

**CZECH UNIVERSITY OF LIFE SCIENCES PRAGUE**

**Faculty of Tropical AgriSciences**



Czech University of Life Sciences Prague

**Faculty of Tropical  
AgriSciences**

**Factors affecting the use of food safety practices:  
A case of Bauchi state, Nigeria**

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**Author:**

Mustapha Yakubu Madaki

**Supervisor:**

Miroslava Bavorova



## **Declaration**

I hereby declare that I have done this thesis entitled “**Factors affecting the use of food safety practices: A case of Bauchi state, Nigeria**” independently, all texts in this thesis are original, and all the sources have been quoted and acknowledged by means of complete references and according to Citation rules of the FTA.

In Prague, 2019

.....  
Mustapha Yakubu Madaki

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## **Abstract**

The aim of this study was to assess the factors affecting the use of food safety practices in higher institutions of learning in Bauchi state, Nigeria. Purposive sampling method was applied to select six higher educational institutions and random sampling method to select 181 food vendors interviewed. Questionnaire survey was conducted to collect data in face-to-face interview. The data was analysed using Multiple Linear Regression, Pearson Product Correlation and Structural Equation Modelling. The regression results showed that increasing age, literacy, and increasing number of years of education as well as consulting friends/colleagues on food safety were statistically significant determinants of increasing food safety knowledge of the food vendors. Food safety knowledge, food safety attitude and food safety practice behavior have significant positive relationship. Sanitation facilities, food safety knowledge, economic and social control were strongly affecting food safety practices behavior in positive way, however food safety attitude negatively affected food vendors' food safety practices behavior. As both the food handling trainings and information from food inspection institutions did not statistically significantly affected the food safety knowledge, we emphasize the need of improvement of effectiveness of food safety information provision by the institutions that provide them and provision of sanitation facilities.

**Key words:** Food safety knowledge, food safety behaviour, sanitation facilities, economic and social constraints, Bauchi state, Nigeria.

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## **List of the abbreviations used in the thesis**

AfDB: African Development Bank

APC: Aerobic Plate Count

BASEPA: Bauchi State Environmental Protection Agency

BSADP: Bauchi State Agricultural Development Programme

Cd: Cadmium

CPC: Consumer Protection Council

Cu: Copper

FAO: Food and Agricultural Organization

GHP: General Hygiene Practices

HACCP: Hazard Analysis Critical Control Points

Hg: Mercury

LGA: Local Government Area

NAFDAC: National Agency for Food and Drugs Administrations Control

NARTO: National Association of Road Transport Owners

NBS: National Bureau of Statistics

NURTW: National Union of Road Transport Workers

Pb: Lead

SEM: Structural Equation Model

SES: Socio-economic Status

SON: Standard Organization of Nigeria

TPB: Theory of Planed Behaviour

TRA: Theory of Reason Action

WHO: World Health Organization

# **1. Introduction and Literature Review**

## **1.1. Introduction**

World Health Organization (WHO 2007) reported that Foods hygiene and safety has become a global major concern due to the great impact on the economy and health of the people of developed and developing countries. Up to 2 million people per year, most of whom are children, die because of diseases caused by the consumption of contamination of food and water (FAO 2014). European Food Safety Authority (EFSA 2010) reported that around of 48.7% of foodborne illness are associated with food services in the food premises. WHO 2007 reported that in the year 2005 alone, nearly 1.8 million people died result to diarrhoea cases globally and the most of them consumed contaminated food and water and mentioned that every year, more than one-third of the total population in developing countries are affected by foodborne diseases.

Research shows that majority of these foodborne diseases occur between farm gate and consumption (Aluko et al. 2014; Ahmed et al. 2017; Stratev et al. 2016). The study of Saidatul and Dahan 2013; Low et al. 2016 and Sani & Siow 2014) were all carried out in the higher institutions of learning, this shows that they are part of the victims of foodborne disease incidence. However, little or non-was carry out in the study area despite its paramount important as comprised all the disease vulnerable groups. However, street and places of work (in our case higher learning institutions) foods sold by street vendors and consumed at higher institutions of learning -first of all by students- have been identified as important sources of foodborne disease outbreaks (Soon, Singh, & Baines, 2011; Sani & Siow, 2014). Epidemiological data on foodborne disease outbreaks in Nigerian schools is not obtainable but in broad a 1997 Local Government Health System profile of the country implicated diarrhoea as the cause of 25% of all deaths, followed by malaria (21.0%) and accidents (9%) Federal Ministry of Health [FMOH] (2004). Most foodborne diseases in Nigeria appear to occur predominantly as isolated sporadic cases rather than taking the form of outbreaks. Many, if not most cases of foodborne infections, are unrecognized, uninvestigated and poorly documented (Olatunji, 2017). Many patients do not seek help from hospitals but rather engage in self-medication or use of medicinal herbs. Data from Microbiological

Department of Bauchi State Specialist Hospital reported a near epidemic recurrence of *E-coli* infection which is traceable to the consumption of contaminated food (Aliboh, 2009). This is probably due to poor sanitation and lack of food hygiene practices in the state. Adeneye et al. (2016) studied the patients affected by foodborne diseases in the Bauchi state and reported that, 54.8% of them dispose their waste in bush and only 4.1% use public disposal bin, 56.2% are using well water as their source of water and 84.9% do not care about food hygiene and 39.4% do not know the causes of food infectious diseases, in particular cholera.

The study assessed the factors affecting the use of hygiene food safety practices among food handlers in the higher institutions of learning in Bauchi state, Nigeria. The research was guided by the knowledge-gap theory and theory of planned behaviour of which the findings will be useful for the management of those higher institutions of learning in knowing the factors affecting the uses of food safety practices, both socio-economic and institutional; formulating laws and codes for food vendors and regulate the culinary business aspect within their micro environment, because the implementation of such recommendations is hardly implemented in developing countries at macro level of which Nigeria is included (Alimi 2016).

## **1.2. Literature review**

This chapter brings overview of streets and places of work food vending business, its socio- economic importance, health problems associated with, causes of the problems, vendors knowledge, behaviour and attitude towards food safety practices and the theories that guiding the knowledge and attitude. Furthermore, environmental sanitation, personal hygiene and food processing procedure among others. Finally, the chapter discussed the previous major findings in the literature on association between food hygiene practices knowledge, behaviour and attitude as well as the methods of determining those relationship and summarized by studying relevant scientific literature resources, mainly from scientific articles of electronic resources i.e. e-database like Web of Science, Research gate and Science Direct. Many useful information and case studies have been gained from reports and resources of Food and Agricultural Organization (FAO) and World Health organization (WHO). Statistical data were obtained from free and open-accessed database of Nigerian Bureau of Statistics (NBS).

### **1.2.1. Street food sector overview**

Many people around the globe are engaged in the production, processing and consuming of ready-to-eat foods on street or places of work. Majority relying on it for living, source of earning and livelihood while some as source of their primary food. This food constitutes the primary source of food for many low- and middle-income consumers outside their home (FAO 2009). For many city residents of developing countries, including Nigeria, India, South Africa and Haiti access to food relies on the work of street food from vendors and places of work (Samapundo et al. 2015 and Suneetha 2011). Street and places of work foods are defined by the FAO as foods or beverages that are prepared and/or sold by vendors typically on streets or similar, can be consumed immediately or at a later stage, but require no further processing or preparation (FAO 2013). Food in this form is not only important source of nutrition and access to food for the population, but also provides some possible ways for self-reliance for urban inhabitants (Choudhury et al. 2011) also, contributes to incomes of household, large number of urban inhabitants are interested in this work as they lack the skills or education required to attracted in the formal workforce. The minimum skill needed for

most food handling business, together with the small financial investment needed and comparative ease of which one can start vending, make it attractive prospect for the people striving to find employment, particularly rural migrants (Biswas et al. 2010). McKay et al. (2016) reported that “street vendors play an important role in food security and providing income to many low educated people in Indian”. Despite this important role, they are facing great financial challenges. Many food vendors have little to no formal education, are not fully interested in the modern banking systems to make saving and borrow money, as a result, food quality regulation standard is important in the sector and effective and efficient quality assurance has becoming important.

The phenomenal growth and increasing of the street food vendors in several countries including Nigeria may be regard to the great significant socio-economic gain derived from it. Such benefits comprise of provision of different of less cost, convenient and many times nutritious food; provision of job opportunities and income, especially for women (Omemu & Aderoju 2008). Studies conducted in selected African countries like Nigeria and Morocco, shown that most street food vendors usually earn and obtain more than the country’s minimum wage, in Nigeria it is cheaper to buy street food than to cook it and street foods vendors also serve as the major source of nutrients for many of the adolescents in Abeokuta, Nigeria (Omemu & Aderoju 2008).

## **1.2.2. Theoretical framework of the study**

The theory can be explained as a body of rules, ideas principles and techniques that apply to a subject especially when seen as distinct from actual practices. The term theory is defined as a set of concepts and/or statements with specification of how phenomena relate to each other. Theory provides an organizing description of a system that accounts for what is known and explains and predicts phenomena (Rachel et al. 2015). This study will briefly use some of the ideas and theories which are considered relevant to the research namely: Knowledge-gap theory, information theory and theory of planned behaviour/theory of reason action.

### **1.2.2.1. Knowledge-gap theory**

The knowledge gap hypothesis has important implications for public information campaigns. The hypothesis as originally formulated by Tichenor et al. (1970) in Rachel et al. (2015) holds that "as the infusion of mass media information into a social system

increases, segments of the population with higher socio-economic status (SES) tend to acquire this information at a faster rate than the lower status segments, so that the gap in knowledge between these segments tends to increase rather than decrease".

The hypothesis thus implies that projects which disseminate information through the mass media will always benefit higher socio-economic status audience segments more than lower segments. Such projects cannot, then, equalize the distribution of information within a social system. These implications are more clear-cut than the support for the hypothesis itself, however. To support the original formulation of the hypothesis Tichenor and his associates reviewed several studies which reported a relationship between information gain and SES (James et al. 1983).

Among them was a study by Star and Hughes (1950) as in Rachel et al. (2015) which reported that an information campaign about the United Nations tended to reach only the better educated segments of the audience. Similarly, a study by Budd et al. (1966) in Rachel et al. (2015) found that knowledge of a news event diffused more rapidly to higher SES individuals than lower SES individuals. In a later study Tichenor et al. (1973) found that in a few small community's heavier newspaper coverage of national news events was associated with stronger correlations between education and knowledge. This did not hold for local news events, however, in contrast to these results several studies suggest that knowledge gaps do not always widen because of an infusion of information into a social system. The Star and Hughes findings are counterbalanced by those of Douglas, et al. (1970) as in Rachel et al. (2015), which showed that an information campaign on the topic of mental retardation was most effective among those with less education. Similarly, the Budd, et al. study is countered by Larson and Hills (1954) as in Rachel et al. (2015), who found that slightly more people in a working-class neighbourhood had heard of a news event than people in a professional neighbourhood. In addition, Shingi and Mody (1976) reported a narrowing of a gap in agricultural knowledge among Indian farmers after an information campaign, also working in India, found that gaps in agricultural and health knowledge tended to narrow because of an information campaign (James et al 1983).

Several attempts have been made to explain these inconsistent results. Ettema and Kline (1977), for example, suggest that the relationship between knowledge and socioeconomic status (usually indicated by education) is probably due less to a deficiency of information processing skills on the part of lower SES population

segments than to differences between higher and lower SES segments in interest and use for the information being disseminated. That is, the sort of information disseminated by the mass media and typically studied by communication researchers (e.g., basic news and public affairs) is not so complicated that it requires highly sophisticated information processing skills. This information is, however, probably of more interest and use to higher SES individuals. Simply stated, the argument is that gaps in knowledge disseminated through the mass media will open among those who are differentially motivated to acquire that knowledge but will not open among those who are equally motivated (James et al. 1983).

Ettema and Kline's arguments are built, in part, upon those presented by Donohue, et al. (1975) as in Rachel et al. (2015), who were required to reconsider the original formulation of their hypothesis when confronted with the inconsistent results of their research i.e. Tichenor, et al. 1973. In the 1973 study the authors found that the knowledge gap narrowed for local events information but widened for national events information because of heavy newspaper coverage in several small communities.

The authors argued that the local events were highly conflict-ridden and thus quite salient to everyone in the small communities. This, in turn, equalized motivation to acquire information about these events across the various population segments. By comparison, the national events were less salient, motivation to acquire information about them remained unequal, and the gap widened. Working along these same theoretical lines, Genova and Greenberg (1979) as in Rachel et al. (2015) compared the correlations between education and knowledge of two continuing news stories to correlations between interest in those stories and knowledge of them. The authors found that early in the life of the stories, interest correlated slightly more strongly with knowledge than did education. Later in the life of the stories, however, interest was significantly more strongly correlated with knowledge than was education. These relationships held for both "factual knowledge" (knowledge of simple facts such as names and dates) and "structural knowledge" (knowledge of the relationships among persons and events) (James et al 1983).

The knowledge-gap these authors found after continued media coverage was, between those population segments more and less interested in the stories. In overview, these attempts to explain the apparently contradictory results of research on knowledge gap phenomena all emphasize one key concept: motivation to acquire information in the

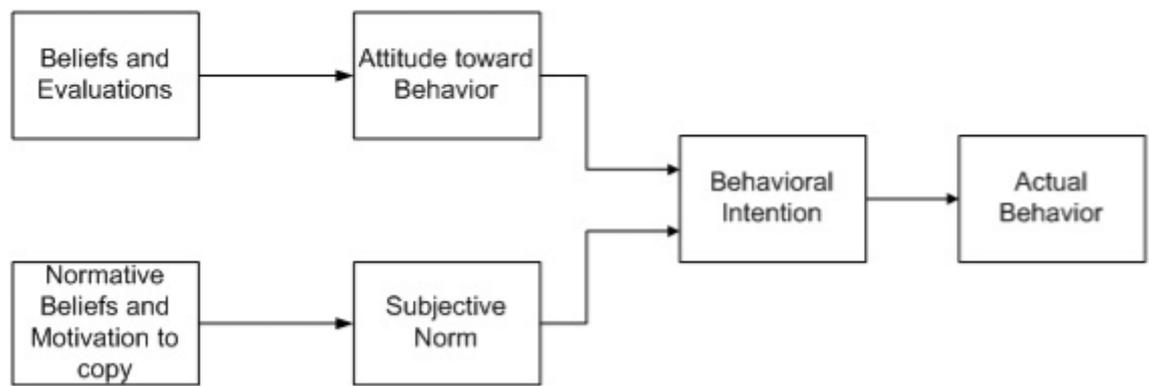
knowledge domain under study. Gaps widen when there is a difference in motivation among population segments. Gaps narrow or do not open in the first place when motivation is equalized across these segments.

Motivation to acquire information within any given audience segment can, of course, vary across knowledge domains. Some knowledge domains are of more interest and use to higher SES segments. Public affairs knowledge as typically studied by mass communication researchers is, no doubt, such a domain. Other domains, however, are likely to be equally interesting and useful to higher and lower SES segments but differentially interesting and useful to various population segments identified by age, lifestyle, or other such factors. For such domains, then, the effects of motivation would be likely to overpower the effects of education as facilitators of knowledge acquisition (James et al. 1983). The research will focus on influence of food handlers' SES, motivational and deterrence factors on predicting their food safety knowledge.

#### **1.2.2.2. Theory of planned behaviour**

The reasoned action approach that Martin Fishbein pioneered has emerged as the dominant conceptual framework for predicting, explaining, and changing human social behaviour. The most popular model in this tradition, the theory of planned behaviour, has generated a great deal of empirical research supporting the premises of this approach (Ajzen 2012). It has been shown that behavioural, normative, and control beliefs provide the basis, respectively, for attitudes toward the behaviour, subjective norms, and perceived behavioural control; that these three factors jointly account for a great deal of variance in behavioural intentions; and that intentions and perceived control can be used to predict actual behaviour. Based on these insights, investigators have been able to design effective behaviour change interventions (Ajzen 2012).

Understanding of the fundamental causes of food illness problems and develop the improvement and precautionary measures to address those problems is important to a wide range of studies involved in the study of health psychology. The most widely tested models of this nature are the Theory of Reasoned Action (Fishbein & Ajzen, 1975; Ajzen & Fishbein 2005) as in Ajzen, (2012). The Theory of Reasoned Action posits that behaviour is a function of behavioural intentions that are, in turn, a function of attitudes and subjective norms (see Figure 1).



