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Brandon, Wiles N.; Dudenhoeffer, Gregory A.; Zhang, Yongfang; and Omara-Alwala, Thomas R., "Biweekly Growth Characteristics of Juvenile Bluegill Fed Different Protein Diets" (2016). *Cooperative Extension Research Publications*. 7.
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BIWEEKLY GROWTH CHARACTERISTICS OF JUVENILE BLUEGILL FED DIFFERENT PROTEIN DIETS

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Abstract

*Wiles, N. Brandon, G. A. Dudenhoeffer, Y. Zhang, and R.T. Omara-Alwala. Department of Agriculture and Environmental Science, Lincoln University. BIWEEKLY GROWTH CHARACTERISTICS OF JUVENILE BLUEGILL FED DIFFERENT PROTEIN DIETS. This study evaluated growth rates of juvenile bluegill (*Lepomis macrochirus*) fed different protein levels, raised indoors. Six experimental diets containing protein levels of 32, 35, 38, 41, 44, and 47% with 346 kcal/g energy were fed to four replicates of 12 fish with initial mean weight of 24.9±0.51g. Fish were fed by hand to satiation three times daily for 16 weeks. Percent weight gain, for fish fed 32, 35, 38, 41, 44 and 47% protein diets were 180.5±43.8, 203.6±32.33, 256.4±19.4, 235.8±20.63, 249.1±19.59, and 275.2±47.3, and specific growth rates 0.91±0.15, 0.98±0.10, 1.13±0.05, 1.08±0.05ab, 1.11±0.05ab, and 1.17±0.11a, respectively for the study. Biweekly mean weight differences ($p \leq 0.05$) occurred after week eight, with fish fed 47% diet consistently having higher mean weight than those fed 32%. Biweekly weight gain was consistently different after week two between fish fed 47% and 32% protein. However, fish fed 38 and 44% diets sometimes had significantly more gain than those fed 32 and 35%. Biweekly feed consumption differed after week ten with fish fed 47 and 38% consistently consumed more food than fish fed 32% protein. Feed conversion ratio differences occurred at every period with the most common differences seen between the 32 and 47% groups. This study indicated that growth characteristics could be improved with higher protein diets in juvenile bluegill.

Introduction

Bluegill (*Lepomis macrochirus*) is a popular sport fish throughout the United States. Bluegill has potential of becoming a food fish due to its popularity as a sport fish and production attributes such as accepting commercial feed, ability of handling high stress and poor water quality (Heidinger 1975; Brunson & Robinette 1983). Culturing bluegill can provide income opportunities for aquaculture producers and many pond owners in Missouri. About half (45%) of the ~250 fish growers in the Northern Central Region of the United States are involved rearing bluegill mostly used for sport fishing and pond stocking (Morris & Mischke 2003). A major problem associated with bluegill in an aquaculture setting is the lack of nutritionally balanced and affordable diets (Morris & Mischke 2003). Little information is available on the growth patterns of bluegill. The objective of this study was to determine the biweekly growth characteristics of juvenile bluegill fed different levels of protein diet kept in indoor recirculating aquaculture system.

Materials and Methods

Experiment Design, Data Analysis :

- A completely randomized design was used with 4 replications per treatment.
- Treatments consisted of six formulated diets containing protein levels of 32, 35, 38, 41, 44, and 47% with a digestible energy level of 346 kcal/g.
- Experimental tanks were stocked with 12 juvenile bluegill ranging from 20-30 g, with a mean body weight \pm standard deviation of 24.9 \pm 0.5 g and were allowed to acclimate for one week.
- Fish were fed three times daily at 0800, 1200, and 0400 h by hand for 16 weeks.
- Feed consumption was recorded daily and fish were weighed initially and biweekly thereafter.
- Reported data included biweekly growth rate, feed consumption, feed conversion rate (FCR), Specific growth rate (SGR) and percent weight gain for duration of the study.
- Data was analyzed by a one-way ANOVA (SAS version 9.1). Means were separated by Fisher's Least Significant Difference (LSD) (Steele and Torrie, 1980).

