Short Research Article

EFFECT OF *Foeniculum vulgare* MINGLED DIET UPON GROWTH, REPRODUCTION AND SPAWNING PERFORMANCE OF GUPPY FISH

Abstract

Breeding and rearing of ornamental fish is an important sector of aquaculture, which has increased income and employment in the country in recent years. Introducing new methods and developing new food supplements can impact efficiency and sustainable development in this new technology.

In the present study, phytoestrogenic compounds of ethanolic extract of F.vulgar were evaluated on growth performance and fertility rate and gonadal tissue changes of guppy for its introduction as a nutritional supplement in aquaculture.

120 juvenile guppies were distributed three times in 12 glass aquaria at 10 fish/tank. Four treatment doses were prepared with different Foeniculum vulgare seed extract concentrations i.e. 50, 100, 150µl/g while the fourth dose was control with 0µl Foeniculum vulgare extract. These diets were called D0, D1, D2 and D3.

This diet was fed to fish, twice daily, at 3% of body weight, for 90 days. All groups were tested for desired parameters after fifteen days.

Analysis of results showed significant increase in weight gain and fertility rate in group T2 (100µl/g).

There was an increase in gonad cells in the test groups as compared to the control group and an increase in phytoestrogens in the test groups simultaneously.

In follicles, increasing granulose layer with increasing number of ovules at different developmental stage (O1-O7) was observed in test groups.

The increase in fertility rate in the test groups may be due to the increase in estrogenic compound levels which may be due to the action of the extract in the diet.

The observation made in the present investigation shows that F.vulgar can act as a phytoestrogenic compound at low concentration and therefore F. vulgar is considered as a potential and natural fish feed additive in commercial aquaculture. Can be used to increase fertility rate.

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1.Introduction

The fisheries division is playing a pivotal role in nourishment, dietary security, profit earning, and to enhance the national economy (Ariadi et al, 2019). Among fishes, some are edible and some are ornamental and might be perceived as decorative fishes.

They are likewise called “living jewels” due to their friendly behavior, beautiful color, and shape (Nasser and Rajkumar, 2001). All over the world, the trade of aquatic animals and their products has been increased in the last few years (Soeprapto et al, 2023).

Ornamental fish keeping is considered an interesting, easy, and relaxant hobby throughout the world (Madusari et al, 2022). The worldwide exchange of aquatic organisms has been proposed as the wellspring business. Ornamental fishes are very attractive aquatic species in the world.

Ornamental fish is a key element of the aquatic environment and considered an ecosystem maintainer in the aquatic environment (Rodrìguez, 2006).*Poecilia reticulata* is native species from North Brazil and South America (Ojanguren et al., 2005).

Poecilia reticulata is known as "Guppy fish" belongs to the family Poeciliidae, it is a small ornamental fish also called livebearer, inhibited in a freshwater environment. *Poecilia reticulata* is a commercially important fish due to its attractive colors and variation in the tail that makes it the most trading ornamental aquarium fish in the world (Egset et al., 2011).

Poecilia reticulata start to breed from February till while its peak in July. Female *Poecilia reticulata* are livebearers and give birth to live young. The rearing period of *Poecilia reticulata* in the Southeastern U. S. starts in May and finishes in September and October (Hidebrand, 1921).

At the age of 10-12 weeks, females become mature while males mature at the age of 7 weeks. Female Poecilia reticulata show polyandry, female can mate with multiple males. Females can give birth 20-200 young in a single spawn. The gestation period of *Poecilia reticulata* is about 4-6 weeks (Coad, 2017).

Seeds availability is only possible by the reproduction. Natural reproduction is not enough to meet the seed availability according to demand. Induce breeding is the best way to enhance the reproduction, to produce the seeds.

Availability of seeds can be possible by reproduction as well as artificially induced breeding in hatchery (Sudha and Gokula, 2015).Due to the lack of proper environmental condition, reproduction and growth of fishes is disturbed, and it is difficult to meet the demand of fish seed by natural resources. So, to fulfill this demand synthetic stimulators are used for fish breeding (Ojima and Iwata, 2009; Ariadi et al, 2022).

For egg development and spawning, female need appropriate amount of lipid and protein. Diet play a significant job for development and reproduction of ornamental fish, and various feeds have been utilized for its raising.

Supplement feed, hormones, anti-infection agents, and numerous herbal products are used for enhancements for fecundity and gametes maturation of ornamental fish (Ghosh et al., 2007; Ariadi et al, 2022).

There are many ways to stimulate the reproduction of fish. Reproduction of fish can be provoked by using one of these products in ornamental fish, Ovaprim a liquid form injection which is a mixture of GnRH and domperidone in the liquid of propylene glycol.

Ovaprim used as a spawning abet to induce evolution (Yanong et al., 2010). Gonadosomatic index (GSI) is the ratio between body weight and gonads weight of fish.

Gonadosomatic index involves to identify the spawning season of fish. While fecundity is the relation between numbers of eggs produced in each spawn and body weight of fish. It is most important parameters used in the study of reproduction of fish (Hunter and Macewicz, 2001; Ariadi et al, 2023).

