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Research Article

Meal provisioning and food handling practices at Early Childhood Development (ECD) centres. A cross-sectional study in Johannesburg, South Africa

Christel K. Kimoto[1]*; Moleen Zunza[2]; Ros Sambell[3]; Yolande Smit[1]

[1]Division of Human Nutrition, Faculty of Medicine and Health Sciences, University of Stellenbosch, South Africa; [2]Division of Epidemiology, Department of Global Health, Faculty of Medicine and Health Sciences, University of Stellenbosch, Cape Town, South Africa; [3]Nutrition and Health Innovation Research Institute, School of Medical and Health Science, Edith Cowan University, Perth, Australia

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***Corresponding Author**
Kimoto C.K.
chriskimt@gmail.com
ORCID: 0000-0002-2316-4732

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Highlights/Key Messages

- Meals lacked dietary diversity.
- Suboptimal handwashing and temperature control.
- Challenges occurred across centres.
- Support required through funding.

Background
Early Childhood Development (ECD) centres have been recognised as an important setting to improve children's dietary intake and eating habits. ECD centres can provide a large proportion of their daily dietary requirements during attendance.

Objective
The present study aimed to evaluate the meal provisioning and describe the food handling practices of food handlers at registered ECD centres in Johannesburg, South Africa.

Methods
A descriptive cross-sectional study with an analytical component was conducted among 48 participants from 22 registered ECD centres, each visited for one day. ECD managers completed a self-administered questionnaire on demographics and perceived barriers to providing healthy food, while food handlers completed an interviewer-administered version. An observational checklist was used to assess the food provisioning environment. Dietary diversity scores (DDS) of meals served were calculated using the FAO 13-food group DDS questionnaire.

Results
All ECD centres could provide a menu, but 31% did not adhere to the menu. At least two meals/snacks were served, which had a mean DDS of 3.6 (SD 1.00). Meals consisted mainly of starch (100%) and dairy products (73%). Only 41% of ECD centres had trained their staff on correct handwashing procedures. There was no significant difference between the practices in formal and informal ECD centres ($p>0.05$). The barriers to optimal nutrition included lack of external funders (68%), lack of government support (59%), tedious registration process (55%), and loadshedding (planned power outages) (52%).

Conclusion
Optimising child nutrition is key to reducing malnutrition, as stunting and undernutrition have major individual and societal impacts. Ongoing training and monitoring are needed to support ECD practitioners in applying nutrition guidelines, ensuring safe food handling, and providing nutritious meals that promote healthy growth and development.

Keywords: meal provision, food handling practices, dietary diversity score, food safety, childcare, early childhood education and Care

Introduction

Malnutrition remains a leading cause of mortality among children under five (Wambua et al. 2025). ECD centres are key settings for improving nutritional status, given their broad reach among young children and their holistic approach that integrates health, nutrition, learning, and psychosocial support (Hurley et al. 2016). Quality ECD services support children's rights, development, and health, and contribute to broader societal development (Republic of South Africa 2015).

About 40% of South African children under five attend ECD centres, where they depend on practitioners for meal provision (Department of Basic Education 2022). Food quality is influenced by practitioners' knowledge, perceptions, and food-handling practices (Freedman & Alvarez, 2010). The 2021 ECD census reported that 99% of centres provide meals, with 84% offering breakfast and 94% lunch (Department of Basic Education 2022). Well-planned menus could supply up to two-thirds of a child's recommended daily intake, particularly where children spend up to eight hours at centres (Benjamin-Neelon 2018). Therefore, nutritious meals prepared under safe food-handling standards are essential and depend on adequately trained practitioners (Pietersen et al. 2002).

Beyond food safety training, nutrition support is a priority in the South African National Integrated ECD Policy (Republic of South Africa, 2015). National guidelines emphasise that ECD programmes must provide a healthy food environment with safe preparation, handling, and storage of nutritious meals (Department of Health 2018). Resources such as the South African Paediatric Food-Based Dietary Guidelines (Vorster et al. 2013) and the Western Cape Operational Manual (Western Cape Government 2015) guide practitioners in providing diverse, nutritious meals that support healthy growth and eating habits. However, studies report poor adherence to these guidelines (Grady et al. 2018; Nzama & Napier 2017; Gerritsen et al. 2017; Seward et al. 2017; Sambell et al. 2020). Gerritsen et al. (2017) found that awareness alone may improve menu quality, but not compliance without adequate training and monitoring.

