TITLE

Assessing the Food Safety Attitudes and Awareness of Managers of School Feeding Programmes in Mpumalanga, South Africa

AUTHORS:

1) Mr July J Sibanyoni

Address: Department of Life and Consumer Sciences, University of South Africa, Cnr Christiaan de Wet Road and Pioneer Avenue, Florida, Roodepoort 1710, South Africa.

Tel: +27 11 471 2080

Fax: +27 11 471 2796

Email: sibanjj@unisa.ac.za

2) Dr Frederick T Tabit (Corresponding Author)

Address: Department of Life and Consumer Sciences, University of South Africa, Cnr Christiaan de Wet Road and Pioneer Avenue, Florida, Roodepoort 1710, South Africa.

Tel: +27 11 471 2080

Fax: +27 11 471 2796

Email: tabitft@unisa.ac.za

Abstract The managers of school feeding programmes are responsible for ensuring the safety of the food which is provided to schoolchildren, but very few studies have been conducted on the food safety knowledge and awareness of these managers. The objective of this study is to evaluate the food safety attitudes and awareness of managers of the National School Nutrition Programme (NSNP) in schools in Mpumalanga, a province of South Africa. A cross-sectional survey study was conducted in which questionnaires were used to collect data from 300 NSNP food service managers. The majority of schools offering NSNP meals were located in informal settlements and most were found to lack basic resources such as electricity (power supplies to the food preparation facility) and potable tap water in their kitchens. No school was found to have implemented the hazard analysis and critical control points (HACCP) programme, and only a few staff had received food safety training. Food safety implementation is worst in informal schools in rural areas due to limited resources and infrastructure. The NSNP food service managers in some schools – especially those located in rural settlements – were found to have little knowledge and awareness of HACCP. These results indicate an urgent need to provide NSNP managers with food safety training and resources (potable water supplies, electricity, dedicated food preparation facilities), particularly in schools in rural settlements.

Keywords Food safety; Attitude; Awareness; Managers; School Feeding Programme

Introduction

School feeding programmes are powerful instruments that seek to alleviate short-term hunger and improve nutrition and the cognitive abilities of school children by providing free meals in schools [1, 2, 3]. A positive correlation has been found between the academic performance of school children and the provision of free school meals in schools located in poor communities [4]. Endemic poverty in many communities in developing countries has necessitated the implementation of school feeding programmes [2, 5]. The implementation of food safety

measures in school feeding programmes is important, considering that many schoolchildren are deemed vulnerable due to their weaker immune systems, when compared to healthy adults [6, 7, 8]. Foodborne disease outbreaks are becoming a frequent occurrence in school settings [9] due to a lack of adequate infrastructure as well as inadequate food safety knowledge on the part of employees of school feeding programmes [10, 11].

Foodborne disease outbreaks in school feeding programmes can be caused by inadequate food preparation and food storage facilities in food preparation establishments which do not meet hygiene standards [12]. The absence of prerequisite programmes such as production control, raw material control, pest control, good manufacturing practices (GMP), good hygiene practices (GHP) together with the absence of standard food safety programmes such as hazard analysis and critical control points (HACCP) in most food preparation facilities at schools constitute a food safety concern [13].

In 2012, the South African Department of Basic Education (DBE) reported that the majority of employees working for the National School Nutrition Program (NSNP) had not received formal food safety training [14]. This means many managers of NSNP food service facilities may not be knowledgeable on the establishment of food safety policies or the implementation of food safety standards [15]. Despite this, these managers are expected to commit monetary and material resources and to assume a leadership role in the implementation of food safety programmes [16]. These managers also have to make sure that staff undergo food safety training and oversee the consistent implementation of a comprehensive food safety programme within the food preparation facilities of school feeding programmes [17, 18].

In a school setting, where thousands of infants and children are served food daily, an outbreak of foodborne disease can lead to sickness which can result in death or the loss of school days due to illness amongst learners [2, 8, 19]. Very few studies have been conducted on the food safety

knowledge and awareness of school feeding programme managers who are responsible for ensuring the safety of the food which is provided to schoolchildren. Therefore, the objective of this study is to evaluate the food safety attitudes and awareness of NSNPs managers in schools in Mpumalanga, South Africa.