Gonadosomatic index and fecundity measures are helpful in measuring population dynamics, population carrying capacity and productivity (Shankar and Kulkarni, 2005).

It evaluate the reproductive system of a fish by calculating the total body size. It is considered as the most important parameter of fish reproductive biology, provides us a comprehensive view about the fish breeding and the reproductive status of related species, especially in finding the fish breeding seasons. Fertility and effectiveness are estimated by Gonadosomatic Index and fecundity (Chavan and Muley, 2014).

To check the effect of traditional herb *Foeniculum vulgare* on growth rate, reproductive performance of *Poecilia reticulata*.
To evaluate the influence of *Foeniculum vulgare* on spawning of female *Poecilia reticulata*.

2.Materials and Method

Complete Random Design (CRD) was used for sampling purposes to evaluate the variable of growth (weight gain, length gain, FCR, and survival rate) and Reproduction (Fecundity, GSI, Hatching rate, and spawning).

The present study was conducted in the Laboratory, Department of Zoology, The University of Lahore, Sargodha Campus. *Poecilia reticulata* stock of 120 was kept in the 12-glass aquarium of size of 12×12×18. Juvenile *Poecilia reticulata* having size range of 0.19 ± 0.02 were divided into four experimental groups. Each glass aquarium for experimental treatment contains 10 juvenile guppies (30 in triplicate). Fish feed used during the experiment was commercial.

Sample Size

Present experiment was performed for 3 months (90 days) after being acclimatized in laboratory conditions for two weeks.Initial stocks of 120 juvenile *Poecilia reticulata* having an average weight of 0.19 ± 0.007 were purchased from a commercial fish shop in Sargodha.

Fish were identify by following the Coad, (2017). Guppies were kept in the four aquariums to make them acclimatized the laboratory condition for two weeks before the research. After two weeks, fingerlings were divided into four Aquarium manually @ ten fish per aquarium.

During this period juveniles were observed and diseased juveniles were separated from the healthy fishes, then remaining stocks were divided into four treatments having an average weight of 0.18±0.01 g (T_1), 0.19±0.01 g (T_2), 0.19± 0.01g (T_3), and 0.19±0.01g (T_4).

Poecilia reticulata were provided with a feed named "INCH GOLD" a commercial feed of 3% of body weight twice a day i.e. 8:00 am and 6:00 pm. Aquarium water was changed weekly to maintain a healthy and clean water environment.

***Foeniculum vulgare* SEEDS EXTRACT PREPARATION**

Foeniculum vulgare seeds were purchased from the herbal shop in Sargodha, Pakistan. *Foeniculum vulgare* seeds were identified by the Department of Botany, Lahore University, Sargodha Campus. *Foeniculum vulgare* seeds were grinded with a blender to get a fine powder.

To get *Foeniculum vulgare* seed extract, *Foeniculum vulgare* seed powder (50 g) was taken and 96% ethanol mixed with a ratio of 1: 1. The extract was kept at room temperature for 24 hours with continuous stirring.

What-man filter paper No.1 was used to filter the extract. The obtained extract was diluted with distilled water to obtain the final solution (Nazari and Roozbehani, 2015).

Treatment Feed Preparation

Feed was prepared by followings (Haghighi et al, 2014). Commercial feed which is "Inch gold" used in feed and mixed with *Foeniculum vulgare* seeds extract in Petri dish. Four treatments diets with different *Foeniculum vulgare* seeds extract concentration were prepared i.e. 50, 100, 150µl/g while fourth diet was control having 0µl *Foeniculum vulgare* extract.

These diets were termed as D_0, D_1, D_2, and D_3. Feed pellets were dry at room temperature. The pellets were air dried and stored in air tight container at room temperature until fed. This feed was fed to fishes, twice a day, at the 3 % of body weight, for 90 days. From all groups required parameter evaluation was checked after fifteen days.

Seed Analysis

Foeniculum vulgare seed extract was analyzed through gas chromatography-mass spectroscopy system (Hammouda et al., 2014).

GC-MS system contains an auto-sampler unit, injector use, and a gas chromatograph with a mass spectrometer. With a ratio of 1: 100, approximately 2µl samples were inserted into split mode. Helium gas was used as the carrier with a pressure of (65.2 kPa).

The ionization energy used to identify the compounds by GC-MS was 70 eV. The temperature in the Column oven was 80^0C to 220^0C. The flow rate of helium gas was used as 1.5 l ml/min as a carrier gas.

The average temperature range for the injector and MS transfer line was 220^0C to 290^0C. Total time required for separation was 65 minutes. The MS capillary column was extracted the *Foeniculum vulgare* seed extract compounds (Alam, 2019).