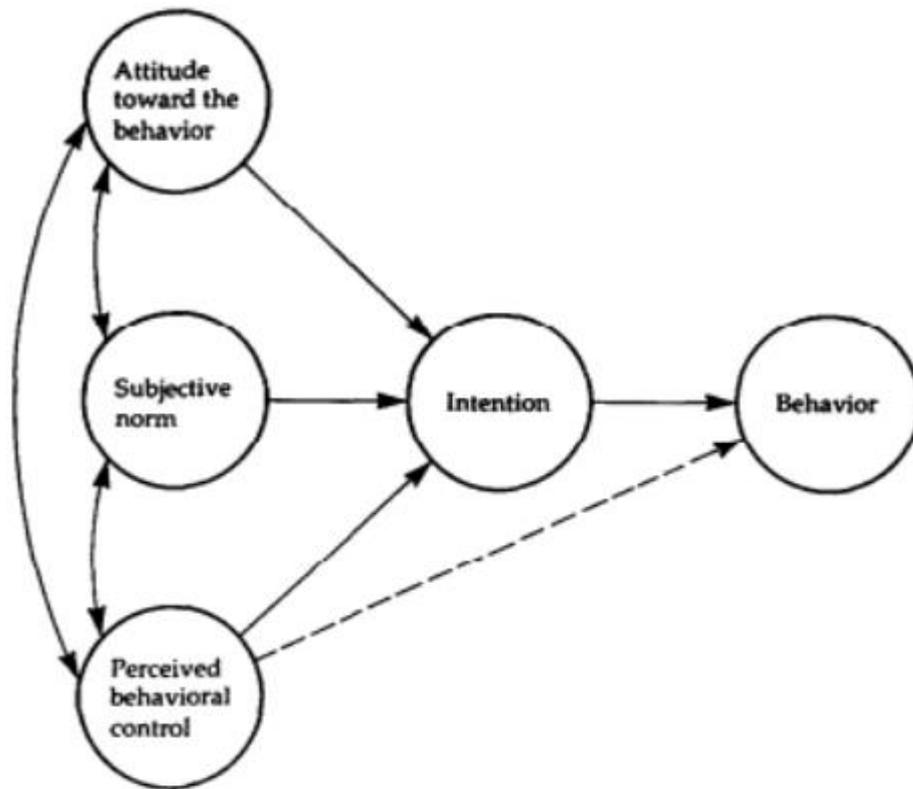
**Figure 1: Theory of reasoned action**

Source: Fishbein & Ajzen 1975

Fishbein and Ajzen 1975 as in Ajzen (2012) postulated that people’s assessment of or attitudes with regard an object are determined by their available and readily accessible beliefs toward the object, where a belief is defined as the subjective probability that the object has a certain attribute. According to the expectancy-value model, a person’s overall attitude toward a psychological object is determined by the subjective values or evaluations of the attributes associated with the object and by the strength of these associations. Such attitudes are acquired automatically and inevitably as we form beliefs concerning the object’s attributes and as the subjective values of these attributes become linked to the object (Ajzen 2012).

Dulany’s (1968) theory of propositional control stimulated the development of what came to be known as the theory of reasoned action (Ajzen and Fishbein 1980). As the first determinant of intentions in Dulany’s theory was reconceptualized as attitude toward the behaviour of interest. The Second component, the behavioural hypothesis, was termed a “normative belief” in the TRA (Ajzen 2012). The theory of planned behaviour took the components of the theory of reasoned action but, added perceived behavioural control as an additional factor predicting both behavioural intentions and behaviour as shown in Figure 2.

It was defined as a person’s subjective probability that normative referent (the experimenter in Dulany’s case) wants the person to perform a given behaviour. As in Dulany’s model, this normative belief is weighted (multiplied) by the person’s motivation to comply with the referent’s perceived expectation. However, in the TRA, it is assumed that people can hold normative beliefs with respect to more than one referent individual or group Ajzen (2012).



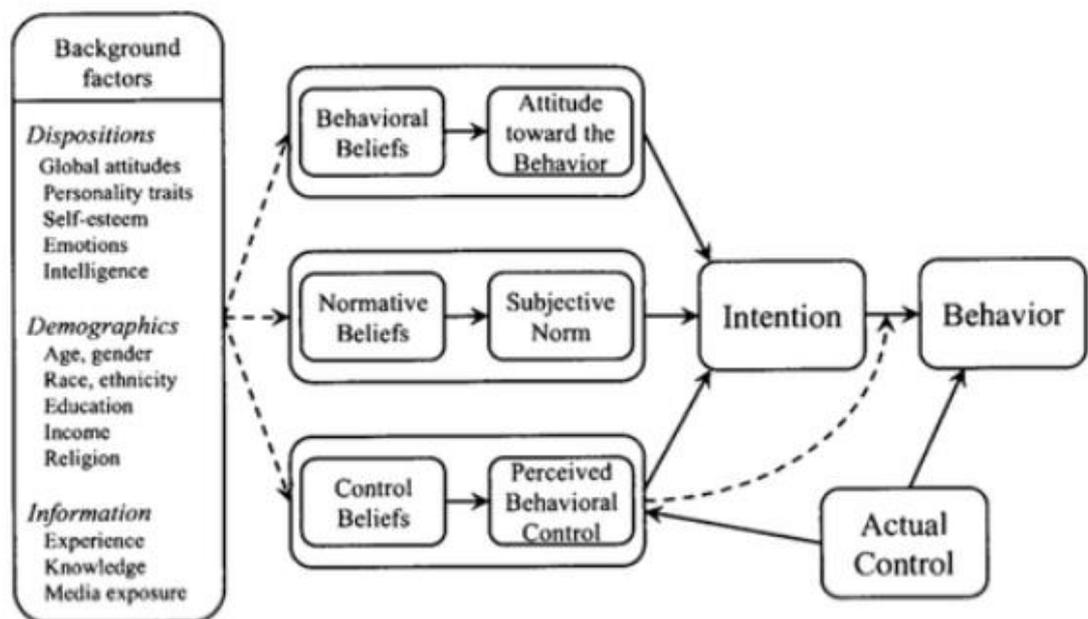
**Figure 2: Theory of planned behaviour**

Source: Ajzen, 1991.

Commonly identified referents are a person’s spouse or partner; close family and friends; and, depending on the behaviour under consideration, co-workers, health professionals, and law enforcement authorities. The normative beliefs regarding such social referents combine to produce an overall perceived social pressure or subjective norm. Drawing an analogy to the expectancy-value model of attitude toward a behaviour, it is assumed that the prevailing subjective norm is determined by the total set of readily accessible normative beliefs concerning the expectations of important referents. Specifically, the strength of each normative belief is weighted by motivation to comply with referent and the products are aggregated across all accessible referents (Ajzen 2012).

The theory formulated explicitly confined the behaviours over which people have volitional control, under the assumption that this category includes most behaviours of interest to social psychologists. However, it soon became apparent that this formulation imposed too severe a limitation on a theory meant to predict and explain all kinds of socially significant behaviour (Ajzen 2012). Many behaviours, even

if in principle under volitional control, can pose serious difficulties of execution. To accommodate behaviours over which people may have limited volitional control, the TRA Model had to be expanded by taking degree of control over the behaviour into account (Ajzen 1985). The theory of planned behaviour was designed to accomplish this goal by incorporating the concept of “perceived behavioural control” as an additional predictor of intentions and behaviour. This construct is conceptually equivalent to Bandura’s (1977) as in Ajzen (2012) concept of perceived self-efficacy. In recent years, these models have been metamorphosed under the umbrella of the TPB Approach as shown in Figure 3 below.



**Figure 3: Theory of planned behaviour**

Source: Fishbein & Ajzen, 2010.

Like attitudes and subjective norms, perceptions of behavioural control are assumed to follow consistently from readily accessible beliefs in this case, beliefs about resources and obstacles that can facilitate or interfere with performance of a given behaviour. Analogous to the expectancy value model of attitudes, the power of each control factor to facilitate or inhibit performance of a behaviour is expected to contribute to perceived behavioural control in direct proportion to the person’s subjective probability that the control factor is present (Ajzen 2012).

The basic structure of the theory of planned behaviour (TPB) is that, according to the theory, human action is guided by three kinds considerations: beliefs about the likely outcomes of the behaviour and the evaluations of these outcomes (behavioural beliefs), beliefs about the normative expectations and actions of important referents and motivation to comply with these referents (normative beliefs), and beliefs about the presence of factors that may facilitate or impede performance of the behaviour and the perceived power of these factors (control beliefs). In their respective aggregates, behavioural beliefs produce a favourable or unfavourable attitude toward the behaviour, normative beliefs result in perceived social pressure or a subjective norm, and control beliefs give rise to perceived behavioural control. In combination, attitude toward the behaviour, subjective norm, and perception of behavioural control lead to the formation of a behavioural intention. As a rule, the more favourable the attitude and subjective norm, and the greater the perceived control, the stronger is the person's intention to perform the behaviour in question.

Despite all the modifications and introductions of new constructs, the theory remains with its importance in assessment the behavioural changes in health and other social intervention, the study considered cost and benefit, customers patronage, food safety knowledge and food safety attitude as likely outcomes of the behaviour, conformity of food safety practices with culture, belief, ethics, as control beliefs that lead to perceived behavioural control and sanitary conditions such as availability of sources of water, distance to the source, presence and nature of toilet, refuse disposal bin and storage facilities will be consider as factors that may facilitate or impede the food safety practices behaviour.

### **1.2.3. Factors affecting food safety**

While street foods and places of work are important for access to foods in many developed and developing countries, they are also a source of poor health. Across the world, up to 2 million people per year die because of diseases caused by the consumption of contamination of food and water (FAO 2014). The safety of street and places of work foods is dependent on many factors including environmental, the quality of the raw materials, the food preparation area, the supply of water and the handling and storage conditions (Asiegbu et al. 2016; Choudhury et al. 2011). But all the risk can be group into environmental, chemical and biological risks. However, the health concern

mostly is on general hygiene practices, health and spoilage/microbial related (Umoh and Odoaba 1999; Lues et al. 2006).

### **1.2.3.1. Agricultural practices**

Increase in world population is putting high pressure on food production. The attendant effect is the increasing need to maximize available resources for improved farm yield to feed the growing population. Farmers use inorganic agrochemicals and organic manure to improve the yield of farm produce, prevent competition with weeds and maintain the quality by preventing infestation by insects and spoilage by microorganisms on the field and during storage. The use of these chemicals is well regulated in developed countries through the enactment and enforcement of acts and laws which control and limit their usage for agricultural practices (Alimi 2016).

Laws were put in place to prevent the residual effect and long effect of these chemicals on consumers (Harris 2002). But reverse is the case in developing countries where farmers use chemicals at ad libitum to achieve maximum yields per unit area. Farmers are easily patronizing to synthesize chemicals and other inputs in developing countries, cheap and patent expired chemicals (Carvalho 2006). Residues from excessive chemical applications to increase farm yield have been reported in high concentrations in soils, livestock and aquatic animals (Carvalho 2006; Taylor et al. 2003). Significant correlation has been proved between residual chemical accumulation in the soil and uptake by crops during growth (Huang et al. 2012). These chemicals are stored in the consumable parts of crops, livestock and aquatic animals (Carvalho 2006; Wang et al. 2006). Scientific research has proven that the presence of the residual chemicals from Fertilizer, pesticides etc., in foods is cause damages to human health. The accumulation of foreign chemicals such as arsenic (As), lead (Pb), copper (Cu) and mercury(Hg), cadmium (Cd), in human body system has been linked to immune-suppression, hypersensitivity to chemical agents, breast cancer, reduced sperm count and infertility (Omemu and Aderoju 2012; Uri 1999).

### **1.2.3.2. Sources and quality of raw foods and ingredients**

Pursuance of making higher profit by the street and places of work food vendors or the need to make their foods cheap and affordable for the consumers make some vendors patronize cheap and unsafe food stuff and other raw materials that may lead to

health problem of the consumers. Results of survey in Nigeria, conducted by Omemu and Aderoju (2008) revealed that food vendors considered the volume (94%) and the price (93%) than the freshness and cleanliness when purchasing food raw materials. Study conducted in India, Choudhury et al. (2011) observed that procurement and purchasing habits of food stuff by street vendors varies according to the size of the establishments and was significantly influenced by the type of vendors, ownership and average monthly income.

Alimi et al. (2016) reported that all the street food vendors and owners of small restaurant purchase unlabelled and unpacked food grains and semi-processed ingredients from grocery shops, 87% of owners of small restaurants purchase labelled and packed paste, dry fruits and spices from grocery, 44%) of the mobile food vendors purchase condiments and spices, nuts and dry fruits from traditional weekly or daily markets with 37% of them prepared, dried and powdered their own ingredients at home. Studies have shown that home-made grains flour and paste used in street foods preparations are contaminated with *Bacillus cereus* (Umoh and Odoba 2008) which was reported to be responsible for outbreak of food borne illness (Gilbert 1979) as in Alimi (2016). Umoh and Odoba 1998 reported that highest frequency of *B. cereus* observed for 'kunu', a fermented cereal product in West Africa was due to local spices and raw materials used as condiments in their survey of microbial quality of street foods sold in the street of Zaria, Nigeria. Some street food vendors use leftover perishable raw materials for next day preparation without having storage facilities. No single small restaurant owners interviewed had refrigeration facility, whereas 20%, 93%, 97% and 30% of them stored left-over green vegetables, raw food materials, canned/bottled foods, and milk and milk products, respectively for more than 24 hours by Choudhury et al. (2011). Meat and milk from sick and old animals, use of substandard slaughter facility and vegetables and crops with heavy chemical residues are often use for food preparation in some developing countries. These practices were encouraged by weak regulatory and inspection facilities in these countries (Okoli et al. 2005). Distance from slaughter facility, exorbitant user fees and inadequate security at the slaughter house which led to theft of meat were the major reasons given by the suppliers of meat for street food preparation in Ga District, Ghana for not using slaughter facility provided by the government (King et al. 2000).

Improper cooking of the raw material with heavy microbial loads could lead to survival of disease-causing organism of significant health importance to the public (Mensah et al. 2002). In the four consecutive months survey of the microbiological loads of street vended fruit salads and gravies in Johannesburg, South Africa, Kubheka et al. (2001) reported high aerobic plate counts (APC) and spore counts in gravies even though they were generally cooked before consumption, however, the APC and spore counts were significantly lower than those from salad samples which are usually consumed uncooked and *Clostridium perfringens* was isolated in 3% of the salad samples.

Bryan et al. (1988) reported high load of APC in street vended beans and chick peas in Dominican Republic and Pakistan. Mensah et al. (2002) also reported high load of *Shigella sonnei* and pathogenic *Escherichia coli* in samples of salads, soups and sauces, and macaroni served with stew sold in the streets of Accra, Ghana. Apart from tomato, which was the major stuff in the stew for macaroni, water sources for watering of vegetables during growth and wetting to preserve the moisture content till sales was not hygienic due to animal wastes, such as chicken faces, used as manure were also responsible for the high faecal microbial load.

### **1.2.3.3. Food handling and preparation**

Temperatures use in the cooking and frying activities during food preparations in street vending are good enough to destroy the vegetative cells, but the resistant spores of micro-organisms may survive (Bryan et al. 1988). However, the manners and ways street foods are being handle, prepared and serve predispose them to recontamination, cross contamination and transmission of disease-causing organism and food borne diseases. Foods for street vending are mostly prepared in bulk at different times ahead of retailing (Omoh and Adoba 1999). The food stays for period of more than 6 hours, sometimes at ambient temperature, Muyanja et al. (2011) reported to be a usual factor causing food borne diseases via multiplication of pathogen favoured by holding temperature in the range of 5 and 60°C (described as danger zone). Mosupye and von Holy (2000) suggested that handling and holding conditions which suited the survival and germination of *Bacillus* spores may be the cause for the great load of *Bacillus* spp.

Transportation method plays an important role in street food contamination. It has been revealed that means of movement and display of meats play significant part in

the increasing of their spoilage and transmitting of zoonotic diseases Okoli et al. (2005). The way of transporting animal carcasses from slaughter points to retailing points in rough and crude structures such as wooden push carts, open plastic or aluminium trays on heads or pick up vehicles increased the possibility of cross contamination. Okoli et al. (2005) reported that it is common in Nigeria to see vehicle not design for meat transportation such as taxis and buses without cooling facilities and even motorcycles carrying meat products from slaughter points to the retailing points. Okoli et al. 2005 mentioned that it is normal to see butchers and retailers turning carcasses meat for human consumption into sitting or resting platforms in the vehicles during the cause of transportation. Meats are retailed in the markets and streets of Africa in open wooden trays that are usually difficult to wash carefully and thoroughly thereby harbouring niches for microorganisms' contamination of meats and deposition of airborne pollutants.

Mosupye and von Holy (2000) study high aerobic plate and spore counts of 7.6 and 2.2 log cfu/g, respectively, in raw beef/chicken for retailing in the streets' utensils of Johannesburg, South Africa. Some studies reported great loads of microbes more than recommended tolerable levels from most processed meats for street vending even with the high temperature of processing. Bryan et al. (1988) and Ekanem (1998) reported great coliforms levels greater than 10 cfu/g in processed beef and chicken vending in the streets of Zambia and Nigeria, respectively. Lues et al. (2006) attributed the great levels of microorganisms isolated from the processed meats to recontamination by the hands of the processors, utensils and vending environment. Improper regulation of time and holding temperature had been identified as major risk factors in street foods that contribute to diseases outbreak (Muyanja et al. 2011).

Most of the vendors in Abeokuta, Nigeria (90%) and Ozamiz city, Philippines (55%), cooked their food in the morning of sale (Omemu and Aderoju. 2008; Canini et al. 2013) while, majority of the vendors in Kampala, Uganda prepared foods on the premises (75%) and 77% of them in advance of consumption (Muyanja et al. 2011). Other factors identified as risk in the preparation and handling of street foods include: usual use of stove charcoal for maintaining and warming of food for a long period of time which some time may not provide adequate temperature enough to prevent proliferation of disease causing organisms (Lues et al. 2006; Canini et al. 2013) as reheating of food at temperature less than 40°C could accelerate salmonella

contamination, Cardinale et al. (2005) reported overheating at higher temperature could cause the loss of vital nutrients and flavours in the food; holding of foods at ground level and incessant exposing of foods for dispensing of exposed street foods to dust contamination and insect which has been linked to food borne illnesses such as cholera and diarrheal.

Mosupye and von Holy (2000) reported that ready to eat foods could be left exposed for up to 10 min at a time when vendors were serving customers. Umoh and Odoaba (1999) revealed that more than 13% of street foods surveyed in Zaria, Nigeria were contaminated with *S. aureus* of which 43.8% were haemolytic strains and 18% enterotoxigenic. The study identified post processing handling as responsible for the contamination because the high temperature of processing and low water activity of most foods surveyed were enough to prevent proliferation of microorganisms and formation of toxins which are hazardous to human health.

