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in the Context of the African Union's  
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## Compliance with Good Handling Practices among Tomato Farmers in Kaduna State

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### Abstract

Tomato is one of the most popular fruit vegetables grown in Nigeria because of its nutritional and medicinal value. However, it is highly perishable and large volumes of tomatoes are lost every year due to post harvest handling practices. Good Handling Practices (GHPs) are essential to retain its value which could be lost through microbial contamination and damage. This study therefore examined compliance with GHPs among tomato farmers in Kaduna State. Multi-stage sampling procedure was used to select 150 respondents. Data were obtained through the use of interview schedule and analyzed using Chi-Square and Pearson Product Moment Correlation. The result shows that the mean age of respondents was  $52 \pm 12$  years with majority (96.0%) being males. Respondents produced an average of 1,511 baskets of tomatoes and earned average monthly income of  $138,900 \pm 47,478$ . Respondents (90.7%) had high knowledge of GHPs. All the respondents (100%) always handle tomatoes carefully to minimize bruising and breaking of the skin while 92.7% had high compliance with GHPs. The most severe constraint ( $\bar{x}=2.00$ ) to compliance was high cost of packaging materials. Type of labour and knowledge were significantly related to compliance with GHPs. Respondents' association should contribute to buy packaging materials in bulk and provision of subsidized packaging equipment like Returnable Plastic Crates (RPC) by the government will encourage farmers to purchase and use in marketing their produce.

### Introduction

Fruit and vegetables are important parts of our daily diet. They are natural and contain vitamins and minerals that can keep us healthy. Fruits and vegetables are also important sources of income, especially in urban and peri-urban areas. The most popular fruit vegetables grown in West Africa are tomato, pepper, okra, carrot etc. The nutritional and economic importance of tomato (*Lycopersicon esculentum*) has led to its global production. Tomato is an important crop to an average Nigerian accounting for about 18% of the average daily consumption of vegetables. Nigeria became the 13<sup>th</sup> largest producer in the World in the year 2008 as a result of increased tomato production of about 1,701,000 tons (Babalola, Makinde, Omonona and Oyekanmi, 2010).

Meanwhile, Post-harvest losses of fruits and vegetables have been identified as one of the determinants of the food security in most developing countries (FAO 2004). In Nigeria, it amounts to 35 - 45% of the annual production because post-harvest handling procedures of fruits and vegetables are not fully recognized and understood by the major stakeholders. Postharvest loss is a major challenge to tomatoes production in most developing countries (Arah, Kumah and Amaglo, 2015). Tomato being a perishable crop as a result of its high moisture content has short shelf life of about 48 hours under

tropical conditions (Muhammad, Bamisheyi and Olayemi, 2011). Hence, specialized postharvest handling practices and treatment methods are needed in order to extend the shelf life of the crop after harvest. Failure of which will result in high amount of losses (up to 50%) between the harvesting and consumption stages of the distribution chain in the tropical countries (Kader, 2005, Pila, et.al, 2010). Gustavo et al. (2003) noted that between 49 and 80% of all agricultural commodities end up with the consumer whilst the remainder is lost. Hence, the need for Good Agricultural Practices (GAP)

GAPs are different sets of codes, standards and regulations developed by government, NGOs and private sector (FAO, 2012). FAO uses GAP as a collection of principles to apply for on-farm production and post- production processes, resulting in safe and healthy food and non -food agricultural products, while taking into account economic, social and environmental sustainability. GAP relies on four principles: economically and efficiently produce sufficient (food security), safe (food safety) and nutritious food (food quality); Sustain and enhance natural resources; Maintain viable farming enterprises and contribute to sustainable livelihoods; Meet cultural and social demands of society. Good Handling Practices (GHPs), a subsection of GAP are food safety steps that are taken after harvesting and field packing. GHP suggests efforts to reduce the risk of microbial contamination from harvesting, in the packing, handling, storage, transportation and processing stages. Thus, GHP operates the same principles with organic practices in reduction of post-harvest losses and contamination of tomatoes. GHPs have been disseminated to tomato farmers in four states of Nigeria namely; Kaduna, Kano, Jos and Lagos by Growth and Employment in states (GEMS4), a non-governmental organization, hence, the need to ascertain farmers' level of compliance with the GHPs principles in Kaduna state. The study ascertained knowledge of GHPs, constraints to utilizing GHPs and level of compliance with GHPs by tomato farmers in Kaduna State. It was assumed that no significant relationship exists between knowledge, constraints and compliance with GHPs.

