World Nutrition, March 2026; 17(1):19-30
DOI: https://doi.org/10.26596/wn.202617119-30

WORLD NUTRITION
The Official Journal of the World Public Health Nutrition Association
Journal homepage: https://www.worldnutritionjournal.org
WPHNA
ISSN: 2041-9775

Research Article

Food-handling practices, nutrition and food safety knowledge, and attitudes of staff at early childhood development centres in the City of Cape Town, South Africa

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OPEN ACCESS

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Article History
Received: September 26, 2025
Reviewed: November 06, 2025
Revised: January 14, 2026
Accepted: March 02, 2026
Published: March 31, 2026

Citation
Smit Y., Pérez-Escamilla R., Nel D.G., du Plessis L.M. (March 2026). Food-handling practices, nutrition and food safety knowledge, and attitudes of staff at early childhood development centres in the City of Cape Town, South Africa. *World Nutrition*, 17(1):19–30. https://doi.org/10.26596/wn.202617119-30

Academic Editor
Ted Greiner, PhD

Highlights/Key Messages

- Differences in menu planning may lead to variability in nutritional adequacy. of foods served.
- Food handling practices of ECD centre staff can be improved.
- Nutrition knowledge was adequate, but gaps may impact food safety adversely.

Background
Early childhood development (ECD) centres offer an ideal setting to reach vulnerable children below five years and provide an environment for developing healthy eating behaviours

Objective
To describe the food provisioning environment, nutrition and food safety knowledge, and attitudes of staff at ECD centres in Cape Town.

Methods
Forty-six randomly selected ECD centres participated in the cross-sectional study. An observational audit was conducted of the food provisioning environment and food-handling practices. Staff (N=162) completed a self-administered questionnaire assessing nutrition and food safety knowledge and attitudes.

Results
Managers were responsible for compiling the menus in 89.1% of centres. The format of the menus varied considerably. Twenty-three per cent (n=11) of the centres had a separate eating area. Six (13.1%) lacked cooling facilities, and three (6.5%) had a freezer. Cooked leftover food was stored correctly in 14.3% (n =7) of the ECD centres where this observation was made. The personal hygiene score was 86.5%. Hands were not washed regularly (n=16; 34.7%). One third (32.6%, 51/156) of the staff had received nutrition-related training. The staff's nutrition knowledge score was 69.9% (SD 10.15). The lowest knowledge scores related to food safety such as how to defrost meat (30.8%). There was a statistically significant difference in the level of education and the knowledge score ($p < 0.01$). ECD centre staff (86.2%, n=138) displayed a positive attitude towards their role in promoting healthy eating habits.

Conclusion
There is a substantial opportunity to improve the food-provisioning environment at ECD centres in the City of Cape Town. Despite the availability of nutrition guidelines for ECD centres, implementation remained poor. Regular training and monitoring should be a priority to ensure implementation and adherence to food provision guidelines. Insights from this study provide stakeholders with guidance on how to improve the food-provisioning environment at ECD centres in a multi-sectoral manner.

Keywords: Nutrition guidelines; early childhood development; food provisioning environment; food-handling practices

Introduction

Good nutrition is the cornerstone of the primary healthcare approach and is considered a key developmental priority in many countries. For this reason, global nutrition authorities, including WHO, recommend promoting healthy eating patterns in childhood as a key strategy for chronic disease prevention (WHO 2003). Investing in comprehensive, multi-sectoral quality services for infants and young children that foster healthy eating habits yields a high return on investment. This means that when a good foundation is laid in the early years of life to enable children to perform better at school, they are more likely to be healthy and successfully employed adults contributing to society (Black et al. 2017).

Changes in social structure, specifically mothers' workforce participation, have increased the demand for childcare settings such as ECD centres. The large number of children attending these centres and the importance of their nutritional status support the relevance of the meals provided at ECD centres. Seward et al. (2017a) found in their systematic review that the food environment in ECD centres may influence young children's dietary intake and contribute to the development of their eating habits. Equally important is the safe preparation of meals in these settings.

The WHO lists lower levels of literacy and education, as well as insufficient food safety legislation or suboptimal implementation of such legislation, as some of the causes of foodborne disease (WHO 2018). Proper management practices, such as optimal personal hygiene, appropriate food sanitation, and accurate temperature controls, are integral to preventing foodborne disease outbreaks (Puckett 2013). Although most studies on food preparation practices were conducted in restaurants and school settings, which differ from ECD centres, the same principles are applicable. For example, issues such as time and temperature abuse, the lack of thermometers, and improper thawing practices have been identified by Giampaoli et al. (2014). Unless we address the issues in current food provisioning practices, progress in this domain will be delayed. Children will subsequently be at risk of receiving food of suboptimal nutritional quality and safety, thereby negatively impacting their nutritional and health status.

Providing safe meals that align with nutritional recommendations for young children is a cost-effective strategy to mitigate the burden of disease during this critical stage of development (Grady et al. 2018). Yet even with adequate knowledge, childcare providers' attitudes significantly influence the dietary choices and eating behaviours of young children in ECD centres. A qualitative study conducted by Sisson et al. found that ECD staff tended to prioritise their nurturing and educational role over viewing themselves as influencers of children's health behaviours (Sisson et al. 2017). Limited understanding of their responsibilities regarding nutrition, coupled with insufficient nutrition knowledge, may be a barrier to effective promotion of healthy eating amongst children attending ECD centres (Moore et al. 2005; da Vitória et al. 2021; Sisson et al. 2017; Derscheid et al. 2010).