***List 1 : Foeniculum vulgare* seed extract composition (%) by GC-MS**

Chemical compound	**%**
4-Hexen-2-one	0.20

3-Hydroxytetrahydropyran	0.65
Acetic acid	0.10
Fenchone	11.68
Delta-3-carene	0.52
Camphor	Trace
Tetradecane	0.90
Benzaldehyde-4-methoxy	10.01
L-Histidine	Trace
Benzene -1- methoxy-4- (2-propene)	2.52
Fenchyl acetate	0.11
Cyclohexane	0.41
1-Methyl-2-methylene-4-isopropyl	Trace
Trans-anethole	64.49
1-Tetradecene	0.74
1-Methoxy-3-(ethenylcarbonyl)B	0.81
Hexatriacontane	1.54
10-Nonadecanone	3.17

shows the chemical component of fennel seed extract. With the aid of GC–MS, 18 compounds were described. Trans-anethole (64.49 percent), Fenchone (11.68 percent), and Benzaldehyde-4-methoxy (10.01) were the main constituents of the ethanolic extract of fennel seed. Furthermore, the fennel seed contained significant amounts of different minor constituents, with a contribution of less than 10%.

3.Results

GROWTH PARAMETERS

4.4.1 Weight gain and length gain

Table 1: Growth data of *Poecilia reticulata* record after 14 days Trail.

Difference between Initial reading and after 14 days reading of samples						
	Initial	Final	weight gain	Initial	Final	length

Treatments	Wt(g)	Wt(g)	(W_f - W_i)	Length (cm)	Length (cm)	gain L_f-L_i
T_0	0.17	0.21	0.04	1.93	2.2	0.27
T_1	0.19	0.24	0.05	1.95	2.4	0.45
T_2	0.19	0.27	0.08	1.97	2.7	0.73
T_3	0.18	0.24	0.06	1.92	2.5	0.58

Table 2:Growth data of *Poecilia reticulata* record during Trail.

Total Weight gain and length gain durig experiment (90 days)							
Sr. No	**Treatment**	**Initial Wt(g)**	**Final Wt (g)**	**weight gain (W_f - W_i)**	**Initial Length (cm)**	**Final Length (cm)**	**Net length gain L_f-L_i**
1	**T_0**	0.17	0.31	0.12	1.93	3.07	1.41
2	**T_1**	0.19	0.38	0.19	1.95	3.73	1.78
3	**T_2**	0.19	0.44	0.25	1.97	4.09	2.12
4	**T_3**	0.18	0.39	0.21	1.92	3.66	1.74

Calculated results for weight gain and length gain were presented in Table 2. Statistical analysis shows that maximum weight gain was observed in T_2 while minimum growth rate was recorded in T_0 (Control group) respectively.

The increase in length was also observed during the experiment to check the effect of *Foeniculum vulgare* extract on total length gain. Length increase is presented in Table 2. Analysis of increase in length presented in graph (Fig 1) shows that the maximum length was attaining by Treatment T_2 and T_0 achieved minimum length.

Growth performance results showed that with a concentration of 100µl of *Foeniculum vulgare* seed extract containing has a positive effect (P<.0.05) on the growth parameters of *Poecilia reticulata*.

Comment [WU2]: There needs to be additional, up-to-date comparative literature on each study result

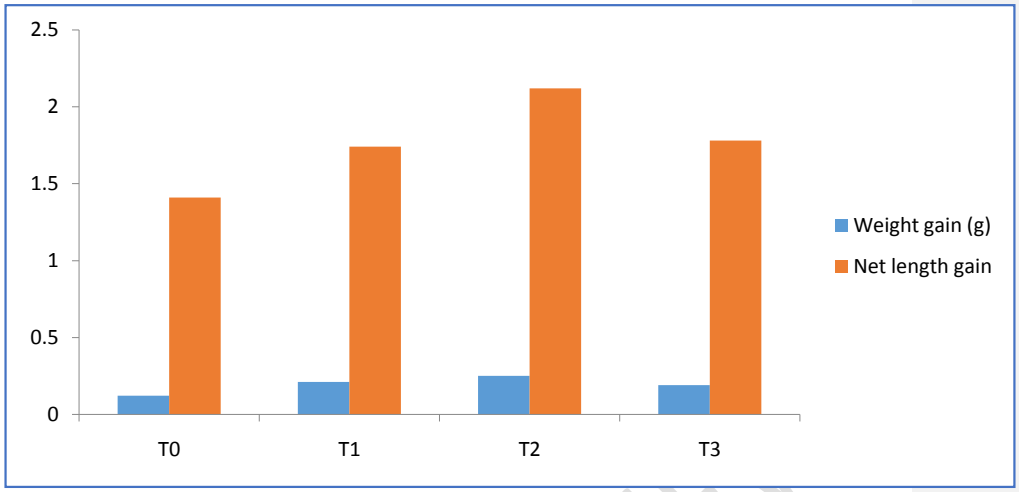

Figure 1: Increase growth rate observation fed with *Foeniculum vulgare* concentrations.

Weight gain, height increase, survival rate, and feed conversion ratio were recorded in (Table 3). Growth parameters were recorded after fifteen days. The statistically analyzed data showed that as the concentration of *Foeniculum vulgare* increases the weight and length were also increases significantly ($p<0.05$).

Table 3: Growth parameters of *Poecilia reticulata* fed diets containing different concentrations of *Foeniculum vulgare* for 90 days.

