

# An Assessment of the Role and Effectiveness of the Environmental Protection Agency in Ensuring Food Safety and Production in Osun State, Southwestern Nigeria

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**Abstract**— *The relevance of food to human health and survival cannot be over-emphasized. It enhances the development and growth of the people when it is correctly handled, while inappropriate supervision of food could bring ailment and sicknesses. The study examined the level of performance of the Environmental Protection Agency, food safety practices by food handlers, and potential factors affecting the effectiveness of the Environmental Protection Agency strategy in food production in Osun State, Southwestern, Nigeria. The descriptive and quantitative approaches used to conduct this study have Environmental agencies in Osun State as respondents with the application of SPSS and R software packages. A T-test was carried out to find out the difference in the responses of the respondents. The finding revealed that the food supply to the consumers is edible and of good quality is part of the agency's role (83.1%). This study established that environmental protection agencies are charged with the responsibility to secure a quality environment suitable for good health and well-being, protect people in the society against food that is injurious to health and enter the food business premises at a reasonable time and regularly. The results showed that the level of performance of environmental agencies in educating the populace that everybody stands an equal chance of being affected by food poisoning is very high (98.8%). The finding showed that agencies always advocate that the health status of workers should be evaluated before employment (96.4%). The results indicated that swollen cans may contain the microorganism, clostridium botulism, which causes botulism (92.4%). The results revealed that food handlers did not use gloves during the distribution of unpacked food (72.3%). The result also indicated that food handlers were not checking the shelf life of food at the time of delivery (67.5%). The results showed that the major factor affecting the effectiveness of the Environmental Protection Agencies (96.4 %). The findings showed that there was a significant statistical difference ( $p < 0.05$ ) in the responses of respondents. The study concluded that environmental protection agencies have important roles to play in food processing, but some factor affect their effectiveness.*

**Keywords**— *Environmental protect agency, health, Food processing, Food safety. Legislation.*

## I. INTRODUCTION

The Environmental Protection Agency (EPA) is a federal agency created in 1970 to protect human health and the environment by researching and regulating the production, processing, distribution and use of chemicals and other pollutants. The Environmental Protection Agency (EPA) is charged with creating and enforcing regulations that protect people and the planet from the harmful impacts of pollutants, not just in our environment but also in food and animal feed and water [1,2]. So, with that said, an environmental agency or environmental protection agency is a multi-signature organization or commission tasked with protecting the environment, resource management, and preservation and established within or outside of government. They also said that these agencies must preserve the environment from the misuse of its resources due to human degradation of the environment by climate change. For humans to exploit the earth's environmental resources sustainably for generations to come, we need proper environmental management [3].

Haris et al. [4] continued that food processing is the conversion of raw materials into finished products. This involves establishing connections through time, but also physical space: food is one of the most basic human necessities. proved that

food is key to life and the basis for all that we do. Food is needed mainly to preserve life [5,6], and food must be wholesome and palatable, devoid of untoward compounds, including lethal chemicals, toxins, and infectious microorganisms [7]. Inefficient or inappropriate food processing technologies, inadequate post-harvest handling practices and unavailability or lack of storage facilities, packing houses and inadequate market infrastructures are some of the factors that can be attributed to the high level of post-harvest food losses in West Africa (8) Food must be handled, prepared and stored in such a way as to avoid causing foodborne diseases such as cholera and gastroenteritis [9]. Environmental factors play a role in street food safety. These are knowledge and awareness about food safety measures, low food hygiene practices and lower socioeconomic conditions for food vendors, poor attitude of food vendors toward food safety, socio-cultural beliefs, and trust [10,11].

Foodborne and waterborne diarrheal diseases cause an estimated 2.1 million deaths annually, mainly among children in developing countries [12,13]. The Nigerian government has a National Policy on Food Hygiene and Safety, which was implemented as part of the National Health Policy in 2010. To achieve high food hygiene and safety practices to promote health, control food-borne diseases, and minimize and eventually eliminate the risk of diseases associated with poor food hygiene and safety is the overall goal of the National Policy on Food Hygiene and Safety [14,15].