Methods

The study area

The study was conducted on public primary and secondary schools that offer NSNPs in Mpumalanga, one of the nine provinces in South Africa and home to 7.2% of the South African population [20]. The province has 1 966 public schools, of which 74% offer free meals provided by the NSNP [21].

Research design and sampling

A cross-sectional survey study was conducted in which questionnaires were used to collect data from respondents. A total of 300 respondents were randomly selected from a list of 1 455 (74%) public schools that offer the NSNP in the province. Respondents were individuals 18 years and older, who have been designated by their respective school governing bodies to manage the NSNP in their schools.

Research instrument

The questionnaire instrument used for data collection comprised the following sections: socio-demographic details of respondents, details of NSNP food service facilities in schools, attitudes of NSNP managers, requisition and inventory practice, and HACCP awareness of NSNP foodservice managers. The questionnaire was piloted in ten schools using 30 food handlers, but these data were not included in the final sample. After the pilot study, the structure and wording of the questions were revised. The reliability and validity of the different sections of the research

instrument were determined and the Cronbach's α for the different constructs were found to range from 0.689 to 0.821.

Data collection

Prior to data collection the College of Agriculture and Environmental Science Ethics Committee approved and monitored this study which involved human participants (2015/CAES/018). The Department of Basic Education, Mpumalanga province provided permission for the conduct of this research in schools. Appointments to conduct interviews were made in advance with the relevant school principals. The questionnaires were distributed to each school NSNP manager/coordinator to complete. A consent form was signed by participants to affirm their voluntarily participation and their right to withdraw from the study if they so desired. The questionnaire of each respondent was coded to ensure anonymity.

Statistical analysis

The results were evaluated and analysed using the SPSS 20.0 software package. The data of all variables were presented as percentages. ANOVA was used to examine variations in response to some food safety parameters.

Results and Discussions

Socio-demographic details of respondents

Looking at the demographic characteristics of respondents, over 90% of the NSNP managers were female, with the vast majority (72%) older than 45 years (Table 1). This can be attributed to the fact that female educators are often nominated to coordinate the NSNP since they have cooking experience acquired as a result of preparing meals for their families [22]. Similarly, the majority (88%) of respondents had obtained a post-high school qualification, while almost all (99.3%) of them were full-time employees of the DBE (Table 1). An explanation for this is that

most of them are qualified educators, with at least a post-high school teaching qualification. These managers have been nominated by their respective schools to manage the NSNP and to serve on the nutrition committee of the NSNP in their respective schools [21]. Schools are required to nominate a member of the school governing body (parents, educators, non-educators, learners and co-opted members of the community) to manage the NSNP, and teachers are often nominated to perform this duty in addition to their normal teaching responsibilities [22]. NSNP managers are expected to ensure the safety of the food which is served to learners benefiting from the programme, by ensuring that employees implement safe food-handling practices [15].

Details of NSNP food service facilities in schools

The majority of NSNP foodservice managers (68%) indicated that their schools were located in rural areas and NSNP meals were prepared at all (100%) these schools (Table 2). The reason why the majority of schools offering NSNP meals were located in rural areas can be attributed to the fact that households in these communities are more likely to be poor. Learners in these schools are thus more likely to require free meals from the NSNP to reduce hunger during school periods [22]. School feeding programmes are a convenient means by which important nutrients can be provided to needy children in schools located in poor communities; the programme ensures that schoolchildren have food to eat, thereby helping them to concentrate better during lessons [23]. All South African public schools are categorised according to five quintiles, with quintile one comprising schools located in the poorest communities in the country. The quintile ranking is important because it determines the amount of financial support that each school receives annually from the South African DBE, and whether or not free meals of the NSNP are provided to learners at a particular school [21].

