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Agriculture and Veterinary

Highlights

- Coastal Fisheries Development
- Formaldehyde Treated Sesame
- Agricultural Insurance Scheme
- Performance of Broiler Chicken

Discovering Thoughts, Inventing Future

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Effect of Formaldehyde Treated Sesame Cake Feeding on Growth Performnce of Growing Female Goats in Fodder based Basal Diet

By M.R. Tiwari, D. Adhikari, D.P. Adhikari, R.P. Ghimire & S.H. Ghimire

Nepal Agricultural Research Council, Nepal

Abstract - An experiment was carried out on fifteen growing female goats (50% Barberi 6, Kiko 6 and Khari 6) at the Agriculture Research Station (Goat), Bandipur for 90 days. Female goats of an average six months age and of body weight 7.82 kg were allocated into three groups having five animals in each group by using Complete Randomized Design (CRD). For T_1 and T_2 concentrate mixture was composed by using procured feed ingredients with 16% crude protein level while T_3 was fed with commercial feed. Experimental animals of T_1 group was provided forest mixed fodder (adlib) + formaldehyde treated sesame cake included concentrate mixture @ 1.5% of body weight, T_2 group was provided forest mixed fodder (adlib) + sesame cake included concentrate mixture @ 1.5% of body weight whereas T_3 was provided forest mixed fodder (adlib) + commercial concentrate mixture @ 1.5% of body weight. Experiment revealed that higher intake of concentrate feed was recorded for T_3 (139.79 g) followed by T_2 (123.1 g) and T_1 (116.36 g) which was highly significant ($P<0.001$) among diet groups. Similarly, fodder intake was noted significantly higher ($P<0.001$) among diet groups (1425.1 g, 1422.5 g and 1321.4 g for T_2, T_1 and T_3, respectively).

Keywords : goats, bypass protein feeding.

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EFFECT OF FORMALDEHYDE TREATED SESAME CAKE FEEDING ON GROWTH PERFORMNCE OF GROWING FEMALE GOATS IN FODDER BASED BASAL DIET

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Effect of Formaldehyde Treated Sesame Cake Feeding on Growth Performnce of Growing Female Goats in Fodder based Basal Diet

M.R. Tiwari [α], D. Adhikari [σ], D.P. Adhikari [ρ], R.P. Ghimire [ω] & S.H. Ghimire [¥]

Abstract - An experiment was carried out on fifteen growing female goats (50% Barberi 6, Kiko 6 and Khari 6) at the Agriculture Research Station (Goat), Bandipur for 90 days. Female goats of an average six months age and of body weight 7.82 kg were allocated into three groups having five animals in each group by using Complete Randomized Design (CRD). For T_1 and T_2 concentrate mixture was composed by using procured feed ingredients with 16% crude protein level while T_3 was fed with commercial feed. Experimental animals of T_1 group was provided forest mixed fodder (adlib) + formaldehyde treated sesame cake included concentrate mixture @ 1.5% of body weight, T_2 group was provided forest mixed fodder (adlib) + sesame cake included concentrate mixture @ 1.5% of body weight whereas T_3 was provided forest mixed fodder (adlib) + commercial concentrate mixture @ 1.5% of body weight. Experiment revealed that higher intake of concentrate feed was recorded for T_3 (139.79 g) followed by T_2 (123.1 g) and T_1 (116.36 g) which was highly significant ($P<0.001$) among diet groups. Similarly, fodder intake was noted significantly higher ($P<0.001$) among diet groups (1425.1 g, 1422.5 g and 1321.4 g for T_2, T_1 and T_3, respectively). Feed intake of different genotypes of goats was found to be non-significant whereas fodder intake was found to be significant ($P<0.05$) among goat breeds. In addition, feed conversion ratio per kg body weight gain was observed higher for T_3 (13.25:1) followed by T_2 (12.52:1) and T_1 (11.91:1). Likewise, daily crude protein intake was found higher for T_2 (82.59 g) followed by T_1 (81.4 g) and T_3 (79.13g) whereas crude protein expenditure per kg weight gain was found to be higher in T_3 (1.6 kg) followed by T_2 (1.52 kg) and T_1 (1.44 kg) which was none significant among diet groups. Initial body weight of T_1, T_2 and T_3 was 7.55 kg, 8.0 kg and 7.9 kg, respectively that reached 12.95 kg, 12.65 kg and 12.25 kg during 90 days of experiment for T_1, T_2 and T_3, respectively. Both initial and final body weight was non-significant among diet groups. Similarly, there was also non-significant effect of goat breed on body weight gain. Total body weight gain was recorded higher for T_1 (5.10 kg) followed by T_2 (4.9kg) and T_3 (4.45 kg) which was insignificant among diet groups. Similarly, average daily gain was also noted higher in T_1 (56.66g) followed by T_2 (54.44 g) and T_3 (49.44 g).

Keywords : goats, bypass protein feeding.

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I. Introduction

Goats, important domestic animals in many part of world, have served mankind for ages. They provide substance in term of food and clothing. These hardy ruminants can exist in harsh environment in which other livestock species would perish. Goats grow and reproduce under extreme conditions from rugged mountain areas where winters are bitter cold to desert regions where it is hot and dry, and water and forage are sparse. The goat has been considered as *poor man's cow* (mini cow) of poor people because of its immense contribution in rural economy and national income. Goat products like milk and meat are not only nutritious and easily digestible but also a great source of regular income for the poor, landless and marginal farmers. Being a small sized animal it can be easily maintained by women and children (Aziz 2010). Goat population of Nepal is estimated to be 9.19 million. Of 9.19 million, goat population of western hills is 1.13 million which account 12.32% of total goat population that producing 5284 mt meat per annum (MoAD 2012).

Bypass protein is that the original amino acids in the protein meal are absorbed in the small intestine instead of converted to microbial protein in the rumen. Another benefit of feeding meals with high bypass protein is that the portion of the protein that is rumen degradable breaks down in the rumen very slowly. Formaldehyde treatment is most widely used chemical treatment for the protection of protein. Generally there is increased fecal nitrogen and decreased urinary nitrogen which indicates effectiveness of protection. The use of formaldehyde to protect dietary protein for ruminants is based on the premise that bound formaldehyde markedly reduces the solubility of the protein thereby rendering it highly resistant to microbial attack in the rumen without significantly reducing its digestibility in the small intestine.

Supplementation with other palatable materials, mainly agro-industrial by-products has been used in many developed countries for improving locally available nutrients of feed resources (Xianjun *et al.* 2012). It is well established that feed cost accounts for more than 70% of the total cost in any livestock production. Hence, it is paramount important to

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incorporate locally available byproducts and raw materials into the feed of ruminant animals. Agricultural and industrial by-products that are relatively cheaper are best sources for supplementation of animals on fibrous basal feeds. Sesame cake is one of the byproducts available in Nepal at cheaper price throughout the year. The sesame oilseed cake contains DM (83-96%), CP (23-46%), ash (7.5-17%), ether extract (1.4-27%), NFE (25-32%) and crude fiber (5-12%), respectively (FAO 1990).

Growth comparison of goats fed with formaldehyde treated sesame cake is not evaluated so far in Nepal. Hence, a study was carried out to compare the growth performance of growing female goats fed with formaldehyde treated sesame cake mixed concentrate mixture at Agriculture Research Station (Goat), Bandipur, Tanahun.

II. Methodology

a) Experimental Animals

This experiment was carried out on fifteen growing female goats (50% Barberi 5, Khari 5 and Kiko goats 5) at Agriculture Research Station (Goat), Bandipur, Tanahun from 30 March to 26 June 2013 (069/12/17 to 070/03/12). Female goats of average five months old with average body weight of 11.86 kg were allocated into three groups having six animals in each group by using Complete Randomized Design (CRD). They were drenched with Fenbendazole @ 5 mg/kg body weight against internal parasites before assigning in experiment.

b) Concentrate mixture composition

Feed ingredients maize, soybean cake, rice bran, minerals and salt were procured from Khowpa Feed Industry, Bhaktapur. For T1 and T2 concentrate mixture were composed by using procured feed ingredients with 16% crude protein level that has been presented in Table 1 while for T3 commercial compound feed was used made by Pancharatna Feed Industry, Narayangadh, Chitwan.

Table 1 : Composition of concentrate mixture

S/n	Ingredients	T 1		T2	
		Part	Crude Protein (%)	Part	Crude Protein (%)
1	Maize	50	4.4	50	4.4
2	Rice bran	18	1.58	18	1.58
3	Til cake	20	5.61	20	5.61
4	Meat com bone meal	10	4.92	10	4.92
5	Mineral mixture	1	0	1	0
6	Salt	1	0	1	0
Total		100	16.51	100	16.51

c) Formaldehyde treatment of sesame cake

Sesame cake was treated with 1-1.2g formalin (40%)/100 g crude protein (CP) as suggested by (Thomas *et al*. 1979; Hagemeister *et al*. 1980). At first one part of formalin was diluted in nine part of water. That after formalin diluted solution was sprayed over cake and mixed manually for five minutes then the cake was stored in plastic bags.

d) Experimental diet of the animal

The dry matter requirement of goats was calculated based on 5 kg per 100 kg body weight. Following diets were formulated to the experimental animals (Table 2).

Table 2 : Experimental diets of the animals

Treatment	Experimental diet
1	Forest mixed fodder (adlib) + formaldehyde treated sesame cake included concentrate mixture @ 1.5% of body weight
2	Forest mixed fodder (adlib) + sesame cake included concentrate mixture @ 1.5% of body weight
3	Forest mixed fodder (adlib) + commercial concentrate mixture @ 1.5% of body weight

e) Feeding Regime

Concentrate mixture and *adlib* amount of fodder was provided to the experimental animals individually in plastic vessel. Concentrate mixture was provided once a day in the morning whereas fodder twice a day (morning and evening). Quantity of concentrate mixture and fodder given daily to the animals was weighed daily and refusal was weighed in next morning. Experimental animal had free access to drinking water.

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f) Chemical Analysis

The samples of feed ingredients, prepared concentrate mixture and forest mixed fodder were sent to the Animal Nutrition Division, Khumaltar, Lalitpur for proximate analysis. Representative samples were analyzed for dry matter (DM), crude protein (CP), crude fibre (CF), ether extract (EE) and total ash contents (TA). The DM was determined by oven drying at 100°C for 24 hrs. Crude protein of the samples was determined using the Kjeldahl method. Ether extract was determined using Soxhlet apparatus. Ash content was determined by ashing at 550°C in a muffle furnace for 16 hrs (AOAC 1980). Crude fibre of the samples was determined using the Van Soest method (Goering, H.K. and Van Soest 1970).

g) Results Recording

The trial period consisted 90 days after an adaptation period of 7 days. Total feed intake by the goats was recorded daily for entire experimental period. The body weight gain of individual animal was measured fortnightly in the morning before feeding.

h) Data Analysis

Data of feed intake and body weight gain were analyzed by "*One Way Annova*" test for every measurement using computer statistical package Minitab 2003, versions 13.20.

III. Results and Discussion

a) Chemical composition of feedstuffs

The result of chemical analysis has been given in Table 3 and crude protein content of prepared concentrate mixture was verified in laboratory that is presented in Table 4.

Table 3 : Chemical composition of different feed ingredients (% DM basis)

Ingredient	DM	OM	TA	CP	CF
Maize	87.69	97.97	2.03	7.53	2.34
Rice bran	87.85	89.5	10.5	11.52	4.83
Sesame cake	90.3	92.63	7.37	30.5	11.3
Meat come bone meal	93.22	67.2	32.8	49.93	3.43
Mixed forest fodder	39.94	90.01	9.99	11.16	NA

The calculated value of crude protein was verified with laboratory analysis, which is presented in Table 4.

Table 4 : Chemical composition of prepared concentrate mixture (% DM basis)

Particular	DM	OM	TA	CP	CF
Formaldehyde treated sesame cake included concentrate mixture	91.92	92.54	7.46	16.83	5.95
Sesame cake included concentrate mixture	91.58	92.10	7.90	16.92	5.64
Commercial feed	90.74	89.85	10.15	15.94	6.45

b) Feed Intake

Average daily intake of concentrate mixture and fodder by goats during experimental periods has been presented in Table 5.

Table 5 : Average feed intake of experimental animal/day/animal

Feedstuffs	Mean ± SD		
	T1	T2	T3
Feed intake (g)	116.36±52.92	123.10±49.44	139.79±47.39
Fodder intake (g)	1422.5±389.5	1425.1±397.9	1321.6±406.3
Daily crude protein intake (g)	81.4±23.46	82.59±23.38	79.13±23.01
Total protein intake (kg)	7.33	7.43	7.12
Daily dry matter intake (g)	675.11	681.91	654.7
Total dry matter intake (DMI) (kg)	60.76	61.36	58.92
Feed conversion ratio (FCR) (kg)	11.91:1	12.52:1	13.24:1
Crude protein expenditure per kg weight gain (kg)	1.44	1.52	1.6

Higher intake of concentrate feed was recorded for T_3 (139.79 g) followed by T_2 (123.1 g) and T_1 (116.52 g) which was highly significant ($P<0.001$) among diet groups. Similarly, fodder intake was also noted highly significant ($P<0.001$) among diet groups (1425.1 g, 1422.5 g and 1321.6 g for T_2, T_1 and T_3, respectively). Highest dry matter intake per day was higher in T_2 (681.91 g) followed by T_1 (675.11 g) and T_3 (654.7 g) which resulted higher total dry matter intake (61.36 kg, 60.76 kg and 58.92 kg for T_2, T_1 and T_3, respectively).

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Feed intake of different genotypes of goats was found to be non-significant among goat breeds whereas fodder intake differed significantly ($P<0.05$). In addition, feed conversion ratio per kg body weight gain was observed higher for T_3 (13.24:1) followed by T_2 (12.52:1) and T_1 (11.91:1).

Similarly, average crude protein intake per day per animal was recorded for T_2 (82.59 g) followed by T_1 (81.4 g) and T_3 (79.13 g) which resulted higher total crude protein intake (7.43 kg, 7.33 kg and 7.12 kg for T_2, T_1 and T_3, respectively). Furthermore, crude protein expenditure per kg weight gain was found higher in T_2 (1.52 kg) followed by T_1 (1.44 kg) and T_3 (1.6 kg). Both average crude protein intakes per day and crude protein expenditure per kg body weight gain was none significant among diet groups.

c) Growth Performance

The growth performance of experimental goats is presented in Table 6 and Figure 1. Initial body weight of T_1, T_2 and T_3 was 7.55 kg, 8.0 kg and 7.9 kg, respectively that reached 12.95 kg, 12.65 kg and 12.25 kg during the experimental period for T_1, T_2 and T_3, respectively. Both initial and final body weight was non-significant among diet groups. Similarly, there was also non-significant effect of goat breed on body weight gain. Total body weight gain was recorded higher for T_1 (5.1kg) followed by T_2 (4.9 kg) and T_3 (4.45 kg) which was non-significant among diet groups. Similarly, average daily gain was also noted higher in T_1 (56.66g) followed by T_2 (54.44 g) and T_3 (49.44 g) which also non-significant among diet groups.

Table 6 : Growth performance of goats

Parameter	Mean ± SD		
	T1	T2	T3
Initial Body weight (kg)	7.55±0.79	8.0±1.35	7.9±2.66
Initial metabolic weight (kg)	4.55	4.75	4.71
Final Body weight (kg)	12.95±1.17	12.65±1.59	12.25±3.45
Final Metabolic weight (kg)	6.83	6.70	6.55
Total weight gain (kg)	5.1±1.46	4.90±1.15	4.45±1.20
Average daily gain (g)	56.66±16.27	54.44±12.82	49.44±13.38

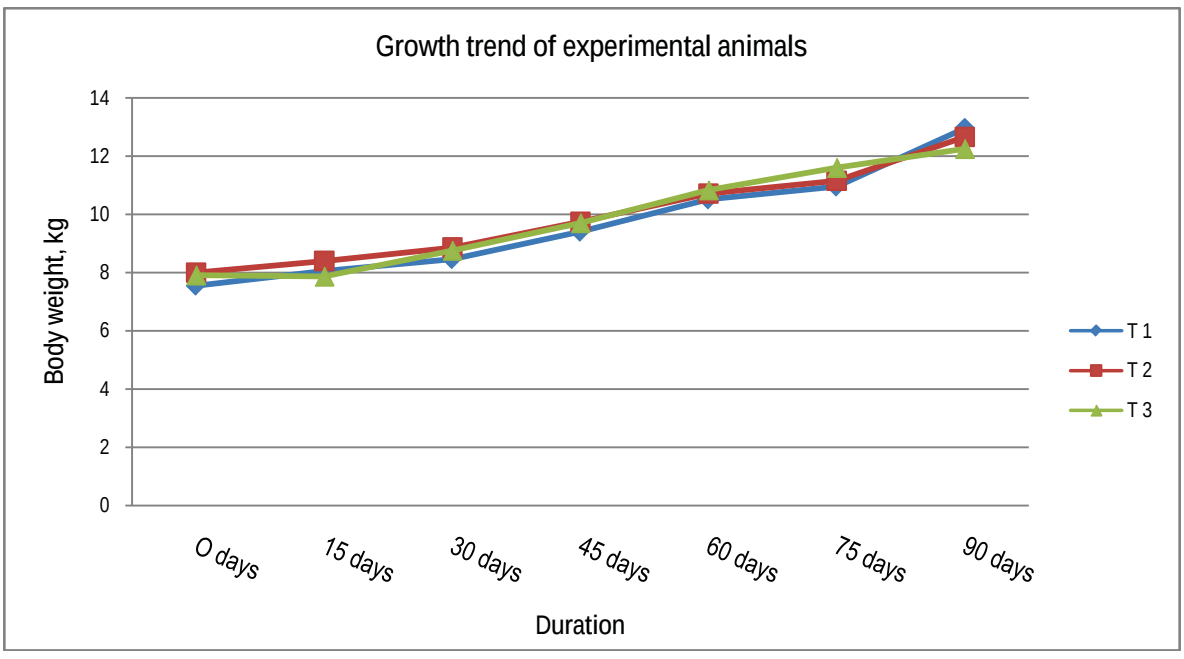

Figure 1 : Body weight gain trend of goats during experiment period

IV. Discussion

This study was initiated with objective to compare the growth performance of female goats of different breeds fed with formaldehyde treated and none treated sesame cake incorporated concentrate mixture, and commercial compound feed on fodder based basal diet. Result revealed that concentrate feed and fodder intake was highly significant ($P<0.001$) among diet groups. Both initial and final body weight was not significant among groups. Similarly, total weight gain and average daily gain also found to be non significant

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among the diet groups. Furthermore, average crude protein intake and crude protein expenditure per animal per day was also not significant among diet groups. Several work has been done by different researchers to improve the bypass protein level in goats through heat treatment but feeding of formaldehyde treated sesame cake to goats is not recorded / documented.

V. Conclusion

Our experiment revealed that there is no significant effect of formaldehyde treatment of sesame cake on body weight gain of goats, however, feed and fodder intake differed significantly. Therefore, it can be concluded that formaldehyde treatment of sesame cake does not improve the bypass of protein in goats. Hence, sesame cake can be incorporated in concentrate mixture of goats without any treatment.

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Value-Chain Analysis for Coastal Fisheries Development in Nigeria

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Abstract - This study evaluated the coastal fisheries value chain (CFVC) of Ogun Waterside Local Government Area (LGA), Nigeria. 176 fisherfolks were selected using purposive and simple random sampling techniques for interview schedule administration. Data collected were analyzed using descriptive and inferential statistical tools. Fishermen, fish processors and fish-marketers were the major actors of the CFVC and their average ages were 34.79+0.57, 39.05+0.58 and 36.73+0.65 years; 91.7%, 57.8% and 70.4% of them were married, having an average household size of 9, 10 and 6 persons respectively. Actors in the CFVC were mainly uneducated (43.1%, 31.2% and 66.0% respectively). Chi-Square analysis revealed a significant association ($P < 0.05$) between the socio-economic characteristics and total revenue of the respondents. There was no significant association between the constraints faced by the fishermen ($\chi^2=0.253$, $P > 0.05$) and total revenue; although it was significant for the fish processors ($\chi^2=0.000$, $P < 0.05$) and fish-marketers ($\chi^2=0.000$, $P < 0.05$) at 95% fractile level. The study concluded that poor transportation network, high cost of fishing inputs, inadequate funding and poor storage facilities were major constraints to CFVC development and that the fish-marketers stage was the most profitable compared to the other stages in the CFVC.

