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Food Packaging: Challenges and Strategies for Improvement

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Abstract:

Getting food in good quality through effective delivery system to the target audience is a necessity. However, the desired quality of foods as they leave the point of production usually decline with time and this has raised series of packaging concerns. This work therefore sought to analyze the issues that bothered on food packaging especially the implications on food safety among others. It employed descriptive survey design. The population of the study comprised the 547 federal university academics in the Faculty of Agriculture in the South-Eastern Nigeria. A sample of 110 lecturers was drawn using purposive sampling technique. Four objectives, four research questions and four null hypotheses guided the study. The instrument for data collection was questionnaire. The reliability coefficient that was tested using the Cronbach Alpha method yielded 0.83 internal consistency. Data was analyzed using mean and standard deviation for research questions and z-test for the hypotheses. From the findings, it was revealed that food packaging has serious implications on food safety. Some challenges that affect food packaging include the rising cost of food, productivity, freshness, and sustainability. It was recommended that food safety and environmental protection should be the driving force behind food packaging to preserve human health.

Keywords: Food packaging, Improvement, Safety, Challenges, Sustainability, Environmental protection

INTRODUCTION

Food has been described as any substance which when absorbed into the body cells or an organism yields energy and materials for growth; repairs damaged tissues, and regulates body processes without harming the living organism [1]. In other words, food should by no means constitute harm and must be safeguarded from becoming hazardous if it must serve its purpose. Getting food in good quality through effective delivery system to the target audience is a necessity. However, the desired quality of foods as they leave the point of production usually

decline with time and this has raised series of packaging concerns. Many processes are involved in food industry. Among the most important processes is packaging. According to [2], food packaging lies at the very heart of the modern food industry. In addition, modern food systems could not function properly without packaging [3]. This is because it caters for the protection of the food from chemical, biological and physical alterations as well as enables containment, preparation for storage and transportation, and advertisement as it leaves the point of production to the point of consumption. [1]. Some of the roles of efficient food packaging have been highlighted to include: protecting the food product, improving food value, ensuring ventilation and temperature control, reducing damage in transportation and handling, appropriate portion sizes, information on product features, nutritional contents, uses, and expiry date; all lead to the attainment of optimal food security [4-6].

Food packaging encompasses the development of packages and packaging systems for foods especially in respect to the processing, preservation, distribution and marketing of a particular food as it gets to the final consumer. It also provides useful product information and determines the content size for pricing. The essence of packaging has made it one important process that cannot be overemphasized because it is almost impossible to think of more than a handful of foods that are sold in an unpackaged state.

Over the years, this important process has been done traditionally. However, the society has witnessed series of improvement in ensuring food safety over time especially with the advancement in science and technology. Without this improvement, it would be nearly impossible to have food to cater for the ever-growing human population. Human population is expected to reach close to 10 billion by 2050 (United Nations Population Fund [UNFPA], 2014 in [7]. According to [8] about one-third of annual global food production (approximately 1.3 billion tons and valued at $1 trillion) for human consumption is either wasted or lost. This substantial level of waste is as a result of the prevalent rudimentary harvesting, storage, processing, packaging, distribution, preservation, and consumption techniques in the food value chains [9]. Food wastage drains natural resources as well as poses serious negative environmental impacts.

The improvement of food package quality and design can make a positive difference in limiting food waste through sustainable material management practices. Food packaging continues to evolve with development and human society because ineffective packaging is capable of ruining long-term food security efforts while imposing socio-economic and environmental costs [9]. It therefore becomes more interesting to note that packaging for different foods cannot be made without a full knowledge of the nature of the food, nature of the available packaging materials, the characteristics of the distribution system and the required shelf life. Also noteworthy is the need for intimate knowledge of packaging requirements of various food groups including flesh foods, horticultural products, dairy products, cereal and snack foods as well as beverages [9].

STATEMENT OF PROBLEM

There are diverse, ready-to-eat foods, diet and drinks varying from one tribe and geographical locations to another, with different packaging material forms and methods adopted [9-10]. South-East is one of the six geopolitical zones in Nigeria. The region has for long felt the impact traditional methods of food handling. There are various traditional methods undertaken with a view to protect the food from spoilage, contamination and to attract consumers and mostly for containment [9]. Contamination is the unintended presence of harmful substances or microorganisms in food [11].

Traditionally, food products are packaged with leaves, animal skins, newspaper, cement paper bags, jute bags, basket, bamboo, cane and reed basket, and pottery, discarded bottles and jars, old stock of paper prints, broad leaves, empty fluted gourds, fruit shell, coconut shells, maize-sheath, glass-sided boxes, jute sacks, poly sacks, polyethylene bags, wineskins (bota bags), wooden boxes, pottery, vases, ceramic amphorae, barrels of wood, etc. [10],[12-14]. Regrettably, these traditional materials offer little or no protection to perishable foods, and are not considered very effective for efficient handling and transportation of food products [15][16]. According to [13], a food package should be resistant to both internal and external hazards, as well as possessing the ability to effectively guarantee resistance to gas, oxygen, water and odours. Hence, there have been significant challenges in the trade and marketing of the products using the traditional packaging system.

There is therefore the need for packaging innovations founded on better hygienic principles for locally produced foods to enable them stand out in megastores in many urban settlements. There has also been growing demand for effective packaging to enable the reach of local food products to be extended to more consumers through exportation. If the packaging innovations become inclusive, there will be capability of causing an expansion in local farming and food processing, as well as creating millions of new jobs. However, this may turn an urban trend which may be farfetched from what is obtainable in rural centres where the age-long tradition of selling poorly packaged food in open-air markets persists [9]. This is the major challenge facing the Nigerian agriculture and food commodity industries. Hence, it is upon this premise that this paper becomes imperative not just to review the challenges but also amidst other interests, look for applicable strategies for improvement of sustainable packaging.

AIM AND OBJECTIVES

There were three objectives that guided the study. They are to:

1. Ascertain how effective packaging affects consumers' access to food products in the South-Eastern zone of Nigeria.

2. Determine the roles of food packaging that guarantee food safety in the South-Eastern zone of Nigeria.

3. Determine the challenges that hinder effective food packaging in the South-Eastern zone of Nigeria.

4. Proffer applicable strategies for improvement of sustainable food packaging.

RESEARCH QUESTIONS

This study was guided by the following questions:

1. How does effective packaging affect consumers' access to food products in the South-Eastern zone of Nigeria?

2. What are the roles of food packaging that guarantee food safety in the South-Eastern zone of Nigeria?

3. What challenges hinder effective food packaging in the South-Eastern zone of Nigeria?

4. What are the applicable strategies for improvement of sustainable food packaging?

HYPOTHESES

Ho1: The mean response scores of male and female academic staff on the effect of effective packaging on consumers' access to food products in the South-Eastern zone of Nigeria do not differ significantly.

