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Poultry farmers' adaptation to climate change in Enugu North Agricultural Zone of Enugu State, Nigeria

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Abstract

The study surveyed the perceived effect and adaptation of climate change on poultry production in Enugu-North Agricultural Zone of Enugu State. A questionnaire/interview schedule was used to collect information from 60 poultry farmers. Percentage and mean score were used to analyze the data. Reduced body weight ($M=3.1$); reduced fertility ($M=3.3$) and reduced feed intake ($M=3.1$) were perceived by farmers as effects of climate change on poultry. Coping strategies used by farmers included keeping of resistant varieties (56.5%); adapting extensive poultry management (65.8%) and keeping other livestock (53.8%). Respondents perceived climate change as excessive sunshine (90%); excessive rainfall (80%) and increased incidence of drought (66%). The perceived causes of climate change included burning of fossil fuels from industries ($M=4.2$); burning of firewood ($M=4.0$) and deforestation ($M=3.7$). Sources of information available to the farmers were radio (33.3%); farmers' meeting (28.3%), and friends (26.7%). Technical innovations (adaptation measures) should be made available to farmers to enable them cope with the challenges of climate change.

Keywords: Climate change, poultry farmers, adaptation

Introduction

Poultry keeping is makes an important contribution to the livelihoods of the most vulnerable rural households in developing countries. Poultry has become a popular industry for the small holders that have great contribution to the economy of the country (Nigeria). The poultry profession has assumed greater importance in improving employment opportunity and animal food production. (Olagunju and Babatunde, 2011). The poultry industry has also been described as the fastest means of bridging the protein deficiency gap prevailing in the country (Eekeren, Mass, Saatkamp and Verschuur 1995; Apantaku, Omotaya and Oyesola 1998). A report by Okonkwo and Akubuo (2001) shows that about ten (10) percent of the Nigerian population is engaged in poultry production, mostly on subsistence and small or medium-sized farms. People depend on poultry for food and poultry farming serves as part-time work to supplement the income of small and marginal farm families. Poultry production is essential activity because of its vast potential to bring about rapid economic growth, particularly benefiting the weaker or the less privileged in the community. Furthermore, it needs low capital and short period of time to make quick returns within weeks and months in case of broilers and layers, respectively (Ekunwe, Soniregun and Oyedeji, 2006)

However, it is obvious that temperature has influence on poultry farming. This influence has amplified as there is climate change across the globe. Climate change is any change in climate over time, whether due to natural variability or as a result of human activity (BNRCC, 2011). Evidence from the Intergovernmental Panel on

Climate Change (IPCC, 2007) is now overwhelmingly convincing that climate change is real, that it will become worse, and that the poorest and most vulnerable people will be the worst affected. The IPCC predicts that by 2100 the increase in global average surface temperature may be between 1.8° C and 4.0° C. With increases of 1.5° C to 2.5° C, approximately 20 to 30 per cent of plant and animal species are expected to be at risk of extinction (FAO, 2007) with severe consequences for food security.

The International Fund for Agricultural Development (IFAD, 2009) acknowledges climate change as one of the factors affecting rural poverty. While climate change is a global phenomenon, its negative impacts are more severely felt by poor people in developing countries such as Nigeria who rely heavily on the natural resource base for their livelihoods, and due to their low level of coping capabilities (Nwafor, 2007; Jagtap, 2007). Changes in climate are severely affecting agricultural production in many African countries (APF/NEPAD, 2007). Studies by Deressa, Hassan, Alemu, Yesuf et al. (2009) reveal that African's agriculture is negatively affected by climate change and its rural poor communities rely greatly for their survival on agriculture and livestock keeping that are also amongst the most climate-sensitive economic sectors. The weather is erratic, vulnerable and unreliable to livestock farmers. Todaro and Smith (2009) conclude that worst impacts of climate change are felt by livestock farmers.

Climate changes in form of drought, temperature variability, too much sunshine and windstorm (Gueye, 2003) have negative effects on poultry production. High or low temperatures lead to diseases infection while wind may serve as agent for spread of air-borne diseases that affects poultry (Guey, 2003). Furthermore, Rajkuma, Reddy, Rama Rao, Radhika et. al. (2011) reported that poultry flocks are particularly vulnerable to climate change because birds can only tolerate narrow temperature ranges. Adaptation to climate change refers to adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities (IPCC, 2001). Poultry farmers therefore need to consider making adaptations now to help reduce cost, risk and concern in the future (Farming Features, 2009). Therefore, this study answers the following questions: What are farmers perceive evidence to climate change? What are their perceive effects of Climate change? What are the effects of climate change on poultry? What adaptive measures do the farmers undertake and what are the constraints for carrying out these measures successfully.