The vending processing practices and utensils use for dispensing street foods were recognized in the literature as great contributors to the cross contamination of street foods. For example, Bryan et al. (1988) reported that most contamination of street foods happen at vending sites because of cross contamination during cutting and chopping. Mosupye and von Holy (2000) observed that raw meat and poultry as well as gravy and salad being sold in Johannesburg, South Africa were cut and chopped with the only one knife on same surface without cleaning in-between. The research (Muyanji et al. 2011; Omemu and Aderoju 2008; Canini et al. 2013). reported that the same vendor chopped salad raw materials for food preparation with bare hands without protective gloves and even exchange knives with colleagues without cleaning thereby increasing the possibility of cross contamination. Most of street vendors, as revealed in different researches and survey, used non-disposable plates, cups and cutleries for serving foods.

Some vendors changed the washing and rinsing liquids only two times in a day, others used the same detergent solution unchanged for a complete day. These practices, observed by the authors, give favourable and good condition for recontamination of street vended foods. For instance, the use of same set of cutleries caused cross contamination and transmission of some communicable diseases among unsuspecting consumers (Mosupye and von Holy 2000). A comparative study on the risks involved in the use of hands, utensils and cutleries to serve street foods in Ghana by Mensah et al.

(2001) revealed that the use of bare hands to serve accelerate the level of contamination. Research also, identified serving stage as an important point in the street food vending industry. Enteropathogenesis, such as *Salmonella typhi* that can survive on human hands for more than three hours have been isolated in vendors' hands in Ghana (Mensah et al. 1999). Enterogenic *E. coli* of the form isolated in diarrhoea incidence were isolated in some women's hands in Thailand (Echeverria et al. 1987 in Alimi 2016).

Orasi et al. 2007 reported that in Nigeria factors such as improperly washed utensils and equipment, poor hygiene, dirty environment and the presence of animals in the cooking environment contributed to the contamination of foods prepared in the boarding schools. The major hazards associated with foods prepared in the schools studied were the inadequate (5 - 10 min) time/temperature exposure of foods (akamu, tuwo, eba), extensive handling of foods by cooks after preparation, leaving cooked foods open till served to students and the presence of toxigenic strains of *B. cereus* and *E. coli*.

Traditional fermentation method and technology is still being used in developing countries, especially Africa where refrigeration is not a readily available option. Despite the preservation advantage offer by the low pH of between 3.5 and 5.0 because of lactic acid bacteria activities, the safety of street vended traditional fermented food products in Africa is still of serious concerns in view of the reported isolation of microorganisms of public health importance from some fermented food products. Alimi et al. (2016) reported isolation of pathogenic organisms from 'nunu' (fermented milk product) samples, while Olasupo et al. (2002) isolated *S. aureus* and *Klebsiella* spp. From 'wara' (West African soft cheese), *E. coli*, *Salmonella* sp. And *Klebsiella* sp. from 'nunu', and *Bacillus subtilis*, *E. coli*, *S. aureus* and *Enterococcus faecalis* from 'ogi' and 'kunu' (cereal based fermented foods). The fact that traditional fermentation technology is still at rudimentary and crude stage which does not give room to the control of the process coupled with the ways and manners the products are being sold on the streets further predisposed their consumers to serious health risks (Sefa-Dede 1993 in Alimi 2016).

While some vendors use left over from previous batch as starters for the next batch of products which was recognized by Edelsten (1996) as in Alimi (2016) to be responsible for the spread of disease causing organisms in most traditionally fermented products, others leave the fermentation process to proceed spontaneously by the dictate of the environment. Since the process is not controlled (Umoh and Odoaba 2008).

#### **1.2.3.4. Environmental condition**

Researches and surveys have promoted serious concerns on the health and hygiene abuse of street foods, of which are exposed to in the preparation and sold environments. Street food vendors usually focus and target high human traffic places for the display of their products to attract sellers. Street food vending everywhere in such sites, industrial/construction sites, bus/train terminals, public places and school compounds (Akinbode et al. 2011). The food vender is either mobile or stationary using stall which is open or protected with crude structures such as push carts, display wooden tables, aluminum trays or bowls or chop bars (Canini et al. 2013).

The environmental conditions under which street foods are being processed, prepared, sold and consumed predisposed them to recontamination and cross contamination from environmental storms such as airborne chemicals in dusts, exhaust discharges from moving vehicles and industrial engines, burning fumes and offensive smell from accumulated waste and effluent from industrial discharge, insects and rodents (Mensah et al. 2002). Airborne illnesses and microorganisms which may be pathogenic if allowed to settle on the prepared food surfaces abound in dust (Muyanja et al. 2011). Bryan et al. (1988) observed accumulation of large heaps of garbage around street food vending sites in Zambia which harboured insects and animal pests.

Littering was also observed to be a common and usual practices at the vending sites in Uganda (Muyanja et al. 2011). Since proximity to potential customers is the primary target of street food vendors, vending sites usually lack basic facilities such as toilets, hand washing facilities, potable water, good drainage and waste disposal system (Idowu and Rowland 2006). Where some of these facilities are provided, large concentration of vendors in human congested areas usually placed serious strain on them resulting in interference with city plans and adverse effects on daily life (Muyanja et al. 2011). All these conditions increase the incidence of food borne diseases and transfer of it among large consumers of street foods (Ekanem 1998).

#### **1.2.3.5. General hygiene practices**

Researches on hygiene practices of street food vending confirmed that most street food vendors have good knowledge of hygiene practices but concluded that most of them were not putting the knowledge to practice (Muyanja et al. 2011; Lues et al. 2006; Omemu and Aderoju 2008). Though street vendors revealed to exhibit good

personal cares, however, they were carelessness to compliance with adequate hygienic practices at the food handling stage and vending sites. Inadequacy or near absence of necessary facilities at the food preparation sites were mostly responsible for non-compliance with basic hygienic principles. Study on the hygiene practices by street food vendors in West Indies, Studies revealed that majority of the vending places observed there is no pipe borne water, 97.5% did not have drainage to remove waste water and toilet facilities (Alimi 2016). The result is in line with the street food vending sites in Kingston, Jamaica, Lima, Peru, Philippines and Uganda (Powell et al. 1999; Bhat and Waghray 2000; Azanza 2000; Muyanja et al. 2011).

Inadequate of toilet and lavatory equipment and facilities at the vending sites induced majority of street food hawkers to seek secluded areas within the vicinity like bushes and uncompleted buildings for excretion which lead to the open defecation. Idowu and Rowland (2006) in their study revealed that most of the street food vendors surveyed in Abeokuta, Nigeria used dung hills and nearby bushes in place of toilets and clean up with sheets of paper, open bins were commonly used for garbage collection. However, Muyanja et al. (2011), reported that 92.8% of vendors in Kampala, Ugandan used gunny bags for garbage collection. Several studies reported that overflowing of garbage bins was a common site in most vending points while the final garbage disposals are usually far away from vending sites. Heaps of garbage around the vending sites could serve as breeding sites for rodents, insects and flies which promote transmission of microorganisms and enhanced the risk of contamination of foods and transmission of diseases (Umoh and Odoaba 2008; Mensah et al. 2002).

Studies investigating foods from street vendors in Brazil have found food vendors insufficiently engaging in good hygiene practices such as hand washing, wearing hair covering, or maintaining cold storage (Cortese et al. 2016; Kothe et al. 2016). While studies of food vendors in India have found contamination to be largely as the result of poor water quality, and poor hygiene during food preparation, unclean utensils, poor personal hygiene, peeling or cutting fruits and vegetables long before consumption, and crowded and dusty shopping areas located alongside busy roads (Tambekar et al 2008).

The safety of street foods is affected by several factors as clearly mentioned above, starting from the quality of the raw materials, to food handling and storage practices. In most cases, the flow of water from taps is not regular for hand and dish

washing, cooking or drinking, leading the street vendors to store water under vulnerable conditions subject to contamination. Street foods are exposed to appalling environmental conditions, such as the presence of insects, rodents, domestic animals and air pollution (Hanashiro et al. 2005). Besides, most food vendors do not observe good food handling practices, exposing foods to dangerous conditions such as cross contamination, unsafe storage and poor time-temperature conditions (Ekanem 1998).

Street food vendors operate from such places as bus terminals, industrial sites, market places, school compounds or around the gates, road sides and other street corners where there are ready and numerous clientele. Unfortunately, these locations usually do not meet all food safety requirements. Street food vending has been associated with causing food borne illnesses in the population owing to the difficulties inherent in ensuring that food is prepared and sold under hygienic conditions (Bryan et al. 1988). Large amounts of garbage accumulate and provide harbourage for insects and animal pests around the vending sites (Bryan et al. 1997).

#### **1.2.3.6. Food safety knowledge and attitude**

Most of the food illnesses outbreaks related to street foods were linked to carelessness and negligence of food handlers (WHO 2002). About 15 cases of foodborne illnesses outbreaks investigated in Zhapo, China, from 2008 to 2011 were related to the negligence and carelessness of food vendors (Liu et al. 2015). Studies from various developing countries (Chouldhry et al. 2011; Muyanja et al. 2011; Omemu and Aderoju 2008; Toh and Birchenough 2000; Liu et al. 2014) have made a concerted effort to study the extent of food safety knowledge, disposition to food safety issues and practices of street food vendors. Their reports identified education, food safety training, race and vending environment among the factors that affect knowledge and attitude of food vendors to food safety practices. Toh and Birchenough 2000, established interdependence of knowledge and attitude of street food vendors to food safety practices with strong linear relationship. Though several authors reported that education and training enhanced hawker's knowledge and attitude to food safety practices (Toh and Birchenough 2000; Pang and Toh 2008).

Choudoury et al. (2011), however, revealed that education had no significant influence on knowledge and attitude of vendors in Guwahati, India to food safety practices such as procurement of fresh and good foods, food adulteration/impurities and

management of leftover foods. Liu et al. (2015) reported that more than 66% of the vendors in Shijiazhuang, China that have basic food safety knowledge were still negligent of food safety practices. Summary from different studies on the safety perception of street food vendors is that vendors are not completely ignorant of basic food safety practices. For examples, studies reported that most vendors knew that they must bath regularly and not attached bath to visible dirt or objectionable odour (Alimi 2016). Washe their hands during food processing, serving, after using the toilet, sneezing, coughing and handling contaminated materials like exchange of money (Muyanja et al. 2011). Smoking is dangerous for their health and should not engage in it while serving foods (Sabratty et al. 2004 as in Alimi 2016). In all these researches education and sources of information were considered among the socio-economic factors, though some researches on knowledge on Avian influenza shows that gender, income, years of experience and others has significant influence on knowledge (Yusha'u et al. 2015; Dairo and Elelu 2013; Elelu 2017).

However, convenience and economic aspect were the main reasons why most vendors were not implementing their knowledge of safety practices. Food vendors in Malaysia regarded wearing of head covering, apron and glove as cumbersome and their regular removal as time wasting and consuming. They also preferred selling their products by the roadsides to designated places with inadequate safety facilities because of better patronage which came with nearness to consumers (Pang and Toh 2008). And, all the street food vendors interviewed by Lues et al. (2006) in Bloemfontein, South Africa, agreed that they had prepared food for public consumption at some point while sick probably because their sustenance depended on daily returns from the trade.

### **1.2.3.7. Inter- relationship between food safety knowledge, attitude and behaviour**

Studies (Ko 2013) tried to establish an inter-relationship between food safety knowledge, food safety attitude and /Hazard Analysis Critical Control Points (HACCP) using structural equation modelling (SEM), while Baser et al. 2017; Lim et al. 2016 related with food safety behaviour of which theory of planned behaviour and reason action theory were employed to explain the SEM result However, the studies failed to considered sanitation facilities and socio-economic factors that can affect the HACCP and food safety behaviour and general hygiene practices in the model such as,

availability of the water, type and distance to water sources, availability of toilet as identified as an important (Canet & N'diaye 1996). Time, cost of compliance and rush to serve customer also, affect their HACCP and food safety behaviour Liu et al. (2015).

## **2. Objectives of the Thesis**

### **2.1. Main objective**

The main objective of the study was to assess the factors affecting the use of food safety practices in higher institutions of learning in Bauchi state, Nigeria.

### **2.2. Specific objectives**

The main objective was achieved by achieving the following research specific objectives:

- i. To determine the influence of socio-economic and sources of information used by food handlers on food safety knowledge;
- ii. To determine the relationship that exist between food safety knowledge, food safety attitude and food safety practices behaviour;
- iii. To analyse the determinants of food safety practices behaviour of food vendors.

### **2.3. Research questions**

- i. What is the influence of socio-economic and sources of information used by food handlers on food safety knowledge?
- ii. What is the relationship that exist between food safety knowledge, food safety attitude and food safety practices behaviour?
- iii. What are the determinants of food safety practices behaviour among food vendors?

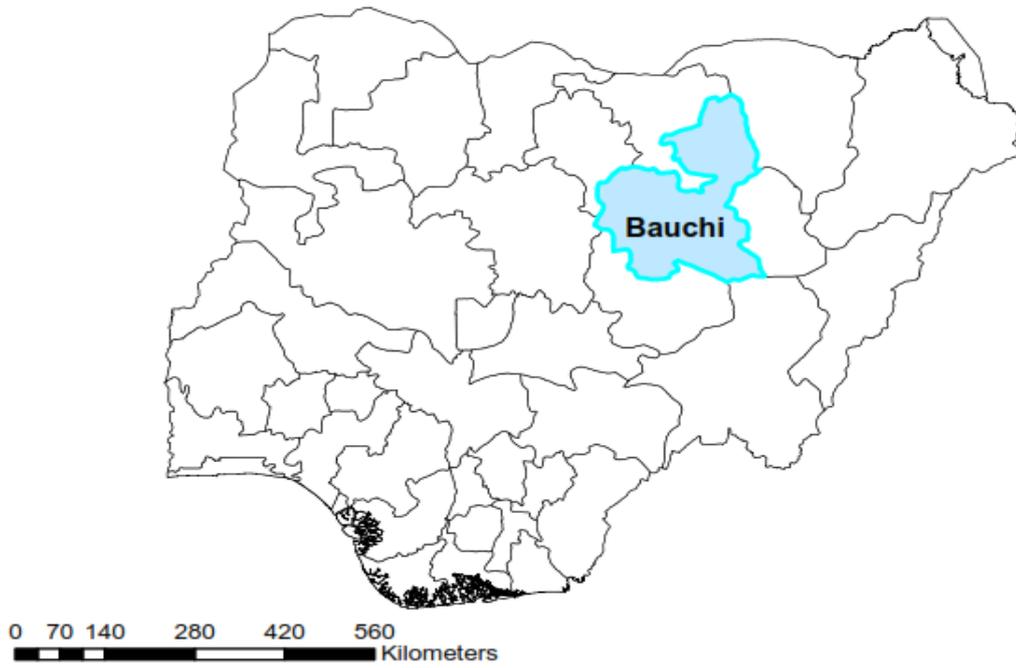
### **3. Research methodology**

#### **3.1. Study area**

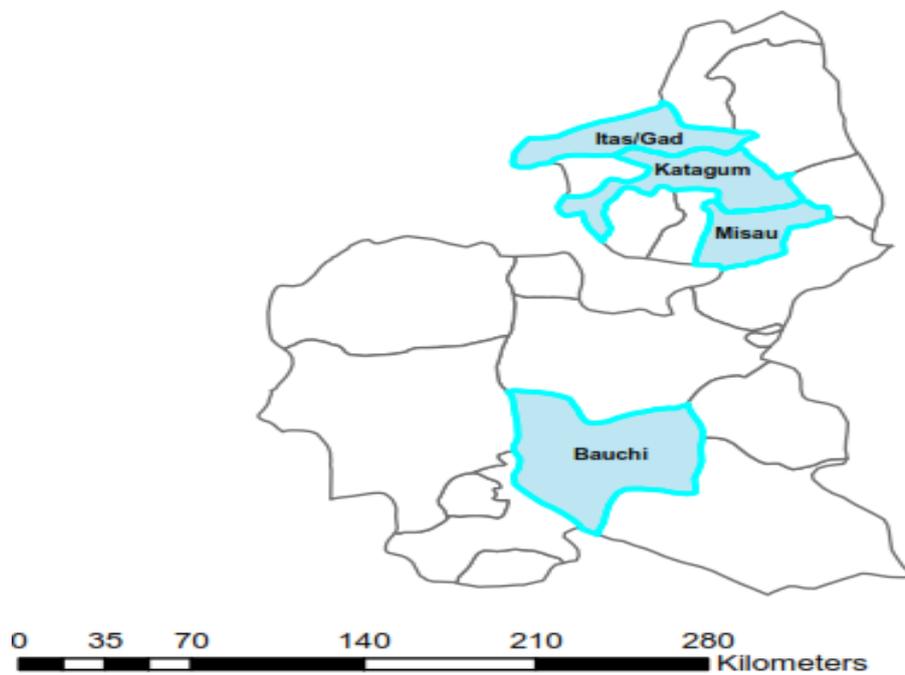
The study was carried out in higher institutions of learning in Bauchi State, Nigeria, the state located in North-east geo-political Zone of the country as shown in Figure 1 and was created in February 1976 after the disintegration of North-eastern Nigeria into three states viz: Bauchi, Borno and Gongola states. The state occupies a total land area of 49,119 km<sup>2</sup> representing about 5.3% of Nigeria's total land mass and is located between latitudes 9° 3' and 12° 3' north and longitudes 8° 50' and 11° east, with the population of 6 million inhabitants (NBS 2018). The State has a total of 55 tribal groups in which Hausawa, Fulani, Gerawa, Kirfawa and Jarawa are the main tribes. This means that they have backgrounds, occupational patterns, beliefs and many other things that form part of the existence of the people of the state. There are cultural similarities in the people's language, occupational practices, dresses, festival and there is a high degree of ethnic interaction especially in marriages. Some of the ethnic groups have joking relationship that exist between them, e.g. Fulani and Kanuri, Jarawa and Sayawa, etc. 90% of the population are peasant crop and livestock producers, rice, maize, millet and cowpea are the major crops in the area (BSADP 2010). The state is administered under twenty (20) Local Government Areas (LGAs) as shown in figure 2. The state has thirteen (13) public institutions of learning that consist of two Universities, two Polytechnics, two collages of education, one Collage of Agriculture, one Collage for Legal and Islamic studies, one Collage of Health Technology, one Social Development Institute and School of Nursing and Midwifery.

