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RESEARCH ARTICLE

Impact of Short-term Artificial Low Salinity Stress on the Flavor Quality of *Scylla Paramamosain*

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ABSTRACT

Scylla paramamosain is a kind of large euryhaline marine crab. As an important physicochemical parameter of seawater, salinity has a great impact on the survival, growth and quality of Scylla paramamosain. This research tested the content of non-volatile flavor substance, lactic acid and taurine on the 0, 1st, 3rd, 7th and 15th day in three salinity gradients (3, 13, 23) with HPLC (High-performance Liquid Chromatography) technology. Results have shown that in low salinity stress, the cumulative amount of free amino acids in muscle of *Scylla paramamosain* is more than that in hepatopancreas, while the cumulative amount of essential amino acids in hepatopancreas is more than that in muscle. In muscle, contents of three flavor amino acids are ranked as follows: sweet, bitter and delicious amino acid, and in hepatopancreas, it is bitter, sweet and delicious amino acid. The fluctuation rule of free amino acid, essential amino acid and lactic acid in *Scylla paramamosain* in the low salinity group is similar to that of other salinity control group, while the content of sweet amino acid, bitter amino acid, nucleotide, EUC, taurine is different from that of other salinity control groups.

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Introduction

Scylla paramamosain is a kind of euryhaline large marine crab, which is generally believed to easily adapt to the changes in salinity.

Yuan Lei, et al. [1] (2011) studied the impact of sudden salinity decrease on the growth of megalopa larva and Na+/-K+-ATPase activity of Scylla paramamosain, and showed that proper salinity decrease could increase the survival rate of megalopa larva, and the optimal salinity was 19.2, the lower limit of salinity suitable for growth ranged between 12.8 and 19.2, and the lower limit of salinity for survival ranged between 6.4 and 12.8.

Yuan Lei, et al. [2] (2013) studied the impact of salinity (6, 13, 20, 27 and 33) on the growth of young Scylla

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paramamosain and Na^+/K^+-ATPase activity, and indicated that salinity had a significant impact on the shell width and specific growth rate of body weight of young Scylla paramamosain, C3 molting interval, shell width increment (C1 to C2 and C2 to C3), and Na^+/K^+-ATPase activity (*P<0.05*), but it had no significant impact on the survival rate of young Scylla paramamosain, C2 molting interval and C3 to C4 shell width increment (*P>0.05*). In low salinity environment, the increase of Na+/K+-ATPase activity would help young Scylla paramamosain adapt to the hypotonic solution.

Huang Haitao, et al. [3] (2011) placed molting Scylla paramamosain in the seawater (whose salinity was 0, 5, 10, 15, 20, 25, 30, 35, 40, 45 and 50 respectively) for experiment, and showed that salinity had a slight impact on the increase of shell width, shell length and weight of Scylla paramamosain after molting, but when the salinity was 5, the growth rate of length and width was the highest, when the salinity was 30 and 35, the growth rate of length, width and weight was smaller than other salinity groups. Therefore, it was believed that the best molting and survival salinity ranged between 15 and 20, while 5-35 was the appropriate salinity for the survival of Scylla paramamosain before molting, and 10-30 was the appropriate salinity for survival after molting.

Diao Le, et al. [4] (2019) studied Na^+/ H^+-exchanger, Na^+/K^+-ATPase and ANT2 of Scylla paramamosain, and indicated through RT-qPCR analysis that the expression of Na^+/ H^+-exchanger gene had tissue specificity, and the expression level in gill was the highest, proving that gill may be an important osmotic pressure sensing and control organ of sea crab; the expression level of ANT2 in heart was the highest, but it was really low in gill and eyestalk, so it was inferred that ANT2 may not be a direct low salinity stress regulatory protein[117].

Wang Huan, et al. [5-7] (2018) found numerous genes related to the low salinity stress adaptation of Scylla paramamosain, and screened out 135 Nr-annotated DEGs, including 108 for up-regulation and 27 for down-regulation. According to KEGG pathway and DEGs biofunction enrichment analysis, among top-ranked 20 pathways, 7 were directly related to the activity regulation of Na^+/K^+ ATPase. Among KEGG pathways related to ion channels, 3 were screened out to be directly related to the regulation of Na^+/K^+-ATPase activity: bile secretion, mineral absorption and myocardial contraction pathway. According to the changes of gill miRNA, by sorting out the DESs functions when the target gene response salinity decreased from 23 to 3, it was found that 91 (28.53%) were related to metabolism.