The majority of NSNP food service managers (77%) indicated that their schools had access to tap water, but only 17.3% of them indicated the usage of electricity as a source of power to prepare the food, compared to 82.7% which used gas, paraffin or wood (Table 2). It is encouraging that the majority of schools had access to tap water, since it ensures that clean water is available for the preparation of food – an important requirement for food safety implementation [11]. Without running tap water in schools, food handlers would be forced to fetch water from distant places to prepare NSNP meals, which can lead to water contamination and, concomitantly, food contamination [24]. However, the fact that only a few schools used electricity as a source of power in their food preparation facilities is cause for concern, because the lack of electricity limits the use of important electrical equipment (e.g., refrigerators, freezers) at NSNP food service facilities [25]. The lack of electricity supply also limits the ability to store food at high or low temperatures respectively [26]. Time-temperature control measures are vital in preventing the growth and multiplication of microorganisms in food [27].

Up to 43% of NSNP food service managers indicated that their schools did not have a dedicated storage facility for the NSNP service. The absence of a dedicated storage facility in most schools can lead to improper food storage practices and concomitant cross-contamination between foods during storage [12, 28]. The proper storage of food is important in maintaining both nutritional value and safety [11, 29].

Attitudes toward food safety implementation

Up to 78% of NSNP food service managers monitored their staff regarding the implementation of food safety at least once a week (Table 3). This is a good practice which can ensure that food handlers consistently and correctly implement proper measures [32]. Frequent monitoring of food handlers ensures that food safety implementation lapses are corrected to early enough to prevent the contamination of food [33]. NSNP managers must ensure that food handlers comply

142 with food safety procedures [17] and the monitoring of food safety implementation should form
143 part of the food safety management process of any food service establishment, to ensure the
144 consistent and effective implementation of food safety measures [34, 35].

145 Up to 73.3 % of respondents indicated that the DBE representative visited the school to assess
146 the NSNP's activities at least once a term (Table 3). These monitoring activities by
147 representative of the DBE ensure that the food preparation facilities of schools conform to
148 prescribed food safety measures, in addition to ascertaining the safety and quality of the food
149 served to schoolchildren [35].

150 Most of the NSNP food service managers indicated that their food service facilities had written
151 policies or standard operating procedures (SOPs) for food storage (66.7%), serving of food
152 (66%), and the cleaning and disinfecting of food contact surfaces and equipment (54%). (Table
153 3) The fact that above food safety measures were practiced is commendable because they ensure
154 that standard procedures for implementing food safety measures are followed by everyone [17,
155 28, 35]. Food safety SOPs are important food safety assurance instruments in any food service
156 establishment [7, 12].

157 The fact that only a minority of NSNP managers (26.7%) indicated that they monitor the
158 temperature of food is a concern because (Table 3) the cooking or storage of food at incorrect
159 temperature can give rise food spoilage due to the growth and multiplication of microorganisms
160 [11, 25]. The continuous monitoring of temperatures ensures that food products are safe during
161 storage [7]. Lower storage temperatures decrease the reproduction rate of bacteria and reduce the
162 rate of food product spoilage during storage [25]. The vast majority of NSNP foodservice
163 managers (84.7%) indicated they carry out regular inspections of raw food materials in their
164 NSNP food service establishments (Table 3). This is encouraging, as it ensures that supplied raw
165 food materials are of good quality and are suitable for use in preparing NSNP meals [13, 36].

Only a minority of NSNP foodservice managers (39.3%) indicated that food handlers in their NSNP facilities had received food safety training courses on HACCP and food hygiene procedures (Table 3). This is a concern given that the guidelines on hygiene and food safety, as issued by the South African DBE, state that a series of food safety workshops should be conducted throughout the year to train NSNP staff [11]. The continuous training of food service staff will ensure that they remain aware of food safety measures at all times, thereby preventing lapses in the implementation of food safety measures [37].

