

**THE EFFECT OF DIETARY INGREDIENTS
MANIPULATION AT VARIOUS LIFE STAGES
OF GIANT FRESHWATER PRAWN,
Macrobrachium rosenbergii PRODUCTION**

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UNIVERSITI MALAYSIA SABAH



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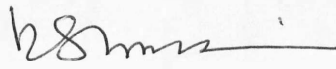
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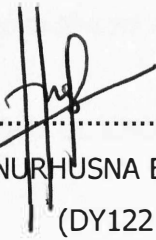
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“In The name of Allah, Most Gracious, Most Merciful”

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ABSTRACT

The present study was carried out to determine the effect of dietary ingredients manipulation at various life stages of giant freshwater prawn, *M. rosenbergii* productions. Four feeding experiments were conducted to investigate the effects of dietary ingredients on the growth performances, survival, feed utilization efficiency and whole body composition of giant freshwater prawn, *Macrobrachium rosenbergii*. In experiment 1, five isoproteic (40 %) and isolipidic (10 %) diets with fishmeal (FM), shrimp meal (SHM), squid meal (SQM), bivalve meal (BVM) and a mixture of SHM, SQM and BVM (MIX) were fed to triplicate groups of broodstock and cultured in a recirculation water system. The mean initial wet weight of females and males broodstock were 30 g and 70 g, respectively and stocked at 5 prawns/tank (1 male : 4 females). The prawn was fed at 3 % of body weight (BW), three times daily (8 am, 12 pm and 5 pm) for 180 days. The fecundities of prawn fed MIX (1449.52 ± 64.15 egg/g female) and BVM (1308.53 ± 40.41 egg/g female) were significantly higher ($P < 0.05$) than those fed SQM (1085.73 ± 62.92 egg/g female), FM (924.84 ± 67.75 egg/g female) and SHM (875.74 ± 28.14 egg/g female). The largest egg diameter was also found in MIX diets (0.567 ± 0.005 mm) and survival of larvae was all diets is very high (95.06 to 99.71 %). The present study revealed that formulated diet based on SHM, SQM and BVM mixture (MIX diet) can be successfully used in the breeding program of *M. rosenbergii*. In experiment 2, five experimental feeding regimes were tested in the larviculture of *M. rosenbergii*: ART (*Artemia* sp.), ART-MIX (*Artemia* sp. + egg custard MIX; a mixture of squid, shrimp and bivalve -based egg custard, with palm oil), ART-PBM (*Artemia* sp. + egg custard PBM; poultry by-product meal-based egg custard with fish oil), egg custard MIX only and egg custard PBM only. Larvae were fed using different feeding regime on stage VI (11 day) thrice daily at 9 am, 12 pm and 5 pm. The larvae were stocked at the rate of 100 larvae/liter in each tank (volume: 70 L) in the static water system. The highest survival was recorded in diet ART-PBM (46.07 ± 0.84 %) and the lowest was in MIX diet (8.87 ± 0.51 %). ART-PBM diet has successfully reduced the rearing period from larvae to post-larvae (PL) stage by 19% compared with ART diet. While, ART-PBM diet can improve the survival from larvae to PL stage by 80 % compared with MIX diet. However, the use of PBM and MIX alone increased the rearing period up to 11 % compared with ART diet. The feeding regime of ART-PBM and ART-MIX has provided nutritional advantages and can be successfully practiced in the hatchery of *M. rosenbergii*. The innovative approach of using poultry by-product meal and palm oil in the egg custard formulation in the present study can provide the prawn hatchery operators with more options in terms of dietary ingredients and cost-effective solutions. In experiment 3, five isoproteic (40 %) and isolipidic (10 %) experimental diets were formulated using PBM to replace FM at 0, 25, 50, 75 and 100 % replacement levels in the PL of *M. rosenbergii*. A total of eighty four PL (initial weight: 0.02 ± 0.01 g) were randomly stocked in rectangular tank (1.05 x 1.05 x 0.36 m; 400L) with triplicate group. The PL was fed at three times daily (9 am, 1 pm and 5 pm). The feeding rate was adjusted from 20 % to 7 % based on their average body weight of each tank. PL was cultured in a recirculation water system for 90 days. The final weight (FW), percentage weight gain (WG) and specific growth rate (SGR) was the highest in diet 75PBM (2.28 ± 0.03 g, 11301.85 ± 165.24 % and 5.06 ± 0.00 %/day, respectively). The best feed conversion ratio (FCR) was observed in 75PBM

