

Growth, immunity and ammonia excretion of albino and normal *Apostichopus japonicus* (Selenka) feeding with various experimental diets

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Abstract

An experiment was conducted to evaluate the effects of six experimental diets on growth performance, ammonia excretion and immunity of albino and normal *Apostichopus japonicus*. A factorial design was used, the factors being type of diets (six levels) and colour of *A.japonicus* (two levels). A total of 30 randomly selected albino *A.japonicus* were housed in each (60 x 50 x 30 cm(3)) of 18 blue plastic aquaria to form six groups in triplicate, and the same set-up was used for the normal *A.japonicus*. Each group of animals was fed with one of the six experimental diets. Apparent dry matter digestibility (ADMD) and apparent crude protein digestibility (ACPD) were analysed using acid-insoluble ash (AIA) content method. At the end of the experiment, all *A.japonicus* were harvested and weighed to calculate growth parameters. After weighing, six individuals from each aquarium were randomly sampled for immune indices. Results indicated that all growth parameters of *A.japonicus* increased with decreasing nutrient content in their diets ( $p < .01$ ), whereas an opposite result was observed in case of the ammonia-nitrogen production by *A.japonicus*. Normal *A.japonicus* grew better ( $p < .01$ ) and produced lower ( $p < .01$ ) quantity of ammonia nitrogen compared to the albino *A.japonicus*. Immunity particularly superoxide dismutase and lysozyme activities was higher ( $p < .05$ ) in normal compared to albino *A.japonicus*. Considering all measured variables, D1 (diet containing crude protein, crude lipid, carbohydrate and crude ash 51.8, 8.7, 231.3, 708.2 g/kg, respectively) was the best diet among all experimental diets. More research is still needed to optimize nutrients in the diet of *A.japonicus*, as this study does not provide information about critical threshold level of nutrients in diets. Until then, diet D1 can be recommended for *A.japonicus* aquaculture.

Keywords

Author Keywords: ammonia excretion; apparent digestibility; diet; growth; immunity; metabolism; sea cucumber  
KeyWords Plus: CARP CYPRINUS-CARPIO; SHRIMP LITOPENAEUS-VANNAMEI; SEA-CUCUMBER; COMMON CARP; DIGESTIBILITY; FISH; SEAWEED; PROTEIN; PONDS

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**Cited References: 39**

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1.	<b>Noncellular nonspecific defence mechanisms of fish</b> By: Alexander, John B.; Ingram, George A. Annual Review of Fish Diseases Volume: 2 Issue: 0 Pages: 249-279 Published: 1992	Times Cited: <b>338</b>
2.	Title: [not available] By: *AOAC OFFICIAL METHODS ANA Pages: 1298 Published: 1990	Times Cited: <b>114</b>
3.	<b>EVALUATION OF ACID-INSOLUBLE ASH AS AN INDICATOR OF FEED DIGESTIBILITY IN RAINBOW-TROUT (SALMO-GAIRDNERI)</b> By: ATKINSON, JL; HILTON, JW; SLINGER, SJ CANADIAN JOURNAL OF FISHERIES AND AQUATIC SCIENCES Volume: 41 Issue: 9 Pages: 1384-1386 Published: 1984	Times Cited: <b>123</b>
4.	<b>The myths surrounding people with albinism in South Africa and Zimbabwe</b> By: Baker, Charlotte; Lund, Patricia; Nyathi, Richard; et al. JOURNAL OF AFRICAN CULTURAL STUDIES Volume: 22 Issue: 2 Pages: 169-181 Published: 2010	Times Cited: <b>14</b>
5.	<b>PERFORMANCE OF ALBINO AND NORMAL CHANNEL CATFISH (ICTALURUS-PUNCTATUS) IN DIFFERENT WATER TEMPERATURES</b> By: BONDARI, K FISHERIES MANAGEMENT Volume: 15 Issue: 3 Pages: 131-140 Published: 1984	Times Cited: <b>5</b>
6.	<b>RAPID AND SENSITIVE METHOD FOR QUANTITATION OF MICROGRAM QUANTITIES OF PROTEIN UTILIZING PRINCIPLE OF PROTEIN-DYE BINDING</b> By: BRADFORD, MM ANALYTICAL BIOCHEMISTRY Volume: 72 Issue: 1-2 Pages: 248-254 Published: 1976	Times Cited: <b>201,826</b>
7.	<b>Activities and characterization of bacteriolytic substances in serum, skin and intestine mucus of grass carp</b> By: Chen, C. F.; Ji, G. L. Journal of Huazhong Agricultural University Volume: 11 Pages: 276-279 Published: 1992	Times Cited: <b>17</b>
8.	<b>Generation of superoxide anion and SOD activity in haemocytes and muscle of American white shrimp (Litopenaeus vannamei) as a response to beta-glucan and sulphated polysaccharide</b> By: Cordova, Al; Hernandez-Saavedra, NY; De Philippis, R; et al. FISH & SHELLFISH IMMUNOLOGY Volume: 12 Issue: 4 Pages: 353-366 Published: APR 2002	Times Cited: <b>147</b>
9.	<b>EFFECTS OF FOOD-SUPPLY, HUNGER, DANGER AND COMPETITION ON CHOICE OF FORAGING LOCATION BY THE 15-SPINED</b>	Times Cited: <b>62</b>

