DURATION OF APPETITE INHIBITION PREDICTS SOCIAL DOMINANCE IN NILE TILAPIA *Oreochromis niloticus* L

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INTRODUCTION

- Heterogeneous fish growth is a common phenomenon in cultured fish populations
- Variation in individual growth rates attributed in part to:
  - social interactions
  - formation of feeding hierarchies
- Fish status in a stable dominance hierarchy:
  - dominant
  - subordinate, or
  - Intermediate
- There are changes in fish behavior once the fish is exposed to stress
- Behavioral stress response can be used in breeding programs to select individuals with high resistance to stress which can be used to produce stress-resistant lines
- Can DAI during the isolation predicts the outcome of contest for social dominance?

Significance

- Contribution to the social/ behavioral science
- Contribute to an easy identification of would be dominant fish in a group, thus facilitating selection of individuals for different purposes
- Breeding is largely driven by social behavior and an understanding or ability to predict dominance may contribute to tilapia breeding program (selection of individuals to produce stress resistant strains)

METHODOLOGY

Experimental Fish

- One hundred size #20 all-male Nile tilapia (mean wt = 0.60 g) were obtained from the Phil-Fishgen, CLSU, Science City of Muñoz, Nueva Ecija
- Maintained in a rectangular tank (2 x 1 x 1 m) receiving continuous flow of water for around 4 months

- Fed three times a day (3% BW)

Isolation

- Weight & length of each fish were obtained

- Isolation of 50 fish for 10 days in 30 cm x 15 cm x 30 cm aquaria

Monitoring the DAI after transfer to isolation

- After introduction in the isolation units, each fish was immediately hand fed with three pieces of floating feeds placed in a feeding ring

- The duration from time of feed introduction to the time the fish started to eat was recorded and was considered as the DAI

- This duration of appetite inhibition and the weight of the fish served as the bases for pairing the fish for social interaction (fast eater against slower one with both fish having similar weight)

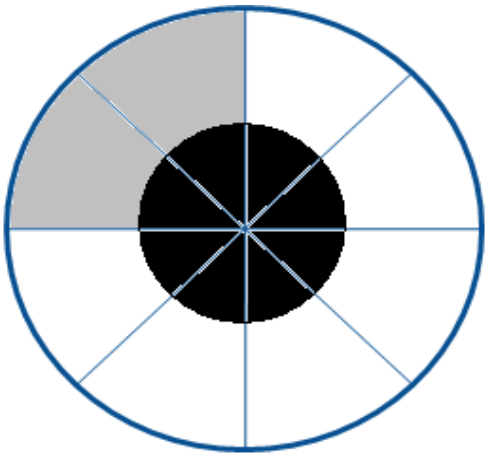
Social interaction

- After 10 days of isolation, fish were size-matched for the later pairing with maximum size difference of 12.85% (mean = 3.33%±0.67)
- Fish were individually marked by cutting the lower (with longer DAI) or upper (with shorter DAI) part of the caudal fin
- To prevent the effect of place familiarity, the fish in a pair were introduced at the same time in a new environment (30x15x30 cm aquarium

Monitoring of eye color pattern (ECP) during social interaction

- ECP was measured by quantifying the darkened area between the iris & sclera; from zero (no darkening) to eight (total darkening)

- The eye was divided into 8 equal parts using 4 imaginary diameter lines



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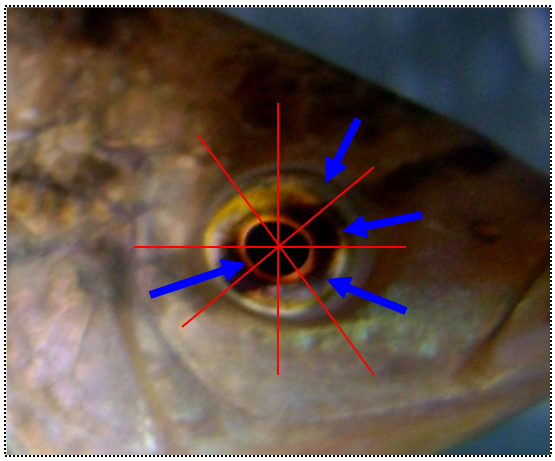