Growth parameters	T_0 (0 µl)	T_1 (50 µl)	T_2 (100 µl)	T_3 (150 µl)
Initial weight (g)	0.17 ± 0.008^{a}	0.18 ± 0.01^{a}	0.19 ± 0.008^{a}	0.19 ± 0.007^{a}
Final weight (g)	0.31 ± 0.03^{c}	0.38 ± 0.01^{b}	0.44 ± 0.03^{a}	0.39 ± 0.03^{b}
Weight gain (g)	0.12^{c}	0.21^{b}	0.25^{a}	0.19^{b}
Initial Length(cm)	1.93 ± 0.13^{a}	1.95 ± 0.16^{a}	1.97 ± 0.1^{a}	1.92 ± 0.14^{a}
Final Length (cm)	3.07 ± 0.1^{c}	3.66 ± 0.2^{b}	4.10 ± 0.3^{a}	3.73 ± 0.2^{b}
Net length gain	1.14^{c}	1.71^{b}	2.12^{a}	1.81^{b}
Feed conversion ratio	3.11 ± 0.8^{a}	2.52 ± 0.4^{b}	2.24 ± 0.1^{c}	2.93 ± 0.2^{ab}

Survival rate (%)	100 ± 0.00 [a]	100 ± 0.00 [a]	100 ± 0.00 [a]	100 ± 0.00 [a]

Note: Values given are mean ± standard error. Means with the same letter in the same column are not statistically significantly (P < .05) different

4.4.2 Feed conversion ratio

According to the results, data is presented in Table 3, different concentrations of fennel extract has a positive effect on the FCR of feed fed by *Poecilia reticulata* in experimental treatments. FCR values were recorded as in T_0 (3.11±0.8), T_1 (2.52±0.4) T_2 (2.24±0.1), and T_3 (2.93±0.2), respectively. A significant decrease in the FCR value of T_2 is observed when compared with other groups in the experiment. Fennel seed extract contains anethole which is a digestive stimulator, a reason for the decrease in FCR. Graphical presentation (Fig 2) of Feed Conversion Ratio shows that highest in T_0 while it was lowest in T_2. The results indicate that T_2 has significantly differed from T_1, T_3, and T_0. The results about FCR showed that *Foeniculum vulgare* reduces the Feed conversion ratio.

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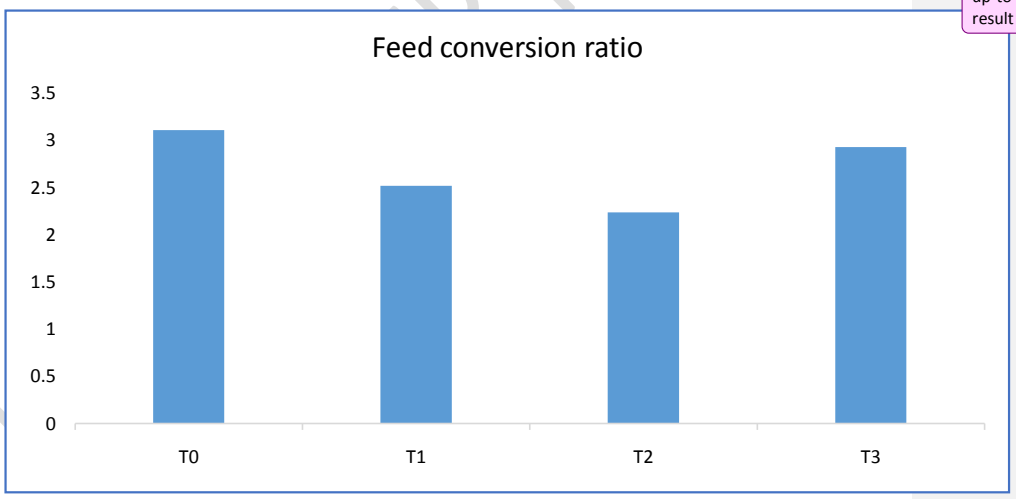

Figure 2. Mean values of feed conversion ratio under varying stocking concentration of fennel extract on *Poecilia reticulata*

4.4.3 Survival rate

Graphical presentation of survival rate (Fig 3) showed that fennel extract did not negatively affect the Survival rate of *Poecilia reticulata* in every experimental group. The survival rate in all experimental and control were consistently high (P>0.05). The survival rate of all treatments is recorded as 100 %. It is inferred that