Keywords : value, coastal, artisanal, chain, development.

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VALUE-CHAIN ANALYSIS FOR COASTAL FISHERIES DEVELOPMENT IN NIGERIA

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I. Introduction

Nigeria has become a major destination for imported seafood ever since the Government made a tariff reduction on all fishery products in 2001 from 25% to 5% (NBS, 2006). The European Union accounts for more than 70% of the Nigerian sea food supply while the US provides about 1% (Nzeka, 2003). The massive potentials of a coastline of 853km, a 200 nautical miles Exclusive Economic Zone (EEZ), over 2,658 fish farms as well as 937 Dams and Reservoirs, 365 lakes and reservoirs and 687 ponds and floodplains totaling over 13 million hectares of water bodies (Earth Trends, 2003) remain largely untapped. Despite the abundant fisheries resources and the relatively high consumption of fish in Nigeria (FDF, 2008), its domestic output of 0.85 million metric tonnes in 2010 still falls short of demand of 3.02 million metric tonnes (CBN, 2007; FDF, 2008; FDF, 2010). The fisheries sector represent a major food source, which is invaluable for the protein they provide and the industrial products they produce. Fish is economically, socially and culturally important as a global dietary aspect of sustainable food security. Economically fish provides an important source of food and income for both men and women and fishing has an important social and cultural position in riverine communities. However A deficit of 2.17 million metric tonnes is required to meet the ever increasing demand for fish in Nigeria. This large deficit between the demand and supply of fish is augmented by massive importation of frozen fish which is a rigorous drain on the exchange earnings of the nation (FDF, 2008).

Availability of fish to the consumers at the right time, right form, right place and at the lowest possible cost requires an effective marketing system (Shamsuddoha, 2007). Marketing of fish passes through various market participants and exchange points before they reach the final consumers (Ali *et al*., 2008). Nigeria has a great potential of fish resources whose distribution and value chain needs to be strengthened and developed to bridge the gap between demand and supply of fish in Nigeria (Amao *et al*, 2006).

Fish is highly susceptible to deterioration without any preservation or processing measures (Okonta and Ekelemu 2005). Immediately fish dies a number of physiological and microbial deterioration sets in which invariably degrades the quality of fish (Eyo, 2001). It will become unfit for human consumption within about one day of capture, unless it is subjected to some form of processing or preservation. Even after the fish has been processed, particularly if traditional methods have been used, the fish is still subject to many forms of loss and spoilage. Hence, fish being a highly perishable substance needs to be transported to the consumer or final user in time Ali *et al*, 2008) to avoid post harvest spoilage through a coordinated marketing channel (fish value chain).

Based on the aforementioned, the following research questions become pertinent:

1. Who are the actors or institution that makes up the coastal fish value chain?
2. What are the socio-economic characteristics of the major actors that make up the coastal fish value chain?
3. What is the structure of the fresh and processed fish value chain?
4. What are the constraints to the identified fish value chain?

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a) Objectives of the Study

i. *Main Objective*

To analyse and develop the fish value chain in the coastal community of Ogun Waterside, Ogun State, Nigeria

ii. *Specific Objectives are to*

The following specific objectives were addressed in order to achieve the broad objective:

1. Identify and describe the socio-economic characteristics of all the institutions that make up fish value chain in the study area.
2. Identify and analyze the structure of the fresh and processed fish value chains
3. Determine the constraints hindering the development of the identified coastal fish value chain.

b) Justification of the Study

Hunger, malnutrition, and poor health are widespread and serious development challenges hindering economic development in Nigeria. These can only be overcome by providing the ever rising human population with better employment opportunities to improve their livelihoods (Akinrotimi *et al*, 2007) and also adequate nutrition to reduce the nutritional deficiencies prevalent in Nigeria. The Nigerian fishery industry plays a significant role in the development of this country by providing livelihood for more than 50 million people in terms of employment, income generation and provision of principal protein to the diet (Akpaniteaku *et al.,* 2005)). Each year, there are an additional 80-90million people to feed, most of them in developing countries, the most reliable source of protein for many of them is fish (Nzeka, 2003). However, irrespective of the great opportunities embedded in capture fisheries in Nigeria, a lot of the fish resources are being discarded on a daily basis due to an unorganized or uncoordinated distribution channel (Aihonsu and Shittu, 2008). Analyzing fisheries value chain provides an insight into various employment opportunities that remain untapped in the fisheries sector (Kaplinsky and Morris, 2000). Fish value chains in Nigeria are not yet developed to meet international market requirements as limited value addition is done in the industry, with the result that market for fish and fish products are limited to domestic markets (Investopedia, 2011). Over the past decade, development practitioners have increasingly shifted their attention from farming systems to targeting agricultural value chains and fisheries by extension, to improve smallholder production and participation in markets (Rota and Sperandini, 2010). This is because small-scale producers are often unable to increase production by adopting productivity-enhancing technologies unless the value chains for their products are sufficiently developed and dynamic (Kaplinsky and Morris, 2000).

c) Hypotheses

The hypotheses of the study tested in the null forms are:

- $H_0$1: There is no significant relationship between the socio-economic characteristics of the chain actors and their total revenue.
- $H_0$2: There is no significant relationship between the total revenue of the chain actors and the constraints faced.

II. Materials and Methods

a) The Description of the Study Area

The geographical location chosen for this study is the Ogun waterside area of Ogun State, Nigeria. The proximity of the area to the Atlantic Ocean, Lagoon systems and in particular, to the good, albeit complex network of streams, rivers, and other water-bodies make the area an appropriate geographical location for this study. She is located in the eastern part of Ogun state sharing boundaries with Ondo state in the north, Lagos state in the south and Ijebu east local government in the west. About half to three quarter of the length of the local government is surrounded by water extending from Lagos state to Ondo state, this peculiar feature gave birth to the name waterside. The study area is closely associated with other maritime states of South-western Nigeria. The area comprises over 50 towns and villages with Headquarter at Abigi at 6°29′N 4°24′E / 6.483°N 4.4°E (www.wikipedia.com), while the main town in this area are Iwopin, Oni, Ibiade, Abigi, Efire, Ilushin, Makun-Omi, Ode-Omi and Lomiro, the area consists largely of Yoruba speaking people of which, the Ijebus comprise about 70 percent, with the Ikales, Ilajes, Itsekiris and Urhobos making up the remaining 30 percent. It has an area of 1,000 km^2 and a population of 72,935 at the 2006 census. This area is also blessed with a large expanse of fertile land (soil) rich in organic matter, well drained and deep which makes it support various crop cultivation especially plantation crops such as oil palm . The choice of the local government is by its close proximity to the Atlantic Ocean and its relative endowment with a complex network of streams, rivers, brackish water and in particular the extension of the Lagos (Lekki) Lagoon to the area. It is the only area of the state with a coastline on the Bight of Benin and also borders Lagos lagoon (Fig 1).

b) Sample Size and Sampling Techniques

A purposive sampling technique was used in the selection of four (Igbosere, JK Camp, Olosumeta and Elefon) coastal fishing communities from the 23 fishing villages of Ogun state coastal area based on their intensity of fishing activities. The second stage involves the use of simple random sampling in the selection of 30% of the fishermen and fish processors in the four selected communities who were interviewed to

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give a total of 72 and 64 respondents respectively. Lastly a purposive sampling method was used in selecting 40 fish marketers at their central market arena to give a total of 176 respondents as indicated in the table 1.

i. *Analytical Procedures*

Combinations of statistical, budgetary and parametric analysis were used to analyze the obtained data. These include descriptive analysis, inferential statistics and profitability indicators.

ii. *Descriptive Statistical Tools*

Frequencies, tables, pie-charts, bar charts and percentages were used to describe the socio-economic characteristics of the respondents. The characteristics included the ages of the farmers, marital status, educational attainment, major occupation, farming experience, sex among others.

III. Results

a) The socio-economic characteristics of the fish value chain actors at the coastal area of Ogun state, Nigeria

The socio-economic characteristics of all institutions and actors that make up the fish value chain in the study area are presented in Table 2. One hundred percent of the fishermen and fish processors were male and female respectively; while 14.2% and 85.8% of the fish-marketers were male and female respectively. Most (43.1%) of the fishermen fell within the age bracket of 41 -50 years with a mean age of 43.79$\pm$ 0.57, 39.05 $\pm$ 0.58 and 36.73$\pm$ 0.65; while 46.8% and 50.6% of the fish processors and fish-marketers were within the age range of 31-40 years respectively. However, the ages of 11.2%, 0.0% and 8.8% of the fishermen, fish processors and fish-marketers were higher than 50 years respectively.

Majority (91.7%, 57.79% and 70.4% respectively) of the fishermen, fish processors and fish-marketers were married with household sizes of 6-10 persons and a mean household size of 9, 10 and 6 persons. Most (54.2% and 52.8%) of the fishermen and fish-marketers practiced Islam, while 56.2% of the fish processors were Christians. Respondents with primary school leaving certificate were 36.1% (fishermen), 49.9% (fish processors) and 13.2% (fish-marketers) as against 31.2% of fish processors with no formal education; hence the high level of illiteracy among value chain actors in Ogun Waterside LGA.

The survey further revealed that out of the 100% fishermen, fish processors and middle men who practiced their occupation on a full time basis, 65.5% (fishermen), 40.6 (fish processors) and 0.0% (middle men) practiced farming as their minor occupation. Based on the years of experience in fish-related business, 26.41%, 74.9% and 37.4% of fishermen, fish processors and fish-marketers respectively had between 11 and 20 years of experience. Out of the 72, 64 and 45 fishermen, fish processors and fish-marketers interviewed respectively, 72 (100.0%), 44 (68.6%) and 17 (38.4%) were not members of any cooperative societies. The structure of the identified coastal fish value chain as mapped out during the survey is presented in Fig 2.

b) Constraints to fish value chain development

79.2% and 62.4% of the fisherman and fish processors reported poor transportation network to their coastal communities as a very severe constraint to the fish value chain development in the coastal area of Ogun State, Nigeria while 82.2% of the fish-marketers regarded poor storage facilities as a major and very severe constraints to the fish value chain development as indicated in Table 5.

IV. Discussion

This research project evaluated the fish value chain in the coastal area of Ogun State, Nigeria. The study identified 3 major marketing nodes along the coastal area, including: fishermen, fish processors and the fish-marketers. All fishermen (100%) and all fish processors (100%) in the Ogun Waterside coastal fish value were male and female respectively. This could be attributed to strenuous and tasking nature of the typical fisherman's work which the male gender could possibly handle better than the weaker female gender; but is opposed to the practice in Idaleketa, another coastal community in Ogun Waterside where only the female gender could fish. These findings were in line with the findings of Olubanjo *et al* (2007), Olawumi *et al* (2010) and Olaoye and Odebiyi (2011) were the business was gender biased. Many (43.1%, 46.8% and 50.6%) of the fisherman, fish processors and fish-marketers interviewed were between 31 and 40years of age, a highly productive and active age when actors could undertake strenuous task. This is in line with the findings of Bello, (2000) and George *et al* (2010) that age had a positive correlation with agricultural productivity.

In rural communities, marriage is a respected and prestigious institution that bestows social status and recognition on people. The marital status of respondents as presented in Table 4 indicated that 91.7%, 57.7% and 70.4% of the respondents respectively were married, implying that most of the women involved in the fish value chain in the study area were married, suggesting that marriage is a cherished value in the study area, with a resultant increase in their household size. This corroborates with the findings of Alfred and Fagbenro, (2006) and Odulate *et al* (2011) who reported higher percentage of married women in the coastal communities of Ondo and Ogun states, Nigeria respectively. From these results, it could be inferred that Islam was mostly practiced by the

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fishermen (54.2%) and fish-marketers (52.8%) than other religions; while the majority (56.2%) of fish processors were Christians. This could be attributed to the fact that fish cuts across all the religion unlike other animals like pig.

Majority (58.4% of fishermen, 80.0% of processors and 33.0% of fish-marketers) of the Actors in the Ogun Waterside coastal fish value chain had household sizes ranging between 6 and 10 persons. This relatively large household size may decrease the number of labour needed at different nodes along the coastal fish value chain. These results were similar to the findings of Fabusoro *et al.,* (2007) that average household size in Africa was about 9 persons.

Education is an important factor which can influence fish production and determine level of awareness on the rate of return on value addition in fish. Results from this study showed that 43.1%, 31.2% and 66.0% of fishermen, fish processors and fish-marketers respectively had no form of education at all; while 36.14% (Fishermen), 49.9% (Processors) and 13.2% (Fish-marketers) respectively had a maximum of primary school education. This confirmed the general opinion that most fisherfolks were illiterate or semi-illiterates; most of whom have dropped out of the formal school system (Olubanjo *et al.,* 2007; and Alfred *et al*, 2008). The low level of education in the Ogun waterside coastal fish value chain could explained by two reasons: firstly, fishing communities are generally isolated and marginalized, with limited or no access to education services. Available government schools are very far, at distances of at least 30 to 40 kilometers from coastal communities. Additionally, regular flooding and threats from hostile crocodiles and hippopotamus are other reasons for parents not to send their children to school. Another important factor, given that fishing is the main economic activity, is that children are often assimilated into the fishing industry at an early age by having to help their parents or guardians in fishing and fish processing. These children are born and brought up in remote fishing communities with limited or no access to education. Due to the above mentioned threats, children often abandon school if they had a chance to even attend one.

Experiences in fishing were determined by the number of years the fisherfolks had been in the business. The respondents' mean years of experience was found to be 23years, 21years and 15years for fishermen, processors and fish-marketers respectively. It is believed that this would enhance their efficiency. This finding is in line with Schumpeterian theory of economic development, which suggest that technical efficiency is influenced by technical knowledge and understanding in addition to other socio – economic environment with which the fisher folks must take decision (Kalirajan, 1990) as cited by Olaoye *et al*., (2012)

Fish and fish related business as the major occupation in the study area is a function of the importance attached to it as a source of livelihood. All the respondents had fishing, fish processing and fish marketing respectively as their major occupation; thus are likely to commit more number of hours and efforts towards the success of these enterprises. Cooperative Society involves social participation that helps farmers to pool their resources together, have access to fisheries inputs and insights in emerging issues in the business. Membership of cooperatives therefore influences the adoption of improved fisheries technologies resulting in higher productivity and poverty alleviation. Majority of the actors (100%, 68.6% and 38.4% of the fisherman, fish processors and fish-marketers respectively) were not in any cooperative society; which may be the reason for not benefiting from any source of loan. This was a throwback to the position of Akinbile (1998) as cited by Odebiyi (2010) that cooperative groups ensure that their members derive benefits from the groups such as they could not derive individually. One of the biggest challenges faced by the seafood sector in the coastal fishing community is value addition. A deprivation of value addition facilities in the study area is a major set back to the fish value chain industry, most of the respondents regarded poor transportation network and lack of storage facilities as major constraints to the value chain development.

V. Conclusion

The value-chain for the fresh and processed fish in the study area is comprised of three main stakeholder groups before fish reaches the consumer. There are virtually no exports of artisanal captured fish, and so the value-chain is short and simple compared to some value chains in other countries. One of the biggest challenges faced by the seafood sector in the coastal fishing community is value addition. Lack of value addition facilities in the study area hindered the development of the fish value chain industry. Smoking was the only form of value addition at the coastal area of Ogun State, Nigeria. Lack of adequate road network hindered other means of value addition to the fish industry which could have created additional employment opportunities along the coastal zone of Ogun Waterside LGA, Nigeria.

a) Recommendation

The study recommends that there is need to develop a comprehensive and effective road networking in the study area as water is the only means of transportation which is a major constraint to the development of the coastal fish value chain. It should be noted that the development of the coastal fish value chain of Ogun waterside LGA would encourage youth involvement and participation in the value chain.

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It is important to create awareness on the need for the formation of fish cooperative societies through which some of the challenges in the value chain can be successfully tackled. Credit facilities should be made available by financial institutions and agencies to improve fish value addition; for the purchase or leasing of fishing inputs (Canoes, Outboard Engine etc). Also, sophisticated storage facilities/cold rooms should be provided by government as well as cooperative societies for the storage of unsold fish.

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Table 1 : Study Population and Location

Chain actors/ Fishing Communities	Fishermen	Fish Processors	Fish-marketers	Total
Igbosere	20	22		52
			40	
Elefon	12	16		38
Olosumeta	23	14		47
JK Camp	17	12		39
Total	72	64	40	**176**

Source: Field survey 2012-2103

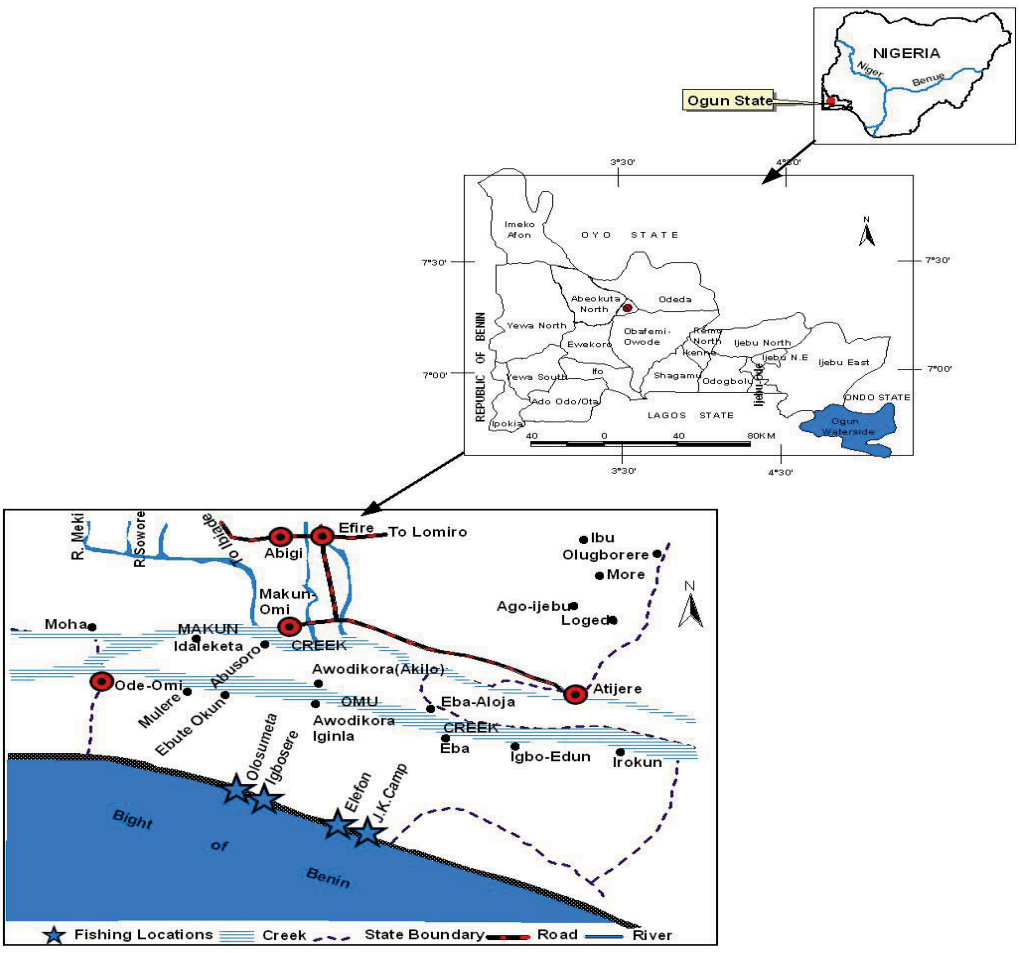

Figure 1 : A map of the study area Table 2: Socio-demographic variables of the chain actors in the fish value chain

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Table 2 : Socio-economic characteristics of the coastal fisheries value chain