Responsible agencies are required to do the following: protect the public from harm caused by the consumption of unwholesome food, ensure that all food establishments are properly inspected and registered, and conduct public health surveillance of food handlers and food processing equipment. educate the public on proper hygiene and safety procedures [16,17]. However, the challenge of food quality and safety in Nigeria, whether for domestic consumption or exportation, requires serious attention. However, Agbola [18] discovered that 45% of his respondents in his study of food insecurity among farming households in Osun State, Nigeria, were food insecure using the Food Security Index Similarly, Banjoko *et al.* [19] Assessment of the Information Needs of Street Food Vendors in Ilorin East Local Government Area of Kwara State. However, these two study did not consider the roles of environmental protection agencies, hence this study evaluates the roles of the environmental protection agency, assess the performance of the environmental protection agency strategy in food production, examine food safety practices by a food handler, and investigate problems associated with the effectiveness of environmental protection agency in food production in Osun State Nigeria.

## **II. MATERIALS AND METHODS**

### **2.1 Description of study area:**

Research Area Osun State lies between latitudes 6°55'N and 8°10'N North and longitudes 3°55'E and 5°05'E East of South Western Nigeria [20]. It covers a landmass of about 7997.5484 square kilometres and an estimated 2001 population of 2,854,832 (NPC, 1997). Osun State was created in 1991 out of Old Oyo State. It is located in the rainforest ecological zone of the country. They are neighbouring Oyo, Ekiti, Kwara and Ondo states. The state has luxuriant vegetation, extensive rainforest (generally in the southern part of the state) and sub-savanna forests [21].

### **2.2 Research design:**

Huysamen [22] further states that the design can be explained as the plan or logic followed during the process of collecting data to answer the research hypothesis or question in the most economical way. This study was conducted with a descriptive and quantitative approach to research. This study is described as such because descriptive studies provide information about characteristics and a picture of the current roles of environmental protection agencies in the Osun State.

### **2.3 Population and sample size:**

The target population refers to the entire set of individuals or elements who meet the sampling criteria [23]. In this study, an accessible population is the portion of the target population to which the researcher has reasonable access [23]. In this study, the accessible population included workers of the Osun State Ministry of Environment and Workers of Osun State Waste Management Agency, Osogbo. The sample size of this study is eighty-three (83).

### **2.4 Validity:**

The instrument was subjected to expert judgment engaging professionals from the Institute of Ecology and Environmental Studies, faculties of health sciences and Education to assess the relevance to the subject matter, its scope, and coverage.

## 2.5 Reliability:

Reliability was established by ensuring internal consistency through the items which constituted the questionnaire and the reliability statistical test revealed that Cronbach's Alpha coefficient is 0.792, a measure that the instrument used in this study is reliable. Table 1 depicts Cronbach's Alpha coefficient.

**TABLE 1**  
**CRONBACH'S ALPHA COEFFICIENT**

Reliability Statistics	
Cronbach's Alpha	No. of Items
0.792	36

## 2.6 Data collection method:

This study makes use of primary data obtained via the direct distribution of a questionnaire by the researcher to the respondents in two environmental protection agencies. The researcher also provided them with a little description of what the questionnaire was all about to ensure valid, reliable and accurate data and also to provide a greater response rate. 150 questionnaires were prepared, 86 were administered, and 83 were returned and properly completed.

## 2.7 Data analysis:

According to Alem [24], data analysis provides possible solutions to an unspecified phenomenon, requiring the researcher to interpret the data that has been gathered it and to present the results in a very manageable and concise manner which enables the researcher to make an overall statement on a population based on a sample using an objective method free of feelings and ambiguities. The data collected for the study were coded and entered into location windows V.20 of SPSS for analysis and a T-test was conducted in the R software package to determine response differentials among the respondents. P values <0.05 were considered statistically significant.