F. vulgare seed extract has no adverse effect on the Survival rate of *Poecilia reticulata*.

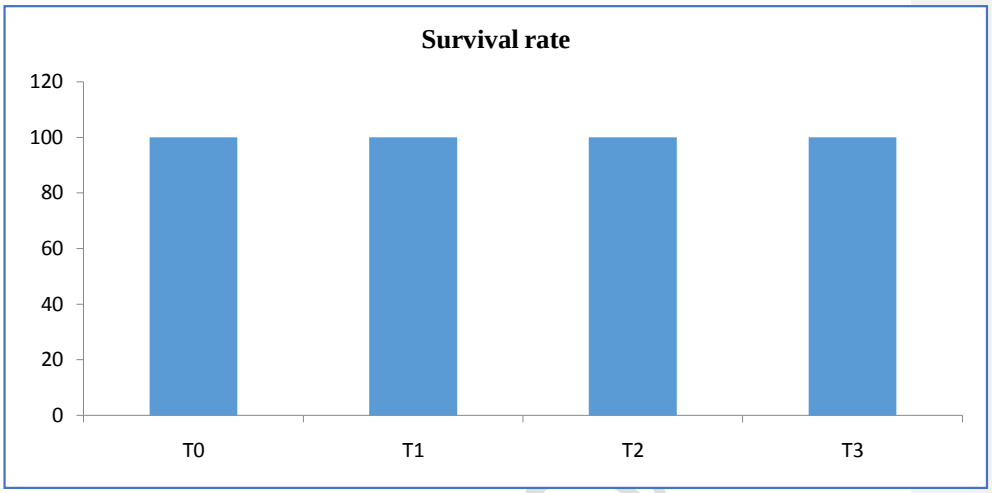

Figure 3: Mean values of survival rate under varying stocking concentrations of fennel extract on *Poecilia reticulata*

4.5 REPRODUCTION PARAMETERS

4.5.1 Gonadosomatic index

Table 4 : Age, fish, and gonad weight, Gonadosomatic index (GSI) of *P.reticulata*

Sr.no	Treatments	T_0	T_1	T_2	T_3
1	**Age in days**	180-192	180-198	180-210	180-195
2	**Fish weight**	0.79 ± 0.008^{c}	0.93 ± 0.008^{b}	1.04 ± 0.01^{a}	0.93 ± 0.008^{b}
3	**Gonads weight**	0.023 ± 0.002^{d}	0.041 ± 0.004^{c}	0.065 ± 0.001^{a}	0.053 ± 0.003^{b}
4	**GSI**	6.07 ± 0.11^{c}	7.03 ± 0.04^{b}	8.69 ± 0.15^{a}	7.54 ± 0.05^{ab}

Note: Values (mean ± SEM) of GSI are superscripted by alphabets within the same line are different significantly ($P<0.05$).

Final data of reproduction parameters are described in Tables 4. The gonadsomatic index was measured by the weight of the fish and the gonad's weight of the fish. Gonad's weight gain at maturity is shown in Fig 4. The highest Gonadosomatic index was observed in T_2 followed by T_1, T_3, and T_0 separately. The groups that contain *F. vulgare* seed extract, the Gonadosomatic index (GSI) is significantly high ($P < 0.05$). The highest GSI was observed in T_2 (8.69±0.2) and lowest GSI was found in T_0 (6.07±0.2) respectively.

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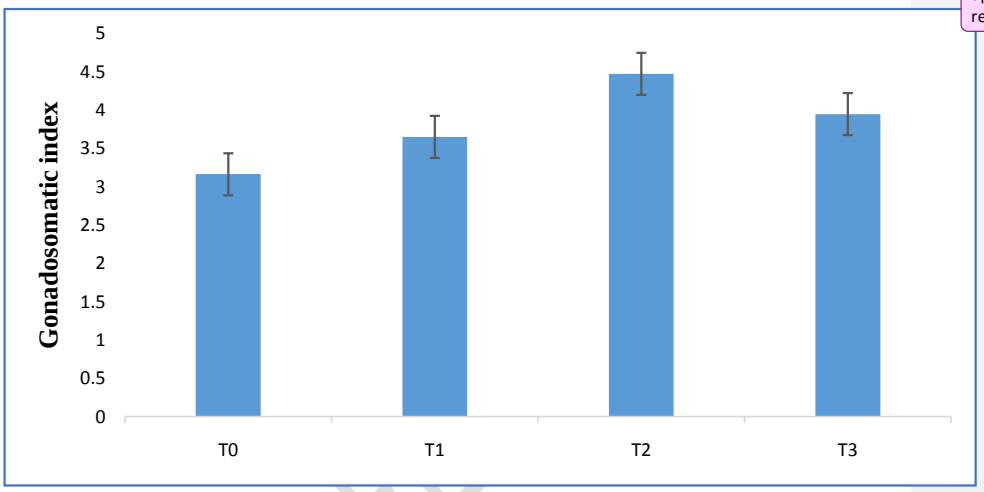

Figure 4: Effect of *Foeniculum vulgare* mingle diet containing different concentrations on Gonadosomatic index (Mean ± SD) of *Poecilia reticulata*

4.5.2 Fecundity

Table 5: The impact of different concentrations of *Foeniculum vulgare* extract on reproductive parameters of *Poecilia reticulata* (♀) for 90 days