Including a variety of foods—animal and plant proteins, fruits, vegetables, starchy foods, and dairy—supports dietary diversity and adequate micronutrient intake (Steyn et al. 2014; Steyn and Temple, 2008). Dietary diversity is a key indicator of diet quality and nutritional improvement over time (Faber et al. 2009), while low diversity is linked to nutrient deficiencies, food insecurity, and malnutrition (Vorster et al. 2013). The South African Food based Dietary Guidelines therefore promotes consuming a variety of foods in appropriate amounts (Vorster et al. 2013; Western Cape Government 2015). Diverse diets at ECD centres also offer important exposure to a variety of foods during early childhood (Love et al. 2020).

Studies from high- and low-income countries highlight inadequate food provision at ECD centres, including low consumption of fruit, vegetables, and dairy, contributing to poor nutrient intake among children (Motadi et al. 2023; Grady et al. 2018). In KwaZulu-Natal, none of 45 ECD centres met more than 60% of the daily recommended intake (DRI) for key nutrients (Nzama & Napier 2017). In Harare, menus showed low dietary diversity and relied mainly on starchy foods, with poor adherence to guidelines (Lewis et al. 2022). In addition, even well-designed menus must be prepared hygienically to ensure food safety and prevent foodborne disease (Aguayo & Menon 2016). This includes proper hygiene, separating raw and cooked foods, thorough cooking, appropriate storage temperatures, and the use of clean water and safe food-contact surfaces (Puckett & Byers 2004).

Johannesburg, South Africa's largest city, has the highest number of ECD centres nationally (Department of Basic Education 2022). In Gauteng, 38.1% of children under five attended formal ECD centres in 2021 (Statistics South Africa 2022). Most centres are registered with the Department of Education and operate for 9–11 hours daily, typically providing breakfast and lunch, and sometimes snacks (Economic Policy Research Institute 2014).

There is limited data on the quality and adequacy of meal provision in South African ECD centres. Existing literature largely focuses on the importance of early nutrition and the impact of deficiencies on child development (Biersteker et al. 2016), while recent studies assess children's dietary intake at home rather than within ECD settings (Motadi et al. 2023; Modjadji et al. 2020). While some have studied these issues in other areas (Nephalama et al. 2024; Smit et al. 2026), the present study complements these studies by evaluating meal provision and food-handling practices in ECD centres in the City of Johannesburg. It aims to describe these practices, determine the dietary diversity score (DDS) of meals provided, and identify barriers to healthy meal provisioning from practitioners' perspectives.

Methods

The Johannesburg metropolitan area comprises seven municipal subdistricts, two of which were conveniently selected for their proximity to the researcher. These included both formal and informal areas. Formal areas are characterised by established urban infrastructure, while informal areas (townships and informal settlements) often have limited access to basic services, overcrowding, and variable infrastructure development (Statistics South Africa. 2004).

The study population was registered ECD centres and ECD practitioners employed at these centres. Sample size estimation was based on the proportion of participants having poor dietary diversity, assumed to be 60% (Faber et al. 2008). To estimate this proportion with a desired level of precision of 12% at a 95% confidence interval, at least 74 participants were needed. Sample size estimation was done using WinPepi computer programme (Abramson 2011).

Selection of ECD centres: Lists of registered ECD centres were obtained in the two selected subdistricts which were then stratified into formal and informal areas. For ECD centres to be included in the study, they had to be registered, operational for more than eight hours per day or serve two meals/day, accommodate more than six children, and prepare food onsite.

Selection of ECD centre managers and food handlers: All eligible practitioners from the 22 enrolled centres were invited to participate, and those who provided written informed consent were included. Eligibility criteria were: ⩾18 years of age and at least three months' employment at the

ECD centre. Managers were defined as individuals responsible for overseeing operations, supervising staff, and maintaining facility standards, while food handlers comprised all other staff involved in cooking, preparing, handling, and serving food.

Data Collection Tool and Process

ECD centres were contacted to determine their eligibility and willingness to participate in the study and to arrange a date for a single visit per ECD centre. Data collection took place between July and October 2023. The purpose of the study was clearly explained to the staff before written informed consent was obtained. Data collection began either before breakfast or shortly after breakfast and ended after lunch.