	Value Chain Actors					
Variables	Fishermen		Fish Processors		Fish-marketers	
	Freq	%	Freq	%	Freq	%
Gender						
Male	72	100.0	0	0.0	6	14.2
Female	0	0.0	64	100.0	39	85.8
Total	**72**	**100.0**	**64**	**100.0**	**45**	**100.0**
Age						
< 20	0	0.0	0	0.0	0	0.0
21-30	14	19.3	30	46.8	12	26.4
31-40	19	26.4	18	28.3	23	50.6
41-50	31	43.1	16	24.9	6	13.2
>50	8	11.2	0	0.0	4	8.8
Mean ± S.E	43.79 ± 0.57		39.05 ± 0.58		36.73 ± 0.65	
Total	**72**	**100.0**	**64**	**100.0**	**45**	**100.0**
Marital status						
Single	6	8.3	11	17.16	4	8.8
Married	66	91.7	37	57.79	32	70.4
Divorced	0	0.0	10	15.6	7	15.4
Widow	0	0.0	6	9.36	2	4.4
Total	**72**	**100.0**	**64**	**100.0**	**45**	**100.0**
Religion						
Christian	27	37.5	36	56.2	21	46.2
Islam	39	54.2	20	31.2	24	52.8
Traditional	6	8.34	8	12.6	0	0.0
Total	**72**	**100.0**	**64**	**100.0**	**45**	**100.0**
Household Size						
1-5	0	0.0	0	0.0	13	28.6
6-10	42	58.4	51	80.0	32	70.4
11-15	30	41.7	13	20.0	0	0.0
Mean± SD	**9.04 ± 0.12**		**10.02 ± 0.05**		6.08 ± 0.12	
Total	**72**	**100.0**	**64**	**100.0**	**45**	**100.0**
Education Level						
No formal education	31	43.1	20	31.2	9	19.8
Primary Education	26	36.14	32	49.9	6	13.2
Secondary Education	15	20.85	12	18.72	30	66.0
Tertiary Education	0	0.0	0	0.0	0	0.0
Total	**72**	**100.0**	**64**	**100.0**	**45**	**100.0**
Major Occupation						
Fisherfolks	72	100.0	64	100.0	45	100.0
Total	**72**	**100.0**	**64**	**100.0**	**45**	**100.0**
Minor Occupation						
Trader	21	29.2	38	59.3	30	66.0
Farming	47	65.3	26	40.6	0	0.0
Driver	1	1.39	0	0.0	15	33.0
Herbalist	3	4.2	0	0.0	0	0.0
Total	**72**	**100.0**	**64**	**100.0**	**45**	**100.0**
Years of experience						
1-10	8	11.1	6	9.4	4	8.8
11-20	19	26.41	48	74.9	17	37.4
21-30	31	43.1	8	12.5	15	33.0
>30	14	19.5	2	3.1	9	19.8
Mean ± SD	22.7 ± 0.61		20.95 ± 0.54		15.3 ± 0.63	

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Total	72	100.0	64	100.0	45	100.0
Cooperative Membership						
Yes	0	0.0	20	31.4	28	61.6
No	72	100.0	44	68.6	17	38.4
Total	72	100.0	64	100.0	45	100.0

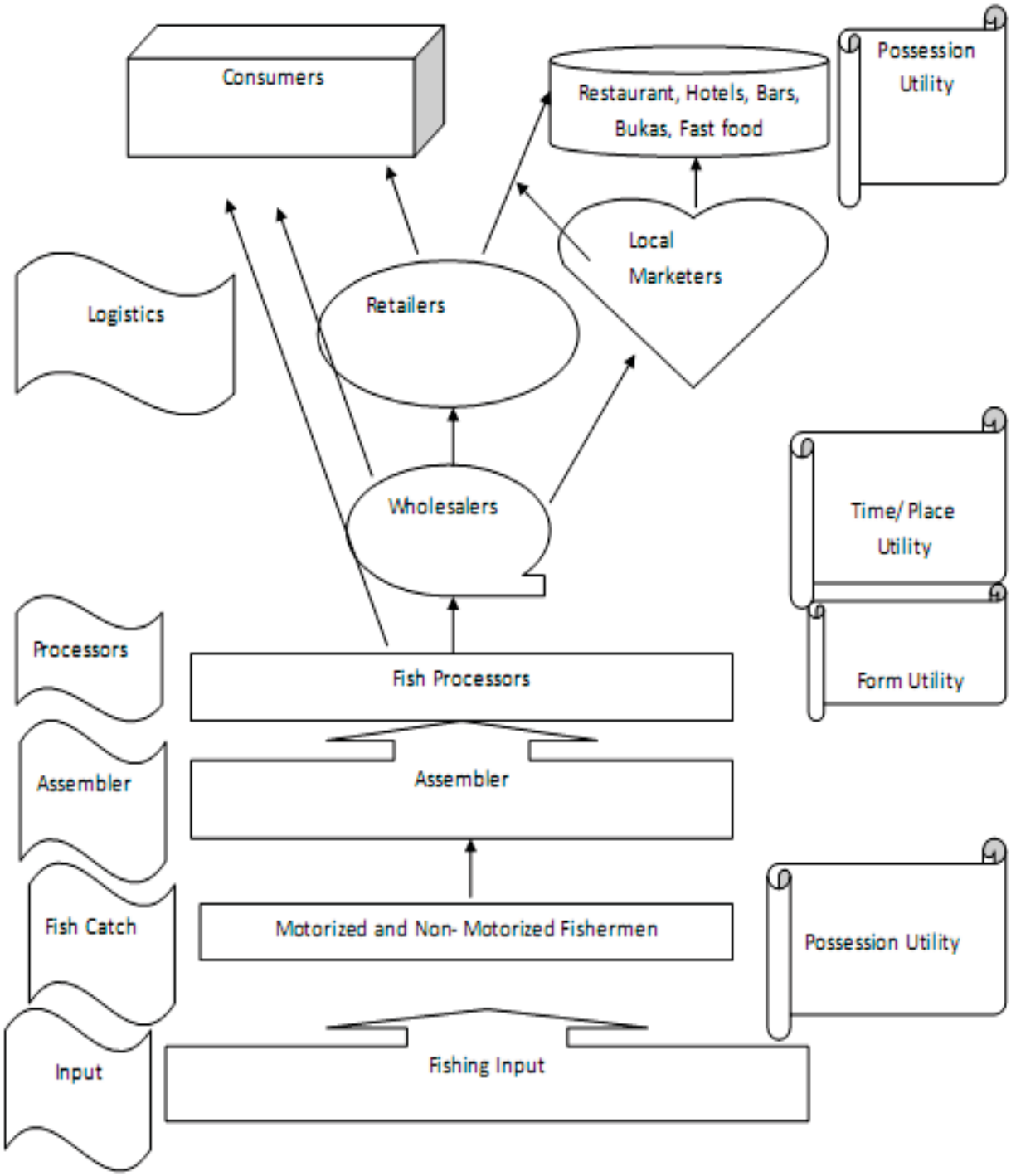

Figure 2 : Map of the coastal fish value chain in Ogun Waterside LGA, Nigeria
Source : Field Survey, 2013

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Hypothesis Testing

Table 3 : $H0_1$ There is no significant difference between the socio-economic characteristics of the chain actors and their total revenue

Variable	Fisherman			Fish Processors			Fish-marketers		
	Value	Df	Sig.	Value	Df	Sig.	Value	Df	Sig.
Age	34.2	9	0.000*	60.44	12	0.000*	135.000	12	0.000*
Marital Status	2.751	3	0.432	55.744	12	0.000*	66.937	8	0.000*
Religion	18.852	6	0.004**	41.007	8	0.000*	30.536	4	0.000*
HHZ	3.840	3	0.279	18.051	4	0.001**	90.000	8	0.000*
YOEX	10.212	9	0.334	78.222	12	0.000*	135.000	12	0.000*
Education	8.887	6	0.180	40.000	8	0.000*	57.600	8	0.000*

*Source : Field Survey, 2012-2013; *=Significance at 0.001, **= Significance at 0.005*
Key : HHZ = Household size, YOEX = Years of experience

Table 4 : $H0_2$: There is no significant difference between the constraints faced by the chain actors and their total revenue

Variable	Fishermen			Fish Processors			Fish-marketers		
	Value	Df	Sig.	Value	Df	Sig.	Value	Df	Sig.
Constraints	21.54	18	0.253	84.44	8	0.000*	100.64	12	0.000*

*Source : Field Survey, 2012-2013; *=Significance at 0.001*

Table 5 : Constraints to the coastal area fish value chain development

Variables	Fisherman			Fish Processors			Fish-marketers		
	Very Severe	Severe	Not Severe	Very Severe	Severe	Not Severe	Very Severe	Severe	Not Severe
1. Inadequate fund	90.4	6.9	2.78	56.2	31.2	21.6	60.0	40.0	0.0
2. Poor storage facilities	0.0	0.0	0.0	0.0	22.0	78.0	82.2	17.8	0.0
3. Social amenities	98.6	1.4	0.0	74.9	25.1	0.0	8.9	20.0	71.1
4. High cost of fish input	11.1	88.9	0.0	12.5	37.4	50.0	71.1	20	8.9
5. Seasonality of fish	25.0	31.9	43.1	31.2	56.2	21.6	40.0	60.0	0.0
6. Poor transportation network	79.2	19.4	1.4	62.4	37.6	0.0	8.9	20.0	71.1
7. Breakage/spoilage of fish	2.8	69.4	27.8	18.7	65.5	15.6	0.0	100.0	0.0
8. Unpredictable weather	12.5	8.3	79.2	0.0	0.0	0.0	0.0	0.0	0.0
9. Trawlers' threat	62.5	30.6	6.9	0.0	0.0	0.0	0.0	0.0	0.0
10. Pollution effluents	66.7	26.4	6.9	0.0	0.0	0.0	0.0	0.0	0.0

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Environmental Conservation Information Needs of Farmers in Owerri West Area of Imo State, Nigeria

By Nnadi, F.N., Chikaire, J., Echetama, J.A., Umunnakwe, P.C. & Ihenacho, R.A.

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Abstract - The enormous consequences of the wanton devastation of the environment inspired this study that evaluated the environmental conservation in Owerri West Area of Imo State, Nigeria. The objectives of the study was; to determine the socio-economic characteristics of the farmers, ascertain the farmers environment conservation information needs, investigate their environmental conservation practices and identify the problem militating against sustainable environment conservation practices. The data for the study was collected from 120 randomly selected farmers from 6 communities out of the 18 existing communicates in the area of study. The data collected were analyzed with the use of descriptive statistics such as frequency counts, percentages, mean. The result showed that farmers needed information in the area of environmental disaster management and funding sources for environmental management. The perceived effects of environmental conservation were to improve the farmers' socio-economic life and reduce hazards. The results also showed that inadequate knowledge base of environmental conservation practices was a major problem militating against environmental conservation and that maturing was the most conservation practice carried out by the farmers.

Keywords : environment, conservation, management, farmers, information.

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ENVIRONMENTAL CONSERVATION INFORMATION NEEDS OF FARMERS IN OWERRI WEST AREA OF IMO STATE, NIGERIA

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Environmental Conservation Information Needs of Farmers in Owerri West Area of Imo State, Nigeria

Nnadi, F.N.[α], Chikaire, J.[σ], Echetama, J.A.[ρ], Umunnakwe, P.C.[Ω] & Ihenacho, R.A.[¥]

Abstract - The enormous consequences of the wanton devastation of the environment inspired this study that evaluated the environmental conservation in Owerri West Area of Imo State, Nigeria. The objectives of the study was; to determine the socio-economic characteristics of the farmers, ascertain the farmers environment conservation information needs, investigate their environmental conservation practices and identify the problem militating against sustainable environment conservation practices. The data for the study was collected from 120 randomly selected farmers from 6 communities out of the 18 existing communicates in the area of study. The data collected were analyzed with the use of descriptive statistics such as frequency counts, percentages, mean. The result showed that farmers needed information in the area of environmental disaster management and funding sources for environmental management. The perceived effects of environmental conservation were to improve the farmers' socio-economic life and reduce hazards. The results also showed that inadequate knowledge base of environmental conservation practices was a major problem militating against environmental conservation and that maturing was the most conservation practice carried out by the farmers. It was however recommended that extension education campaigns on environmental conservation practices should be intensified and the socio-economic determinants of the farmers' information need to be considered in interventions and advocacies.

Keywords : environment, conservation, management, farmers, information.

I. Introduction

Today's farmers are under unprecedented pressure. The world's population is closing in on seven billion, and it is projected to reach nine billion by 2050. Billions of those people will be enjoying an improving standard of living, including increased consumption of more nutritious food such as milk, meat and energy. A crowded planet adds to the environmental challenges of feeding, clothing and powering the world. Water supplies will be increasingly scarce, threatened by pollution, and diverted to population centers. We can no longer set out to farm new frontiers- we must make every acre already being farmed even more productive and prevent environmental degradation (Towery and Werblow, 2010). With shrinking resources and little margin for expansion, the stakes of environmental degradation are too high. Protecting our soils, air and water- and our forests, wetlands and grasslands- is vital to all of us in the long term. Environmental and economic sustainability are essential on every farm (Towery and Werblow).

Norman Borlaug, the legendary plant breeder and Nobel laureate who was the driving force behind the Green Revolution of the 1960s and 1970s, summed up the task when he wrote, "Over the next 50 years, the world's farmers and ranchers will be called upon to produce more food than has been produced in the past 10,000 years combined and to do so in environmentally sustainable ways" (Towery and Werblow, 2010). Increases in agricultural production are possible through modern methods. But these advances in agricultural production are possible through modern methods. But these advances will be useless unless there is enough good land for farming. If the soil on which all agricultural and all human life depends is wasted away, then the battle to free mankind from want cannot be won (ECO-ISSUES, 2010). It is estimated that agricultural production will need to increase by 60 per cent in the next two decades to feed the world. The large part of this will need to come from an intensification of agriculture on lands already being cultivated. In addition, the area of cultivated land should be expanded by 200 million hectares (Favis – Mortlock,2005). An uncertainty in these estimates is the amount of land which is being lost through degradation.

In precise term, multiple relationships exist between man, his activities and the environment, but he has a positive role to play in shaping the environment. An influence how human lives and organizes his life, but he has equally helped to modify and rebuild the environment through time. There is an ecological relationship between man and his environment as evident in the harvesting and exploitation of the environmental resources (France and Kathleens, 2002). However, the nature and the degree of hazards done to the environmental vary according to technology of the people (be it indigenous or modern technology). It depends on the prevailing physical, technological,

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cultural and political circum-stances (France and Kathleens, 2002).

The deterioration of the environment which started when man first settled into villages has been made worse by increasing human activities such as deforestation, burning etc. Natural phenomena like desertification, drought, erosion etc have not helped matters through their degrading effects on the soil fertility, the ecosystem services of the natural environment (France and Kathleens, 2002). Human has influenced his physical environment by fertilizing the poor soil, terracing the hillsides, construction roads, railways and bridges, exploiting the forest resource like timber and extracting the metallurgic and non-metallurgic iron from the environment. Through these processes, he has changed or altered the environment to suit himself.

Sustainable development is necessary because it is capable of alleviating poverty. Therefore, all human must work towards a sustainable environment. To this end, we must have development which is sustainable and built on firm ecological foundation. The attainment of environmentally sustainable development largely depends onour willingness to be genuinely committed to the use of environment through the use of innovations and substitutes of most of the earthly minerals.

However, the fact that this state (IMO STATE) is blesses with immense mineral wealth and considerable agricultural potential, varied climatic zone, continuous sunlight and abundant rainfall which supplies many crops, fibre and medicinal plants and forest products make it imperative to sustain the environment. Although impressive progress in the area of improving the environment has been made in recent years, there seem to be a considerable lack of understanding of the fundamental mechanisms, sources and classification of pollutants causing pollution of different forms (IMSG, 2001). Even with the amount of effort rendered by government and non-government organization to farmers in both rural and urban areas towards conservative measures, farmers still lack essential information in managing their environment. It is vital to create awareness to the public and farmers toward the use of environmental conservation approaches particularly to when every aspect of our lives including agricultural are seriously threatened by variability in weather climate change. The broad objective of the study is to analyze the environmental conservation information needs of farmers in Owerri-west Area of Imo State. The specific objectives of the study include, to;

1. Investigate the socio-economic characteristics of the farmers'.
2. Ascertain the farmers' environment conservation information needs.
3. Investigate their perceived effects of environmental conservation practices.
4. Investigate their environmental conservation practices.
5. Investigate the problems militating against sustainable environmental conservation practices.

II. Methodology

1. The study area was carried out in Owerri-west area of Imo State. It is located in the rain forest zone about 120 Km north of the Atlantic coast and lies on latitude 4^0 14 north and 6^0 15 north, longitude 6^0 51 east 8^0 09 east (ISADAP, 2000). It has a population of 250,000 people and an area of 295 square kilometers in 2013 (NPC, 2006). It shares boundaries with Ngor Okpala LGA in south, Owerri municipal council in the east, Mbaitolu LGA in the north and Ohaji/Egbema LGA in the west. The average annual rainfall measures up to 2550 millimetres, the relative mean temperature ranges annually between 24.5^0 and 25.5^0 and the humidity varies according to the time of the year (ISADAP, 2000). The people are land resource dependent. The farmers' produce crops like cassava, maize, yam, plantain and rear animals like goat, pigs, fish, birds and recently rabbits. Owerri-west was purposely selected because of its nearness to the researcher and the predominance of famers in the area. The entire farmers in owerri-west constitute the sampling population. Multi-stagerandomsamp-lingtechnique was employed in the sampling. First, a random sampling technique was used to select 6 communities from the existing 18 communities. These include: Oforola, Obinze, Eziobodo, Ihiagwa, Amakohia- ubi and Orogwe. From each of the communities, 4 villages were sampled (2nd stage) and from each of the villages, 5 farmers' comprising male and female were randomly sampled to give a sample size of 120 respondents. Data were collected from primary and secondary sources. Primary data were obtained from farmers' in the study area through structured questionnaire to be complemented with interview schedule for farmers' who are not literate enough. Secondary data were collected from annual reports of the Imo state Agricultural Development Programme (ADP), the Imo State Ministry of petroleum and Environment, textbooks, journals, internet and previous studies of other researchers who worked on related topics. The data collected were analysed using descriptive statistical tools such as frequency tables, percentage and mean. Specifically, objectives 1, 4 and 5 which are to investigate the socio-economic characteristics of the farmers; investigate their environmental conservation practices and investigate the problems militating against sustainable environmental conservation practices were analysed with percentages. Objectives 2 and 3

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which are to ascertain the farmers' environment conservation information needs; and investigate their perceived effects of environmental conservation practices were analysed with mean. The formula used was x=EX/N. the likert type scale of agreement had their weights added together and divided by the number of scales. SA=5, A=4, U=3, SD=1. (5+4+3+2+1)/5 = 3 (discriminating index for acceptance and rejection). This means that all mean value of 3 and above were accepted as important.