In conclusion, sudden salinity decrease has a huge impact on the survival, growth and quality of Scylla paramamosain. In order to further demonstrate whether low salinity stress would improve the flavor quality of Scylla paramamosain, artificial short-term low salinity stress experiment was conducted in Sanmen Donghang Aquatic Breeding Technology Co., Ltd. in Jiantiao Town, Sanmen County, Ningbo, Zhejiang in 2020, and systematic analysis was conducted for the technology, efficiency and quality of traditional blue crab – prawn poly-culture mode.

Experiment

Experiment Material

Blue crab: wild Scylla paramamosain, taken from the coastal waters of Sanmen County, Ningbo, Zhejiang, and adult samples were taken from Sanmen Donghang Aquatic Breeding Technology Co., Ltd.

Test Method

1. Test site: the test pond locates in Sanmen Donghang Aquatic Breeding Technology Co., Ltd. in Jiantiao Town, Sanmen County, Ningbo, Zhejiang, where power and water are sufficiently supplied, it is free from industrial pollution, the water quality meets the national and industrial standard, and the salinity is about 23. There are three test ponds, which are cement ponds with mud at the bottom, covering about 500 m^2 each (12*8*5).
2. Test pond renovation: test pond 1 and 2 are artificial short-term culture ponds, while pond 3 is used for control. Before the test, the ponds were renovated to be indoor ponds in greenhouse, to avoid the impact of bay area weather on salinity. First, salinity regulation was conducted by pouring fresh water into the cement pond to prepare clean fresh disinfected seawater. Portable water quality monitor Ysi was used to monitor the salinity changes regularly, until it reached the salinity needed, and then stop pouring fresh water. Except for salinity difference, other environmental indicators of three test ponds shall be basically the same.

Artificial Short-term Cultivation

From September 2 to 17, 60 adult crabs (it would be better if the age is marked) were put into each pond, half male and half female. They were fed with animal bait, specifically, iced raw fish and low-value shellfish (such as potamocorbula rubromuscula) were given twice every day. 1/4-1/3 of the total feed was given in the morning, and the rest was given in the afternoon. The amount of feed was dependent on the feed intake of crab and shrimp.

The salinity of pond 1 was 3, and pond 2 was 13, pond 3 was 23. Throughout the experiment, salinity test was conducted every day to ensure the salinity stability, and other water quality parameters were measured, such as temperature, DO, ammonia nitrogen, nitrite, pH, etc.

Testing Samples

Samples were taken on the 0, 1st, 3rd, 7th and 15th day in half a month of short-term artificial culture. Considering the fewer fights among female crabs, the survival rate of culture

is high, and unmated female crabs taste better. This research took 6 female crabs from the test pond at each time point, and Scylla paramamosain collected were all active, healthy and uniformly-weighted. They were packed immediately after sampling and then sent to the lab. After vivisection, fresh hepatopancreas and muscle were taken immediately for experiment, and the rest samples were kept at -80℃.

Reagents and Equipment

Main reagents, kits and equipment for the experiment can be seen in Table 1.4.1 and 1.4.2.

Table 1.4.1. Main reagents and kits used in the experiment

Reagents and kits	Manufacturer
Trichloroacetic acid (TCA)	SINOPHARM
Normal saline (NS)	SINOPHARM
Lactic acid test kit	Nanjing Jiancheng
BCA protein concentration test kit	Beyotime
Ammonia nitrogen test kit	Hach
Nitrite test kit	Hach
0.22um pore membrane	Millipore
Other general chemical reagents	Sangon Biotech

Laboratory equipment can be seen in Table 1.4.2.

Table 1.4.2. Main laboratory equipment used in the experiment

Equipment	Manufacturer
Pipette	Eppendorf
High speed freezing centrifuge	Eppendorf
Constant temperature oscillator	Shanghai Yiheng Scientific Instrument Co., Ltd.
Electro-heating standing-temperature cultivator	DHP
Real-time PCR	ABI
Microplate reader	SpectraMax 190
High temperature sterilizing oven	Shanghai Shenan Medical Instrument Factory
Magnetic stirring apparatus	IKA
Homogenizer	ThermRuiOS
High performance liquid chromatography analyzer	SHIMADZU
Portable water quality monitor	US YSI

Experimental Process

This research tested environmental factors, non-volatile flavor substance, lactic acid content and taurine content on the 0, 1st, 3rd, 7th and 15th day when the salinity was 3, 13 and 23 respectively, calculated the MSG equivalent and conducted statistical analysis.