# III. RESULT AND DISCUSSION

## 3.1 Identify the roles of the environmental protection agency in food production:

The responsibility of the government is to ensure that the established standards, legislation and enforcement programmes are kept by the food industry to ensure food quality and safety [16, 25]. However, Table 2 below identified the role of environmental agencies in food production in which 67.6% of respondents subscribed to the fact that environmental agencies spread from the federal to state level while 2.4% rejected it. This implies them aware of their roles at the state level. While 83.1 % of the respondents accepted that assuring that the food supply to the consumers is edible and of good quality is part of the agency's role, the remaining 17.9% of the respondents rejected it. The table below also showed that 94% of the respondents subscribed to the fact that taking appropriate steps to ensure food safety and quality of domestic consumption and exportation remains one of the roles of the environmental agency whereas 6.0 % unsubscribed to it and this is in agreement with findings of Ezirigwe [26] and Wu et al., [27]. With responses from respondents, 98% of respectively, this study established that environmental agencies are charged with the responsibility to secure a quality environment suitable for good health and well-being, protect people in the society against food that is injurious to health and enter the food business premises at a reasonable time and regularly and this result is in agreement with Kuppusamy et al.[28], who gave a report on the Integrating AI in food contaminant analysis: Enhancing quality and environmental protection. Almost all the respondents (92.7%) followed the study against the statement "Your agency restrains the sale of food that is unhygienically prepared, adulterated, spoilt, contaminated, and improperly labelled, an implication that restrains the sale of food that is unhygienically prepared, adulterated, spoilt, contaminated, and improperly labelled is not part of responsibility of the environmental agency and this result is inconsistent with findings of Ojinnaka [16] who maintained that restriction on the sale of food that has been improperly prepared, adulterated, contaminated, spoilt, or labelled is part of environmental agency responsibility. However, the result is also consistent with Adebawale and Kassim [29], who worked on food safety and health: a survey of rural and urban household consumer practices, knowledge of food safety and food-related illnesses in Ogun state. The result of findings from the table below indicated that all the respondents agreed that environmental protection agencies educate the populace that infectious agents cause food poison which implied that it is part of their roles. All these imply that the agencies complied with government

policy on food hygiene and safety in discharging their duties Nyor [30]. There was a significant statistical difference ( $p < 0.05$ ) in the responses of respondents in identifying the roles of the Environmental Protection Agency in Food Production in accordance with this study's findings Table 3

**TABLE 2**  
**IDENTIFY ROLES OF THE ENVIRONMENTAL PROTECTION AGENCY IN FOOD PRODUCTION**

S/N	Questions	Yes	No
		(%)	
1	Agency spreads from Federal to State level	98	2.4
2	Assures that the food supply to the consumers is edible and of good quality	83	18
3	Taking appropriate steps to ensure food safety and quality of domestic consumption and exportation	94	6
4	Charging with the responsibility to secure a quality environment suitable for good health and well being	99	1.2
5	Protects people in society against food that injurious to health	99	1.2
6	Restrains the sale of food which are unhygienically prepared, adulterated, spoilt, contaminated, and improperly labeled	7.3	93
7	Enters the food business premises at a reasonable time and regularly	99	1.2
8	Educates the populace that infectious agents cause food poison	100	0

**TABLE 3**  
**INDICATES SUMMARY OF TWO SAMPLE t-TESTS OF IDENTIFY ROLES OF ENVIRONMENTAL PROTECTION AGENCY IN FOOD PRODUCTION**

	Yes	No
Mean value	84.8	15.325
t -value	4.3695	
p-value	0.0006415	
df	14	

### 3.2 Assessment of the level of performance of the environmental protection agency:

Table 4 below shows the level of performance of the Environmental Protection Agency, which is very important because Food processing is a very sensitive area that affects the entire economy, and the quality of food consumed by the Nigerian population determines their health, and a healthy nation is a wealthy nation. In examining whether the agencies educating the populace that everybody stands an equal chance of being affected by food poisoning from the respondents, this study indicated that the Environmental Protection Agency performed very well (98.8%). This implies a high level of performance by the agencies. The majority of the respondents (84.3%) affirmed the fact that the environmental agencies create awareness that reheating cooked foods can contribute to food contamination while the remaining 15% disagreed and this is consistent with the findings of Amaami *et al* [31] who maintained that there is a high awareness of food safety among food vendors. The results are consistent with the findings of Khalil *et al.* [32], who worked on the Preemptive and proactive strategies for food control and biosecurity. The result above is also in line with Onyeaka *et al.* [33]. The result of the findings of this study also demonstrated that all the respondents indicated that the agency always brings it to the notice of the populace that typhoid fever is transmitted by food, an implication which showed the total performance of the agency in that specific area [34]. Out of a total number of respondents, a total number of 96.4% agreed, whereas only 3.6% disagreed with the fact that the agency always advocates that the health status of workers should be evaluated before employment. This also indicated a high level of performance of the agency. In assessing the level of performance of the Environmental Protection Agency in the area of making it open to the populace that salmonella is among the food-borne pathogens, the majority of respondents (95.2%) complied with it. This finding is in agreement with the findings of He *et al.* [35]. The study survey showed that the majority of respondents (70%) believed that the environmental agency always brings it to the notice of the populace that HAV is among the food-borne pathogens, which implied that the high level of performance of the agency in that regard is consistent with Kearney [36]. In relating the performance of the agency with a question that says once make it known that swollen cans may contain the microorganism, clostridium botulism, which causes botulism, 92.4% of respondents affirmed it while 7.6% of respondents