III. Results and Discussions

a) *Socioeconomic Characteristics of Respondents*

The result in the table 1 showed that farmers within age range of 20-29 composed 7.5 percent of the sample, those between 30 and 39 represented 16.67 percent whereas 40-49 years represented 24.17 percent. The farmers between the ages of 50 and 59 and 60-69 represented 28.33 percent and 23.33 percent respectively. The mean age of the farmers was 49. This means that the farmers' are ageing. This implies that they will not readily accept agricultural innovations (Mgbada, 2010). The dominance of the old could be adduced to youth emigration to cities for which collar jobs. This result agrees with Nnadi and Amaechi, (2007) that youth migration from the rural to the Urban areas left agriculture in the hands of the old and ageing farmers. Also Mgbada, (2010) noted that Nigerian farmers are mostly old people. There sultalso showed that the percentage of male farmers in the study was 49.17 percent. The female farmers composed 50.83 percent. The dominance of female farmers in the study could be attributed to increasing engagement of men is polities and rising cases of female headed households. The result agrees with Mollet, (1990) and Mgbada, (2010) who noted that more than one third to half of the total labour contribution to agriculture is made by women. The result on the marital status distribution of the farmers shows that single farmers represented 10.83percent of the sample. The married farmers' represented 70.83 percent, while divorced and widowed represented 3.33 percent and 15 percent respectively. The dominance of married farmers in agricultural production could be to ensure household food security. The result of the distribution of the farmers by education reveals that farmers with no formal education consisted a percentage of 18.33%. The table also shows that 31.09 percent of the respondents had primary and secondary education respectively. While 20.17% had tertiary education. The result implies that the farmers are highly literate with about 81 percent having acquired one level of education or the other. This means that they can be easily convinced to accept better practices of their farming operations. It is in conformity with Nnadi and Amaechi, (2004) that a greater deal of change has occurred within the rural communities in recent times due to the introduction of education. Their high literacy level is an asset as the farmers would be exposed to many information sources, embrace innovations and analyze farm situations objectively. It also supports the view made by Nnadi and Onuoha, (1999) that educated farmers' are good adopters of innovations. The distribution of the farmers by occupation shows that 62.5 percent of the respondents have farming as their major occupation. Civil servants and traders represented 17.5 percent of the sample respectively while artisans represented 2.5 percent. The result further reinforces agriculture as the basis of rural economies where majority are farmers. Thus, farming is a way of life by cultural dictates. This confirms the assertion of Olayide et al., (1981) that Nigeria is characterized as a nation of small scale farmers and the rural population comprises full and part time farmers. The farmers' distribution by household is represented and the result indicates that 15.83% percent of farmers have household size of 1-5 members. A total of 49.17 percent of the farmers have 4-6 persons in their household. Whereas 32.5 percent had 7-9 persons, 2.5 percent had 10 persons and above. The mean household size was 6. The size is modest and in consonance with the household population policy of Nigeria. A large family size could entail many hands in family labour supply, typical of Nigerian agriculture which requires so many hands for labour supply. As farmers and farm families are closely knit, farmers prefer using labour from their household, wives and children (Nnadi and Amaechi, 2004). However, this could imply more household expenditure for food security, social needs and economic needs provision. Thus, production capital could be converted to consumptive capital. The result of the distribution of the farmers by farm size indicates that farmers with farm size less than one hectare represented 49.17 percent of the respondent. They are followed by 29.17 percent that have a farm size of 1-3 hectares. The result also revealed that 17.5 percent of the respondents have between 4-6 hectares of farm land. while 4.16 percent have 7 hectares and above. The mean farm size is 2.16 hectares. The above situation reveals that there is skewdness in the distribution of land in the study area. The greater number (49.17 percent) have small area usually fragmented holding which supported subsistence agriculture. The result supports the assertion made by Nnadi and Amaechi, (2004), that under inheritance, the whole heirs of every family have their shares of land no matter how fragmented and small their sizes area. This lays credence to the subsistence farming characteristic in the southeast. From the result, a dominant number of the farmers indicated membership of social organization. Specifically, 64.7 percentindicated that they belong to one social organization or the other. However, on the contrary, 43 farmers represented by 35.83 percent

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indicated that they do not belong to any social organization. Membership of Social organization satisfies the social needs of farmers in additions to serving as an avenue for access to information on agricultural technology. Farmers by virtue of their membership discern the obvious advantages of agricultural technology as well as clarify their misconception of technology and the adoption. However, the farmers do not belong to social organization may have been ignorant of the obvious gains through membership-the however calls for conceited extension campaigns for farmers member of co-operative society and combined.

b) Areas of Information Needs

The distribution of the farmers according to areas of information is presented in table 2 using five point likert-type scale of agreement, the discriminating index of acceptance or rejection of an item was set at 3. All items with mean value of 3.00 and above were accepted as areas of information needs. The table shows that 8 items had mean scores of information on the environment which had a mean value of 3.06, things that constitute pollution had 3.08 mean score, drainage and irrigation had 3.45, erosion had 3.33, refuse disposal methods had 3.25, pesticide application and use had 3.49, environmental disaster management had 3.93 and was ranked first while funding sources for environmental management had 3.65. Also the result showed that 3 items were not accepted as areas of information needs since their mean scores were not up to 3. They included tree planting exercises, manure and maturing and cropping systems.

c) Effects of Environmental Conservation

The distribution of farmers according to their perceived effects of environmental conservation is presented in table 3. Using the discriminating index of 3, the result shows that 7 items are effects of environmental conservation. These included reduction of ill health and the predisposing factors with a mean score of 3.10, support for life had mean score of 3.03, reduction of hazards had 3.68 mean score. Whereas the statement, favours agricultural products by increasing income had 3.74 was ranked first. Agricultural produce are free from contamination had 3.09 and makes for odour free environment had 3.39. Only one item was not accepted as an effect of environmental conservation.

d) Farmers Conservation Practices

The result in table 4 below shows that among the conservation practices mentioned, manuring had a percentage count of 82.5 and ranked 1st, avoidance of bush burning had a percentage of 75.83 and ranked 2nd, mulching with percentage of 75 ranked 3rd, crop rotation with percentage of 66.67 raked 4th, adequate refuse disposal and cautious use of agro- chemicals and pesticides with percentages of 56.67 each ranked 5th, tree planting ranked 7th with 55.83 percent. Whereas use of cross bars ranked 8th with 55 percent, ridging across the slop and drainage with percentage o 51.67 each ranked 9th. Rotational grazing ranked 10th with 35.83 percent, contour terracing 11th with a percentage of 34.17, use o contour bunds with 32.67 percent ranked 12th while irrigation and recycling of waste with percentage of 30 and 29.17 ranked 13th and 14th respectively.

e) Problems Militating against environmental conservation

The result shows that inadequate knowledge base of environmental conservation practices represented 75 percent to rank 1st. Following thus in rank (2nd) was poor economic base and inadequate farm size with 74.17 percent each. Poor environmental conservation orientation ranked 3rd with 69.17 percent, weak government policies and programme followed in rank (4th) with 47.5 percent. Poor pricing of agricultural produce with percentage count of 40 ranked 5th. A percentage count of 39.17 and 20 ranked 7th and 8th respectively. This means that the problems militating against environmental conservation are enormous and there are implications for extension services.

IV. Conclusion

Environmental degradation impacts negatively on soil fertility. Farmers need information on disaster magenament, Erosion, village practices, pollution, cropping systems and other area. They practice milling, rotation, and others to import their socio economic life, reduce hazards, increase yield and promote agro-biodiversity. Among the problems failing respondents include inadequate knowledge base of environmental conservation practices, poor economic base, small farm holdings, among others. Information provision to farmers on environmental conservation should be based on identified areas of needs like disaster management, fund chemical use.

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Table 1 : Socioeconomic characteristics of respondents

Variables	Frequency	Percentage
Age		
20-29	9	7.50
30-39	20	16.67
40-49	29	24.17
50-59	34	28.33
Sex	28	23.33
Male	59	49.17
Female	61	50.83
Marital Status		
Single	13	10.83
Married	83	70.83
Divorced	4	3.33
Widowed	18	15.0
Education		
No formal Education	22	18
Primary	37	31.09
Secondary	37	31.09
Tertiary	24	20.17
Occupation		
Farming	75	62.5
Civil servant	21	17.5
Trading	21	17.5
Artisan	3	2.5
Household size		
1-3	19	38
4-6	59	49.17
7-9	39	32.5
10 and above	3	2.5
Farm size		
Less than 1	59	49.17
1-3	35	29.17
4-6	21	17.5
7-9	5	4.16
Membership of social organization		
Not Belong	43	
Belong	77	64.17
Farming Experience		
1-5	16	13.33
6-10	43	35.83
11-15	14	11.67
16 and above	47	39

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Table 2 : Distribution of the farmers according to areas of information needs

	Areas	SA	A	U	D	SD	Mean	Rank
a)	Environmental disaster management	245	96	114	16	1	3.93	1st
b)	Funding sources for environmental management	235	72	81	46	5	3.65	2nd
c)	Pesticide application and use	165	84	120	48	2	3.49	3rd
d)	Drainage and irrigation	210	64	72	60	8	3.45	4th
e)	Erosion	190	100	48	16	33	3.33	5th
f)	Refuse disposal methods Tillage practices	95	112	156	12	15	3.25	6th
g)	Things that constitute pollution	145	48	87	80	10	3.08	7th
h)	Sources of information on the environment/practices	180	56	42	68	22	3.06	8th
i)	Tillage practices	75	92	81	72	19	2.82	9th
j)	Tree planting exercise	60	60	135	64	16	2.79	10th
k)	Cropping system	60	60	69	84	28	2.50	11th
l)	Manure and manuring	75	28	51	128	17	2.49	12th

Source: field survey data, 2011.

Table 3 : Perceived effects of environment conservation

	Effects	SA	A	U	D	SD	Mean	Rank
a)	Improves the farmers socio-economic life by increasing income	230	68	126	20	5	3.74	1st
b)	Reduction of hards-inury, harm and accident.	190	108	105	36	2	3.68	2nd
c)	Favours agricultural products by increasing yield	200	100	69	58	3	3.58	3rd
d)	Makes for odour/pollution free environment	165	60	135	40	7	3.39	4th
e)	Reduction of ill health and the predisposing factors	160	80	51	64	19	3.12	5th
f)	Improves gaseous exchange	120	36	144	58	10	3.10	6th
g)	Agricultural produce are free from contamination	155	36	99	68	13	3.09	7th
h)	Support for life	160	84	54	32	33	3.03	8th
i)	Increases longevity	115	20	102	84	16	2.82	9th

Source: field survey data

Table 4 : Farmers conservation practices

Practices	frequency	percentage	Rank
a. Manuring	99	82.5	1st
b. Avoidance of bush burning	91	75.83	2nd
c. Mulching	90	75	3rd
d. Crop rotation	80	66.67	4th
e. Adequate refuse disposal	68	56.67	5th
f. Cautious use of agro- chemicals And pesticides	68	56.67	6th
g. Tree planting	67	55.83	7th
h. Use of cross bars	66	55	8th
i. Ridging across the slope	62	51.67	9th
j. Drainage	62	51.67	10th
k. Rotational grazing	43	35.83	11th
l. Contour terracing	41	34.17	12th
m. Use of contour bunds	38	31.67	13th
n. Irrigation	36	30	14th
o.Recycling of waste	35	29.17	15th

Source : Field survey data, 2011.

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Table 5 : Problems militating against environmental conservation

Practices	frequency	percentage	Rank
a. Inadequate knowledge base of environmental conservation practices	90	75	1st
b. Poor economic base	89	74.15	2nd
c. Inadequate farm size	89	74.15	3rd
d. Poor environmental conservation	83	69.17	4th
e. Weak government policies and programmes			
f. Poor pricing of agricultural produce	54	40	6th
g. Cumbersome nature of the practices	47	39.17	7th
h. Poor linkages between and among the major stakeholders	29	24.17	8th
i. Religious believe	24	20	9th

Source: field survey data, 2011.

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Evaluation of Quality Protein Maize (QPM) and Normal Mazie for Growth Performance of Broiler Chicken in Nepal

By M.R. Tiwari, D. Neopane, T.P. Paudel & U.M. Singh

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Abstract - An experiment was carried out on Cob 500 broiler chickens at Swine and Avian Research Program, Khumaltar, Lalitpur to evaluate the growth performance of broiler chicken fed with normal Vs QPM based diet and with supplementation of synthetic lysine and methionine in both maize for 54 days (16 days starter and 38 days for finisher). The experimental day old birds were procured from Valley Feed, Bajalu, Kathmandu and were allotted into four treatments with three replications having 15 birds in each replication by using Complete Randomized Design (CRD). All experimental birds were vaccinated with F_1 vaccine @ one drop / bird against Ranikhet at the first week and vaccinated with IB+ND vaccine against Gumbaro at 2nd and 5th weeks of experiment. Birds of T_1 were provided normal maize based diet, T_2 normal maize based diet with supplementation of synthetic lysine and methionine, T_3 QPM based diet and T_4 QPM based diet with supplementation of synthetic lysine and methionine. Concentrate mixture feeding was done on group basis and was provided to the experimental birds of all groups once a day (morning) in adlib amount for both periods (starter – 16 days and finisher – 38 days) of the experiment. Quantity of concentrate mixture given daily to the birds in groups weighed daily and refusal was weighed in the next morning.

Keywords : QPM feeding, synthetic lysine and methionine, broiler chicken, Nepal.

GJSFR-D Classification : FOR Code: 820401, 070799

EVALUATION OF QUALITY PROTEIN MAIZE QPM AND NORMAL MAZIE FOR GROWTH PERFORMANCE OF BROILER CHICKEN IN NEPAL

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Evaluation of Quality Protein Maize (QPM) and Normal Mazie for Growth Performance of Broiler Chicken in Nepal

M.R. Tiwari [α], D. Neopane [σ], T.P. Paudel [ρ] & U.M. Singh [ω]

Abstract - An experiment was carried out on Cob 500 broiler chickens at Swine and Avian Research Program, Khumaltar, Lalitpur to evaluate the growth performance of broiler chicken fed with normal Vs QPM based diet and with supplementation of synthetic lysine and methionine in both maize for 54 days (16 days starter and 38 days for finisher). The experimental day old birds were procured from Valley Feed, Bajalu, Kathmandu and were allotted into four treatments with three replications having 15 birds in each replication by using Complete Randomized Design (CRD). All experimental birds were vaccinated with F1 vaccine @ one drop / bird against Ranikhet at the first week and vaccinated with IB+ND vaccine against Gumbaro at 2nd and 5th weeks of experiment. Birds of T_1 were provided normal maize based diet, T_2 normal maize based diet with supplementation of synthetic lysine and methionine, T_3 QPM based diet and T_4 QPM based diet with supplementation of synthetic lysine and methionine. Concentrate mixture feeding was done on group basis and was provided to the experimental birds of all groups once a day (morning) in adlib amount for both periods (starter – 16 days and finisher – 38 days) of the experiment. Quantity of concentrate mixture given daily to the birds in groups weighed daily and refusal was weighed in the next morning. Experiment revealed that cumulative feed intake was found to be higher in QPM based diet group (5597 g) followed by QPM based diet with supplementation of synthetic lysine and methionine group (5403 g) and normal maize based diet with supplementation with synthetic lysine and methionine group (5377 g). The least feed consumption was recorded for normal maize based diet group (4937 g) which was none significant among diet groups. Similarly, total weight gain was found to be higher for QPM based diet with supplementation of synthetic lysine and methionine group (2180 g) followed by normal maize based diet with supplementation with synthetic lysine and methionine group (2141 g) and QPM based diet group (1996 g). The least weight gain was note in normal maize based diet group (1854 g) which was also none significant among diet groups.

Keywords : QPM feeding, synthetic lysine and methionine, broiler chicken, Nepal.

I. Introduction

Broiler is raised specifically for meat production. Typical broilers have white feathers and yellowish skin. Most commercial broilers bred for meat reach slaughter weight at between 5 to 7 weeks of age, although slower growing strains reach slaughter weight at approximately 14 weeks of age. Broiler chickens are most efficient converters of feed into animal protein in comparison to other domestic birds. The broiler farming need less capital, less space and give quick and early returns because of shorter generation intervals. In Nepal, there is high demand of broiler meat in the markets due to low price and remunerative value in comparison to other type of meat poultry industry. There are 39.5 million chickens in the Nepal (MoAC 2010/11). More than 60% of the population belongs to indigenous and rest is exotic origin.

Maize has become the world's chief animal feed. It provides more feed than any other grain. It is outstanding being high in energy, low in fibre and easily digested by most livestock species. Maize has remained a critical feed ingredient in monogastric diets particularly poultry. About 70% of maize produced worldwide is utilized in livestock feed. The normal maize varieties are low in lysine and tryptophan contents (NRC 1988 and FAO 2004).

QPM is a nutritionally superior cereal grain that possesses a higher proportion of two key amino acids, lysine and tryptophan, than is found in normal maize. QPM has amply demonstrated its superior performance as feed for monogastric animals, especially pigs and chickens. Chickens and pigs convert QPM feed into weight gain more efficiently than regular maize feed (Jarkin *et al.* 1970; Maner 1975 and Asche *et al*. 1985). The percentage of lysine content in QPM varied between 0.33 and 0.54 with an average of 0.38. This was 46 percent higher than normal maize, and QPM contained 66 percent more tryptophan (0.08%) than normal maize. These two amino acids allow the body to manufacture complete proteins (Palit and Babu 2003). Therefore, utilization of QPM can correct this deficiency and may be advantageous in the diets of monogastric animals (Hai *et al.* 2010).

Several research works conducted by different researchers around the world reported that broiler chicken fed with QPM was much better over normal maize fed broiler; however, feeding value of QPM has not been evaluated in poultry feed in Nepal. Therefore, an attempt was made to evaluate the feeding value of normal maize and QPM with or without supplementation of synthetic lysine and methionine on broiler chickens at

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II. Materials and Methods

a) Experimental Animals

The experiment was carried out on Cob 500 broiler chickens at Swine and Avian Research Program, Khumaltar, Lalitpur from 14 March to 6 May 2013 (069/12/1 to 070/1/23 BS) for 54 days (16 days starter and 38 days finisher). The experimental day old birds were procured from Valley Feed, Bajalu, Kathmandu and were allotted into four treatments with three replications having 15 birds in each replication by using Complete Randomized Design (CRD). All experimental birds were vaccinated with F1 vaccine @ one drop /bird against Ranikhet at the first week and vaccinated with IB+ND vaccine against Gumbaro at 2nd and 5th weeks of experiment.

b) Diet Composition

Feed ingredients such as normal maize, soybean cake, mustard cake, rice bran, mineral mixture, methionine, lysine, oil, DCP and salt were procured from "*Champadevi Feed Industries*", Chapagau, Lalitpur while QPM was bought from National Maize Research Program, Rampur, Chitawan and wheat grain from Agriculture Botany Division, Khumaltar, Lalitpur. Four types of concentrate mixture were composed for experimental birds; starter (22% CP) and finisher (18% CP) which are presented in Table 1, 2, 3 and 4.

Table 1 : Starter ration for 1-15 days for T_1 and T_3 group

Ingredient	Part	CP	ME Kcal	Methionine	Lysine	Ca	P
Normal Maize / QPM	46	3.68	1351.02	0.041	0.07	0.12	0.11
Soybean meal	15	6.01	307.05	0.087	0.36	0.04	0.09
Rice bran	10	1.08	293.70	0.020	0.45	0.01	0.12
Meat and bone meal	13	7.21	267.96	0.486	0.12	1.34	0.66
Oil	0.15	0.00	1155.00	0.000	0.00	0.00	0
Mineral	0.65	0.00	0.00	0.000	0.00	0.00	0
Salt	0.7	0.00	0.00	0.000	0.00	0.00	0
Mustard cake	13	4.05	277.68	0.089	0.02	0.00	0.09
Wheat grain	0	0.00	0.00	0.000	0.00	0.00	0
DCP	1.5	0.00	0.00	0.000	0.00	0.35	0.25
Total	**100**	**22.03**	**3652.41**	**0.72**	**1.02**	**1.86**	**0.66**

Table 2 : Starter ration for 1 - 15 days for T_2 and T_4 group

Ingredient	Part	CP	ME Kcal	Methionine	Lysine	Ca	P
Normal Maize/ QPM	46	3.68	1351.02	0.04	0.07	0.12	0.11
Soybean meal	15	6.01	307.05	0.09	0.36	0.04	0.09
Rice bran	10	1.08	293.70	0.02	0.45	0.01	0.12
Meat and bone meal	13	7.21	267.96	0.49	0.12	1.33	0.66
Oil	0.15	0.00	1155.00	0.00	0.00	0.00	0
Mineral	0.65	0.00	0.00	0.00	0.00	0.00	0
Salt	0.5	0.00	0.00	0.00	0.00	0.00	0
Mustard cake	13	4.05	277.68	0.09	0.02	0.00	0.09
Wheat grain	0	0.00	0.00	0.00	0.00	0.00	0
Lysine	0.1	0.00	0.00	0.00	0.10	0.00	0
Methionine	0.1	0.00	0.00	0.10	0.00	0.00	0
DCP	1.5	0.00	0.00	0.00	0.00	0.35	0.25
Total	**100**	**22.03**	**3652.41**	**0.82**	**1.12**	**1.85**	**0.66**

Table 3 : Finisher ration for 16 - 54 days for T_1 and T_3 group

Ingredient	Part	CP	ME Kcal	Methionine	Lysine	Ca	P
Normal maize / QPM	40	3.20	1175	0.04	0.08	0.10	0.10
Soybean meal	10	4.01	205	0.06	0.24	0.03	0.06
Rice bran	10	1.08	294	0.02	0.45	0.01	0.12
Meat and bone meal	9	4.99	186	0.34	0.08	0.93	0.46
Oil	0.15	0.00	1155	0.00	0.00	0.00	0.00
Mineral	1.15	0.00	0	0.00	0.00	0.00	0.00
Salt	1.2	0.00	0	0.00	0.00	0.00	0.00

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Mustard cake	11	3.43	235	0.08	0.21	0.00	0.08
Wheat grain	16	2.10	59	1.09	0.51	0.02	0.04
DCP	1.5	0	0	0	0.00	0.35	0.25
Total	**100**	**18.80**	**3307**	**1.62**	**1.56**	**1.44**	**1.10**