Test of Environmental Factors

Temperature, salinity and dissolved oxygen of the culture environment were tested with portable water quality monitor, while the ammonia nitrogen and nitrite content in aquatic water was tested with ammonia nitrogen test kit and nitrite test kit.

Test of Non-volatile Flavor Substance

The edible parts of Scylla paramamosain were separated: muscle, hepatopancreas and gonads in female crab; hepatopancreas and muscle in male crab. HPLC was applied to test the content of free amino acids and free nucleotides in the tissue. Meanwhile, according to Tao's method, external standard method was used for quantitative analysis. 1.00g tissue of all samples was weighed, and then mixed with liquid nitrogen quickly for sufficient grinding. Later, it was added with 1ml 5% trichloroacetic acid and fully mixed, and then poured into a 1.5ml centrifuge tube for 15s of vortex oscillation and 15min of centrifugation at 12,000 r/min. eventually, the supernatant was filtered through a 0.22 μm filter for test.

Test of Lactic Acid and Taurine Content

The content of lactic acid was tested in spectrophotometry. 1g fragmented tissue of samples was weighed from each group, ground with liquid nitrogen, and then added with 1ml normal saline. Later, it was collected to a centrifuge tube for 15min centrifugation at 12,000 r/min. Finally, the supernatant was taken for operation according to Lactate Assay Kit (LAC) specifications.

The content of taurine was tested in HPLC. 1g tissue of samples was weighed, and then mixed with liquid nitrogen quickly for sufficient grinding. Later, it was added with 1ml 5% trichloroacetic acid and fully mixed, and then poured into a 1.5ml centrifuge tube for 15s of vortex oscillation and 15min of centrifugation at 12,000 r/min. Eventually, the supernatant was filtered through a 0.22 μm filter for test.

Calculation of MSG Equivalent

MSG equivalent refers to the equivalent flavor intensity of mixed delicious amino acid and flavor nucleotide compared with a certain concentration of MSG, which is expressed by the following equation:

$$EUC = \sum ai\ bi + 1218(\sum ai\ bi)(\sum aj\ bj)$$

Where, EUC is MSG equivalent (g MSG / 100 g), ai is concentration of flavor amino acid (Asp or Glu) (g / 100 g), bi is the freshness coefficient of flavor amino acid (Glu: 1; Asp: 0.077), aj is the concentration of flavor nucleotide (5'-IMP, 5'-GMP and 5'-AMP) (g / 100 g), bj is the relative conversion index of flavor nucleotide (5'-IMP: 1; 5'-GMP: 2.3; AMP: 0.18), 1218 is the synergetic interaction constant.

Statistical Analysis

SPSS for Windows (Version 21.0) was adopted for analysis. Before analysis, normal distribution and variance analysis were conducted for the original data in Kolmogorov-Smirnov and Levene test. Non-normal and heterogeneous data were converted till reaching normality and homogeneity. Difference in the content of taurine, lactic acid and flavor substance was compared in ANOVA, and it was considered to be significant probability level ($P< 0.05$).

Experimental Results

Test of Environmental Factors

Culture environment is closely related to the physiological activities of aquatic livestock. Therefore, this research tested various water quality and environmental indexes (salinity, temperature, dissolved oxygen, ammonia nitrogen and nitrite) (Table 1) in half a month of artificial culture period in the test ponds. Results showed that the dissolved oxygen of the culture ponds basically stayed at about 8 mg/L, while the ammonia nitrogen and nitrite content was also within the threshold of healthy culture, pH ranged between 8 and 9, which was weak alkaline, and there were barely no significant differences in the water quality indexes of all test ponds. Salinity was the factor of the greatest difference among all test ponds.