rejected it. All findings as regards the level of performance of the Environmental Protection Agency in this study are not consistent with the findings of Amaami *et al* [31] who stated that the effectiveness of regulatory bodies was generally fair (50%) and this may be as a result of the different methodology adopted. It was also established from this study that there was a significant statistical difference ( $p < 0.05$ ) in response of respondents to the level of performance of the Environmental Protection Agency in Food Production

**TABLE 4**  
**ASSESSMENT OF THE LEVEL OF PERFORMANCE OF THE ENVIRONMENTAL PROTECTION AGENCY**

S/N	Questions	Percentage level of response (%)		(n=83)	
		Agree	Strongly agree	Disagree	Strongly disagree
9	Educates the populace that Everybody stands an equal chance of being affected by food poison	67.5	31.3	1.2	0
10	Creates enough awareness that reheating cooked foods can contribute to food contamination	53	31.3	13.3	2.4
11	Always bring to the public's attention that typhoid fever is transmitted by food.	63.9	36.1	0	0
12	Always advocate that the health status of workers should be evaluated before employment	63.9	32.5	3.6	0
13	Making it open to the populace that Salmonella is among foodborne pathogen	68.7	26.5	3.6	1.2
14	Always bring it to the notice of the Populace that HAV is among the food-borne pathogen	70.7	24.4	4.9	0
15	Once make it know that swollen cans may contain the microorganism, clostridium, Botulinum which causes botulism	71.1	21.7	6	1.2

*Source: Field survey, 2023*

**TABLE 4**  
**INDICATES SUMMARY OF TWO SAMPLE T-TESTS OF THE POSSIBLE LEVEL OF PERFORMANCE OF ENVIRONMENTAL PROTECTION AGENCY AND FOOD SAFETY PRACTICES BY FOOD HANDLERS**

	Agree +strongly agree	Disagree +strongly disagree
Mean value	94.657143	5.342857
t-value	32.362	
p-value	0	
df	12,	

### 3.3 Food safety practice by the food handler:

Food laws and regulations attempt to protect the health of consumers. These laws have been kept in place to guide food providers to ensure proper food handling and to ensure the serving of wholesome food to the general public [37, 38]. As regards educating and training food manufacturers and handlers on safe food handling procedures, Environmental health officers and the Environmental Protection Agency are all supportive. They also help in inspecting facilities where food is being cooked for compliance with current safety standards [38, 11]. From Table 6, it was established from the above results that the majority of the respondents (72.3%) confirmed that food handlers did not use gloves during the distribution of unpacked food, while only 27.7% confirmed they used gloves. This implies that food quality control which is deliberate efforts to check the controllable factors that either positively or negatively influence the finished products during food processing is not put into consideration by the food handlers and this finding is not consistent with Food Standards [39] which states that food handlers must have the skills and knowledge that they need to handle food safely as they carry out their work. The Study is also not in agreement with Murwira *et al.* [40], who reported on the Assessment of food handlers' compliance with personal hygiene practices in fast food outlets in Thohoyandou, South Africa. In relating food safety practices by food handlers in Table 6 with the question which says that food handlers cover their hair when distributing unwrapped food, 38.6% of the respondents agreed, but a large volume of respondents (61.4%) disagreed. This could be the result of the negligence of the environmental protection agency, and this implies that food safety is not considered and foods are generally prepared and sold under unhygienic conditions. The results

from the above also indicated that food handlers were not checking the shelf life of food at the time of delivery, and this was confirmed with the majority of respondents' responses (67.5%). This finding was in line with Rane [41] and Al Mamun [42]. The findings from this study also showed that food handlers properly cleaned the food storage area before storing new ones (51.8%). This implies that food handlers obey the principal role of food packaging, which is to protect food products from outside influences and distribution damage, maintain food safety and minimize environmental impact [43]. It has been established from this study that there was a significant statistical difference ( $p < 0.05$ ) in the response of respondents to food safety practices by food handlers.