Table 4 : Finisher ration for 16 - 54 days for T_2 and T_4 group

Ingredient	Part	CP	ME Kcal	Methionine	Lysine	Ca	P
Normal maize / QPM	40	3.20	1175	0.04	0.08	0.10	0.10
Soybean meal	10	4.01	205	0.06	0.24	0.03	0.06
Rice bran	10	1.08	294	0.02	0.45	0.01	0.12
Meat and bone meal	9	4.99	186	0.34	0.08	0.93	0.46
Oil	0.15	0.00	1155	0.00	0.00	0.00	0
Mineral	1.15	0.00	0	0.00	0.00	0.00	0
Salt	1	0.00	0	0.00	0.00	0.00	0
Mustard cake	11	3.43	235	0.08	0.21	0.00	0.08
Wheat grain	16	2.10	59	1.09	0.51	0.02	0.04
Lysine	0.1	0.00	0	0.00	0.10	0.00	0
Tryptophan	0.1	0.00	0	0.10	0.00	0.00	0
DCP	1.5	0.00	0	0.00	0.00	0.35	0.25
Total	**100**	**18.80**	**3307**	**1.72**	**1.66**	**1.44**	**1.10**

c) Experimental Diet

Following diets were formulated to the experimental broiler chickens (Table 5)

Table 5 : Experimental diets of the broiler

Treatment	Experimental diets
1	Normal maize included concentrate mixture
2	Normal maize included concentrate mixture + synthetic lysine and methionine
3	QPM included concentrate mixture
4	QPM included concentrate mixture + synthetic lysine and methionine

d) Feeding Regime

Concentrate mixture feeding was done on group basis and was provided to the experimental birds of all groups once a day (morning) in *adlib* amount for both periods (starter – 16 days and finisher – 38 days) of the experiment. Quantity of concentrate mixture given daily to the birds in groups weighed daily and refusal was weighed in the next morning. Drinking water was provided in adequate amount.

e) Chemical Analysis

The samples of feed ingredients were sent to the Animal Nutrition Division, Khumaltar, Lalitpur for proximate analysis. Representative samples from offered concentrate mixture were analyzed for Dry Matter (DM), Crude Protein (CP), Crude Fibre (CF), Ether Extract (EE) and Ash contents (TA). The DM was determined by oven drying at 100°C for 24 hrs. Crude protein of the samples was determined using the Kjeldahl method. Ether extract was determined using Soxhlet apparatus. Ash content was determined by ashing at 550°C in a muffle furnace for 16 hrs (AOAC 1980). Crude Ether of the samples was determined using the Van Soest method (Goering, H.K. and Van Soest 1970). Similarly, samples of normal maize and QPM were sent to Food Research Division, Khumaltar, Lalitpur for tryptophan and lysine content analysis. Tryptophan was analyzed as suggested by Hornandez H. and Bates L.S. (1969) and Lysine as suggested by Doll H. and Koie B. (1975).

f) Data Measurement

The trial period consisted for 54 days (16 days starter and 38 days finisher). Total feed intake by the experimental birds in the group was recorded daily for both experimental periods. The body weight gain was measured in group basis (replication-wise) in seven days interval in the morning before feeding.

g) Data Analysis

Data of feed intake and body weight gain were analyzed by "*One way Annova*" test for every measurement using statistical package Minitab 2003, versions 13.20

III. Results and Discussion

a) Chemical Composition of feed ingredients

The result of chemical analysis and amino acids content are given in Table 6.

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Table 6 : Chemical composition of feed ingredients (% DM basis)

Ingredients	DM	OM	TA	CP	CF	EE
Normal maize	87.69	97.97	2.03	9.0	2.34	4.48
QPM	89.36	97.62	2.38	9.0	6.26	5.12
Rice bran	87.85	89.5	10.5	10.0	4.83	5.1
Mustard cake	87.27	90.5	9.5	35.0	11.23	NA
Soybean cake	86.87	92.63	7.37	46.29	9.38	0.7
Wheat grain	93.0	91.3	8.7	14.0	8.45	NA
Meat cum bone meal	93.22	67.2	32.8	49.93	3.43	NA

Comparison of nutrient content of QPM and normal maize is given in Table 7

Table 7 : Comparison of the nutritional composition of QPM and Normal maize (on dry basis)

Nutrient	Ortega, *et al*.1986		Osei *et al*. 1999		Our analysis 2012	
	Normal maize	QPM	Normal maize	QPM	Normal maize	QPM
Crude Protein, %	9.8	9.8	8.92	9.11	9	9
Ether Extract, %	NA	NA	4.48	5.12	4.48	5.12
Crude Fibre, %	NA	NA	1.93	2.14	2.34	6.26
Organic matter	NA	NA	98.10	98.40	97.97	97.62
Ash, %	NA	NA	1.90	1.60	2.03	2.38
Lysine, %	0.27	0.43	0.24	0.32	0.19	0.28
Tryptophan, %	0.06	0.10	0.06	0.08	0.04	0.07

b) Feed Intake

The average feed intake of experimental birds has been presented in Table 8.

Average feed intakes of experimental birds were observed 17.05 g in 7 days which reached 5328 g by the end of experiment (54 days) which was none significant among diet groups. Feed intake of QPM based diet group (T_3) was higher than that of normal maize based diet group (T_1) from beginning to the end of experiment which was highly significant ($P<0.001$) in 22 days and 29 days ($P<0.001$) of experiment while rest of period was none significant. Supplementation of synthetic lysine and methionine in QPM based diet group (T_4) performed higher feed intake in 36 days (124.4 g) and 43 days (151.96 g) of experiment only whereas in other periods normal maize based diet with supplementation of synthetic lysine and methionine groups (T_2) had more feed intake. The cumulative feed intake was found to be higher in T_3 (5597 g) followed by T_4 (5403 g) and T_2 (5377 g). The least feed consumption was recorded for T_1 group (4937 g) which was none significant among diet groups.

Table 8 : Feed intake of experimental birds, g (Mean ± SD)

TRT	Days								Cumulative feed intake
	7	15	22	29	36	43	50	54	
1	16.23±0.17	36.03±1.64	64.69±0.57	90.88±2.02	107.21±10.23	132.73±9.02	148.30±17.91	153.18±5.81	4937±0.3
2	17.38±1.19	39.50±0.74	77.72±1.22	110.95±4.1	118.66±6.46	121.6±24.65	163.55±29.9	166.53±14.92	5377±0.52
3	17.28±0.83	37.45±0.60	70.40±0.67	107.07±3.43	121.05±11.43	144.73±2.22	177.87±4.34	173.29±4.19	5597±0.11
4	17.32±0.55	37.71±1.81	70.90±2.09	103.75±2.38	126.4±6.88	151.96±6.24	158.25±21.20	148.46±14.32	5403±0.28
Mean	17.05±0.83	37.67±1.07	70.93±4.94	103.16±8.3	118.33±10.61	137.76±16.72	161.99±20.74	160.37±13.99	5328±0.38
P- value	P>0.05	P>0.05	P<0.001	P<0.001	P>0.05	P>0.05	P>0.05	P>0.05	P>0.05

c) Growth Performance

The growth trend of experimental birds is presented in Table 9 and figure 1

Table 9 showed that initial body weight of experimental birds was 46 g, 45 g, 46 g and 45 g for T_1, T_2, T_3 and T_4, respectively which reached 1854 g, 2141 g,1996 g and 2180 g at the end of experiment (54 days). Both intial and final body weighs were none significant among the diet groups. Body weight gain of QPM fed group (T_3) was found to be higher from beginning to the end of experiment than that of normal maize fed group (T_1), however, significant effect of QPM feeding

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was observed from 22 to 50 days of experiment while 7, 15 and 54 days of feeding was none significant. Supplementation of synthetic lysine and methionine in normal maize based diet group (T_2) performed higher body weigh gain from 7 to 36 days of experiment than that of QPM based diet with supplementation of synthetic lysine and methionine (T_4). Thatfater, from 43 to 54 days of experiment QPM based diet with supplementation of synthetic lysine and methionine (T_4) performed better in body weight gain. Effect of synthetic lysine and methionine supplementation in normal maize and QPM based diet on body weight gain of experimental birds was significant from 22 to 50 days of experiment while 7, 15 and 54 days of feeding was none significant. The total weight gain was found to be higher for T_4 (2180 g) followed by T_2 (2141 g) and T_3 (1996 g). The least weight gain was note in T_1 (1854 g) which was also none significant among diet groups.

Table 9 : Body weight gain of experimental birds, g (Mean± SD)

TRT	Days									
	0	7	15	22	29	36	43	50	54	Total weight gain
1	46±0	114±0	250±0.01	479±0.01	755±0.02	957±0.06	1228±0.07	1305±0.12	1928±0.04	1854±0.06
2	45±0	120±0	271±0	560±0.01	915±0.03	1199±0.01	1465±0.09	1944±0.12	2204±0.08	2141±0.08
3	46±0	115±0	252±0.01	499±0	811±0.01	982±0.03	1347±0.07	1883±0.28	2061±0.07	1996±0.08
4	45±0	112±0	249±0.01	528±0.03	866±0.01	1184±0.08	1547±0.11	2021±0.23	2233±0.32	2180±0.32
Mean	46±0	115±0	255±0.01	517±0.03	837±0.06	1080±0.12	1396±0.14	1788±0.34	2107±0.19	2042.75±0.14
P -Value	P>0.05	P>0.05	P>0.05	P<0.01	P<0.001	P<0.01	P<0.05	P<0.05	P>0.05	P>0.05

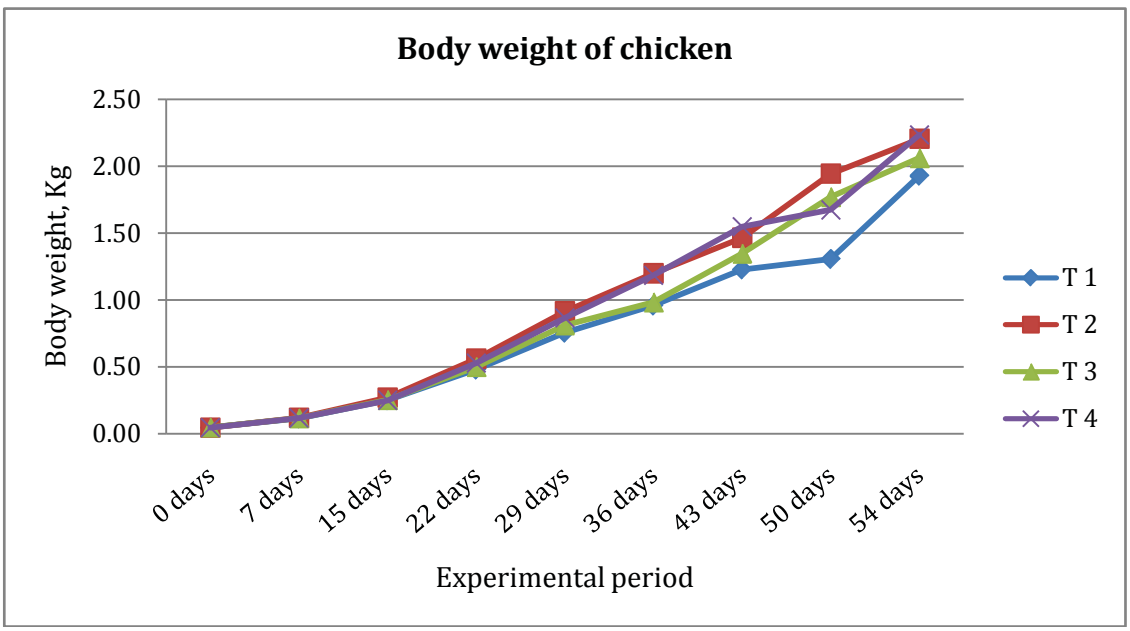

Figure 1 : Body weight gain trend of experimental birds

IV. Discussion

The objective of this study was to evaluate the growth performance and feed intake of broiler chickens fed with normal maize and QPM with or without supplementation of synthetic lysine and methionine in diets. Experiment revealed that there was no significant effect on total body weight gain and cumulative feed intake among normal maize and QPM diet group with or without supplementation of synthetic amino acids. It might be due to the variation in nutrient composition among the QPM cultivars.

Tyagi *et al.* (2008) did not find any significant difference with respect to body weight gain, feed

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conversion and nutrient utilization efficiencies by feeding QPM diet to broiler chickens compared to those fed the normal maize diet. These variations noticed on the performance could be attributed to variation in nutrient composition among the QPM cultivars used in different studies. Bai (2002) reported that there was no significant difference between normal maize and QPM feeding to carcass percentage, abdominal fat percentage, percentage of eviscerated yield and percentage of eviscerated yield with giblets. At a given digestible lysine content, using QPM tended to increase weight gain but there was no statistical evidence to support this (P>0.10). Groote (2000) conducted an experiment by feeding normal maize and QPM to broiler chicken and noted that feed intake of both groups increased from 18.7 grams/bird/day in the first week, to 179.0 g/bird/day in the sixth week and tests showed no significant differences between the two diets (at the 5% level). Total feed intake over the six weeks was 3.38 kg/bird for the broilers on either diet, again with no significant difference between the two diets (F = 0.265, p = 0.994). Weight gain over the six weeks averaged 36.17 grams/ bird/day for broilers fed regular maize and 36.19 g/bird/ day for those fed on QPM diets and no statistical differences were found. Feed conversion efficiency, calculated as the weight gain over the feed intake, was 0.33 for both diets. In another experiment, he observed that dietary substitution of normal maize with QPM did not have any effect on body weight gain and feed consumption. However, feed conversion ratio was significantly (P<0.01) improved by substituting normal maize by QPM or supplementing lysine to normal maize based diet.

Nevertheless, Onimisi *et al*. (2009) reported that QPM in poultry diet improved growth performance of broilers and resulted into higher weight gains than normal maize. QPM did not result into significant changes on carcass and organ development of broilers. Amonelo and Roxas (2008) reported that broilers fed with either normal maize or QPM based diet had higher (P<0.05) live weight gain compared to those fed diets supplemented with synthetic lysine. Broilers fed either the QPM based diet or those supplemented with synthetic lysine had lower (P<0.05) feed consumption compared to broilers fed with normal maize diet. Broilers fed with QPM based diet had the best performance (P<0.05) in terms of feed efficiency. Ose *et al*. (2002) Birds receiving QPM as the sole source of amino acids performed significantly better *(*P<0.05*)* than their counterparts fed on normal maize. QPM fed birds weighed an average 708.0 g each at the end of the trials compared with 532.0 g for those on normal maize. The corresponding feed efficiencies were 4.28 and 6.55, respectively. Compared with birds on the balanced diet, however, QPM was inadequate in supporting broiler growth.

V. Conclusion

This experiment revealed that quality protein maize varieties that are available in Nepal are to be crossed with local varieties due to which content of essential amino acids such as lysine and tryptophan is reduced than as mentioned in literatures. Therefore, QPM could not exhibit better performance over normal maize on total weight gain and cumulative feed intake of broiler chickens.

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Effect of Heat Treated Soybean Cake Feeding on Growth Performnce of Growing Female Goats in Fodder based Basal Diet

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Abstract - Growth comparison of goats fed with treated and none treated soybean cake is not evaluated so far in Nepal. Therefore, an experiment was carried out on eighteen growing female goats (50% Jamunapari 6, 50% Barberi 6 and Kiko goats 6) at the Agriculture Research Station (Goat), Bandipur for 90 days after an adaptation period of 7 days. Female goats of average five months age having body weight 11.86 kg were allocated into three groups having six animals in each group by using Complete Randomized Design (CRD). For T_1 and T_2 concentrate mixture were composed by using procured feed ingredients with 16% crude protein level while T_3 was fed with commercial feed. Experimental animals of T_1 group was provided forest mixed fodder (adlib) + treated soybean cake included concentrate mixture @ 1.5% of body weight, T_2 group was provided forest mixed fodder (adlib) + untreated soybean cake included concentrate mixture @ 1.5% of body weight whereas T_3 was provided forest mixed fodder (adlib) + commercial concentrate mixture @ 1.5% of body weight. Experiment revealed that higher intake of concentrate feed was recorded for T_1 (207.6 g) followed by T_3 (199.58 g) and T_2 (193.87 g) which was highly significant ($P<0.001$) among diet groups.

Keywords : goats, bypass protein feeding.

GJSFR-D Classification : FOR Code: 070799, 070204

EFFECT OF HEAT TREATED SOYBEAN CAKE FEEDING ON GROWTH PERFORMNCE OF GROWING FEMALE GOATS IN FODDER BASED BASAL DIET

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Effect of Heat Treated Soybean Cake Feeding on Growth Performnce of Growing Female Goats in Fodder based Basal Diet

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Abstract - Growth comparison of goats fed with treated and none treated soybean cake is not evaluated so far in Nepal. Therefore, an experiment was carried out on eighteen growing female goats (50% Jamunapari 6, 50% Barberi 6 and Kiko goats 6) at the Agriculture Research Station (Goat), Bandipur for 90 days after an adaptation period of 7 days. Female goats of average five months age having body weight 11.86 kg were allocated into three groups having six animals in each group by using Complete Randomized Design (CRD). For T1 and T2 concentrate mixture were composed by using procured feed ingredients with 16% crude protein level while T3 was fed with commercial feed. Experimental animals of T1 group was provided forest mixed fodder (adlib) + treated soybean cake included concentrate mixture @ 1.5% of body weight, T2 group was provided forest mixed fodder (adlib) + untreated soybean cake included concentrate mixture @ 1.5% of body weight whereas T3 was provided forest mixed fodder (adlib) + commercial concentrate mixture @ 1.5% of body weight. Experiment revealed that higher intake of concentrate feed was recorded for T1 (207.6 g) followed by T3 (199.58 g) and T2 (193.87 g) which was highly significant ($P<0.001$) among diet groups. Similarly, fodder intake was also noted significantly higher ($P<0.001$) among diet groups (1969.5 g, 1967.6 g and 1942 g for T2, T3 and T1, respectively). Feed and fodder intake of different genotypes of goats was found to be non-significant among goat breeds. In addition, feed conversion ratio per kg body weight gain was observed higher for T3 (22.49:1) followed by T2 (17.57:1) and T1 (16.24:1). Similarly, initial body weight of T1, T2 and T3 was 12.15 kg, 11.25 kg and 12.18 kg respectively that reached 17.66 kg, 16.33 kg and 16.40 kg during 90 days of experiment for T1, T2 and T3, respectively. Both initial and final body weight was non-significant among diet groups. Similarly, there was also non-significant effect of goat breed on body weight gain. Total body weight gain was recorded higher for T1 (5.50 kg) followed by T2 (5.08 kg) and T3 (3.98 kg) which was significant ($P<0.05$) among diet groups. Similarly, average daily gain was also noted higher in T1 (61.2g) with variation of 29-122.6g g followed by T2 (56.48 g) with variation of 21-102.6 g and T3 (44.22 g) with variation of 14-101.3 g.

Keywords : goats, bypass protein feeding.

I. Introduction

Goats are important domestic animals in many parts of the world. In the developing countries, goats make a very valuable contribution, especially to the poor in the rural areas. The importance of this valuable genetic resource is underestimated and its extent of contribution to the livelihood of the poor is inadequately understood. Goats are efficient browsers and prefer eating brushy plants along with some other weedy plants found on the ranges. Nevertheless, goats are going to be more important source of livelihood for many more people in coming years and, thus, they deserve greater attention at both the micro and macro levels. Now, it is the time to consider and pay attention to the value and capacity of goats for producing food (Aziz 2010). Neopane and Pokharel (2008) reported that most of the farmers of western hills are rearing Khari goats, crossbred of Khari x Jamunapari and Khari and Barberi). Goat population of Nepal is estimated to be 9.19 million. Out of 9.19 million, goat population of western hills is 1.13 million which account 12.32% of total goat population that producing 5284 mt meat per annum (10% of total goat meat production) (MoAD 2012).

Oil seeds cakes and meals are the residues remaining after removal of the greater part of the oil from oil seeds. The residues are rich in protein and most are valuable feeds for farm animals. Most oil seeds are of tropical origin, they include groundnut, cottonseed, soya bean, mustard, til etc (Bajjlieh 2002). Soybean cake has an average protein content of 40% and oil content of 20% and 2500 to 2800 kcal of metabolizable energy per kilogram. It also has a superior amino acid profile. Soybean protein has great potential as a major source of dietary protein. A by-product from the oil production (soybean cake) is used as a high-protein animal feed in many countries. Moreover, soybean protein is rich in lysine, methionine, valine, and isoleucine. The protein content of soybean tend to be 75 to 80% degraded in the rumen (Broderick *et al*. 1988; Promkot and Wanapat 2003), which restricts its inclusion in diets for high-yielding ruminants.