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|-----|---|-------------------------|
| 10. | <b>DUMAS METHOD FOR NITROGEN IN FEEDS</b><br>By: EBELING, ME<br>JOURNAL OF THE ASSOCIATION OF OFFICIAL ANALYTICAL CHEMISTS Volume: 51 Issue: 4 Pages: 766-& Published: 1968   | Times Cited: <b>69</b>  |
| 11. | Title: [not available]<br>Group Author(s): FAO<br>FishstateJ Published: 2016<br>Publisher: FAO Fisheries Statistics Software, Rome, Italy   | Times Cited: <b>1</b>   |
| 12. | Title: [not available]<br>Group Author(s): FBMA (Fisheries Bureau of Ministry of Agriculture)<br>China fishery statistical yearbook Published: 2013<br>Publisher: China Agriculture Press, Beijing, China   | Times Cited: <b>2</b>   |
| 13. | <b>Immune response of sea cucumber <i>Apostichopus japonicus</i> coelomocytes to several immunostimulants in vitro</b><br>By: Gu, Min; Ma, Hongming; Mai, Kangsen; et al.<br>AQUACULTURE Volume: 306 Issue: 1-4 Pages: 49-56 Published: AUG 15 2010   | Times Cited: <b>44</b>  |
| 14. | <b>STUDIES ON A VARIANT ALKALINE-PHOSPHATASE IN SERA OF PATIENTS WITH HEPATOCELLULAR CARCINOMA</b><br>By: HIGASHINO, K; HASHINOTSUME, M; TAKAHASHI, Y; et al.<br>CLINICA CHIMICA ACTA Volume: 40 Issue: 1 Pages: 67-+ Published: 1972   | Times Cited: <b>123</b> |
| 15. | <b>Effect of sunlight intensity and albinism on the covering response of the Caribbean sea urchin <i>Tripneustes ventricosus</i></b><br>By: Kehas, AJ; Theoharides, KA; Gilbert, JJ<br>MARINE BIOLOGY Volume: 146 Issue: 6 Pages: 1111-1117 Published: APR 2005   | Times Cited: <b>31</b>  |
| 16. | <b>DETERMINATION OF AMMONIA IN LOW CONCENTRATIONS WITH NESSLERS REAGENT BY FLOW INJECTION ANALYSIS</b><br>By: KRUG, FJ; RUZICKA, J; HANSEN, EH<br>ANALYST Volume: 104 Issue: 1234 Pages: 47-54 Published: 1979  | Times Cited: <b>91</b>  |
| 17. | <b>Comparisons of serum contents of immunoglobulin, complement 3, complement 4 and fifty percent hemolytic unit of complement between FMMU albino guinea-pigs and pigment ones</b><br>By: Li., Y.; Guo., G.-H.; Gu., W.-W.<br>Progress in Veterinary Medicine Volume: 24 Pages: 91-92 Published: 2003<br>in Chinese with English abstract                   | Times Cited: <b>1</b>   |
| 18. | <b>Measurement of malondialdehyde in fish: A comparison study between HPLC methods and the traditional spectrophotometric test</b><br>By: Mendes, Rogerio; Cardoso, Carlos; Pestana, Carla<br>FOOD CHEMISTRY Volume: 112 Issue: 4 Pages: 1038-1045 Published: FEB 15 2009   | Times Cited: <b>75</b>  |
| 19. | <b>Growth and survival of normal coloured and albino clarias gariepinus and their reciprocal hybrids</b><br>By: Onyia., U. L.; Ochokwu., I. J.; Akume., C. P.<br>Nigerian Journal of Fisheries and Aquaculture Volume: 4 Pages: 22-27 Published: 2016   | Times Cited: <b>1</b>   |
| 20. | <b>Comparisons on immunity indicator of Serum Between FMMU Albino Guinea-Pigs and Pigment Ones (<i>Cavia porcellus</i>)</b><br>By: Qinghua., Chen.<br>Chinese Journal of Animal Husbandry and Veterinary Medicine Volume: 1 Pages: 41 Published: 2009<br>in Chinese   | Times Cited: <b>1</b>   |
| 21. | <b>Competitive interactions under experimental conditions affect diel feeding of two common aquaculture fish species <i>Labeo calbasu</i> (Hamilton, 1822) and <i>Cirrhinus cirrhosus</i> (Bloch, 1795) of southern Asia</b><br>By: Rahman, M. M.; Balcombe, S. R.<br>JOURNAL OF APPLIED ICHTHYOLOGY Volume: 33 Issue: 1 Pages: 146-151 Published: FEB 2017 | Times Cited: <b>1</b>   |
| 22. | <b>Effects of food type on diel behaviours of common carp <i>Cyprinus carpio</i> in simulated aquaculture pond conditions</b><br>By: Rahman, M. M.; Meyer, C. G.  | Times Cited: <b>18</b>  |