##### **3.1.1. Food safety regulation agencies**

There are three prominent public agencies in Nigeria that authorized to regulate regulating and controlling the manufacture, importation, exportation, advertisement, distribution, sale and use of drugs, food, medical services, and control food safety, these are:



**Figure 4: Map of Nigeria showing Bauchi state**



**Figure 5: Map of Bauchi state showing the locations of the higher institutions of learning**

### **3.1.1.1. The National Agency for Food and Drug Administration and Control (NAFDAC)**

NAFDAC is a Nigerian government federal agency under the under federal ministry of health that is responsible for regulating and controlling the manufacture, importation, exportation, advertisement, distribution, sale and use of drugs, food, medical services, cosmetics, package water and chemicals. The organization was formed to checkmate illicit and counterfeit products in Nigeria in 1993 under the country's health and safety law. The formation of NAFDAC was inspired by a 1988 WHO assembly resolution requesting countries' help in combating the global health threat posed by counterfeit pharmaceuticals. In January 1993, supporting legislation was approved as legislative Decree No. 15 of 1993. On January 1, 1994 NAFDAC was officially established as a “parastatal of the Federal Ministry of Health” (NAFDAC 2013).

The agency has three parts, these include:

- i. The Legal unit is charged with offering legal advice on “law arising from Employee-Employer relationship and is the custodian of legal documents and all agreements relating to the Agency
- ii. The Public Relations unit is headed by the director-general’s office. Its main function is to inform, sensitize, enlighten and create awareness concerning the role of the Agency. The agency is divided into eight directorates with the last two newly added.
- iii. Internal Audit provides a means of measuring the effectiveness of the system of internal control and accounting and carries out special investigations.

Functions of the agency are to:

1. Regulate and control the importation, exportation, manufacture, advertisement, distribution, sale and use of drugs, cosmetics, medical devices, packaged water and chemicals
2. Conduct appropriate tests and ensure compliance with standard specifications designated and approved by the council for the effective control of quality of food, drugs, cosmetics, medical devices, packaged water, and chemicals.
3. Undertake appropriate investigation into the production premises and raw materials for food, drugs, cosmetics, medical devices, bottled water and chemicals and establish a relevant quality assurance system, including certification of the production sites and of the regulated products

4. Undertake inspection of imported foods, drugs, cosmetics, medical devices, bottled water, and chemicals and establish a relevant quality assurance system, including certification of the production sites and of the regulated products.
5. Compile standard specifications, regulations, and guidelines for the production, importation, exportation, sale and distribution of food, drugs, cosmetics, medical devices, bottled water, and chemicals
6. Undertake the registration of food, drugs, medical devices, bottled water and chemicals
7. Control the exportation and issue quality certification of food, drugs, medical devices, bottled water and chemicals intended for export
8. Establish and maintain relevant laboratories or other institutions in strategic areas of Nigeria as may be necessary for the performance of its functions.

**The achievements of the agency include**

- i. The creation of six zonal and 36 state offices for easier accessibility, which are being equipped to function effectively;
- ii. Organization of workshops to enlighten various stakeholders, such as (a) pure water producers (b) the Patent and Proprietary Medicine Dealers Association (PPMDA), and (c) the National Union of Road Transport Workers and National Association of Road Transport Owners (NURTW & NARTO);
- iii. Raising awareness not just in Nigeria, also in other countries like China, Pakistan, India, Egypt and Indonesia;
- iv. Holding meetings, in concert with the Chairman, House Committee on Health and his members, with Ambassadors of countries identified with exporting fake drugs into Nigeria and solicited their support to stop the trend;
- v. Achieving excellent results in the fight against counterfeit drugs, as evidenced by the public destruction of about 2 billion Naira worth of drugs from four sources, namely those handed over by repentant traders, those found in secret warehouses on tip off by the drug sellers and the public, and those seized by the drug sellers' internal task forces and NAFDAC task forces (NAFDAC 2005).

**Problems and controversies**

The activities of NAFDAC have been the subject of considerable scrutiny in recent years. The agency has drawn fire for being susceptible to overt government

interference, subject to bribery, internal feuding and constant rumours and or allegations abound concerning misappropriation of funds (Chibuike 2015).

### **3.1.1.2. Standard Organization of Nigeria (SON)**

SON was established by SON Act No. 14, 2015, which repeals the Standards Organization of Nigeria Act, Cap 59 laws of Federal Republic of Nigeria, 2004, and Enact the STANDARDS ORGANISATION OF NIGERIA Act. 2015 for providing additional functions for the organization, increasing penalty for violation, and for related matters. This SON Act 2015 has now replaced the Enabling Act No. 56 of 1971 which has three amendments: (Act No. 20 of 1978, Act No. 32 of 1984 and Act No. 18 of 1990) (SON 2015).

Mandate of SON are to:

- i. Designation, establishment, approval and declaration of standards in respect of metrology, materials, commodities, structures and processes.
- ii. Certification of products in commerce and industry throughout Nigeria.
- iii. Quality control of products, weights and measures.
- iv. Matters relating to metrology- ensure reference standards for calibration and verification of measures and measuring instruments
- v. Investigation of quality of products etc.
- vi. Enforcement of Standards.
- vii. Quality management.
- viii. Registration and regulation of standard marks and specifications etc.
- ix. Establishment and maintenance of Laboratories.
- x. Compilation and publication of Scientific or order data.
- xi. Sponsoring national and international conferences.
- xii. Preferring professional advice to government of the federation or state on specific problems relating to Standards specifications.
- xiii. Research.

### **3.1.1.3. Consumer Protection Council (CPC)**

CPC is a Parastatal of the Federal Government of Nigeria, supervised by the Federal Ministry of Trade and Investment. Though it was established by Act No. 66 of 1992, it commenced

operations only in 1999, when its institutional framework was put in place. The organization mandated to, among others, eliminate hazardous products from the market, provide speedy redress to consumers complaints, undertake campaigns as will lead to increased consumer awareness, ensure that consumers interest receive due consideration at the appropriate forum, and encourage trade, industry and professional associations to develop and enforce in their various fields quality standards designed to safeguard the interest of consumers (CPC 2015).

The Consumer Protection Council (CPC) by its enabling Act engages in the following activities:

- i. Presentations to various audiences, delivers lectures and speaks to individuals and groups in and out of office, conducts workshops and seminars, broadcast messages on radio and television, places, distribute or display consumer sensitization information in the public domain through print, electronic media, billboards, journal, pamphlets etc.
- ii. The Council carries out surveillance and enforcement activities, Conducts quality tests and analysis on products and services. Compels producers of goods and services to adhere to quality standards/specifications. Issues guidelines, regulations etc. Ban the sale, distribution and advertisement of substandard and defective products and services. Prosecute offenders, when and where necessary.
- iii. The Council receives and acts on consumer complaints, Negotiates, mediates and conciliates consumer complaints, obtains compensation, relief, safeguards etc for injured consumers or communities and applies to court to protect the right of consumers.
- iv. The Council carries out surveys to determine consumer satisfaction / expectations Collaboration with sector regulators, NGOs and all stakeholders in achieving better regulations and standards in the interest of consumers (CPC 2015).

### **3.2. Sampling techniques and study design**

This study was carried out in six higher institutions of learning in Bauchi state, Nigeria. The higher institutions of learning were purposively selected out, from the thirteen institutions located in the state. Following higher institutions of learning were selected: 1. Abubakar Tafawa Balewa University Bauchi; 2. Abubakar Tatari Ali Polytechnic Bauchi; 3. A. D. Rufa'i College for Legal and Islamic Studies Misau; 4. Bauchi State University Gadau, 5. Federal Polytechnic Bauchi and 6. College of education Azare.

The institutions are sited in Bauchi, Misau, Katagum and Itas-gadau as shown in figure 2. From the total of 342 food vendors selling food in the selected institutions, 181 food vendors were randomly selected. The sample size was calculated using the Krejcie & Morgan (1970) equation:

$$S = \frac{X^2 NP(1-P)}{[d^2(N-1) + X^2 P(1-P)]} \quad \dots (1)$$

Where:

**S** = Required sample size

**X<sup>2</sup>** = The table value of chi-square for 1 degree of freedom at desired confidence level (3.841)

**N** = The study population size

**P** = The Population proportion (assumed to be 0.50 to provide maximum sample size)

**d** = The degree of accuracy (0.05).

### **3.3. Data collection**

Structured questionnaire was used as an instrument for the data collection. The questionnaire was used after pre-tested and amended necessary questions, which comprised the following sections:

Food handling sources of knowledge/information; Food safety knowledge section; Socio-economic characteristics (sex, age, income, education etc.) section. food safety attitude questions; Food safety behaviour questions; environmental, sanitation and hygiene condition questions and finally, economic and social controls questions.

The data were collected using face-to-face interviews conducted by the researcher. The researcher conducted the interviews most often in English language except for few, less than 5% in Hausa language (native language of the study area). Those interviews were translated back into English language at the spot. The interview lasted between 20-30 minutes and the data were collected from July to September 2018.

A pilot test survey was conducted with 19 food vendors in the study sites as 10% of the study sample size is recommended (Hertzog 2008). Based on the test, necessary amendment and adjustment were made to make the questionnaire fully understandable for the food vendors. Data collected during the pilot test were not included in the main research.

### 3.4. Data analysis

Descriptive and inferential statistics was used for analysing the data collected. Descriptive statistics in form of arithmetic mean, mode, percentages and standard deviation were employed to describe all the collected data.

Inferential statistics in form Multiple Linear Regression, Pearson Product Correlation and Structural Equation Modelling (SEM) was used to achieve all the stated objectives using Stata 13 statistical software and SPSS AMOS 22. Multiple linear regression

#### 3.4.1. Multiple linear regression

Multiple linear regression was used to determine the influence of socio-economic characteristics and food handling information sources on food safety knowledge as described in table 1.

Below is the model specification:

$$Y = b_0 + b_1X_1 + b_2X_2 + \dots + b_nX_n + e \quad \dots (2)$$

Where:

$Y =$  *Dependent variable* (Food safety knowledge score, ranging from 0-18)

$b_0 - b_n =$  Regression coefficients

$X_1 - X_n =$  Independent variables (socio-economic variables and food handling information sources) and  $e =$  Error term

The model was tested for multicollinearity using correlation, coefficients of tolerance and variance inflation factor (VIF) which indicated that the variables are independent. Durbin-Wu-Hausman test did not indicate any effect of potential endogeneity. Stata 13 statistical software was used for data analysis.

**Table 1: Description of the variables used in the multiple linear regression model**

Dimension	Variable	Description	Literature
Knowledge	Food safety knowledge	Knowledge score 0-18 (correct answer=1, no & I don't know=0)	Elffers et al. 2003; Roberts et al. 2008; Bavorova et al. 2016; Ko, 2013; Lim et al., 2016 & Baser et al. 2017
Vendors characteristics			
	Sex	0= Female and 1= Male	Osaili et al. 2013; Nora et al. 2017
	Age	Number of years	Nora et al. 2017
	Household size	Number of people in the house	Yusha'u et al. 2015
	Literacy Education	0= No and 1= Yes	Webb and Morancie 2015
	Food vending experience	Years of food vending business	Osaili et al. 2013; Webb and Morancie 2015
	Average food vending profit	USD/month	Osaili et al. 2013; Nora et al. 2017
Food handling information sources use			
	Number of training attend	Number of training in life	Webb and Morancie 2015; Osaili et al. 2013
	Radio	No=0 and Yes=1	Christine and Howard 1998; Yusha'u et al. 2015
	Television	No=0 and Yes=1	Yusha'u et al. 2015; Christine and Howard 1998
	Newspaper	No=0 and Yes=1	Christine and Howard 1998; Yusha'u et al. 2015
	Food inspection institution	No=0 and Yes=1	Yusha'u et al. 2015; Christine and Howard 1998
	Social media	No=0 and Yes=1	Christine and Howard 1998;
	Internet	No=0 and Yes=1	Yusha'u et al. 2015
	Colleagues and friends	No=0 and Yes=1	Christine and Howard 1998

### 3.4.2. Pearson Product Correlation

Pearson product correlation was used to achieve objective ii (determine the relationship that exist between food safety knowledge, food safety attitude and food safety practices behaviour).

The equation is:

$$r_{xy} = \frac{n\sum XY - (\sum X)(\sum Y)}{\sqrt{(n\sum X^2 - (\sum X)^2)(n\sum Y^2 - (\sum Y)^2)}} \dots(3)$$

Where:

$r_{xy}$ = Correlation coefficient

$n$ = Number of observations

$X$ = Food safety knowledge and food safety attitude score

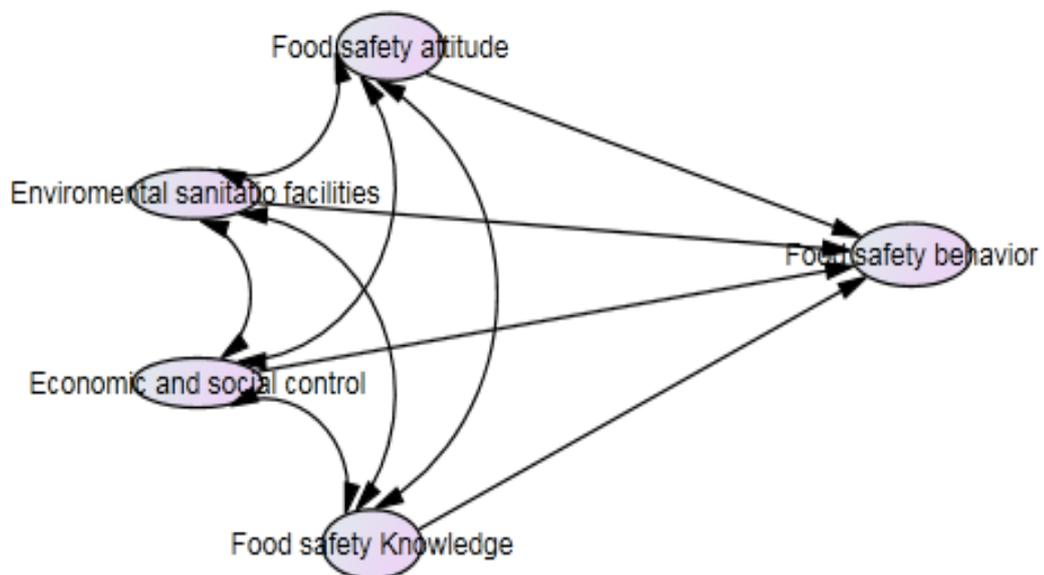
$Y$ = Food safety behavioural score

$\Sigma$ = Summation symbol/sigma

### 3.4.3. Structural equation modelling

Structural equation modelling was used to achieve objective iii (analyse the determinants of food safety practices behaviour among food vendors) the equation will group and compute all the indicators into five components vis vis:

Food safety knowledge, food safety attitude, environmental sanitation facilities, economic and social control and food safety behaviour as shown in figure 3.



**Figure 6: Model development of the determinants of food safety practices behaviour**

## 4. Results and discussion

### 4.1. Sample socio-economic description

Majority (80.7%) of the food vendors in the study area are female (Table 1), this is because traditionally food preparation is the role of female in the study area and chances of female to be absorbed into the formal employment sector is lower compared to their male counterpart.

**Table 2: Socio-economic characteristic of food vendors (N=181), 2018**

Variable	Items	Frequency	%
Sex	Female	146	80.7
	Male	35	19.3
Age (years)	<20	5	2.8
	20-30	104	57.5
	31-40	44	24.3
	41-50	20	11.0
	>50	8	4.4
Marital status	Single	84	46.4
	Married	81	44.8
	Divorced	10	5.5
	Widow	6	3.3
Household size	<5	157	86.7
	5-10	23	12.7
	>10	1	0.6
Highest level of education	Non-formal education	12	6.8
	Primary education	16	8.8
	Secondary education	78	43.1
	Diploma/NCE	48	26.5
	B.Sc.	24	13.3
	Postgraduate	3	1.7
Food vending experience (years)	<5	105	57.5
	5-10	36	19.9
	11-15	28	15.5
	16-20	9	5.0
	>20	4	2.2
Food vending profit (\$/month) <sup>1</sup>	<137.74	150	82.9
	137.74-275.48	26	14.4
	>275.48	5	2.8

<sup>1</sup>1 USD=363 Naira (Nigerian currency) on 10/12/2018 (The original categories were in Naira: 1. <50,000; 2. 50,001-100,000 and 3. >100,000)

This is in line with the African Development Bank [AfDB] (2015) who reported that African women are highly entrepreneurial and driven into small business by the lack of alternatives. The result of this study also corroborated with that of Omemu & Aderoju (2008) who reported that majority of vendors in several countries including Nigeria are women. The 20-30 years age group accounted for 57.8% of the sample respondents. This is corroborated with that of Sani and Siow (2014) who reported that majority of food handlers were between the age bracket of 21-30 years in Universiti Kebangsaan Malaysia and Al-shabib et al. (2016) recorded same in King Saud University Saudi Arabia. 43.1% of respondents had secondary education as their highest-level of education. This agreed with the findings of Sani and Siow (2014); Webb and Morancie (2015). More than half (57.5%) of the respondents have less than 5 years of food vending experience, this corroborated with that of Al-shabib et al. (2016); Sani and Siow (2014); Webb and Morancie (2015). Majority of the interviewed food vendors (82.9%) earn less than \$137 per month. This shows that though majority fell into lowest earning profit category in food vending business but, this lowest category is greater than Nigerian minimum wages. This is in conformity with that of (Omemu & Aderoju, 2008) who reported that Studies in Nigeria and Morocco show that majority of street food vendors usually obtain higher income than the minimum salaries of those countries.

