CHAPTER – 3

Estrous cycle and Hormones in Female rats fed with different ratios of Fish meal during F1 and F2 generation

3.1: Estrous Cycle

Estrus refers to a stage of the cycle of behavioral receptivity (also known as “heat”). Estrous cycle is last for about 4-5 days with following stages: Prooestrus, oestrus, metaoestrus and diestrus.

Estrous cycle in F1 and F2 generation rats are summarized in (Table 7 - 8 & Fig. IX - X).

The results of the present study revealed that the control rats exhibited regular estrous cycle (6.0±0.18) and normal duration of each phases of prooestrus (5.4±0.12), oestrus (6.6±0.04), metaoestrus (5.6±0.11) and diestrus (12.5±0.3) and diestrus index was 41.6%. When rats fed with 1:1 ratio of fish meal, slight difference in the total number of estrous cycle (5.6±0.1) and duration of prooestrus (4.4±0.05), oestrus (5.1±0.02), metaoestrus (3.5±0.09) phases decreased and diestrus phase increased (14.5±0.2) with increased diestrus index (48.3%). Rats when exposed to 1:2 ratios of fish meal, considerable decrease in number of estrous cycle (4.4±0.09), duration of prooestrus (2.6±0.08), oestrus (4.6±0.08), metaoestrus (2.6±0.02) and increased duration of diestrus phase (16.6±0.14) and diestrus index (55.3%) was noticed. Number of Estrous cycle (3.8±0.6) significantly decreased in rats fed with fish meal in 1:3
ratios with decrease in duration of proestrous (1.8±0.04), estrous (3.6±0.05) and metaestrous (2.8±0.02) phases and with significant increase of diestrous phase (20.2±0.1) and diestrous index (67.3%). Rats fed with only fish meal showed a concomitant increase in diestrous (23.83±0.26) phase with diestrous index of (71.3%) with a significant decrease in number of estrous cycle (2.1±0.08) and duration of proestrous (1.16±0.01), estrous (3.3±0.06) and metaestrous (2.13±0.01) phases. There was no significant difference in total number of estrous cycle between control and 1:1 (p=0.046), metaestrous phase between 1:1 and 1:2 (p=0.692), estrous phase between 1:3 and only fish meal fed rats (p=0.067). (Table: 7 & Fig. IX).

During F2 generation regular number of estrous cycle (6.34±0.08) and normal duration of each phases proestrous (5.83±0.08), estrous (6.6±0.04), metaestrous (4.85±0.1) and diestrous phase (13.3±0.02) with diestrous index (44.3%) were observed in control rats. Whereas, number of estrous cycle gradually decreased in all the ratios of fish meal 1:1 (4.9±0.04), 1:2 (3.1±0.01), 1:3(2.5±0.05) and only fish meal (2.0±0.01) in comparison with that of control rats. The rats fed with 1:1 ratios of fish meal showed decreased phases of proestrous (2.3±0.03), estrous (4.6±0.08), metaestrous (3.1±0.02) and increased diestrous phase (16.2±0.04) and diestrous index (54%). Rats of 1:2 ratios of fish meal showed considerable decrease in proestrous (2.3±0.03), estrous (4.6±0.08) and metaestrous durations (3.1±0.02) also increased diestrous phase and diestrous index (18.8±0.1, 62.6%). Significant decrease of proestrous (1.9±0.01), estrous (3.6±0.05) and metaestrous (2.4±0.01) and an increase in diestrous phase and diestrous index (21.65±0.02, 72%) was observed in 1:3 ratios. When rats were fed with only
fish meal decrease of all the phases of proestrous (1.1±0.04), estrous (3.3±0.06) and metaestrous (2.06±0.02) and concomitant increase of diestrous phase (23.83±0.26) and diestrous index (79.3%) when compared with that of control. There was no significant difference in metaestrous phase between 1:1 and 1:2 (p=0.047), 1:1 and 1:3 (p=0.764), 1:1 and only fish meal (p=0.19) and estrous phase between 1:1 and 1:2 (p=0.692), 1:3 and only fish meal fed rats (p=0.067) (Table: 8 & Fig. X).

3.2: Hormones

A significant alteration was accounted in the mean concentration of steroid hormones, such as estrogen, progesterone, LH, FSH, and prolactin during F1 and F2 generation of rats fed with different ratios of fish meal summarized in (Table 9 - 10 & Fig. XI – XII).

3.2.1: Estrogen

During F1 generation serum estrogen level of control rat showed (106.6 ±3.55 pg/ml). Whereas, when the rats fed 1:1 ratios showed reduced estrogen level (102.5±0.83 pg/ml). A gradual decrease of estrogen level was noticed in 1:2 (94.8± 0.40 pg/ml) and 1:3 (85.8 ±0.98 pg/ml) ratios of fish meal. A significant reduction of estrogen was observed in the rats fed with only fish meal (82.3±0.51pg/ml) when compared with that of control. There was no significant difference in estrogen concentration between 1: 3 and only fish meal fed rats (p=0.013). (Table: 9 & Fig. XI).

