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SEASONAL CHANGES IN THE HYDRATION AND CALCIUM CONCENTRATION OF THE DIGESTIVE GLAND, HEAPATOPANCREAS AND GONADS COMPLEX OF THE FRESH WATER CLAMS *Corbicula fluminea* AND *Corbicula fluminalis* IN THE SHATT AL-ARAB REGION

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ABSTRACT: Data on the seasonal changes in water and calcium concentration of the DEG complex of C. *fluminea* and C.*fluminalis* revealed (i) the maximum water content of the complex was in autumn and the minimum was in winter and (ii) The calcium content of the complex was maximum in summer and minimum in winter in both species. The physiological significance of these observations are discussed.

INTRODUCTION

The water content differs according to the type of tissue, age, metabolic activities and environmental effects (Prosser, 1973). Different types of shellfish have different water content. In Cuttlefish the water content reaches 60% (similar to whitefish, whereas mollusks have high level of water for example it is 90% in Oyster (Atkin, 1976). Several hypothesis have been forwarded as a function of the calcareous deposit in the body part. Firstly, it has been suggested that calcium salts are stored for shell repair and operculum or epiphragm formation (Istin and Girard, 1970). The deposits are thought to be anion pool, mainly of carbonates which might play a role in buffering tissue (Burton, 1970; 1976). In the molluses solid calcium salts are not only present in the hard part such as shell, operculum and epiphragm but also in the soft body components (Watabe *et al.*, 1976).

The bivalvia *Corbicula* spp. plays an important role in water system balance due to its ability to convert soluble calcium carbonate to biomass and shell as well as during death it forms a principle energetic sources and nutrients (Marsh, 1985).

Seasonal changes in water and calcium concentration of the haepatopancreas, thoracic muscles and gonads of the crab, *Sesarma boulengeri* as well as temperature and calcium content fluctuation of Shatt-Al-Arab river waters at Basrah have been reported by Sinha and Ahmed (1981); Yousif (1981); Yousif *et al.*(1984). Changes in temperature, life history and production of C.*fluminea* and C.*fluminalis* have been studied earlier by Abdul-Al-Sahib (1989). But, there is no report todate on seasonal changes in water and calcium concentration in the DHG complex of the fresh water clams, C. *fluminea* and C.*fluminalis* and hence reported herein for the first time.

MATERIALS AND METHODS

Speimens of C. *fluminea* and C. *fluminalis* were collected throughout 12 months from Shatt-Al-Arab region and maintained in the laboratory. The digestive gland, heapatopancreas and gonads complex (DHG) were dissected out and soaked with filter paper. Calcium was determined by precipitation (Trinder, 1960) as described by Wooton (1964). The water percentage was determined by drying the tissues in an oven at 60° C till constant weights of tissuse were obtained. The differences between the fresh weight and dry weight gave the water content which was expressed in percentage.

RESULTS AND DISCUSSION

Data on water and calcium concentration of the digestive gland, heapatopancrease and gonads complex (DHG) of both species are given in Tables 1 and 2, respectively. The maximal content of water in the DHG complex is reported during autumn and minimum in winter (Table 1). The higher water content in autumn is occurred during the spawning stage and the lowest in winter is occurred during sexual resting stage. This is supported by the findings of Abdul-Al-Saheb (1989). Thereafter, there is a subsequent increase in autumn (Table 1) during postspawning period. Similar reports have been made in the fish, *Labeo rohita* (Kapur, 1980) and in the crab, *Sesarma boulengeri* (Yousif, 1981; Yousif *et al.*, 1981). It is suggested that the hydration of the DHG complex may serve as an index of reproductive maturity in these two fresh water clams (Al-Rufaie, 1997).

The significant differences between the two species in winter may be due to the beginning of the sexual resting stage in *C.fluminalis* before *C.flumine*a as well as to the differences in the biomass activity during the postspawning period. This findings is supported by the finding of Abdul-Al-Saheb (1989).

Table 1 Water content as a percentage of the DHG complex (digestive gland, hepatopancrease and gonads). Values are mean±S.E., n=8.

Season	*C. flumine*a	*C.fluminalis*
Summer	74.50±0.86	73.63±0.69
Autumn	79.41±0.95	79.23±0.81
Winter	69.79±0.81	63.58±1.25
Spring	71.51±0.76	70.66±0.63

autumn vs summer ($P<0.01$) spring vs winter ($P<0.01$)
autumn vs spring ($P<0.01$) autumn vs winter ($P<0.01$)
summer vs winter ($P<0.01$) summer vs spring ($P<0.01$)
*C.flumine*a vs *C.fluminalis* ($P<0.01$) in winter.

The maximum concentration of calcium in the DHG complex is recorded in summer and minimum in winter (Table 2). It is interesting to note that calcium content in summer is much higher in *C.flumine*a than in *C.fluminalis*. This significant difference may be due to the storage of large quentities of calcium in the DHG complex or may be due to the feeding activity. Calcium plays an impoetant role in irritability of cells (Heilbrunn, 1952). The fact that the calcium decreases the permeability of cell membrane to water and other substances is of great impoetance in fresh water organisms (Giese, 1962). The calcium may activates the egg, and promoting the enzyme to the sperm specially in the acrosomal region (Cardiner, 1972).

Table 2. Calcium concentration in mg/g wet wt. in the DHG complex (digestive gland, hepatopancrease and gonads) of *C.fluminea* and *C.fluminalis*, values are mean±S.E., n=8.

Season	*C.fluminea*	*C.fluminalis*
summer	10.11± 1.5	4.18±0.51
autumn	4.81±0.47	4.11±0.63
winter	2.34±0.36	2.45±0.37
spring	2.82±0.35	2.81±0.40

winter vs autumn ($P<0.01$)
winter vs summer ($P<0.01$)
spring vs summer ($P<0.01$)
autumn vs summer ($P<0.01$) only in *C.fluminea*
autumn vs spring ($P<0.01$)
C.fluminea vs *C.fluminalis* ($P<0.01$) in summer.

The minimal calcium contents are in winter and spring which are associated with the maximal gonadal activity (Table 2). It is suggested that some of the calcium is mobilized from the DHG complex to the ova or may be due to the transfer of some calcium from it to the spermatozoa during their release resulting in relatively lower calcium content during winter and spring (reproductive phase). This finding is supported by the findings of Yousif (1981); Sinha and Ahmed (1981) on the crab, *S.Lontengeri*. The lower calcium content may be due to the reason that the sperms used large quantities of calcium for promoting the enzyme for its entry into the egg or may be acting as a co-factor for the operation of certain enzyme during the release of eggs from the gonad. It is known that calcium binds the protein and nucleoprotein mass together in chromosome (Giese, 1962).

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