Table 1. Salinity, temperature, pH, DO (dissolved oxygen), ammonia nitrogen and nitrite level of culture pond in Sanmen Laboratory

Time	Main producing area	Temperature (℃)	Salnity	DO (mg/L)	Ammonia nitrogen (mg/L)	Nitrite (mg/L)	pH
2020. 09.03	SM	24.17 ± 3.21	3.01± 0.32	8.62 ± 0.77	0.53 ± 0.19	0.12 ± 0.04	8.15 ± 0.29
	SM	24.32 ± 2.62	13.13 ± 0.13	8.55 ± 0.69	0.54 ± 0.18	0.11 ± 0.03	8.16 ± 0.28
	SM	24.72 ± 4.63	23.11 ± 0.61	8.75 ± 0.84	0.56 ± 0.17	0.11 ± 0.05	8.15 ± 0.15
2020.009.1 0	SM	24.85 ± 2.24	3.20 ± 0.38	8.56 ± 0.92	0.74± 0.12	0.13 ± 0.03	8.25 ± 0.14
	SM	24.05 ± 3.25	13.05 ± 0.16	8.62 ± 0.89	0.72 ± 0.10	0.11 ± 0.04	8.24 ± 0.15
	SM	24.21 ±4.16	17.01 ± 2.02	7.96 ± 0.87	0.76 ± 0.19	0.14 ± 0.06	8.25 ± 0.13
2020.09.17	SM	24.35 ± 3.57	3.22 ± 0.13	7.99 ± 0.89	0.61 ± 0.06	0.13 ± 0.02	8.17 ± 0.16
	SM	24.37 ± 2.58	12.97 ± 0.22	8.34 ± 0.89	0.66 ± 0.09	0.12 ± 0.05	8.15 ± 0.22
	SM	24.78 ± 4.59	23.11 ± 0.76	7.97 ± 0.87	0.71 ± 0.06	0.13 ± 0.02	8.17 ± 0.17

Test of Free Flavor Amino Acids in Edible Parts

In the comparison of free amino acids (Fig. 1, Table 2 and Table 3), the content in muscle fluctuated greatly, and that in hepatopancreas was relatively stable.

In muscle (Fig. 1), when time points were set to be 1, 3, 7 and 15 respectively, the content of free amino acid decreased remarkably on the first day, increased on the 3rd and 7th day and dropped back on the 15th day. The fluctuation rule of influence of three salinities was basically the same, which reached the max on the 7th day, and the content in salinity 13 was the highest. On the first day, the highest content in salinity 3 was 621.74 ± 17.39mg/100 g, while the lowest content in salinity 13 was 566.93 ± 75.15mg/100 g, and there was no remarkable difference between the two; on the 3rd day, the highest content in salinity 3 was 683.42±15.21mg/100 g, while the lowest content in salinity 13 was 594.67±27.07mg/100 g, and there was no remarkable difference between the two. On the 7th day, the highest content in salinity 3 was 702.76±97.17mg/100 g, while the lowest content in salinity 23 was 632±99.64mg /100 g, and there was no remarkable difference between the two. On the 15th day, the highest content in salinity 3 was 696.21±36.78mg/100 g, while the lowest content in salinity 13 was 631.8±26.52mg/100 g, and there was no remarkable difference between the two.

In hepatopancreas (Fig. 1), when time points were set to be 1, 3, 7 and 15 respectively, the fluctuation rule of influence of three salinities was basically the same, and the content changed slightly, reaching the highest on the 15th day in salinity 23. On the first day, the highest content in salinity 13 was 384.54±59.56mg/100 g, while the lowest content in salinity 23 was 348±28.82mg/100 g, and there was no remarkable difference between the two. On the 3rd day, the highest content in salinity 3 was 368.9±25.66mg/100 g, while the lowest content in salinity 13 was 337.44±20.11mg /100 g, and there was no remarkable difference between the two. On the 7th day, the highest content in salinity 3 was 382.41±37.03mg/100 g, while the lowest content in salinity 13 was 351.91±16.44mg/100 g, and there was no remarkable difference between the two. On the 15th day, the highest content in salinity 23 was 391.08±80.54mg /100 g, while the lowest content in salinity 13 was 355.28±11.09mg /100 g, and there was no remarkable difference.

In the comparison of essential amino acids (Fig. 1, Table 2 and Table 3), the content in muscle fluctuated greatly, and that in hepatopancreas was relatively stable.

