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Improving Fish Farming through Intergeneric Hybridization Of*clarias Gariepinus And Heterobranchus Longifilis* In Kebbi State. A Case Study of EMJEH Fish Farm, Birnin Kebbi.

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Abstract
Experiment on intergeneric hybridization of Heterobranchus longifilis (H.L) and Clarias gariepinus (CL) was carried out at the EMJEH Fish farm Birnin Kebbi determine growth performance and survival of the bred hatchlings. Pure crossing of Heterobranchus longifilis and Clarias .gariepinus, intergeneric crosses of male Heterobranchus longifilis with female Clarias gariepinus and male Clarias gariepinus with female Heterobranchus longifilis serve as treatments. Each treatment was replicated three times. Percentage hatchability was 41% 51% 56% and 48% for CL XCL, HL X HL, and HL X CL AND CL X HL respectively. The bred hatchlings were maintained for 12 weeks and result shows that hybrid crosses had the highest percentage survival (95% and 94.5%) and differed significantly P(<0.01) from parental crosses . Length – weight relationshipshow a strong relationship as the (P<0.01) for CL X CL and differed significantly P(<0.05) from other treatment. Both crosses exhibited good growth performances Clarobranchus (1152g) but Heteroclariashad the best growth performance of (1175g) and it is therefore recommended for farmers to culture

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I. INTRODUCTION

There is increase rise of interest in fish farming in Kebbi state in particular and Nigeria at large. Many farmers prefer to culture catfish especially the Clariid family (Genus Clarias and heterobranchus) because they exhibit many qualities that make them suitable for aquaculture. Furthermore, Clay, 1997 and Hecht *et al*, 1988 observed that „" the wide spread distribution of clariid catfish is a reflection of their ability to tolerate a wider range of environmental parameters. Clarias in particular have rapid growth, high reproductive potentials and sturdy resistance to environmental variations.

These traits (qualities) include their ability to withstand adverse environmental conditions such as low dissolved oxygen (DO) and P^H level , can grow on both natural, artificial feed; and highly tolerant to poor water quality (Hulsman and Richer 1987, Nwadukwe, 1995 and Haylor, 2002.(Bruton, 1979; Jothilakshmanam*et al*, 2013). Both species have excellent attributes for fish culture, they are excellent breathers, which make them highly tolerant to low dissolved oxygen (do)level, they are also suitable for high density pond culture.

These good qualities coupled with their high commercial demand, high growth rate , and ability to virtually feed on anything make them highly recommendable for farming in Nigeria(Olutunde, 1983 and Bard *et al*, 1976. A good supply of viable fingerlings is essential for successful aquaculture production. The method of hybridization helps the fish farmer to select desirable characteristics of commercial importance such as fast growth, high percentage survival, resistance against unfavourable environmental and disease conditions etc. which can increase the profitability of the farm (Moses and Olufeagba, 2005)

By and large, the understanding of controlled reproduction of clariid catfish family is paramount. If the demand for viable fingerlings by farmers is to be met. The easiest method is to genetically improve on aquaculture stock or initiate a genetic improvement programme to evaluate performance of strains and choose or utilize the best available ones to replace the existing stocks (Legendere*et al*, 1992)

PROBLEM STATEMENT /JUSTIFICATION

Despite these outstanding qualities, virtues and the potentials of clariid catfish for aquaculture; the overall production of catfish is disappointing considering the losses incurred due to mortality rate during the growing out period; and in order to change the trend, there is need therefore, for us to improve on the potentials

traits of and virtues interest in catfish.

Faster growth result in shorter grown-out cycle and greater production capacity are advantageous for any fish farmer. However, Bakos and Gorda, 1995; Adah*et al*, 2014 observed that „‟some success has been achieved with artificial hybridization of clariid catfish at interspecific and intergeneric levels to improve production characteristics in aquatic organisms. The study, when completed will bring improvement in fish farming activities by use of fast growing, disease resistance and breeds that are adaptable to the prevalent water parameters in Kebbi state, it will also add to the existing knowledge and provide opportunity for further research in this field of study

OBJECTIVES OF THE STUDY

1. To produce hybrids thatare superior to the existing stocks in terms of adaptation, fast growth and disease resistance and survival in Kebbistate.
2. To determine mating combination that will give best growth performance in the water parameters prevalent in Kebbistate.

