FLUCTUATIONS OF LIPIDS DURING THE MOULT CYCLE IN BARYTELPHUSA GUERINI

Author: Dr.Mrs.Tasneem Jahan,Lecturer Department of Zoology,St.Ann's college for Women,Mehdipatnam,Hyderabad.

ABSTRACT

The crustaceans constitute about 30,000 species .They are important from both biological and ecological point of view.The Y-organ is a moulting gland in crustaceans that secrete ecdysteroids,a moulting hormone,which is a dietary lipid.The concentration of lipids fluntuates during the moult cycle.

KeyWords: ***Barytelphusa guerini,Moult Cycle,Lipids Fluctuation***

INTRODUCTION:

Lipids are important in all living systems as energy reserves and as structural components of membrane and cellular organelles . Optimization of lipid storage and mobilization of lipid reserves are critical to the reproductive and developmental success of crustaceans. The lipid metabolism in these animals therefore provides some of the biochemical and physiological processes regulating adaptive responses and reproductive success (Capuzzo and Leavitt , 1988).

Lipid metabolism is under endocrine control in crustaceans.Lipids not only play a metabolic role but they are of utmost importance in maintaining the structure and physiological integrity of cellular and subcellular membranes .Lipids are a major source of energy in marine invertebrates including shrimp, *Penaeus monodon* , they are involved in several essential processes for like growth, moulting and reproduction (Yepiz-Plascensia *et al* .,2000) .

The Y-organ is paired gland in crustaceans that secrete a class of steroid hormones (ecdysteroids) that regulate growth, moulting and development. Ecdysteroids in crustaceans fluctuates during the moult cycle , as in *Hommarus americanus* (Synder and Chang,1990), *Orchestia cavimana* (Graf and Delbecque,1987),*Cancer antennarius* (Spaziani *et al* .,1989) . Ecdysteroids are the derivatives of cholesterol , and is essential for crustaceans .Cholesterol is indeed known to meet several endocrine functions , and its mobilization during maturation was reviewed by Harrison (1990) . It is also an important lipid class and is assumed to be an essential dietary lipid for shrimp maturation and reproduction (Wouters *et al* ., 2001) .

Rapid lipid accumulation or rapid utilization of lipids depends on the life history stage occurred at other times of the year . Specifically , once females were fully mature and bearing broods, they begin to utilize their lipid stores rapidly (Nicole *et al* ., 2004).

In crustaceans the main storage organ for lipids is generally the hepatopancreas.This is under the control of endocrine system,The lipid content will increase at mid premoult stage . A high level of dietary cholesterol can give an increased moulting rate with a shorter intermoult stage and might also result in reduced growth (Saravanan *et al* ., 2008).

The present study is focused on, the fluctuations in the lipid content in the Y-organ during the different stages of the moult cycle in different age group of males and females .

Material and Method

Six sets of animals of various age groups were maintained in the laboratory (six animals in each tub) under the laboratory conditions.The varying age groups includes -

NO OF GROUPS	AGE OF THE ANIMALS
Group-1	60 -days old males
Group-2	90-days old males
Group-3	150-days old males
Group-4	60-days old females
Group-5	90-days old females
Group-6	150-days old females

The Y-organs of males and females were dissected and the total lipids were extracted during the different stages of the moult cycle . To determine the different types of lipids present in the Y-organ , a lipid profile is observed in males and females.

EXTRACTION OF LIPIDS –

Extraction of lipids

About 1 gm of the Y-organ tissue is homogenized in 10ml of ethanol and total lipids were extracted during the moult cycle with Chloroform-Methanol-Water (2:2:1) by Bligh and Dyer method (1959).Results are expressed in mg/g of tissue.

Results -

Table -1

Variation in the lipid concentration in the Y-organs of males during the moult cycle .

Lipid concentration (mg/100g of fresh tissue) in males

Samples	Premoult	Moult	Postmoult	Premoult	Moult
Group-1	± 5.50	± 5.87	± 5.10	± 5.47	±5.70
Group-2	± 4.92	± 5.23	± 4.83	± 4.88	±5.15
Group-3	± 4.81	± 5.1	± 4.4	± 4.70	± 4.80

Table -2

Variation in the lipid concentration in the Y-organs of females during the moult cycle .