Therefore this study was designed to ascertain poultry farmers' adaptation measures to climate change in Enugu North agricultural zone of Enugu State, Nigeria. Specifically the study sought to: ascertain perceived evidence of climate change by the farmers; determine perceived causes of climate change by the respondents; ascertain the perceived of climate change on poultry production; determine adaptation measures undertaken by farmers; and identify constraints to the use adaptive measures.

Methodology

The population for the study comprised all poultry farmers in Enugu North Agricultural Zone of Enugu State. Six blocks were randomly selected out of eight blocks in the zone. Two cells were selected from each of the six blocks using simple random sampling procedure. A list of all poultry farmers was collected with the help of extension agents from each of the cells. Five poultry farmers were then selected by simple random sampling technique giving a total of 60 poultry farmers. Pre-tested questionnaire/structured interview schedule was developed based on objectives and used to collect data.

The socioeconomic characteristic of the respondents were measured thus: age (years), sex (male or female) etc. In order to ascertain the perceived evidence of climate change by poultry farmers, a check list was provided for them to tick accordingly. Any respondent that scored 50% and above was regarded as those that perceived evidence of climate change while those that scored less than 50% did not perceive evidence of climate change. The respondents were asked to identify the causes of climate change from the list of possible causes. Therefore, the extent to which the identified causes of climate change were perceived by the respondents were measured on five point Likert-type scale of : to a very great extent (5), to a great extent (4), to an extent (3), to a little extent (2) and to no extent (1). These values were summed up to 15 and divided by 5 to give a mean score of 3.0 The items with mean score ≥ 3.0 were regarded as perceived causes of climate change by the respondents while items with mean score < 3.0 were regarded as not perceived as causes of climate change by the respondents. The level of effects of climate change on poultry production was measured on a four point Likert-type scale of: high (4), moderate (3), low (2) and no effect (1). The values were summed up to 10 and divided by 4 to give a mean score of 2.5 The items with mean scores ≥ 2.5 were regarded as having high effect of climate change on poultry production while those with scores < 2.5 were regarded as having low effects.

In order to obtain a quantitative measure of respondents' agreement on the use of each technique (adaptive measures) in cushioning the effects of climate change, a checklist of various adaptive measures which were obtained from literature and personal interviews, was utilized. Respondents were requested to tick the measures used in adapting to the climate change effects. Any response option (adaptive measure) with score $\geq 50\%$ was regarded as being useful and important while items with scores $< 50\%$ was regarded as not being useful and important in cushioning the effects of climate change by farmers. In case of the constraints, a check list of possible constraints was provided and respondents asked to indicate accordingly. Thereafter, items with scores $\geq 50\%$ were regarded as having constraints to the adaptive measures while items with scores $< 50\%$ were regarded as having no constraints to the adaptive measures. Descriptive statistics such as percentage, mean score and standard deviation were used to analyse the data. Objective 3 and 4 were analysed by use of mean scores and standard deviation while objective 1, 2, 5 and 6 were analysed using percentage.

Results and Discussion

The result shows that majority (75.0%) of the respondents (Table 1) were within the age range of 30-39 years. The mean age of the respondents was 49 years. This shows that the respondents were in their active age and therefore productive. Majority (66.7%) of the respondents were female. This shows that rural women were more involved in poultry production. Therefore women should be targeted in the event of any climate change programmes on poultry in the study area. About 58% of the respondents were married. This shows that married persons predominated in poultry farming in the study area. Married people are responsible and so may easily find ways of adapting to effects of climate change on poultry as this may increase their productivity and subsequently bring to bear in catering for their family. Thirty three percent of the respondents had primary education while 30% had post primary education. Only 12% had tertiary education while up to 25.0% of the respondents had no form of formal education. Thus majority (75.0%) of the respondents were educated at least up to primary school level. This implies that they are able to harness information on climate change. Adedoyin, Fapojuwo and Torimiro (1999) pointed out that high level of education is a very good springboard for effective extension service. Good educational qualification may impact positively on the respondents' biochemical, social and economic understanding of climate change issues and ability to adapt to it. Greater proportion (40.0%) of the respondents engaged in farming as their major occupation.