(1.52) diet, followed by 25PBM (1.60), 50PBM (1.63), 0PBM (1.77) and 100PBM (1.88). The survival was fairly high (79.37 to 83.73 %) without any significant ($P > 0.05$) difference among treatments. The results showed that up to 75 % of fish meal can be replaced with PBM without adversely affecting the growth performance of PL. In experiment 4, isoproteic (40 %) and isolipidic (10 %) diets with 0 % (control diet), 75 % (75PBM), 80 % (80PBM), 85 % (85PBM), 90 % (90PBM), 95 % (95PBM) and 100 % (100PBM) PBM replacing FM protein were fed to triplicate groups of juvenile prawn (average initial weight: 3.77 ± 0.03 g) and cultured in a recirculation water system at 16 juveniles/ tank (dimension: 49 x 49 x 31 cm; volume 70 L). The prawn was fed three times daily (9 am, 1 pm and 5 pm) at 5 % of their body weight for 40 days. FW, WG and SGR were the highest in 100PBM (9.66 ± 0.21 g, 160.64 ± 7.38 % and 2.06 ± 0.07 %/day, respectively) followed by 95PBM, 80PBM, 85PBM, 75PBM, 90PBM and 0PBM. The FCR during the feeding trials ranged from 1.50 to 2.20. The survival of juvenile prawn (83.33-89.58 %) did not show any significant different ($P > 0.05$) among treatments. The result showed that the utilization of PBM is improved in larger *M. rosenbergii*. In conclusion, manipulation of dietary ingredients such as locally available marine protein (shrimp, squid and bivalve) and PBM can be successfully used in the production of *M. rosenbergii* at different life stages without negatively affecting their performances in terms of growth performance, survival, feed utilization efficiency and whole body composition.



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ABSTRAK

KESAN MANIPULASI RAMUAN PEMAKANAN TERHADAP PENGELUARAN PELBAGAI PERINGKAT HIDUP UDANG GALAH (*Macrobrachium rosenbergii*)

Kajian ini di jalankan untuk menentukan kesan manipulasi ramuan pemakanan terhadap pengeluaran pelbagai peringkat hidup udang galah, *Macrobrachium rosenbergii*. Empat eksperimen pemakanan telah dijalankan untuk mengkaji kesan ramuan pemakanan ke atas prestasi pertumbuhan, kemandirian hidup, kecekapan penggunaan suapan and komposisi seluruh badan udang galah, *M. rosenbergii*. Dalam eksperimen 1, lima diet isoproteik (40 %) dan isolipidik (10 %) dengan tepung ikan (FM), tepung udang (SHM), tepung sotong (SQM), tepung kerang (BVM) dan campuran tepung SHM, SQM dan BVM (MIX) diberi makan kepada tiga kumpulan induk dan di kultur dalam sistem kitar semula air. Purata berat basah permulaan betina adalah 30 g dan jantan adalah 70 g. Udang distok pada kepadatan lima ekor/tangki (satu jantan:empat betina). Udang diberi makan pada kadar 3 % daripada berat badan (BW), tiga kali sehari (8 am, 12 pm dan 5 pm) selama 180 hari. Fekunditi udang yang diberi makan diet MIX (1449.52 ± 64.15 telur/g betina) dan BVM (1308.53 ± 40.41 telur/g betina) adalah lebih tinggi secara signifikan ($P < 0.05$) berbanding dengan diet SQM (1085.73 ± 62.92 telur/g betina), diet FM (924.84 ± 67.75 telur/g betina) dan diet SHM (875.74 ± 28.14 telur/g betina). Diameter telur terbesar juga didapati pada diet MIX (0.567 ± 0.005 mm) dan kemandirian hidup larva dalam semua diet adalah tinggi (95.06-99.71 %). Kajian menunjukkan diet yang dirumuskan berasaskan campuran SHM, SQM dan BVM (MIX diet) boleh berjaya digunakan dalam program pembiakan *M. rosenbergii*. Di dalam eksperimen 2, lima eksperimen rejim pemakanan diuji dalam pengkulturan larva *M. rosenbergii*: ART (*Artemia* sp.), ART-MIX (*Artemia* sp. + kastad telur MIX; kastad telur berasaskan campuran sotong, udang dan kerang dengan minyak sawit), ART-PBM (*Artemia* sp. + kastad telur PBM; kastad telur berasaskan produk sampingan ayam dengan minyak ikan), kastad telur MIX sahaja dan kastad telur PBM sahaja. Larva diberi makan dengan rejim makanan yang berbeza pada peringkat VI (hari 11). Larva diberi makan tiga kali sehari pada 9 am, 12 pm dan 5 pm. Larva dimuatkan pada kadar 100 larva/ liter dalam setiap tangki (isipadu 70 L) menggunakan sistem air statik. Kelangsungan hidup tertinggi dicatatkan pada diet ART-PBM (46.07 ± 0.84 %) dan yang terendah pada diet MIX (8.87 ± 0.51 %). Diet ART-PBM berjaya mengurangkan tempoh pengkulturan dari peringkat larva kepada peringkat post-larva (PL) sehingga 19 % berbanding diet ART. Manakala ART-PBM boleh meningkatkan kemandirian hidup sehingga 80 % dari peringkat larva kepada PL berbanding diet MIX. Namun, penggunaan PBM dan MIX sahaja telah meningkatkan tempoh pengkulturan sehingga 11 %. Rejim pemakanan ART-PBM dan ART-MIX memberi kelebihan dari segi nutrisi dan boleh dipraktikkan dengan jayanya di hatcheri *M. rosenbergii*. Pendekatan inovatif menggunakan produk sampingan ayam dan minyak sawit dalam formulasi kastad telur dalam kajian ini boleh memberikan pengusaha hatcheri udang lebih banyak pilihan dari segi ramuan pemakanan dan penyelesaian kos efektif. Dalam eksperimen 3, lima diet isoproteik (40 %) and isolipidik (10 %) dirumuskan menggunakan PBM untuk menggantikan FM pada kadar penggantian 0, 25, 50, 75