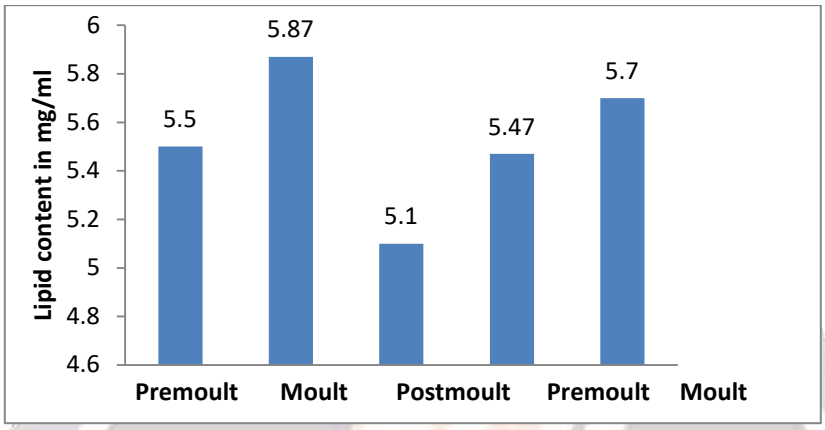
Lipid concentration (mg/100g of fresh tissue) in females

Samples	Premoult	Moult	Postmoult	Premoult	Moult
Group-4	± 5.61	± 5.89	± 5.20	± 5.57	± 5. 80
Group-5	± 5.27	± 5. 84	± 4.95	± 5.25	± 5.50
Group-6	± 4.84	± 5.50	± 4.83	± 4.73	± 5.48

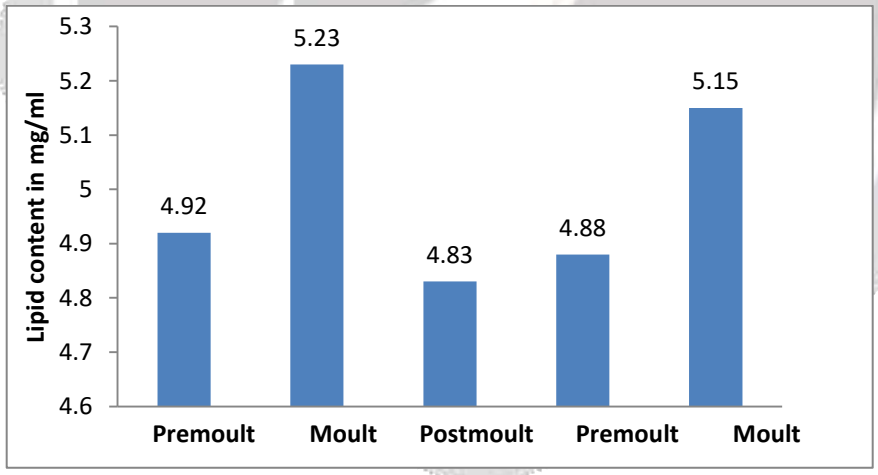
During the moult cycle, a variation in lipid content is observed in the Y-organ. The lipid concentration is less during the premoult period ,reaches to its maximum during the moult period and declines to minimum at postmoult stage . When compared in different age groups, the lipid concentration is high in Group 1 and Group 4 animals (60 –days old males and females) , less in Group 2 and Group 5 animals (90- days old males and females) and least in Group 3 and Group 6 animals(150-days old males and females).

Compared to males, females have high concentration of lipid in the Y-organ during all the stages of moult cycle and in between all the groups.