Table 1
Distribution of respondents by socioeconomic characteristics

Variable	Frequency	Percentage	Mean (M)
Age	4	6.6	
20-29	10	16.7	
30-39	20	33.3	
40-49	15	25.0	49
50-59	6	10.0	
60 and above	5	8.4	
Sex			
Male	20	33.3	
Female	40	66.7	
Marital status			
Married	35	58.3	
Single	15	25.0	
Widowed	8	13.4	
Separated/divorced	2	3.3	
Educational attainment:			
No formal education	15	25.0	
Primary education	20	33.3	
Post primary education	18	30.0	
Tertiary education	7	11.7	
Household size:			
1-5	22	36.7	
6-10	30	50.0	
11-15	5	8.3	7
16-20	3	5.0	
Major occupation			
Farming	24	40.0	
Trading	12	20.0	
Civil service	18	30.0	
Artisans	5	8.3	
Nursing	1	1.7	

Majority (45.0%) of the respondents had 21-40 birds in their farms (Fig 1). The mean stock size was 36. This implies that poultry production in the study area is on subsistence level. This may be because of constraints (of which climate change effect may be one of them) that may hinder expansion of their farms therefore they can adapt easily as the cost and time spent for adaptation will be low.

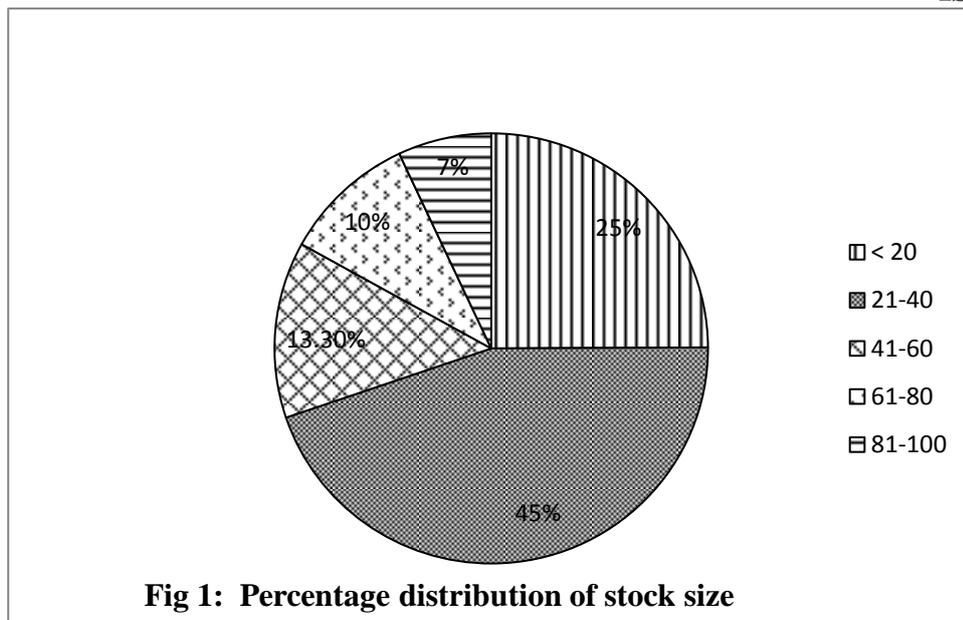
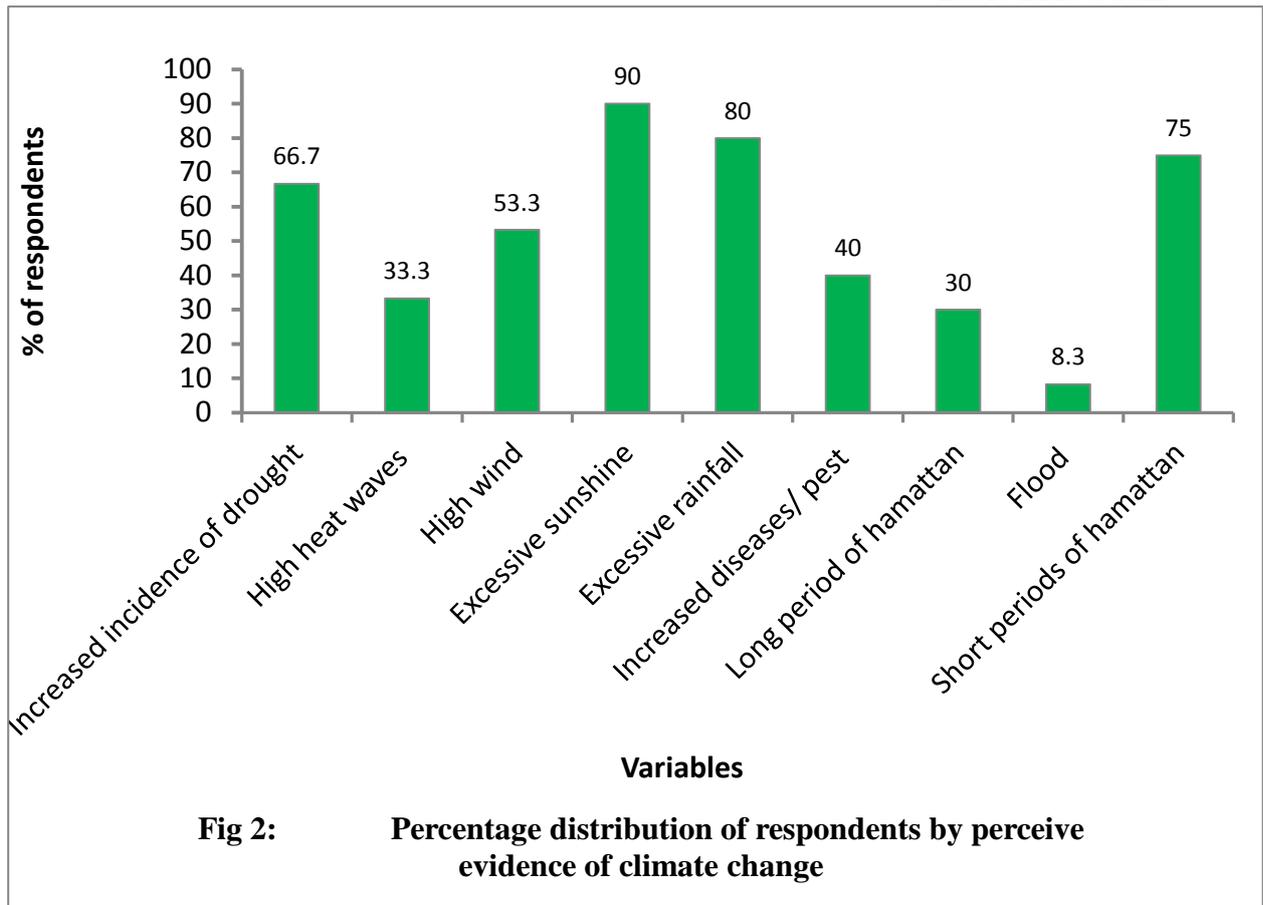