Food inventory requisition and management

A vast majority (89.3%) of NSNP managers indicated that, their food service facilities purchased food supplies from commercial suppliers and the majority of them (76.7%) indicated that these suppliers are contracted to the DBE (Table 4). This is a good food safety practice which it ensures traceability and consistency in the quality of the food products delivered [17, 36, 38, 39]. Despite having contracted suppliers of raw food materials, up to 68.7% of NSNP managers (Table 4) indicated that their food service facilities had no pre-determined delivery schedule with the suppliers. The unplanned delivery of food items can lead to the receipt of poor-quality foodstuffs, as products can be received without proper inspection, given that the NSNP managers are also involved in teaching activities [17, 40]. A planned delivery schedule with suppliers should be in place to ensure that food items are received at an agreed time, to enable proper checks during the receiving process [36]. Furthermore, the price, quality and quantity of food materials delivered should match the information supplied on the invoice and quotation list [36].

The fact that 72.7% of NSNP managers (Table 4) indicated that their food service facilities practised stock rotation is beneficial to the NSNP in terms of food safety management, considering that it ensures that food items are not kept beyond their required storage duration

(use-by date), thereby preventing microbial growth and product deterioration on the shelves during storage [11]. All the NSNP managers indicated that their storage areas their food service facilities were kept locked at all times (Table 4). This ensured that food supplies were secure during storage, thus preventing pillage and any intentional contamination or bioterrorism [41].

HACCP programme implementation and food safety audit awareness

The reason why only 40% of NSNP food service managers agreed that they know what the HACCP programme entail (Table 5), could be attributed to the fact that respondents are qualified classroom teachers with little or no prior food safety training [21]. Furthermore, the fact that HACCP is not known to most of them implies that it is not being implemented in their NSNP food service facilities [42]. The HACCP programme enables the identification, analysis and control of food safety hazards in food service establishments and therefore required by NSNP food service facilities [41, 43]. Despite most of them not knowing what HACCP entails, up to 79.3% of them agreed that food safety is a priority in food service establishments while 74% of them agreed that HACCP can bring food safety benefits to the NSNP food service facilities (Table 5). The advantage of this view is that NSNP managers can start to take the necessary measures to implement HACCP by advocating for food safety training programmes: trained employees have been found to significantly outperform untrained employees with respect to perceptions and practices associated with food safety [38]. Effective training on food safety reinforces food handlers' knowledge, awareness and attitudes towards food safety implementation [44].

A huge majority of the NSNP food service managers (80%) agreed that there should be more regular audits of food safety practices at NSNP food service facilities should be conducted by competent government authorities (Table 5), to ensure the regular and consistent implementation of food safety measures [12, 28]. Food safety audits play a fundamental role in certifying that

proper food safety practices are being adhered to, while ensuring the safe production of food at food service facilities [36, 39, 45].

Food safety parameters affected by the location and food safety monitoring in schools

In terms of location, a significantly higher proportion of schools located in informal settlements do not have running tap water in their kitchens (Table 6) and this can partly be attributed to the legacy of the pre-1994 apartheid government in South Africa, during which informal settlements were neglected and not supplied with sufficient potable water compared to urban areas [46, 47]. Schools in urban areas have access to better water resources from municipal authorities than schools in informal settlements do [8, 48]. The lack of potable water can compromise the safety of the food produced, given that a supply of clean water is required to practise food hygiene in food service establishments [49]. Access to clean and potable water can enable the implementation of basic food safety measures such as hand washing, the washing of equipment and food contact surfaces, as well as raw food materials, thereby preventing the contamination of food [50]. Furthermore, the reason why more schools located in informal settlements do not have a standard operating procedure for monitoring the temperature of food on a daily basis (Table 7) can be attributed to to the lack of training [12] and the non-implementation of food safety programmes such the HACCP [7, 51, 52]. It is important for NSNP managers to be knowledgeable about HACCP and other food safety measures, considering that they form the basis of any integrated food safety management system within a food service establishment [13].

Regarding monitoring, that schools in informal settlements were less likely to conduct monitoring daily compared to those in urban settlement can be attributed to lack of resources required for food safety implementation [53]. Similarly, a significantly higher proportion of NSNP managers from schools in urban settlements responded in the affirmative as to whether there should be more frequent food safety audits by competent authorities in their schools (Table

7). These discrepancies can be attributed to differences in knowledge and awareness of food safety programmes on the part of managers in urban areas [15].