Three data collection tools were used. A self-administered questionnaire for managers and an interviewer-administered questionnaire for food handlers were developed; the latter excluded funding- and budget-related questions. The questionnaires were informed by key policy documents and literature, including the National Integrated Early Childhood Development Policy (2015), the Western Cape Government Operational Manual (WCOM) for the Provision of Food in Care Facilities for Young Children (2015), the National Audit of ECD Centres (Economic Policy Research Institute 2014), and related literature.

Food-handling practices were assessed using an adapted version of the WCOM monitoring tool (Western Cape Government 2015), comprising two sections: foodservice and safe environment. The foodservice section (46 items) covered ordering, receiving, storage, stock control, cleaning, sanitising, and food production, while the safe environment section (18 items) assessed cleaning, sanitation, and food handlers' personal hygiene. ECD staff were informed that the purpose of the observations was to better understand their daily food-handling practices. The presence of the observer could have influenced the behaviour of the ECD staff during the one-day visit. To reduce this risk, the observer spent up to six hours per day at each centre.

The dietary diversity of the food served on the day of the visit at centre level was assessed using a 13-food group scoring system. For example, the starch group included bread, porridge/cereals, pastas, biscuits, cookies or any other foods made from maize, rice, or wheat and the dairy group included milk, cheese, yogurt, or other milk products. The food served was evaluated for the presence of predefined food groups, and a score was calculated based on the number of food groups represented in meals served. The total of foods served was categorised as having low (0–4 food groups) or moderate to high (5–13 food groups) dietary diversity (FAO 2010). At least 15g of a specific food group was required to obtain a score of 1. This was also applied in combination dishes. For menu assessment, fewer than five food groups were classified as having low dietary diversity, consistent with thresholds applied in school feeding research. This reflected the availability of food groups on the menu, not actual consumption.

Validity

A pilot study was conducted at one formal and one informal ECD centre to assess face validity, test data collection tools, and estimate completion time (20–30 minutes). Pilot data were excluded from the main study. Content validity was evaluated by three experts in food service management, ECD management, and/or child nutrition, and all feedback was incorporated.

Statistical Analysis

Quantitative data were analysed using Stata 18 (College Station, Texas 77845 USA). Categorical variables were summarised as count (per cent). Measured variables were summarised as mean (standard deviation) or median (interquartile range), depending on the distribution. The association between dietary diversity, sociodemographic variables, and geographical location was tested using the Chi-squared test or Fisher's exact test in the bivariate analysis. Statistical significance was defined as a p-value < 0.05.

The observational checklist used yes/no questions for each criterion. Observations were scored 1 if the criterion was met; otherwise, 0. To prevent false low scores, the number of "NA" entries was subtracted from the maximum score (denominator) for a specific section before an average percentage was calculated.

To calculate the DDS, each food group served was assigned a score of 1 for "yes" and 0 for "no". An average DDS score was calculated, according to the FAO protocols (Dela Luna 2019). A DDS ≤ 4 indicated a low dietary diversity, and a DDS >4 indicated a higher dietary diversity of the menu served on the day of observation (Steyn et al. 2014). The resulting data should be interpreted for meal assessment, not for individual consumption.

Ethics

Approval for the study was obtained (S18/10/247) from the Health Research Ethics Committee of Stellenbosch University and the Gauteng DBE. Permission to use the FHI360 monitoring tool was obtained. Community representatives provided consent following presentation of the project at forum meetings, and ECD centre managers granted permission for on-site research. Only participants who provided written informed consent were included. Confidentiality and anonymity were ensured through participant coding. Participating centres received a fresh fruit parcel as a token of appreciation.

Results

ECD Centre Description

Data collection concluded with 22 ECD centres and 48 ECD centre practitioners. Eight ECD centres were in formal areas and 14 in informal areas. The average number of children attending these centres was 96.6 (SD 57.2). Most children (92.1%) were aged 13-59 months and 95% of centres operated for more than 8 hours per day. Fees payable by parents/caregivers were the main source of income for all ECD centres, and only 14 of the ECD centres, all in informal areas, received a government ECD subsidy.