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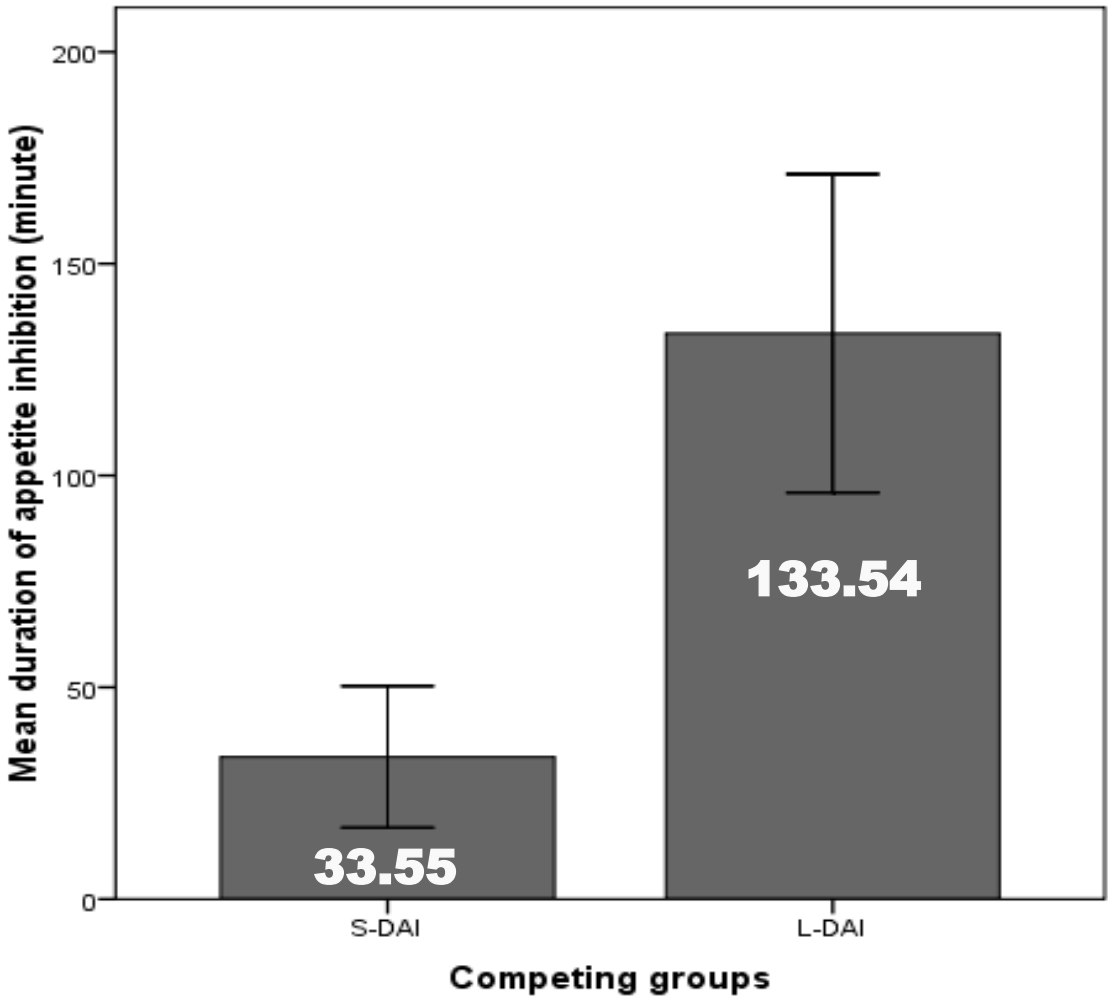
Data gathered

- DAI
- Number of pairs that interacted
- Duration of social interaction
- Social status of each fish after the interaction
- Weight of dominant & subordinate fish a day after the interaction
- Mortality

RESULTS & DISCUSSION

Duration of appetite inhibition



Mean (±S.E.) duration of appetite inhibition (minute) of the two competing groups. S-DAI: short DAI group; L-DAI: long DAI group. Mean DAI were significantly different at *P* < 0.01

