= 37) consumed a source of animal protein daily, and about 63% (n= 24) of the children over 3 years old consumed one animal protein daily. This guideline was thus not adhered to by most caregivers probable due to affordability.
2) Children should consume dark green leafy vegetables and orange fruit and vegetables daily A low intake of orange fruit and vegetables was observed with only 8.7% (n= 2) of the children aged 6 to 12 months who had a daily consumption of orange fruit. In addition, 12.7% (n= 9) of children aged 12 to 36 months and 44.7% (n= 17) of the children between 33 to 5 years consumed orange fruit. Vegetable consumption was better with almost half (47.8%, n= 11) who ate orange or green leafy vegetables daily with 25.4% (n= 18) and 28.9% (n= 11) who ate orange or green leafy vegetables daily, respectively. The guideline was not complied with. However, with nutrition education it can be improved since vegetables like cabbage, spinach and tomatoes are less affordable. Some caregivers are ignorant and do not know the importance of fruits and vegetables.
3) Children older than one year should receive milk, maas or yoghurt every day. Yoghurt was mostly consumed by 47.9% (n= 34) of the children aged between 12 to 36 months and 50% (n= 19) of the children older than three years consumed yoghurt daily. Seventy-nine children were still breastfeeding at the time of the study; therefore, it would be expected that lower dairy intake would be noted in breastfeeding children. The consumption of dairy products did not adhere to the guideline.

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Child dietary diversity

A total of 136 children were included. Others (24 children) were not yet being introduced to complementary foods at the time of data collection while one caregiver did not respond to this question. The information gathered from the CDDS provides more knowledge regarding unique food groups consumed by the children (see Figure 3). The relationship between the CDDS and the nutritional status of the children was also investigated. A relatively high intake of starches, which included cereals (69.9%, n= 95) and white tubers (67.2%, n= 91) were consumed by children, as well as a high intake of sweets (61.7%, n= 84). Food rich in vitamin A was well consumed (67.2%, n= 91). Only 45.4% (n= 62) ate fruit rich in vitamin A and 58.5% (n= 80) ate other fruits. About two-thirds of the children (65.6%, n= 89) consumed milk or dairy products daily or weekly. Protein intake was low in general with an intake of between 53% (n= 72) to 63.4% (n= 86) for the different types of meat.

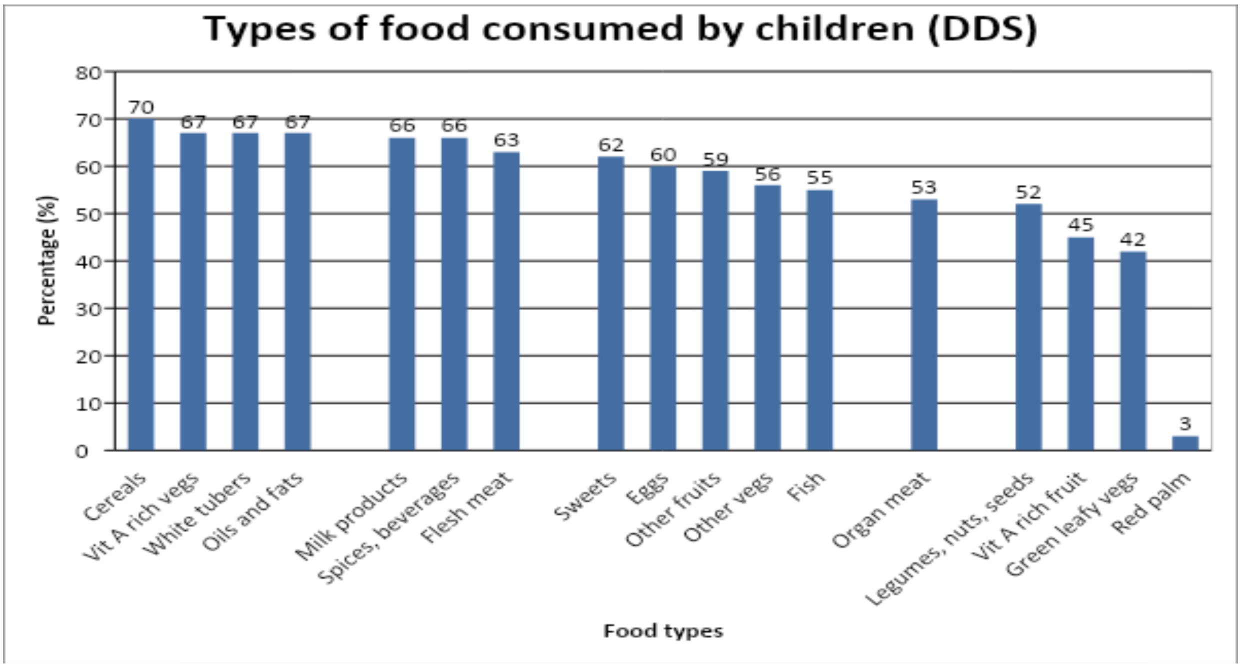

Figure 3: Food types consumed derived from the dietary diversity questionnaire (n=136)

Source: Research data

On the number of food groups eaten by the children, an overwhelming majority used six to seven food groups as illustrated in Table 4. Results for CDDS showed that most children (91.9%, n = 125) had an adequate CDDS. A score of four or more out of seven displayed adequate dietary diversity while a score below four displayed a low dietary diversity.