II. LiteratureReview

DESCRIPTION OF CATFISH

Although more than 100 species of subgenus *clarias* have been described in Africa. A recent research based on the morphological, anatomical and biological studies only 32 valid species were recognised. The subgenus clarias is characterised by an elongated cylindrical body with dorsal fin extremely long nearly reaching or reaching the caudal fin, with both fins consisting of soft rats. The is flattened, highly ossified: the skullbones(aboveandonthesides)forminga„‟casque‟‟‟andthebodyiscoveredwithsmoothscalesscale.The second subgenus of *clariid* catfish is *Heterobranchus*. It has two distinct dorsal fins, namely a rayed dorsal fin with 29-39-6 rays and a fleshy adipose fin of about the same length: the barbells of *Heterobranchus longifilis* are much longer than those of *clarias gariepinus.*Bruton,1979.

Bruton; 1979, Uys and hecht, 1988 „‟ both *clarias gariepinus* and *heterobranchus longifilis* are omnivorous predators

2.2 CATFISH HABITAT

Hetrobranchus and clarias are the freshwater clariid catfish for aquaculture in Africa .Hulsmanet al 1987.Venden et al, 1990 „‟ they are cultured primarily in freshwater ponds in tropical countries where they are widely found.

According to Egwui, (1986) two types of systems are used for catfish farming in Africa. Namely, earthen ponds and concrete ponds. Ponds are used in small and large extensive and semi extensive farming operations. While tanks are are used mainly for the high-density culture of catfish (under either flow-through or water circulatory conditions). Clay, 1997 and Hecht et al, 1988 observed that „‟ the wide spread distribution of clariid catfish is a reflection of their ability to tolerate a wider range of environmental parameters. Clarias in particular have rapid growth, high reproductive potentials and sturdy resistance to environmental variations.

2.3 CULTURINGMETHOD

Salam et al (1993) culturing of catfish can be mono or poly culture systems Mono culure of catfish are condition where fish are kept on only. Polyculture of catfish are ideal for Africa catfish farmers. Heterobraanchus is often poly cultured with Tilapia Oreochromis species, clarias gariepinus has also been used in poly culture with tilapia guinensis under any culture system.

2.4 FEEDING OFCATFISH

Uys and Hecht, (1988) From the age of 6 weeks dietary requirement of clarias gariepinus do not seem to change except that the required daily ration decreases with size. As the fish grows, the relative consumption rate decreases from approximately 10% body weight per day (4weeks) to 2% of body weight per day and food conversion ratio increases from 0.7toi.2

Several types of feeds used to rare catfish in Africa, include various kinds of pellets (formulated catfish pellets) ranging in protein content from 18% - 45%. Salami et‟‟al 1993, Hecht et al 1988.

Non pelletized feeds such as maize bran, cocoa pod husk, brewery wastes have also been used to rear catfish. Haylor, (1992)

2.5 CATFISH HYBRIDIZATION

Moses and Olufeagba (2005). Defined hybridization as „‟the union of gametes from two different species or strains to produce new organisms, some successes has been achieved with the artificial hybridization of Clariid catfish at interspecific and intergeneric levels.‟‟‟‟

At interspecific level *clarias gariepinus* (Burchell) has been hybridized withg*clarias fuscus* (Lacepede) in China. Zhen pan *et al,* 1988 While, at intergeneric level, Salami *et al* reported the highest growth rate in hybrids of *clarias gariepinus* and *heterobranchus bidosalis* and a successful intergeneric hybridization between *heterobranchus longifils* (Val..) and *clarias ggariepinus* has been reported by several authors (Hecht *et al,* 1985, Legendre *et al* 1992

