INTRODUCTION:– As zinc regulates more than 1000 metalloenzymes (Pallauf, 2005) it plays an important role in overall development of the biological system and more precisely in testosterone secretion (McDowell et al.,1993) and have led to their use in the form of biomarkers (Hambridge, 2003). The deficiency of zinc decreased output of pituitary gonadotropin and androgen production (Reeves and Odeel, 1988; Martin and White, 1992). Zinc also enhanced production of cAMP activity (Nishi et al.1984). Zinc has been shown to be important for normal testicular development and maintenance of the germinal epithelium (Anderson et.al., 1993). Rapidly developing testis of the young male may be particularly sensitive to inadequate amount of zinc (Prasad et.al., 1990). Therefore, the present experiment was undertaken to establish the effect of supplemental zinc in three levels viz:-100ppm (group A), 200ppm (group B) and 300ppm (group C) consisting 5 piglets in each groups for a period of 3 months. The experimental animals were kept under intensive system of rearing as per routine standard farm managemental practices. Blood was collected from the anterior vena-cava at monthly interval from start to end of the experiment. Testis was collected at five (5) months of age by open method of castration. At 5 months of age significantly higher (P<0.05) level of serum zinc and testosterone concentration was recorded in B and C groups. As the concentration of supplemental zinc increased (A < B < C) the serum cAMP activities also found to be increased. The histological section of testis reveals that, section of B, C had compact healthy seminiferous epithelium with wide lumen packed with sperm cells.

MATERIALS AND METHODS:- The animal experimentation was conducted at the pig farm of ICAR Research Complex for North Eastern Hill Region, Umiam, Barapani, Meghalaya and the laboratory work was done in the Department of Veterinary Physiology, College of Veterinary Science, Assam Agricultural University, Khanapara, Guwahati, Assam. The pig farm, where the animals were maintained is located at 25° 41’21”N latitude and 91° 55’25”E longitude at an altitude of 1010msl. The agro climatic zone classified for the place is within the sub tropical hill agro ecological zone. The maximum and minimum temperature normally ranges from 20.9 to 27.4°C and from 6.7 to 18.1°C, respectively. The mean annual rainfall is 2399.8 mm with relative humidity between 85 percent and 59 percent. A total of fifteen numbers of weaned piglets (10.60 ± Kg body weight; 60 days of age) were used to study the supplemental effect of dietary zinc in three levels viz:-100ppm (group A), 200ppm (group B) and 300ppm (group C) consisting 5 piglets in each groups for a period of 3 months. The experimental animals were kept under intensive system of rearing as per routine standard farm managemental practices. Blood was collected from the anterior vena-cava at monthly interval from start to end of the experiment; serum was separated and preserved at -20 C. For estimation of serum zinc the samples were processed as per the method of Fick, et al. (1979) and were estimated using Atomic Absorption Spectrophotometer, GBC 932AA. The serum cAMP activities and testosterone concentration were estimated by using Radio Immuno Assay kits supplied by IMMUNOTECH, Czech Republic. Testis was collected at five (5) months of age by open method of castration. The representative testicular tissue samples were collected and then fixed in adequate amount of 10% formalin solution. The tissue sections of testis were processed by the method described by Dellfield as stated by Luna (1968) and stained by Hematoxylin & Eosin (Luna, 1968) for histological studies. The estimated data in the present experiment were statistically analyzed using SPSS software version 11.5.

RESULT AND DISCUSSION:- As supplemental zinc increases the serum zinc concentration also recorded significantly (P<0.05) higher in group B and C (Table 1).
Supplementation of zinc in the diet during the growing period results steady rise in serum zinc concentration with advancement of age (Harlikar et al., 2000; Saikia, 2010). The rise in serum zinc concentration with advancement in age was due to reduction in growth and consequently a lower zinc requirement in the body systems (Hoekstra et al. 1967). Many workers have reported higher serum zinc concentration when supplemented with higher dose level of zinc in the diet (Hill et al., 2001; Case and Carlson, 2002; Buff et al., 2005) and lower serum concentration in zinc deficient pigs (Burch et al., 1975; Petkevicius et al., 2003).

