A COMPARISON OF GIFT AND RED TILAPIA FOR FILLET YIELD AND FLESH QUALITY ASSESSED BY A PANEL OF UNTRAINED CONSUMERS

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INTRODUCTION

The present is a companion paper of Khaw *et al.* (2006, these Proceedings) on the same topic, which dealt with a sensory evaluation of flesh quality assessed by a trained panel of assessors in a controlled and standardized food processing laboratory environment. By contrast, the evaluation reported here was conducted by a panel of untrained consumers, not in a laboratory environment, but instead, in a cafeteria where WorldFish staff normally have their lunch. The Quantitative Descriptive Analysis (QDA) approach used by Khaw *et al.* (2006) is generally recommended for product evaluation. It relies on especially trained personnel and it does not lend itself to situations in which the number of samples to be assessed is large. Furthermore, in reality, the acceptance or rejection of a product is determined by ordinary untrained consumers, not by trained personnel. Hence, without detracting from the value of the QDA approach, it was decided to conduct an evaluation based on an assessment made by untrained consumers, namely, volunteers among WorldFish staff. In this paper we present the results of this evaluation and discuss them in relation to those from the QDA approach.

MATERIAL AND METHODS

The fish and the environment. Two trials were conducted, in 2003 and 2005, referred to here as trials 1 and 2, respectively. In trial 1 the fish were a sample of GIFT and Red Tilapia stocks present at the time at the Aquaculture Extension Center, Jitra, Kedah State, Malaysia. For both strains these fish were from the generation preceding the one corresponding to the fish in the study reported by Khaw *et al.* (2006). The three sources of Red Tilapia (Enggor, Melaka, Negeri Sembilan) were present but their identity was not retained after the sampling, and are hence considered as a mixed Red Tilapia stock. Only sensory evaluation data are available in trial 1. The fish were grown out in an earthen pond (0.05 ha) at a density of two pieces per m^2 and fed at a rate of 5 % of the average fish weight per day (feed with 34 % of protein). At harvest the fish were 11 months old. In the case of trial 2 the fish were spawned at a private farm (PKPS Farm Mart) located in Selangor State, Malaysia, where the first growing out phase took place. PKPS farm has its own Red Tilapia stock, whereas GIFT in this comparison was derived from fish provided by the Aquaculture Extension Center, Jitra. Both strains were spawned in synchrony in May 2004. The fish were reared in earthen ponds (25m x 25m x 2m deep) at an initial stocking density of eight fish per m^2. The feed was the same as in trial 1, but the rate of feeding was 8% per day of the average fish weight at 60 days of age and was gradually decreased to 2.5% at 180 days. In January 2005 all the fish were moved to the WorldFish Center facilities in Penang (average weight 400g, 205 days old) for the final grow out before conducting the flesh quality evaluation. They were stocked in five fibre glass tanks (1m x 3m x 0.5m deep) for three months until they reached an average size of 550g. The feeding rate was 3 % of average fish weight per day with the same feed as in the earlier phase.

Flesh quality assessment and filleting. For the tasting evaluation in trial 1, 30 fish from each strain were sent to a caterer for gutting and cooking. The fish were cut into three portions. Both strains were supposed to be prepared in Straits Settlement style (fried with sweet and sour sauce and pineapple cubes). Unfortunately, despite our indication to the caterer, GIFT was

cooked in Malaysian style (fried with barbeque sauce), whereas the Red Tilapia was cooked in Straits Settlement style. Hence, in trial 1 there is a confounding between strain and cooking style which needs to be kept in mind when interpreting the results. However, because in both instances the fish were first fried and the sauces added on later the confounding effect is unlikely to be of major significant. In trial 2, 50 fish of each strain were sent to a caterer for gutting and cooking. All the fish were weighed before sending to the caterer. They were cut into two portions and all were cooked in Straits Settlement style. For both trials the sensory evaluation was carried out in the cafeteria at the WorldFish Center, Penang. Each fish portion was served on a plate to which a scoring sheet was attached with a coded number that related it to one of the strains. The number of panelists was 56 in trial 1, whereas it was 79 in trial 2. The flesh quality traits evaluated are listed in Table 1. In trial 2 an additional 113 fish (55 GIFT, 58 Red Tilapia) were filleted at the WorldFish Center, Penang, by two trained staff from the Fisheries Research Institute, Penang. Fish and fillets weights were recorded, from which fillet yield was calculated as: F % = (fillet weight/harvest weight) x 100.