2.6 CHARACTRRISTICS OF HYBRIDS

These traits(qualities) include their ability to withstand adverse environmental conditions such as low dissolved oxygen (DO) and PH level , can grow on both natural, artificial feed; and highly tolerant to poor water quality.
The hybrid cross between *Heterobranchus* and *Clarias* is receiving considerable attention in Africa particularly in Nigeria. These hybrids have been reported to show heterosis or hybrid vigor. Owodeinde*et al* 2011;Nwadukwe, 1995 and Aluko, 1998.
F1 hybrids of this crosses are commonly referred to *heteroclarias*(cross between male *Heterobranchus* and female Clarias) and Clarobranchus (cross between male *Clarias* and female *Heterobranchus*) . These F1 hybrids have been reported to be fertile Aluko, 1995 and Nwadukwe, 1995.
Faster growths result in shorter grow-out cycle and greater production capacity, which are advantageous for many fish farmers. Aluko, 1995.
Adah*et al*, 2014 observed that „"some success has been achieved with artificial hybridization of clariid catfish at interspecific and intergeneric levels to improve production characteristics 2.7.1 **ADVANTAGES OF HYBRIDIZATION**
Aluko, 1999 reported that catfish hybrids generally exhibits intermediate phenotypic characteristics pertaining their parents, also hybrids have advantageous qualities like fast growth, better food conversion, high survival and resistance against unfavourable environmental conditions and diseases. Advantages of hybridization include hybrid vigor and phenotypic uniformity in crossbreedprogeny.

2.7.2 **DISADVANTAGE OF HYBRIDIZATION**

On the disadvantages of hybridization it has been reported that F1 hybrids produced as a results of intergeneric hybridization is fertile, which aquaculture practioners in Nigeria exploited by using the hybrids for breeding purposes. It has been demonstrated that some of the F2 back cross hybrids produced from this F1 hybrids could not be easily differentiated from pure parent *heterobranchu*s and *clarias;* and also have poor growth performance leading to economic loss (Aluko, 1999).
Aluko, (1998); Nwadukwe, (1995) are of opinion that indiscriminate use of F1 fertile brood stocks for further propagation poses threat to the purity of indigenous clariid specie
Aluko, (1999) stressed that the only solution to indiscriminate use of F1 hybrids as brood stock by aquaculturists is to develop sterile F1 through chromosome engineering.

2.8 MARKETING OFCATFISH

The clariid catfish are very popular with aquaculturists and consumers alike and as such command good commercial value in the market. Venden*et al* 1990. The high market value of clariid catfish as food has generated substantial interest among fish farmers in Cameroon and Nigeria. Tave*et al*, 2007

Olufeagba, 1999 it has also been observed that interest in fish farming culture is growing rapidly in Nigeria, if well develop and managed, fish farming could make a significant contribution to the economy of Nigeria.

2.9 LIMITATIONS TO CATFISHCULTURE

The main limitation on the expansion of catfish culture in Africa is the inadequate supply of high quality seed especially at the right time and place for stocking purpose (Charo and Oireri, 2000; Dugan, 2003;Ayinla and Nwadukwe, 2003). Duham*et al* (1987); Hylor, (1992) explained that the availability and good quality of clariid catfish fingerlings for pond stocking can be considered as one of the major constraints to the development and expansion of clariid catfish in most African countries. Nevertheless, the future potentials for farming clariid catfish through their distribution range are immense

III. MATERIALS ANDMETHOD

The experiment is to be carried out at EMJEH fish farm in Birnin Kebbi, Kebbi state. Mature brood stocks of clarias gariepinus and heterobranchus longifilis weighing between 800g -1.5kg were sourced from Labana Fish Farm, Aliero, Kebbi state. They were acclimatised with intensive feeding for one week before the selection and the treatment.

3.1 SELECTION OF BROODSTOCKS.

Male brood stocks were selected based on the rigidity and reddish infusion of their genital papillae while females were selected based on the reddening of their genital openings and distension of their belly, release of the egg on slight pressure applied at the abdomen, the females were intraperitonealy injected withovaprim.

3.2 MILT, EGG COLLECTION ANDINCUBATION

Heterobranchus with longer latency period of 15 hours is induced three (3) hours before Clarias with relatively lower 12 hours latency period. Stripping and milt collection was done between 10-12 hours after the inducement.While, the male fish were sacrificed to collect their milt. The fertilization of the egg (mixing of egg and milt) was carefully done with a clean feather for 2-3 minutes, little quantity of saline solution was added to the mixture to prevent sticking together and label on petri-dishes as thus,

PARENTAL CROSSES

Male		Female	
CG	X	CG	= Clarias gariepinus
HL	X	HL	= Heterobranchus longifilis.