Prior to interaction

Circling at each other, provoking the other fish to start the interaction

Fins of both fish were erected indicating that they were ready to fight

During the interaction

Biting directly at each others mouth

Biting at the caudal part of the opponent

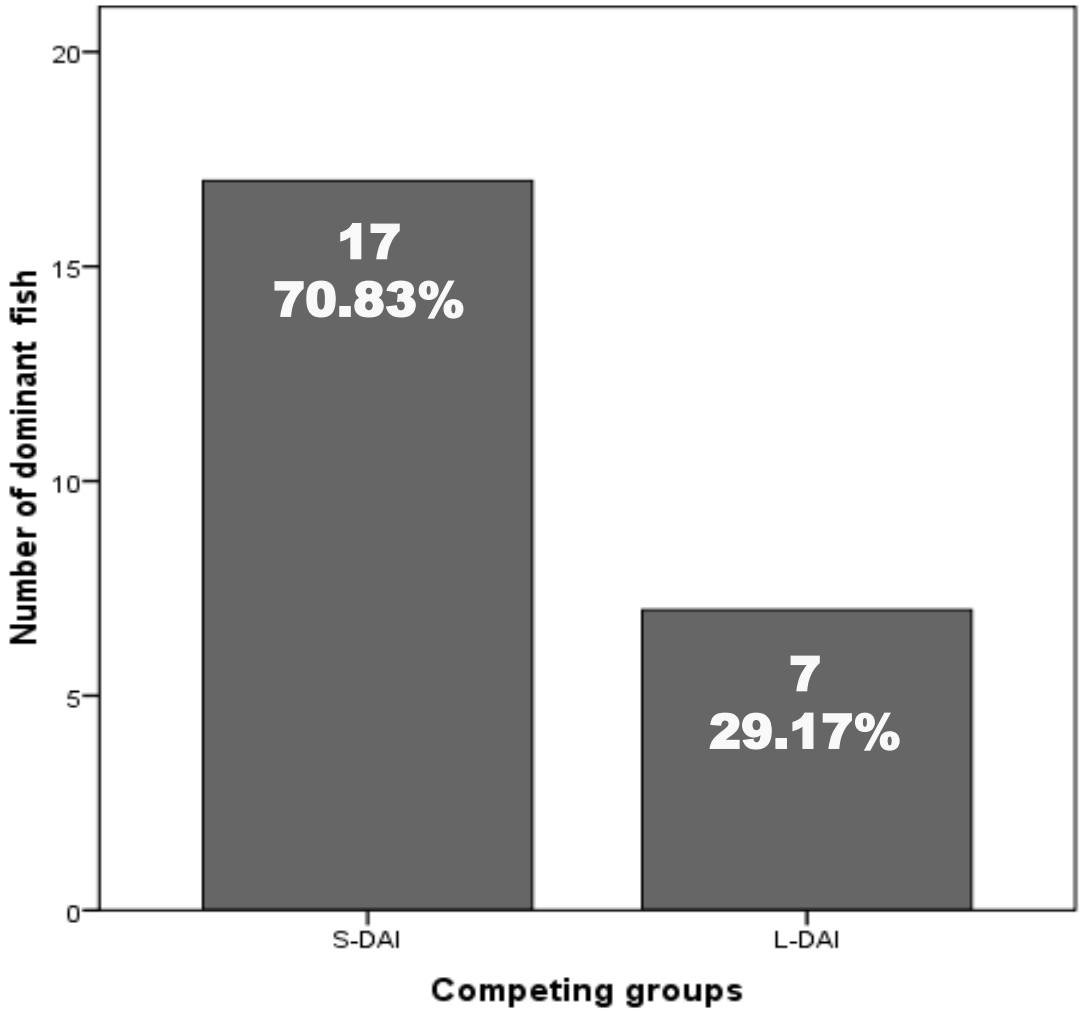
Biting at body part of the opponent

After the interaction

Subordinate fish retreating during attacks of dominant fish

Social interaction

24 of the 25 pairs interacted



Number of dominant fish in the two competing groups. S-DAI: short DAI group; L-DAI: long DAI group. Frequency difference was significantly different at $P < 0.05$

Social interaction

- Duration of social interaction: Shortest (15.18 min); Longest (55.00 min); 7 pairs interacted >30 min & 17 pair <30min