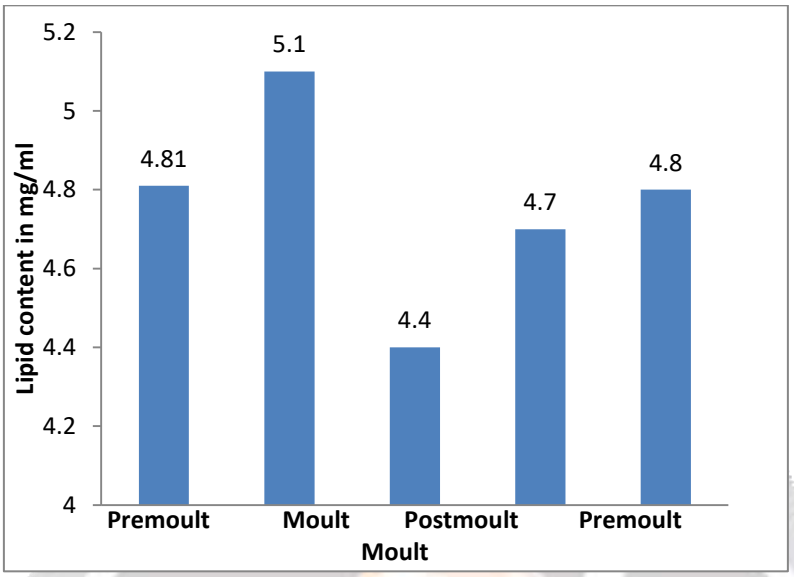
Lipid content in (mg/ml)in Group 1 animals (60 days old males) during the moult cycle



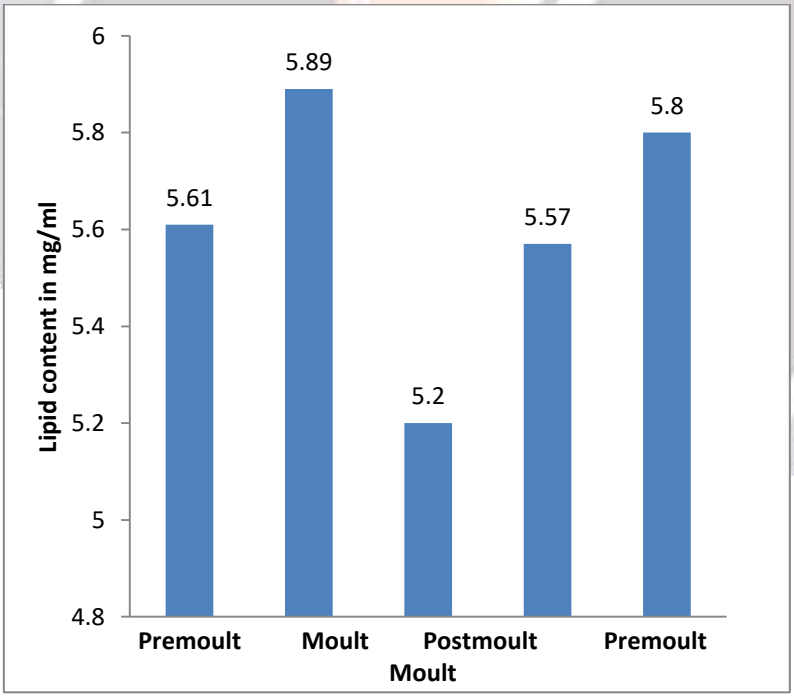
Lipid content in (mg/ml)in Group 2 animals (90 days old males) during the moult cycl



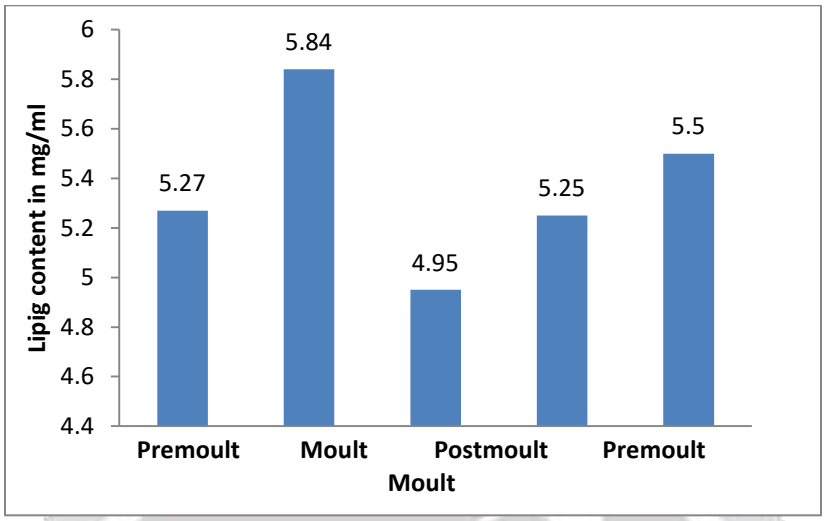
Lipid content in (mg/ml)in Group 3 animals (150 days old males) during the moult cycle