INTERGENERIC CROSSES

CG	X	HL	= Claro-branchus
HL	X	CG	= Hetero-clarias.

Each treatment will be triplicated and incubated in 12 aquaria with well aerated and controlled temperature of between 27^{O}C- 29^{O}C. The fertilized egg was then rinsed with distilled waterand introduced into the hatching troughs containing kakabans for incubation. Water aeration was maintained by flow-through-system The hatchlings are expected after 12hours of incubation. When hatching was completed, dead eggs were removed and egg shell and dead eggs that fell down the trough weresiphoned

100 frys were stocked per aquaria (300) per treatment, after yolk absorptions, frys were fed with artemia at interval of 6 hours that is 4 times daily.water quality parameters such as water pH, temperature and dissolved oxygen were monitored.

Percentage hatchability, survival and growth performance were takenusing NIFFR standard of 1g of fertilised egg is equal 800 pieces of egg was used to determine total number of fertilised eggs while,

$$\%\text{Hatchability}=\frac{Totaumberof\quad atc\quad edegg}{Total\ number\ of\ fertilized\ egg}\ X\ 100$$

$$\%\text{survival}=\ \frac{Number\ of survival}{Totalnumberoffis\quad stoced}\ X100$$

SETTING INDOOR EXPERIMENT

Indoor experiment was set, hatchlings monitored and intensively fed with artemia, while indoor, pool weight, length and survival was taken on the 15^{th} day of hatching.After two weeks indoor, fingerlings were transfer to outdoor tanks

SETTING OUTDOOR EXPERIMENT

At outdoor each treatment was be duplicated and stocked into 8 tanks at 100 fingerlings per tank,(200) fingerlings per treatment. They were fed with COPPENS/BLUE CROWN feeds as shown

0.2 mm-0.3mm	3weeks
0.3 mm-0.5mm	4weeks
0.5mm-0.8mm	3weeks
0.8mm-0.9mm	5 weeks

Regular weekly sampling for pool weight, length was carried out 12 weeks. Then sampling was done every two weeks, on the last sampling morphometric measurements and meristic counting of each treatment was also carried out

Experimental design and statistical analysis

Complete Random sampling was used for the experiment. The data obtained were subjected to one way analysis of variance (ANOVA) and all differences in mean value of parameters were determined at P=0.05 level of significance. Tukey-kremerMultiple comparison test was used to determine length /weight relationship while Bartlett method was used for mean separation.

IV. RESULTS

The result of percentage hatchability (Table 1.0) show that there is significant difference (P<0.05) between the two genera and their hybrids there was also a significant difference in respect to their indoor survival (Table 1.1) and growth (Table 2.1). However, the two hybrids had the best indoor percentage survival of 86% each; while, the parental crosses clarias gariepinus and heterobranchus longifilis had 881% and 75% respectively.But the outdoor percentage survival (Table 1.1) at the time of terminating this report recorded 84% and 95% for Clarobranchus and heteroclarias respectively and the parental crosses having 71.5%each.

The initial growth performance indoor of the parental crosses and the hybrids crosses was extremely significant (P=0.0001) and slight significant difference (P<0.05) between the growth performance of the two hybrid crosses (Table 2.1). The indoor final result (Table 2.2) shows no significant difference (P>0.005)between both hybrid crosses; but the parental crosses indicated a significance difference (P<0.05) in their growth performances.

The early outdoor observation of parental crosses (Table 3.2) show that they maintain their growth performance obtained indoor for the first few weeks but later observations (Table 3.2) indicated no significance difference (P>0.05) in the growth performance of the four treatments. Additionally, it was observed that there is little significance difference (P>0.01) between the length gained by parental crosses and hybrid crosses; and no significance (P>0.05) between the length gained by hybrids (Table 3.3).

Finally (Figure 4.1) is a chart showing the final growth performance of the four treatments indoor and (Figure 4.2) showed the weekly growth performance of the four treatments outdoor.

V. Discussion

The low percentage hatchability of 41% was recorded for parental clarias gariepinus due to egg color (white) this is in contrast to result reported (moses and olufeagba, 2005) which show high percentage hatchability for clarias and high percentage for other treatments. However percentage hatchability of 56% was recorded in heteroclarias hybrids and parental heterobranchus longifilis which also corroborate part of the findings of the above named authors, Nwadukwe 1993 reported high percentage hatchability of 40-70% for heterobranchus longifilis.