Sr. no.	Parameter	Treatments			
		T_0	T_1	T_2	T_3
1	Fish weight	0.79± 0.008^{c}	0.93± 0.008^{b}	1.04± 0.01^{a}	0.93±0.008^{b}
2	Fish length	3.9 ± 0.2^{d}	4.4 ± 0.12^{c}	5.6 ± 0.08^{a}	5.1 ± 0.04^{b}
3	Absolute fecundity	5.7± 0.12^{d}	7.9 ± 0.12^{c}	9.4 ± 0.19^{a}	8.3 ±0.15^{b}
4	Relative fecundity	46.8 ±	53.5 ± 0.98^{b}	62.3 ± 1.87^{a}	57.1±1.71^{ab}

		1.20[c]			
5	Gonadosomatic index	6.07 ± 0.11[d]	7.03±0.04[c]	8.69 ± 0.15[a]	7.54 ± 0.05[b]
6	Hatching (%)	62.3 ± 1.69[c]	81.2 ±0.08[b]	91.3± 4.1[a]	85.5 ± 2.3[b]

Note: Values (mean ± SEM) superscripted by various letter sets inside a similar line are differ essentially (P < 0.05).

Findings of reproductive parameters are presented in Table 5 and Fig 5. Significant differences were found among treatments in Gonadosomatic index (P<0.05); although absolute fecundity and relative fecundity of guppy fish significantly increased (P<0.05) in T_2 fed with 100 µl of *Foeniculum vulgare* extract. .

As the gonads weight increase, relative fecundity and absolute fecundity also increase. The numbers of eggs were highest count in T_2. This showed that fennel seed extract with 100µl concentration in diet has significant results (p<0.05) on the Gonads initial maturity and fecundity.

The present study reported that, the gestation period of *Poecilia reticulata* was 25-35 days with an average of 28 days.

In *Poecilia reticulata*, treatment is interior and happens through mating of couples demonstrating explicit mating conduct. Male play out S-formed stance known as 'sigmoid display' and orientates himself before the females toward the start of courtship (Krumholz, 1948).

Comment [WU5]: There needs to be additional, up-to-date comparative literature on each study result

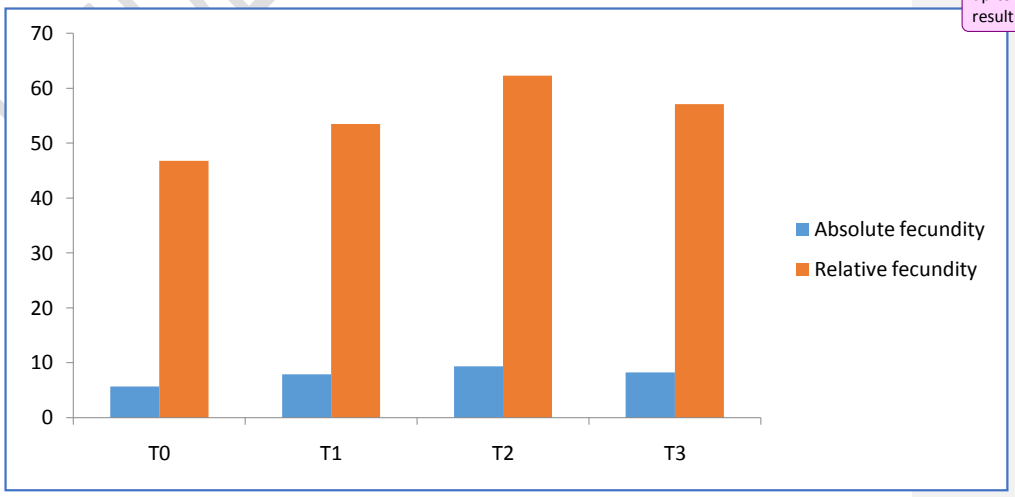

Figure 5: Comparison of absolute fecundity and relative fecundity changes in test groups and control during experiment.

4.5.3 Hatching

Results for hatching rate (%) were presented in Table 5.According to graph (Fig 6) highest value was observed in T_2 ($p< 0.05$) which show that increased significantly followed by T_1, T_3 andT_0 respectively. Results were best in T_2 which contains 100 µl extract of *Foeniculum vulgare.* Highest and lowest hatchling rate were respectively in T_2 and control group. According to result *Foeniculum vulgare* has a positive effect towards increase in hatching percentage.