Table 1 indicates that 50.0% of the respondents have a household size within the range of 6-10. The mean household size was 7. This implies that the respondents had fairly large household size which could possibly serve as source of farm/family labour. It could also serve as source of information on climate change issues.

Perceived evidence of climate change

Excessive sunshine was noted by most (90.0%) of the respondents as a sign for climate change (Fig 2). Also majority (80.0%) of the respondents indicated excessive rainfall as a major evidence of climate change. Others included: short period of hamattan (75.5%) and increased incidence of drought (66.7%). This implies that the respondents have perceive evidence that climate has changed and therefore will be willing to adopt new technologies related to climate change adaptation. Yahaya, (2009) stated that the unusual weather change which brings about rain in different parts of Nigeria in January is an indication of serious negative effects of climate change.



Perceived causes of climate change

The results Table 2 indicate that farmers perceived causes of climate change included: burning of fossil fuel (M=4.2), burning of firewood for cooking (M=4.0), use of generator (M=3.9), bush burning (M=3.8), deforestation (M=3.4), overgrazing (M=3.5), use of fertilizer on farmland (M=3.4), use of pesticides (M=3.4) and decomposition of organic waste (M=3.5). This implies that human activities are to a large extent the major causes of climate change as indicated by respondents in the study area. There is strong evidence that the warming of the earth's over the last half century has been caused largely by human activity, such as the burning of fossil fuels and changes in land use including agriculture and deforestation (The Rural Society, 2010). Similarly, IPCC (2007) noted that the main cause of climate change has been attributed to anthropogenic (human) activities while Lohnman (2006) opined that climate change is closely associated with burning of oil, coal or gas. However, the respondents perceived to no extent that swamp rice production (M=2.4), gas flaring from oil companies (M=2.4), oil spillage (M=2.5) etc. were causes of climate change. The reason why they did not perceive oil spillage as one of the causes of climate change may be because oil exploration is not yet common in the zone.

Table 2
Perceived causes of climate change

Variable	Mean (M)	SD
Burning of fossil fuel by industries	4.2*	1.22
Burning of firewood for cooking	4.0*	1.21
Use of generator to generate electricity	3.9*	1.24
Bush burning	3.8*	1.20
Deforestation	3.7*	1.25
Over-grazing of farm land by livestock	3.5*	1.22
Use of excess fertilizer on farm land	3.4*	1.23
Use of pesticides	3.4*	1.45
Decomposition of organic waste	3.5*	1.48
Gas flaring from oil companies	2.4	1.5
Gas releases such as CO ₂ from industries	2.6	1.4
Swamp rice production	2.4	1.5
High rate of irrigation	2.5	1.4
Oil spillage	2.5	1.6