Participant Demographics

Twenty-three managers and 25 food handlers participated in the study; 39 of them had been working in the ECD sector for more than 4 years. Training in various food service-related topics had been received by most of them (Table 1).

Table 1. Demographic characteristics of the study participants

Characteristics	All participants *n*= 48 *n* (%)	Participants per location *n*=48 *n* (%)		Managers *n*=23# *n* (%)		Food handlers *n*=25 *n* (%)	
		Informal *n*=30	Formal *n*=18	Informal *n*=15	Formal *n*=8	Informal *n*=15	Formal *n*=10
Age							
<30	3 (6.2)	0	3 (21.4)	0	1 (12.5)	0	2 (20)
31–59	38 (79)	24 (80)	14 (78)	10 (67)	6 (75)	14 (93)	8 (80)
>60	7 (15)	6 (20)	1 (7.1)	5 (33)	1 (13)	1 (6.7)	0
Gender							
Female	44 (92)	26 (87)	18 (100)	13 (87)	8 (100)	13 (87)	10 (100)
Male	4 (8.3)	4 (13)	0	2 (13)	0	2 (13)	0
Highest qualification							
<Grade 12/Std 10	12 (25)	9 (30)	3 (17)	0	0	9 (60)	3 (30)
Grade 12/Std 10	11 (23)	3 (10)	8 (44)	2 (13)	1 (13)	1 (6.7)	7 (70)
Certificate	11 (23)	10 (33)	1 (5.6)	5 (33)	1 (13)	5 (33)	0
Diploma (4 years)	9 (19)	5 (17)	4 (22)	5 (33)	4 (50)	0	0
Basic degree	5 (10)	3 (10)	2 (11)	3 (20)	2 (25)	0	0
Experience in the ECD sector							
> 1 year & <2 years	3 (6.3)	1 (3.3)	2 (11)	0	0	1 (6.7)	2 (20)
Between 2 & 4 years	6 (13)	5 (17)	1 (5.6)	0	0	5 (33)	1 (10)
>4 years	39 (81)	24 (80)	15 (83)	15 (100)	8 (100)	9 (60)	7 (70)
Training							
Food handling	39 (81)	23 (77)	16 (89)	11 (73)	7 (88)	12 (80)	9 (90)
Personal hygiene	39 (81)	23 (77)	16 (89)	12 (80)	7 (88)	11 (73)	9 (90)
Food preparation	38 (79)	23 (77)	15 (83)	11 (73)	7 (88)	12 (80)	8 (80)
Food safety	39 (81)	23 (77)	16 (89)	12 (80)	7 (88)	11 (73)	9 (90)
Nutrition	34 (71)	19 (63)	15 (83)	10 (67)	7 (88)	9 (60)	8 (80)

One ECD centre had two managers

Meal provisioning at the ECD centres

All ECD centres displayed the menus. Table 2 depicts menu- and meal-related information. Food handlers reported that 92% of meals were served in the classroom and that 96% of them did not eat with the children but had separate mealtimes. There were adequate plates (n=22; 88%), bowls (n=23; 92%), cutlery (n=21; 84%) and cups (n=23; 92%) for each child.

The median self-reported meal cost was R22 ($1.30) per child per day (IQR: 17–30). Nearly half of managers (46%) reported insufficient food budgets, and 27% received food donations, including fruit, vegetables, grains, and canned foods (Table 2); 57% occasionally used personal funds to cover costs, while others reduced purchases or sought alternative funding.

In response to an open-ended question, the participants said when the food prepared seems too little, they employ strategies like decreasing the portion size, giving bread, noodles or porridge instead, or supplementing with sandwiches for those who eat a lot.

DDS of the meals served at the ECD centres

The mean DDS for the whole group was 3.6 (SD 1.00). The DDS categories for both types of ECD centres are presented in Table 3.