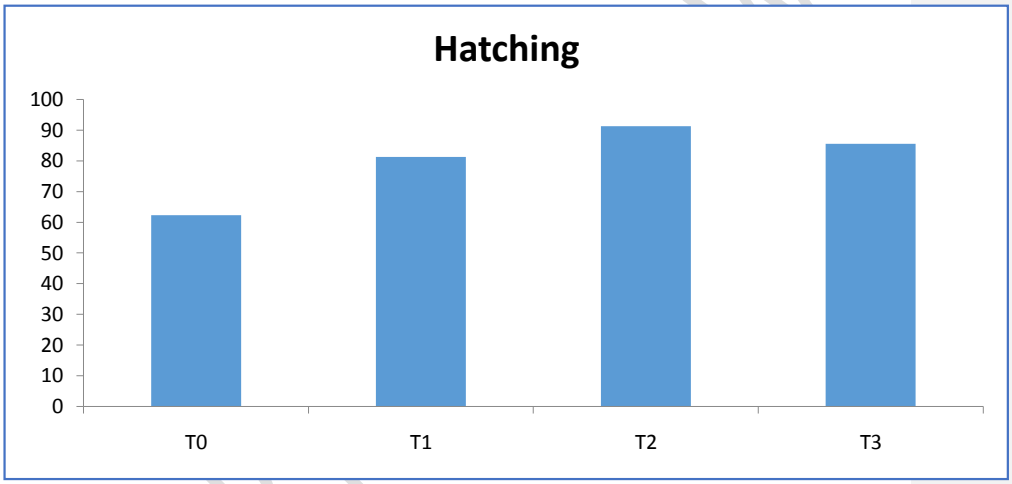

Figure 6: Number of young ones released by control and experimental groups with varying concentrations of *Foeniculum vulgare.*

4.5.4 Spawning performance

Table 6: Evaluation of spawning response of *Poecilia reticulata*

Parameters	Treatments			
	T_0	**T_1**	**T_2**	**T_3**
Survival rate percentage	100 ± 0.00 [a]	100 ± 0.00 [a]	100 ± 0.00 [a]	100 ± 0.00 [a]
Number of larva	45±3.5[d]	74± 1.4[c]	91± 0.81[a]	82± 1.6[b]
Number of ova	34±2.4[d]	68±2.9[c]	81±2.1[a]	75±2.4[b]

Spawning time(hours)	88±0.81[a]	65±0.81[c]	39±2.94[d]	76±1.63[b]

Note: Values (mean SEM) superscripted by alphabets are significantly different (P < 0.05).

To evaluate the influence of *Foeniculum vulgare* on the spawning performance of Guppy fish results were presented in the Table 5. Graphical presentation (Fig 7) presented that guppy fish laid more egg when treated with Ethanolic extract of *Foeniculum vulgare* with 100µl concentration. Treatment (T_2) when treated with 100µl *Foeniculum vulgare* resulted a significantly positive effect ($p<0.05$) 91±2.1 on no of young ones produced by *Poecilia reticulata.* Present findings indicated that herbal extract of *Foeniculum vulgare* is a positively effective stimulator for spawning of *Poecilia reticulata.*

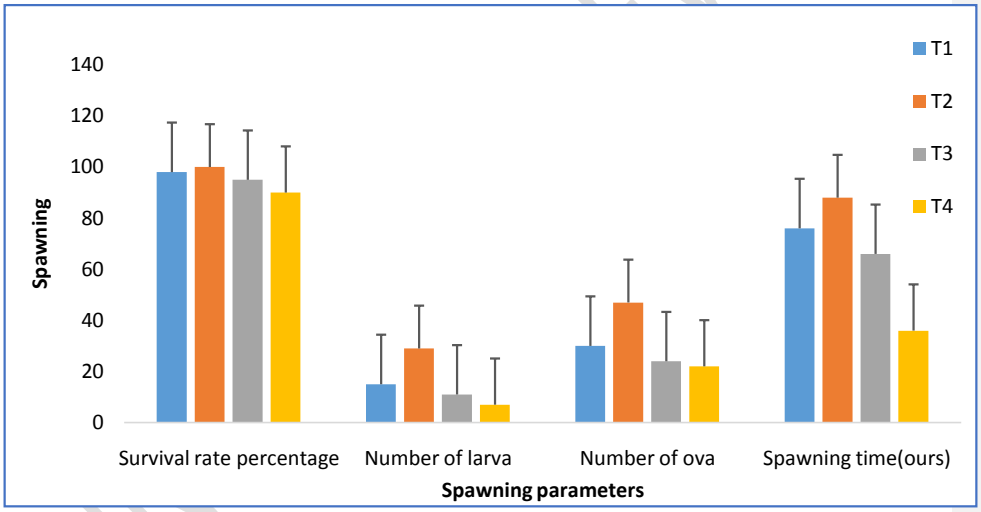

Figure 7: graphical comparisons of different doses of *Foeniculum vulgare* mingle diet on spawning performance in *Reticulata*.

4. DISCUSSION

The success of aquaculture depends on a number of parameters, the most important is a suitable diet that contains the complete balanced nutritional diet for the average growth of fish (Salehi, 2008).

The aim of this research was to investigate the effect of *F. vulgare* extract mingles diet on the growth and reproductive performance of *Poecilia reticulata.* According to results of the present study, FCR decreased in T_2 as compared to other treatments. *Foeniculum vulgare* seed extract contains the Anethole and Estragole perform the function as a digestive stimulant may be a reason for the decrease in FCR (Frankic et al., 2009).

More than this growth of *Poecilia reticulata* significantly ($p < 0.05$) positive increase in T_2. The growth parameter, the survival rate was uniformly the same in all treatments which are about 100% in all treatments.

This justified that *Foeniculum vulgare* has no ($p > 0.05$) effect on the survival rate. There are similarities between the current study and those investigated by Sotoudeh & Yeganeh (2017). The finding of the research is also co-related with the work of Yilmaz et al. (2012). His research investigated that dietary thyme improved the growth performance of *Dicentrarchus labrax*.