The protein content in diets of ruminant animals is essential for growth and production requirements. Possibility that reasonable portions of high quality protein of feedstuffs may be degraded in the rumen is occurred, which negatively affect animal utilization of the feed. In this context, there are several methods for protection of dietary protein from degradation in the rumen (EL-Shabrawy 1996). The heat treatment is

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known one of the methods to increase the protection of the proteins. During the process of manufacturing oil seed meals, they are subjected to different degree of heating which partly explains differences in the degree of protection. Thorough heating of protein supplement causes denaturation of protein; it provides effective protection against microbial fermentation in the rumen. Heat treatment of protein meal at 125- 150^0 C for 2-4 hours improves the bypass protein. The main benefit of "*bypass*" protein is that the original amino acids in the protein meal are absorbed in the small intestine instead of converted into microbial protein in the rumen, thereby providing a different balance of essential amino acids for better animal nutrition hence, production (Schroeder 1997).

Growth comparison of goats fed with treated and none treated soybean cake is not evaluated so far in Nepal. Hence, a study was carried out to compare the growth performance of growing female goats fed with heat-treated and none treated soybean meal mixed concentrate mixture at Agriculture Research Station (Goat), Bandipur, Tanahun.

II. Methodology

a) Experimental Animals

This experiment was carried out on eighteen growing female goats (50% Jamunapari 6, 50% Barberi 6 and Kiko goats 6) at Agriculture Research Station (Goat), Bandipur, Tanahun from 29 November 2012 to 25 March 2013 (069/8/14 to 069/11/14). Female goats of average five months old with average body weight of 11.86 kg were allocated into three groups having six animals in each group by using Complete Randomized Design (CRD). They were drenched with Fenbendazole @ 5 mg/kg body weight against internal parasites before assigning in experiment.

b) Concentrate Mixture Composition

Feed ingredients maize, soybean cake, rice bran, minerals and salt were procured from Khowpa Feed Industry, Bhaktapur. For T1 and T2 concentrate mixture were composed by using procured feed ingredients with 16% crude protein level that has been presented in Table 1 while for T3 commercial compound feed was used made by Pancharatna Feed Industry, Narayangadh, Chitwan.

Table 1 : Composition of concentrate mixture

S/n	Ingredients	T 1		T2	
		Part	Crude Protein (%)	Part	Crude Protein (%)
1	Maize	50	3.94	50	3.94
2	Soybean cake	28	10.7	28	10.7
3	Rice bran	20	1.77	20	1.77
4	Mineral mixture	1	0	1	0
5	Salt	1	0	1	0
Total		**100**	**16.41**	**100**	**16.41**

c) Heat treatment of soybean cake

The drying of forage is known to increase the protection of the proteins. Thorough heating of protein supplement causes denaturation of protein; it provides effective protection against microbial fermentation in the rumen. Heat treatment was done by using hot air oven at temperature 125- 150^0 C for 2-4 hours as suggested by Suresh, *et al* (2009).

d) Experimental diet of the animal

The dry matter requirement of goats was calculated based on 5 kg per 100 kg body weight. Following diets were formulated to the experimental animals (Table 2).

Table 2 : Experimental diets of the animals

Treatment	Experimental diet
1	Forest mixed fodder (adlib) + treated soybean cake included concentrate mixture @ 1.5% of body weight
2	Forest mixed fodder (adlib) + untreated soybean cake included concentrate mixture @ 1.5% of body weight
3	Forest mixed fodder (adlib) + commercial concentrate mixture @ 1.5% of body weight

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e) Feeding Regime

Concentrate mixture and *adlib* amount of fodder was provided to the experimental animals individually in plastic vessel. Concentrate mixture was provided once a day in the morning whereas fodder twice a day (morning and evening). Quantity of concentrate mixture and fodder given daily to the animals was weighed daily and refusal was weighed in next morning. Experimental animal had free access to drinking water.

f) Chemical Analysis

The samples of feed ingredients, prepared concentrate mixture and forest mixed fodder were sent to the Animal Nutrition Division, Khumaltar, Lalitpur for proximate analysis. Representative samples were analyzed for dry matter (DM), crude protein (CP), crude fibre (CF), ether extract (EE) and total ash contents (TA). The DM was determined by oven drying at 100°C for 24 hrs. Crude protein of the samples was determined using the Kjeldahl method. Ether extract was determined using Soxhlet apparatus. Ash content was determined by ashing at 550°C in a muffle furnace for 16 hrs (AOAC 1980). Crude fibre of the samples was determined using the Van Soest method (Goering, H.K. and Van Soest 1970).

g) Results Recording

The trial period consisted 90 days after an adaptation period of 7 days. Total feed intake by the goats was recorded daily for all experimental period. The body weight gain of individual animals was measured fortnightly in the morning before feeding.

h) Data Analysis

Data of feed intake and body weight gain were analyzed by "*One Way Annova*" test for every measurement using computer statistical package Minitab 2003, versions 13.20.

III. Results and Discussion

a) Chemical composition of feedstuffs

The result of chemical analysis has been given in Table 3 and crude protein content of prepared concentrate mixture was verified in laboratory that is presented in Table 4.

Table 3 : Chemical composition of different feed ingredients (percentage DM basis)

Ingredient	DM	OM	TA	CP	CF	EE
Maize	87.69	97.97	2.03	8.92	2.34	4.48
Rice bran	87.85	89.5	10.5	11.52	4.83	5.1
Soybean cake	86.87	92.63	7.37	44.29	9.38	0.7
Mixed forest fodder	39.94	90.01	9.99	11.16	NA	NA

The calculated value of crude protein was verified with laboratory analysis, which is presented in Table 4.

Table 4 : Chemical composition of prepared concentrate mixture (% DM basis)

Particular	DM	OM	TA	CP	CF
Treated soybean cake included concentrate mixture	91.92	92.54	7.46	16.83	5.95
Untreated soybean cake included concentrate mixture	91.58	92.10	7.90	16.92	5.64
Commercial feed	90.74	89.85	10.15	15.94	6.45

b) Feed Intake

Average daily intake of concentrate mixture and fodder by goats during experimental periods is given in Table 5. Higher intake of concentrate feed was recorded for T1 (207.6 g) followed by T3 (199.58 g) and T2 (193.87 g) which was highly significant ($P<0.001$) among diet groups. Similarly, fodder intake was also noted significantly higher ($P<0.001$) among diet groups (1969.5 g , 1967.6 g and 1942 g for T2, T3 and T1, respectively), however, dry matter intake was observed almost similar for all treatment group (89.53 kg, 89.33 kg and 89.28 kg for T3, T1 and T2, respectively). Feed and fodder intake of different genotypes of goats was found to be non-significant among goat breeds. In addition, feed conversion ratio per kg body weight gain was observed higher for T3 (22.49:1) followed by T2 (17.57:1) and T1 (16.24:1).

Table 5 : Feed intake of experimental animals/day/animal

Feedstuffs	Mean ± SD		
	T1	T2	T3
Feed intake (g)	207.6±57.96	193.87±45.70	199.58±35.15
Fodder intake (g)	1942.3±439.1	1969.5±440.4	1967.6±443.1
Total dry matter intake (DMI) (k)g	89.33	89.28	89.53
Feed conversion ratio (FCR)	16.24:1	17.57:1	22.49:1

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c) Growth Performance

Growth is a complex; highly integrated process involving numerous interactions among nutrients, environment, genotype, and many different hormones and receptors of these hormones in various tissues (Spencer 1985).The growth performance of experimental goats is given in Table 6 and Figure 1. Initial body weight of T1, T2 and T3 was 12.15 kg, 11.25 kg and 12.18 kg, respectively that reached 17.66 kg, 16.33 kg and 16.40 kg during 90 days of experiment for T1, T2 and T3, respectively. Both initial and final body weight was non-significant among diet groups. Similarly, there was also non-significant effect of goat breed on body weight gain. Total body weight gain was recorded higher for T1 (5.50 kg) followed by T2 (5.08 kg) and T3 (3.98 kg) which was significant ($P<0.05$) among diet groups. Similarly, average daily gain was also noted higher in T1 (61.2g) followed by T2 (56.48 g) and T3 (44.22 g) which also significant ($P<0.05$) among diet groups.

Table 6 : Growth performance of goats

Parameter	Mean ± SD		
	T1	T2	T3
Initial Body weight (kg)	12.15±4.43	11.25±3.11	12.18±2.27
Initial metabolic weight (kg)	6.5	6.14	6.51
Final Body weight (kg)	17.66±4.48	16.33±3.03	16.40±2.56
Final Metabolic weight (kg)	8.61	8.12	8.14
Total weight gain (kg)	5.50±0.36	5.08±1.06	3.98±0.40
Average daily gain (g)	61.20±4.01	56.48±11.87	44.22±4.48

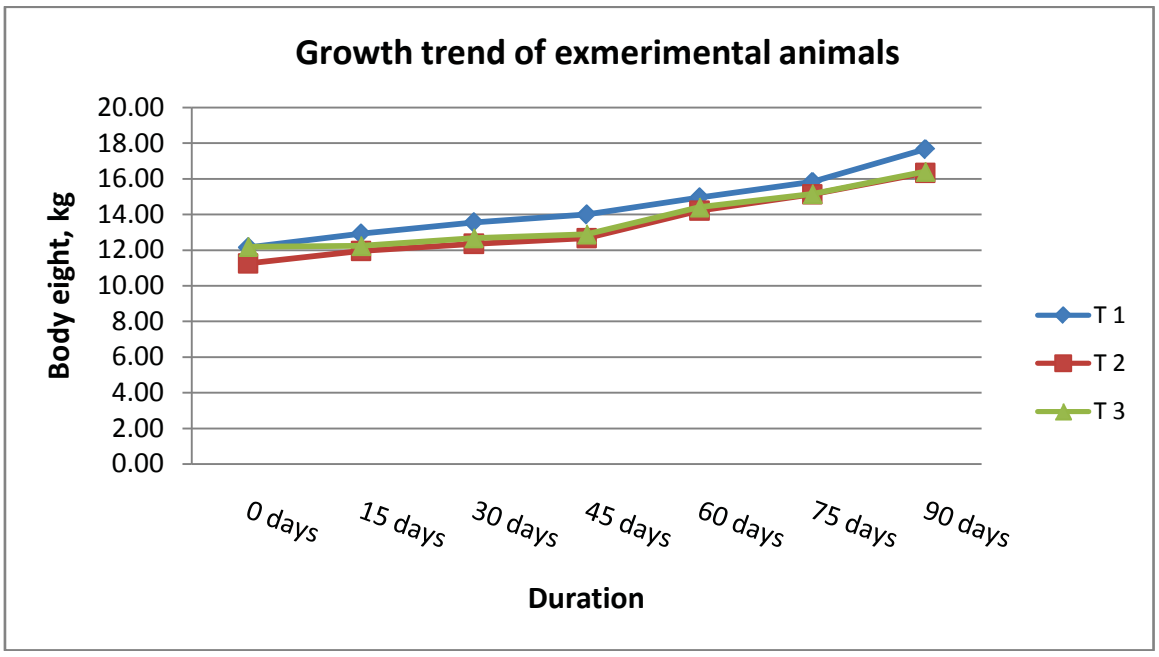

Figure 1 : Body weight gain trend of goats during experiment period

IV. Discussion

This study was initiated with objective to compare the growth performance of female goats of different breeds fed with treated, none treated soybean cake incorporated concentrate mixture, and commercial compound feed on fodder based basal diet. Result revealed that concentrate feed and fodder intake was highly significant ($P<0.001$) among diet groups. Both initial and final body weight was not significant among groups, however, total weight gain and average daily gain of experimental animals significantly ($P<0.05$) differed among diet groups. Similarly, result proved that there was not significant effect of breed in feed intake and body weight gain. This experiment revealed that heat treatment of soybean cake significantly improves the feed intake and body weight gain in comparison to without heat treatment.

Limea *et al.* (2011) tested the effects of a treated soybean cake incorporated concentrate diet on 32 Creole goats for growth, carcass fat, and fatty acid composition of muscle (supraspinatus), perirenal and intramuscular adipose tissues. Goats were fed a tropical green forage *Digitaria decumbens* ad libitum with no concentrate (G0) or 1 of 3 levels of concentrate: 140, 240 and 340 g/day, respectively. Goats were

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slaughtered according to the standard procedure at the commercial body weight (22 to 24 kg). Goats fed the concentrate diets had greater average daily gain ($P < 0.001$), cold carcass weights ($P < 0.001$), perirenal ($P < 0.01$) and intramuscular ($P < 0.01$) adipose tissues weights. Feeding increased concentrate did not increase the content of any cholesterol-increasing saturated fatty acid in meat.

Sahlu *et al*. (2012) conducted an experiment on growing female angora goats with four treatment groups. Experimental animals were fed with low protein high degradability, 12% CP with conventional, solvent-extracted soybean meal; Low protein low degradability, 12% CP with expelled, heat-treated soybean meal; high protein high degradability, 19% CP with conventional, solvent-extracted soy- bean meal; and high protein low degradability, 19% CP with expelled, heat- treated soybean meal. They reported that average initial body weight of the goats was 22.1 kg and the final body weight was 26.2 kg with no differences ($P > 0.05$) in body weight gain between treatments. Mean DMI increased significantly ($P < 0.01$) as dietary CP level increased but was not affected significantly ($P < 0.05$) by heat treatment of the dietary protein. Their observations were in agreement with those of Roffler *et al*. (1978), Barney *et al*. (1981) and Blauwiekel and Kincaid (1986). Others have reported a decrease in DMI when dietary CP was increased (Foldager and Huber 1979; Edwards *et al*. 1980; Grieve *et al*. 1980). A recent study indicated that DMI increased linearly in young growing goats as dietary CP level increased (Lu and Potchoiba 1990)

V. Conclusion

Our experiment revealed that there is a significant effect of heat-treated soybean cake on feed and fodder intake, and total body weight gain of goats; however, it could not be seen as mentioned in different literatures. Perhaps it might be due to winter season of experiment conduction when most of the protein and energy were spent for body maintenance. Therefore, it is suggested that this type of experiments should be continued in future also considering winter loss of weight gain of animals.

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Analysis of Rural Cassava Farmers' Participation in the Nigeria Agricultural Insurance Scheme in Imo State, Nigeria

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Abstract - The importance of insurance in mitigating food insecurity necessitated this study that analyzed rural cassava farmers' participation in the Nigeria agricultural insurance scheme in Imo State, Nigeria. The study focused on the socio-economic differentials of participants and non participant; reasons for participation and determinants of participation. Data collected from 90 sampled cassava farmers using structured questionnaire and interview schedule were analyzed with the aid of percentage count, frequency tables, z-test and logit regression model at 0.05 levels of significance. The result shows socio-economic differentials in the age, education, farming experience, social organization membership, status of participants and non participants in the scheme. The reasons cited for participation included to acquire loan and continue in business even after suffering losses. While the reasons for non – participation included inadequate knowledge of the scheme and cost of insurance, the socio-economic and farm enterprise characteristics of age, education, marital status, farming status, farming experience, farm size and credit opportunity determined the farmers that participated in the scheme. It was recommended that extension education campaign be mounted for enlightenment of the scheme and consideration should be given to the farmers socio-economic and farm enterprise characteristics in designing intervention strategies and advocacy on the scheme.

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ANALYSIS OF RURAL CASSAVA FARMERS PARTICIPATION IN THE NIGERIA AGRICULTURAL INSURANCE SCHEME IN IMO STATE, NIGERIA

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Analysis of Rural Cassava Farmers' Participation in the Nigeria Agricultural Insurance Scheme in Imo State, Nigeria

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Abstract - The importance of insurance in mitigating food insecurity necessitated this study that analyzed rural cassava farmers' participation in the Nigeria agricultural insurance scheme in Imo State, Nigeria. The study focused on the socio-economic differentials of participants and non participant; reasons for participation and determinants of participation. Data collected from 90 sampled cassava farmers using structured questionnaire and interview schedule were analyzed with the aid of percentage count, frequency tables, z-test and logit regression model at 0.05 levels of significance. The result shows socio-economic differentials in the age, education, farming experience, social organization membership, status of participants and non participants in the scheme. The reasons cited for participation included to acquire loan and continue in business even after suffering losses. While the reasons for non – participation included inadequate knowledge of the scheme and cost of insurance, the socio-economic and farm enterprise characteristics of age, education, marital status, farming status, farming experience, farm size and credit opportunity determined the farmers that participated in the scheme. .It was recommended that extension education campaign be mounted for enlightenment of the scheme and consideration should be given to the farmers socio-economic and farm enterprise characteristics in designing intervention strategies and advocacy on the scheme.

I. Introduction

In spite of the impressive effort and conceited persuasion to invest in agriculture by the government, the reluctance expressed by credit institutions has been worrisome. This stems from the low confidence in the agricultural sector following unprecedented risks and uncertainties in the practice. Agriculture is bedeviled by price fluctuation, instability in input and production supplies, poor yield and post harvest losses, pests and diseases attack, inclement weather and vagaries of environmental conditions. These have individually and collectively enmeshed the rural farmers in the web of poverty. Ijere (1981) observed that large volume of investible fund is imperative to disentangle the rural farmers from the vicious cycle of poverty. However, the nostalgia about credit disbursement to farmers is based on the skepticism on their repayment ability. Njoku and Nzenwa (1990) attributed high loan default rate to the occurrence of natural hazards. Insurance is considered as one of the most effective means of reducing the vulnerability of the poor from the impacts of disease, theft, violence, disability, fire and other hazard. Insurance protects against unexpected losses by pooling the resources of the many to compensate for the losses of the few, the more uncertain the event the more insurance becomes the most economical form of protection (Brown and Churchill 1999). Policyholders only pay the average loss suffered by the group rather than the actual costs of an individual event: insurance replaces the uncertain prospect of large losses with the certainty of making small regular affordable premium payments (Brown and Churchill, 1999). The primary function of insurance is to act as a risk transfer mechanism to provide peace of mind and protect against losses. Risk can be handled by: assumption, combination, transfer or loss prevention activities. Insurance schemes utilize the combination method by persuading a large number of individual to pool their risks into a large group to minimize overall risk (Aliero and Mukhtar, 2012). In the developed world insurance is part of society, such that some forms of cover are required by law. In developing countries the need for such a safety net is much greater particular at the poorest level where vulnerability to risk is much greater and there are fewer opportunities available to recover from a large loss (Aliero and Mukhtar, 2012).

In the light of the above, the Government of Federal Republic of Nigeria identified Agricultural insurance as a panacea to the doubt and attendant disenchantment expressed by credit institutions following the multifarious risks and uncertainties in agriculture. In 1987, the government of Nigeria formerly launched the Nigerian Agricultural Insurance Scheme (NAIS) and in 1988 incorporated the Nigeria Agricultural Insurance Company (Nnadi, *et al*, 2013). Agricultural insurance is the stabilization of income employment prices and supplies of agricultural products by means of regular and deliberate savings and accumulation of funds in small installments by many in favorable time periods to defend the participants in bad times (Mordi

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1995). Farmer's losses, indisposition and fear are allayed following the cushioning effects from the accumulated saving. Thus farmers are put back to business irrespective of misfortune suffered provided the peril is covered.

The Nigerian agricultural insurance scheme was institutionalized in 1987 to obviate problems of knowledge imperfection, risks and Uncertainties in agricultural enterprises. The scheme inter alia offers protection to the farmers from the effects of natural disaster and ensures payment of appropriate compensation, sufficient enough to keep farmers in business after suffering losses. The government on the other hand is provided with back-up and information on agricultural development in the county. The scheme covers arable crops, crops and livestock. The Nigeria agricultural insurance company (NAIC) succinctly put the objectives of the scheme as follows:

(a) To promote agricultural production by enhancing greater confidence in adopting new and improved farming practices greater confidence in adopting new and improved farming practices and making for greater investment in the agricultural sector thereby increasing the total production.
(b) To provide financial support to farmers in the event of losses arising from natural disasters.
(c) To increase the flow of agricultural credit from lending institutions to the farmers.
(d) To minimize or eliminate the need for emergency assistance provide by government during periods of agricultural disasters.