Table 2. Selected criteria of the menu and meal-related information from the managers (N=22)*

Meal/Menu related information	Yes "responses" %	*N*
	Menu Governance	
Parents are not involved in the menu planning	50	11
The menu is always followed when preparing the meals	68	15
The recipes are available every time the meals are cooked	68	15
	Procurement and Supply	
Presence of a vegetable garden	50	11
The vegetables are harvested from the local garden	82	9/11
The food is delivered by a foodstuff supplier	27	6
Food donation received	27	6
	Meal Provision	
Breakfast meal offered at the ECD centre	82	18
Mid- morning snack offered at the ECD centre	54	12
Lunch meal offered at the ECD centre	100	22
Afternoon snack offered at the ECD centre	73	16
No snacks offered at the ECD centre	23	5
Classrooms and pre-plated meals	86	19
Bulk service in dining room	14	3
	Financial Resources	
Do you have a food budget	91	20
Food expenses not fully covered by food budget	46	10
Government ECD subsidy	64	14

*One ECD centre had two managers; however, only one manager responded on behalf of that centre N=22

Table 3. DDS of the meals served at the ECD centres

Variables	ECD centres (n=22)	Geographical location		*p*-values
		Formal ECD centres (n= 8)	Informal ECD centres(n=14)	
	n (%)	*n* (%)	*n* (%)	
Low DDS [a]	18 (82)	7(88)	11(79)	
High DDS [b]	4 (18)	1(12)	3 (21)	1.0[d]
Mean DDS (SD)	3.6 (SD 1.0)	3.5 (SD 0.93)	3.7 (SD 1.1)	0.64[e]

a Low DDS means DDS≤4. b High DDS means DDS>4. d Fisher exact t-test was used. e Two- sample t test was used

A summary of the food groups served on the day of the visit at the selected ECD centres (N=22) is shown in Table 4. No statistically significant difference was found (p=0.2) in mean DDS between ECD centres providing three or more meals per day (n=19) and those offering two meals (n=3). No statistically significant difference in mean DDS between ECD centres with a vegetable garden and those without (Mean=0.21, 95% CI [-0.73,1.2], p=0.68) were found.

Table 4. Summary of the food groups served per day at the selected ECD centres grouped according to number of meals served and dietary diversity score for each centre (N=22)

		Food groups offered at each ECD centre*												
Formal (F) or Informal (I) ECDs	DDS out of 13	Starch	Vitamin C rich Vegetable	Vitamin C rich Fruit	Vitamin A rich green Vegetable	Vitamin A rich yellow Vegetable	Vitamin A yellow Fruit	Other Fruits &Vegetables	Organ meat	Flesh meat	Egg	Small fish	Legumes	Dairy
Centres offering ALL meals: Breakfast, Lunch, Morning Snack, Afternoon Snack														
I	6													
I	5													
I	4													
I	4													
F	4													
F	3													
I	3													
I	3													
I	3													
I	3													
I	3													
I	3													
F	3													
I	2													
F	2													
Centres offering THREE meals: Breakfast, Lunch, Morning snack														
I	4													
Centres offering THREE meals: Breakfast, Lunch, Afternoon Snack														
I	4													
I	4													
Centres offering THREE meals: Morning Snack, Lunch, Afternoon Snack														
F	3													
Centres offering TWO meals: Lunch, Afternoon Snack														
F	5													
F	4													
F	4													

- Foods includes per food group

All Starch Staples: Bread, Porridge/Cereals, Pastas, Biscuits, Cookies Or Any Other Foods Made From Maize, Rice, Wheat
Vitamin C Rich Vegetables Pepper, Broccoli, Brussel Sprouts, Cabbage, Spinach, Marog
Vitamin C Rich Fruits: Guava, Orange, Strawberries, Mango, Tomato, Pineapple, Kiwi, Citrus Fruits, Melon
Vitamin A-Rich Dark Green Leafy Vegetables: Dark Green/Leafy Vegetables, Spinach, Broccoli, Brussel Sprouts
Vitamin A Rich Deep Yellow/Orange Vegetables: Carrot, Butternut, Sweet Potato, Pumpkin
Vitamin A Rich Fruits: Ripe Mangoes, Melon, Dried Apricots, Dried Peaches
Other Fruits and Vegetables: Other Fruits Include Wild Fruits, Canned Fruit, Dried Fruits; Other Vegetables Include Onion, Eggplant, Cabbage, Cauliflower, Beetroot, Peas, Green Beans
Organ Meat (Iron Rich): Liver, Kidney, Heart or Other Organ Meats, Offal/Tripe
Flesh Meats: Beef, Pork, Lamb, Goat, Rabbit, Wild Game, Chicken, Duck, Or Other Birds
Eggs
Small Fish: Fresh Or Dried Fish or Shellfish Tinned Pilchard/Sardines/Tuna
Legumes And Nuts: Dried Beans, Split Peas, Lentils, Nuts, Or Foods Made from These
All Dairy: Milk And Milk Products. Milk, Cheese, Yogurt or Other Milk Products

Meals served at ECD centres mainly comprised starches (100%) and dairy products (73%). No significant difference in mean DDS was found between centres in formal and informal areas (Mean =0.21, 95% CI [-0.7,1.2], p = 0.6). Informal-area centres served fruit and vegetables more frequently, and only these centres included legumes and nuts.