Despite the availability of nutrition guidelines for ECD centres, implementation remains limited, and research indicates suboptimal adherence (Finch et al. 2019). Quantitative and qualitative studies have concluded that a lack of knowledge about nutrition and personal hygiene among food handlers is a barrier. This increases the likelihood of unsafe food provisioning practices, which may adversely affect vulnerable children in ECD centres by increasing their risk for foodborne diseases (Seward et al. 2017b; De Souza et al. 2018; da Vitória et al. 2021).

A recent census conducted among ECD centres in South Africa (SA) revealed that of the 6.5 million children aged 0–5 years (mainly 3-5), approximately 1.6 million are enrolled at ECD centres (Department of Education 2022). Almost all registered South African ECD centres provide at least one meal per day (Department of Basic Education 2021). It is estimated that children can receive a third to one-half of their recommended daily allowance (RDA) while in ECD centre care (Benjamin-Neelon et al. 2018; Crawley et al. 2006). To ensure that nutritionally adequate meals of good quality and safe for consumption are provided at ECD centres, nutrition guidelines for ECD centres have been developed by many countries. These guidelines vary from country to country but generally provide information on adequate and appropriate meal choices, menu planning, food preparation, hygiene, and safety aspects. In SA, the National Integrated Early Childhood Development Policy and the Nutrition Guidelines for ECD centres serve as guiding documents for food provisioning at ECD centres (National Department of Health 2015; Department of Health 2016). In addition, an operational manual for the provision of food in care facilities for young children was developed for the Western Cape province, henceforth referred to as WC Operational Manual. This manual includes an auditing tool for monitoring purposes (Western Cape Government 2015). These documents provide information on best practices at all steps in the flow of a foodservice facility. Though not legally binding, these documents include recommendations on ordering, safe storage of food products, safe food preparation, and general and personal hygiene. In South Africa, factors affecting food provision at ECD centres include, staff who may lack sufficient training or knowledge about nutrition, insufficient monitoring, sanitation issues, challenges with personal hygiene and food-handling practices well as infrastructure that may not fully support effective service delivery (Pietersen et al. 2002; Nzama & Napier 2017).

While evidence on food-handling practices at ECD centres is increasing, data from low- and middle-income countries (LMICs) remain limited. In addition, most existing studies focus on menu compliance rather than food-handling practices in the ECD centre context. A comprehensive understanding of the food-provisioning environment at ECD centres offers valuable insights into the development of nutrition education programmes to advance the food-provisioning practices of ECD centre staff. Additionally, this information can inform policymakers and stakeholders in formulating effective strategies for nutrition-related services within ECD centres. Therefore, the aim of the study was to investigate the food provisioning environment at ECD centres in SA. The specific objectives were to obtain baseline data to describe the food-provision environment at ECD centres by examining food-handling practices, nutrition knowledge, and attitudes regarding their role in promoting healthy eating among ECD centre staff.

Methods

Study Design

A descriptive, cross-sectional study was conducted at registered ECD centres in three sub-districts of the City of Cape Town, Western Cape province, South Africa. These sub-districts have diverse demographic profiles, although they are all situated in an urban district.

Participants and Recruitment

At the time of data collection, the Department of Social Development was the custodian of the ECD sector and provided the researchers with a list of registered ECD centres situated in the sampling area. A sample size of 46 ECD centres yielded a two-sided 95% confidence interval with a margin of error of 2.98 when the estimated SD is 10. A 95% confidence interval approach was used to calculate a minimum sample size for a quantitative knowledge score. The estimated SD was based on a similar South African study (Pietersen et al. 2002) to inform the SD estimate.

ECD centres in the three sub-districts were stratified using multistage cluster sampling. Probability-proportional sampling was used to determine the number of ECD centres per sub-district (East n = 15, North n = 15, and South n = 16). The ECD centres were randomly selected, contacted telephonically, and screened for eligibility. They were eligible if they were registered with the Department of Social Development, had been in operation for more than six months, operated for more than six hours per day, and prepared and served at least one meal and a snack per day. Another ECD centre was randomly selected if an eligible ECD centre declined participation, could not be accessed because the area was deemed unsafe, other research was taking place at the same centre, or unforeseen circumstances prohibited participation during the data-collection phase.

ECD centre managers and staff were included through census sampling. To be included in the study, staff were required to have worked at the ECD centres for a minimum of three months and were fluent in Afrikaans, English or isiXhosa to be able to complete a self-administered questionnaire. Each ECD centre had one manager, resulting in 46 managers identified as potential study participants. The exact number of other staff members was unknown prior to the study, but it was estimated that each ECD centre employed at least 2 staff members.

Ethical clearance was obtained from the Health Research Ethics Committee of Stellenbosch University (ID 14417, S20/02/032). After receiving permission from the Department of Social Development on 12/1/2/4, additional permission was obtained from the individual ECD centres prior to starting data collection. Furthermore, permission from the provincial government of the Western Cape Department of Health was obtained to use sections of their audit tool (Western Cape Government 2015). Participation was voluntary, and prior to data collection, all participants provided written informed consent to partake in the study. Anonymity was ensured by coding the research instruments, and data were holistically presented.

Data Collection Instruments

Two instruments were used for data collection: an observational audit to assess food provisioning practices and a self-administered questionnaire to assess staff nutrition and food safety knowledge and attitudes.