The CDDS data supports FFQ findings. The implication of this variety is that the diet will be energy-dense and low in high-quality protein and essential micronutrients. The results of this study also showed that just over half of the children had an adequate CDDS, while one in five children had an adequate score. A similar South African study aimed to investigate the dietary diversity of households and found that two-fifths of children had a poor CDDS [24]. The results of this study showed that starches were eaten most frequently, especially cereals and white roots (white tubers). Dark green leafy vegetables were eaten by only two-fifths of children, while over half ate other vegetables and fruit. Meat was eaten by just over half of the participants and less than three-quarters ate dairy products.

Anthropometry
Table 5 indicates the anthropometric classification of the surveyed children. The results indicated that that 2.8% (n= 5) of the children were classified as SAM, 3.9% (n= 7) were MAM and 13.3% (n= 24) of the children were at risk of wasting. A few children (7.2%, n= 13) were overweight or obese. According to the WAZ, 13.6%, (n= 25) of the children were underweight for their age. A quarter of the surveyed children (25.6%, n= 47) were stunted. A total of 12.5% (n= 23) were severely stunted. The majority (86%, n= 89) of the children above six months old had a normal MUAC while a total of 14% (n= 17) were either classified as MAM or at risk of wasting.

Anthropometric classification
The results of the current study showed a prevalence of underweight for age at 13.6%, which is higher than the national average of 5.2% [3] and the Eastern Cape 7% [12]. One of the possible reasons for the difference could be the different patient populations used and sample sizes. Furthermore, the sample for this study was drawn from a hospital. Stunting was prevalent in one in four children in this study which is slightly higher but similar to the national average of one in five children in 2013 [3], and lower than the 2016 results of one in three children [13]. Wasting was prevalent with 5.7% of children classified either as MAM (3.9%, %, n= 7) or SAM (2.8%, n=5)). The current results are higher than the 2013 and 2016 results at 2.6 % and 3%, respectively for SAM [3,12]. (Table 5). A cross-sectional analytic study conducted in Limpopo province, South Africa, to determine factors associated with mortality in children under five years old hospitalized for SAM concluded that herbal medication use, poor appetite, lower respiratory tract

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infection, anemia, hypoglycemia, and HIV infection were associated with mortality among children with SAM [26].

Relationship between socio-demographic, dietary patterns, dietary diversity, food insecurity, and anthropometry
Only variables that have shown a significance with a p-value of <0.05 have been reported. The selected variables include anthropometry of children, socio-economic factors and dietary patterns. All the investigated correlations were only slightly positive, meaning that a causal relationship could not be determined, but that value X and value Y would agree in terms of being low, moderate or high. There may be a causal relationship between the variables which needs to be confirmed with further research.

Height for age showed a positive correlation with MUAC (p= 0.0001). This would indicate that taller children would likely have a larger MUAC and vice versa [27]. Weight-for-age also showed a positive correlation with MUAC (p= 0.0001) as well as gestational age (p = 0.038). An increase in WAZ is usually associated with a larger MUAC, and a lower WAZ is associated with a smaller MUAC.

The MUAC showed a positive and significant correlation with the child's appetite (p= 0.000). The presence of a social grant would increase the household income. A higher household income showed an improved nutritional status in children and a lower household income showed a lower nutritional status in children.

A positive and significant correlation was seen between CDDS and WHZ (r= 0.28, p= 0.001), CDDS and WAZ (r= 0.21, p= 0.014), and CDDS and MUAC of the child (r= 0.18, p= 0.035). An increase in the diversity of the child's diet showed an increased WAZ, HAZ and WHZ, which could indicate that eating a more varied diet could improve nutritional markers. A lack of dietary diversity would likely be associated with a lower WAZ, HAZ and WHZ. There is a positive and significant correlation between CDDS and the child's age (p= 0.0014), showing that older children had higher dietary diversity scores [28, 29, 30].