Ho2: There is no significant difference on the mean response scores of male and female academic staff on the roles of food packaging that guarantee food safety in the South-Eastern zone of Nigeria.

Ho3: The means response scores of male and female academic staff on the challenges that hinder effective food packaging in the South-Eastern zone of Nigeria do not differ significantly.

Ho4: There is no significant difference on the mean response scores of male and female academic staff on the applicable strategies for improvement of sustainable food packaging.

LITERATURE REVIEW

Food packaging

For a more in-depth understanding, an attempt has been made to distinguish between the words "package," "packing, and "packaging." A package is a physical entity that contains the product. Packing is the enclosing of an individual item (or several items) in a package or container. From the above, packaging is the discipline saddled with making and using suitable package for

packing a product to preserve it in the best condition to be received by the final consumer or user. Food packaging aims to protect, secure, sell, and keep products from the initial point to the point of consumption and prolong the shelf life of products [17]. Food packaging is defined as enclosing food to protect it from tampering or contamination from physical, chemical, and biological sources, with active packaging being the most common packaging system used for preserving food products [18]. It is an integrated process of enclosing or protecting a food product because of the multi-disciplinary and industrial requirements [19],[20]. This process ensures that commercially produced foods or raw food materials can be safely distributed to minimize loss as well as wastage [21],[22].

Furthermore, the now-defunct Packaging Institute International [23] defined packaging as the enclosure of products, items or packages in a wrapped pouch, bag, box, cup, tray, can, tube, bottle or other container form to perform one or more of the following functions: containment, protection, preservation, communication, utility and performance. If the device or container performed one or more of these functions, it was considered a package. Food packaging is not just getting food enclosed with anything; it involves technical activities including machinery design, graphic design, package development, package manufacture, shelf life testing, distribution, and marketing. Food packaging is indeed, a broad area in food industry involving the collective efforts of packaging technologists, scientists and engineers, packaging material suppliers, packaging converters, packaging machinery manufacturers, food processors, food retailers, and regulatory agencies [24].

There are various levels of packaging: primary, secondary, tertiary, and quarternary packaging [2] though this paper will not dwell much on them. Primary packaging is the main material in direct contact with the food that is being processed thereby protecting the food. In secondary packaging, two or more primary packages are combined into a single pack or box. Tertiary packaging combines two or more secondary packages into one pallet.

Types of packaging materials

There are different packaging needs for different types of food. The kind of packaging applied varies according to the product characteristics, the level of protection required, the intended shelf-life, the target market, the distribution and the sales circuit [25]. There should be consideration for cost and environmental degradation before selecting a particular food package. Other factors include: the food item, the process of production, accessibility and sustainability of the material, the shape, size, colour, texture, stacking options, and recyclability.

Modern packaging process can encompass more than one type of material to explore and combine the functional or aesthetic properties of each one [26]. However, any material chosen will be considered excellent if it has the capability to withstand barriers against temperature, moisture, dust and other foreign matter not to harm the desired products [17]. Though the

selection of appropriate material is not the only factor that guarantees the product's shelf-life, the conditions under which the food is stored are equally important [26]. Examples of food packaging materials include: boxes, bags, cans, aseptic processing, glass, cartons, flexible packaging, pallets, trays, wrappers, ceramics, metals, paper and board, plastics, wax, wood, textile and corks, and pouches. This paper will not go into the details of each of these as some other relevant literatures have done justice to them. [Refer to [2],[9],[17],[25-37].

Effective packaging and consumers' access to food

Packaging is considered effective if it is able to sell itself. Selling itself here implies being able to fulfill its purpose of safeguarding the food in best possible state until it gets to the consumer. Effective packaging offers proper food safety knowledge during food handling and preparation **[**38]. Usually, package is the face of a product that the consumers have to experience before making a purchase [26]. Essentially, the package should present good aesthetics [25] to convince the consumers to buy the product. Therefore, packaging can drive sales in a competitive market, and also enhance the image or differentiate one product from others [39].

Initially, packaging was primarily focused on technical functions such as protection, containing, and logistics. However, this has improved recently to influence the attraction of consumers to a brand, boost its image, promote the products and affect consumers' perceptions of a product thus improving the relationship between packaging and consumers' buying behaviour to a higher extent [14],[40-42].

Many studies have been carried out to investigate consumer buying behaviors, and they all agree that packaging affects customers buying behaviour [14],[42],[43]. According to [44], some packaging barriers lead to consumers' dissatisfaction in Tanzania. In a study conducted by [45], the results showed that majority of the participants 94.54% strongly agreed that packaging influenced their purchase decisions. Only 5.47% of the respondents admitted to no influence at all for packaging. Also, the findings showed that the majority (93%) rated packaging as important when choosing a food product. Customers feel that effective food packaging appeals to them regardless of the age, protects the food from damage or contamination, helps them to easily identify the product they are looking for, and trace the location of food item. Also, packages made of high quality materials are more preferred than low quality ones [46]. For [14], the quality and color of the packaging materials were noted to impact consumer behaviour during the buying process.

An effective packaging for a brand should be sustainable; environmentally focused to help their public image. That is what that will make it stand up to competition when costumers are trying to figure out which product to purchase from a retail store. A package standing on the shelf is a critical factor in the decision-making process [14] because it communicates to consumers [47] and ensures that their response is favorable. The package provides a concise, clear and relevant

message that will attract the right audience. A well-placed label on the packaging can provide the extra little push to win them to your side. This is supported by [14] whose study revealed that the label of the package is important in the decision buying process. Although, label use is affected by education, gender, age and time pressure [48],[49].

Packaging brings essential information about the product, such as a list of ingredients, nutritional composition, preparation instructions, brand identification, and prices [26]. On the other hand, poor packaging as reported by [50] repels customers, leads to loss in business, and failure for products to compete and meet the international standards. In addition, poor packaging results have been observed with some conditions such as odours, shocks, dust, temperature, physical damage, light, microorganisms, and humidity [17]. The various characteristics of effective packaging are briefly examined below.