Conclusion

Most NSNP managers were female, older than 45 years, in possession of a post-high school qualification and employed full time as educators by the DBE. The majority of schools offering NSNP meals were located in informal settlements, where most schools lack basic resources such as electricity (power supply to the food preparation facility) and potable tap water (in kitchens). Despite regular visits by DBE monitors, the availability of hygiene policies and procedures, no school was found to be implementing the HACCP programme and only a few food handlers in select schools had received food safety training. Food safety implementation was found to be worst in informal school, mainly due to resource and infrastructural constraints, as well as relatively more limited knowledge and awareness of HACCP on the part of NSNP managers in those schools. The development of food safety knowledge, attitudes and awareness of managers in the NSNP will improve food safety implementation and compliance in schools. It is recommended that food safety training to staff and managers of the NSNP, especially in schools located in rural settlements, to improve their knowledge and awareness. Schools – especially those in rural settlements – must be provided with relevant resources such as potable water supplies, electricity and dedicated food preparation facilities, to ensure that food is prepared and served safely to schoolchildren. SOPs and food safety policies should be drawn up/provided and enforced in all schools offering NSNPs, to ensure the production of safe meals at all food service facilities.

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Author's Contribution Frederick Tawi Tabit and July Johannes Sibanyoni conceived the study and wrote the final manuscript. Data collection was performed by July Johannes Sibanyoni.

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Table 1: Demographic characteristics of NSNP foods service staff (N=300)

Variables		Frequency (%)
Gender	Male	26 (8.7)
	Female	274 (91.3)
Age	Under 25 years	0 (0)
	25–35 years	4 (2)
	36-45 years	78 (26)
	46–55 years	164 (54.7)
	56–65	50 (16.7)
	Over 65 years	2 (0.7)
Level of education	Less than high school	18 (6)
	High school	18 (6)
	Some college	104 (34.7)
	University of Technology Diploma/degree	48 (16)
	University	112 (37.3)
Type of employment	Full time	298 (99.3)
	Part time	2 (0.7)

Table 2: Description of NSNP food service facilities at schools (N=300)

Variables		Frequency (%)
Is the school location classified as urban or rural/informal settlement?	Urban	96 (32)
	Rural/informal	204 (68)
Are meals prepared at the school?	Yes	300 (100)
	No	0 (0)
Indicate your position in the NSNP	Volunteer	2 (0.7)
	Food handler	4 (1.3)
	Manager/Coordinator	278 (92.7)
	Other	16 (5.3)
Where does the school's water come from?	Tap (i.e., running water)	234 (77)
	Water tanker (mobile)	50 (16.7)
	Communal water supply	16 (5.3)
	River (collected)	0 (0)
What power supply is used to prepare the food?	Electricity	52 (17.3)
	Gas/paraffin/wood	248 (82.7)
Does your school have a designated storage facility for the NSNP?	Yes	170 (57)
	No	130 (43)

Table 3: Attitudes of NSNP managers toward food safety assurance (N=300)

Variables			Frequency (%)
How often do you monitor your staff regarding the application of food safety and procedure manuals?	Daily		110 (36.7)
	Weekly		124 (41.3)
	Monthly		26 (8.7)
	Once a term		14 (4.7)
	Seldom		20 (6.7)
	Never		4 (1.3)
How frequently does a representative from the Department of Basic Education visit the school to assess the NSNP? (Select one)	Once a month		52 (17.3)
	Once a term		168 (56)
	Twice a year		62 (20.7)
	Less than once a year		18 (6)
	Never		0 (0)
Are there available written policies or standard operating procedures (SOPs) regarding each of the following in your NSNP food service facility?	Receiving	Yes	208 (69.3)
		No	92 (30.7)
	Food Storage	Yes	200 (66.7)
		No	100 (33.3)
	Serving of food	Yes	198 (66)
		No	102 (34)
	Cleaning and disinfection of food contact surfaces and equipment	Yes	162 (54)
		No	138 (46)
	Monitoring temperature of foods	Yes	80 (26.7)
		No	220 (73.3)
Inspections of raw materials are regularly carried out in your NSNP food service facility		Yes	254 (84.7)
		No	6 (5.3)
Has on-the-job food safety training (e.g. HACCP and food hygiene) been provided to food handlers?		Yes	118 (39.3)
		No	182 (60.7)