Agricultural insurance holds wonderful prospects for the transformation of the agricultural sector. By indemnifying farmers from the perils covered in the scheme (Mordi, 1995), they are put in the same closer financial pedestal to operate after suffering losses. Following the numerous advantages of the scheme, it is expected that farmers involved in the production of crops prone to high risk and uncertainties but distinguished for mitigating food insecurity, and have wide spread uses should avail themselves of the scheme. Cassava (*Manihot esculentus*) is marked with such potentials. Cassava provides about 40 percent of calories consumed in Nigeria (Nwajiuba, 1995) and about 70 percent of the daily calorie intake of more than 50million Nigerians (Ugwu et al, 1989). Whereas, Adekanya (1985) posited that cassava is the most important root crop in the tropics. Odigbo (1983) observed that the demand for cassava especially for export has increased appreciably following the Federal Government of Nigeria's cassava initiative. Cassava production is bedeviled by pests and diseases attack, fire outbreak, flooding, poor storage etc (Youdeowei et 1985; Theberge 1985).

It is however unfortunate that despite the status of cassava little or nothing is known about the farmers' participation in Nigeria agricultural insurance scheme to boost production by forestalling risks and uncertainties. There are on empirical data on this. Information available are based on guesses and suppositions. These have given rise to a wide gap in knowledge the ensuing gap has been inhibiting the formulation of holistic policy measures. A study of cassava farmer's participation in the scheme has become as timely as it is important, not only to position the farmers strategically but to equip them with the necessary thrust essential for meeting the food security needs of the nation ensuring persistence in farming and overcoming the challenges of the present especially in the light of the global clima te change.

a) Objective of the study

The broad objective of the study is to analyze the participation of cassava farmers in the Nigeria Agricultural Insurance Scheme with a view to making policy recommendations. The specific objectives include;

1. to analyze the socio–economic differentials of participants and non participants in the scheme.
2. to investigate reasons for the participation and non participation of the farmers in the scheme.
3. to analyze the socio-economic and farm enterprise factors that determines participation in the scheme.

II. Methodology

The study was carried out in Imo state, Nigeria with specific focus on Ohaji-Egbema Local Government area (LGA). The local Government area is one of the 27 local government areas that make up the state. Located in owerri agricultural zone of the state, the headquarters is in Egbema. It shares boundaries with Oguta L.G.A in the East, Owerri west in the West and North and Rivers State in the South. Ten communities make up the Local Government Area: Egbema, Awara Umuapu, Umuagwo Mgbirichi/ Abakuru, Ohuba Assah/ Obitti, Umuokanne, Mmahu and Abuchara. The population by 2013 census is 209,593 projected from 2009 official (FGN 2009) the people are Igbos. The area is located in the rainforest region two distinct seasons abound- rainy and dry. The mean rain fall is 200-25cm (FDLAR1985), with temperature of 26-28c and relative humidity of 80-90 percent (Ugwu and Lekwa, 1988). Agriculture features prominently in the economy. This is rain-fed. Soil fertility maintenance is mostly by natural means, bush fallow system. Crop production encompasses the cultivation of cassava, yam, maize, pineapple, banana, plantain, oil palm and various forms of vegetables. The animals reared include goat, sheep, pig, poultry and most recently grass-cutter. There are also pockets of farmers engaged in aquaculture and apiculture. Data were collected from primary and secondary sources. These

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included the use of semi-structured questionnaire supplemented by interview schedule and records from Nigeria agricultural insurance company (NAIC) and agricultural development programme (ADP). The semi-structured questionnaire was validated by experts in agricultural extension and rural sociology. These were tested for reliability using test-re-test method on a group of cassava farmers in Oguta local government area of Imo state to yield a coefficient of 0.68, significant at 5 percent level. The questionnaire and interview schedule were administered between February and June, 2008 by the researchers with the assistance of the extension agents working in the ADP circles covered in the study. The cassava farmers in the L.G.A. composed the study population. They were purposively dichotomized into participants and non participants in the Nigeria agricultural insurance scheme. From the NAIC list of cassava farmers who participated in the scheme in 2007, a total of 45 participants was randomly sampled without recourse to their communities as they were few (<50). Also from the ADP list of cassava farmers, 45 non participants in the scheme were also randomly selected. Thus, a total of 90 cassava farmers; participants and non participants in the scheme made up the sample size. Percentage count and frequency tables were used to describe objectives 1 and 2. while z-test and Logit regression technique were used to analyze objectives 3 and 4 respectively. The z-test statistic expressed as:

$$z=\frac{X_1 - X_2}{\sqrt{\frac{S_1^2}{n_1}+\frac{S_z^2}{n_2}}}$$

where ;

x_1-mean values of the socio-economic variables of participants in NAIS.

X_2- mean values of the socio-economic variables of non participants in the scheme.

S_1^2-variance of participants in the scheme

S_2^2- variance of non participants in the scheme

n_1- number of participants

n_2- number of non participants

X_1-x_6- variables whose differentials were determined

X_1- age (years)

X_2-eductation (years of formal education)

X_3- household size (number of people that feed from the same pot)

X_4- farm size (hectares)

X_5- farming experience (number of years of farming)

X_6- social organization membership status none member =0, ordinary member= 1,regular attendant to meeting =2, financial member=3, committee member =4, executive member=5)

The logit regression technique wasexpressed as follows (pindyck and Rabinfeld, 1981):

$$P1=c/(1+e\text{-}^{2}i)$$

Where

P1- probability that an individual farmer I (i=1,2….n) will make a particular choice)

c-constant

z-choice index

$$zi\text{-}\ \beta_0+\beta 1x1j+\beta 2x2j+\ldots\beta_k xkj$$

where ;

x_j,j=2…k are the factors influencing the farmers' decision to participate or not in NAIS.

III. Results and Discussion

a) Socio–economic differentials and non participants in Nigeria agricultural insurance scheme

The z-test results of the socio-economic differentials of participants and non- participants in the Nigerian agricultural insurance scheme (table1) shows that 66.67 percent of the explanatory variables investigated differed significantly between the two groups. Specifically, the variables age education farming experience and social organization membership status differed significantly between the participants and non participants. The mean age of the participants was 46.56 years while that of the non-participants was 50.24. The variance for participants was 5.39 while that of non-participants was 8.03. The z-value was -2438. This implies that the higher the age the lower the participant. Thus the participants were younger than the non-participants, and were more disposed to participating in Nigerian agricultural insurance scheme. This could be explained by their higher venturesomeness, innovativeness and more risk proneness, and insurance is a pool of risk. The result corroborates Nnadi and Akwiwu (2006 a) in which young women farmers utilized proved soil management practices more than the old.

The mean number of years of formal education by participants and non participants were 10.85and respectively. Whereas the variance for the participants was 4.07, that of non–participants was 1.46. The z-value was 6.226. The positively significant difference implies that higher years of formal education predisposed participation in the scheme. This could be explained by better understanding of the scheme, adequate knowledge of the gain and potentialities for greater investment. of course highly educated farmers could access diverse information sources on the scheme, and better clarification for participation. These affirm the excellence of educated farmers in improved technologies adoption (Nnadi and Akwiwu, 2005a; Onu, 2005; Polson and Spencer, 1981)

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Farming experience by participants in the scheme had a mean value of 17.41 while that of the non- participants was 21.03 years. With variance of 6.79 and 9.03 for participants and non participants respectively, the z-value was -2.033. The significant but inverse difference shows that non participants had more of experience but this was not an asset for participation in the scheme. Long years of farming experience presuppose increased chronological age of the farmers. The older the more risk averse and the more conservative the farmers become.

The mean value for social organization membership status; of participants in the scheme was 3.72. The variance was 1.28. The non participants had a mean of 0.39 and variance of 0.11. The z- value was 16.165. It implies that the participants had higher commitments to their social organizations and this positively impacted on their embrace of the scheme. Social organization membership besides meeting up with the farmers' social needs exposed farmers to settings where their misconceptions and distortions are clarified. The result is in consonance with Mgbada (2002) that the more active the farmers are in their social organizations, the more they are exposed to useful information about innovation and the farm size were not significantly different. These are not important variables for consideration in targeting cassava farmers for participation in the scheme.

b) Reasons for participating in Nigeria agricultural insurance scheme

Diverse reasons were given for participating in the Nigeria agricultural insurance scheme (Table 2). The whole farmer (100%) indicated that their participation was to enable them have access to loan. Agricultural credits were described as an imperative for rural transformation (Ijere, 1981). As a condition for accessing agricultural credit from Nigeria Agriculture Credit and Rural Development Bank (NACRDB), farmers must undertake insurance cover. By compulsion most prospective loan beneficiaries indemnify their farms to increase the confidence of the lending institution. On questioning the farmers for their reasons for settling for the rigors for obtaining loan from Nigeria Agriculture, Co-Operatives and Rural Development Bank (NACRDB), three-quarters of the farmers indicated that the bank render better and friendly services.

Another reason for participating in the scheme by the farmers was to continue to be in business after suffering losses (79%). The third reason on the rank was to protect the farmers from the effect of natural disaster (69.2%). The various underscore adequate understand-ding of the objectives of the scheme and thus laid credence to the perception of insurance as a social device to provide financial compensation for the effect of misfortune. The fourth reason for participate in the scheme was to expand investment in agriculture (59.0%). The farmers were further interview on why they though insurance could help them expand their agricultural investment. Two thirds of the farmers noted that unindemnified losses could either push farmers to the basic or our business but indemnity portends rays for continuity and opens farmers' eyes to vistas of opportunities hitherto unexplored. To get along with other farmers rank 5th with 25.6 percent. The response does not reflect adequate understanding of the importance of the scheme. This calls concerted extension awareness campaign.

c) Reasons for non participation in the Nigeria agricultural insurance scheme

The reasons for not participating in the Nigeria agricultural insurance scheme ranged from logistics in the scheme (70.7%), 1st in the rank. The inadequate knowledge could be attributing to poor extension campaign or poor geographical spread of NAIS offices for easy access by the farmers. Logistics in the scheme could be explained by the bureaucracy in registration, subsequently verification and processing of document at the event of loss. The cost of premium ranked 2nd with 90.2 percent. The third in the rank, lack of confidence in institution had 85.4 percent. This could be attributed to unsavoury past experience. Fear of the unknown ranked 4th with 78.1 percent. This could be adduced to poor understanding of the scheme and the methods operation. Generally, the reasons for not participating in the scheme are based on ignorance and hence unfounded. Participation could be improved through education campaign.

d) Socio–economic and farm enterprise determinants of cassava farmers' participation in NAIS

The logic regression result of the socio economic and farm enterprise determinant of cassava farmers participation in NAIS (table 4) shows that seven independent explanatory variables (70%) were significant at 0.05 level. The variable included age (X_1) education (X_3) marital status (X_4) farming status (X_6) farming experience (X_7) farm size (X_9) and credit opportunity (X_{10}).

The age of the farmers (X_1) had a coefficient of 0.1847 and T value of 3.3515. The result implies that increasing the magnitude of the farmer's age increased their participation in NAIS. Specifically, each additional year to the age farmers increased the probability of their participation by about 19 percent. Age is therefore a major consideration in designing strategies to increase participation in the scheme. This could be attributed to increased maturity and experience as the farmers are bound to make better informed decisions following increased life encounters over time. More so, increased age is associated with more responsibilities, marriage, caring for children and expanded scope of dependants and insurance could become a source of respite by ensuring continuity in farm engagement, even after

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suffering losses. In line with this, age was found to be positively significant to rural women's use of improved crop production technologies in Imo State (Nnadi and Akwiwu 2005b).

Education had a coefficient of 0.1192 with a t-value of 3.722. The result shows that increases number of years of normal education impacted positive on the farmers in NAIS. The result implies that each additional year of formal schooling increased the probability of participating in NAIS by about 12 percent. Education furnished facts exposed farmers to multifarious information sources, polished their reasoning and decision making processes. The result concurred with Agada and Philip (2002) in which education maize farmers participated more in NAIS in Kaduna State, Nigeria.

The status of the farmers (full time or part time0 had a coefficient of 0.1604 and t-value of 2.6081. The positive but significant relationship implies that an additional improvement in farming status, by part time becoming full time farmers, increased the probability of participating in NAIS by 16 percent. Full time farming status could entail that the farm is the monolithic source of revenue to the farmer. Insurance therefore becomes a safe guard for subsistence, especially during losses. Farming experience had 0.0882 and 2.1356 as coefficient and t-value respectively. Increasing the number of years of farming experience thus increased the farmers' participation in NAIS. The result implies that each additional year of experience in farming resulted to about 9 percent increase in the probability of their participation in NAIS. Increased years of farming experience just like increased age could entail several varied encounters in farming which could influence farm decision making. The study of Nnadi and Akwiwu (2006b) also established positive significant relationship between years of farming experience of women and the number of coping strategies against economic marginalization.

The coefficient of farm size was 0.0436 while the t-value was 4.1983. The result implies that each additional hectare of land put into cassava cultivation resulted to 4 percent increase in the probability of participating in NAIS. Large farm size could entail a large farm asset base. This could also mean high level of investment; input, credit technologies, etc insurance therefore becomes an imperative option against unprecedented. Losses. The result of the studies of Nnadi and Akwiwu (2006c) and Nnadi and Akwiwu (2005a) affirmed the importance of farm size in farm decision making.

The coefficient of credit opportunity (0.0843) was positively significant with a t-value of 2.0611. Increased the farmers' participation in NAIS. Specifically, the result implies that additional increase in the number farmers that had access to credit offers opportunity to increase a farmer's capital base and subsequently has investment. The finding agrees with Nnadi and Akwiwu (2006a) in which credit opportunity positively influenced rural women's adoption of proven soil management practices.

However, the variables gender, household size and social organization membership status were not significant related to the farmer's participation in NAIS. They therefore do not determine their participation and as such should be discountenanced in advocacy and designing intervention strategies.

IV. Conclusion

Participants in the Nigeria agricultural insurance scheme differed significantly from non participant in the scheme, in respect of age education, faming experience and social organization membership status. The reasons for participating included being able to acquire loan, to continue in business after suffering losses and expanding investment in agriculture. The reason for non participation included inadequate knowledge about NAIS, cost of insurance and lack of confidence in the institution. The farmers participation in the scheme were determined by their socio-economic and farm enterprise characteristics of age education, marital status, farming experience, farm size and credit opportunity.

Policy implication

Extension education campaign should be embarked upon enlighten non participants in the scheme on the prospect as well as sustain the interest of the participants.

- The socio-economic and farm enterprise characteristics of the farmers should be put into consideration in designing intervention strategies and advocacy for increased participation in NAIS
- Institutional reforms, land and credit should be vigorously pursued to avail more farmers of them for increased participation in the scheme.

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Table 1 : z test result of the socio-economic differential between participants and non participants in NAIC

Explanatory variables	Means of participant	Means of non participant	Variance of participants	Variance of non participants	Z value
Age	46.53	50.24	5.39	8.03	-2.438*
Education	10.85	7.88	5.09	1.46	2.226*
Farmers size	8.41	9.59	3.05	4.19	-1.455
Farm size	4.08	3.59	1.68	1.24	1.471
Farming exp.	17.41	21.03	6.79	9.03	-2.033*
Social org. mem. Status	3.72	0.39	1.28	0.11	16-165*

*significant z value at 0.05 levels sources survey data, 2008

Table 2 : reasons for participating in the Nigeria agricultural insurance scheme

Reasons	F	%	Rank
To continue after suffering losses	31	79.5	2nd
To be able to acquire loan	39	100.0	1st
To expand investment in agriculture	23	59.0	4th
To be protected from the effect of natural disaster	27	69.2	3rd
To get along with other farmer	10	25.6	5th

*multiple responses N=39

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Table 3 : Reasons for non participation in NAIS

Reasons	*F	%	Rank
Inadequate knowledge of NAIS	38	92.7	1st
Lack of confidence in the institution	35	85.4	3rd
Logistics in the scheme	29	70.7	5th
Cost of insurance	37	90.2	2nd
Fear of the unknown	32	78.1	4th

*Multiple responses N = 41

Source –fields survey data, 2008

Table 4 : logic regression result of the socio-economic and farm enterprise determinant of farmers' participation in NAIS

Explanatory variables	Logistic coefficient	t-value
Constant	-23.4016	-5.7944
Model chi square	57.0844	
Degree of freedom	49	
Number of cases	80	
Gender	0.0943	1.1542
Age (X_1)	0.1847	3.5315*
Education (X_2)	0.1192	3.7722*
Marital status (X_3)	0.0349	3.2315*
Household size (X_4)	0.0839	1.1541
Farming status (X_5)	0.1608	2.6081*
Farming experience (X_7)	0.0882	2.1356*
Social organization		
Membership (X_8)	0.1903	1.0485
Farm size(X_9)	0.0436	4.1923*
Credit opportunity (X_{10})	0.0843	2.0611*

*significant t-value at 0.05 level

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Livelihood Vulnerability to Climate Change based on Agro Ecological Regions of Nepal

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Livelihood Vulnerability to Climate Change based on Agro Ecological Regions of Nepal

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Abstract - This study based to assess the livestock holders' vulnerability to climate change across four agro ecological regions of Nepal. Altogether 240 households, 60 from each agro ecological region, were selected using stratified random sampling technique. Primary data were collected through household survey and Focus Group Discussion using structured and pre tested questionnaire and analyzed by descriptive statistics. Integrated vulnerability approach based on the Principle Components Analysis to create vulnerability indices to conduct a comparative analysis of vulnerability at the regional levels. The results reveals that the farmers were aware of climate change. The result shows that livestock holders from the fragile warm temperate mountainous region are more vulnerable because of greater exposure to climatic induced hazards, catastrophe, and low adaptive capacity results from highly pauper economic condition, with limited access to basic services, assets, and poor infrastructure. Based on the results, measures to prioritize and target the vulnerable livestock holders for awareness creating activities and of off farm employment opportunities is recommended to enhance their adaptive capacity.

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I. Introduction

Nepal, with a population of 26.6 million (CBS, 2011) the world's fourth most vulnerable country to climate change due to the fragile ecosystem, which is very sensitive to even slight changes in natural climate, weaker geological situation and complex topography (Maplecroft, 2011). Livestock is an integral part of the mixed farming system and socio-economical life in the country, and contributes nearly 26 percent to the total Agricultural Gross Domestic Product (MoAD, 2012). Around 87 percent of the country's total population keeps some form of livestock at home (IRIN, 2013). Although, Nepal has one of the highest ratios of livestock and poultry to humans (5.8 animals per household) in Asia, the country's livestock sector is declining (IRIN, 2013). While not definite, it would seem that livestock in Nepal is at par with livestock systems in other developing countries and is changing rapidly in response to many external and internal drivers including climate change which is seen as a negative impact (Thornton et al., 2007).

The Intergovernmental Panel on Climate Change (IPCC, 2007) suggests that within the agricultural sector livestock are among the most climate sensitive economic areas. Studies on livestock and climate change revealed that climate change adversely affects the animal health and livestock production. Cool temperate Grassland is projected to shift northward with climate change and net primary productivity will decline (Christensen et al., 2004). The limited herbaceous production, heat stress from higher temperature, and limited water intake due to the decrease in rainfall could cause poor livestock performance and an increased incidence of animal diseases. These effects will be felt mostly by the smallholder and subsistence livestock holders' of developing countries are the most vulnerable to livelihood from the effects of climate change (Stern, 2006; Heltberg, 2009) because of lack of resources, knowledge, veterinarian extension services and research technology development (FAO, 2008). This indicates that the livestock sector is the most vulnerable to any adverse impacts of climate variability and extreme events that might result from climate change.

According to the IPCC (2007), vulnerability is defined as the degree to which a system is susceptible to, or unable to cope with, adverse effects of climate change, including climate variability and extremes. Vulnerability is a function of the character, magnitude, and rate of climate variation to which a system is exposed, its sensitivity, and its adaptive capacity. According to Raut (2006), the most vulnerable ecological and socio-economic systems are those with the greatest sensitivity to climate change and the least ability to adapt. Nepal's major natural resources, biodiversity and water, are at the forefront of climate vulnerability. Moreover, Nepal posses less coping and adaptive capacity to address the additional impacts of climate change.

There is increasing important to understand the likely impacts of climate change on livestock production and their vulnerability. The degree of vulnerability to climate change among the different groups of people is different based upon agro ecological regions. It was necessary to identify likely hotspots that were already vulnerable and that are likely to suffer substantial

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impacts as a result of climate change. In this backdrop, this study aims on the assessment of livestock vulnerability to climate change based on agro ecosystem elevation, along with other relevant biophysical and social factors and possible adaptation measures.