The highest indoor survival of 86% were reported for the hybrid crosses, the same result was reported by Yisaetal , 2015 ; Ataguba, (2012).This isattributed to egg and milt quality/viability which resulted in hatchling with good vigour and a chance for high survival trait. This is in contrast to report by Olufeagba, 2000 who recorded highest percentage survival of 72.5 and 58.75 for parental crosses clarias gariepinus and heterobranchus longilis. The statistical analysis shows that no significant difference (P<0.05) in indoor survival rate as also obtained by olufeagbaetal; (2000)too.

At the twelfth week of outdoor rearing, both hybrids were observed to have better survival rate of 84% and 95% for heteroclarias and clarobranchus (table 1.1), similar result was reported by Aluko, (1999). Mortality rate in parental clarias cross may be due to some factors highlighted by Yisaetal; 2015 poor quality of egg and milt, quantity of eggs stripped, transition from yolk sac feeding to exogenous feeding as observed by Nlewadin and Madu(2004). The result show that no significant difference (P<0.05) in survival out door for all treatments. The same result was reported by Salami etal: (1993) and olufeagba, (2000).

Clarias was observed to have better growth performance indoor 9.00 (Table 2.2) and the least 4.57 was recorded for heterobranchus. The growth advantage exhibited by clarias may be due to its sturdy resistance to environmental variations and hardy nature (clay, 1997) and poor growth performance of heterobranchus may be due to its docility and slow or gradual responses to environmental variations. (Ollevier, etal (2000).

Maduetal, (1992) reported that „" no distinct heterotic characteristics where exhibited by hybrids at fry stage…."" This might probably be one of the reasons why low indoor growth performances were recorde for the hybrid crosses.

The statistical analysis shows no significance difference (P>0.05) between the growth performance of the parental crosses while a slight significance difference (P<0.01) in growth performance was observed between the parental and hybridcrosses.

The final growth performance indicated that the hybrids has the best growth rate of 11.75 and 11.52 for Clarobranchus and heteroclarias respectively. Although statistical analysis indicated no significance difference(P>0.05).

The relationship between length and body weight of the parental and hybrid crosses show a strong relationship as the (P<0.01) thus increase in length leads to increase in body weight. This observation was made by Gupta and Gupta (2013) as reported by Yisaetal (2015). This is clear indication for good response to feed by fish which makes it robust, plumpy and healthier.

VI. CONCLUSION

From the research carried out, it was observed that the intergeneric hybrids crosses still perform better than the parental crosses. Heteroclarias exhibited growth performances probably due to in inherited traits from its male Heterobranchus parent (1175mg) while clarobranchus had longer length due to inherited length trait from its male clariasparent(88.7cm)

VII. RECOMMENDATIONS

From the aforementioned it is recommended that the production of hybrids of male heterobranchus and female clarias (Heteroclarias) be massively embarked upon.
Fish farmers should be encouraged to culture this high breed for its fast growth and sturdy resistance to environmental variations.

TABLE 1.0
PERCENTAGE HATCHABILITY

GENETIC COMBINATION	PERCENTAGE HATCHABILITY
PARENTAL CROSSES MALE FEMALE CL X CL	41^{d}
HL X HL	51^{b}
INTERGENERIC CROSSES MALE FEMALE HL X CL	56^{a}
CL X HL	48^{c}

a-d means with different superscript within column are significantly different (P<0.05)

TABLE 1.1
PERCENTAGE INDOOR AND OUTDOOR SURVIVAL

GENETIC COMBINATION	% SURVIVAL INDOOR	% SURVIVAL OUTDOOR
PARENTAL CROSSES MALE FEMALE CL X CL	81^{b}	71.5^{a}
HL X HL	75^{b}	71.5^{a}
INTERGENERIC CROSSES MALE FEMALE HL X CL	86^{a}	84^{b}
CL X HL	88^{a}	95^{b}

Treatments with the same superscript within column are not significantly different (P>0.05)

