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Meat quality of Kuruma prawn (*Marsupenaeus japonicus*): preliminary evaluation

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RIASSUNTO – Qualità delle carni di *Marsupenaeus japonicus*: valutazione preliminare. *Lo studio ha inteso valutare le caratteristiche qualitative delle carni di gamberi tigre, in considerazione della somministrazione di una dieta in parte fornita dall'uomo (Ca), rispetto a quelle che sono le condizioni di vita pressoché selvatiche di un allevamento estensivo (Le). Sui maschi e sulle femmine sono stati rilevati i parametri colorimetrici e la durezza delle carni a 0, 1 e 40 giorni. Inoltre al tempo 0 è stata determinata la composizione chimica delle carni. La sperimentazione ha messo in evidenza l'influenza del sistema di allevamento, del sesso e dei differenti tempi di conservazione sui parametri colorimetrici e sulla tenerezza. Il contenuto proteico era uguale nei due allevamenti, al contrario delle altre componenti chimiche.*

Key words: *Marsupenaeus japonicus*, quality traits, storage, shrimp culture.

INTRODUCTION – Among the peneids, *Marsupenaeus japonicus*, a cold-temperate species, carnivorous, is the mostly cultured prawn in Italy and in the Mediterranean Sea basin, thanks to the good adaptability to the temperature and salinity variations, to the good resistance to the manipulations (better resistance out of water), to its appreciate nourishing qualities and to the good growth rate (Lumare, 1998). Whereas the literature on cultured fish fillet is rich (Gjedrem, 1997; Lanari *et al.*, 1999; Parisi *et al.*, 2003), few are the information about the shrimp meat quality traits. Therefore, the present work aimed at typifying the variations of the meat quality characteristics in shrimps from semi-intensive (supplemented with an artificial diet) or extensive rearing systems.

MATERIALS AND METHODS – The shrimps, belonging to the same genotype, were from a semi-intensive rearing system Ca (S. Caterina, Cagliari), where they received food supplementation and an extensive one Le (Lesina, Foggia), where the animals were exclusively fed on the resources of the basin. The shrimps were separated for sex and weighed. After that, each of them was distributed in three groups: the first one (time 0) immediately analyzed; the second one (time 1) analyzed after refrigeration at 4°C for 24 hours and the third one (time 40) analyzed after freezing at -18°C for 40 days. Following the dissection, the colorimetric indexes: L*-Lightness, a*-redness, b*-yellowness were detected from the tail muscle using a bench colorimeter HunterLab (ColorFlex, Illuminant D65), by making five readings for each sample. Subsequently they were submitted to the shear force device, according to the Warner Bratzler Shear device system (WBS test), by using an Instron 5544 machine. Peak force was expressed as kg/cm2 and represents the cutting force required to shear perpendicularly to the direction of the fibres. All the parameters were obtained according to the ASPA methodologies (1996). The chemical analyses of the shrimp meat were also effected. Data were submitted to the analysis of variance using the GLM procedure of SAS (1999) and considering as main effects the culture system and the sex and their interaction. Moreover, just for the tenderness, it was also used a model which considered as main effect only storage. Means were compared by the "t" test of Student.

RESULTS AND CONCLUSIONS – The shrimps from the two culture systems showed different average weights ($P<0.01$) (Table 1), the females had greater weights than the males in both rearing systems ($P<0.01$) according to Lumare (1998). Regarding to the colour indexes at time 0, differences were noticed both between the rearing systems and between the sexes. The L* was higher ($P<0.01$) in the meat of the shrimps of Ca in comparison with those of Le, as well as resulted higher in the males than in the females ($P<0.01$). The trend

of L* didn't vary after the 24 h between the two culture systems and the two sexes, and it increased in the time (Table 2). The a* was higher in the meat of Le than Ca (P<0.01) and in the males in comparison with the females. The b* at time 0 showed a difference between Ca and Le, with a lower value in Ca than Le and in the males than the females (P<0.05). After 24 h and 40 days, the males had b* index significantly higher in comparison with the females (P<0.01).

Table 1. Measurements at time 0 on tail muscle.

	Culture system		Sex		Culture system × SexSED				
	Ca	Le	F	M	F		M		DF=180
					Ca	Le	Ca	Le	
Shrimps (n)	100	84	122	62	60	62	40	22	
Weight (g)	20.82B	26.17A	24.78A	22.21B	22.36C	27.20A	19.27D	25.14B	3.208
L*	43.19A	34.22B	37.82B	39.59A	43.16A	32.48C	43.23A	35.95B	3.121
a*	-0.73B	0.55A	-0.25b	0.07a	-0.80B	0.30Ab	-0.66B	0.81Aa	0.818
b*	-1.07	-0.70	-0.46A	-1.31B	-0.77Ba	-0.14A	-1.36Bb	-1.25B	1.236
Chroma	1.72	1.79	1.49B	2.03A	1.65ABb	1.33Bc	1.79Ab	2.26Aa	0.756
Hue	0.50A	0.10B	0.22	0.37	0.43a	0.01Bb	0.57A	0.19	0.931
Peak force	1.68	1.70	1.79A	1.60B	1.70b	1.87Aa	1.66B	1.53B	0.391

Table 2. Measurements at time 1 (after 24 h at 4°C) on tail muscle.