II. Research Methodology

a) Study sites, sampling, data collection

The Gandaki River Basin (GRB), Nepal spreads from 27.21'45" to 28036'36" degree north longitude to 83008'00"- 84053'00" degree east latitude and elevation ranging from about 144 Masl to 8167 Masl (DDC, 2002). It covers the areas in the Mountain zone (Mustang, Manang, Gorakha, Rasuwa Districts), Hill zone (Myagdi, Kaski, Tanahun, Lamjung, Syangja, Parbat, Dhading, Nuwakot, Makawanpur, Baglung, Gulmi, Palpa), and the valley Terai zone (Nawalparasi, Chitwan, Kapilvastu). The average temperature of this area ranges from -9 °C in Mustang to 42.5°C in Chitwan (DADO, 2012; DLSO, 2011b). Average annual rainfall is 26.58 mms in mustang to 2500 mm in Chitwan (DADO, 2012; DLSO, 2011b). Four agro-ecological regions were selected from Chitwan, Myagdi and Mustang districts of GRB in Nepal. From each region 60 households were selected using purposive simple random sampling technique accruing the total households to be surveyed were 240 households. The primary data was collected through household survey using pretested semi structured questionnaire via face to face interview during October to December 2012.

Fig.1 : Shaded regions showing study area in Gandaki River Basin, Nepal. This research was based on four agro ecological regions namely the tropical region (below 500 meters above sea level) from Chitwan District, subtropical (500 -1000 Masl) and warm temperate regions (1000-2000 Masl) from Myagdi District and cool temperate region (2000-3000 Masl) from Mustang District

As far as Participation goes, two Focus Group Discussions (FGDs) and one Key Informant Interview (KII) were conducted to triangulate the data and to supplement the household survey. Information on the livestock holder's perception on climate change, and major effects on livestock due to changing climatic conditions were assessed through these participatory methods. The Geographical Positioning System (GPS) was used to determine the altitude and latitude of the study areas.

b) Integrated vulnerability assessment

Livestock based livelihood vulnerability to climate change in the study areas was accessed by an integrated vulnerability assessment approach. The integrated vulnerability approach is superior over other approaches and is particularly useful for policy decision making (Deressa et al., 2008). Integrated vulnerability approach comprises socioeconomic and biophysical indicators of vulnerability and classified these indicators into adaptive capacity, sensitivity, and exposure. The data on adaptive capacity and sensitivity were obtained from primary and secondary sources of data while dichotomous variables namely river flooding, landslide and drought on climate extremes captured exposure. Principal Component Analysis (PCA) was performed to compute the component score to weigh the variables to calculate the vulnerability indices. The purpose of using weights obtained from the PCA is to avoid the uncertainty of unequal weighting, given the diversity of indicators used (Deressa et al., 2008). Vulnerability was calculated as defined by IPCC (2001).

Vulnerability= Adaptive capacity - Sensitivity - Exposure……1.1

Equation 1.1 can be expressed as follows:

$$V_k = \sum_{i=1}^{n} W_{ki}.X_{ki} - \left(\sum_{i=1}^{n} W_{ki}Y_{ki} + \sum_{i=1}^{n} W_{ki}Z_{ki} \right) ....1.2$$

Where

i = 1, 2, 3, … n Households

k=1, 2, 3, and 4, representing ecological regions

V_k =Vulnerability index for kth region

W_{ki} =Weight obtained from first principal component scores of ith variable for k^{th} region

X_{ki} = Adaptive i^{th} for k^{th} region

Y_{ki} = Sensitivity i^{th} for k^{th} region

Z_{ki} = Exposure i^{th} for k^{th} region

While calculating the direction of relationship in vulnerability indicators (i.e., their sign), negative value was assigned to both exposure and sensitivity. The justification is that areas that are highly exposed to damaging climate are more sensitive to damages, assuming constant adaptive capacity (Deressa et al.,

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2008). The implication is that a higher net value indicates lesser vulnerability and vice versa (Madu, 2012).

III. Results and Discussion

a) *Livestock Holding*

Livestock is an important asset on which livelihood of majority people hinged on. Livestock holding depicts the picture about farmers' economic condition and it also gives the idea about the total farm yard manure availability in the households. Selected household were observed to raise various kind of livestock species in different number especially Chauri, Chyangra, cattle, buffalo, pig, goat, sheep and poultry.

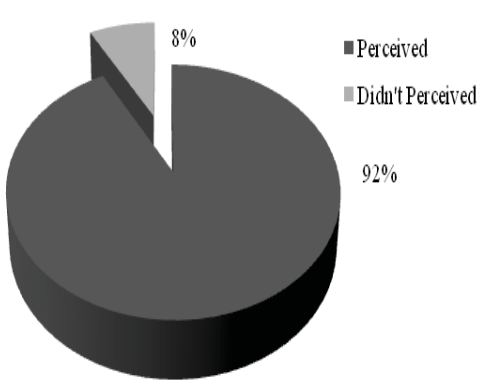
Table 1 : Livestock holding of respondents across the regions

	Agro Ecological Regions					χ^2
	Tropical	Subtropical	Warm Temperate	Cool Temperate	Total Mean	
LSU	54.07	22.25	8.12	18.82	25.81	
S. E.(±)	19.76	7.74	0.94	5.16	5.54	

b) *Perception to climate change*

Change in the weather parameters is important factor that determine the farmer's perception about climate change. Nearly all of the respondents (92%) had observed the deviation of weather parameters like variation in rainfall, temperature, humidity and snowfall (Figure 2).

The average livestock holding was 25.81 Livestock Standard Unit (LSU)[1]. Livestock holding was greater in tropical (54.07 LSU) among the agro ecological zones under study while least livestock holding was found in warm temperate (8.12 LSU) (Table 1). The highest LSU in tropical may be due to large number of poultry in cluster production and commercial cow production and Chitwan is emerging as the commercial pocket area for livestock sector and contributed more in the household annual income. There was significant differences ($\chi 2 = 7.27$, $P > 0.1$) in the distribution of LSU in households across all agro ecological regions.



Source: Field Survey, 2012

Fig. 2 : Livestock holders'perception of climate change in the study area

Similarly, study revealed that nearly 73.0% of respondents perceived the increase in temperature. According to findings, 10.8% respondent didn't observe any change in the temperature while 3.3 % realized the decrease in temperature (Table 1). The result also showed the decreased and erratic rainfall trend in both summer and winter monsoon in the recent years. More than half of the respondents opined the decreased winter monsoon. Delayed initiation of summer monsoon has noticed as in the case of winter monsoon but quite unpredictable onset of winter monsoon was experienced.

[1] LSU= 1 (Cow/Bull) + 1.5 (Buffalo) + 0.4 (Goat/Sheep) + 0.6 (Swine/Pig) + 0.2 (Poultry)

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Table 2 : Perception of respondents towards temperature across the regions

Temperature	Agro Ecological Regions					χ^2
	Tropical	Subtropical	Warm temperate	Cool temperate	Total	
Increased	47.00 (78.33)	43.00 (71.67)	41.00 (68.33)	45.00 (75.00)	176.00 (73.33)	10.46
Decreased	3.00 (5.00)	2.00 (3.33)	1.00 (1.67)	2.00 3.33	8.00 (3.33)	
Same	1.00 (1.67)	10.00 (16.67)	9.00 (15.00)	6.00 (10.00)	26.00 (10.83)	
Don't know	9.00 (15.00)	5.00 (8.33)	9.00 (15.00)	7.00 (11.67)	30.00 (12.50)	
Rainfall						
Increased	2.00 (3.33)	5.00 (8.33)	6.00 (10.00)	4.00 (6.67)	17.00 (7.08)	26.17*
Decreased	37.00 (61.67)	33.00 (55.00)	27.00 (45.00)	29.00 (48.33)	126.00 (52.50)	
Erratic	8.00 (13.33)	14.00 (23.33)	6.00 (10.00)	9.00 (15.00)	37.00 (15.42)	
Same	0.00 (0.00)	0.00 (0.00)	9.00 (15.00)	8.00 (13.33)	17.00 (7.08)	
Don't know	13.00 (21.67)	8.00 (13.33)	12.00 (20.00)	10.00 (16.67)	43.00 (17.92)	

Source : Field Survey, 2012

*Indicates significant at 10 percent level of significance.
Figure in the parenthesis indicates percentage.

c) *Livestock holders' vulnerability*

The result of statistical description and classification of variable indicate (refer Table 3 and Appendix 1) that the socio-economic characteristics vary widely within the agro ecological regions with the highest being recorded for electricity, toilet, mobile or cell phone, and television, radio, access to road, access to market, access to credit, saving, and member of organization. The variation in the adaptive variables is remarkable. The adaptive capacity variables were categorized in to two groups, household assets; social services and facilities. Average number of household assets possessed by the sampled respondents in the tropical was highest (12.07), followed by subtropical (8.82) and least in the warm temperate (8.00). The F value indicated that the distribution was more heterogeneous and they were significant ($P<0.01$). There was more disparity in the ownership of assets. Analysis of access to the services and facilities indicated that sampled respondents in the tropical had more access to these services with the mean of 7.68 followed by the subtropical (7.050) and least in the warm temperate region (5.00). Similarly, there was high variation in the exposure variables like drought, flood and landslide within the agro ecological regions. The mean of drought, flood and landslide, being all of these variables Binary, indicated that cool temperate region was found more exposed followed by the warm temperate while tropical zone was least exposed to these climatic extreme events. Moreover, sensitivity variables in the study area included annual temperature variation and annual rainfall variability.

Table 3 : Summary of assets, services exposure and sensitivity variables across the regions

Agro ecological regions						
Variables	Tropical	Subtropical	Warm temperate	Cool temperate	Total	F- value
Total assets	12.07	8.82	8.00	8.25	9.28	24.072***
Services	7.68	7.05	5.00	5.40	6.28	30.574***
Exposure	0.03	0.40	0.92	1.02	0.59	27.765***
Rainfall	170.39	129.86	129.86	33.46	117.4	130.080***
Temperature	24.35	19.25	19.25	10.98	18.52	98.932***

Source : Field Survey, 2012

*** Significant at 1 percent level of significance

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Analysis of annual temperature range showed that warm temperature (Beni Bazar station) had experienced the highest range of 24.50 percent while lowest annual range of 2.60 percent was recorded in tropical (Rampur station). Analysis of annual rainfall variation showed that the coefficient of variation of 26.04 percent in the annual rainfall was highest in the warm and subtropical (Beni Bazar station) while lowest variation was found in the tropical.

The result of Principle Component Analysis (PCA) showed that nine components with the Eigen value of 1 or greater accounting for 67.85 percent of total variance. The first component had an Eigen value of 6.06 and accounted for 21.66 percent followed by the second component with an Eigen value of 2.71 and percent explanation was of 9.91. The analysis also revealed that the components scores as earlier stated only the component score of the first component were used in weighing the variables for the construction of vulnerability indices. The components score are shown in the Appendix 2.

Table 4 : Vulnerability indices across the regions

Agro Ecological Regions	Vulnerability Index
Tropical	8.11
Subtropical	5.62
Warm temperate	3.29
Cool temperate	3.62

The calculation of vulnerability indices showed that all agro ecological regions had positive values implying that they were less vulnerable. However, some regions were in better position to withstand climate change than others. Accordingly, tropical, subtropical, cool temperate and warm temperate region with the indices of 8.1, 5.62, 3.62, 3.29 respectively in the order of increasing vulnerability (Table 4). It could be concluded that warm temperate by its least indices was most vulnerable while tropical region with highest indices indicates less vulnerable to climate change. According to the GIEC report (2007), mountain ecosystems are considered extremely vulnerable to climate change.

Tropical region experienced low vulnerability to climate change because the rural households have high literacy rate, high household income, and have more access to infrastructure and technology. They are characterized by the high degree of nonfarm employment. The diversification of economic activities and access to the infrastructure technology make the household less reliant on livestock which is more sensitive to climate change. It should also be noted that although drought occasionally occurs, flood rarely occurs and landslide hasn't noticed in this region. Temperature variation and rainfall variability was least over last thirty one years and all these explain why tropical is experiencing low vulnerability. A major reason for high vulnerability of the warm temperate region is the low level of technology and infrastructure development. There is also higher incidence of poverty in more vulnerable region. The high degree of vulnerability in the warm temperate region can in addition be explained by the higher variation in the annual rainfall and temperature variation and more frequent occurrence of occurrence of floods and landslides.

IV. Conclusion

Most of livestock keepers had observed the variation on weather patterns and experienced increased temperature, decreased but erratic precipitation and delayed summer monsoon. The result revealed that highly impoverished livestock keepers from the fragile mountain with limited access to basic services, wealth and assets, are most vulnerable to extreme climatic events than those with better access to services and wealth.

Policies should focus on: the investment on basic services; the inception of livestock insurance, provision of agroecology based technology package to enhance their specific adaptation potential; the strengthening of productive safety net programs through the involvement of governmental and Non Governmental organization. Tackling the problem of vulnerability to climate change among the regions in the Nepal which from the differences in a number of physical and socioeconomic factors requires climate change adaptation policies that implemented within the framework of integrated rural development specially focusing on,

a. Creation of off farm employment opportunities.
b. Provision of credit, training and extension exposure opportunities and climate information.
c. Establishment of cooperatives and agricultural group in the rural areas.
d. Tackling the climate induced hazards like floods, drought and landslide.
e. Water harvest scheme.
f. Rural poverty alleviation program.
g. Income diversification.
h. Improvement in farming practices.

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Appendix 1 : Description of variables used in vulnerability assessment through PCA

Variables	Tropical	Subtropical	Warm temperate	Cool temperate	Total	F-Value
Upper caste	0.92	0.68	0.10	0.03	0.43	107.52***
Radio	0.70	0.60	0.70	0.60	0.65	0.87
TV	0.92	0.82	0.57	0.60	0.73	9.48***
Mobile	1.00	0.93	0.87	0.83	0.91	4.07***
Cycle	0.97	0.15	0.02	0.03	0.29	233.37***
Computer	0.32	0.25	0.02	0.02	0.15	13.21***
Toilet	0.98	0.97	0.85	0.92	0.93	3.354**
Organization	0.57	0.63	0.28	0.48	0.49	5.84***
Access to credit	0.78	0.92	0.72	0.63	0.76	4.96***
Saving	0.45	0.72	0.48	0.50	0.54	3.65**
100 LSU	0.54	0.22	0.08	0.19	0.26	3..27**
Off farm income	0.15	0.07	0.02	0.15	0.10	1.50
Total income	0.32	0.29	0.12	0.28	0.25	2.59*
Economically active members	4.18	3.63	3.82	3.55	3.80	1.44
Food sufficient	0.93	0.17	0.25	0.53	0.47	44.31***
Land	0.97	0.98	0.92	0.88	0.94	2.18*
Access to road	0.95	0.98	0.75	0.73	0.85	9.03***
Access to market	0.80	0.78	0.72	0.68	0.75	0.95
Access to agrovet	0.27	0.12	0.02	0.00	0.10	11.22***
Educated family	3.37	3.43	1.90	1.78	2.62	10.98***
Quality of house	0.38	0.02	0.07	0.07	0.13	17.72***
Cooking source	0.85	0.33	0.20	0.28	0.42	28.63***

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Literacy rate	0.90	0.82	0.68	0.70	0.78	1.85
Rainfall	0.17	0.26	0.26	0.18	0.49	130.08***
Temperature	0.03	0.25	0.25	0.07	0.32	98.93***
Drought	0.03	0.07	0.03	0.17	0.08	3.54**
Flood	0.00	0.15	0.30	0.33	0.20	9.86***
Landslide	0.00	0.18	0.58	0.52	0.32	28.05***

***,** and * Indicate significant at 1, 5 and 10 percent level of significance.

Appendix 2 : Component scores of coefficient for component first through PCA

Indicators	Types of variables	Component scores
Higher caste	Adaptive capacity	0.742
Ownership of radio	Adaptive capacity	0.247
Ownership of TV	Adaptive capacity	0.471
Ownership of cell phone/telephone	Adaptive capacity	0.279
Ownership of cycle	Adaptive capacity	0.761
Ownership of Computer	Adaptive capacity	0.641
Ownership of Toilet	Adaptive capacity	0.265
Member of organization	Adaptive capacity	0.159
Access to credit	Adaptive capacity	0.128
Saving	Adaptive capacity	0.051
Livestock standard unit (100 LSU)	Adaptive capacity	0.375
Off farm income in NRs	Adaptive capacity	0.443
Total income in NRs	Adaptive capacity	0.445
Economically active family members	Adaptive capacity	0.242
Food sufficient	Adaptive capacity	0.442
Ownership of land	Adaptive capacity	0.301
Access to road	Adaptive capacity	0.341
Access to market	Adaptive capacity	0.186
Access to agrovet	Adaptive capacity	0.560
Educated family member	Adaptive capacity	0.512
Quality of house	Adaptive capacity	0.447
Improved cooking source	Adaptive capacity	0.642
Literacy rate	Adaptive capacity	0.108
Rainfall variability	Sensitivity	0.707
Temperature variation	Sensitivity	0.700
Drought	Exposure	-0.390
Flood	Exposure	-0.610
Landslide	Exposure	-0.555

Extraction method: Principal component analysis. Nine components were extracted
Rotation method: Varimax with Kaiser Normalization.

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3. Submission of Manuscripts,

4. Manuscript's Category,

5. Structure and Format of Manuscript,

6. After Acceptance.

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· Use present tense to report well accepted

· Use past tense to describe specific results

· Shun familiar wording, don't address the reviewer directly, and don't use slang, slang language, or superlatives

· Shun use of extra pictures - include only those figures essential to presenting results

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Abstract:

The summary should be two hundred words or less. It should briefly and clearly explain the key findings reported in the manuscript--must have precise statistics. It should not have abnormal acronyms or abbreviations. It should be logical in itself. Shun citing references at this point.

An abstract is a brief distinct paragraph summary of finished work or work in development. In a minute or less a reviewer can be taught the foundation behind the study, common approach to the problem, relevant results, and significant conclusions or new questions.

Write your summary when your paper is completed because how can you write the summary of anything which is not yet written? Wealth of terminology is very essential in abstract. Yet, use comprehensive sentences and do not let go readability for briefness. You can maintain it succinct by phrasing sentences so that they provide more than lone rationale. The author can at this moment go straight to shortening the outcome. Sum up the study, with the subsequent elements in any summary. Try to maintain the initial two items to no more than one ruling each.

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- Fundamental goal
- To the point depiction of the research
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- Significant conclusions or questions that track from the research(es)

Approach:

- Single section, and succinct
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- Center on shortening results - bound background information to a verdict or two, if completely necessary
- What you account in an conceptual must be regular with what you reported in the manuscript
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- Present a justification. Status your particular theory (es) or aim(s), and describe the logic that led you to choose them.
- Very for a short time explain the tentative propose and how it skilled the declared objectives.

Approach:

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- If use of a definite type of tools.
- Materials may be reported in a part section or else they may be recognized along with your measures.

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- Report the method (not particulars of each process that engaged the same methodology)
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- Simplify - details how procedures were completed not how they were exclusively performed on a particular day.
- If well known procedures were used, account the procedure by name, possibly with reference, and that's all.

Approach:

- It is embarrassed or not possible to use vigorous voice when documenting methods with no using first person, which would focus the reviewer's interest on the researcher rather than the job. As a result when script up the methods most authors use third person passive voice.
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What to keep away from

- Resources and methods are not a set of information.
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- Leave out information that is immaterial to a third party.

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The principle of a results segment is to present and demonstrate your conclusion. Create this part a entirely objective details of the outcome, and save all understanding for the discussion.

The page length of this segment is set by the sum and types of data to be reported. Carry on to be to the point, by means of statistics and tables, if suitable, to present consequences most efficiently.You must obviously differentiate material that would usually be incorporated in a study editorial from any unprocessed data or additional appendix matter that would not be available. In fact, such matter should not be submitted at all except requested by the instructor.

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- Present a background, such as by describing the question that was addressed by creation an exacting study.
- Explain results of control experiments and comprise remarks that are not accessible in a prescribed figure or table, if appropriate.
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Approach

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Approach:

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References	Complete and correct format, well organized	Beside the point, Incomplete	Wrong format and structuring

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