1. Reduced weight and inconveniency.

2. Security of the food product.

3. Adaptability

4. Dependability

5. Durability

6. Aesthetics [25]

7. Product differentiation [39].

Packaging environment

Knowledge of the functions of packaging and the environments where it has to perform will lead to the optimization of package design and the development of real, cost-effective packaging. Ignoring this will result in poorly designed packages, increased costs, consumer complaints and even avoidance or rejection of the product by the customer. Varying aspects of the packaged product life cycle from identification of the product, through purchase and use of the product to the separation and disposal of the package, are all considered and executed within the environment. The identified three packaging environments [2] can be briefly considered below:

1. **Physical environment:** This environment can facilitate physical damage on the product. Such damage can come from shocks from drops, falls and bumps, vibrations arising from transportation on road, rail, sea and air and compression and crushing damage arising from stacking during transportation or storage in warehouses, retail outlets and the home.

2. **Ambient environment:** This is the environment around the package which can pose significant hazard to the product. Examples include gases (particularly O2), water and water

vapor, light (particularly Ultraviolet radiation) and temperature, as well as microorganisms (bacteria, fungi, molds, yeasts and viruses) and macro-organisms (rodents, insects, mites and birds) that are ubiquitous in many warehouses and retail outlets. In the ambient environment, exhaust fumes from automobiles and dust and dirt can also contaminate the product if there is no effective barrier against them.

3. **Human environment:** Here, the package interacts with people hence, it is required that based on this environment packages should be designed considering the knowledge of the variability of consumers' capabilities including vision, strength, weakness, dexterity, memory and cognitive behavior. Consideration should also be made on the knowledge of the results of human activity such as liability, litigation, legislation and regulation. Package in human environment should be able to communicate important messages to be clearly received by consumers to avoid abuse.

Roles of food packaging

Packaging plays remarkable roles to ensure the products maintains the desired quality and effectiveness throughout the supply chain [17]. Packaging is considered as a potential tool to mitigate the effective logistics and supply chain [51]. Generally, there are basically four functions of packaging. These are always aiming at containment, protection, communication, and convenience [2],[52-54].

1. **Containment:** This function of packaging guards against product loss and pollution. It ensures that products are put together before they can be moved from one place to another. Many products would have scattered in the environment as they are moved from place to another. Hence, packaging ensures that the food contents do not leak out from around the closures and seals of their packages to litter the environment. This also makes room for accurate measurements and pricing of products. Also, according to the [55] the consideration for durability of the package ensures that food has to survive transport from the food processing facility to the supermarket to the home of the consumer.

2. **Protection:** To retain safety and quality, food packaging is essential in protecting food from environmental contamination and other influences [56] such as from water, water vapor, gases, odors, microorganisms, dust, shocks, vibrations and compressive forces. The package should be able to reasonably protect the food from biological agents such as rats, insects, and microbes. It should ensure that the product is protected without affecting its flavor. Once the integrity of the package is breached, the product is no longer preserved. Packaging also protects or conserves much of the energy expended during the production and processing of the product. If the protective function of packaging is removed, the product is prone to attacks which will eventually lead to waste or spoilage. Hence, though packaging adds additional cost to the actual production cost, it has been considered as a necessary evil.

3. **Convenience**: The demand for a wide variety of food and drink at outdoor functions such as sports events, and increased leisure time, has created a demand for greater convenience in household products [2]. Thus, packaging plays an important role in meeting the demands of consumers for convenience. Apportionment function of packaging for convenience entails reducing the output from industrial production to a manageable, desirable "consumer" size. This helps to promote sales as consumers will be able to afford the products at smaller quantities and reduced price. The convenience function also ensures that a product is resealable to retain the quality and to avoid deteriorating until it is used up if it was not entirely consumed when the package was first opened. Consumer convenience considers making the product easy to hold, open and pour as appropriate.

4. **Communication:** Packaging should be clear, concise and unique enough to communicate a comprehensible message to the consumers. The modern methods of consumer marketing would fail were it not for the messages communicated by the package. The ability of consumers to instantly recognize products through distinctive shapes, branding and labeling enables supermarkets to function on a self-service basis [2]. Smart labels, symbols, Universal Product Code (UPC) and visual clues are provided by the graphics and the distinctive shapes of the packaging to help consumers make timely purchasing decisions especially in supermarkets and warehouses.

Food packaging for food safety

Food safety has become a major issue of public concern as safe food is one of the most important human rights and improvement of human health is of primary importance [57]. A safe food is such that would not constitute health hazard to consumers in any way from its access to utility. Food safety therefore entails the measures of ensuring that food is free from contamination that will constitute health hazard to the consumer. Food safety is the process of handling, preparation and storage of food in ways that prevent food-borne infection/illness such as Staphylococcus, Hepatitis A, E. coli, Shigella, and Salmonella [11]. As noted by [57], food safety is the degree of confidence that food will not cause sickness or harm to the consumer when it is prepared, served and eaten according to its intended use. Food safety can at times, be a cause of concern because some packaging materials such as certain types of plastic, polythenes, and styrofoam can release toxins when they are heated hence become dangerous to consumers [58]. Considerable proportion of food borne diseases is owing to unsafe food-handling practices [57].

The packaging materials are mostly always in direct contact with the foodstuff. For example, the beverage cartons have a laminated plastic layer in direct contact with the food. Packaging materials which are irradiated (along with food) can transfer unsafe substances into the food [24]. Therefore, it is essential to understand the chemical composition of the packaging material and the levels at which these compounds can partition into foodstuffs, a process that is known as migration [59]. If a package is not designed in such a way that it can effectively protect the food,

it will turn to be a toxic generator and source of contamination to the food. Sometimes, for safety purposes, a package is often labeled with information such as amount of the contents, ingredients, nutritional value, cooking directions, and shelf life. Relevant authority such as Federal Ministry of Health/FMoEnv, National Agency for Food and Drug Administration and Control (NAFDAC), Standards Organization of Nigeria (SON) and National Codex Committee should certify the packaging materials individually by subjecting them to rigorous testing protocols for effective consumers' protection. Therefore, those involved in the design, development, production or use of packaging and packaging materials must be aware of the environmental demands now placed on them. These demands arise as a consequence of both the materials and processes that are used, and the packaging that is produced, utilized and recovered or discarded [2]. The package needs to be designed and selected in such a manner that there are no adverse interactions between it and the food [55]. Also, those who handle food, whether as part of their job or cooking at home, should always apply the proper food safety principles. Potential food hazards exist in a food handling environment, many of which carry with them serious consequences.