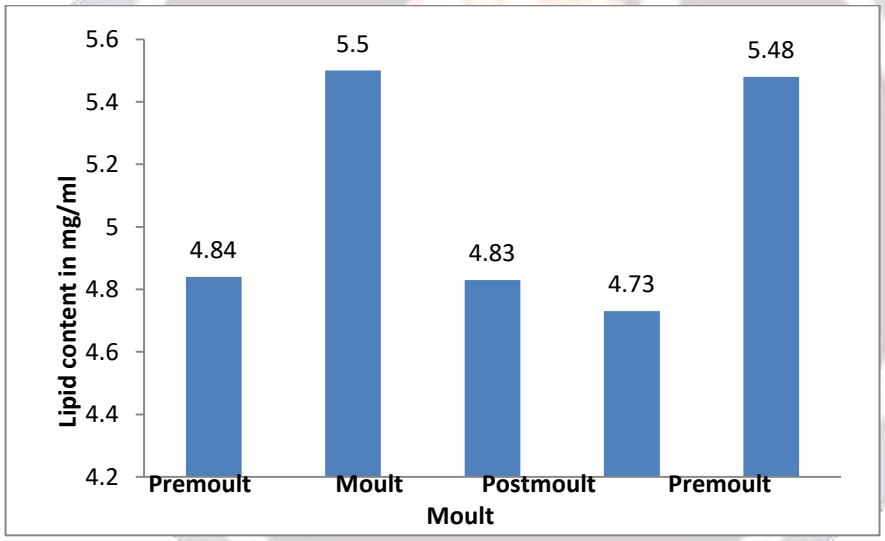
Lipid content in (mg/ml)in Group 4 animals (60 days old females) during the moult cycle



Lipid content in (mg/ml)in Group 5 animals (90 days old females) during the moult cycle



Lipid content in (mg/ml)in Group 6 animals (150 days old females) during the moult cycle



Discussion

Crustaceans contain high concentrations of lipids although they have no differentiated adipose tissue . In land crab,stored lipids are mainly present in muscle tissue and hepatopancreas
(O'Connor and Gilbert , 1968; Chang and O'Connor ,1983; Heried and Full , 1988) .

During the periods of high energy demands such as moulting and gametogenesis large amount of lipids are mobilized specially from hepatopancreas (Rosa and Nunes ,2003 b ; Oliveira *et al* ., 2007). Ingested lipid is digested by gastric lipase and apparently absorbed into depot –lipid as β –monoglycerides.The variation in the content and composition of the depot- lipid is a function of both the external environment and internal control systems (O'Connor and Gilbert , 1968) .

Studies indicate that aspects of lipid metabolism may be under endocrine control in crustaceans.In crab,*Gecarcinus lateralis,* the induction of premoult by destalking markedly increases the synthesis of lipid from metabolic precursors and its subsequent incorporation into the depot – lipid of the hepatopancreas . In the late premoult stages

there is a decrease in the lipid content of the hepatopancreas . This occurs as the lipid is mobilized from the hepatopancreas to meet the energy demands of all those processes resulting in ecdysis (O'Connor and Gilbert , 1968) .

Steroid hormone controls moulting ,in *Macrobrachium rosenbergii* ,the steroid hormone concentration fluctuates being low during postmoult stages and high during premoult.At the time of ecdysis the animal is inactive and therefore has to utilize reserves,particularly the lipids stored during the prior intermoult stage.In crustaceans this is under the control of endocrine system.The lipid content will increase at mid premoult.A higher level of dietary cholesterol can give an increased moulting rate with a short intermoult stage (Saravanan *et al*.,2008) .

The fluctuation of lipid composition during moulting has been demonstrated in crustacean species . In *Cancer pagurus* there is a increase in lipid content just before the secretion of new exoskeleton begins in premoult . The lipid level in *Callinectus sapidus* have been shown to increase during premoult and peak dramatically during postecdysis before returining to intermoult level . Increase in lipid synthesis is a characteristic of premoult in crayfish *Procambarus species* (Bollenbacher and O'Connor ,1972).