Table 4: Requisition and inventory practices in NSNSP food service facilities (N=300)

Variables		Frequency (%)
Where do the food supplies come from?	Commercial supplier	264 (89.3)
	Local community member	28 (9.3)
	Both 1 & 2	0 (0)
	Missing system	2 (1.3)
Are there contracts with the suppliers?	Yes	230 (76.7)
	No	70 (23.3)
Is there a planned delivery schedule?	Yes	94 (31.3)
	No	206 (68.7)
Are all the food items and invoices checked during delivery?	Yes	298 (99.3)
	No	2 (0.7)
Is a stock rotation system in place?	Yes	218 (72.7)
	No	82 (27.3)
Is the storage area for food materials always kept locked?	Yes	300 (100)
	No	0 (0)

Table 5: HACCP awareness of NSNP food service managers (N=300)

Variables	Frequency (%)		
Please tick (x) to indicate whether you agree or disagree with each of the following:	Agree	Disagree	No idea
I know what HACCP entails	120 (40)	128 (42.7)	52 (17.3)
HACCP is regularly carried out in your NSNP food service facility	0 (0)	300 (100)	0 (0)
Food safety is a major priority in NSNP food service	238 (79.3)	44 (14.7)	18 (6)
I know that HACCP/food safety systems have benefits	222 (74)	14 (9.3)	100 (16.7)
There should be more regular food safety audits by competent authorities in the NSNP	240 (80)	60 (20)	0 (0)

Table 6: Food safety variables for which there was significant (p≤0.05) difference in the responses of NSNP managers due to the location of schools (N=300)

Food safety parameters		Percentage response within food safety parameters based on the location of managers' schools		p value
		Urban (%)	**Informal (%)**	
Where does the school water come from?	Kitchen tap (i.e. running water)	36 (37.5)	38 (18.45)	**0.007**
	Outside tap (i.e. running water)	48 (50)	112 (54.37)	
	Water tanker (mobile)	8 (8.33)	42 (20.39)	
	Communal water supply (collected)	4 (4.17)	12 (5.83)	
	Total	**96 (100)**	**206 (100)**	
Do you have a Standard Operating Procedure or guideline document for Monitoring the temperature of foods	Yes	40 (41.67)	40 (19.42)	**0.005**
	No	56 (58.33)	164 (79.61)	
	Total	**96 (100)**	**206 (100)**	
There should be more food safety audit by competent authorities in the NSNP	Agree	92 (95.83)	154 (74.76)	**0.001**
	Disagree	4 (4.17)	56 (25.24)	
	Total	**96 (100)**	**206 (100)**	

Table 7: Food safety variables for which there was significant (p≤0.05) difference in the response of NSNP managers regarding how often monitoring of food safety implementation is conducted by NSNP managers (N=300)

Food safety parameters		Percentage response within food safety parameters on how often monitoring is conducted						p value
		Daily	Weekly	Monthly	Once a term	Seldom	Never	
Is the school location classified as urban or rural/informal settlement?	Urban	50 (52.1)	28 (29.2)	4 (4.2)	2 (2.1%)	8 (8.3%)	4 (4.2)	**0.015**
	Informal	60 (29.7)	96 (47.5)	22 (10.9)	12 (5.9%)	12 (5.9%)	0 (0.00)	
Are there available written policies and procedures regarding receiving foodstuffs?	Yes	86 (41.7)	94 (45.6)	10 (4.9)	8 (3.9)	8 (3.9)	0 (0.00)	**0.003**
	No	24 (26.1)	30 (32.6)	16 (17.4)	6 (6.5)	12 (13.0)	4 (4.3)	