Perceived effects of climate change

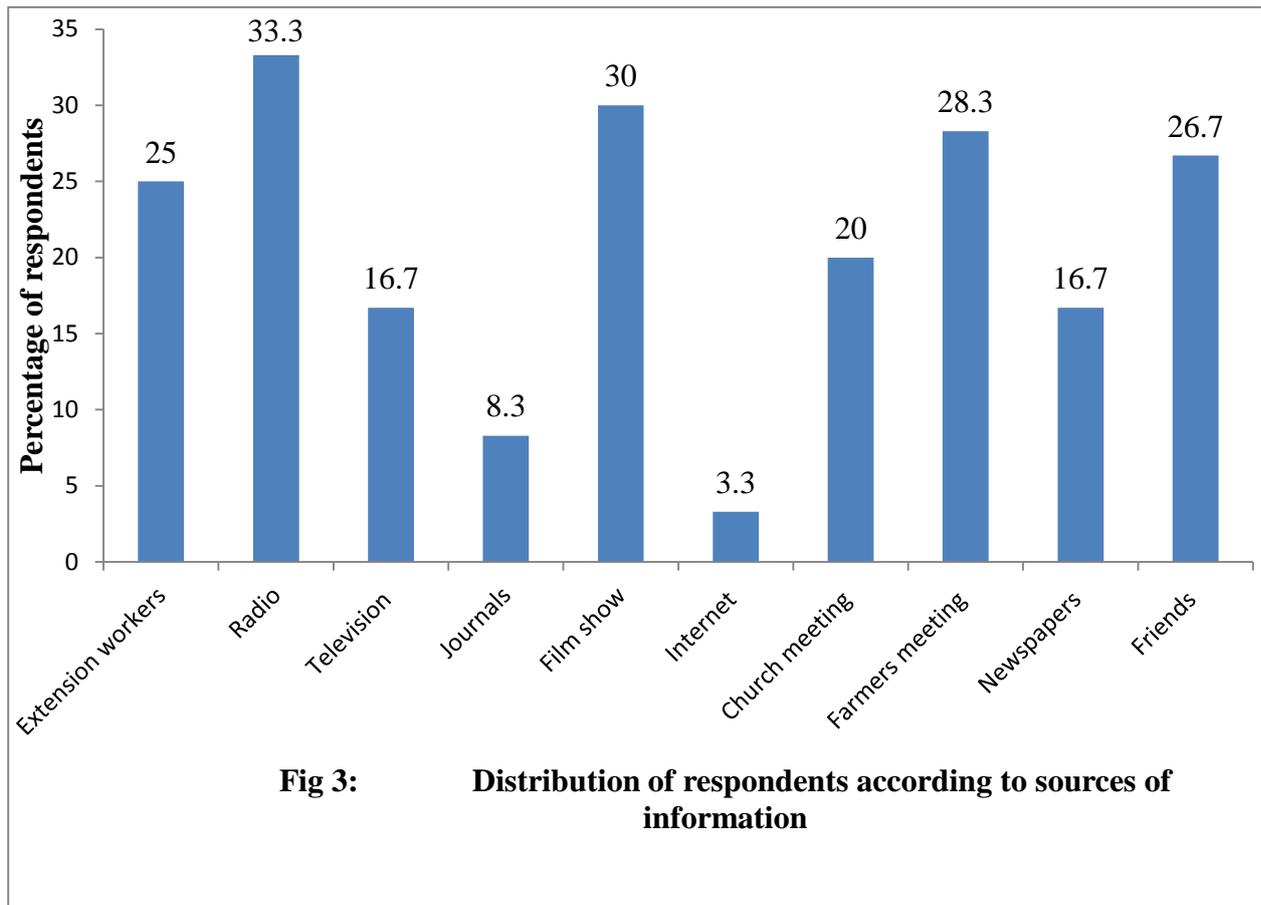
Most farmers in the study area have noticed significant changes in the climatic conditions (see Fig 2) and they claim such climatic conditions have been manifested in several forms. Table 3 summarizes the climatic effects farmers have observed. Almost all the variable except reduced sale of poultry birds (M=1.5) and change in taste of poultry meat (M=2.1) were perceived as high effects of climate change on poultry as their mean scores were greater than 2.5. Data in Table 3 also show that the standard deviations for all the issues considered were less than 1.5. This indicates that farmers' individual scores as regards their experience of climate change effects/impacts on agriculture did not differ much from their mean scores. These results are not surprising since it is obvious that high heat waves have a negative effect on poultry production and could have serious impact on poultry industry. This finding corroborates the opinion of Gueye, (2003) who reported that climate changes in form of drought, temperature variability, too much sunshine and windstorm have negative effects on agricultural production especially on poultry production. High or low temperatures lead to diseases infection while wind may serve as agent for spread of air-borne disease that affects poultry (Gueye, 2003). These extreme climatic events could have dramatic effects on the economy of the country. Heat distress suffered by animals will reduce the rate of animal feed intake and result in poor growth performance (Rowlinson, 2008). For rural communities, losing livestock assets could trigger a collapse into chronic poverty and have a lasting effect on livelihoods.