## Materials and Method

The study was conducted in Kaduna State of Nigeria. The state has a coordinate of between latitude 90 and 140 north of the equator and longitude 70 and 100 east of the Greenwich meridian. The State occupies an area of approximately 48,473.2 square kilometers and has a population of 760,084 (National Population Commission, 2006). Agriculture is the main stay of the economy of Kaduna state with about 80% of the people actively involved in farming. The crops grown are guinea corn, millet, carrot, groundnut, tomato, finger millet, onions and maize. Population of the study comprises all tomato farmers in Kaduna state. Purposive sampling technique was used to select 40% of Local Government Areas (LGAs) where tomato is highly cultivated. Two (2) wards from the selected LGA were randomly selected to give a total of fifteen (10) wards. Lastly, 10% of tomato farmers were randomly selected from each of the wards given a total of one hundred and fifty (150) respondents. Knowledge of GHP was measured on a two point scale of "Yes and No" with a score of 1 and 0 respectively. Compliance with GHP was measured on a three point scale of "Always, Sometimes and Never with assigned scores of 2, 1 and 0 respectively. The mean was computed and used for categorization into low or high.

## Result and Discussion

The mean age of the respondents was 52±12 year and majority (96.0%) was male which might be due to commercial perception nature of tomato. This is in consonance with findings of World Bank (2012) that in Africa when a crop is perceived as commercial, men are more likely to take over from women.

Majority (97.3%) were married thus; they have family responsibilities to cater for and this could make them comply with GHPs in order to reduce post-harvest losses and increased their income to be able to meet up with family responsibilities. The result is in line with Nnadi and Akwiwu (2008) who observed that probability of participating in rural agriculture is higher for married farmers especially males, who are heirs due to increased concern for household welfare and food security following marital

**Table 1. Distribution of respondents based on socio-economic characteristicsn=150**

Variables	Frequency	Percentage	Mean	SD
<b>Age</b>			52	12
25-48	62	64.4		
49-75	88	58.7		
<b>Sex</b>				
Male	144	96.0		
Female	6	4.0		
<b>Marital status</b>				
Single	4	2.7		
Married	146	97.3		
<b>Household size</b>			18	5
7-16	57	36.1		
17-28	93	62.0		
<b>Farm size</b>			2	0.6
< 1	15	10.0		
1-3	135	90.0		
<b>Farming experience</b>			24	6
10-21	60	40.0		
22-35	90.0	60.0		
<b>Type of labour</b>				
Hired labour	65	43.3		
Family labour	52	34.7		
Communal labour	11	7.3		
Self-labour	22	43.3		
<b>Quantity of tomato produced</b>			1,511	704
135-1544	74	49.4		
1545-2800	76	50.6		
<b>Income from tomato</b>			138,900	47,478
40,000-127,001	66	44.0		
127,002-167,002	39	26.0		
167,003-240,000	45	30.0		
<b>Association</b>				
<b>Membership of tomato sellers association</b>				
Member	59	60.7		
Non member	91	39.3		

Source: Field survey, 2018



**Table 2a. Distribution of respondents based on knowledge of GHPs**

Practices	Yes Freq. (%)	No Freq. (%)
<b>Harvesting of tomatoes</b>		
Reducing the number of time the commodity is handled	0.0	100.0
Handling with care to minimize bruising and breaking of the skin	100.0	0.0
Heaped at collection center on the farm	0.0	100.0
Not exposed to sun	97.3	2.7
Harvesting of tomato in the cool part of the day	100.0	0.0
Harvesting of tomato at correct stage of ripeness (mature green)	98.0	2.0
Use of sharp knives for harvesting	0.0	100.0
<b>Pre-cooling of tomato</b>		
Precooling immediately after harvesting	0.0	100.0
Cover crates to protect tomatoes, keep them cool and dry	11.3	88.7
Store in cool room to keep tomatoes fresh	100.0	0.0
<b>Cleaning, sorting and grading</b>		
Use recommended detergents and clean water	100.0	0.0
Removal of injured and damaged tomatoes	100.0	0.0
Remove dirt from tomatoes before putting into containers	100.0	0.0
Sort tomatoes according to sizes	100.0	0.0
<b>Packaging</b>		
Use clean, smooth and ventilated containers for packaging	100.0	0.0
Use containers that are appropriate for tomatoes	100.0	0.0
Equipment that touches tomatoes are cleaned and sanitized	100.0	0.0
Establish routine cleaning and sanitizing procedures	100.0	0.0
Maintain all equipments so as to minimize contamination of injuring tomatoes	100.0	0.0
<b>Transportation</b>		
Inspect any vehicle for cleanliness, dirt and debris before loading	100.0	0.0
If there is any doubt regarding previous loads transported in a vehicle, verify records	100.0	0.0
Ensure transporters maintain positive lot identification	100.0	0.0
Use plastic crates in place of raffia baskets	100.0	0.0
<b>Storage</b>		
Separate damage tomatoes and dispose quickly	100.0	0.0
Store under appropriate temperature and humidity	100.0	0.0
Store in sanitary manner	100.0	0.0