TABLE 2.1
INITIAL GROWTH PERFORMANCE INDOOR

GENETIC COMBINATION			INITIAL WEIGHT INDOOR
PARENTAL CROSSES			
MALE		FEMALE	
CL	X	CL	0.12^{b}
HL	X	HL	0.06^{d}
INTERGENERIC CROSSES			
MALE		FEMALE	
HL	X	CL	0.09^{a}(ab)
CL	X	HL	0.14^{a} (ab)

a-d means are extremely significant difference (P<0.0001)
ab-ab means slightly significant difference P<0.05)

TABLE 2.2
FINAL GROWTH PERFORMANCE INDOOR

GENETIC COMBINATION			FINAL WEIGHT INDOOR
PARENTAL CROSSES			
MALE		FEMALE	
CL	X	CL	9.00^{b}
HL	X	HL	4.57^{c}
INTERGENERIC CROSSES			
MALE		FEMALE	
HL	X	CL	5.00^{ab}
CL	X	HL	5.90^{ab}

ab-ab with the same superscript within the column means no significant difference (P>0.05)
b-c with different superscripts wiyhin column shows significant difference (P<0.05)

TABLE 3.1
INITIAL GROWTH PERFORMANCE OUTDOOR

GENETIC COMBINATION			INITIALMEAN WEIGHT OUTDOOR
PARENTAL CROSSES			
MALE		FEMALE	
CL	X	CL	9.90^{a}
HL	X	HL	5.25^{c}

INTERGENERIC CROSSES MALE X FEMALE HL X CL	5.20^{d}
CL X HL	6.35^{b}

a-b means different superscripts within column shows a significant difference P<0.01)

TABLE 3.2
FINAL GROWTH PERFORMANCE OUTDOOR (4 MONTHS)

GENETIC COMBINATION	FINAL WEIGHT INDOOR
PARENTAL CROSSES MALE X FEMALE CL X CL	$876g^{b}$
HL X HL	$996g^{b}$
INTERGENERIC CROSSES MALE X FEMALE HL X CL	$1175g^{a}$
CL X HL	$1152g^{a}$

Treatments with the same superscripts show no significant difference P>0.05)

TABLE 3.3
INDOOR AND OUTDOOR FINAL MEAN LENGTH

GENETIC COMBINATION	FINAL MEAN LENGTH INDOOR	FINAL MEAN LENGHT OUTDOOR
PARENTAL CROSSES MALE X FEMALE CL X CL	$7.67g^{aa}$	$8.87g^{a}$
HL X HL	5.51^{dd}	7.42^{b}
INTERGENERIC CROSSES MALE X FEMALE HL X CL	5.96^{bb}	7.37^{c}
CL X HL	5.64^{cc}	7.07^{d}

aa-bb Treatments with different superscript within column shows are significant difference in length (P<0.01).
bb-cc different superscript mean within column show no significant difference (P>0.05)
c-d different superscript mean within column show no significant difference (P>0.05)