**TABLE 6**  
**FOOD SAFETY PRACTICE BY FOOD HANDLER**

S/N	Questions	Percentage level of the response (%)	
		TRUE	FALSE
16	The producers/sellers of food normally use gloves during the distribution of unpackaged food	27.4	72.3
17	Covering the hair when distributing unwrapped food	38.6	61.4
18	Eating or drinking at the workplace	19.3	80.7
19	Always check the shelf life of food at the time of delivery	32.5	67.5
20	They properly clean the food storage area before storing new ones	51.8	48.2

*Source: Field survey, 2023*

**TABLE 7**  
**INDICATES SUMMARY OF TWO SAMPLE t-TESTS OF FOOD SAFETY PRACTICE BY FOOD HANDLER**

	TRUE	FALSE
Mean value	33.92	66.02
t-value	-4.1512	
p-value	0.003204	
df	8	

### 3.4 Possible factors that could affect the effectiveness of the environmental protect agency:

Table 8 below shows possible factors that could be responsible for the ineffectiveness of the Environmental Protection Agency and from this table, it indicated that out of the total number of respondents, 69.9%, 20.5%, 4.8%, and 4.8% agreed, strongly agreed, disagreed and strongly disagreed respectively to the fact that agency facing a challenge from the higher office could be a possible factor. The majority of the respondents (57.8% and 28.4%) disagreed and strongly agreed, respectively, while the remaining 14.5% and 19.3% agreed and strongly disagreed, respectively, to the fact that there are enough funds and allocations to carry out assigned responsibilities from the federal. This implies that the federal government is not funding the environmental agencies appropriately, and it is consistent with the findings of Akuu et al. [44] and Maji et al. [45], who maintained that regulatory bodies failed to perform their duties due to a lack of logistics and resources. The survey from the table below revealed that most of the respondents (49.4% and 39.8%) disagreed and strongly disagreed, whereas the remaining 0% and 10.8% strongly agreed and agreed, respectively, that Salaries and other welfare packages are paid as at when due. Table 8 showed that 73.5% and 22.9% of the total respondents agreed and strongly agreed, respectively, to the question of facing any challenge whenever they charged those who violated the rules of the agency, and the remaining 3.6% and 0% disagreed and strongly disagreed, respectively. Undue political interference from the federal government remains part of the possible factors affecting the effectiveness of environmental protection agencies [46] and Liu et al. [47]. This is also evident from this study as the majority (94.0%) of respondents agreed that there is undue political interference from the federal government in achieving the aims of the agency.

A very small number of the respondents, 3.6% and 1.2% disagreed, and strongly disagreed, respectively, that corruption is one of the factors influencing environmental protection agencies while most of the respondents (69.9% and 25.1%), agreed and strongly agreed. The result is in agreement with Ganda [48] who worked on the the influence of corruption on environmental sustainability in developing economies. The majority of the respondents from Table 8 (50.6% and 27.7%) agreed and disagreed

with whether religion plays a role in carrying out the activities of the agency whereas the remaining respondents 16.9% and 4.8% strongly agreed and strongly disagreed respectively, an implication that religion is not left out as regards the factors affecting the functionality of the environmental protection agency in Osun State. Indication from Table 8 revealed that very few numbers of the respondents (7.2% and 14.5%) strongly agreed and strongly disagreed respectively that environmental protection agencies at times do not consult the local people and traditional leaders for preferred activities before embarking on it while the majority of the respondents (54.2% and 24.1%) agreed and disagreed. The survey showed that the same number of respondents (1.2%) disagreed and strongly disagreed with the fact that the low educational level of many food business operators could be one of the factors responsible for the ineffectiveness of environmental protection agencies whereas the larger number of the respondents (66.3% and 31.3%) agreed and strongly agreed respectively and this is in line with findings of Subratty, Beecharry, and Chan sun (2004).