Most of the investigated correlations were only slightly positive. This means that association could not be determined, but that the two values would agree in terms of being low, moderate or high. There may be a causal relationship between the variables which needs to be confirmed with further research. Poor dietary practices include poor continuation of breastfeeding, a high intake of grains and high-sugared snack foods with a poor intake of protein-rich foods, dairy, fruits and vegetables. While an increase in dietary diversity showed an increase in weight

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Volume 23 No. 9 September 2023
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and height of the child, an increase in the age of the child also showed an increase in the CDDS. The implication of this variety is that the diet will be energy-dense, low in high-quality protein and essential micronutrients. The results of this study also showed that just over half of the children had an excellent CDDS while one in five children had an adequate score. A similar Southern African study aimed to investigate the dietary diversity of households and found that two-fifths of children had a poor CDDS [31]. Furthermore, results of the Thornton study [24] revealed that dietary intake was characterised by a high intake of tubers and bread and a poor intake of vegetables, fruits, dairy and meat. This was consistent with the dietary intake patterns observed in the current study, especially low consumption of milk, fruits and vegetables.

The study limitations

The limitations include that a homogenous sample was used, where a more heterogeneous sample would allow for comparison between groups (for example, rural and urban). The sample was recruited from the hospital, thus they would not represent an otherwise healthy population of children under five years. Food portions were higher than recommended amounts for children, but it is unclear whether the same children may be eating a portion of milk, yoghurt and amasi daily or whether most children are truly receiving a portion of dairy daily. Another limitation is that caregivers could have reported being more health consciousness since data collection took place at a health facility. Due to the wide range of contributing factors that could be included for investigation in the study, time limitations restricted the complete utilisation of all possible data collected. Further research should be conducted with a sample recruited from households.

CONCLUSION, AND RECOMMENDATIONS FOR DEVELOPMENT

The prevalence of stunting, underweight and wasting among children was high. The results of this study showed that starches were eaten most frequently, especially cereals and white roots (white tubers), dark green leafy vegetables were eaten by only two-fifths of children, while over half ate other vegetables and fruit, meat was eaten by just over half of the participants and less than three-quarters ate dairy products. The contributing factors to malnutrition were found to be multifactorial with basic, immediate and underlying contributing factors. Non-adherence to the three PFBGD was observed. The study findings confirm the contribution of dietary diversity and dietary patterns to the nutritional status of children under 60 months of age. The child’s dietary diversity score had a significantly positive relationship with weight for height, weight for age and mid-upper arm circumference, showing an acceptable nutritional status when a more

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varied diet is eaten. Other factors identified include low socioeconomic status, low household income, early sensation of breastfeeding, low consumption of dairy, fruits and vegetables.

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Volume 23 No. 9
September 2023
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Table 1: Demographic characteristics of children surveyed (n = 184)

Characteristics of children	Frequency (n)	Percentage (%)
Gender		
Male	97	52.7
Female	87	46.3
Ethnicity		
African	108	58.7
Coloured	68	37
Caucasian	6	3.3
Indian	1	0.5
Other	1	0.5
Age distribution (months)		
0–6	52	28.4
6–12	23	12.6
12–24	35	19
24–36	36	19.7
36–48	24	13
48–60	14	7.3

Source: Research data

ajfand SCHOLARLY, PEER REVIEWED
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Volume 23 No. 9
September 2023
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Table 2: Feeding practices of children surveyed (n = 184)

Dietary intake of child	Frequency (n)	Percentage (%)
Appetite of child (as reported)		
Good appetite	136	73.9
Poor appetite	48	26.1
Appetite changes reported		
Same appetite (no change)	120	6..2
Increased appetite	18	9.8
Decreased appetite	46	25
Frequency of breakfast consumption (n = 138)		
Daily	131	95.4
1–5 times/week	7	4.6
Age of introduction of solid food (n = 138)		
0–3 months	14	10.1
3–5 months	34	24.6
5–6 months	31	22.5
> 6 months	59	42.8
Type of solid food first introduced to child 6-59 months (n = 138)		
Maize meal porridge	17	12.3
Infant cereal	76	55
Ready-to-eat bottled baby food	6	4.3
Vegetables	38	27.5
Other: rice and liver	1	0.9
Tea or coffee given to child		
Tea or coffee given	100	54.3
No tea or coffee given	84	45.7
Sugar added to tea or coffee (n = 100)		
Sugar added	92	92
No sugar added	8	8

*A total of 46 participants were not yet introduced to complementary food:: therefore n = 138. Source: Research data

ajfand SCHOLARLY, PEER REVIEWED
AFRICAN JOURNAL OF FOOD, AGRICULTURE, NUTRITION AND DEVELOPMENT
Volume 23 No. 9
September 2023
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ISSN 1684 5374

Table 3: Frequency of intake of starches, grain and protein sources 6-59 months (n = 132)