Observational audit: The audit tool in the WC Operational Manual served as the basis for all observations. The audit tool was adapted to align with the objectives of the study, after which content and face validity were determined. It included the following sections: demographic and general information pertaining to the ECD centre; observations regarding the menus, receiving and storage of food items, food-handling practices, personal hygiene, and the eating environment. These baseline data were used to describe the food provisioning environment at ECD centres. A research fieldworker completed the audit form, selecting "yes", "no", or "not applicable" for each question.

Nutrition and food safety knowledge, and attitude questionnaire: Owing to the lack of a validated nutrition knowledge questionnaire for ECD staff, the questions for the knowledge section were compiled based on the relevant literature (Pietersen et al. 2002), (Yardımcı et al. 2015), (Whati 2005) as well as the revised draft South African Paediatric Food-based Dietary Guidelines (Bourne et al. 2007). The knowledge and attitude questionnaire for the staff comprised three sections: demographic information, nutrition and food safety knowledge, and attitudes towards meal provision.

The nutrition and food safety knowledge section included 34 questions: 22 "true" or "false" and 12 multiple-choice. To explore the attitudes of ECD staff and their role in promoting healthy eating, eight nutrition-related phrases were presented. A five-point Likert scale was used to elicit responses ranging from "strongly disagree" to "strongly agree" or "I do not know". (Moore et al. 2005; Derscheid et al. 2010) This self-administered questionnaire was available in three of the official languages and took about 15 minutes to complete.

Data Collection

Two trained fieldworkers, both qualified dietitians, assisted with data collection from October through December 2020. A suitable date for a one-day visit was arranged with eligible ECD centres. The observational audit of the food provisioning environment was conducted during the morning and children's lunch hour. The questionnaires were completed after the children's lunch was served, when staff had ample time to complete the questionnaire undisturbed.

Quality Control Measures

Content validity of the research instruments was evaluated by three experts in food service management, early childhood development, and questionnaire development. The experts' feedback on the relevance, level of understanding, and appropriateness of the content informed some minor changes to the research instruments.

A pilot study was conducted at two purposively selected ECD centres, which were excluded from the main study. Face validity of the questionnaire was assessed with respect to the legibility of the text, length of the questionnaire, clarity of the instructions, comprehension of the questions, and the time it took to complete the nutrition knowledge questionnaire. The fieldworkers received training before and after the pilot study to ensure consistency and accuracy in auditing, administering of questionnaires, and data capturing.

Data Analysis and Reporting

Microsoft® Excel® (Microsoft 365, Version 16.0.16529.20100; Microsoft Corp, Redmond, WA, USA) was used to capture the data. Each section of the audit tool included specific criteria required to be approved as adequate. Observations meeting the criteria received a score of one. If not, a score of zero was captured. Criteria that could not be observed during the one-day visit, e.g., ordering or receiving of food items, were captured as "not applicable" on that day. The number of "not applicable" entries was subtracted from the maximum score for a specific section before an average percentage was calculated to prevent false low scores. A total score for each ECD centre was calculated and expressed as a percentage. Scores were interpreted as follows: 75% fully compliant, 60 – 74% mostly compliant, and below 60% poor compliance. (Department of Health 2010)

Correct answers to knowledge questions were scored as 100%, and incorrect or "do not know" answers scored zero percent. Knowledge scores were expressed as percentages for each question and for the study population. An average knowledge score was calculated for each question and for overall knowledge. Nutrition knowledge scores were reported as percentages and summarized descriptively. The knowledge score was interpreted as acceptable if the mean score was ⩾70% (Soares et al. 2012).

Data from the five-point Likert scale were reported as frequency tables and percentages. Quantitative data were analysed using STATISTICA® version 14 (TIBCO Software Inc., 2020, http://tibco.com). Summary statistics described the characteristics of the study population. One-way ANOVA tests were conducted on the continuous response variable, average knowledge score, across groups of nominal variables, including the ECD region, the role of staff at the ECD centre, and level of education, among others. A 95% CI indicated significant differences.

Results

The questions pertaining to the specific ECD centres were completed by the ECD centre managers (n=46), henceforth referred to as managers. All but one manager was female, and 84.8% (n=39) were 41 years and older. Most managers had obtained a certificate/diploma/degree (58.6 %, n=27). Only 10.8% (n=5) were aware of the WC Operational Manual. Four (8.6%) indicated having a nutrition policy available, but only one could provide it. Two-thirds (67.4%, n=31) of ECD centres had been audited in the past 12 months. Eighteen (39.1%) managers had received formal nutrition training, mostly >12 months ago (77.8.0%, n=1418). Training was presented by sources other than the Department of Health or Social Development in 47.3% (n=9/19) of cases (Table 1).

The mean number of children attending ECD centres on the day of the visit was 42.1 (SD 2.51). The mean monthly food expense was reportedly R8 228.88. Based on the average number of children at the ECD centres on the day of the visit, the mean cost per child per day was calculated to be R8.94 (US$0.51). Half of the managers did not know the daily food cost per child.

