Journal of Animal and Veterinary Advances 5(5) : 423-425, 2006

Relationship Between Body Condition and Spermatological Properties in Goldfish (*Carassius auratus*) Semen

Yusuf Bozkurt
Department of Aquaculture, Faculty of Fisheries, Mustafa Kemal University,
31040 Hatay, Turkey

Abstract: In collected sperm, volume, motility, movement duration, density, total density and pH were recorded. Furthermore, body weight and body length were measured and correlations between spermatological properties and these parameters were assessed. There were significant positive correlations between total density and volume ($r=0.981$, $p<0.01$). On the other hand, the phenotypic correlation between body weight and length was not found statistically important ($r=0.509$, $p>0.05$).

Key words: *Carassius auratus*, goldfish, semen quality, body condition, male broodstock

INTRODUCTION

Artificial insemination requires a large quantity of good quality semen. Collection and storage of good quality semen can improve artificial insemination by reducing the stress to male broodstock caused by repeated semen sampling that reduces semen quality[1].

Semen quality data are required for successful artificial insemination and semen handling techniques. In addition, semen quality is a measure of the ability of semen to successfully fertilise an egg. Any quantifiable physical parameter that directly correlates with the fertilization capacity of semen could be potentially used as a measure of semen quality. Optimal semen quality is important for effective broodstock management and should be a criterion in the selection of male broodstock.

Under fish culture conditions, the semen quality mainly depends on the conditions of maintenance and intensity of use of the same male and also on the conditions of hypophysial injection. On the other hand, the knowledge about the trends in semen quality changes is very important for developing semen technology of aquarium fishes for selective breeding purposes due to high market prices.

Semen quality in aquarium fish may be affected by diferent components of broodstock husbandry during collection and storage of semen prior to fertilization. In some species, poor semen quality can be a limiting factor in their culture. However, even when fertilization succes is high, differences in sperm quality between males when mixed sperm from multiple males is used may severely reduce the apparent population size and may affect the future genetic integrity of the stock.

Considered together, available data indicate that there are individual differences in sperm quantity and quality that must be identified to select the most valuable fish for broodstock. Up to now, differences in sperm production and quality among male *Carassius auratus* have not been evaluated.

From this point of view, the objectives of this study were to examine the semen quality parameters of *Carassius auratus* as well as investigate the influence of body condition on the physical parameters of semen.

MATERIALS AND METHODS

Broodstock: Ten adult and sexually mature males (38.9±5.25 g of body weight and 13.0±2.16 cm total length) were chosen randomly. Males were examined to determine the sexual maturity by the presence of semen in the genital papilla after a light pressure of the abdomen.

Collection of semen: In the pre-spawning period the fish were kept separately in small ponds and fasted 48 hours prior to semen collection. Their abdomens and urogenital papillas were dried before stripping and semen was collected from anesthetized (0.5 mg L MS 222) males. The semen was collected directly into clean and dry 1.0 mL glass tubes. Care was taken to avoid contamination of semen with water, urine or faecal matter. The tubes were covered and kept on crushed ice until evaluation.

Evaluation of semen quality: The semen quality parameters including semen volume (mL) and colour, spermatozoa density ($x10^9$/mL), spermatozoa motility (%) and duration of spermatozoa movement (s) were evaluated.

Volume and colour of semen: The semen was collected in glass tubes graded and the volume of the semen was

Table 1: Spermatological parameters of goldfish semen (n=10)

	Semen volume (mL)	Spermatozoa motility (%)	Movement duration (s)	Spermatozoa density (x10^9/mL)	Total no. spermatozoa (x10^9)	Semen pH
Means±SD	0.32±0.24	82.5±6.34	208.6±26.7	13.000±2.031	4.082±3.045	7.3±0.48
Range	0.1-0.8	75-95	167-247	10.000-16.000	1.000-9600	6.5-8.0

Table 2: Correlations between body weight-length and spermatological properties of goldfish semen

Weight	Length	Volume	Motility	Mov.dur.	Density	Total den.
Length	0.509					
Volume	0.140	0.042				
Motility	-0.141	-0.527	-0.036			
Mov. dur.	-0.516	-0.173	0.175	-0.154		
Density	-0.273	-0.057	-0.174	0.603	0.257	
Total den.	0.104	0.029	0.981*	0.087	0.247	-0.018
pH 0.167	-0.053	-0.151	-0.272	0.182	-0.567	-0.170

*Correlation is significant at p<0.01

registered immediately following semen collection. The colour of each sample of semen was judged visually and only white colour was observed.