Table 3
Perceived effects of climate change

Variable	Mean (M)	SD
Reduced body weight	3.1*	1.22
Increased disease infection	3.0*	1.21
Reduced egg size	2.8*	1.24
Reduced feed intake	3.1	1.20
Reduced fertility	3.3*	1.25
Decreased activity	3.1*	1.22
Increased mortality	3.2*	1.23
Reduced farmers income	2.7*	1.45
Change in taste of poultry meat	2.1	1.48
Reduced sale of poultry birds	1.5	1.46

Sources of information about climate change

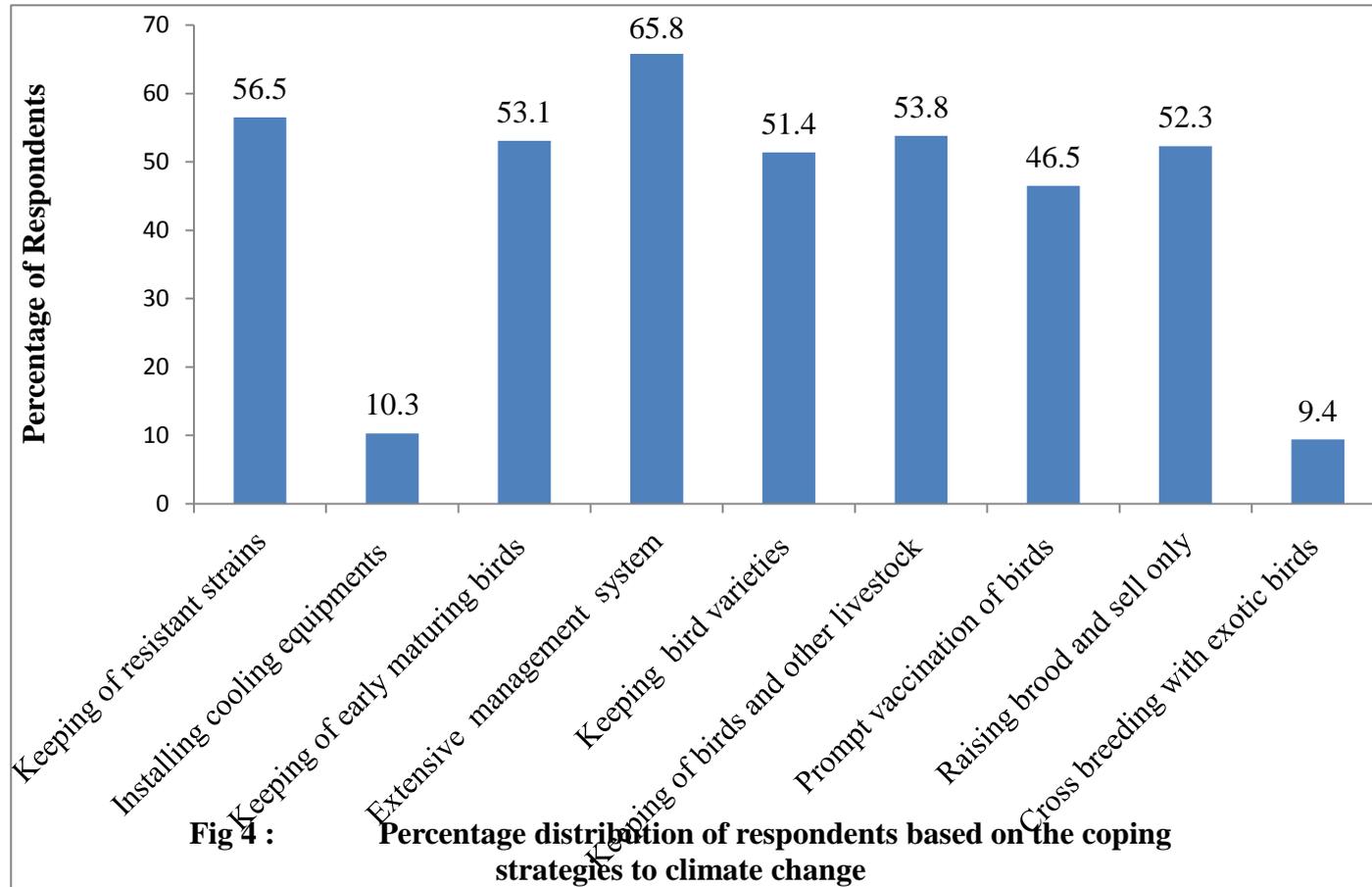
Respondents' sources of information (Fig 3) on climate change included: radio (33.3%), film show (30.0%), farmers meeting (28.3%), friends (26.7%) and extension workers (25.0%). This result corresponds with the report of Christanell, Burger-Scheidlin and Vogl (2009) who opined that in Australia, farmers' explanations for climate change are dominated by prevailing scientific discourses represented in the media and rarely base on the farmers' conclusions drawn from their own (local) observations. This shows that extension workers did not perform their duties very well as to supply climate change information to the farmers in the study area. In order to sustain the agricultural sector that plays pivotal roles in human existence in terms of the provision of food, fibre, fun, fuel and income, strategies of change need to be urgently initiated to cope with the changing climate. Agricultural extension has key roles to play in initiating this change. This is because adaptations to climate change impacts require changes in knowledge, attitudes, resilience capacities, and skills of the people and agricultural extension can bring this change. It has been observed that agricultural extension is involved in public information and education programmes that could assist farmers in mitigating/adapting to the effects of climate change (MOE FRN, 2003) such as awareness creation and knowledge brokerage on the issues of climate change; building resilience capacities among vulnerable individuals, communities and regions; encouragement of wide participation of all stakeholders in addressing climate change issues; and developing appropriate frameworks for coping/adapting to climate change effects/impacts.