#### **4.1.1. Food safety knowledge description**

The result presented in Table 2 revealed that food vendors had highest knowledge of the following questions on food safety: i. Food, from unhygienic and unclean source might harbour disease causing organism (87.8% respondents know); ii. Unaccredited, off brand and bulk product should not be purchased (80.1% know); iii. Some diseases are transferable from animal to human (zoonotic diseases) (79.6% know) and iv. After touching raw food stuff, touching cooked food without cleaning hand cause transfer of microorganism (77.9% know). The vendors had relatively low knowledge on the questions: i. Keeping cooked food with raw food in refrigerator can cause health problems (41.4% know) and ii. Internal temperature of the refrigerator should be less than 5 degrees Celsius i.e. less than danger zone (47.5% know)

**Table 3: Descriptive result of food safety knowledge (N=181)**

<b>Dimension</b>	<b>Question</b>	<b>Correct (%)</b>
<b>Hygienic source of food stuff</b>		
	Food can be source of disease infection	<b>74.0</b>
	Food from unhygienic and unclean source might harbour disease causing organism	<b>87.8</b>
	Using expired food can't cause health disorder	<b>53.6</b>
	No foodborne disease/contamination can cause death	<b>49.7</b>
	Purchased food may seem clean, but there are bacteria in all food	<b>70.2</b>
	Unaccredited, off brand and bulk product should not be purchase	<b>80.1</b>
<b>Cross contamination</b>		
	A frequently used rags and laundry should not be kept out of kitchen	<b>59.7</b>
	Some diseases are transferable from animal to human (zoonotic diseases)	<b>79.6</b>
	Human can't be infected from unhygienic food stuff	<b>68.5</b>
	Food can't be contaminated from improper handling/processing	<b>71.3</b>
	Microorganism are not frequently found in hand	<b>56.4</b>
	The taste of a food should be checked with a different spoon	<b>54.1</b>
<b>Storage and leftover food handling</b>		
	Keeping cooked food with raw food in refrigerator is not causing health problem	<b>41.4</b>
	After touching raw food stuff, touching cooked food without cleaning hand cause transfer of micro organism	<b>77.9</b>
	Keeping cooked food at room temperature more than 2 hours can lead to contamination	<b>58.6</b>
	Internal temperature of the refrigerator should be less than 5 degrees Celsius	<b>47.5</b>
	Cooked meat, fish, poultry and milk should not be stored at more than 5 degrees	<b>54.1</b>
	Leftover food should be stored in refrigerator within two hours	<b>60.2</b>

#### **4.1.2. Socio-economic and food handling sources of information used in regression model**

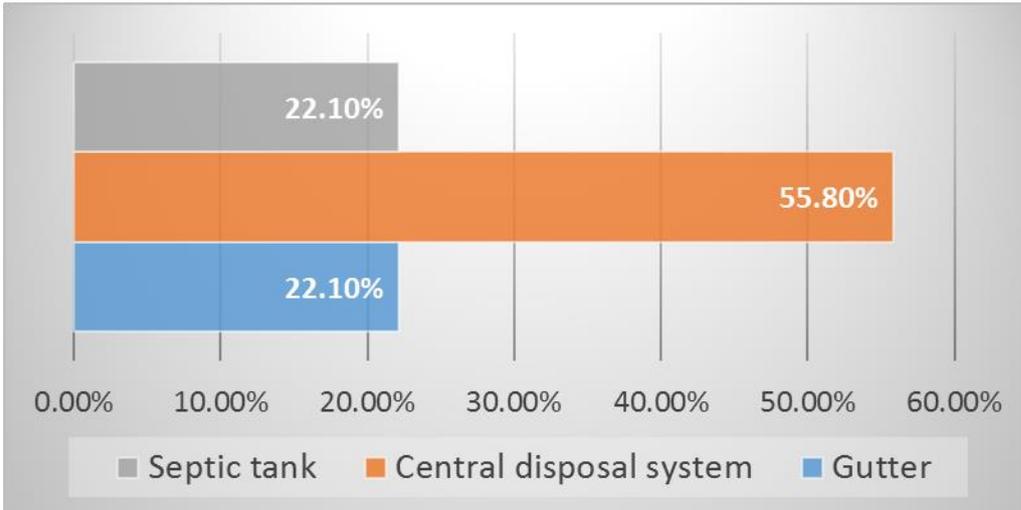
Variables used in the Linear Regression Model (Appendix: 1) shows that that the minimum food safety knowledge score of the respondents is 2 points while the

maximum is 17 points with mean of 10.89 and standard deviation of 3.05. The minimum age is 15 years and 60 years is the maximum, with the mean of 30.71 and standard deviation of 9.59. The minimum household size reported is 1 member while the maximum is 15 members, with mean and standard deviation of 2. The minimum years of education recorded was 0 and the maximum was 18 with mean and standard deviation of 12.12 and 3.93 respectively. Among the interviewed vendors, minimum years of vending experience was 1 and maximum of 40 years with 7.54 and 6.24 as mean and standard deviation respectively.

Furthermore, large differences in the profit from food vending. The minimum food vending profit was 41 \$/month and maximum of 555 \$/month with mean of 87.35 and 85.49 as standard deviation. 55.2% of the food vendors attended food handling training, from them the maximum number of training attended is 4 times and the minimum is ones in life. Regarding food handling information sources, more than half (51.9%) consult friends and colleagues as their food handling source of information followed by food inspection institutions (42%) and TV with 28.7%. Only 9% of the participants use social media and 7.7% Internet as their food handling information source.

#### **4.1.3. Environmental Sanitation facilities**

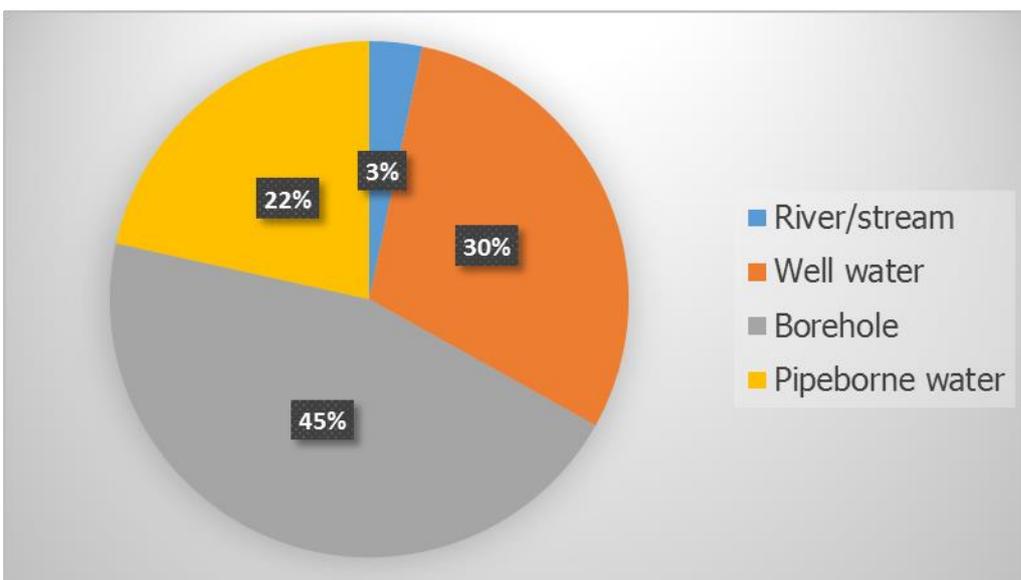
Result (Figure: 7) shows that Majority (55.80%) of the respondent reported that available sewage disposal system in their shop places is central disposal system, both septic tank and gutter system constituted 22.10% each. This implies that food vendors disposed their garbage in open dumping area properly selected by authority, but the problem is that the accumulated refuse may remain for more than a month to form a heap without evacuation which created an odour and the place serve as disease vector breeding areas. This agreed with that of Alimi (2016) who observed accumulation of large heaps of garbage around street food vending sites in Zambia which harboured insects and animal pests. Similarly, heaps of garbage around the vending sites could serve as breeding sites for rodents, insects and flies which promote transmission of



**Figure 7: Type of sewage disposal system in study site**

microorganisms and enhanced the risk of contamination of foods and transmission of diseases (Umoh and Odoaba 2008; Mensah et al. 2002).

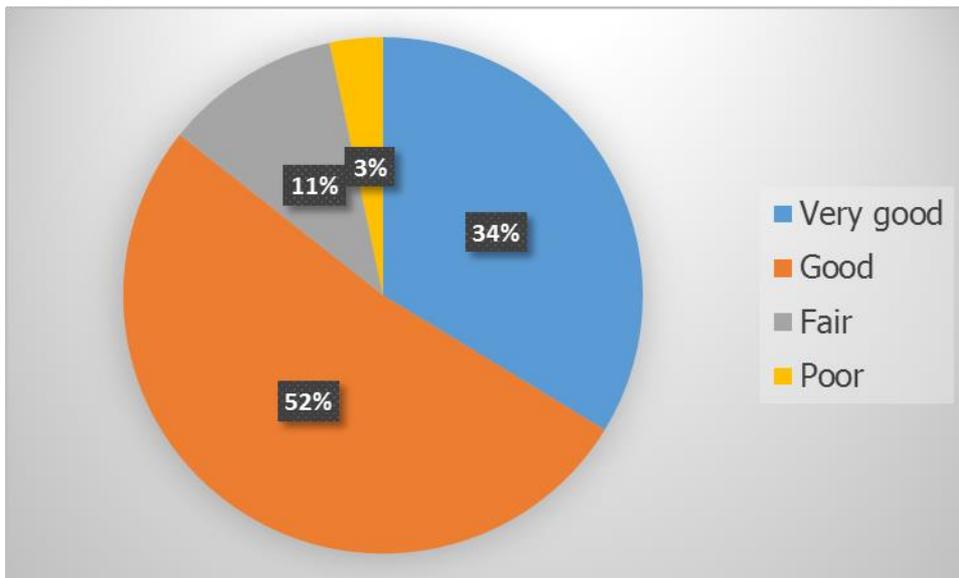
Regarding source of water, fig. 8 shows that 45% of the respondents reported that the available source of water in their vending site is borehole then 30% well water and 22% pipe borne water while 3% river/stream. This shows that the dominated sources of water at vending site are borehole and well water of which both are non-treated water though, they are better than river/stream but below pipe borne water in term of quality. Similarly, Benny-Olliviera and Basrie (2007) revealed that majority of the observed vending sites there is no pipe borne water in West Indies.



**Figure 8: Type of source of water in the study site**

This inadequacy of pipe borne water tallying with vending site in Philippine and Uganda as reported by the studies (Azanza 2000; Muyanja et al. 2011).

Regarding the quality of water, result (figure 9) shows that majority (52%) of the food vendors perceived that the water at their disposal is good, 34% very good and 11% fair while only 3% perceived that the water is poor.

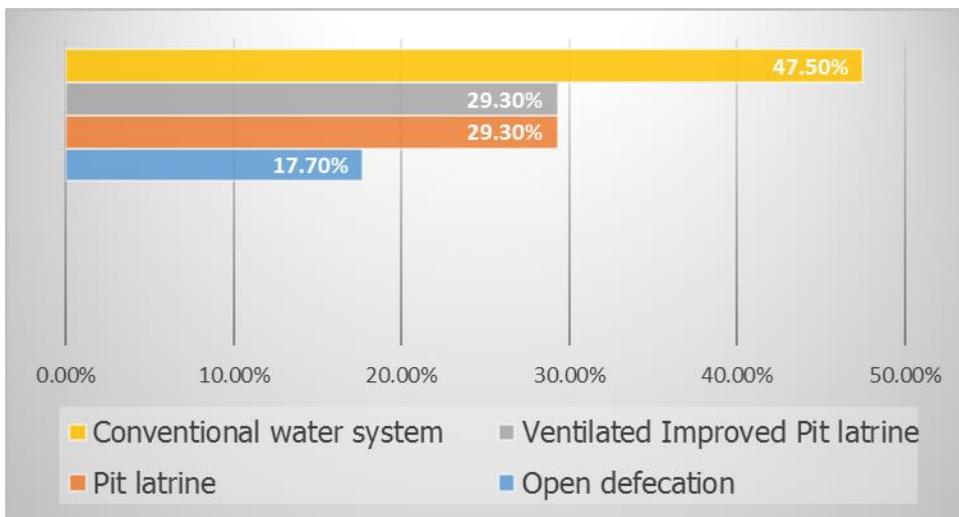


**Figure 9: Perceived water Quality by food vendors**

This shows that even based on their perception 14% (fair and poor) agreed that the water cannot be describe as good not to talk of standard laboratory water evaluation which probably the water quality will be lower than their perception as reported by the studies of Tambekar et al. (2008) who reported food vendors in India have found contamination to be largely as the result of poor water quality, and poor hygiene during food preparation.

Regarding type of toilet in the study vending site, figure 9 revealed that 47.50% of the food vendors reported that the available type of toilet in their vending site is conventional water system type of toilet, pit latrine and ventilated improved pit latrine constituted 29.30% each and 17.70% have none in their vending site which make them to practice open defecation. This implies that almost 1/5 of the food vending site has no any available toilet for food vendors which serious issue, because open defecation creates a serious problem of direct and indirect disease transmission not only to the vending site but also to the neighbouring community during rainfall and overflowing.

This agreed with that of Idowu and Rowland (2006) who revealed that most of the street food vendors surveyed in Abeokuta, Nigeria used dung hills and nearby bushes in place of toilets. Places where these facilities are provided, large number of food vendors in human congested areas usually pose serious strain on them resulting in interference with master city plan and adverse effects on daily life (Muyanja et al. 2011). Studies by Benny-Olliviera and Basrie, (2007) revealed that 97.5% of food vendors did not have drainage to remove waste water and toilet facilities in West Indies.



**Figure 10: Type of toilet in the study site**

#### **4.1.4. Economic and social control**

Result (Appendix: 2) revealed that wearing of gloves, caps, frequent hand washing etc. (food safety practices) is costly (money) has mean of 3.16 and standard deviation of 1.52. This means cost of food safety practice compliance is the major cause of non-compliance among the food vendors. This corroborated with that of Lues et al. (2006) in Bloemfontein, South Africa, who reported that food vendors agreed that they had to prepare food for public consumption at some point while they were sick probably because their sustenance depended on daily returns from the trade. Azaza et al. (2000) established a significant gap between food safety knowledge and food safety practice behaviour attributed the non-compliance with financial issue among food vendors in Philippine university.

Food safety practices is time consuming has a mean of 2.87 and standard deviation of 1.54 (Appendix: 2). this mean time spend during food safety practice

compliance is also impediment to good food safety practices among food vendors. This is in line with that of Pang and Toh (2008) who revealed that food vendors in Malaysia consider wearing of head cover, apron and glove as cumbersome and their regular removal as time wasting and consuming, they also preferred selling their products by the roadsides to designated places with inadequate safety facilities because of better patronage as result of proximity to consumers. Omemu and Aderoju (2008) recorded that 93% and 94% of the food vendors consider price and volume respectively when buying raw food while only 39% of them consider reputable wholesalers in Abeokuta, Nigeria. Similarly, Liu et al. (2015) reported that time, cost of compliance and rush to serve customer also, affect food vendors HACCP compliance.

The result (Appendix: 3) also, revealed that between food vending shop and source of water has an average distance of 119.85m and standard deviation of 254.91m. Toilet from vending shop has an average distance of 121.02m and standard deviation of 260.99m. Sewage disposal site from vending shop has an average distance of 137.17m and standard deviation of 293.89m. This finding agreed with that of Powell et al. 1999; Bhat and Waghray 2000; Azanza 2000; Muyanja et al. 2011 in Jamaica, Lima, Peru, Philippines and Uganda reported that inadequacy and absence of necessary sanitation facilities at the food preparation sites were mostly responsible for non-compliance with basic hygienic principles. Idowu and Rowland (2006) revealed that most of the street food vendors in Abeokuta, Nigeria used dung hills and nearby bushes in place of toilets and clean up with sheets of paper. Muyanja et al. (2011), reported that 92.8% of vendors in Kampala, Uganda used gunny bags for garbage collection. Several studies reported that overflowing of garbage bins was a common site in most vending points while the final garbage disposals are usually far away from vending sites.

#### **4.2. Influence of vendors' socio-economic characteristics and used information sources on food safety knowledge**

The results of Multiple Linear Regression (Table 4) revealed that the age of food vendor has statistically significant impact on her/his food safety knowledge. The negative regression coefficient of -0.0836 means that the one-year increase in food

vendor's age result in 0.08 decrease in food safety knowledge score. This may be, because the family and community social responsibilities that are increasing with age of the person in the study area which will lead to the decrease on the time devoted to the information sources. Similarly, Nora et al. (2017) reported a significant impact of age on food safety knowledge of consumers in Republic of Ireland. In their study the age group 26-35 years, has higher food safety knowledge than other age groups.