Sustainable food packaging

Sustainable packaging is the concept of sourcing, developing, and using packaging solutions that have minimal environmental impact and footprint [60]. It is an Eco-friendly or Earth-friendly initiative aimed at minimizing the further depletion of natural resources, waste and pollution that end up in our landfills and oceans. Its target is on the preservation of the environment. The materials for the production of a sustainable package should be sourced from what the environment can comfortably and renewably afford without being unduly degraded. The steps to implement sustainable packaging have been noted to involve following: (1)start with changing a part at once, (2) order product samples, (3) adjust your pricing, and (4) order small volumes.

Putting sustainability in mind can help in attracting, getting and retaining more customers and boosting loyalty as customers are increasingly considering sustainability when choosing which brands to do business with. According to Forbes [61], a brand that aligns itself for the good of the environment is something that the world wants to hear about. They always go where they get it and as they need it especially based on their economic value. Customers are also becoming more comfortable with the idea of reducing packaging materials in order to minimize waste and facilitate storage efficiency. Shipping these smaller packages will help customers to get it at a lower cost. For packaging to be considered sustainable, the Sustainable Packaging Coalition (SPC) cited in [60] has offered 8 criteria to be met as follows; is it:

1. Beneficial, safe & healthy for individuals and communities throughout its lifecycle?
2. Able to meet market criteria for performance and cost?
3. Sourced, manufactured, transported, and recycled using renewable energy?

4. Optimizing the use of renewable or recycled source materials?
5. Manufactured using clean production technologies and best practices?
6. Made from healthy materials throughout the life cycle?
7. Physically designed to optimize materials and energy?
8. Effectively recovered and utilized in biological and/or industrial closed-loop cycles?

Challenges of effective food packaging in Nigeria

This may be better discussed by analyzing each packaging type but since the major focus of this work was not on assessing in details each of them rather more on the impact, a general perspective will be considered. Among the major challenges of food packaging are issues of poor infrastructure, unfavourable regulations and absence of sustainable policies, competitive pressures among stakeholders, consumer behaviour and needs, stakeholder relationships, inferior technology, reduced resource pool for sourcing new packaging materials, lack of research and collaboration, poor investments in enhancing traditional packaging materials to withstand foreign competition, population growth, lack of dynamic markets, and increasing demands Also, internal barriers to packaging are inadequate expertise, poor infrastructure and technology with the government management support, poor business models and financial resource regulations [8],[17],[62-64].

Also, lack of consideration for environmental protection, lack of technical support and training as a result of poor investments in research and development remain a major contributor of packaging challenges. Financial resources has been identified as the first external factor mainly because they determine the amount and quality of raw material to be utilized in the food processing and also the kind of technology to be procured for processing and packaging [65].

Other food packaging concerns include: insufficient knowledge of food materials, the necessary packaging requirements for a particular or different foods; limited choice of packaging materials and poor management of package processing cost. These and many more are the reasons that traditional packaging materials cannot keep food products in good and healthy conditions for a long time [64]

Practical strategies for improving sustainable packaging

If the challenges could be addressed, there is hope for improving food quality and safety, increase consumer trust and acceptance of new packaging technologies, and reduce the harmful impacts of packaging waste and food loss on the environment [56].

Food safety education will help to improve the practice of sustainable packaging. Educating the customers on the best general ways to recycle and dispose of your packaging materials. Clearly

labeling reusable or recyclable packaging on the product package can go a long way. Some other strategies as noted by [60] include:

i. **Ship in a smaller package:** This means using fewer filler materials and smaller boxes, bags, and containers for your products to help enhance sustainability and lower the shipping costs. This can be done by playing around with the size and positioning of your products and see if they can fit in smaller packages.

ii. **Recycled packaging materials:** Recycled packaging is a great way to extend the life of previously used materials. A common example of recycled packaging is the paperboard cardboard made of lightweight, easily cut and formed used papers beaten into pulp. This makes it ideal for shipping boxes. Containers and mailers that are made from previously used plastic materials such as single-use bags and bottles can be recycled and put back into circulation in the form of packaging supplies.

iii. **Plant-based packaging:** Plant-based options are rapidly making inroads into the world of product packaging. As its name suggests, everything from mushrooms and seaweed to corn and food waste. Plant based packaging is mostly biodegradable.

iv. **Compostable and biodegradable plastic alternatives:** Compostable packaging is made out of materials that can be composted at home and commercially. They're often made from plant-based polymer that can break down in compost. Depending on the quality and materials, a commercial compost facility can break these packages down in 90 days, while domestic compost conditions can do it in 180 days.

v. **Avoid over-packaging throughout the supply chain:** Products are bagged, baled, or bundled before they get to you, often using additional packaging. Optimizing how merchandise moves across the chain can help minimize additional materials—and the waste that comes with them. Therefore, it is better to consolidate shipments using fewer packaging materials and ensuring supply chain partners use sustainable materials throughout the process.

METHODOLOGY

This study employed descriptive survey design. This is to help the researcher to obtain information that describes the existing phenomena by asking individuals about their perceptions, attitudes, and values [14],[66]. The population of the study comprised the 547 federal university academics in the Faculty of Agriculture in the South-Eastern Nigeria. South East is the predominantly Igbo language speaking region of Nigeria that is bounded by Cameroon eastwards and the Atlantic Ocean southwards. The region currently has five states which include: Abia, Anambra, Ebonyi, Enugu and Imo state respectively. Each of these states has one federal owned university making it a total of five universities from where the population of the study emerged

(Michael Okpara University of Agriculture, Umudike, Nnamdi Azikiwe University, Awka, Alex Ekwueme University, Ndufu-Alike, University of Nigeria, Nsukka, and Federal University of Technology, Owerri, in line with the order of the states listed above). A sample of 110 lecturers (61 females and 49 males) was drawn from two universities using purposive sampling technique. Four objectives, four research questions and four null hypotheses guided the study. The instrument for data collection was a modified four-point likert questionnaire. The reliability coefficient that was tested using the Cronbach Alpha method yielded 0.83 internal consistency. The data collected were analyzed using mean and standard deviation for research questions and z-test for the hypotheses. Nominal values were assigned to the responses as follows: Strongly Agreed (4), Agreed (3), Disagreed (2), and Strongly Disagreed (1). Hence, the cut-off point was calculated as follows: (4+3+2+1)/4 = 10/4 = 2.5. So, the mean of 2.5 and above were accepted whereas those below the cut of point were rejected.

DATA ANALYSIS AND PRESENTATION

Research question one: How does effective packaging affect consumers' access to food products in the South-Eastern zone of Nigeria?