Adaptation strategies of poultry farmers to climate change

The most significant adaptive measures used by farmers in coping with climate change effects in the study area are presented in Fig 4. The respondents undertook keeping of resistant birds (56.5%), keeping of early maturing birds (53.1%), extensive poultry management system (65.8), keeping different bird varieties (51.4%), keeping of birds and other livestock (53.8%), raising brood and sale (52.3%) etc as adaptive strategies to poultry production. This shows that farmers are already making efforts to cushion the effects of climate change. On the contrary, in Australia, even though farmers are aware of the impact climate change has on agricultural land and local ecosystems, farmers rarely react through adaptive actions or changes in the local agricultural production (Christanell, Burger-Scheidlin and Vogl 2009). On the other hand, Nzuma et al. (2010) stated that in Africa local farmers are already using local adaptation strategies to cope with climate change. Furthermore, ILRI (2008) reported investment in multiple livestock species as one of the adaptive measures for farmers to cope with the effect of climate change. In Enugu State, Nigeria, the most popular adaptive measure used by respondents was the use of resistant crop and animal varieties/species (Ozor and Nnaji, 2008). The use of resistant poultry species provides useful adaptations and resilience to the effects of climate change. Such birds are known to survive and complete their life cycles normally even when the environment will not allow others to thrive. The increased adoption of resistant species may not be unconnected with the fact that farmers encounter serious disease infections, which have been recognized as one of