As presented in Table 1, the serum cAMP activities (Mean ± SE) at 2 months of age in A, B and C group were recorded as 1.83 ± 0.03, 2.11 ± 0.02 and 1.87 ± 0.04 nMol/L respectively. At 5 months of age in A, B and C group were recorded as 3.18 ± 1.24, 3.72 ± 1.11 and 3.63 ± 2.74 nMol/L respectively. The Significantly (P<0.01) highest serum cAMP activities at 5 months of age was recorded in C and B group than that of the A group. An increasing trend of serum cAMP activities was observed with advancement of age this may be attributed to cAMP, which involved in signal transduction such as transferring the effects of hormones which cannot pass through the cell membrane by involving in the activation of protein kinases so, it is also known as the major communicator molecules in the living cells. Cyclic adenosine monophosphate regulates the glycogen, glucose, lipid metabolism as well as hormonal action. In the growing age the metabolic activities increases and while nearing puberty the different hormonal concentration are also found in elevated levels which might have trigger more cAMP concentration in the blood so that, cAMP will help to transfer the biomolecules inside for its specific function. As the concentration of supplemental Zn increased (A < B < C) the serum cAMP activities also found to be increased which was in agreement with the report of Nishi et al., 1984; and C (Fig. 1b,c) however the seminiferous tubular section of the group A (Fig. 1a) showed no such incident. The histological section of testsis reveals that, section of B, C group had compact healthy seminiferous epithelium with wide lumen packed with sperm cells which was absent in group A. The present findings directly or indirectly support the earlier finding of Prasad et al., (1990); Anderson et al., (1993).

**Conclusion:** The present experiment has established that zinc plays an important role in the comprehensive testicular development by modulating hypothalamo-pituitary-gonadal axis mediated through different metabolic processes.

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In respect to the histological architecture of the testis a healthy seminiferous epithelium along with the seminiferous epithelial cycle was observed in group B and C (Fig. 1b,c) however the seminiferous tubular section of the group A (Fig. 1a) showed no such incident. The histological section of testsis reveals that, section of B, C group had compact healthy seminiferous epithelium with wide lumen packed with sperm cells which was absent in group A. The present findings directly or indirectly support the earlier finding of Prasad et al., (1990); Anderson et al., (1993).

The serum testosterone concentration (Mean ± SE) at 2 months of age in A, B and C group were recorded as 0.726 ± 0.104 ng/ml (A group), 0.654 ± 0.125 ng/ml (B group) and 0.622 ± 0.121 ng/ml (C group) at 2 months of age and at 5 months of age the values recorded was 4.77 ± 0.284, 6.54 ± 0.461 and 9.753 ± 0.730 ng/ml in A, B and C groups respectively. The serum testosterone concentration increased steadily from 2 to 5 months of age in all the groups. At 5 months of age significantly higher (P<0.05) level of serum testosterone concentration was recorded in B and C groups. Zinc appeared to have a localized affect in the testsis where, the development of its capacity to produce testosterone is reduced leading to lowering in intra testicular concentration of testosterone, a critical factor for growth, development and function of the seminiferous tubules. The overall function of the testsis was controlled by the gonadotropins, LH and FSH. Decreased secretion of gonadotropins was reported in Zn deficient animal (Martin and White, 1994). Zinc deficiency resulted in impaired testicular development (Hidiroglou and Knipfel, 1984). Zinc provides an antioxidative function and it had a positive effect on testosterone metabolism. In leydig cells of the testsis, Zn ion modulates the secretion of testosterone (Mehta et al., 1989). There are reports on positive correlation between Zn concentration and plasma testosterone concentration was observation (Kumar et al., 2006; Devi, 2009). Zinc might have a role in functional maturational hypothalamo-pituitary-gonadal axis mediated through different metabolic processes in the body involving various enzyme systems, more particularly, associated with carbohydrate, lipid and protein metabolism. Not only adequate supply of nutrient both macro and micro is essential for maturational hypothalamo-pituitary-gonadal axis but proper assimilation in the system which in more important where zinc play a significant role. Present study also indicate that there was a positive correlation between serum Zn concentration and serum testosterone level indicating a major role of Zn in regulation of male reproduction.