Table 1.1: Responses generated on the effect of effective packaging on consumers' access to food products in the South-Eastern zone of Nigeria

S/N	ITEM DESCRIPTION	MEAN	STD DEV	REMARK
1	Effective packaging attracts me to a product or brand	3.27	0.84	Accepted
2	Packaging image and colour help me differentiate brands	3.05	0.85	Accepted
3	Attractive packaging materials promotes my choice of the food product	3.39	0.83	Accepted
4	Quality packaging materials makes me develop positive attitudes towards the product buying	3.11	0.95	Accepted
5	The label on a product's package offers me food safety knowledge during food handling and preparation thereby influencing my decision in buying process	3.33	0.89	Accepted
	Grand mean	**3.23**	**0.87**	**Accepted**

The Table 1.1 above showed the responses generated on the effect of effective packaging on consumers' access to food products in the South-Eastern zone of Nigeria. Based on the total mean score of 3.23, it could be stated that they generally agreed that effective packaging has a positive impact on consumers' access to food products in the area of the study. Their responses showed that effective packaging can attract customers to a product, help them differentiate

between brands, promote choice of food products, and help them develop positive attitude towards product buying. Also, mean score (3.33) of item 5 showed that a product's label offers safety knowledge during food handling and preparation and therefore helps to influence decision in buying process.

Research question two: What are the roles of food packaging that guarantee food safety in the South-Eastern zone of Nigeria?

Table 2.1: Responses generated on the roles of food packaging that guarantee food safety in the South-Eastern zone of Nigeria

S/N	ITEM DESCRIPTION	MEAN	STD DEV	REMARK
6	Packaging safeguards the food in best possible state until it gets to the consumer	3.23	0.74	Accepted
7	Packaging communicates a clear, concise, unique and comprehensible message to the consumers.	3.3	0.81	Accepted
8	Packaging guards against product loss, food contents leakage and pollution.	3.22	0.84	Accepted
9	Packaging ensures that food is not contaminated	3.57	0.64	Accepted
10	Packaging meets the demands of consumers for convenience which prevents deterioration of food	3.55	0.59	Accepted
	Grand mean	**3.37**	**0.724**	**Accepted**

Table 2.1 above showed the responses generated on the roles of food packaging that guarantee food safety in the South-Eastern zone of Nigeria. As indicated by the total mean score of 3.37, it could be concluded that packaging play important role to guarantee food safety. As shown, it ensures that food gets to the consumer in best possible state. It communicates the right message to the consumers. It guards against product loss, food contents leakage and pollution. Items 9-10 with mean scores 3.57 and 3.55 respectively, support that packaging prevents food contamination and meets the demands for convenience by the consumers.

Research question three: What challenges hinder effective food packaging in the South-Eastern zone of Nigeria?

Table 3.1: Responses generated on the challenges that hinder effective food packaging in the South-Eastern zone of Nigeria

S/N	ITEM DESCRIPTION	MEAN	STD DEV	REMARK
11	Lack of financial resources to procure desired amount and quality of raw materials and technologies needed	3.37	0.59	Accepted
12	Poor knowledge of consumer behaviour	3.16	0.80	Accepted

13	Lack of research for sound knowledge of the packaging materials	3.34	0.60	Accepted
14	Insufficient knowledge of food materials	3.06	0.79	Accepted
15	Inadequate expertise	3.37	0.80	Accepted
	Grand mean	**3.26**	**0.72**	**Accepted**

Table 3.1 above showed the responses generated on the challenges that hinder effective food packaging in the South-Eastern zone of Nigeria. From the results, the total mean score of (3.26) showed that the various challenges highlighted among others were agreed to constitute serious threats to effective food packaging in the South-Eastern zone of Nigeria.

Research question four: What are the applicable strategies for improvement of sustainable food packaging?

Table 4.1: Responses generated on the applicable strategies for improvement of sustainable food packaging

S/N	ITEM DESCRIPTION	MEAN	STD DEV	REMARK
16	Everything should not be changed at once but sample your packaging options to inspect the quality as well as assess the reactions of customers	3.17	0.60	Accepted
17	Ensure the concept of sustainability is embedded on the product to help ensure the environment is safe.	3.42	0.67	Accepted
18	Involve only manufacturing partners with sustainable practices	3.01	0.96	Accepted
19	Use compostable and biodegradable alternatives for packaging designs	3.15	0.73	Accepted
20	Consider packaging from recyclable materials to enable adjustment in price	3.32	0.63	Accepted
	Grand mean	**3.21**	**0.718**	**Accepted**

Table 4.1 above showed the responses generated on the applicable strategies for improvement of sustainable food packaging. The results showed that sustainable packaging could be achieved by selective changing at a time thereby sampling your packaging options to inspect the quality as well as assessing the reactions of customers. Items 17 showed that ensuring the concept of sustainability is embedded on the product would help to ensure the environment is safe. Item 18 agreed that involving only manufacturing partners with sustainable practice can be of help. Items 19 and 20 agreed to the use of compostable and biodegradable alternatives for packaging designs and packaging from recyclable materials to enable adjustment in price, respectively.

TEXT FOR HYPOTHESIS

Ho1: The means response scores of male and female academic staff on the effect of effective packaging on consumers' access to food products in the South-Eastern zone of Nigeria do not differ significantly.

Table 1.2: Summary of z-test on the means response scores of male and female academic staff on the effect of effective packaging on consumers' access to food products in the South-Eastern zone of Nigeria.

Category	N	Mean	SD	Df	z.cal	z.crit	Decision
Male	49	16.4	2.09				
				108	1.482	1.96	accepted
Female	61	15.9	1.66				

Data presented on table 1 shows that the z-calculated value of 1.482 is less than z-critical value of 1.96 with a degree of freedom 108. Therefore, the null hypothesis was accepted.

Ho2: There is no significant difference on the mean response scores of male and female academic staff on the roles of food packaging that guarantee food safety in the South-Eastern zone of Nigeria.

Table 2.2: Summary of z-test on the mean response scores of male and female academic staff on the roles of food packaging that guarantee food safety in the South-Eastern zone of Nigeria.

Category	N	Mean	SD	Df	z.cal	z.crit	Decision
Male	49	16.9	1.86				
				108	0.421	1.96	accepted
Female	61	16.8	1.51				

Data presented on table 1 shows that the z-calculated value of 0.421 is less than z-critical value of 1.96 with a degree of freedom 108. Therefore, the null hypothesis was accepted.

Ho3: The means response scores of male and female academic staff on the challenges that hinder effective food packaging in the South-Eastern zone of Nigeria do not differ significantly.

Table 3.2: Summary of z-test on the means response scores of male and female academic staff on the challenges that hinder effective food packaging in the South-Eastern zone of Nigeria.