Table 1: Descriptive information pertaining to ECD centres (N=46) in Cape Town, South Africa

Parameter	Yes (*n*)	%
Training		
Have you received any formal nutrition training?	18	39.1
When was this training done? (*n* = 18)		
⩽12 months ago	4	22.2
>12 months ago	14	77.8
Who presented the training?		
Department of Social Development	7	36.8
Department of Health	3	15.7
Other	9	47.3
Do you have policy/rules/guidelines for nutrition that are used at the ECD centre?	4	8.6
Are you aware of the Western Cape Operational Manual for the provision of food to young children in care facilities?	5	10.8
Do children have free access to drinking water?	34	73.9
Special diets		
Do you have children with special dietary needs?	13	28.3
Do you serve special/therapeutic diets?	4	8.7
Do parents pay a monthly school fee?[#]	46	100
< R500	27	58.7
R501–R1000	8	17.4
R1001–R2000	5	10.9
R2001–R4999	6	13.0
Do you receive a monthly subsidy from the Department of Social Development?	29	63.04
Facilities availability		
Dry store	45	97.8
Refrigerator	40	86.9
Freezer	43	93.5
Running water	46	100

[#] 1 US Dollar = 17,5 ZAR at the time of the field work

Food Provisioning Environment

Menus

Most managers were responsible for compiling the menus (n=41; 89.13%). The format of the menus varied considerably, with some typed or handwritten and others using pictures to depict which meal items should be served. None of the menus indicated portion sizes. The types of porridge, fruit, vegetables, or bread to be served were incompletely specified. Subsequently, the menu items served often deviated from the planned menus. Based on the observations of the meals served, all lunches included a protein and starchy menu item, but fruit, vegetables, and milk were served less frequently on the observed day (7.8%, 60.8%, and 51.1% of ECD centres, respectively).

Eating Environment

Twenty-three percent (n=11) of the ECD centres had a separate area where children could take their meals. The eating environment was relaxed (97.8%, n=45) and the television was switched off at most ECD centres (82.6%, n=38). Staff reported setting a good example by not eating unhealthy food in front of the children during mealtimes (82.6%, n=38). Few staff discussed the food served with the children (6.5%, n=3) (Figure 1).

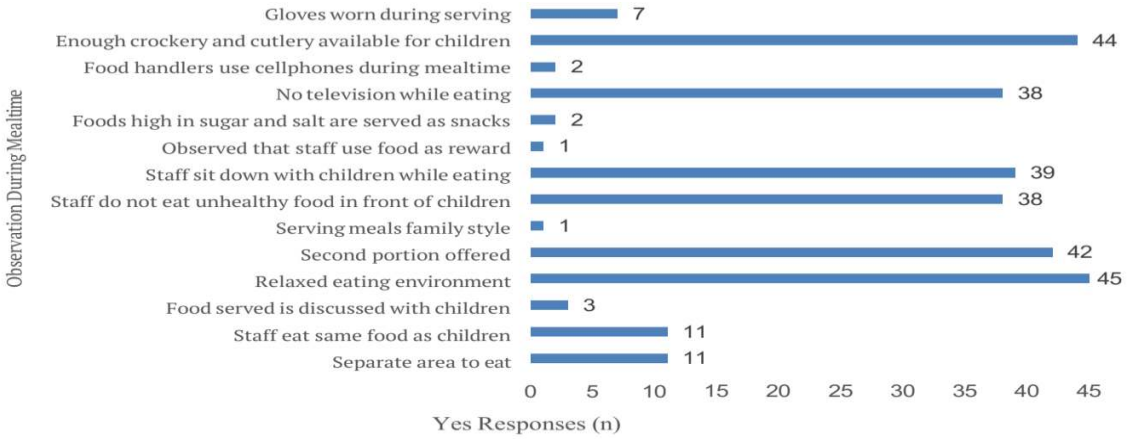

Figure 1. Single-day observations pertaining to the eating environment at the 46 ECD centres

Food-Handling Practices

Overall, the mean score for the food-handling practices observed was 50.0% (SD 11.78), indicating poor compliance. There was no statistically significant difference between the mean score for the observational audit in the three regions, namely 53.3% (SD 14.22), 48.5% (SD 11.64) and 48.2% (SD 9.20) (p=0.42).

Ordering and Receiving

The overall mean score for the ordering and receiving section was 26.8% (SD 20.40) and 16.6% (SD 21.3) respectively. The amount of food ordered was not based on the menu (43.2%, n=20) nor was it calculated using portion sizes (21.7%, n=10). Managers reported that they "work on experience" to compile a shopping list. None of the ECD centres placed orders with suppliers for weekly deliveries, but managers purchased food items themselves from food retailers. Self-reported information regarding receiving practices indicated that few managers checked internal temperatures or expiry dates of perishable foods (4.3%, n=2 and 6.5%, n=3 respectively).

Food Storage Practices Observed

Six (13.1%) ECD centres did not have cooling facilities and three (6.5%) lacked a freezer (Table 1). The overall mean scores for food storage areas varied: dry storage 72.6% (SD 16.9), refrigerators 43.1% (SD 26.5), and freezers 55.6% (SD 28.6). The temperatures of storage areas were not visible nor recorded in any of the ECD centres. Stores were kept clean and tidy (range 62.0%-86.3). Fruit and vegetables were stored separately from raw meat in the refrigerator (85.7%, n=18). Cooked leftover food stored in the refrigerator was covered and labelled in 14.3% (n=7/44) of ECD centres where this observation could be made. In the freezers, secondary packaging was removed (69.4%, n=25/36) but then food was left unmarked (50.0%, n=17/34) (Table 2).