	Culture system		Sex		Culture system × Sex				SED
	Ca	Le	F	M	F		M		DF=164
					Ca	Le	Ca	Le	
Shrimps (n)	80	88	88	80	40	48	40	40	
Weight (g)	19.84B	24.83A	24.56A	20.11B	20.42BC	28.70A	19.26C	20.96B	2.703
L*	45.25A	41.63B	39.40B	47.48A	45.11B	33.69C	45.40B	49.56A	1.748
a*	-1.86B	1.19A	-0.44B	-0.22A	-2.03C	1.14A	-1.68B	1.24A	0.557
b*	-0.56b	-0.15a	-0.67B	-0.03A	-0.74B	- 0.61B	-0.38b	0.31Aa	1.252
Chroma	2.37A	1.69B	2.11	1.95	2.71A	1.50C	2.02B	1.88B	0.566
Hue	0.21A	-0.22B	-0.12b	0.11a	0.23A	- 0.48B	0.19A	0.04A	0.668
Peak force	2.06	1.99	2.01	2.04	2.09a	1.94b	2.04	2.03	0.294

Peak force (kg/cm^2); A, B, C, D: P<0.01; a, b, c: P<0.05.

The shrimps of Le had globally the darker meat (in the time 0 and 1) and redness and yellowness higher (in the three times) than Ca. Following the storage, the L* had the rising trend during the time, a* went down, while b* increased (Table 3), probably depending on an oxidation of the pigments present in the meat. In the three times of storage, the more coloured meat (taking into consideration a* and b* indexes) belonged to the shrimps naturally fed, thus confirming that the colour is also the result of the type of diet according to Treece (2000).

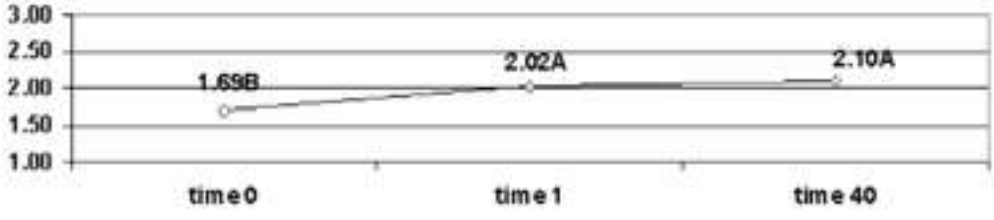
Table 3. Measurements at time 40 (after 40 days at -18°C) on tail muscle.

	Culture system		Sex		Culture system × Sex				SED
	Ca	Le	F	M	F		M		DF=146
					Ca	Le	Ca	Le	
Shrimps (n)	94	56	82	68	54	28	40	28	

L*	45.43B	46.15A	45.25B	46.32A	45.38B	45.13B	45.48B	47.17A	1.416
a*	-2.93B	-1.46A	-2.16	-2.22	-2.95B	-1.37A	-2.91B	-1.54A	0.550
b*	-0.98B	2.80A	0.44B	1.38A	-1.45C	2.33Ab	-0.51B	3.27Aa	1.448
Chroma	3.29	3.45	3.22	3.52	3.35	3.10c	3.24bc	3.80a	0.362
Hue	0.30A	-0.87B	-0.16A	-0.41B	0.44A	-0.75Ca	0.17B	-0.99Cb	1.032
Peak force	1.93B	2.28A	2.14	2.06	1.92B	2.36A	1.93B	2.19A	0.432

Peak force (kg/cm^2); A, B, C: P<0.01; a, b, c: P<0.05.

Regarding the tenderness of the meats (Table 1) the females were significantly harder than the males at time 0 (P<0.01), but not more after the 24 h; the females of Le were harder than those of Ca (P<0.05), with an evident correspondence between the peak force and the average weight in the females. The possible cause of such result is the greater sizes of the shrimps (great shrimps have harder muscle tails than the small ones). At the time 40 days meat from Le (Table 3) showed a higher value in comparison with Ca (P<0.01). Peak force progressively rose from time 0 to time 40 (Figure 1), showing significant differences at the time 1 (P<0.01) and evidencing values not dissimilar in the time 40 in comparison with the time 1. Such tendency is explainable, considering that the rigor mortis already



occurs during the first 24 h. The analysis of the meat chemical composition (Table 4) showed no differences between the sexes, while Ca and Le were different (P<0.01), in fact the moisture and fat contents were higher in Le, and ash one was higher in Ca.

In conclusion, following the time the colour showed a progressive increase of L* and b* and a lowering of a* for both culture systems. Shrimp meats at time 0 were more tender than those refrigerated for 24 h and stored for 40 days.

Figure 1. Peak force (kg/cm2) in the three times of storage.

Table 4. Meat chemical composition (% on wet matter) at time 0.

	Culture system		Sex		Cult. syst.	SED
	Ca	Le	F	M	× Sex	DF=36
Samples (n)	18	20	22	16		
Moisture	75.44B	76.32A	75.91	75.86	n.s.	0.681
Protein	22.53	22.28	22.37	22.44	n.s.	0.621
Fat	0.48B	0.64A	0.57	0.56	**	0.055
Ash	1.13A	0.64B	0.86	0.91	n.s.	0.150

A, B: P<0.01; n.s.: not significant; **: P<0.01.

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