Source: Field survey, 2018

**Table 2b. Distribution of respondents based on level of Knowledge on GHPs**

Level of awareness	Frequency	Percentage	Minimum	Maximum	Mean	SD
Low (20-21.0)	14	9.3	20	22	21.1	0.34
High (21.1-22)	136	90.7				
Total	150	100.0				

Source: Field survey, 2018

### Constraints to compliance with GHPs on Tomato

High cost of packaging materials such as plastic crates or collapsible cartons was ranked first as the most severe constraint faced by the respondents with the highest mean ( $\bar{x}$  of 2.00). This implies that most of the respondents might be restrained from getting material which would help them comply with good GHPs in the study area. However, poor state of vehicles used to convey tomato ( $\bar{x} = 0.00$ ), inadequate knowledge on harvesting period ( $\bar{x} = 0.00$ ), inadequate knowledge on sorting and grading ( $\bar{x} = 0.00$ ) and inadequate knowledge on the best time to transport fresh tomato ( $\bar{x} = 0.00$ ) were the least constraints facing respondents in a bid to comply with GHPs.

### Compliance with GHPs

Findings from the study revealed that majority (92.7%) of the respondents had high level of compliance with GHPs which suggests that most of the respondents were serious and business minded farmers who would like to protect their tomatoes in order to reduce damages. This in turn could make respondents to have good market price for their produce and consequently increase income. High level of compliance to GHPs by respondents can be attributed to the indigenous or organic nature of the activities in GHPs thus part of the practices have been carried out before the introduction of GHPs and this makes it easy for greater percentage of respondents to adopt and comply.

Table 3. Distribution of respondents based on level of compliance with GHPs

Level of compliance	Frequency	Percentage	Minimum	Maximum	Mean	SD
Low (0-30.6)	11	7.3	0	35	30.7	8
High (30.7-35)	139	92.7				
Total	150	100.0				

Source: Field survey, 2018

### Relationship between selected socio-economic characteristics of respondents, awareness, constraints and compliance with GHPs

Using Chi-square, table 4a shows a significant relationship between educational attainment, type of labour, secondary occupation and compliance with GHPs. This implies that the more educated the respondents are, the easy they understand the practices. This result agrees with Ozor and Cynthia (2010) who opined that an increase in educational status of farmers positively influence the adoption of improved technologies and practices. Using Pearson Product Moment Correlation table 4b however, the results revealed a significant relationship between age, household size, years of experience, income from tomato and compliance with GHPs. This finding is in line with Abu *et. al*, (2011) that socioeconomic variables particularly farm size and labour significantly influenced tomato output. Large household size as revealed in this study might be for farm activities especially when tomato is to be picked/ harvested by hand as stipulated in GHPs. Members of respondents' household will be more careful in handling the tomatoes so as to reduce losses. Also, significant but inverse relationship was found between respondents' knowledge of GHPs and compliance with GHPs. This implies that the more the respondents' knowledge of GHPs, the less the compliance. The plausible reason for this might be high cost of packaging materials (such as plastic crates or collapsible cartons) and other equipments which were identify by respondents to be major constraints to compliance with GHPs.

**Table 4a. Relationships between selected socio-economic characteristics of respondents and compliance with GHPs**

Variables	$\chi^2$	df	P-value
Educational attainment	6.890	1	0.009
Type of labour	22.371	3	0.001
Secondary occupation	36.302	3	0.002

Source: Field survey, 2018

Significant at the 0.05 level (2-tailed)

**Table 4b. Relationship between selected socio-economic characteristics of respondents, awareness, constraints and compliance with GHPs**

Variable	r value	p value
Age	-0.306	0.000
Household size	-0.206	0.011
Years of experience	-0.456	0.000
Income from tomato	-0.168	0.039
Awareness	-0.681	0.000

Source: Field survey, 2018

Significant at the 0.05 level (2-tailed)

## Conclusion

Respondents were mostly commercial farmers with high annual income from tomato cultivation. They had high level of knowledge on Good Handling Practices which lead to high compliance in almost all stages of Good Handling Practices. Government should assist the farmers by giving them credit or subsidized inputs such as conveyor, proper washing, packing machines and packaging equipment to enhance compliance and to encourage younger and women to participate in tomato farming. Extension system should be used to sensitize more farmers and to monitor and persuade Good Handling Practices users in order to improve compliance in the study area.

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