Water parameters recorded during the experiment were temperature, alkalinity,dissolved oxygen, TDS, TSS, and EC. Water temperature recorded during the experiment was range from 24^0C to 30^0C.

Environmental parameter, the temperature was accordingly to the work of Dawes, (1991). The results of this study are congruous with the finding of Yilmaz et al, (2012). They evaluated that a dietary cumin level of 1% provides the best survival rate for tilapia, *Oreochromis mossambicus*, with no inauspicious effect on growth performance simultaneously.

Tribulus Terrestris showed the same results with a significant difference ($P<0.05$) in weight gain (Yeganeh et al., 2017). The present investigation showed similar findings as *Thymus vulgaris, Rosmarinus officinalis*, and *Trigonella foenum graecum* had a positive response towards the growth performance of *Dicentrarchus labrax* (Yilmaz et al., 2010).

After the chemical analysis of *Foeniculum vulgare* seed extract resulted that *Foeniculum vulgare* extract contains the trans-anethole (64.49 %) which is similar in structure to 17-beta- estradiol.

The presence of trans-anethole may cause a significant increase in estrogenic hormones; lead to an increase in reproductive performance and fecundity (Albert-Puleo, 1980). An increase in the reproduction activities

of *Poecilia reticulata* fed feed containing *F.vulgare* seed extract, a reason for increasing the level of estrogenic hormones lead to increase the reproductive performance. A similar result was reported by Nazari and Roozbehani, (2015). Their finding showed that the fertility rate of *Poecilia reticulata* enhanced when used *Foeniculum vulgare* extract in the diet.

Among dietary treatments used in this research, T_2 show positive increase in GSI (8.69 ± 0.2), Fecundity (9.4 ± 0.19), and hatching rate. Dada and Adeparusi (2012) intimate that diets with *Sesa-mum indicum* supplement and seed powder of *Croton zambesicus* were improved female *C. gariepinus* GSI.

Dada and Ajilore (2009) distinguished an increase in egg diameter and fecundity of *C. gariepinus* when treated with *Garcinia* seeds extract. Sadeghpour et al. (2015) commented that increase in serum level estrogen in mice female when injected with extracts of *Foeniculum vulgare.*

The findings of another research are also consistent with this current research, fecundity of guppy was directly proportional to the bodyweight of the fish, which means that the fecundity increased with the increase in body weight (Shahjahan et al., 2013). The use of injection of ovaprim shown the highest fecundity of *Pterophyllum scalare* suggested by Chatterjee, Patra, and Talwar, (2013).

Ghosh et al. (2007) reported that incorporation of probiotics in feed influenced the reproductive performance of livebearers in terms of high fecundity, high Gonadosomatic index, high fry survival rate, reduction in fry mortality and deformity, and higher average weight and length gain of fish fry.

Nielsen and Baatrup, (2006) treated *Poecilia reticulata* with estrogens that enter into the aquatic system, results of this research showed that no significant difference was seen in the Gonadosomatic index (GSI).

A similar observation was found with *Cyprinus carpio* when treated with *Ferula coskunii* (Yilmaz et al., 2006).Current research finding indicated that *Poecilia reticulata* treated with *Foeniculum vulgare* seed extract, increased number of young's ones produced by guppy fish in T_2 were 91±2.1 while the control group produced 45±2.5. Dada (2012) investigated that feed supplement with *G. kola* seed powder improved hatchability and fecundity of *C. gariepinus*.

Successful spawning of *C.punctatus* at 0.3and 0.5ml/kg and 3000IU/kg weight of HCG was noted by Kather and Sridhar (2002). For *H.fossilis* the utilization of

ovaprim came about greatest Successful body spawning (Chatterjee et al., 2013). Effective spawning of *C.punctatus* is when treated with HCG. *Natrum muriaticum* showed a positive effect on the spawning performance of *Poecilia reticulata* (Sudha and Gokula, 2018).

The findings of previous research are similar to the results of the current investigation. There are also similarities between the work of (Sudha and Gokula, 2015) when *Puntius conchonius* treated with similar herbal medicine *Natrum muriaticum* on spawning response.

5. CONCLUSIONS

The present study investigated that *F.vulgare* seeds extract has a significant effect on the growth performance of *Poecilia reticulata*.

Under the report of the current investigation, *F.vulgare* seed extract has a significant positive effect on reproductive parameters.

Increasing the level of estrogen hormones in fish fed with *F.vulgare* ethanol extract, due to the presence of trans-anethole, reproduction activities and fecundity of the fish was increased.

Considering, fennel seed extract within the diet has a significant increase in the Gonad's initial maturity Gonadosomatic index increase is directly proportional to a female's body size.

As the gonad's weight increases, relative fecundity, and absolute fecundity also increase the number of eggs.

It is suggested that herbal extracts contain estrogenic compounds as in *Foeniculum vulgare* can be used as a supplement in fish diets.

In the future, the use of plant extract in aquaculture will be an effective tool to attain durable, economically safe fish production.

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