**Table 4: Multiple linear regression result**

<b>Variable</b>	<b>Coefficient</b>	<b>Std. Err.</b>	<b>p-value</b>
Sex	-0.0695	0.5747	0.904
Age (years)	-0.0836	0.0316	<b>0.009</b>
Household size	-0.0423	0.1112	0.704
Literacy	2.8475	1.2984	<b>0.030</b>
Education (years)	1.7962	0.4871	<b>0.000</b>
Food vending experience	0.3021	0.2588	0.245
Food vending profit	0.6042	0.5085	0.236
Food handling training	<b>0.0355</b>	<b>0.0360</b>	<b>0.326</b>
Radio	-0.4147	0.5855	0.480
Television	0.4723	0.5173	0.363
Newspaper	0.7417	0.7981	0.354
Formal institution	0.3369	0.5444	0.537
Social media	-0.8298	0.7936	0.297
Internet	-0.0364	0.8748	0.967
Friends and colleagues	1.0184	0.4882	<b>0.039</b>
Constant	7.7891	1.4858	0.000
F-value			0.0005
R <sup>2</sup>	0.2157		

**\*\*= significant at p<0.05 and \*\*\*= significant at p<0.01**

Regarding whether the food vendor is literate or not, the study shows that literacy is significantly at p<0.05 with positive regression coefficient of 2.8275. This means that the literate food vendors had almost 2.82 higher food safety knowledge score than illiterate food vendors. This may be explained by the fact that literate food vendors have more access to the written information sources and understand it.

The result in Table 3 also shows that years of education has significant influence on food safety knowledge of the food vendors at  $p < 0.01$  with positive regression coefficient of 1.7962, which implies that a one-year increase in formal education of the food vendor will result in 1.79 increase on food safety knowledge score of the food vendor.

This finding is in line with that of Toh and Birchenough (2000) who reported the statistically significant impact of education on food safety knowledge among 100 food hawkers in Malaysia. Also, it agrees with that of Webb and Morancie (2015) who reported a significant difference between different levels of education among food service workers in university campus of Trinidad and Tobago, where workers with high education had more food safety knowledge. Osaili et al. (2018) reported that education levels have statistically significant impact on food safety knowledge among food service staff in restaurants of 34 campuses of universities in Jordan. However, this result contradicts the one by Choudhury et al. (2011) who revealed that years of education had no statistically significant influence on food safety knowledge and attitude of vendors in Guwahati, India.

Surprisingly, attending food handling training has no statistically significant effect on food safety knowledge of the food vendor. These results contradict the findings of Toh and Birchenough (2000) and Pang and Toh (2008) who reported a significant influence of food handling training on food safety knowledge of the food vendor. Similarly, Al-shabib et al. (2016) reported a significant positive correlation between food safety training and food safety knowledge among male food handlers employed in restaurant of King Saud University Saudi Arabia. Also, Webb and Morancie (2015) found a significant food safety knowledge differences between those that attended basic food training and those who did not attend the training among food service workers in university campus of Trinidad and Tobago. Similarly, Choudhury et al. (2011) found out a significant difference of food safety knowledge and hygiene before and after providing food safety training to selected 80 street food vendors in India. One explanation for no effect of attending food handling training on food safety knowledge in our study can be the low frequency of trainings. In our study, more than half of the vendors mentioned that they attended the training in the past but not very frequently (maximal 4 times in their life). Further, it may be that the training took part long time ago and the vendors already forgot the knowledge received. In addition,

inappropriate information received during the training could result in its low effect on the food safety knowledge.

Similarly, also the use of food inspection institution information has no statistically significant effect on food safety knowledge.

Use of media such as radio, television, newspaper, social media and internet for food safety information do not statistical significantly affect the food safety knowledge in our model. Differently, consulting friends and colleagues has significant influence on food safety knowledge at  $p < 0.05$  with positive regression coefficient of 1.0184. This implies that food vendor that use friends/colleagues as source of information will have one-point higher food safety knowledge score than the food vendor who doesn't.

### 4.3 Relationship between food safety knowledge, food safety attitude and food safety behaviour

The result (Table 5) shows the relationship between food safety knowledge, food safety attitude and food safety behaviour. The result shows that there is a significant positive relationship between food safety knowledge and food safety attitude at  $p < 0.05$  with correlation coefficient of 0.152. This implies that increase in one will lead to the increase in another one, this agree with that of Lim et al. (2016) who reported a significant positive correlation between food safety knowledge and food safety attitude among food handlers of Bum-Bum island community of Samporna, Sabah, Malaysia. It is also, corroborated with that of Ko (2013) who reported a significant relationship between food safety knowledge and food safety attitude among restaurant employees in Taiwan.

The result also, shows that there is a significant relationship between food safety knowledge and food safety behaviour at  $p < 0.01$  with correlation coefficient of 0.271. This implies that increase in one will lead to the increase on another one.

**Table 5: Relationship between food safety knowledge, attitude and behaviour**

Variable	Food safety knowledge	Food safety attitude	Food safety behaviour
Food safety knowledge	<b>1</b>		
Food safety attitude	<b>0.152**</b>	<b>1</b>	
Food safety behaviour	<b>0.271***</b>	<b>0.287***</b>	<b>1</b>

\*\*= Significant at  $p < 0.05$  and \*\*\*= Significant at  $p < 0.01$

This is in line with that of Ko (2013) who reported a significant positive relationship between food safety knowledge and HACCP practices behaviour among restaurant employee in Taiwan. But, disagree with that of Baser et al. (2017) who reported not significant relationship between food safety knowledge and food safety behaviour among hotel staff in Turkey also, contradicted the findings of Lim et al. (2016) who reported a significant negative correlation between food safety knowledge and food safety behaviour among food handlers of Bum-Bum island community of Samporna, Sabah Malaysia.

The result revealed that there is a significant positive relationship between food safety attitude and food safety behaviour at  $p < 0.01$  with correlation coefficient 0.287. this means that increase in one will lead to the increase on another one. This agree with that of Lim et al. 2016; Baser et al. 2017 and Ko 2013

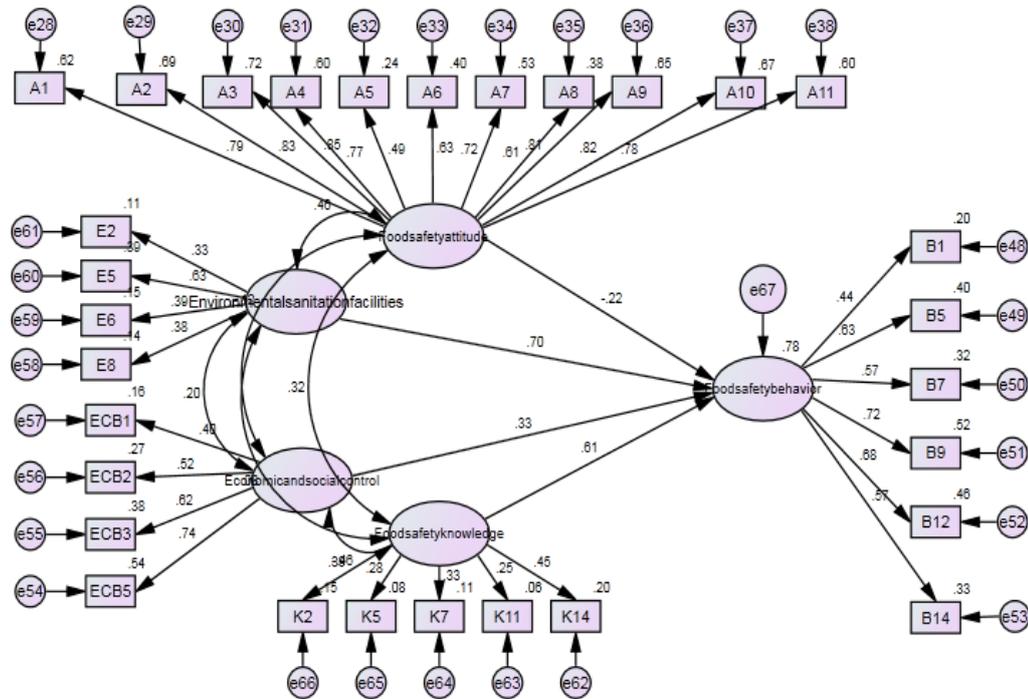
#### **4.4. Determinants of food safety behaviour among food vendors**

The results (Figure 7) show the determinants of food safety behaviour among of food vendors in the study area. The result shows that food safety knowledge has significant positive impact ( $\beta_1 = 0.61$ ,  $p < 0.05$ ) on food safety behaviour of food vendors. This implies that increase in food safety knowledge will result in increase on food safety behaviour. The result also, shows that there is a significant relationship between food safety knowledge and food safety behaviour at  $p < 0.01$  with correlation coefficient of 0.271. This implies that increase in one will lead to the increase on another one.

This is in line with that of Ko (2013) who reported a significant positive relationship between food safety knowledge and HACCP practices behaviour among restaurant employee in Taiwan. The result also, shows that there is a significant relationship between food safety knowledge and food safety behaviour at  $p < 0.01$  with correlation coefficient of 0.271. This implies that increase in one will lead to the increase on another one.

This is in line with that of Ko (2013) who reported a significant positive relationship between food safety knowledge and HACCP practices behaviour among restaurant employee in Taiwan. However, contradicted with that of Baser et al. (2017) who reported that food safety knowledge has no significant influence on food safety behaviour among hotel staff in turkey, also it is in contrary to that of Lim et al. (2016) who reported a significant negative correlation between food safety knowledge and food

safety behaviour among food handlers of Bum-Bum island community of Samporna, Sabah, Malaysia.



**Figure 11: SEM of Determinants of food safety practices behaviour**

**4.5. Limitation**

The result of this study was conducted on the food vendors of the higher institutions of learning in Bauchi state, Nigeria, therefore it can't represent the other higher institutions in other part of the world or generalize to outside of higher institution in the study area, result also, is prone to the bias as the data were collected by self-reporting from the food vendors.

## 5. Conclusions

The descriptive results on the knowledge of food vendors in higher institutions of learning of Bauchi state, Nigeria, show that there are large differences in the food safety knowledge of the study participants. To understand the differences in more detail, Multiple Linear Regression was used to test the influence of socio-economic characteristics and sources of information on food safety knowledge was analysed econometrically.

Regarding food vendor's socio-economic characteristics, the regression results show that age, literacy and increasing level of education statistical significantly increase the food safety knowledge of the food vendors in the study area. Assuming the higher knowledge is connected to food safety compliant behaviour, this result implies that to prevent the foodborne illnesses caused by food bought from vendors at the higher education facilities that the food handling trainings should be especially oriented at education of older, less educated and illiterate vendors.

The results of this study on sources of information on food safety used show, differently as in several previous studies, that the food handling training does not have an effect on the food safety knowledge score. One possible reason is low frequency and low quality of the training the respondents received. In order to improve food safety knowledge, we recommend the food regulation agencies in particular BASEPA in Bauchi State to put increased emphasis to the planning, implementation and evaluation of quality of food safety education programs. The further finding namely that those who receive information from formal food inspection institutions do not have more food safety knowledge than those who do not receive such information emphasize the need of improvement in information provision by public food safety bodies (NAFDAC, Ministry of Health and BASEPA). This finding can be used also by FAO that proposes technical assistance to help national and municipal authorities to ensure the safety and quality of street food. FAO (2009) also published very useful free learning material "Good hygienic practices in the preparation and sale of street food in Africa" to support the effectiveness in increasing food vendors' knowledge of trainings organized.

Also, the finding that those food vendors who receive the food safety information from their friends and colleagues have higher food safety knowledge than

those who do not receive information from this source have implication for policies aimed at increasing food safety knowledge. The policy makers could support establishment of professional groups of street food vendors that would provide a platform for meetings and information exchange among the members to increase the food safety knowledge as often is the case among farmers.

In the further studies it would be relevant to investigate if vendors with higher food safety knowledge also apply this knowledge and comply with the rules while preparing and storing food.

There is a positive relationship between food safety knowledge, food safety attitude and food safety behaviour of food vendors, therefore study recommended the provision of awareness and training on food handling which will result in an improvement on their food safety behaviour.

Sanitation facilities, food safety knowledge, social and economic control were positive determinants of food vendors' food safety practices behaviour. Provision of sanitation facilities, food safety awareness and training were recommended

## 6. References

Adebitan EO. 2011 Assessing compliance with food hygiene requirements among urban and sub-urban classified hotels in Bauchi state, Nigeria. A thesis submitted in partial fulfillment of the requirements for the award of Masters of Science in the school of hospitality and tourism management of Kenyatta University, unpublished, pp. 124.

Adeneye AK, Musa AZ, Oyedeji KS, Oladele D, Ochoba M, Akensinde KA, Niemogha MT, Nwaokorie FO, Bamidele TA, Brai BI, Ominigbehin EA, Bamedele M, Fesobi TW, Smith SI and Ujah IAO. 2016. Risk factors associated with cholera outbreak in Bauchi and Gombe state in north east Nigeria. *Journal of public health and epidemiology* 8 (11) 286-296.

AfDB. 2015. Empowering African women: An Agenda for an action, Africa Gender Equality Index 2015 pp. 11-13.

Ahmed Z, Afreen A, Hassan MU, Ahmad H, Anjum N and Waseem M. 2017. Exposure of Food Safety Knowledge and Inadequate Practices among Food Vendors at Rawalpindi; the Fourth Largest City of Pakistan. *Journal of Food and Nutrition Research*, Vol. 5, No. 1, 63-73.

Ajzen I. 2012. The Reasoned Action Approach the annals of the American Academy, pp 11-28.

Ajzen I. 1991. The theory of planned behavior. *Organizational Behaviour and Human Decision process* 50 (2) 179-211.

Ajzen I. and Fishbein M. 2005. The influence of attitude on behaviour. *The hand book of attitude*, Mahwah, NJ: Lawrence Erlbaum associates, pp 173-221.

Ajzen I. 2012. Theory of planned behaviour. *Hand book of theories of social psychology*, London: Sage, 1, 438-459

Akinbode SO, Dipeolu AO, Okuneye PA. 2011. Willingness to pay for street food safety in Ogun State, Nigeria, *J. Agric. Food Influence* 12, 154–166.

Aliboh, M. G. (2009). Antibioqram and serum resistance of E-coli isolated from chemical specimen. A B.Sc. thesis in applied microbiology. Biological science programme, Abubakar Tafawa Balewa University Bauchi, Nigeria.

Alimi BA. 2016. Risk factors in street food practices in developing countries: A review, *Food Science and Human Wellness* 5, 141–148.

Al-shabib NA, Mosilhey HS and Husain FM. 2016. Cross-sectional study on food safety knowledge, attitude and practices among male food handlers employed in restaurant of King Saud University, Saudi Arabia. *Food Control* 58, 212-217.

- Aluko OO, Ojeremi TT, Olaleke DA and Ajidagba EB. 2014. Evaluation of food safety and sanitary practices among food vendors at car parks in Ile Ife, southwestern Nigeria. *Food Control* 40, 165-171.
- Asiegbu CV, Lebelo SL and Tabit FT. 2016. The food safety knowledge and microbial hazards awareness of consumers of ready-to-eat street-vended food. *Food Control*, 60, 422-429.
- Azanza MPV, Gatchalian CF and Ortega MP. 2000. Food safety knowledge and practices of street food vendors in a Philippines university campus, *Int. Journal Food Science and Nutrition* 51, 235-246.
- Baser F, Ture H, Abubakirova A, Sanlier N and Cil B. 2017. Structural modelling of the relationship among food safety knowledge, attitude and behaviour of hotel staff in Turkey, *Food Control* 73, 438-444.
- Bauchi State Agricultural Development Programme [BSADP]. 2010. BSADP annual Crop Production Report Prepared by Planning, Monitoring and Evaluation Sub programme, pp 4-5.
- Bavorova M, Fietz AV and Hirschauer N. 2016. Does disclosure of food inspections affect business compliance?. The case of Berlin, Germany. *British Food Journal* 119, 143-163.
- Benny-Ollivierra C and Badrie N. 2007. Hygienic practices by vendors of the street food doubles and public perception of vending practices in Trinidad, West Indies, *Journal of Food Safe* 27. 66-81.
- Biswas S, Parvez M, Shafiquzzaman M, Nahar S and Rahman M. 2010. Isolation and characterization of *Escherichia coli* in ready-to-eat foods vended in Islamic University, Kushtia. *Journal of Bio-Science*, 18,99-103.
- Bryan FL, Jermini M, Schmitt R, Chilufya EN, Mwanza M, Matoba A. 1997. Hazards associated with holding and reheating foods at vending sites in a small town in Zambia. *Journal of Food Protection* 60, 391-398.
- Bryan FL, Michanie S, Alvarez P. & Paniaywa A. 1988. Critical control points of street-vended foods. *Journal of Food Protection*, 51, 373-383.
- Canini ND, Bala JJO, Maraginot EN, and Mediana BCB. 2013. Evaluation of street food vending in Ozamiz city, *Journal of Multidisciplinary Study* 1, 104–124.
- Carvalho FP. 2006. Agriculture, pesticides, food security and food safety, *Environ. Sci. Policy* 9, 685–692.
- Chibuike O. 2015. NAFDAC fines Guinness \$5 million over expired raw materials. *Financial Nigeria*. Retrieved 29 August 2016.

Choudhury M, Mahanta LB, Goswami JS and Mazumder MD. 2011. Will capacity building training interventions given to street food vendors give us safer food?: A cross-sectional study from India. *Food Control* 22, 1233-1239.

Christine MB, and Howard GS. 1998. Consumer food safety knowledge and practices. *Journal of food safety* 19, 73-87.

Cortese RDM, Veiros MB, Feldman C and Cavalli SB. 2016. Food safety and hygiene practices of vendors during the chain of street food production in Orianopolis, Brazil: A cross-sectional study. *Food Control*, 62,178-186.

CPC. 2015. Consumer protection council's activities. Retrieved on 26, May 2018, available on <http://www.cpc.gov.ng/index.php/cpc-activities> .