JOURNAL OF FISH BIOLOGY Volume: 74 Issue: 10 Pages: 2269-2278 Published: JUN 2009

23. **Effects of intra- and interspecific competition on diet, growth and behaviour of *Labeo calbasu* (Hamilton) and *Cirrhinus cirrhosus* (Bloch)** Times Cited: **18**  
By: Rahman, Mohammad Mustafizur; Verdegem, Marc  
APPLIED ANIMAL BEHAVIOUR SCIENCE Volume: 128 Issue: 1-4 Pages: 103-108 Published: DEC 2010
24. **Effects of co-cultured common carp on nutrients and food web dynamics in rohu aquaculture ponds** Times Cited: **11**  
By: Rahman, Mohammad Mustafizur  
AQUACULTURE ENVIRONMENT INTERACTIONS Volume: 6 Issue: 3 Pages: 223-232 Published: MAY 2015
25. **Common carp (*Cyprinus carpio* L.) alters its feeding niche in response to changing food resources: direct observations in simulated ponds** Times Cited: **31**  
By: Rahman, Mohammad Mustafizur; Kadowaki, Shusaku; Balcombe, Stephen Richard; et al.  
ECOLOGICAL RESEARCH Volume: 25 Issue: 2 Pages: 303-309 Published: MAR 2010
26. **Role of common carp (*Cyprinus carpio*) in aquaculture production systems** Times Cited: **13**  
By: Rahman, Mohammad Mustafizur  
FRONTIERS IN LIFE SCIENCE Volume: 8 Issue: 4 Pages: 399-410 Published: OCT 2 2015
27. **Ontogenetic shift in dietary preference and low dietary overlap in rohu (*Labeo rohita*) and common carp (*Cyprinus carpio*) in semi-intensive polyculture ponds** Times Cited: **22**  
By: Rahman, Mohammad Mustafizur; Hossain, Md Yeamin; Jo, Qtae; et al.  
ICHTHYOLOGICAL RESEARCH Volume: 56 Issue: 1 Pages: 28-36 Published: JAN 2009
28. **Multi-species fishpond and nutrient balance** Times Cited: **19**  
By: Rahman, Mustafizur M.; Verdegem, Marc C. J.  
FISHPONDS IN FARMING SYSTEMS Pages: 79-88 Published: 2007
29. **Optimum dietary protein and lipid levels for growth of juvenile sea cucumber *Apostichopus japonicus*** Times Cited: **30**  
By: Seo, J. -Y.; Lee, S. -M.  
AQUACULTURE NUTRITION Volume: 17 Issue: 2 Pages: E56-E61 Published: APR 2011
30. **Echinoderm fisheries of the world: a review.** Times Cited: **6**  
By: Sloan, N.A.  
Echinoderms Volume: 1984 Pages: 109-124 Published: 1985

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