Table 2. Selected food storage practices at ECD centres (N=46) in Cape Town, South Africa

Criteria	Number of observations*	*Number complying* (%)
Dry store area		
Goods are stored above the ground and not directly on the floor	44	39(88.6)
Storage area is clean	44	38(86.3)
Secondary packaging removed	44	33(75.0)
No dented cans	39	18(46.)
Refrigerator		
Cooked food and leftover food are covered and labelled	7	1(14.3)
Cooked food and leftover food are stored on the top shelves separate from raw food that should be on the bottom shelves	7	6(85.7)
Fruit and vegetables are stored separately from raw meat	21	18(85.7)
Secondary packaging removed	36	25(69.4)
First in, first out to ensure no food is past expiry date	38	32(84.2)
Freezer		
Items clearly marked if removed from original packaging	34	17(50.0)
Meat stored in the coldest compartment of the freezer	26	17(65.3)
Sufficient space between food items to allow circulation of air	35	27(77.1)
Secondary packaging is removed	35	21(60)

Food-Handling Practices and Personal Hygiene Observed

The mean scores for food-handling practices and personal hygiene were 48.4% and 86.5%, respectively. Seven (15.1%) of the ECD centres could present a programme scheduling when the various areas and equipment should be cleaned. Most of the ECD centres had hand wash soap or hand sanitiser, dishwashing soap, all-purpose cleaner, and some form of disinfectant to sanitise surfaces (80%, n=37; 95%, n=44; 91.3%, n=42; and 69.5%, n=32, respectively).

Table 3 presents data on observations of food-handling practices and personal hygiene. All personnel had clean, short nails and did not wear any jewellery. The most concerning results were that hands were not washed regularly (n=16; 34.7%) and only half of the staff could demonstrate the correct handwashing technique (n=24; 52.1%). Colour-coded chopping boards were seldom available (4.6%, n=2/43), and disposable gloves were seldom worn when serving meals (13.0%, n=6/46).

Table 3. Food-handling practices and personal hygiene observed in ECD Centres (N=46) in Cape Town, South Africa

Criteria	# of observations*	Frequency *n* (%)
Food-handling practices (ave score 48.4%)		
Regular handwashing	46	16(34.7)
Staff able to demonstrate the correct handwashing procedure	46	24(52.1)
Food handler washes and sanitises equipment between different food items	43	18(41.8)
Food handler washes work surfaces before preparation starts	42	23(54.7)
Cooked food is ready for serving not more than two hours before serving time	46	33(71.7)
Different colour-coded chopping boards used	43	2(4.6)
Food handler uses a different portioning spoon for each food type	36	24(66.6)
Does not leave food uncovered	45	43(95.5)
Left-over foods are cooled, covered, and labelled	5	3(60.0)
Gloves worn when serving meals and discarded afterwards	46	6(13.0)
Food handler follows all the steps of the cleaning and sanitation process	46	41(89.1)
Personal hygiene (ave score 86.5%)		
Can demonstrate correct handwashing procedure	46	24(52.1)
Clean aprons worn	46	32(69.5)
Clean and closed shoes	46	28(60.8)
Hair covered and personal protective equipment worn	46	29(63.0)
No eating and drinking during meal preparation	46	46(100)
No-smoking policy adhered to	46	46(100)
Cell phones not used or visible during food preparation or serving.	46	45(97.8)

*n – values differ due to some observations being not applicable.

Nutrition and Food Safety Knowledge

A total of 162 ECD centre staff completed the self-administered knowledge and attitude questionnaire. Almost all participants had more than 5 years' experience in ECD centres (56.7%, n=92). One third (32.6%, n=51/156) of all participants received nutrition-related training. Half of the staff indicated they were familiar with the WC Operational Manual (48.1%, n=78) (Table 4).

Table 4. Background information on staff who completed the nutrition knowledge and attitude questionnaire at ECD centres in Cape Town, South Africa (N=162)

Parameter	*n*	%
Role of staff member at ECD		
Manager	46	28.3
Cook	30	18.5
General assistant	14	8.9
Teachers	72	45.6
Highest level of education (*N*=161)		
Grade 7	11	6.8
Grade 8–11	46	28.5
Grade 12	38	23.6
Diploma or degree	66	40.9
Received training in food handling	65	40.4
Received nutrition-related training (*N*=156)	51	32.6
Period employed in role at ECD centre (years)		
Less than a year	13	8.1
One–three years	41	25.5
Four to five years	16	9.9
More than five years	92	56.7
Familiar with Western Cape Operational Manual for the provision of food in care facilities for young children	78	48.1

Radio, television, and magazines were identified as the primary sources of ECD centre staff nutrition information (42.2%, n=68/161), followed by information from parents (34.2%, n=55/161) and training provided by the Department of Health and other providers (34.2%, n=55/161).

The average knowledge score was 69.7% (SD 10.15). Questions pertaining to limited sugar consumption scored >90%, and participants knew that brown bread is the healthier option (96.2%). Participants could not identify food high in calcium (17.3%). There were misconceptions that ample water should be used when cooking vegetables (69.1%) and that sugar is rich in vitamins and minerals (66.0%). Questions related to the storage (27.7%) and thawing (30.9%) of frozen food were answered incorrectly (Table 5).