Dairo MD And Elelu N. 2013. Knowledge and preventive practices related to Avian influenza among livestock farmers and poultry traders in Ikorodu, Lagos state, Nigeria. *Journal of Public Health and Epidemiology* 5, (4) 202-207.

Dulany DE. 1968. Awareness, rules, and propositional control: A confrontation with S-R behaviour theory. In *Verbal behaviour and S-R behaviour theory*, eds. David L. Hornton and Theodore R. Dixon. Englewood Cliffs, Nj: Prentice Hall.

Ekanem EO. 1998. The street food trade in Africa: safety and socio-environmental issues. *Food Control* 9(14), 211-215.

Elelu N. 2017. Epidemiological risk factors of knowledge and preventive practice regarding avian influenza among poultry farmers and live bird traders in Ikorodu, Lagos State, Nigeria. *International Journal of Veterinary Science and Medicine* 5, 47-52.

Elffers H, Heijden PV and Hezeman M.2003) Explaining regulatory non-compliance: A survey study of rule of transgression for two Dutch instrumental laws, applying the randomized response method. *Journal of Quantitative Criminology* 19, 409-439.

Ettema JS and Kline FG. 1977. Deficits, differences and ceilings: contingent conditions for understanding the knowledge gap. *Communication Research* 4, 179-202.

European Food Safety Authority (EFSA). 2010. The community summary report on trends and sources of zoonoses, zoonotic agents and food borne outbreaks in the European Union in 2008. *The EFSA Journal* 8,1-313.

FAO & WHO. 2013. Global forum of food safety regulators. Marrakech, Morocco: World Health Organization.

FAO. 2009. Good hygienic practices in the preparation and sale of street food in Africa. FAO Corporate Document Repository. Available at: <http://www.fao.org/tempref/docrep/fao/012/a0740e/a0740e00.pdf> (Accessed 20.02.2019).

Federal Ministry of Health [FMOH]. 2004. Revised national health policy. Federal Republic of Nigeria: Federal Ministry of Health, pp. 41-42.

- Fishbein M and Ajzen I. 1975. Brief attitude intention and behaviour: An introduction to theory and research. Reading, MA: Addison-Wesley.
- Fishbein M and Ajzen I. 2010. Predicting and changing behaviour. The reason action approach. New York, Psychology Press.
- Hanashiro A, Marisa M, Glavur R, Maria H, Matt-e E and Torres AFS. 2005. Microbiological quality of selected street foods from a restricted area of Swao Paulo city. Brazil. Food Control 16, 439-444.
- Harris CA. 2002. The regulation of pesticides in Europe – Directive 91/414, J. Environ. Monit. 4, 28–31.
- Hertzog, MA. 2008. Consideration in determining sample size for pilot study research in Nursing and Health 180-191.
- Huang ZY, Chen T, Yu J, Qin DP and Chen L. 2012. Lead contamination and its potential sources in vegetables and soils of Fujian, China, Environ. Geochem. Health 34, 55–65.
- Idowu OA and Rowland SA. 2016. Oral fecal parasites and personal hygiene of food handlers in Abeokuta, Nigeria, Afr. Health Sci. 6, 160-164.
- James S, Ettema JWB and Russell VL. 1983. Knowledge Gap Effects in a Health Information Campaign Source: The Public Opinion Quarterly, Vol. 47, No. 4 pp. 516-527 Published by: Oxford University Press on behalf of the American Association for Public Opinion Research.
- King LK, Awumbila B, Canacoo EA and Ofosu-Amaah S. 2000. An assessment of the safety of street foods in the Ga district, of Ghana; implications for the spread of zoonoses, Acta Trop. 76, 39-43.
- Ko W. 2013. The relationship among food safety knowledge, attitudes and self-reported HACCP practices in restaurant employees, Food Control 29, 192-197.
- Kothe CI, Schild CH, Tondo EC and Silva MP. 2016. Microbiological contamination and evaluation of sanitary conditions of hot dog street vendors in Southern Brazil. Food Control 62, 346-350.
- Krejcie V and Morgan DW. 1970. Determining sample size for research activities. Educational Psychological Management 30, 607-610.
- Kubheka LC, Mosupye FM and Von Holy A. 2001. Microbiological survey of street-vended salad and gravy in Johannesburg city, South Africa, Food Control 12, 127–131.
- Lim T, Chye FY, Sulaiman MR, Suki NM and Lee J. 2016. A structural modeling on food safety knowledge, attitude, and behaviour among Bum Bum Island community of Semporna, Sabah, Food Control 60, 241-246.

Liu S, Liu Z, Zhang H, Lu L, Lingling J, Liang J. and Huang Q. 2015. Knowledge, attitude and practices of food safety amongst food handlers in the coastal resort of Guangdong, China, *Food Control* 47, 457–461.

Liu Z, Zhang G and Zhang X. 2014. Urban street foods in Shijiazhuang city, China: current status, safety practices and risk mitigating strategies, *Food Control* 41, 212–218.

Low YW, Jana R, Halim AH and Alias AA. 2016. Determinants of food hygiene knowledge among youths: A cross-sectional online study. *Food Control* 59, 88-93.

Lues JF, Rasephei MR, Venter P and Theron MM. 2006. Assessing food safety and associated food handling practices in street food vending, *Int. J. Environ. Health Res* 16, 319–328.

McKay F, Arbind S, Sangeeta S. Suvajee G and Richard HO. 2016. Street vendors in Patna, India: Understanding the socio-economic profile, livelihood and hygiene practices, *Food Control* 70, 281-285.

Mensah P, Owusu D, Yeboah-Manu D, Ablordey A, Nkrumah FK and Kamiya H. 1999. The role of street food vendors in the transmission of enteric pathogens in Accra, Ghana *Med. J.* 33, 19–29.

Mensah P, Yeboah-Manu D, Owusu-Darko K and Ablordey A. 2002. Street foods in Accra, Ghana: how safe are they? *Bulletin of the World Health Organization*, 80, 546-554.

Mosupye FM and Von Holy A. (1999). Microbiological quality and safety of ready to-eat street- vended foods in Johannesburg, South Africa. *Journal of Food Protection* 62, 1278-1284.

Muyanja C, Nayiga L, Brenda N, Nasinyama G. 2011. Practices, knowledge and risk factors of street food vendors in Uganda, *Food Control* 22, 1551–1558.

NAFDAC. 2005. In Rotting State, Petitioners Say, Alleging Fraud and Waste". *Sahara Reporters*. July 17, 2015. Retrieved 29 August 2016.

[NAFDAC. 2013. Battle against fake drugs.](http://www.nafdac.gov.ng/) Available on <http://www.nafdac.gov.ng/> Retrieved on 2006-03-25.

National Bureau of Statistics [NBS]. 2017. Demographic statistical bulletin 7<sup>nd</sup> series. NBS publication No. 24-28.

Nora A, Moreb AP and Amit KJ. 2017. Knowledge of Food Safety and Food Handling Practices amongst Food Handlers in the Republic of Ireland. *Food Control* doi: 10.1016/j.foodcont. 2017.05.020

Okoli IC, Aladi NO, Etuk EB, Opara MN, Anyanwu GA and Okeudo NJ. 2005. Current facts about the animal food products safety situation in Nigeria, *Ecol. Food Nutrition* 44, 359-373.

- Olatunji O. 2017. Dangerous meat, toxic waters 3: Nigerians die from ‘food poisoning’ The Nation, on: August 26, 2017 In: [Saturday Magazine](#), [Special Report](#).
- Omemu AM and Aderoju ST. 2008. Food safety knowledge and practices of street food vendors in the city of Abeokuta, Nigeria, Food Control 19, 396-402.
- Oranusi S, Galadima M, Umoh VJ and Nwanze PI. 2007. Food safety evaluation in boarding schools in Zaria, Nigeria, using the HACCP system. Scientific Research and Essay 2(10), 426-433.
- Osaili TM, Al-Nabulsi AA and Krashneh, HDA. 2018. Food safety knowledge among food service staff at Universities in Jordan. Food Control 89, 167-176.
- Pang F and Toh SP. 2008. Hawker food industry: food safety/public health strategies in Malaysia. Nutr. Food Sci. 38, 41-51.
- Powell D, Brodber E, Wint E and Campbell V. 1990. Street Foods of Kingston, Institute of Social and Economic Research, University of the West Indies, Kingston, Jamaica, 1990, pp. 1–15.
- Racheal D, Rona C, Zoe H, Lorna H and Susan M. 2015. Theories of behaviour and behavioural change across the social and behavioural sciences: a scoping review, Health Psychology Review 9(3), 323-344.
- Robert KR, Barrett BB, Howells AD, Shanklin CW, Pillings VK and Barannon LA. 2008. Food safety training and food service employee’s knowledge and behaviour. Food Protection Trends 28 (4) 252-260.
- Saidatul AA and Dahan MH. 2013. Food handlers’ attitudes towards safe food handling in School Canteens. Procedia social and behavioral sciences 105 (2013) 220-228.
- Samapundo S, Climat R, Khaferi R and Devlieghere F. 2015. Food safety knowledge, attitudes and practices of street food vendors and consumers in Port-au-Prince, Haiti. Food Control, 50,457-466.
- Sani NA and Siow, ON. 2014. Knowledge, attitudes and practices of food handlers on food safety in food service operations at the Universiti Kebangsaan Malaysia. Food Control Journal 37, 210-217.
- Shingi PM and Mody B. 1976 "The communication effects gap: a field experimentation on television and agricultural ignorance in India." Communication Research 3:171-90.
- SON 2015. Standard organization of Nigeria’s mission, available on <http://son.gov.ng/standards> retrived on 27 May, 2018.
- Soon JM, Singh H, and Baines R. 2011. Foodborne diseases in Malaysia. Food Control 22, 823-830.

Star S and Hughes HM. 1950 "Report of an educational campaign: the Cincinnati Plan for the United Nations." *American Journal of Sociology* 55, 389-97.

Stratev D, Odeyemi OA, Pavlov A, Kyuchukova R, Fatehi F and Bamidele AF. 2017. Food safety knowledge and hygiene practices among veterinary medicine students at Trakia University, Bulgaria. *Journal of Infection and Public Health* 10, 778–782.

Suneetha C, Manjula K and Depur B. 2011. Quality assessment of street foods in Tirumala. *Asian Journal of Experimental Biological Sciences* 2, 207-211.

Tambekar D, Jaiswal V, Dhanorkar D, Gulhane P and Dudhane M. 2008. Identification of microbiological hazards and safety of ready-to-eat food vended in streets of Amravati City, India. *Journal of Applied Biosciences* 7,195-201.

Taylor MD, Klaine SJ, Carvalho FP, Barcelo D, Everaarts J. 2003. *Pesticide Residues in Coastal Tropical Ecosystems: Distribution, Fate and Effects*, (Eds.), CRC Press, 2003.

Toh PS and Birchenough A. 2000. Food safety knowledge and attitudes: culture and environment impact on hawkers in Malaysia: knowledge and attitudes are key attributes of concern in hawker food handling practices and outbreaks of food poisoning and their prevention, *Food Control* 11, 447–452.

Umoh VJ And Odoba, MB. 1999. Safety and quality evaluation of street foods sold in Zaria, Nigeria, *Food Control* 10, 9–14.

Uri ND. 1997. A note on the development and use of pesticides, *Sci. Total Environ.* 204, 57–74.

Wang G, Su MY, Chen YH, Lin FF, Luo D and Gao SF. 2006 Transfer characteristics of cadmium and lead from soil to the edible parts of six vegetable species in southeastern China, *Environmental Pollution* 144, 127–135.

Webb M and Morancie, A. 2015. Food safety knowledge of foodservice workers at a university campus by education level, experience, and food safety training. *Food Control* 50, 259-264.

World Health Organization. 2015. WHO Regional Office for Africa, WHO Estimate of Global Burden of Foodborne Disease, 2015. <http://www.afro.who.int/health-topics/food-safety>. Retrieved 5.2.18.

World Health Organization. 2007. Fact sheet no 237: Food safety and food borne illness. <http://www.who.int/mediacentre/factsheets/fs237/en/index.html>. Retrieved 10.11.14.

# **Appendices**

## **List of the Appendices:**

**Appendix 1: Mean score of items in food safety knowledge, attitude, behaviour, sanitation facilities and economic and social control**

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**Appendix 7: Photo during an interview**

**Appendix 1: Mean score of items in food safety knowledge, attitude, behaviour, sanitation facilities and economic and social control**

<b>Construct</b>	<b>Item</b>	<b>Mean</b>	<b>SD</b>
Food safety knowledge	K2. Food from unhygienic and unclean source might harbour disease causing organism	0.87	0.32
	K5. Purchased food may seem clean, but there are bacteria in all food	0.59	0.49
	K7. A frequently used rags and laundry should not be kept out of kitchen	0.70	0.45
	K11. Microorganism are not frequently found in hand	0.56	0.49
	K14. After touching raw food stuff, touching cooked food without cleaning hand cause transfer of micro organism	0.77	0.41
Economic & social control	ECB1. Wearing gloves, caps, frequent hand washing etc. (food safety practices) is costly (money)?	3.16	1.52
	ECB2. Food safety practices is time consuming?	2.87	1.54
	ECB3. Food safety practices is against my religion/ belief?	1.71	1.29
	ECB5. Compliance to food safety practices reduce customer patronage?	2.32	1.56
Env. sanitation facilities	E2. Do you have refrigerator in your shop?	0.61	0.48
	E5. How do you rate the quality of the water?	3.10	0.74
	E6. Which type of toilet do you have in your shop place?	2.40	0.84
	E8. What type sewage disposal system do you have in your shop place?	2.00	0.66
Food safety attitude	A1. Safe food handling is an important part of my job	4.04	1.25
	A2. Learning more about food safety is an important to me	4.22	1.16
	A3. I believed that how I handle food relates to food safety	4.04	1.25
	A4. Raw food should be kept separate from cooked food	4.01	1.23
	A5. Deforested food should be frozen only once	3.28	1.65
	A6. Using masks, protective gloves, caps and adequate clothing reduces the risk of food contamination	3.72	1.25
	A7. It is important to know the temperature of the refrigerator to reduce the risk of food contamination	3.86	1.08
	A8. It is necessary to check the thermometer setting of refrigerator and freezer once in a day	3.67	1.11
	A9. Improper storage of food may be hazardous to health	4.05	1.15

## Appendix 1 continue

	A10. Sick staff should not be involved in food handling and food services	4.09	1.20
	A11. Staff with cut or open wound on finger or hand should not touch unwrapped food	4.07	1.31
Food safety behaviour	B2. Do you concern about hygienic source of food stuff?	0.12	0.26
	B5. How frequent you wash your hands after using gloves?	0.37	0.60
	B7. Do you use a mask when touching or distribution of unwrapped food?	0.75	0.62
	B9. Do you wash your hands before touching unwrapped raw foods?	0.74	0.44
	B12. Do you wash your hands before touching unwrapped cooked foods?	0.83	0.46
	B14. Do you sterilize your utensils?	0.90	0.43

**Appendix 2: Description of the dependent (Knowledge) and independent variables imported into the multiple linear regression model (N=181), Bauchi state, Nigeria, 2018.**

<b>Dimension</b>	<b>Variable</b>	<b>Description</b>	<b>Min</b>	<b>Max</b>	<b>Mean (SD)</b>
<b>Knowledge</b>	Food safety knowledge	Knowledge score 0-18	2	7	10.7 (3.05)
<b>Vendor characteristics</b>					
	Sex	0= Female and 1= Male	0	1	0.19 (0.39)
	Age	Number of years	15	0	30.71 (9.59)
	Household size	Number of people in the house	1	5	2.09 (2.64)
	Literacy	0= No and 1= Yes	0	1	0.95 (0.2)
	Education	Years of education	0	8	12.2 (3.93)
	Food vending experience	Years in food vending business	1	0	7.45 (6.24)
	Average food vending profit	USD/month <sup>1</sup>	41	56	109 (80.64)
<b>Food handling information sources used by vendor</b>					
			<b>Used by vendor (yes)</b>		
			<b>no.</b>	<b>%</b>	
	Food handling training	No=0 and Yes=1	100	55.2	
	Number of trainings attended	Number of food handling trainings in life	1 (min)	4 (max)	1.34 (1.45)
	Radio	No=0 and Yes=1	34	18.8	
	Television	No=0 and Yes=1	52	28.7	
	Newspaper	No=0 and Yes=1	16	8.8	
	Food inspection institution	No=0 and Yes=1	76	42.0	
	Social media	No=0 and Yes=1	18	9.9	
	Internet	No=0 and Yes=1	14	7.7	
	Colleagues and friends	No=0 and Yes=1	94	51.9	

### **Appendix 3: Descriptive result of economic and social control**

<b>Item</b>	<b>Mean</b>	<b>SD</b>
Wearing gloves, caps, frequent hand washing etc. (food safety practices) is costly (money)?	3.16	1.52
Food safety practices is time consuming?	2.87	1.54
Food safety practices is against my religion/ belief?	1.71	1.29
Food safety practices is not compatible with my culture?	1.98	1.39
Compliance to food safety practices reduce customer patronage?	2.32	1.56
Compliance with food safety practices against with my peer group attitude?	2.37	1.46
Compliance with food safety practices can hot my family?	2.08	1.46

### **Appendix 4: Descriptive result of distance to sanitation facilities**

<b>Variable</b>	<b>Mean</b>	<b>SD</b>
What is the approximate distance from your shop and the source of water (in meters)?	9.85	254.91
What is the approximate distance from your shop and the toilet (in meters)?	21.02	60.99
What is the approximate distance from your shop and the disposal point (in meters)?	37.17	93.89

### Appendix 5: Descriptive result of food safety attitude

Item	Mean	SD
Do you concern about hygienic source of food stuff?	4.12	.26
How frequent you avoid buying expired food stuff?	3.99	.49
Do you use gloves when touching or distribution of unwrapped food?	2.98	.56
How frequent you wash your hands before using gloves?	2.98	.63
How frequent you wash your hands after using gloves?	3.37	.60
Do you use protective clothing when touching or distribution of unwrapped foods?	3.16	.61
Do you use a mask when touching or distribution of unwrapped food?	2.75	.62
Do you wear a cap during food processing/distribution?	3.58	.60
Do you wash your hands before touching unwrapped raw foods?	3.74	.44
Do you wash your hands after touching unwrapped raw foods?	3.92	.93
Do you remove your Jewries during food services?	3.34	.59
Do you wash your hands before touching unwrapped cooked foods?	3.83	.46
Do you wash your hands after touching unwrapped cooked foods?	4.09	.27
Do you sterilize your utensils?	3.90	.43
Do you dispose food when the colour is changed?	4.18	.21
Do you dispose food when the taste is change?	4.16	.27
Do you dispose food when it developed some odour?	4.33	.24.
Do you dispose food when it developed a worm?	4.37	.26

## Appendix 6: Study Questionnaire

### Factors affecting the use of food safety practices Questionnaire

I'm a student of Sustainable Rural Development of faculty of Tropical AgriSciences, Czech University of Life Sciences Prague, conducting a research on food safety. Please fill the following questionnaire. The data collected will be used strictly for the academic purpose, thank you.