Spermatozoa motility: The motility of semen in each sample was evaluated within the thirty minutes after collection. About 10 μL semen was placed on a glass microscope slide (1.0-1.2 mm depth) and 100 μL activation solution (0.3% NaCl) was added. After activation with activation solution, spermatozoa was observed under 400x magnification and the percentage of motil spermatozoa was determined. Only forward movements of the spermatozoa were assessed as motility, whereas simply vibrating semen were assessed as immobile. Observations were made at room temperature (20°C).

Duration of spermatozoa movement and semen pH: The duration of spermatozoa movement was assessed using a chronometer that was started simultaneously with the addition of activation solution into the sample. Semen pH was measured with standart pH electrodes within thirty minutes of sampling.

Spermatozoa density: Spermatozoa were counted using a haemacytometer within two hours of semen collection. For the haemacytometer counts, semen was diluted (1/1000) in Hayem solution (5 g Na_2SO_4, 1 g NaCl, 0.5 g $HgCl_2$, 200 mL bicine) and determined at magnification of 200x and expressed as x10^9/mL. Counting chambers were always kept in a moist atmosphere for at least 10 min before cell counting.

Statistical analysis: All values are expressed as means ± standart deviation. All statistical analysis were carried out using SPSS 10 for windows software package.

RESULTS AND DISCUSSION

Spermatological properties and the correlations between body weight-length and spermatological properties of scaly carp semen of are presented in Table 1 and 2.

Since almost there is no report related with sperm characteristics of the *Carassius auratus* all spermatological comparings were made with *Cyprinus carpio*. Mean sperm volume of goldfish was found rather low when compared to mirror carp reported by Akçay *et al.*[2]. The differences may be due to the feeding conditions and regime, environmental factors or spawning time.

The mean spermatozoa motility was similar to the results of Bozkurt and Secer[3] for mirror carp. Duration of spermatozoa movement was found lower when compared to the results of Akcay *et al.*[2] and also found lower than Bozkurt and Secer[3] for mirror carp. Spermatozoa motility varies in vigor and duration not only among males but also within an individual male depending on ripeness[4]. Most studies on fish species have shown that the duration and motility of semen may vary seasonally[2,5]. The mean pH generally confirmed by Munkittrick and Moccia[6] and Tekin *et al.*[7].

Sperm production and quality can be affected by both fish size and physiological status. On the other hand, the phenotypic correlation between body weight and length was not found statistically important (r=0.509, p>0.05). Relationships found as low and insignificant in this experiment between fish size and sperm quality indices indicate that physical condition of mature fish has not a influence on sperm quality in goldfish. Sperm quality may be affected from the effects of genetics, diet, environmental stres (toxicants, water quality, fish density) or disease. In addition, according to Campbell *et al.*[8], fish held in captivity experience conditions that often increase stress and lead to reduced gamete quantity.

CONCLUSION

The present study indicates that, mature males releasing sperm with low motility and low density should

be culled from the broodstock. Reducing the number of male broodstock maintaining for spawning can significantly improve hatchery efficiency and minimize feed costs under aquarium conditions. Our data can be used to select high quality mature males for fertilizing eggs in a commercial aquarium operations.

REFERENCES

1. Ritar, A.J., 1999. Artificial insemination with cryopreserved semen from stripped trumpeter (*Latris lineata*). Aquaculture, 180: 177-187.
2. Akcay, E., Y. Bozkurt, S. Secer and N. Tekin, 2004. Cryopreservation of mirror carp semen. Turk. J. Vet. Anim. Sci. 28: 837-843.
3. Bozkurt, Y. and S. Secer, 2005. Effect of short-term preservation of mirror carp (*Cyprinus carpio)* semen on motility, fertilization and hatching rates. The Israeli J. Aquaculture B Bamidgeh, 57: 207-212.
4. Akcay, E., Y. Bozkurt and S. Kayam, 2002. Cryopreservation of mirror carp (*Cyprinus carpio* L. 1758) semen: With emphasis on post-thaw motility. In: 1st Int. Cong. Aquacult.-Fish. Technol. Environ. Management., June 8-10. Athens, pp: 5.
5. Benau, D. and C. Terner, 1980. Initiation, prolongation and reactivation of the motility of salmonid sp. ermatozoa. Gamete Res., 3: 247-257.
6. Munkittrick, K.R. and R.D. Moccia, 1987. Seasonal changes in the quality of Rainbow trout semen: Effect of a delay in stripping on spermatocrit, volume and seminal plasma constituents. Aquaculture, 64: 147-156.
7. Tekin, N., S. Secer, E. Akcay, Y. Bozkurt and S. Kayam, 2003. The effect of age on spermatological properties in rainbow trout (*Oncorhynchus mykiss* W. 1792). Turk. J. Vet. Anim. Sci., 27: 37-44.
8. Campbell, P.M., T.G. Pottinger and J.P. Sumpter, 1992. Stress reduces the quality of gametes produced by rainbow trout. Biology of Reproduction, 47: 1140-1150.