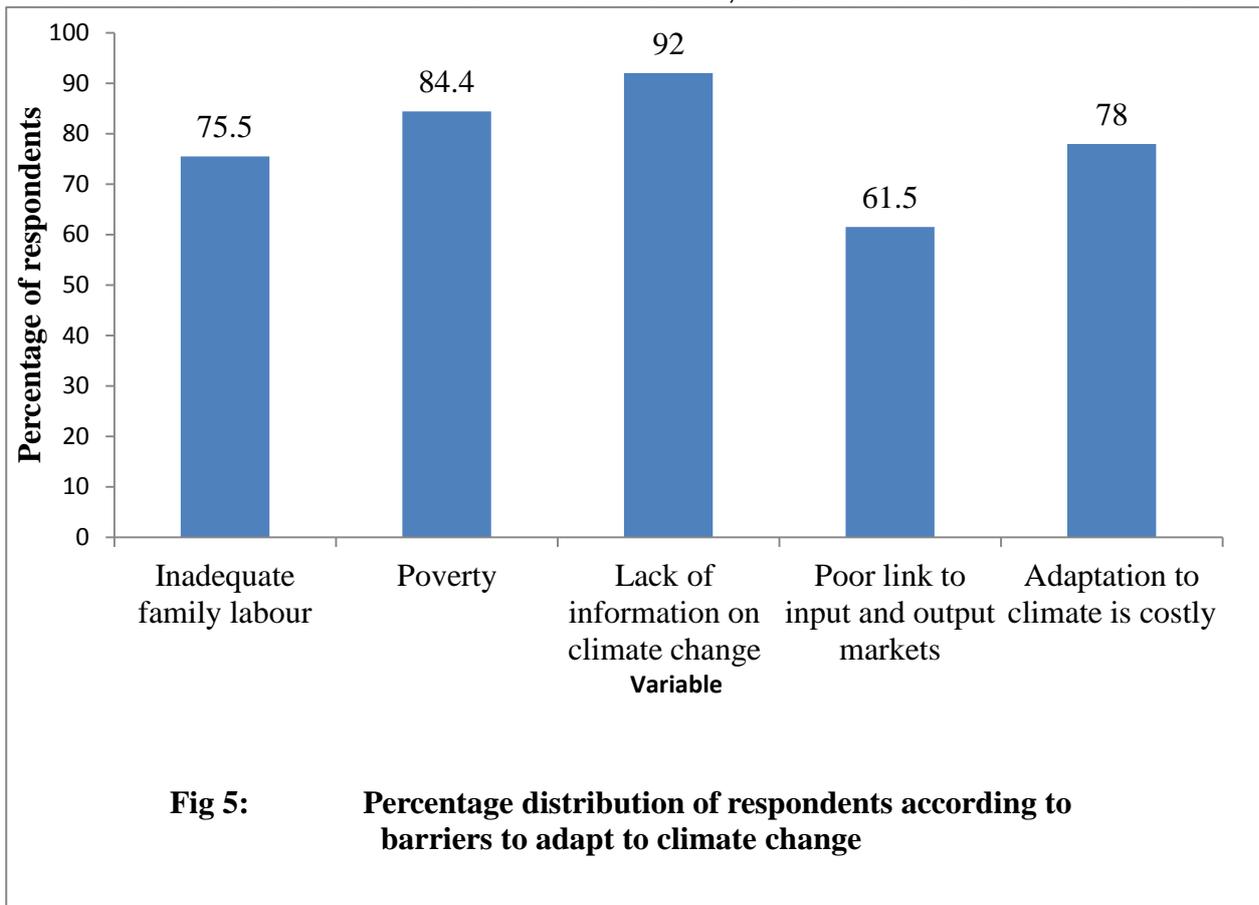
the most outstanding effects of climate change in the area (see Table 4). Keeping different types of livestock is adopted by farmers for reasons which may be to ensure food security, increased income, reduced incidence of pests and diseases, among others.



Constraints to adoption or use of climate change adaptive measures

The analysis of barriers to adaptation to climate change in the study area indicates that there are five constraints to climate change adaptive measures. These are lack of information (92.0%), high cost of adaptation (78.0%), shortage of labour (75.5%), poverty (84.4%) and poor link to input and output markets (61.5%) (Figure 5). Most of these constraints are associated with poverty. Lack of money hinders farmers from getting the necessary resources and technologies. However, lack of information to adaptation options could be attributed to the fact that researches on climate change and adaptation options have not been strengthened in the country hence, information is lacking in this area. The fact that adaptation strategies are costly ((Mendelson and Williams, 2004) makes farmers vulnerable to the negative effects of climate change. This cost could be revealed through the need for intensive labour use. Thus, if farmers do not have sufficient family labour or the financial means to hire labour, they cannot adapt easily to climate change. Apata et al, (2009) reported that the most adverse effects of climate change are felt mainly by developing countries, especially those in Africa due to their low level of coping capabilities (Nwafor, 2007; Jagtap, 2007). It is noted by IFAD (2009) that the capacity of local communities to adapt to climate change and mitigate its impacts will also depend on

their socio-economic and environmental conditions, and on the available resources.



Farmers need more information and enlightenment on how to curb and mitigate the effect of climate change. The same frontal attack that was and is currently given to HIV/AIDS campaign is needed for climate change issues if we are to ensure food security in the face of unabated urbanization. This circumstance poses great challenge for agricultural extension. Climate change presents new challenges and threats to food security in most countries especially the developing ones. This demands that extension service shall brace up to the development by re-training its staff to acquire the capability (knowledge and skills) in managing the risks that climate change pose especially in rural areas where the greater part of agricultural activities take place.

Conclusion and recommendation

Based on the findings of the study, the following conclusions were drawn: farmers perceived excessive sunshine as evidence of climate change, while anthropogenic causes were the main causes of climate change in the study area; key effect of climate change in the study area was reduced fertility while the key adaptive measure used by farmers was extensive poultry management system; and lack of information on climate change and poverty were the major barriers to climate change adaptation. The study recommended the following: extension has to play a key role in providing information to farmers in the study area; technical innovations (adaptation measures) should be made available to farmers to enable them cope with the challenges of climate change; government should grant loans to poultry farmers to

enable them procure new technologies to meet the protein demands of an ever increasing population; and efficient and affordable adaptation practices need to be developed for the rural poor who are unable to afford expensive adaptation technologies.

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