dan 100%. Sejumlah lapan puluh empat PL (berat permulaan: 0.02 ± 0.01 g) diletakkan secara rawak didalam tangki segiempat tepat ($1.05 \times 1.05 \times 0.63$ m; 400 L) dengan kumpulan triplikat. PL diberi makan tiga kali sehari (9 am, 1 pm dan 5 pm). Kadar pemberian makanan diubah daripada 20 % kepada 7 % berdasarkan purata berat badan udang di setiap tangki. PL dikultur dalam sistem kitar semula air selama 90 hari. Berat akhir (FW), peratusan berat badan (WG) dan kadar pertumbuhan spesifik (SGR) adalah tertinggi pada diet 75PBM (masing-masing, 2.28 ± 0.03 g, 11301.85 ± 165.24 % dan 5.06 ± 0.00 %/hari). Nisbah penukaran makanan (FCR) yang terbaik dilihat pada makanan udang 75PBM (1.50) diikuti dengan 25PBM (1.60), 50PBM (1.63), 0PBM (1.77) dan 100PBM (1.88). Kemandirian hidup adalah tinggi (79.37-83.73 %) tanpa sebarang perbezaan bererti ($P > 0.05$) di antara semua rawatan. Hasil kajian menunjukkan 75 % FM boleh digantikan dengan PBM tanpa menjejaskan prestasi pertumbuhan PL. Dalam eksperimen 4, diet isoproteik (40 %) dan isolipidik (10 %) dengan 0 % (diet kawalan), 75 % (75PBM), 80 % (80PBM), 85 % (85PBM), 90 % (90PBM), 95 % (95PBM) dan 100 % (100PBM) PBM menggantikan FM protein diberi makan kepada tiga kumpulan juvenil (purata berat permulaan: 3.77 ± 0.03 g) dan dikultur dalam sistem kitar semula air dengan 16 juvenil/tangki (dimensi: $49 \times 49 \times 31$ cm; isipadu 70L). Udang diberi makan tiga kali sehari (9 am, 1 pm dan 5 pm) pada jumlah 5 % daripada BW selama 40 hari. FW, WG dan SGR adalah tertinggi pada 100PBM (masing-masing, 9.66 ± 0.21 g, 160.64 ± 7.38 % dan 2.06 ± 0.07 %/hari) diikuti dengan 95PBM, 80PBM, 85PBM, 75PBM, 90PBM and 0PBM. FCR sepanjang percubaan makanan adalah antara 1.50-2.20. Kemandirian hidup juvenil (83.33-89.58 %) tidak menunjukkan sebarang perbezaan bererti ($P > 0.05$) di antara semua rawatan. Keputusan menunjukkan penggunaan PBM adalah lebih baik dalam *M. rosenbergii* yang lebih besar. Sebagai kesimpulan, manipulasi ramuan makanan tempatan seperti protein marin (udang, sotong dan bivalvia) dan PBM boleh digunakan dengan jayanya dalam menghasilkan *M. rosenbergii* tanpa memberi kesan negatif pada prestasi pertumbuhan, kemandirian hidup, kecekapan penggunaan makanan and komposisi seluruh badan.

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