#### Section A: Food handling sources of knowledge/information to the respondent

1. Did you attend training on cooking and food services (food handling)?						
Yes <input type="checkbox"/>			No <input type="checkbox"/>			
2. If yes, how many times did you attend food handling training (number in life)? .....						
3. From where you learnt food handling? (multiple responses are allowed)						
Observation <input type="checkbox"/>		Home <input type="checkbox"/>		Restaurant <input type="checkbox"/>		Formal institution <input type="checkbox"/>
4. from which of the following you get food handling information (multiple choice)						
Radio <input type="checkbox"/>	Television <input type="checkbox"/>	News papers <input type="checkbox"/>	Food inspection institution <input type="checkbox"/>	Social media <input type="checkbox"/>	Internet <input type="checkbox"/>	Friends/colleagues <input type="checkbox"/>
5. Do you have a medical certificate?						
Yes <input type="checkbox"/>			No <input type="checkbox"/>			
6. Do you know that the medical certificate is not transferable						
Yes <input type="checkbox"/>		No <input type="checkbox"/>		I don't know <input type="checkbox"/>		
7. How frequent food safety inspectors visit your shop?						
Never <input type="checkbox"/>	Once in a year <input type="checkbox"/>		Two times in Year <input type="checkbox"/>	Three times in year <input type="checkbox"/>	More than three times <input type="checkbox"/>	

#### Section B: Food safety knowledge of the respondent

8. Food can be source of disease infection		
Yes <input type="checkbox"/>	No <input type="checkbox"/>	I don't know <input type="checkbox"/>
9. Food from unhygienic and unclean source might harbor disease causing organism		
Yes <input type="checkbox"/>	No <input type="checkbox"/>	I don't know <input type="checkbox"/>

10. Using expired food can't cause health disorder		
Yes <input type="checkbox"/>	No <input type="checkbox"/>	I don't know <input type="checkbox"/>
11. Some foodborne disease/contamination can't cause death		
Yes <input type="checkbox"/>	No <input type="checkbox"/>	I don't know <input type="checkbox"/>
12. A frequently used rags and laundry should not be kept out of kitchen		
Yes <input type="checkbox"/>	No <input type="checkbox"/>	I don't know <input type="checkbox"/>
13. Unaccredited, off brand and bulk product should not be purchase		
Yes <input type="checkbox"/>	No <input type="checkbox"/>	I don't know <input type="checkbox"/>
14. Purchased food may seem clean, but there are bacteria in all food		
Yes <input type="checkbox"/>	No <input type="checkbox"/>	I don't know <input type="checkbox"/>
15. Some diseases are transferable from animal to human (zoonotic diseases)		
Yes <input type="checkbox"/>	No <input type="checkbox"/>	I don't know <input type="checkbox"/>
16. Human can't be infected from unhygienic food stuff		
Yes <input type="checkbox"/>	No <input type="checkbox"/>	I don't know <input type="checkbox"/>
17. Food can't be contaminated from improper handling/processing		
Yes <input type="checkbox"/>	No <input type="checkbox"/>	I don't know <input type="checkbox"/>
18. Microorganism are not frequently found in hand		
Yes <input type="checkbox"/>	No <input type="checkbox"/>	I don't know <input type="checkbox"/>
19. The taste of a food should be checked with a different spoon		
Yes <input type="checkbox"/>	No <input type="checkbox"/>	I don't know <input type="checkbox"/>
20. Keeping cooked food with raw food in refrigerator is not causing health problem		
Yes <input type="checkbox"/>	No <input type="checkbox"/>	I don't know <input type="checkbox"/>
21. After touching raw food stuff, touching cooked food without cleaning hand cause transfer of micro organism		
Yes <input type="checkbox"/>	No <input type="checkbox"/>	I don't know <input type="checkbox"/>
22. Keeping cooked food at room temperature more than 2 hours is lead to contamination		
Yes <input type="checkbox"/>	No <input type="checkbox"/>	I don't know <input type="checkbox"/>
23. Internal temperature of the refrigerator should be at less than 5 degrees Celsius		
Yes <input type="checkbox"/>	No <input type="checkbox"/>	I don't know <input type="checkbox"/>
24. Cooked meat, fish, poultry and milk should not be stored at more than 5 degrees		
Yes <input type="checkbox"/>	No <input type="checkbox"/>	I don't know <input type="checkbox"/>
25. Leftover food should be store in refrigerator within two hours		
Yes <input type="checkbox"/>	No <input type="checkbox"/>	I don't know <input type="checkbox"/>

**Section C: food safety attitude of the respondent**

Please tick the appropriate point that rate your level of agreement with the following statements (tick one out of three point)

26. Safe food handling is an important part of my job				
Strongly disagree <input type="checkbox"/>	Disagree <input type="checkbox"/>	Uncertain <input type="checkbox"/>	Agree <input type="checkbox"/>	Strongly Agree <input type="checkbox"/>
27. Learning more about food safety is an important to me				
Strongly disagree <input type="checkbox"/>	Disagree <input type="checkbox"/>	Uncertain <input type="checkbox"/>	Agree <input type="checkbox"/>	Strongly Agree <input type="checkbox"/>
28. I believed that how I handle food relates to food safety				
Strongly disagree <input type="checkbox"/>	Disagree <input type="checkbox"/>	Uncertain <input type="checkbox"/>	Agree <input type="checkbox"/>	Strongly Agree <input type="checkbox"/>
29. Raw food should be kept separate from cooked food				
Strongly disagree <input type="checkbox"/>	Disagree <input type="checkbox"/>	Uncertain <input type="checkbox"/>	Agree <input type="checkbox"/>	Strongly Agree <input type="checkbox"/>
30. Deforested food should be frozen only once				
Strongly disagree <input type="checkbox"/>	Disagree <input type="checkbox"/>	Uncertain <input type="checkbox"/>	Agree <input type="checkbox"/>	Strongly Agree <input type="checkbox"/>
31. Using masks, protective gloves, caps and adequate clothing reduces the risk of food contamination				
Strongly disagree <input type="checkbox"/>	Disagree <input type="checkbox"/>	Uncertain <input type="checkbox"/>	Agree <input type="checkbox"/>	Strongly Agree <input type="checkbox"/>
32. It is important to know the temperature of the refrigerator to reduce the risk of food contamination				
Strongly disagree <input type="checkbox"/>	Disagree <input type="checkbox"/>	Uncertain <input type="checkbox"/>	Agree <input type="checkbox"/>	Strongly Agree <input type="checkbox"/>
33. It is necessary to check the thermometer setting of refrigerator and freezer once in a day				
Strongly disagree <input type="checkbox"/>	Disagree <input type="checkbox"/>	Uncertain <input type="checkbox"/>	Agree <input type="checkbox"/>	Strongly Agree <input type="checkbox"/>
34. Improper storage of food may be hazardous to health				
Strongly disagree <input type="checkbox"/>	Disagree <input type="checkbox"/>	Uncertain <input type="checkbox"/>	Agree <input type="checkbox"/>	Strongly Agree <input type="checkbox"/>
35. Sick staff should not be involved in food handling and food services				
Strongly disagree <input type="checkbox"/>	Disagree <input type="checkbox"/>	Uncertain <input type="checkbox"/>	Agree <input type="checkbox"/>	Strongly Agree <input type="checkbox"/>
36. Staff with cut or open wound on finger or hand should not touch unwrapped food				
Strongly disagree <input type="checkbox"/>	Disagree <input type="checkbox"/>	Uncertain <input type="checkbox"/>	Agree <input type="checkbox"/>	Strongly Agree <input type="checkbox"/>

**Section E: Food safety behaviour of the respondent**

Please tick only one that can represent your behaviour toward the following activities

37. Do you concern about hygienic source of food stuff?				
Never <input type="checkbox"/>	Rarely <input type="checkbox"/>	Sometimes <input type="checkbox"/>	Often <input type="checkbox"/>	Always <input type="checkbox"/>
38. How frequent you avoid buying expired food stuff?				
Never <input type="checkbox"/>	Rarely <input type="checkbox"/>	Sometimes <input type="checkbox"/>	Often <input type="checkbox"/>	Always <input type="checkbox"/>

39. Do you use gloves when touching or distribution of unwrapped food?				
Never <input type="checkbox"/>	Rarely <input type="checkbox"/>	Sometimes <input type="checkbox"/>	Often <input type="checkbox"/>	Always <input type="checkbox"/>
40. Do you wash your hands before using gloves?				
Never <input type="checkbox"/>	Rarely <input type="checkbox"/>	Sometimes <input type="checkbox"/>	Often <input type="checkbox"/>	Always <input type="checkbox"/>
41. Do you wash your hands after using gloves?				
Never <input type="checkbox"/>	Rarely <input type="checkbox"/>	Sometimes <input type="checkbox"/>	Often <input type="checkbox"/>	Always <input type="checkbox"/>
42. Do you use protective clothing when touching or distribution of unwrapped foods?				
Never <input type="checkbox"/>	Rarely <input type="checkbox"/>	Sometimes <input type="checkbox"/>	Often <input type="checkbox"/>	Always <input type="checkbox"/>
43. Do you use a mask when touching or distribution of unwrapped food?				
Never <input type="checkbox"/>	Rarely <input type="checkbox"/>	Sometimes <input type="checkbox"/>	Often <input type="checkbox"/>	Always <input type="checkbox"/>
44. Do you wear a cap during food processing/distribution?				
Never <input type="checkbox"/>	Rarely <input type="checkbox"/>	Sometimes <input type="checkbox"/>	Often <input type="checkbox"/>	Always <input type="checkbox"/>
45. Do you wash your hands before touching unwrapped raw foods?				
Never <input type="checkbox"/>	Rarely <input type="checkbox"/>	Sometimes <input type="checkbox"/>	Often <input type="checkbox"/>	Always <input type="checkbox"/>
46. Do you wash your hands after touching unwrapped raw foods?				
Never <input type="checkbox"/>	Rarely <input type="checkbox"/>	Sometimes <input type="checkbox"/>	Often <input type="checkbox"/>	Always <input type="checkbox"/>
47. Do you remove your jewelries during food services?				
Never <input type="checkbox"/>	Rarely <input type="checkbox"/>	Sometimes <input type="checkbox"/>	Often <input type="checkbox"/>	Always <input type="checkbox"/>
48. Do you wash your hands before touching unwrapped cooked foods?				
Never <input type="checkbox"/>	Rarely <input type="checkbox"/>	Sometimes <input type="checkbox"/>	Often <input type="checkbox"/>	Always <input type="checkbox"/>
49. Do you wash your hands after touching unwrapped cooked foods?				
Never <input type="checkbox"/>	Rarely <input type="checkbox"/>	Sometimes <input type="checkbox"/>	Often <input type="checkbox"/>	Always <input type="checkbox"/>
50. Do you sterilize your utensils?				
Never <input type="checkbox"/>	Rarely <input type="checkbox"/>	Sometimes <input type="checkbox"/>	Often <input type="checkbox"/>	Always <input type="checkbox"/>
51. Do you dispose food when the colour is changed?				
Never <input type="checkbox"/>	Rarely <input type="checkbox"/>	Sometimes <input type="checkbox"/>	Often <input type="checkbox"/>	Always <input type="checkbox"/>
52. Do you dispose food when the taste is change?				
Never <input type="checkbox"/>	Rarely <input type="checkbox"/>	Sometimes <input type="checkbox"/>	Often <input type="checkbox"/>	Always <input type="checkbox"/>
53. Do you dispose food when it developed some odour?				
Never <input type="checkbox"/>	Rarely <input type="checkbox"/>	Sometimes <input type="checkbox"/>	Often <input type="checkbox"/>	Always <input type="checkbox"/>
54. Do you dispose food when it developed a worm?				
Never <input type="checkbox"/>	Rarely <input type="checkbox"/>	Sometimes <input type="checkbox"/>	Often <input type="checkbox"/>	Always <input type="checkbox"/>

**Section E: Environmental, sanitation and hygiene condition**

Tick only one option that describe your shop environment

55. Do you have access to electricity in your location?			
Yes <input type="checkbox"/>		No <input type="checkbox"/>	
56. Do you have refrigerator in your shop?			
Yes <input type="checkbox"/>		No <input type="checkbox"/>	
57. Which type of source of water do you have in your area? (multiple choices are allowed)			
River/stream <input type="checkbox"/>	Well water <input type="checkbox"/>	Borehole <input type="checkbox"/>	Pipe borne water <input type="checkbox"/>
58. What is the approximate distance from your shop and the source of water (in meters)? .....			
59. How do you rate the quality of the water?			
Poor <input type="checkbox"/>	Fair <input type="checkbox"/>	Good <input type="checkbox"/>	Very good <input type="checkbox"/>
60. Which type of toilet do you have in your shop place?			
Open defecation <input type="checkbox"/>	Pit latrine <input type="checkbox"/>	Conventional water system <input type="checkbox"/>	VIP latrine <input type="checkbox"/>
61. What is the approximate distance from your shop and the toilet (in meters)? .....			
62. What type sewage disposal system do you have in your shop place? (multiple choices are allowed)			
Gutter <input type="checkbox"/>	Central disposal <input type="checkbox"/>	Septic tank <input type="checkbox"/>	
63. What is the approximate distance from your shop and the disposal point (in meters) .....			

### Section F: Economic and Control beliefs

64. Wearing gloves, caps, frequent hand washing etc. (food safety practices) is costly (money)?				
Surely no <input type="checkbox"/>	Probably no <input type="checkbox"/>	Undecided <input type="checkbox"/>	Probably yes <input type="checkbox"/>	Surely yes <input type="checkbox"/>
65. Food safety practices is time consuming?				
Surely no <input type="checkbox"/>	Probably no <input type="checkbox"/>	Undecided <input type="checkbox"/>	Probably yes <input type="checkbox"/>	Surely yes <input type="checkbox"/>
66. Food safety practices is against my religion/ belief?				
Surely no <input type="checkbox"/>	Probably no <input type="checkbox"/>	Undecided <input type="checkbox"/>	Probably yes <input type="checkbox"/>	Surely yes <input type="checkbox"/>
67. Food safety practices is not compatible with my culture?				
Surely no <input type="checkbox"/>	Probably no <input type="checkbox"/>	Undecided <input type="checkbox"/>	Probably yes <input type="checkbox"/>	Surely yes <input type="checkbox"/>
68. Compliance to food safety practices reduce customer patronage?				
Surely no <input type="checkbox"/>	Probably no <input type="checkbox"/>	Undecided <input type="checkbox"/>	Probably yes <input type="checkbox"/>	Surely yes <input type="checkbox"/>
69. Compliance with food safety practices against with my peer group attitude?				
Surely no <input type="checkbox"/>	Probably no <input type="checkbox"/>	Undecided <input type="checkbox"/>	Probably yes <input type="checkbox"/>	Surely yes <input type="checkbox"/>
70. Compliance with food safety practices can hot my family?				
Surely no <input type="checkbox"/>	Probably no <input type="checkbox"/>	Undecided <input type="checkbox"/>	Probably yes <input type="checkbox"/>	Surely yes <input type="checkbox"/>

**Section G: Socio-economic characteristics of the respondent**

71. What is your sex?					
Male <input type="checkbox"/>			Female <input type="checkbox"/>		
72. How old are you? (years) .....					
73. What is your marital status?					
Single <input type="checkbox"/>		Married <input type="checkbox"/>		Divorce <input type="checkbox"/>	Widow <input type="checkbox"/>
74. How many children do you have? .....					
75. Do you know how to read and write?					
Yes <input type="checkbox"/>			No <input type="checkbox"/>		
76. What is your highest level of education					
Non formal education <input type="checkbox"/>	Primary school <input type="checkbox"/>	Secondary school <input type="checkbox"/>	Diploma/NCE <input type="checkbox"/>	B.Sc. <input type="checkbox"/>	Postgraduate <input type="checkbox"/>
77. What is your primary occupation?					
Farming <input type="checkbox"/>	Civil servant <input type="checkbox"/>	Food processing business <input type="checkbox"/>		Business <input type="checkbox"/>	Politics <input type="checkbox"/>
78. For how long you have been in food processing business? (years).....					
79. What is your average income from food processing business (Naira/month)? .....					
80. What is the volume of your food business capital (Naira)?.....					
81. What is your average income from other sources (Naira/month)? .....					

**Appendix 7: Photo documentation during an interview**