Category	N	Mean	SD	Df	z.cal	z.crit	Decision
Male	49	16.6	1.32				
				108	2.11	1.96	Rejected
Female	61	16.0	1.67				

Data presented on table 1 shows that the z-calculated value of 2.11 is greater than z-critical value of 1.96 with a degree of freedom 108. Therefore, the null hypothesis was rejected.

Ho4: There is no significant difference on the mean response scores of male and female academic staff on the applicable strategies for improvement of sustainable food packaging.

Table 4.2: Summary of z-test on the means response scores of male and female academic staff on the on the applicable strategies for improvement of sustainable food packaging.

Category	N	Mean	SD	Df	z.cal	z.crit	Decision
Male	49	16.6	1.82				
				108	3.12	1.96	Rejected
Female	61	15.6	1.38				

Data presented on table 1 shows that the z-calculated value of 3.12 is greater than z-critical value of 1.96 with a degree of freedom 108. Therefore, the null hypothesis was rejected.

DISCUSSION OF FINDINGS

Findings of research question one showed a total mean score of 3.23 which was clear evidence that it was generally agreed that effective packaging has a positive impact on consumers' access to food products in the South-Eastern zone of Nigeria. Based on the result, it could be stated that they accepted that effective packaging can attract customers to a product, help them differentiate between brands [39], promote choice of food products, and help them develop positive attitude towards product buying. Also, the finding showed that a product's label offers safety knowledge during food handling and preparation and therefore helps to influence decision in buying process. These were in line with [14],[40-42].

Based on the test result z-cal (1.48) < z-crit. (1.96) and degree of freedom (108) presented on table 1.2, the null hypothesis stated was accepted. This showed that mean response scores of male and female academic staff on the effect of effective packaging on consumers' access to food products in the South-Eastern zone of Nigeria did not differ significantly.

Research question two as shown in table 2 showed the academics' response on the roles of food packaging that guarantee food safety in the South-Eastern zone of Nigeria. The grand mean of 3.37 and standard deviation of 0.724 showed that there was a general agreement that packaging safeguards the food in best possible state until it gets to the consumer [17],[55]. Packaging communicates a clear, concise, unique and comprehensible message to the consumers. Packaging guards against product loss, food contents leakage and pollution. Packaging ensures that food is not contaminated. It also showed that food packaging meets the demands of consumers for convenience which prevents deterioration of food. These were in agreement with [2],[11],[52-54],[56].

As presented on table 2.2, the test result of the null hypothesis showed that the z-calculated value of 0.421 is less than z-critical value of 1.96 with a degree of freedom 108. Therefore, the null hypothesis was accepted. This meant that the respondents generally believed that food packaging guarantee food safety in the South-Eastern zone of Nigeria. Their responses did not differ significantly. Research question three showed responses generated on the challenges that hinder effective food packaging in the South-Eastern zone of Nigeria. It had a grand mean score of 3.26 and standard deviation of 0.72. This showed that the respondents accepted all the factors presented as challenges that hinder effective food packaging. It could then be stated that lack of financial resources to procure desired amount and quality of raw materials and technologies needed [65] was a major problem. Poor knowledge of consumer behaviour, lack of research for sound knowledge of the packaging materials and insufficient knowledge of food materials were all serious threats to packaging. The finding also revealed that expertise required for effective packaging was inadequate. These were supported by the positions of [8],[17],[62-64].

Based on the test result as presented on table 3.2, the z-calculated value of 2.11 is greater than z-critical value of 1.96 with a degree of freedom 108. This means that the null hypothesis which says that there is no significant difference on the mean response scores of male and female academic staff on the challenges that hinder effective food packaging in the South-Eastern zone of Nigeria was not significant. Hence, it was rejected. In other words, there was significant difference in the mean response scores of the respondents.

Research question four as shown in table 4.2 showed the responses generated on the applicable strategies for improvement of sustainable food packaging in Nigeria. The grand mean of 3.21 and standard deviation of 0.718. In other words, the academics generally accepted that the strategies highlighted could be applicable for the improvement of food packaging. Hence, selectively changing at a time can provide more sampling packaging options as well as help to assess the reactions of customers. The concept of sustainability embedded on the product would help to ensure the environment is safe. Involving only manufacturing partners with sustainable practice can be of help. Also, the use of compostable and biodegradable alternatives for packaging designs, and packaging from recyclable materials to enable adjustment in price were accepted. These were all supported by [56],[60]

It was noted from the test result presented on table 4.2 that the z-calculated value of 3.12 is greater than z-critical value of 1.96 with a degree of freedom 108. Therefore, the null hypothesis which says that there is no significant difference on the mean response scores of male and female academic staff on the applicable strategies for improvement of sustainable food packaging was not significant. Hence, it was rejected.

CONCLUSION

This study brought us to the territory of food packaging, exploring the effect of effective packaging on consumers' access to food products, the roles of effective packaging that guarantee food safety, the various challenges that hinder effective food packaging and also the practical ways to improve sustainable food packaging. The study also revealed that food packaging is a critical issue in modern food industry. Therefore, building support around it will ensure that food products retain their shelf life and get to the final consumers in good state. This will ensure good health to both man and the environment.

RCOMMENDATION

Based on the findings, the following were recommended:

1. Food industries should consider selective changing at a time, sampling their packaging options to inspect the quality as well as assessing the reactions of customers to help them transition well into the modern packaging standard.

2. The concept of sustainability should be embedded on the product to ensure the environment is safe.

3. Packaging industries should involve only manufacturing partners with sustainable practice.

4. Government should enforce policies and regulations to ensure that packaging materials are tested and certified to promote food safety.

The use of compostable and biodegradable alternatives for packaging designs should be promoted.

Reference:

- G. Idodo-Umeh. Idodo-Umeh collegebiology. Idodo-Umeh Publishers Limited. 2011
- G. L. Robertson. Food packaging and sustainability. 2012. Retrieved from https://www.taylorfrancis.com/chapters/mono/10.1201/9781439894071-6/overview-food-packaging-
- W. M Macena, R. Carvalho, L. P. Cruz-Lopes, and R. P. F Guiné. Plastic foodpackaging: perceptions and attitudes of Portuguese consumers about environmentalimpact and recycling. sustainability. 2021, 13, 9953. https://doi.org/10.3390/su13179953
- S. Kane. Addressing the Future of Packaging Industries. Daily independence. June 23rd 2014. Available on www.dailyindependencenig.com
- K. Verghese, H. Lewis, S. Lockery, and H. Williams. Packaging’s role in minimizing food loss and waste across the supply chain. Packaging Technol. Sci., vol 28, pp 603–620, 2015 DOI: 10.1002/pts.2127.