In the present investigation the variation in the lipid content in the Y-organ is observed . During the moult cycle the lipid concentration is high during the ecdysis stage , whereas it decreases during the postmoult and then increases from premoult. This shows that lipids are the important source of energy during ecdysis.In females the utilization of lipids during the moult cycle is more when compared to males .

The growth and physiology of crustaceans are closely related to moulting . The increase in lipid concentration at premoult period and the stored lipids at early or mid premoult period may be

utilized as energy source during the period of late premoult to ecdysis. The pre-ecdysial accumulation of lipds in the whole body of prawn is a increase of both polar and neutral lipids (Teshima and Kanazawa ,1976).

Literature cited

1. Bligh, E.G. and Dyer, W. 1959.Can.J. Biochem.Physiol.,37: 911-917..
2. Bollenbacher,W.E.Borst,D.W.O'Connor,1972 . Regulation of lipid synthesis in Decapod crustaceans .
3. Capuzzo , J.M.and Leavitt,D.F.1988 . Lipid composition of the digestive glands of *Mytilus edulis* and *Carcinus maenas* in response to pollutant gradients.Mar.Ecol.Prog.Ser.,Vol.46:139-145.
4. Chang. S.O'Connor , J.D. 1983 . Metabolism and transport of carbohydrates and lipids . The biology of crustacean. Internal Anatomy and physiological regulation. New York , Acad.P., 263-287.
5. Graf ,F.and Delbecque ,J.P. 1987. Ecdysteroid titres during the moult cycle of *Orchestia cavimania* . 65:23-33 .
6. Herreid and Full , R.J. 1988 : Energetics and locomotion : Macmohan 3. Ed. Biology of land crabs.p.337-37
7. Lee, R.F., Puppione, D.L.1978. Serum lipoprotein in the spiny lobsters *Panulirus interruptus*.Comp. Biochem. Physiol.,59 B : 239-243.
8. Nicole , B. Richoux , D.D. Raymond , J.T. and Christophor C. 2004 . Seasonal changes in the lipids of *Mysis mixta* from the hyperbenthos of a cold ocean environment .Can.J.Fish. Aqua. Sci., 61 : 1940-1953.
9. O'Connor,J.D. and Gilbert , L.I. 1968 . Aspects of lipid metabolism in crustaceans.Amer.Zool.,8: 529-539.
10. Oliveria , G.J.Fernandes , F.A.Bueno , A.P and Bond-Bakup , G. 2007 . Seasonal variations in the intermediate metabolism of *Aegla platenis*. Comp.Biochem and Physiol.A., 147: 600-606.
11. Rosa , R.A. and Nunes , M.C.2003 b . Changes in organ indices and lipid dynamics during the reproductive cycle of *Aristeus antenntus* , *Parapaenaeus longirostris*.crustacean. 75 ; 1095-1105.
12. Saravanan, S., Kamalam, S.B.,Stephen,J.and Sampath, K. 2008. Moulting and behaviour changes in fresh water prawn, *Macrobrachium rosenbergii* , Pub.in Shell fish news 25 spring summer 1-3.
13. Spaziani ,E., Rees ,H.H. Wang,W.L. and Watson ,R.D. 1989 . Evidence that Y-organs of the crab *Cancer antennarius* secrete 3 -dehydroecdysone .Molec.Cell.Endocrinol.,66:17-25 .
14. Synder,M.J. and Chang,E.S. 1991 . Ecdysteroids in relation to the moult cycle of the American lobster , *Homarus americanus* .Haemolymph titres and metabolites .Gen. Comp. Endocrinol ., 81 :133-145.
15. Teshima , S. and Kanazawa , A. 1976 . Bull. Japan. Soc. Sci. Fish., 42 : 1129-1135.
16. Watson ,R.D.,Spaziani,E., Rees,H.H.and Wang ,W.L.1989 . Evidence that Y-organs of the crab *Cancer antennarius* secrete 3-dehhydroecdysone .Molec .Cell. Endocrinol ., 66(1) : 17-25
17. Wouters,R., Lavens,P., Nieto,J.and Sorgeltos,P .2001 . Penaid shrimp brood stock nutrition .An update review on research development.Aquacuture .,202 :1-21 .
18. Yepiz-Plascencia ,G., Vargas-Albores,F. and Higeero-ciapara, I. 2000 . Penaeid shrimp haemolymph lipoproteins . Aquaculture ., 191: 177-189 .