Culture System:

- Water recirculating aquaculture system was composed of flat bottom round tanks (~151-L; 40-gal) with valve controlled inlet pipes and centrally located internal standpipes. Water residence time ranged from 30 to 45 minutes. Sump tank, bead filter, and submerged media bio-filter were other components of the system.
- Mean water temperature and dissolved oxygen \pm standard deviation was 24.2 \pm 0.44°C and 7.26 \pm 0.46 mg/L, respectively.

Experimental Fish:

- Two Northern Bluegill (*Lepomis macrochirus*) broods were produced from offspring of wild stock held at the Lincoln University Aquaculture Research Center on Allen T. Busby Farm.
- Larvae were fed brine shrimp, *Artemia nauplii* spp for 14 days after nest exodus and then weaned on dry fish feed (Bio-Oregon) until stocked into experimental tanks.

Results

Table 1. Specific growth rate and weight gain (%) for duration of study

	32%	35%	38%	41%	44%	47%
SGR	0.91±0.15c	0.98±0.10bc	1.13±0.05a	1.08±0.05ab	1.11±0.05ab	1.17±0.11a
Gain (%)	180.5±43.8c	203.6±32.33c	256.4±19.4a	235.8±20.63a	249.1±19.59a	275.2±47.3a

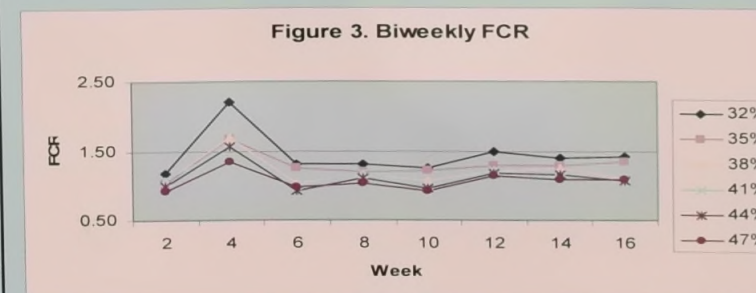
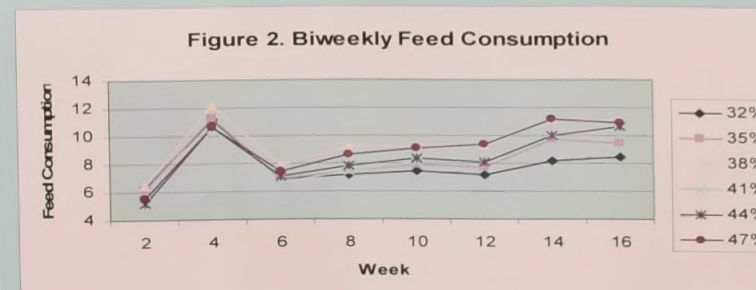
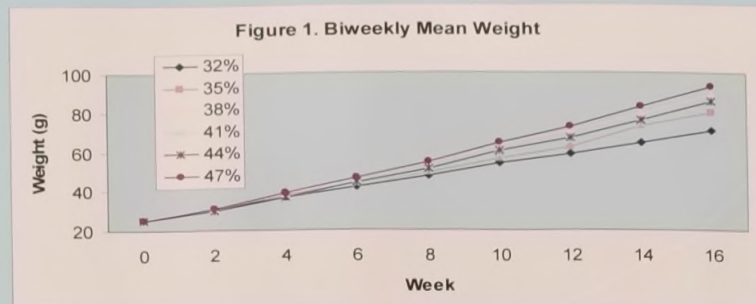