Estrogen concentration in control rat of F2 generation showed the value of 110.6±2.16 pg/ml. Decrease concentration of estrogen level was observed in rats fed with 1:1 ratio (100.15 ±0.40 pg/ml), Further a noticeable decrease in level of estrogen
was recorded in 1:2 and 1:3 ratios (92.16± 0.40 pg/ml 80.66± 0.51pg/ml). Whereas, more significant decrease was observed in rats when fed with only fish meal (75.33± 0.51 pg/ml) when compared with that of control. The values are significant at p<0.05. (Table: 10 & Fig. XII).

3.2.2: Progesterone

During F1 generation progesterone level in the control rats was 30.3±1.03 ng/ml, whereas rats fed with 1:1 ratio of fish meal showed decrease in the level of progesterone (28.15±0.25 ng/ml). Further decreased level of progesterone level was noticed in the ratios of 1:2 and 1:3 (25.1±0.75 ng/ml & 22.8±0.40 ng/ml). A significant decrease in progesterone level was observed in the rats fed with only fish meal (18.8±4.35 ng/ml) when compared to control. There was no significant difference in progesterone level between 1:1 and 1:2 (p=0.134), 1:2 and 1:3 (p=0.303), 1:3 and only fish meal fed rats (p=0.018) (Table: 9 & Fig. XI).

Progesterone level was found to be 30.3±1.03 ng/ml in control rats of F2 generation. Decrease concentration of progesterone was noticed in 1:1 ratio 1 (27.1± 0.40 ng/ml). Further reduction was observed in rats fed with 1:2 and 1:3 ratios (22.3±0.5 ng/ml, 20.1± 0.4 ng/ml). Whereas, a significant reduction was noticed in rats fed with only fish meal in comparison with control (18.5 ±0.8 ng/ml). Values are significant at p<0.05 level. (Table: 10 & Fig. XII).

3.2.3: Follicle Stimulating Hormone (FSH)

During F1 generation the FSH level showed decrease in the ratio of 1:1 (27.4± 0.18 ng/ml) when compared to that of control (29.0± 0.4 ng/ml). A drastic decrease in the FSH level was
observed in 1:2 (24.9 ±0.50 ng/ml) and 1:3 ratios (22.7 ±0.51 ng/ml). Whereas, a significant decrease in FSH was noticed in rats fed with only fish meal (20.4± 0.33 ng/ml). Values are significant at p<0.05 level (Table: 9 & Fig. XI).

FSH level in control rats of F2 generation showed 28.3± 0.3 ng/ml. When the rats were fed with 1:1 ratio fish meal showed a slight decrease in level of FSH (26.2±0.11ng/ml). A Significant decrease was noticed in 1:2 and 1:3 ratios of fish meal (22.8±0.97 ng/ml, 21.2± 0.07 ng/ml). Whereas, a noticeable significant reduction was observed in only fish meal fed rats (19.2± 0.2 ng/ml) in comparison with that of control. Values are significant at p<0.05 level (Table: 10 & Fig. XII).

3.2.4: Leutinizing Hormone (LH)

During F1 generation the LH level in control rats was estimated to be  8.6 ±0.08 ng/ml. In 1:1 ratio showed, decreased level of LH (8.2± 0.06 ng/ml) was noticed. A drastic decrease in LH was observed in rats fed with 1:2 and 1:3 ratios of fish meal (7.6± 0.09 ng/ml, 6.5± 0.05 ng/ml) A significant reduction of LH was observed in rats fed with only fish meal when compared to control (5.1±0.16 ng/ml). Values are significant at p<0.05 (Table: 9 & Fig. XI).

LH in control rats of F2 generation was found to be 8.61±0.14 ng/ml. When the rats were fed with 1:1 ratio showed decreased level of LH (7.6±0.28 ng/ml). Further, decrease of LH was noticed in 1:2 and 1:3 ratios of rats (7.1±0.05 ng/ml, 6.13±0.05 ng/ml). A drastic significant decrease was observed in only fish meal fed rats (4.3 ±0.2 ng/ml) compared with that of control. Values are significant at p<0.05 (Table: 10 & Fig. XII).

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3.2.5 Prolactin

During F1 generation prolactin level in control rats was $15.1 \pm 0.54$ ng/ml. Prolactin level decreased considerably in 1:1 and 1:2 ratios of fish meal ($14.8 \pm 0.29$ ng/ml, $12.18 \pm 0.97$ ng/ml). There was a further decrease in prolactin level 1:3 ratios ($10.61 \pm 0.24$ ng/ml). Whereas, a significant decrease was noticed in only fish meal fed rats ($8.46 \pm 0.05$ ng/ml) when compared with that of control. There was no difference in prolactin concentration between control and 1:1 ($p=0.017$) (Table: 9 & Fig. XI).

During F2 generation the control rat showed prolactin level of $14.85 \pm 0.80$ $7.33 \pm 0.08$ ng/ml. When rats were fed with 1:1 ratios of fish meal, decrease in level of prolactin ($14.25 \pm 0.32$ ng/ml) was noticed. A Gradual decrease was noticed in 1:2 ($11.16 \pm 0.13$ ng/ml) and 1:3 ratios ($8.32 \pm 0.05$ ng/ml). Further, a significant decrease in prolactin level was observed in rats fed with only fish meal ($7.33 \pm 0.08$ ng/ml) when compared with control. No significant difference was noticed between control and 1:1 ($p= 0.097$) (Table: 10 & Fig. XII).