Figure 4.1

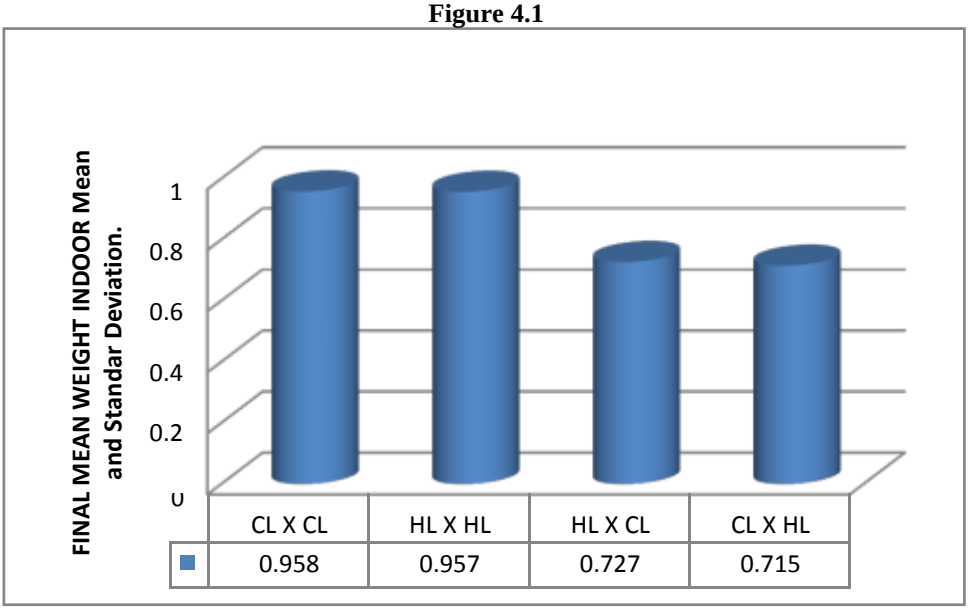
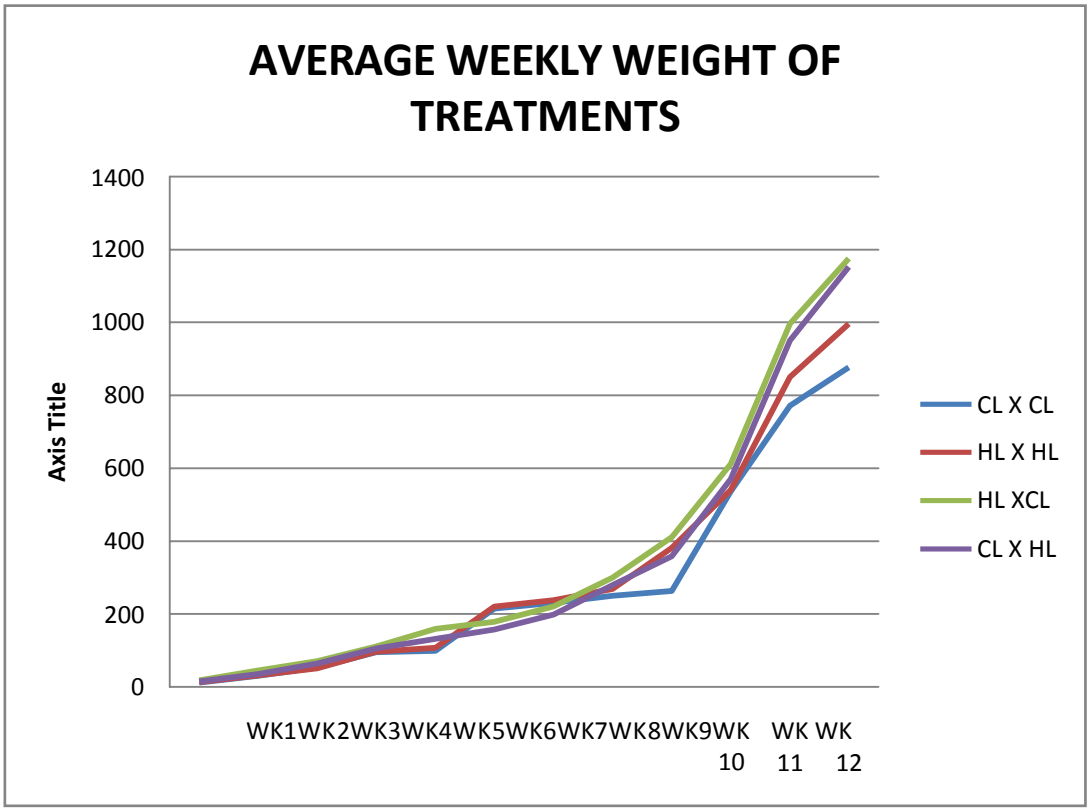


Figure 4.2
AVERAGE WEEKLY WEIGHT

	WK 1	WK 2	WK 3	WK 4	WK 5	WK 6	WK 7	WK 8	WK 9	WK 10	WK 11	WK 12
CL X CL	11.25	30	52.9	94.6	98.5	213.9	229.6	249.11	262.5	535	770.5	876
HL X HL	12.96	31.2	50.33	96.5	106.6	220.35	237.6	268.5	381.3	540	850	996
HL XCL	17.2	44.8	69.53	110.5	159	177.7	220	298.75	409.5	610.6	995.5	1175
CL X HL	14.5	34.5	63.43	105	131.65	156.65	198.15	278.65	357.6	570	950.4	1152



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