- K. Keating. Reducing food waste through best practices in sustainable packaging design. 2017. Avalable online: http://www.pkgbranding.com/blog/reducing-food-waste-throughbest-practices-in-sustainable-packaging-design
- A. A. Elmi. Food security in the Arab Gulf Cooperation Council States. Springer International Publishing AG 89-114, 2017
- FAO: Food and Agricultural Organization. SAVE FOOD: Global initiative on foodloss and wastereduction. 2018. Available online: http://www.fao.org/savefood/ resources/keyfindings/en/
- S. E. Evivie, M. C. Ogwu, P. A. Ebabhamiegbebho, E. S. Abel, J. O. Imaren, and J. O. Igene. Packaging and the Nigerian food industry: Challenges and opportunities. In C.A. Ogunlade, Ph.D, K.M. Adeleke & M.T. Oladejo, Ph.D (Eds.). Food, technology and culture in Africa. Reamsworth Publishing, 2021.
- B. A. Adejumo, and F. A. Ola. The appraisal of localfoodpackagingmaterials in Nigeria. Cont. J. Eng. Sci., Vol3, pp 13 – 20, 2008.
- S. Olanrewaju. (2022): Basics of food safety and hygiene. 2022. Retrieved from https://oer.unimed.ng/LECTURE%20NOTES/1/1/SUNDAY-OLANREWAJU-Basics-of-food-and-HygieneOER1037206.pdf
- O. W. Oladepo, K. A. Taiwo, and M. O. Ilori. Environmental policy implications of packaging waste disposal practices in Nigerian food sector. 2015.
- S. O. Sarpong. Exploring the concept of standout in structural packaging-challenges and prospects in Ghana, Department of Communication Design in the Faculty of Art, Master of Communication Design thesis, Kwame Nkrumah University of Science and Technology. 136p. 2015. Available online; http://ir.knust.edu.gh/bitstream/123456789/6907/3/SAMUEL%20
- J. Lomayani. The role of packaging in consumer buying behavior: A case of selected small-scale entrepreneurs in arusha city. British Journal of Marketing Studies. Vol 9 no 3, pp 1-12, 2021
- O. C. Aworh, and A. O. Olorunda. Effects of packaging methods on post- harvest losses of perishable fruits and vegetables in the Nigerian marketing system. Nig. Food J., Vol 3: pp 33 -57, 1981
- G. I. Salami. Assessment of some needs of the food packaging industry in South-western Nigeria. M.Sc. Thesis submitted to Obafemi Awolowo University, Ile-Ife, Ngeria. pp 88, 2002
- E. Kajula. Assessment of packagingbarriers tomanagement in Tanzania maximumefficiency of foodsupplychain. Bachelor thesis, Technology, communication and transport Degree Programme in Logistics Engineering JAMK University of Applied Science. 2021

- Gases in Agro-Food Processes. Food packaging. 2019. Retrieved from: https://www.sciencedirect.com/topics/agricultural-and-biological-sciences/food-packaging
- N. O. Kabuo, S. N. Asoegwu, J. N. Nwosu, N. C. Onuegbu, L. O. Akajiaku, and J. C. Nwaimo. Assessment of leaf-type and number of leaves used in wrapping on the quality of "ugba" (fermented Pentaclathra macrophylla, Benth seed). Eur. J. Food Sci.Technol., vol. 3, no.1,pp. 11-23, 2015
- A. Omah, and F. Oba. Made-in-Nigeria: Golden opportunity for the packaging industry. 2017 Available online: https://nigeriapackaging.com/made-in-nigeria-goldenopportunities- for- the-packaging-industry/
- WPO: World Packaging Organisation. Position Paper Packaging and Food Safety. 2009. Available on www.worldpackaging.org
- J. Shin, and S. E. M. Selke. Food packaging. In: Clark, S., Jung, S. and Lamsal, B. (Eds). Food processing: Principles andapplications, Second Edition. John Wiley and Sons, Ltd. pp. 249- 273, 2014
- D. S. Lee, K. L. Yam, and L. Piergiovanni. Food packagingscience and technology (1st ed.). 2008
- L. B. De Souza, and A. A. C. Moura. Embalagens para alimentos: Tendências e inovações. Hig. Aliment. vol. 5, pp. 25–29, 2017
- K. Marsh, and B. Bugusu. Food packaging? Roles, materials, and environmental issues. J. Food Sci. vol. 72, R39–R55, 2007
- S. Balzarotti, B. Maviglia, F. Biassoni, and M. R. Ciceri. Glass Vs. Plastic: Affective judgments of food packages after visual and haptic exploration. Procedia Manuf. Vol 3, pp. 2251–2258, 2015
- H. J. Kim, S. J. Kim, D. S. An, and D.S. Lee. Monitoring and modelling of headspace-gas concentration changes for shelf life control of a glass packaged perishable food. LWT Food Sci. Technol. vol. 55, pp. 685–689, 2013
- D. I. Vaireanu, A. Cojocaru, I. Maior, and I. A. Ciobotaru. Food packaging interactions in metal cans. In Reference Module in FoodScience; Elsevier: Amsterdam, The Netherlands, 2018.
- I. N. Pasias, K. G. Raptopoulou, and C. Proestos. Migration from metal packaging into food. In Reference Module in Food Science; Elsevier: Amsterdam, The Netherlands, 2018.
- Y. Sapozhnikova. Non-targeted screening of chemicals migrating from paper-based food packaging by GC-Orbitrap mass spectrometry. Talanta. vol. 226, 122120, 2021
- Y. He, H. Li, X. Fei, and L. Peng. Carboxymethyl cellulose/cellulose nanocrystals immobilized silver nanoparticles as an effective coating to improve barrier and antibacterial properties of paper for food packaging applications. Carbohydr. Polym. vol. 252, 117156, 2020