**TABLE 8**  
**POSSIBLE FACTORS THAT COULD AFFECT THE EFFECTIVENESS OF THE ENVIRONMENTAL PROTECTION AGENCY**

S.No.	Questions	Percentage level of the respondents (%)			
		Agree	Strongly agree	Disagree	Strongly disagree
21	Facing any challenge from the higher office	69.9	20.5	4.8	4.8
22	There are enough funds and allocations to carry out the assigned responsibilities from the federal level	14.5	28.4	57.8	19.3
23	Salaries and other welfare packages are paid as of when due.	10.8	0	49.4	39.8
24	Facing any challenge whenever they charged those who violated the rules of the agency	73.5	22.9	3.6	0
25	There is undue political interference from state and federal government in achieving the aims of the agency	69.9	24.1	3.6	2.4
26	Corruption is one of the factors influencing environmental protection agency	69.9	25.3	3.6	1.2
27	Religion plays a role in carrying out the activities of the agency	50.6	16.9	27.7	4.8
28	Environmental protection agencies at times do not consult the local people and traditional leaders for preferred activities before embarking on it	54.2	7.2	24.1	14.5
29	The low educational level of many food business operators	66.3	31.3	1.2	1.2

*Source: Survey field, 2023*

**TABLE 9**  
**INDICATES SUMMARY OF TWO SAMPLE T-TESTS OF POSSIBLE FACTORS THAT COULD AFFECT THE EFFECTIVENESS OF THE ENVIRONMENTAL PROTECTION AGENCY**

	Agree +strongly agree	Disagree +strongly disagree
Mean value	72.91111	27.06667
t-value	3.2121	
p-value	0.005	
df	16,	

### 3.5 Mean and mean ranking possible factors that affected the effectiveness of the environmental protection agency

Following the result from the mean ranking of the possible factors that could affect the effectiveness of the agency “ religion plays role in carrying out the activities of the agency is the least factor while the unpaid salary and other is the most factor affecting the effectiveness of the agency Table 10

**TABLE 10**  
**MEAN AND MEAN RANKING POSSIBLE FACTORS THAT AFFECTED THE EFFECTIVENESS OF THE ENVIRONMENT PROTECTION AGENCY**

S/ N	Questions	(1)	(2)
		Mean	Rank
30	There are enough funds and statutory allocations to carry out assigned responsibilities at the federal level	1.45	3
31	Your salaries and other welfare packages are paid as when due	2.82	2
32	Does your agency face any challenge whenever they charge those who violated the rules of the agency in court	3.18	1
33	There is undue political interference from the state and federal government in achieving the aims of the agency	0.53	8
34	Corruption is one of the factors influencing environmental protection agency	0.68	5
35	Religion plays a vital role in caring out the activities of the environmental protection agency strategy	0.61	7
36	The agency at times did not consult the local people and the traditional leaders for the preferred activities before embarking on it	0.1	9
37	The low educational level of many food business operators	1.17	4
38	Are you facing any challenges from the higher offices of the agency	0.58	6

*Source: Field survey, 2023*

## IV. CONCLUSION

In conclusion, this study is timely because it is inspired by the reality that food processing is a very sensitive area that affects the entire economy and the quality of food consumed by the Nigerian population determines their health. A healthy nation is a wealthy nation which means enforcement and supervisory powers of the regulatory agencies should be strengthened to cover food for local consumption since the majority of Osun State people are low-income earners and depend on food prepared or manufactured locally. The findings from this study indicated an assessment of the roles of environmental protection agencies in food processing. It was indicated from this study that, food safety practices by food handlers were ineffective and inadequate. The findings from this study also revealed that some factors hindered the effectiveness of environmental protection agencies. This study concluded that environmental protection agencies have important roles to play in food processing but some factor affect their effectiveness. It also concluded from this study that food is generally prepared and solid under unhygienic conditions.

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## CONFLICT OF INTEREST

The authors declare that they have no conflict of interest.

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