Table 5. Percentage scores of selected questions in the nutrition and food safety knowledge questionnaire completed by staff members at ECD centres in Cape Town, South Africa (N=162)

Question	(%)
Nutrition knowledge	
Eating many different foods is healthier than eating only a few kinds of foods	71.6
Dried beans, pulses, and lentils are a healthy choice to eat in place of meat	91.9
Fruit juice can be given in place of a fruit	38.2
Very high cooking temperatures and long cooking times will destroy vitamins	87.0
Vegetables must be cooked in a lot of water	69.1
Vegetables should be peeled and scraped just before cooking because the longer a vegetable stands, the more nutritional value is lost	57.9
Sugar and food containing sugar should be eaten in small amounts	95.0
Drinks that have added sugar, such as tea and coffee or cold drinks, must not be given to a child younger than 2 years.	90.6
Too much sugar is bad for your teeth	98.7
Sugar contains a lot of vitamins and minerals	66.0
Brown bread is a healthier option than white bread	96.2

Question	(%)
How much milk should a 2–6-year-old child drink per day while at the day care centre?*	53.1
The number of portions of fruit and vegetables to be eaten by a 2–6-year-old child daily while at the day care centre should be?*	87.0
A portion of cooked vegetables for a 2–6-year-old child is equal to?*	55.5
Which food contains a lot of calcium?*	17.3
Which food contains a lot of Vitamin C?*	81.5
Food safety knowledge	
The temperature of a refrigerator should be between 0º C and 5º C	77.8
Frozen foods cannot be refrozen after defrosting	76.5
Where is the best place to defrost frozen meat?*	30.9
Where should you store meat, fish, and chicken if you don't want it to spoil?*	27.7
Germs in food grow very quickly at temperatures between 5º C and 65º C.#	79.6
Raw and cooked food can be stored on the same shelf in the refrigerator	82.0
Raw foods should be stored on the lower shelf of the refrigerator	74.7

#Temperature of the danger zone according to the Western Cape Province Operational manual. *Participants could choose from a list of answers, of which one was correct

Managers had statistically significantly higher knowledge scores (74.53%, SD 10.74) than the rest of the staff ($p < 0.01$). There was also a statistically significant difference in the level of education and the average knowledge score ($p < 0.01$).

No statistically significant difference in knowledge was found between the period each participant was employed in a specific role ($p=0.6$) or whether they had received nutrition training ($p=0.09$). Furthermore, awareness of the Western Cape Operational Manual did not significantly affect knowledge scores ($p=0.1$).

Attitudes of ECD Centre Staff

ECD centre staff displayed a positive attitude towards their role in promoting healthy eating habits in the children. This was evident in participants' responses (agreed or strongly agreed) that they were responsible for promoting healthy eating habits (86.2%, n=138) and that the eating habits formed during childhood continue into adulthood (89.4%, n=143). A third (37.5%, n=60) of participants agreed or strongly agreed that the ECD centre kitchen was not suitable for preparing food according to the needs of individual children (Table 6).

Table 6: Attitudes of ECD centre staff (N=162) in Cape Town, South Africa, concerning their role in promoting healthy eating habits

Statement#	Strongly disagree		Disagree		Agree		Strongly agree		Don't know	
	n	%	*n*	%	*n*	%	*n*	%	*n*	%
It is only the parents' responsibility to ensure children eat healthily (*n*=159)	29	18.2	79	49.7	20	12.6	29	18.2	2	1.3
Childcare workers are responsible for promoting healthy eating habits (*n*=160)	4	2.5	16	10.0	83	51.8	55	34.4	2	1.3
Government guidelines are helpful in providing healthy food to children. (*n*=160)	4	2.5	11	6.9	83	51.9	54	33.7	8	5.0
The menu is planned according to what the parents want (*n*=157)	17	10.8	89	56.7	30	19.1	18	11.5	3	1.9
It is difficult to persuade children to eat healthy food. (*n*=158)	12	7.5	64	40.0	70	43.8	12	7.5	2	1.2
The eating habits children learn early in life will influence their eating habits as adults (*n*=159)	1	0.6	11	6.9	84	52.8	59	37.1	4	2.5
A child is more willing to try new or healthy foods in a group than at home (*n*=161)	1	0.6	1	0.6	98	60.9	60	37.3	1	0.6
Our kitchen facility makes it difficult for us to prepare food for the needs of individual children (*n*=160)	28	17.5	68	42.5	48	30.0	12	7.5	4	2.5

#n=x varies, as some participants did not respond to all statements

Discussion

We examined food provisioning in EDC centres in Cape Town, South Africa. We found a lack of awareness of provincial food provisioning guidelines for ECD centres and a fragmented implementation of optimal food provisioning approaches. Although no statistical difference was found between the mean scores of the observational audit and those of participants familiar with the nutrition guidelines, we believe the importance of guiding documents cannot be underestimated. Indeed, several international studies have shown that the availability of nutrition guidelines can positively impact the food-provisioning environment at ECD centres (Seward et al. 2017a; Spence et al. 2020).

Food-Provisioning Environment

The menus available at ECD centres differed in format and lacked detailed information such as the specific food items to be served and portion sizes. Vague menu writing at ECD centres lacking in detail is widely reported and may lead to poor compliance with optimal food provisioning as recommended by nutrition guidelines for ECD centres (Nzama and Napier 2017; Pietersen et al. 2002; Gerritsen et al. 2017; Finch et al. 2019; Seward et al. 2017b). Food served at various ECD centres deviated from the menus. The main areas of concern were the inadequate quantities of milk, fruit, and vegetables served, which places pre-school children at risk of developing micronutrient deficiencies such as calcium, Vitamin A, and zinc (Kruger et al. 2022; Lewis et al. 2022). Evidence from a recent desktop review for

the National Dietary Intake Survey (NDIS) 2022 reported on the poor nutritional status and food intake of young children in South Africa (Kruger et al. 2022). Strategies to promote increased consumption of these food groups are required, and ECD centres are particularly well-positioned to support higher daily intake through their responsibilities for food provision.