In muscle (Fig. 1), when time points were set to be 1, 3, 7 and 15 respectively, the content of essential amino acid decreased remarkably on the first day, increased on the 3rd and 7th day and dropped back on the 15th day. The fluctuation rule of influence of three salinities was basically the same, which reached the max in salinity 13 on the 7th day. On the 1st day, the content in the three salinities was almost the same, the highest content in salinity 23 was 19.24±5.97mg/100 g, while the lowest content in salinity 3 was 16.22±3.64mg/100 g, and there was no remarkable difference between the two; on the 3rd day, the highest content in salinity 23 was 35.77±5.75mg/100 g, while the lowest content in salinity 13 was 17.31±8.92mg/100 g, and there was no remarkable difference between the two. On the 7th day, the highest content in salinity 13 was 78.37±18.01mg/100 g, while the lowest content in salinity 23 was 35.53±21.81mg/100 g, and there was significant difference between the two. On the 15th day, the highest content in salinity 13 was 44.32±8.26mg/100 g, while the lowest content in salinity 23 was 23.82±4.63mg/100 g, and there was significant difference between the two.

In hepatopancreas (Fig. 1), when time points were set to be 1, 3, 7 and 15 respectively, the content of essential

amino acid increased on the 1st day, and decreased on the 3rd day, increased on the 7th day and dropped back on the 15th day. The fluctuation rule of influence of three salinities was basically the same, which reached the max in salinity 13 on the 1st day. On the first day, the highest content in salinity 13 was 157.07±21.80mg/100 g, while the lowest in salinity 23 was 121.62 ± 18.00mg /100 g, and there was no remarkable difference between the two. On the 3rd day, the highest content in salinity 3 was 138.09±25.11mg/100 g, while the lowest content in salinity 23 was 115.37±27.59mg/100 g, and there was no remarkable difference between the two. On the 7th day, the highest content in salinity 13 was 143.56±14.42mg/100 g, while the lowest content in salinity 23 was 119.08±42.03mg/100 g, and there was no remarkable difference between the two. On the 15th day, the highest content in salinity 3 was 127.16±19.60mg/100 g, while the lowest content in salinity 23 was 117.8±13.05mg/100 g, and there was no remarkable difference.