- F. Testa, V. Di Iorio, J. Cerri, and G. Pretner. Five shades of plastic in food: Which potentially circular packaging solutions are Italian consumers more sensitive to. Resour. Conserv. Recycl. vol. 173, 105726, 2021
- L. Montoille, C. M. Vicencio, D. Fontalba, J. A. Ortiz, V. Moreno-Serna, L. Peponi, S. Matiacevich, and P. A. Zapata. Study of the effect of the addition of plasticizers on the physical properties of biodegradable films based on kefiran for potential application as food packaging. Food Chem. vol. 360, 129966, 2021
- C. W. Kwon, and P. S. Chang. Influence of alkyl chain length on the action of acetylated monoglycerides as plasticizers for poly (vinyl chloride) food packaging film. Food Packag. Shelf Life. vol. 27, 100619, 2021
- L. Van Hai, R. M. Muthoka, P. S. Panicker, D. O. Agumba, H. D. Pham, and J. Kim. All-biobased transparent-wood: A new approach and its environmental-friendly packaging application. Carbohydr. Polym. vol. 264, 118012, 2021 [PubMed]
- R. Hossain, M. Tajvidi, D. Bousfield, and D. J. Gardner. Multi-layer oil-resistant food serving containers made using cellulose nanofiber coated wood flour composites. Carbohydr. Polym. vol. 267, 118221, 2021. https://doi.org/10.1016/j.porgcoat.2016.08.016
- Australian Institute for Food Safety. 2019. Retrieved from: https://www.foodsafety.com.au/blog/what-is-food-safety
- N. Farmer. 6-Packaging and marketing. In Packaging Technology; Emblem, A., Emblem, H., Eds.; Woodhead Publishing, pp. 87–105, 2012
- S. A. Mousavi, and M. M. Jahromi. Examining the relationship between packaging and consumer buying behavior. A case study: comparison of pasteurized 1.5l milk of brands Roozaneh and Mihan. Indian Journal of Fundamental and Applied Life Sciences. Vol. 4, no. 1, 2014
- K. Azeem. Role Of packaging on consumerbuyingbehavior. Master's Thesis, Superior Group of Colleges College, University Campus, Lahore. 2015
- N. LaMarco. Importance of productpackaging in marketing. 2019. Retrieved from https://smallbusiness.chron.com/importance-product-packaging-marketing-648.html.
- J. Zekir, J. and V. V. Hassan. The role and impact of the Packaging effect on consumer buying behaviour. ECOFORUM. Vol. 4, no. 1, 2015
- S. Mmari. Consumers' perceptions on packaging of processedfoodproducts in Dodoma Municipality, Tanzania. Social Sciences, vol. 4, no. 4, pp. 77, 2015. https://doi.org/10.11648/j.ss.20150404.11
- S. Martí. UnPlastic myfood: Plastics in take-awaypackaging,consumerbehaviors and eco-packagingpossibilities. A Master's Thesis Presented to the department of Design for Social Impact in partial fulfillment of the requirements for "Master of Arts" in Design for Social Impact.PARIS COLLEGE OF ART. 2018

- A. N. Agata. The influence of productpackaging on the millenial consumer's buying behaviour – A case study of the juice, nectar and still drinks category in Kenya. Master's Thesis. United States International University –Africa. 2017.
- R. L. Underwood. The communicative power of product packaging: Creating brand identity via lived and mediated experience. Journal of Marketing Theory and Practice. vol. 11, no. 1, pp. 62-76, 2003
- A. C. Drichoutis, P. Lazaridis, and R. M. Nayga. Consumers' use of nutritional labels: a review of research studies and issues. Academy of Marketing Science Review, vol. 9, no. 1, pp.1-22, 2006
- M. Arslanagic-Kalajdzic, A. Pestek, and S. Kadic-Maglajlic. Perceptions of healthyfoodpackaginginformation: Do men and womenperceivedifferently? Article in Procedia -Social and Behavioral Sciences. January 2014.DOI: 10.1016/j.sbspro.2013.12.423
- Kazimoto, P. Assessment of challenges facing small and mediumenterprises towards Journal of Academic Research in Accounting, Finance and Management Sciences. Vol.4, no. 2, pp. 303–311, 2014
- C. Tambe, D. Graiver, and R. Narayan. Moisture resistance coating of packaging paper from biobased silylated soybean oil. Progress in Organic Coatings, vol.101, pp. 270-278, 2016.
- N. N. Trung. Sustainable packaging logistics: The link between green packaging and sustainability in supply chain, JAMK University of Applied Sciences. 2020
- A. Aggarwal, and H. –C. Langowski. Packaging functions and their role in technical development of food packaging systems: Functional equivalence in yoghurt packaging. Procedia CIRP. vol. 90, pp. 405–410, 2020
- S. E. Fawcett, G. M. Magnan, and M. W. McCarter. Benefits, barriers, and bridges to effective supply chain management. Supply Chain Management: An International Journal, Vol.13, no. 1, pp. 35–48, 2014
- New world encyclopedia (n.d). Food packaging. Retrieved from: https://www.newworldencyclopedia.org/entry/Food_packaging
- J. Han, J. Qian, L. Ruiz-Garcia, and X. Yang. Food packaging: A comprehensive review and futuretrends., Comprehensive Reviews in Food Science and Food Safety, Vol. 17, 2018. Institute of Food Technologists, doi: 10.1111/1541-4337.12343.
- M. Zeeshan, H. Shah, Y. Durrani, and M. Ayub. A Questionnaire-based survey on food safety knowledge during food-handling and food preparation practices among university students. Journal of Clinical Nutrition & Dietetics.**Vol. 3, no. 2**:18, pp. 1-8, 2017
- R. K. Gupta, and P. Dudeja. Packaging and food safety. In R.K. Gupta, P. Dudeja (Eds.) Food safety in the 21st century. 2017
- J. Muncke. Food packaging. 2012. Retrieved from: https://www.foodpackagingforum.org/food-packaging-health/food-packaging-materials

- F. Nicasio. (n.d). Why you need to offer sustainable packaging — and how to do it right. Available online: https://www.bigcommerce.com/blog/sustainable-packaging/#what-is-sustainable-packaging
- P. Forbes. (n.d). Implementing genuinely sustainable packaging in a small brand**.** Retrieved from: https://packhelp.com/sustainable-packaging/Food safety
- O. P. Abioye, A. A. Abioye, S. A. Afolalu, and S. O. Ongbali. A review of biodegradable plastics in Nigeria. Int. J. Mech. Eng. Technol. (IJMET), vol. 9, no. 10, 2018
- B. C. Chine, A. U. Nnedum, and P. Ike. Product packaging and advertising as correlates of consumer buying behaviour in Awka urban, Anambra State, Nigeria. Int. J. Health Soc. Inq., vol. 4, no. 1, 2018
- Ekblom. Challenges facing food processing MSEs in Tanzania, A qualitative case study of the sunflower oil industry in Babati, Manyara, Södertörn University | School of Science, Technology and Environmental Studies, Stockholm. 2016
- O. M. Mugenda, and A. G. Mugenda. Research Methods: Quantitative and Qualitative Approaches. Nairobi: African Center for Technology Studies. 1999.