Receiving and storage

Receiving procedures may vary among foodservice facilities, yet basic standards apply to all such facilities (Puckett 2013). No studies were found that reported on receiving practices in ECD centres in South Africa. It would be beneficial to adapt the receiving and storage criteria for ECD centers to align more closely with the operational realities of smaller foodservice facilities, such as ECD centres.

Observational Audit of Food Handling Practices

The observational audit identified areas for improvement in food storage practices. The criteria with the lowest scores concerned the recording of temperatures in storerooms and the covering and labelling of food items in cold storerooms. Although most participants knew the correct refrigerator storage temperature, none of the ECD centres monitored or recorded these temperatures daily. A study conducted in Portugal also reported poor temperature-control practices among food handlers in childcare settings (De Souza et al. 2018). Extended exposure of food to the temperature danger zone (5–650 C) or cross-contamination between raw and cooked food items may result (Puckett 2013). These conditions can increase the risk of bacterial growth and foodborne illness outbreaks, which is of particular concern in vulnerable population groups, such as young children.

A positive finding, aligned with the recommendation in the Western Cape Operational Manual, was that food was cooked and ready for serving close to mealtimes in more than two-thirds of the ECD centres. This practice reduces the risk of bacterial growth if cooked food is left at room temperature for >2 hours before being served (Puckett 2013; WHO 2006; Western Cape Government 2015; Department of Health 2016). This finding is not the norm in all foodservice facilities. For instance, Jeon et al. (2015) reported that the practice of keeping cooked meals at appropriate temperatures received the lowest score in the cooking area of restaurants in South Korea.

Only 15% of ECD centres could present a written cleaning programme, and many did not have any surface sanitiser available. The purpose of a cleaning programme is to coordinate the cleaning procedures in a foodservice facility in an organised and consistent manner (Puckett 2013; Department of Health 2016). Furthermore, all-purpose cleaners do not have the same sanitizing effectiveness as a surface sanitiser, and their use as a substitute may negatively affect food safety. Jeon et al. (2015) also reported a relatively low score for the presence of a cleaning schedule.

Personal hygiene practices observed

Evidence indicates that many cases of foodborne disease are associated with insufficient personal hygiene among food handlers (Tappes et al. 2020). The good personal hygiene practices of the ECD centre staff we studied, as reflected in a high overall score, should be interpreted with caution, as each individual criterion needs to be controlled according to global food safety measures (WHO 2006). Observation of ECD centre staff activities revealed that staff would benefit from receiving regular training and require daily monitoring to instil sound hygiene practices. For example, a few staff washed equipment between tasks or washed work surfaces before meal preparation started. Similarly, Osaili et al. (2018) reported several factors associated with foodborne diseases due to cross-contamination such as poor food-handling and preparation methods, storage at inappropriate temperatures, and poor personal hygiene and sanitation in university foodservice facilities in Jordan.

The correct handwashing procedure, as well as frequent handwashing at appropriate intervals, is the cornerstone of personal hygiene and a critical step in safe food-handling practices (WHO 2006; FAO 2009). Although the recommended handwashing procedure is included in the WC Operational Manual, only half of the ECD centre staff successfully demonstrated it. Similar findings have been reported in studies in other countries. Poor compliance with handwashing recommendations was reported by Osaili et al. (2018), who found that foodservice staff complied with the prescribed FDA handwashing recommendations less than 30% of the time.

To overcome this challenge, wearing gloves during service is recommended. Results showed that only thirteen percent of the ECD centre staff were compliant. Robinson et al. (2016) debated the protective effect of gloves, as food handlers often neglect handwashing when wearing them. Even when wearing gloves, the same surfaces are touched; therefore, gloves should be changed frequently. The question then arises: is the criterion for wearing gloves appropriate for ECD centres, or should proper handwashing be enforced?

Mealtime environment

A positive mealtime environment can help young children establish healthier eating habits and a positive relationship with food (Mita et al. 2015; Battista et al. 2014). Mealtime practices observed in this study were generally aligned with the guidelines. However, discussion of food with children during mealtimes was not observed in most ECD centres. This could be seen as a missed opportunity to engage in healthy food conversations, encourage them to try new foods, and help children self-regulate decisions about food intake (Mita et al. 2015; Battista et al. 2014), a skill required to prevent under- and over-nutrition. (Pérez-Escamilla 2021). The current nutrition guidelines provide valuable direction but present an opportunity to include more guidance on fostering a positive mealtime environment, including responsive feeding (Department of Health 2016; Western Cape Government 2015).

Nutrition and Food Safety Knowledge

The average nutrition score reported by ECD centre staff aligns well with findings from other studies (70.0%-73.0%) on food handlers working in school kitchens (da Vitória et al. 2021; Rida et al. 2018; Bentley et al. 2016). The absence of fundamental nutrition knowledge and appropriate food-handling practices is a significant concern, as it may increase the risk of nutritional deficiencies in children. The limited knowledge regarding the appropriate number of portions and portion sizes reported in this study is not unique. Only two-thirds of participants in a study conducted in Nebraska correctly identified the portion of milk recommended for children aged 3–5 years (Rida et al. 2018).