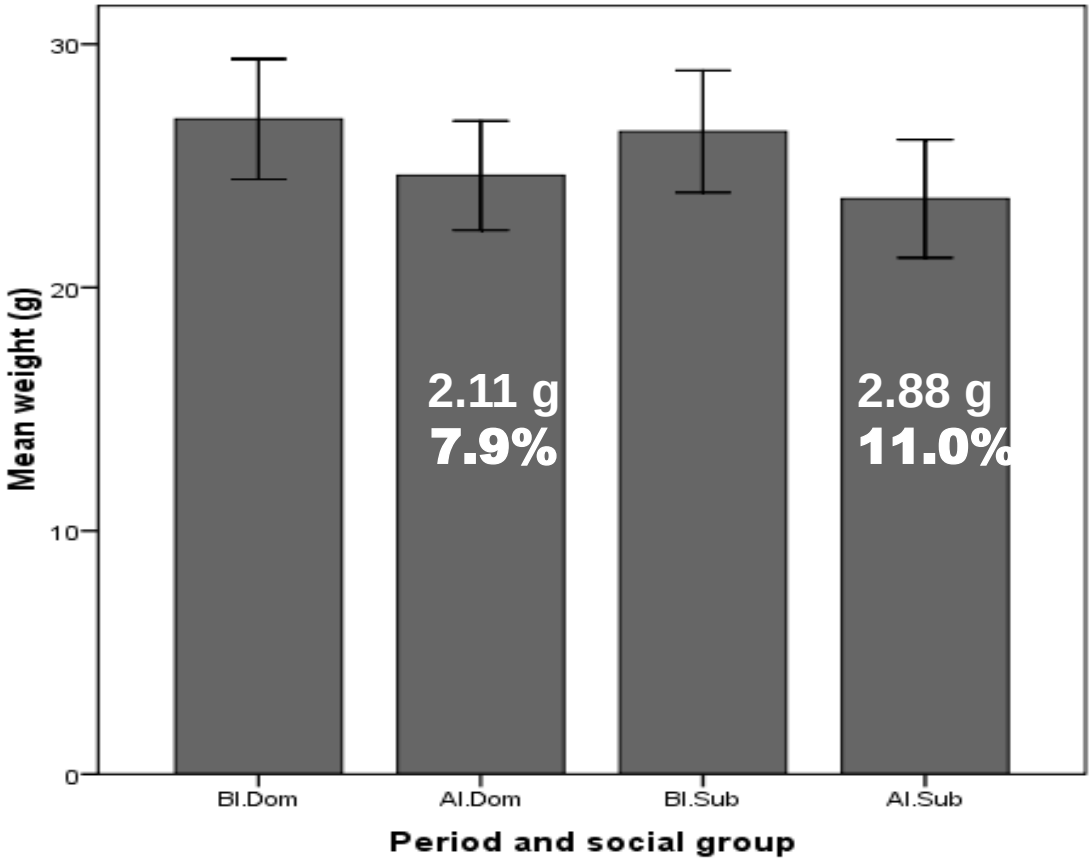
- Tilapia with shorter DAI after its transfer to a new environment (during isolation or before a fight) is most likely or has a greater chance to become dominant

Body weight one day after the fight

Weight loss a day after the interaction

Subordinate: 26.17 (1.40) g to 23.39 (1.36) g

Dominant: 26.81 (1.45) g to 24.70 (1.33) g



Mean weight (±S.E.) of dominant & subordinate fish before & after the social interaction. Bl.Dom: dominant - before the interaction; Al.Dom: dominant – after the interaction; Bl.Sub: Subordinate – before the interaction; Al.Sub: Subordinate – after the interaction. Mean weight loss difference was significantly different at *P*<0.05

Body weight one day after the fight

- Reduced weight of subordinate a day after the interaction: more on appetite inhibition rather than a reflection of mobilization of stored energy for physical activity associated with social stress
- Reduced weight of dominant a day after the interaction: increased physical activity
- Body weight differences between dominant & subordinate mainly attributed to behavioral differences rather than to differences in physical activities

Mortality of subordinates

Death can be the most overwhelming effect of stress

Day after the fight	Mortality
1	1
2	4
3	9
4	3
5	5
6	1
7	1

Mortality was most likely the result of exhaustion caused by social stress

CONCLUSIONS

Tilapia with shorter DAI during the isolation has a greater possibility to win the fight for social dominance

The greater weight losses in subordinates compared to dominants after the establishment of social hierarchy were mainly attributed to behavioral differences such as appetite rather than to differences in physical activities

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THANK YOU

for your attention