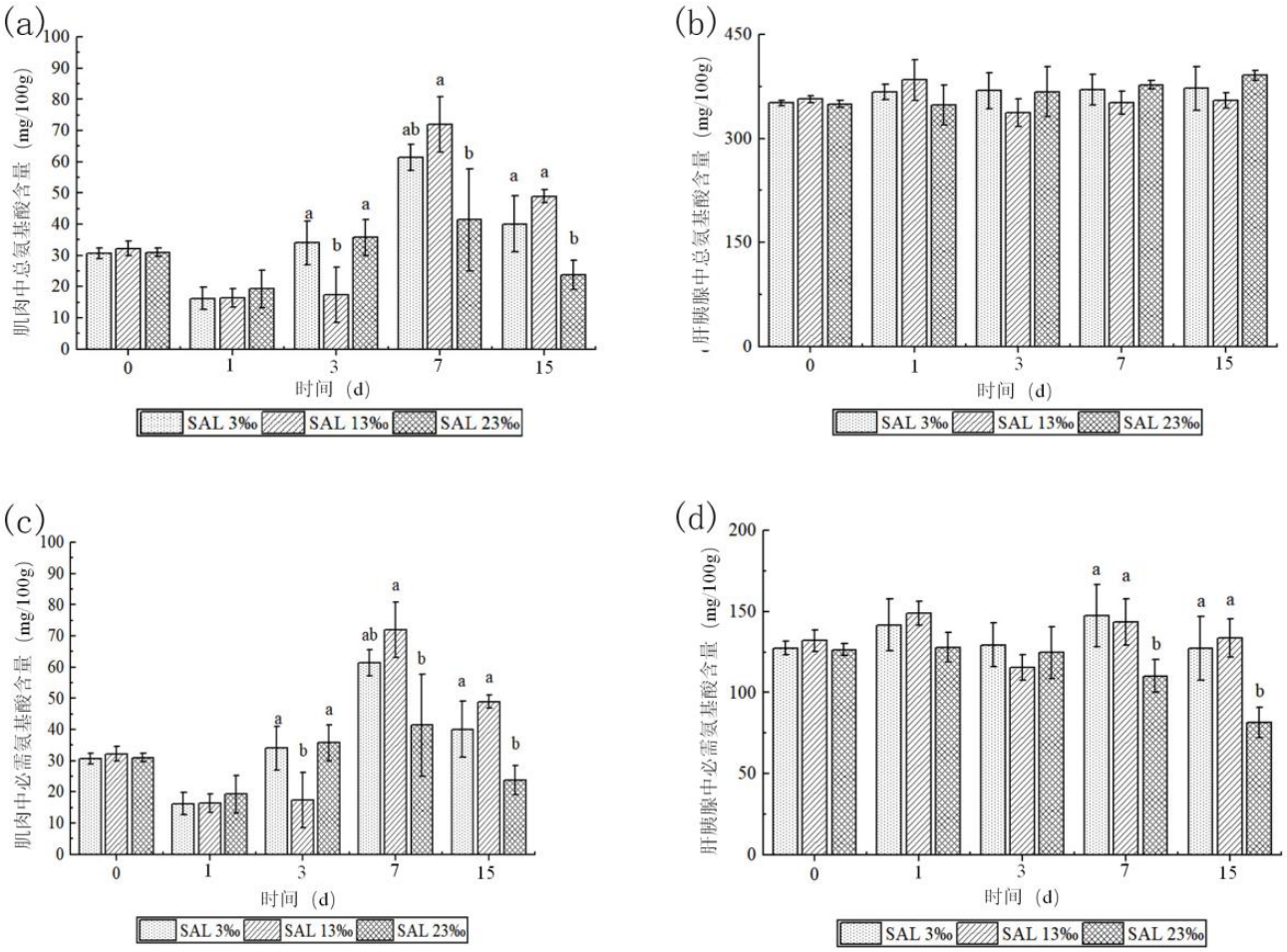

Fig. 1. Change charts of free amino acid and essential amino acid at different time points

In the comparison of delicious amino acid (Fig. 2, Table 2 and Table 3), its content in muscle and hepatopancreas fluctuates greatly.

In muscle (Figure 2), when time points were set to be 1, 3, 7 and 15 respectively, the content in salinity 3 and 13 increased on the 1st and 3rd day, dropped back on the 7th day and basically unchanged on the 15th day. In salinity 23, it decreased on the 1st day, and increased on the 3rd, 7th and 15th day. The content in salinity 13 on the 3rd day was the highest.

In which, the fluctuations of Asp content were as follows: on the 1st day, the content in three salinities was close, the highest in salinity 23 was 1.94±0.73mg/100 g, while the lowest in salinity 13 was 1.91±0.29mg/100 g, and there was no remarkable difference between the two. On the 3rd day, the highest content in salinity 23 was 3.11±1mg/100 g, while the lowest in salinity 13 was 2.01±1.43mg/100 g, and there was no remarkable difference between the two. On the 7th day, the highest in salinity 23 was 3.62±0.54mg/100 g, while the lowest in salinity 13 was 1.18±0.05mg/100 g, and there was significant difference between the two. On the 15th day, the highest in salinity 13 was 3.4±1.69mg/100 g, while the lowest in salinity 3 was 2.67±0.26mg /100 g, and there was no remarkable difference between the two.

The fluctuations of Glu content were as follows: on the 1st day, the highest content in salinity 13 was 16.24±6.29mg/100 g, while the lowest in salinity 23 was 10.28±1.55mg/100 g, and there was no remarkable difference between the two. On the 3rd day, the highest content in salinity 3 was 15.99±1.16mg/100 g, while the lowest in salinity 23 was 11.06±1.11mg/100 g, and there was

no remarkable difference between the two; on the 7th day, the highest content in salinity 3 was 11.01±3.46mg/100 g, while the lowest in salinity 13 was 7.62±1.21mg/100 g, and there was no remarkable difference between the two. On the 15th day, the highest content in salinity 13 was 14.29±3.29mg/100 g, while the lowest in salinity 3 was 11.34±2.16mg/100 g, and there was no remarkable difference between the two.

In hepatopancreas (Fig. 2), when time points were set to be 1, 3, 7 and 15 respectively, the content decreased on the 1st day, increased on the 3rd and 7th day, and dropped back on the 15th day. The fluctuation rule of influence of three salinities was basically the same, and the content in salinity 13 on the 1st day was the highest.