Consistent with the results of this study, Moore et al. (2005) reported low levels of nutrition information delivery by local authorities to childcare providers in the UK. It is disconcerting that nearly half of the ECD centre staff in this study reportedly obtained knowledge from non-scientific sources, such as radio, TV, and magazines. Childcare providers may be unaware of evidence-based best practice nutrition information and may rely on personal knowledge and experience when working in ECD centre kitchens. Unfortunately, personal knowledge and practices are often inadequate or incorrect (Rida et al. 2018). Several researchers have suggested that reliance on personal nutrition knowledge is the main reason for poor compliance with nutrition guidelines (Cole et al. 2017; Bell et al. 2015). The nutrition knowledge score of staff aware of the WC Operational Manual was not significantly different ($p=0.1$) from that of staff unaware of the manual. The absence of a statistically significant difference ($p=0.1$) between staff awareness and unawareness of the Western Cape Operational Manual suggests that awareness alone may be insufficient to influence nutritional knowledge. This finding highlights potential gaps in dissemination and training, indicating that policy availability does not necessarily translate into improved staff competency. This emphasises the need for staff training programmes that link to learning the manual's content.

The observed gaps in food safety practices were consistent with responses to the knowledge questionnaire completed by all ECD staff. The knowledge gaps identified in this study have been observed in other foodservice settings as well. De Souza reported that only 60% of restaurant staff knew the correct method of thawing meat (De Souza et al. 2018). A study conducted in Trinidad and Tobago found that 80% of foodservice staff working at university canteens did not know the temperature danger zone or its purpose, and only 37% of participants answered the question on handwashing procedures correctly (Webb and Morancie 2015). In a study conducted in South Korea, participants received the lowest scores on food-handling situations among staff with foodborne illnesses and skin injuries (Jeon et al. 2015). No question on skin injuries was included in the observation audit of the current study.

Attitudes of ECD Centre Staff

Participants in this study perceived themselves as responsible for promoting children's health and encouraging healthy eating behaviours from an early age, consistent with findings in the existing literature (Moore et al. 2005; Sisson et al. 2017; Derscheid et al. 2010; Cavallera et al. 2019). Almost all the participants (90%) agreed or strongly agreed that eating habits formed during childhood continue into adulthood. Recognising and understanding their professional roles is critical for fostering an enabling food-provisioning environment within ECD centres (Grady et al. 2018).

Limitations

The authors acknowledge the limitations of the study. Many of the practices could not be observed during the one-day visit, and therefore, some information was self-reported. Low audit scores in the absence of prior exposure to the audit criteria likely reflect inadequate training and systemic implementation gaps rather than true non-compliance, and results should be interpreted accordingly. Due to a lack of detailed information on the menus, it was not possible to compare them with prescribed menu guidelines. Even though a pilot study was conducted, some criteria listed in the audit tool were not always applicable on the one-day visit, for example, no observations could be made regarding the ordering of food, and we could provide only self-reported information. Given that ECD centre managers were aware of the visit date, practices may differ on other days. Although research assistants were trained and standardised, inter-rater reliability was not assessed. The ECD sector was closed for six months due to the COVID-19 pandemic, and data collection commenced shortly after its reopening. An immediate post-pandemic picture of the situation at ECD centres was subsequently captured, which may not be typical. Generalisability of the results may be limited by the geographical area from which the ECD centres were sampled. Only registered ECD centres were included in the sample, and therefore, results should not be generalised to those that are not registered.

Conclusions/Implications for Research and Practice

There is substantial room for improvement in the food provisioning environment at ECD centres in the City of Cape Town. It is therefore recommended that ECD centres should take heed of the Nutrition Guidelines for Early Childhood Development Centres (National Department of Health 2015; Department of Health 2016). Only a comprehensive training programme and regular monitoring can help ECD centre staff understand, retain, and comply with the nutrition guidelines.

Furthermore, the results of the knowledge questionnaire revealed certain knowledge gaps and misconceptions about nutrition and food safety amongst ECD staff. Yet the staff's positive attitudes indicated that they were eager to improve their knowledge and practices if given the opportunity.

Future studies should use qualitative methods to examine the challenges ECD centre managers encounter when implementing nutrition guidelines and to explore the reasons for the disconnect between guidelines and practice. Policy changes at government level could strengthen food

provisioning guidelines, keeping in mind the barriers that may exist. Intervention studies can be designed to measure the impact of training on guideline implementation.

Comprehensive multi-sectoral services for infants and young children have been shown to have high returns on investment. It is therefore recommended that the SA ECD sector be adequately supported and resourced to improve children's health outcomes. This will, in the long term, contribute to the country's growth and development. This study provides insights that enable stakeholders to better understand the sector's specific requirements and inform the development of targeted interventions for improvement.

Author Contributions

YS: Conceptualization, Methodology, Investigation, Data curation, Writing-original and draft preparation. LMDuP: Conceptualization, Methodology, Supervision, Writing-reviewing and editing RP: Conceptualization, Methodology, Supervision, Writing-reviewing and editing. DGN: Statistical analysis and reviewing of data analysis section. All authors have read and approve the final version of the paper and its submission.

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

Nothing to disclose.

Acknowledgements

The Early Childhood Development (ECD) centre audit tool was developed by Family Health International (FHI 360) technical staff in collaboration with the WC DOH. FHI 360 extended permission to include sections of the audit tool in the research instruments for this study.

Data Availability Statement

All relevant data are available within the manuscript

Funding

The project was funded by the National Research Foundation: Thuthuka funding

Conflict of Interest

The authors declare that they have no conflicts of interest.

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