Table 2. Formulation and composition of diets fed to bluegill

Protein (%)	32	35	38	41	44	47
Formulation (% by weight)						
Fish meal *	48.08	52.81	57.54	62.27	67.00	71.73
Wheat midds	4.00	4.00	4.00	4.00	4.00	4.00
Dextrin	23.00	20.00	17.00	14.00	10.90	8.00
Fish Oil *	9.65	9.24	8.82	8.41	8.00	7.58
Vitamin Mix ^b	3.00	3.00	3.00	3.00	3.00	3.00
Mineral premix ^c	0.10	0.10	0.10	0.10	0.10	0.10
Ascorbic Acid	0.05	0.05	0.05	0.05	0.05	0.05
CMC ^d	2.00	2.00	2.00	2.00	2.00	2.00
Choline Chloride	0.80	0.80	0.80	0.80	0.80	0.80
Cellulose	9.32	8.00	6.69	5.37	4.15	2.74
Proximate composition and energy calculation						
Crude Protein (%)	32.16f±0.30	35.00±0.38	38.28d±0.26	41.28c±0.40	44.56b±0.40	46.88a±0.44
Crude Lipid (%)	13.34±0.05	13.39b±0.11	13.56ab±0.19	13.60ab±0.11	13.66ab±0.19	13.84a±0.18
Ash (%)	12.28f±0.01	13.28e±0.02	14.56d±0.18	15.43c±0.22	16.57b±0.17	17.59a±0.25
Moisture (%)	4.96f±0.01	5.13e±0.01	5.22d±0.04	5.48c±0.01	5.59b±0.03	5.70a±0.05
Digestible Energy ^e	346.04	346.02	345.99	346.01	345.64	345.97

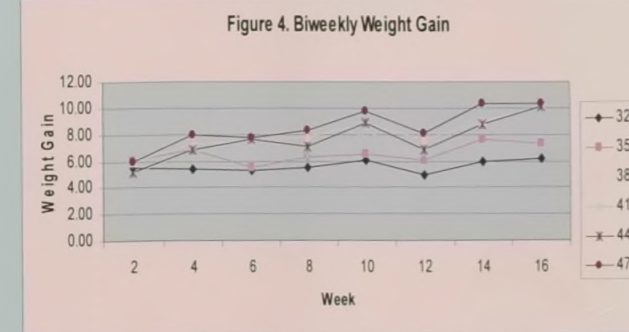
* Menhaden fish meal and oil

^bVitamin premix

^cTrace mineral premix

^dCarboxymethyl cellulose sodium salt

^eCalculated energy



Discussion

➤ Significant difference in Specific Growth Rate (SGR) and percent weight gain occurred in fish fed 38 and 47% protein diets and those fed 32 and 35% protein diets.

➤ Biweekly fish mean weight differences occurred after the 8th week and continued thereafter. The most frequent difference observed were between fish fed 47% and those fed 32% dietary protein diets.

➤ Biweekly FCR differences occurred immediately with a similar pattern as biweekly weight gain. However biweekly feed consumption differences did not occur until week 10 in the study.

➤ Biweekly weight gain difference occurred after the 2nd week between fish fed 47 and 32% protein diets and similar trends continued thereafter.

➤ Diets containing 38% protein could be adequate for optimal growth of bluegill. Most differences in growth characteristics were seen between fish fed 32 and 35% dietary protein and those fed 38% dietary protein and above. Little to no differences occurred among fish fed the higher protein levels.

Conclusion

➤ This study demonstrated that dietary protein levels could affect biweekly growth characteristics of juvenile bluegill.

➤ Juvenile bluegill fish fed diets with protein levels of 38, 41, 44, and 47% had improved growth characteristics than those fish fed diets containing 32 and 35% protein.

➤ The study indicated that diets containing protein levels of 38% were adequate to produce good growth characteristics in juvenile bluegill.

Acknowledgements

➤ This project was supported by USDA/NIFA Evans-Allen Agricultural Research Project. We would like to thank the Lincoln University Aquaculture team for assistance in this study.



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