Barriers to the Provision of Healthy Food

Participants could rate a set of statements pertaining to barriers to optimal nutrition care on a 4-point Likert scale. They selected barriers related to a lack of support from the three government departments (DSD: 13, 59%; DBE: 14, 64%; and DOH: 14, 64%) and from external funders (15, 68%). Government support refers broadly to any resources provided to centres, such as menus, information on donations, or organisational guidance. Barriers also identified were a difficult registration process (12; 55%) and loadshedding (25; 52%). Loadshedding is a planned power outage, where certain areas receive electricity while others are temporarily cut off (Masinga and Madzivhandila 2023). Participants did not regard limited nutrition knowledge as a barrier (44; 92%)

Food-handling Practices of Food Handlers

The overall mean score for food handling practices was 70% (SD 9.4). There were no statistically significant differences between sections in formal and informal areas (p>0.05). Table 5 presents a summary of the mean scores for selected criteria pertaining to food provisioning, cleaning, sanitising and personal hygiene. Although ECD staff achieved a mean personal hygiene score of 80%, only nine (41%) centres had trained staff on correct handwashing procedures (Table 5).

Table 5. Food provisioning and food handling practices in need of improvement (scores <75%)

Observation of storage areas	Number of observations	*YES* *n* (%)
Dry storage (Overall mean 85% SD 16)		
Secondary packages are removed.	22	16 (73)
Refrigerator (Overall mean 70% SD 19)		
Cooked food / leftover food is covered.	8*	5 (63)
Cooked food / leftover food is stored on top shelves.	9*	5 (56)
Storage area is clean.	17*	12 (71)
Do you record the temperature of the fridge daily (show evidence)?	17*	3 (18)
Freezer (Overall mean 57% SD 22)		
Packages are clearly marked if removed from original packaging.	14*	5 (36)
Sufficient space available between food.	14*	7 (50)
Do you record the temperature of the freezer daily (show evidence)?	16*	2 (13)
Observation of cleaning and sanitising practices	**Number of observations**	***YES* *n* (%)**
Cleaning practices throughout the flow of food (Overall mean 62% SD 19)		
Practitioner washes hands before handling received goods.	6*	0 (0.0)
Practitioner washes hands between handling different food items.	6*	0 (0.0)
Practitioner washes and sanitises equipment and utensils between different food items.	22	14 (64)
Personal hygiene observations	**Number of observations**	***YES* *n* (%)**
Personal hygiene observations (Overall mean 80% SD 13)		
Trained on correct hand washing procedures?	22	9 (41)
If no access to uniforms, practitioner always wears a clean and washable apron.	22	17 (78)
Practitioner does not wear jewellery except for a plain wedding band.	22	16 (73)

* The variations in the number of observations indicate those criteria that were not observed in business as usual

Discussion

An assessment of meal provisioning and food-handling practices underscored the critical need for enhanced training, support, and ongoing supervision. Failing that, the vision of the ECD policy to alleviate hunger cannot be achieved (Republic of South Africa, 2015). This diverse group of ECD centres provides a picture of a contingent of caregivers who strive to improve the quality of life for young children. Despite numerous challenges, they achieved an average score of 70% in food handling practices. However, some crucial areas need to be prioritised, such as regular handwashing and time-temperature control of food.

Food Provisioning and Dietary Diversity

Only 70% of the ECD centres reported following the menus displayed, which could partially explain the low mean DDS score for the meals served during the one-day visit. A nutritionally balanced menu guides all food provisioning activities, and non-adherence to such menus has been shown to negatively affect the DDS (Lewis et al. 2022; Gerritsen et al. 2017). In the current study, the lack of government support was identified as a barrier to serving healthy meals. Therefore, the distribution of nutrition guidelines, combined with in-depth training and regular monitoring, would help enhance the quality of services provided.