In which, the fluctuations of Asp content were as follows: on the 1st day, the content in three salinities was almost the same, the highest in salinity 13 was 6.3±0.6mg/100 g, while the lowest in salinity 23 was 4.47±1.22mg/100 g, and there was no remarkable difference between the two. On the 3rd day, the highest content in salinity 23 was 5.24±1.19mg/100 g, while the lowest in salinity 3 was 4.32±1.57mg/100 g, and there was no remarkable difference between the two. On the 7th day, the highest in salinity 13 was 7.84±2.27mg/100 g, while the lowest in salinity 23 was 5.29±1.69mg/100 g, and there was no remarkable difference between the two. On the 15th day, the highest in salinity 13 was 5.52±2.15mg/100 g, while the lowest in salinity 23 was 4.1±0.92mg/100 g, and there was no remarkable difference between the two.

The fluctuations of Glu content were as follows: on the 1st day, the highest content in salinity 23 was 32.14±5mg/100 g, while the lowest in salinity 3 was 28.23±6.33mg/100 g, and there was no remarkable difference between the two. On the 3rd day, the highest content in salinity 3 was 27.03±2.73mg/100 g, while the lowest in salinity 23 was 23.51±4.36mg/100 g, and there was no remarkable difference between the two; on the 7th day, the highest content in salinity 3 was 27.96±2.99mg/100 g, while the lowest in salinity 13 was 19.39±2.16mg/100 g, and there was no remarkable difference between the two. On the 15th day, the highest content in salinity 23 was 35.43±4.69mg/100 g, while the lowest in salinity 3 was 24.58±5.39mg/100 g, and there was significant difference between the two.

In the comparison of sweet amino acid (Fig. 2, Table 2 and Table 3), the content in in muscle and hepatopancreas fluctuates slightly.

In muscle (Fig. 2), when time points were set to be 1, 3, 7 and 15 respectively, the content in salinity 3 decreased on the 1st day, and increased on the 3rd, 7th and 15th day; the content in salinity 13 and 23 increased on the 1st day and decreased on the 3rd and 7th day, but it continued to decrease in salinity 13 on the 15th day, while the content increased in salinity 23 on the 15th day. The fluctuation rule of the influence of three salinities was completely different, and the content in salinity 23 on the 1st day was the highest.

In which, the fluctuations of Gly content were as follows: on the 1st day, the highest content in salinity 13 was 281.57±31.21mg/100 g, while the lowest in salinity 3 was 194.44±31.82mg/100 g, and there was significant difference between the two. On the 3rd day, the highest content in salinity 23 was 270.17±39.27mg/100 g, while the lowest in salinity 3 was 224.5348.94±mg/100 g, and there was no remarkable difference between the two. On the 7th day, the highest content in salinity 23 was 212.88±68.43mg/100 g, while the lowest in salinity 13 was 140.36± 4.65mg/100 g, and there was no remarkable difference between the two. On the 15th day, the highest content in salinity 23 was 245.87±17.04mg/100 g, while the lowest in salinity 13 was 158.49±40.1mg/100 g, and there was significant difference between the two.

The fluctuations of Pro content were as follows: on the 1st day, the highest content in salinity 3 was 146.78±19.65mg/100 g, while the lowest in salinity 13 was 91.06±27.44mg/100 g, and there was significant difference between the two. On the 3rd day, the highest content in salinity 3 was 129.64±19.51mg/100 g, while the lowest in salinity 23 was 93.07±20.62mg/100 g, and there was no remarkable difference between the two. On the 7th day, the highest content in salinity 3 was 150.61±28.08mg/100 g, while the lowest in salinity 23 was 107.37±mg/100 g, and there was no remarkable difference between the two. On the 15th day, the highest content in salinity 23 was 134.12±23.98mg/100 g, while the lowest in salinity 13 was 99.94±7.16mg/100 g, and there was no remarkable difference between the two.

The fluctuations of Ser content were as follows: on the 1st day, the highest content in salinity 3 was 6.29±1.83mg/100 g, while the lowest in salinity 23 was 1.98±1.3mg /100 g, and there was significant difference between the two. On the 3rd day, the highest content in salinity 23 was 6.4±2.1mg/100 g, while the lowest in salinity 3 was 3.27±1.59mg/100 g, and there was no remarkable difference between the two. On the 7th day, the highest content in salinity 13 was 24.68±11.22mg/100 g, while the lowest was 9.05±0.72mg/100 g, and there was no remarkable difference between the two. On the 15th day, the highest content in salinity 3 was 11.73±8.54mg/100 g, while the lowest in salinity 23 was 1.14±0.75mg/100 g, and there was significant difference between the two.