Table 1. Flesh quality attributes and scoring system

Attributes	Scoring system				
	1	2	3	4	5
Aroma	Very bad	bad	average	good	Very good
General appearance	Objectionable	Not appetizing	Acceptable	Appetizing	Very Appetizing
Colour	Very bad	Bad	Average	Good	Very good
Texture, firmness or consistency	Very soft	Soft	Ideal	Moderately tough	Very tough
Juiciness	Very dry	Dry	Ideal	Watery/Oily	Very watery/oily
Taste or flavor	Very bad	Bad	Average	Good	Very good

Statistical analysis. The flesh quality data were analysed using PROC MIXED in SAS (SAS Institute Inc., 1997). The model fitted for fillet yield included strain only as a fixed effect. Fish and fillet weights were also analyzed using PROC MIXED, fitting strain, sex and the two way interaction term as fixed effects. Harvest weight was fitted as covariate in the model for fillet weight.

RESULTS AND DISCUSSION

There were no significant differences in flesh quality attributes between GIFT and Red Tilapia, except for texture in trial 1, in which case GIFT was closer to the ideal (Table 2). The cooking style in this test was different (Malaysian and Straits Settlement) between the strains, but no differences in sensory attributes were observed (Table 2) and both strains scored high acceptability by the sensory assessors (Table 2). According to Fauconneau et al. (1995), the cooking method is very important in detecting the differences of flesh quality, but in most cases they are not obvious because cooking is not properly designed. With regards to trial 2, there were no significant differences between the strains, and the scores indicated a very favourable reaction to both strains by the panelists.

Table 2. Sensory attributes least squares means for strains

Variable	Strain	Least Squares Means	
		Trial 1	Trial 2
Aroma	GIFT	4.16	3.51
	Red Tilapia	4.19	3.32
General appearance	GIFT	3.71	3.66
	Red Tilapia	3.93	3.55
Colour	GIFT	3.89	3.61
	Red Tilapia	4.15	3.71
Texture and	GIFT	4.31_a	2.85
firmness/consistency	Red Tilapia	4.73_b	2.63
Juiciness	GIFT	4.52	2.95
	Red Tilapia	4.57	2.95
Taste/Flavour	GIFT	4.07	3.83
	Red Tilapia	4.29	3.68

Means without common subscript are significantly different ($p<0.05$)

Table 3 shows the least squares means for harvest weight and fillet traits. GIFT had greater harvest weight than Red Tilapia. Strain, sex and the strain by sex interaction were statistically significant for harvest weight but not for the other two traits.

The average value for fillet yield was slightly lower than in other reports (e.g. Rutten *et al.*, 2005; Khaw *et al.,* 2006). The strain by sex significant interaction for harvest weight arose because there was a difference between the sexes in GIFT, but not in Red Tilapia. Other differences were not statistically significant, having corrected for differences in harvest weight for fillet yield. However, the strain effect bordered the five per cent level of significance for fillet yield and weight.

Table 3. Fillet traits and fish weight least squares means for strain and sex

Effect			Harvest Weight	Fillet Yield (%)	Fillet Weight
Strain	G		601.90_a	27.61	145.28
	R		451.26_b	26.66	139.06
Sex	F		488.51_a	27.42	142.99
	M		564.66_b	26.85	141.34
Strain*Sex	G	F	520.26_a	28.26	147.39
		M	683.54_b	26.95	143.18
	R	F	456.75_c	26.58	138.60
		M	445.78_c	26.75	139.51
Regression coefficient	Harvest weight				0.2572

Means without common subscript are significantly different ($p<0.05$).

With one exception (texture in trial 1) there were no significant differences in flesh quality traits between GIFT and Red Tilapia. Because of the problem of confounding between strains and cooking method there is a risk that strain differences were concealed in the data for trial 1. However, this is unlikely to have affected the relative ranking of the strains because both cooking methods used entailed frying the fish, and differed only in the type of sauce that accompanied them, relatively mild in either case. For both strains (and trials) the flesh quality scores assigned by the panelists fell within a range indicating high acceptability. This is consistent with Lovshin (2000), who states that Red Tilapia has no market advantage over

Nile tilapia when their final products are skinless fillets, as well as with the findings reported by Khaw *et al.* (2006, these Proceedings). Furthermore, in the present evaluation the samples were served as whole pieces with skin and they were very favorably scored for both strains. Note that the Red Tilapia stock used in the present comparison is from a different source to that in the paper by Khaw *et al.* (2006).

CONCLUSION

The combination of greater growth rate and likely greater fillet yield with highly rated flesh quality attributes comparable to those of Red Tilapia, make GIFT a very attractive strain capable of contributing to productivity increases to both domestic and export markets.

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