Food items	Daily (≥ 4/week) n (%)	Weekly (1–3/week) n (%)	Seldom n (%)	Never n (%)
Grains				
Soft porridge	99 (75)	16 (12.1)	3 (2.3)	13 (9.8)
White bread	72 (54.5)	40 (30.3)	5 (3.8)	14 (10.6)
Breakfast cereal	60 (45.5)	38 (28.8)	7 (5.3)	26 (19.7)
Rice	57 (43.2)	48 (36.4)	9 (6.8)	17 (12.9)
Brown bread	51 (38.6)	30 (22.7)	17 (12.9)	33 (25)
Pasta	33 (25)	69 (52.3)	9 (6.8)	20 (15.2)
Stiff porridge	14 (10.6)	42 (31.8)	23 (17.4)	53 (40.1)
Samp	3 (2.3)	36 (27.3)	27 (20.5)	65 (49.2)
Potatoes	72 (54.5)	40 (30.3)	5 (3.8)	14 (10.6)
Dairy products				
Yoghurt	67 (50.1)	40 (30.3)	9 (6.8)	15 (11.4)
Fresh milk	51 (38.6)	21 (15.9)	8 (6.1)	44 (33.3)
Fresh milk powder	21 (15.9)	6 (4.5)	5 (3.8)	99 (75)
Amasi	13 (9.8)	50 (37.9)	14 (10.6)	54 (40.9)
Cheese	12 (9.1)	32 (24.2)	22 (16.7)	65 (49.2)
Animal foods				
Chicken	32 (24.2)	71 (53.8)	5 (3.8)	23 (17.4)
Eggs	30 (22.7)	57 (43.2)	17 (12.9)	26 (19.7)
Processed sliced meat (polony)	31 (23.5)	42 (31.8)	14 (10.6)	43 (32.6)
Processed sausages (viennas)	16 (12.1)	38 (28.8)	25 (18.9)	52 (39.4)
Chicken livers	9 (6.8)	66 (50)	14 (10.6)	42 (31.8)
Beef	4 (3)	25 (18.9)	37 (28)	65 (49.2)
Fish	4 (3)	48 (36.4)	30 (22.7)	49 (37.1)
Chicken feet and heads	4 (3)	16 (12.1)	13 (9.8)	98 (74.2)
Chicken offal	3 (2.3)	10 (7.6)	16 (12.1)	101 (76.5)
Pork	3 (2.3)	34 (2.8)	22 (16.7)	72 (54.5)
Lamb	2 (1.5)	20 (15.2)	31 (23.5)	77 (58.3)
Plant protein				

ajfand SCHOLARLY, PEER REVIEWED
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Volume 23 No. 9
September 2023
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Peanut butter	55 (41.7)	35 (26.5)	12 (9.1)	29 (21.7)
Soya	12 (9.1)	21 (15.9)	26 (19.7)	72 (54.5)
Beans	9 (6.8)	44 (33.3)	22 (16.7)	56 (42.2)
Lentils	9 (6.8)	33 (25)	16 (12.1)	73 (55.3)
Peanuts	3 (2.3)	11 (8.3)	8 (6)	109 (82.6)

*Only 132 children had already started with complementary feeding at the time of data collection. Source: Research Data

Table 4: Child dietary diversity Score (n= 136)

CDDS total score	Frequency (n)	Percentage (%)
0	1	0.8
2	1	0.8
3	3	2.2
4	6	4.4
5	9	6.6
6	35	25.7
7	81	59.5

Source: Research data

ajfand SCHOLARLY, PEER REVIEWED
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Volume 23 No. 9
September 2023
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ISSN 1684 5374

Table 5: Anthropometric classification of children surveyed (n=184)

Anthropometry as per z- scores	Frequency (n)	Percentage (%)
Weight-for-age (WAZ)		
Severely underweight for age <-3	13	7.1
Moderate underweight for age -3 to <-2	12	6.5
Normal ≥ -2	159	86.4
Height-for-age (HAZ)		
Severely stunted <-3	23	12.5
Moderately stunted -3 to <-2	24	13.1
Normal ≥ -2	137	74.4
Weight-for-height (WHZ) *3 values missing values due to child too small to determine WHZ (n=181)		
SAM <-3	5	2.8
MAM -3 to <-2	7	3.9
At risk of wasting -2 to <-1	24	13.3
Normal -1 to < 1	104	57.4
At risk of overweight 1 to < 2	28	15.4
Overweight 2 to <3	10	5.5
Obese >3	3	1.7
MUAC (n= 106)		
MAM (11- 12.5cm)	4	3.8
At risk of malnutrition (12.5–13.5cm)	11	10.4
Normal (>13.5cm)	91	85.8

Source: Research Data

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