Although the South African Food based Dietary Guidelines emphasize diet variety and daily fruit and vegetable consumption (Vorster et al. 2013), starchy foods and dairy were mostly served in this study, with only a few servings of fruit and vegetables, and fewer than half of the ECD centres offered any at all on the day of our visit. This finding is consistent with other studies in ECD centres in Cape Town, Limpopo and Northwest Provinces (Motadi et al. 2023; Pietersen et al. 2002; Modjadji et al. 2020).

Low fruit and vegetable consumption contributes to micronutrient deficiencies, especially vitamin A, iron, folic acid, and zinc (Labadarios 1999; Vassilakou, 2021). The limited inclusion of vegetables rich in vitamin A and C observed in this study, therefore, raises concerns regarding the nutritional adequacy of meals served in these settings (Kruger et al. 2022).

Almost three-quarters of the ECD centres in the current study offered dairy products on the day of the visit, consistent with previous studies and national survey findings indicating relatively high dairy consumption in SA (Motadi et al 2023.; Erinosho et al. 2011; Labadarios 1999). However, provision varies regionally, with lower intake reported in ECD centres in KwaZulu-Natal (Nzama & Napier,

2017) and Northwest province (Modjadji et al. 2020) and there are likely seasonal differences in availability in most areas. Data collection was conducted during winter and spring, which may have influenced the types and quantities of foods observed, since fruits and vegetables are somewhat less available during those seasons.

A diverse food selection at ECD centres can help children develop healthy food preferences, improve food acceptance and positively shape their taste and enjoyment through repeated exposure (Gerritsen et al. 2017). While most ECD centres rely on local supermarkets, few maintained vegetable gardens, which can cost-effectively improve food availability and dietary diversity if sustainably managed (Davis and Brann, 2017). As ECD centres were visited on only one day, associations between government subsidy status and DDS should be interpreted with caution. Although the findings may suggest that subsidies contribute to improved DDS, they also indicate that factors beyond subsidies such as donations, local food sourcing, and community support, may also play a role.

Currently, there are no available comparative data on the nutritional status of under-five children between formal and informal areas. However, Motadi et al. (2023) found that low DDS was linked to poor outcomes, particularly stunting, among children attending ECD centres. Their findings suggested that poor household socio-economic status significantly influences food choices, which in turn affects children's nutritional status. While this highlights the importance of dietary diversity, the relative impact of ECD centre meal programmes across formal and informal areas remains unclear due to the absence of disaggregated data. It was, however, noted in our study that the government subsidy allocated to ECD centres was insufficient to cover the reported food cost of R22 per child, thereby limiting the effectiveness of the meal programme.

Financial constraints were identified as a barrier to providing nutritionally adequate meals, consistent with findings from other ECD contexts (Lindsay et al. 2015). Half of the ECD centre managers reported insufficient income to cover food expenses, leading to reduced purchases, substitution with lower-cost foods, or the omission of more expensive food items. At the time of data collection, the government subsidy was R17($1) per child, of which 40% was allocated to food. In this study, the subsidy covered only 30.9% of food costs, which was insufficient to meet the minimum menu cost of R12.09 at wholesale prices (Droomer et al. 2023) and was far below the median food cost of R22.00 (IQR = 17–30). Since the data collection period, some progress has been made when the 2025 National Budget increased the subsidy to R24 ($1.42) per child per day (Ilifa Labantwana 2025). However, this still falls short of covering both the minimum menu cost of R12.09 and the median food cost of R22.00, highlighting the ongoing need for reforms to ensure nutritional adequacy and sustainability in ECD centres. Nutrition guidelines offered basic procurement tips but limited cost-management strategies (Droomer et al., 2023). By contrast, New Zealand centres achieved a quality menu on less than NZ$2.35 (R25.76) per child through seasonal purchasing, bulk discounts, donations and on-site produce (Gerritsen et al. 2017).

