SUMMARY AND CONCLUSION

➢ Water samples and fish (Tilapia mossambicus) were collected from Nagavara Lake in Bangalore to determine the presence of heavy metal contaminants.

➢ Water analysis revealed the presence of heavy metals such as cadmium, chromium, lead, iron and zinc. These metals were observed to be present above permissible limit given by WHO and BIS in the order of lead > chromium > iron > zinc > cadmium.

➢ Fish muscle showed the presence of heavy metals in the order of chromium > lead > cadmium > zinc > iron

➢ Fish collected from Nagavara lake were brought to the laboratory, sun-dried, made into pellets and used as fish meal for experimental rats.

➢ Rats, 30 days old and weighing around 50g were procured from Raghavendra enterprises and used in the present study.

➢ Animals were acclimatized to the laboratory environment (24°C±2° C and photoperiod of 12L/12D) for 15 days prior to the commencement of the experiments and fed with normal rat feed procured from Amruth India limited

➢ The studies were carried out on F1 and F2 generation derived from F0 generation. The rats were divided into 5 groups, group-1 served as control and others served as experimental groups. Group- 2 rats were fed with fish meal
in the ratio of 1:1 (1 part rat feed and 1 part fish meal), Group 3 – 1:2 (1 part rat feed and 2 part fish meal), Group 4 – 1:3 (1 part rat feed and 3 part fish meal) and group -5 rats fed with only fish meal, during F1 and F2 generations.

➢ Vaginal smear of control and experimental animals of both F1 and F2 generation were collected to study estrous cyclicity.

➢ At the end of experimental period, blood was drawn and used for hormonal assay and haematological studies. Further, ovary, oviduct and uterus were removed and processed for histological studies, ovary and uterus for bio chemical estimations.

➢ Reproductive performance (fertility index, number of implantation, number of corpora lutea, number of resorptions, gestation length, delivery index, number of pups delivered, and weight of the pups) of both F1 and F2 generations were carried out.

➢ Results of the present study revealed :

➢ In rats of F1 and F2 generation fed with only fish meal the ovary and uterus showed increase in concentration of heavy metals.

➢ A significant reduction (p<0.05) in food consumption, body weight and weight of the ovary and uterus was observed. These results were more pronounced in F2 than F1 generation.

➢ The control animals showed normal estrus cycle of 4-5 cycles, while experimental animals revealed decreased length of estrus cycle. The vaginal smear from control showed normal phases of proestrous, estrous, metaestrous and diestrous, while experimental animals showed only prolonged
diestrus phase in rats fed with only fish. These result were more prominent in F2 than F1 generation.

- Estrogen, progesterone, FSH, LH and prolactin hormones showed a significant decrease (p < 0.05) in rats fed with only fish meal. These result were more prominent in F2 than F1 generation.

- Histology of Ovary revealed significant decrease in number of growing follicles and a significant increase in atretic follicles. Growing follicles showed hypotrophy and significant decrease in corpus luteum in rats fed with only fish meal. These results were more pronounced in F2 than F1 generation.

- Oviduct showed thick mucosal folds with increase in number of cilia and decrease in number of non ciliated cells. These results were more pronounced in F2 than F1 generation.

- A significant decrease in luminal epithelium, thickness of endometrium and lesser number of uterine glands was noticed in the uterus of the experimental rats. These results were more conspicuous in F2 than F1 generation.

- Hematological parameters showed a significant decrease (p < 0.05) in Hb, RBC, PCV, MCV, MCH, MCHC, platelet count and differential Leucocyte count (Neutrophils, Eosinophils, Monophils and Basophils) in rats fed with higher ratios of fish meal. These results were more pronounced in F2 than F1 generation.

- Biochemical studies revealed reduction in the amount of protein, glycogen and cholesterol in the ovary and an increase in the uterine cholesterol level in rats fed with 1:3 ratio and only fish meal. These results were more pronounced in F2 than F1 generation.

- In rats fed with 1:3 ratios and only of fish meal, a decrease in fertility index, delivery index, implantation number,
number of corpora lutea, number of resorption, number of live pups (day 0 and day 21) and weight of pups (day 0 and day 21) was significant at $p < 0.05$. On the other hand increase in gestation length was observed. These results were more pronounced in F2 than F1 generation.

In conclusion the above study revealed metals in the fish meal consumed by rats, altered the ovarian steroidogenesis and vaginal cyclicity along with histological alterations that affected the fertility potential of females during subsequent generations. Further investigations are necessary to comprehend the deleterious effects of contaminated fish consumption on reproductive toxicology at molecular level. The results of the present study can also be extrapolated to understand toxicological effects of metals on humans.

**Recommendation**

This study is aimed at increasing human understanding of fish consumption strategies. We can channel this legitimate concern into actions that will result in stricter water quality regulations. The end result of such action will improve water quality which will benefit the health of the fish and health of the people who consume