Food Handling Practices

ECD centres are responsible for providing a safe food environment and adhering to proper food-handling practices, as children are particularly vulnerable to foodborne disease due to their developing immune systems (Martins et al. 2014). The findings showed major gaps in food storage practices, with none of the criteria fully met, particularly the lack of daily monitoring of refrigerator and freezer temperatures. This is a critical concern given the frequent power outages at the time of data collection in SA, as undetected temperature fluctuations can compromise food safety. Food held between 5–60°C for more than four hours can support microbial growth and increase the risk of foodborne illness (Puckett & Byers, 2004). Similar poor storage practices have been reported in Portugal (Martins et al. 2014) and Jordan (Osaili et al. 2018), indicating ongoing challenges with cold-chain management in such institutional settings.

Improper handwashing is a major contributor to foodborne disease outbreaks in childcare settings (Lee et al. 2017; De Souza et al. 2018). Food handlers are required to follow hand hygiene practices throughout food preparation, as outlined in national guidelines (Western Cape Government 2015; De Souza et al. 2018). Since proper handwashing with soap can reduce diarrhoea morbidity and mortality by 30–48% (Richard et al. 2013; Ejemot-Nwadiaro et al. 2021), poor compliance is a significant public health concern. Recent child deaths and hospitalisations linked to unsafe food practices in Gauteng further highlight the urgency of strengthening food safety in ECD settings (Mnukwa, 2024), consistent with national and international findings of poor compliance (Melariri et al. 2019; Da Vitória et al. 2021; Mwapasa et al. 2023; Steenkamp et al. 2020).

While food safety training improves knowledge and attitudes (Soon et al. 2012), it is insufficient on its own to ensure sustained practice. Ongoing refresher training and continuous reinforcement are recommended (De Souza et al. 2018; Soon et al. 2012; Da Vitória et al. 2021), alongside clearer designation of governmental responsibility for training and monitoring in South African ECD centres.

Strengths and Limitations

Strengths of the study include the use of multiple data sources and direct observation of food-handling practices, rather than relying solely on self-reported data. To our knowledge, this is the first study to compare the dietary diversity of meals served across urban areas.

Limitations include lower-than-expected enrolment, which reduces the precision of estimates, and limited generalisability beyond the study regions. Menus were not analysed, and some self-reported data may be affected by recall, social desirability, and reporting bias, potentially leading to misclassification or over- or underestimation of practices. In addition, food observed on a single day may not reflect usual provision, and one-day observations of food-

handling practices may not represent routine behaviour. Most of the ECD centres were the size of a household kitchen; therefore, several criteria in the observational checklist were not applicable.

While dietary diversity scores provide a useful indicator of the variety of food groups offered, they do not assess portion size, nutrient adequacy, or compliance with specific feeding guidelines. Therefore, DDS should be interpreted as a proxy measure of meal diversity rather than a direct indicator of policy compliance or nutritional adequacy.

Recommendations

Given the study's preliminary nature, future research should aim to employ an analytical framework to link external factors to internal adaptation strategies. Future research should use larger, well-resourced samples to compare ECD practices, dietary diversity scores, and centres across and within provinces. Studies should include multiple days of observation to reduce bias, along with plate waste analysis to better assess children's actual nutrient intake. Nutritional analysis of menus is also recommended to more accurately determine the nutrient content of meals.

Conclusions

This study provides a snapshot of meal provisioning and food handling practices at ECD centres in Johannesburg, South Africa. Gaps identified in this study indicate a need to improve the nutritional quality and micronutrient density of meals served to children. Although national nutrition guidelines provide recommendations for safe and appropriate food provision, adherence appears limited. Continuous training and monitoring of ECD practitioners are therefore essential. A multisectoral approach, involving dietitians and relevant governing bodies, is needed to strengthen meal provisioning and food-handling practices at ECD centres.

Author Contributions

CKK: Conceptualization, Methodology, Investigation, Data curation, Writing-original and draft preparation. YS: Conceptualization, Methodology, Supervision, Writing-reviewing and editing. RS: Writing-reviewing and editing. MZ: Statistical analysis and reviewing of data analysis section. All authors have read and approved the final version of the paper and its submission and have given consent for publication.

Declaration of Generative AI and AI-Assisted Technologies in Scientific Writing

AI was used to support the summarisation and shortening of an original article. The AI tool was used solely for language refinement and content condensation, and all intellectual input, interpretation, critical review, and final approval of the manuscript were performed by the author(s).

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Data Availability Statement

All relevant data are available within the manuscript

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Conflict of Interest

The authors declare no conflict of interest.

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