The fluctuations of Thr content were as follows: on the 1st day, the highest content in salinity 13 was 7.25±1.78mg/100 g, while the lowest in salinity 3 was 5.29± 0.99mg /100 g, and there was significant difference between the two. On the 3rd day, the highest content in salinity 23 was 10.13±1.45mg/100 g, while the lowest in salinity 13 was 4.62±2.21mg/100 g, and there was no remarkable difference between the two. On the 7th day, the highest content in salinity 13 was 21.12±5.55mg/100 g, while the lowest in salinity 23 was 11.04±3.46mg/100 g, and there was significant difference between the two. On the 15th day, the highest content in salinity 3 was 9.3±3.48mg/100 g, while the lowest in salinity 13 was 7.97±1.88mg/100 g, and there was no remarkable difference between the two.

The fluctuations of Ala content were as follows: on the 1st day, the highest content in salinity 3 was 35.38±8.14mg/100 g, while the lowest in salinity 13 was 20±

2.22mg/100 g, and there was significant difference between the two. On the 3rd day, the highest content in salinity 23 was 38.04±7.23mg/100 g, while the lowest in salinity was 29.62±3.14mg/100 g, and there was no remarkable difference between the two. On the 7th day, the highest content in salinity 23 was 54.67±10.94mg/100 g, while the lowest in salinity 13 was 40.96±0.45mg/100 g, and there was significant difference between the two. On the 15th day, the highest content in salinity 3 was 9.3±3.48mg/100 g, while the lowest in salinity 13 was 85.28±7.36mg/100 g, and there was no remarkable difference between the two.

In hepatopancreas (Fig. 2), time points were set to be 1, 3, 7 and 15 respectively. The content in salinity 3 and 23 decreased on the 1st day, and continued to increase on the 3rd, 7th and 15th day. The content in salinity 13 decreased on the 1st and 3rd day and increased on the 7th and 15th day. The fluctuation rule of the influence of three salinities was different, and the content in salinity 23 on the 15th day was the highest.

In which, the fluctuations of Gly content were as follows: on the 1st day, the highest content in salinity 13 was 35.91±11.7mg/100 g, while the lowest in salinity 3 was 31.1±13.55mg/100 g, and there was no remarkable difference between the two. On the 3rd day, the highest content in salinity 23 was 36.28±11.92mg/100 g, while the lowest in salinity 13 was 30.52±13.56mg/100 g, and there was no remarkable difference between the two. On the 7th day, the highest content in salinity 23 was 47.91±38.87mg/100 g, while the lowest in salinity 13 was 21.12±0.63mg/100 g, and there was no remarkable difference between the two. On the 15th day, the highest content in salinity 23 was 48.41±4.07mg/100 g, while the lowest in salinity 13 was 28.93±7.56mg/100 g, and there was no remarkable difference between the two.

The fluctuations of Pro content were as follows: on the 1st day, the highest content in salinity 23 was 25.35±9.29mg/100 g, while the lowest in salinity 13 was 18.22±6.05mg/100 g, and there was no remarkable difference between the two. On the 3rd day, the highest content in salinity 23 was 26.61±4.69mg/100 g, while the lowest in salinity 13 was 17.7±3.17mg/100 g, and there was no remarkable difference between the two. On the 7th day, the highest content in salinity 3 was 23.34±7.24mg/100 g, while the lowest in salinity 23 was 19.48±3.05mg/100 g, and there was no remarkable difference between the two. On the 15th day, the highest content in salinity 23 was 28.09±20.48mg/100 g, while the lowest in salinity 3 was 17.35±8.42mg/100 g, and there was no remarkable difference between the two.

The fluctuations of Ser content were as follows: on the 1st day, the highest content in salinity 3 was 9.16±2.99mg/100 g, while the lowest in salinity 13 was 5.38±0.75mg/100 g, and there was significant difference between the two. On the 3rd day, the highest content in salinity 3 was 8.57±4.58mg/100 g, while the lowest in salinity 13 was 4.83±1.26mg/100 g, and there was significant difference between the two. On the 7th day, the highest content in salinity 3 was 6.58±1.94mg/100 g, while the lowest in salinity 13 was 5.87±1.22mg/100 g, and there was no remarkable difference between the two. On the 15th day, the highest content in salinity 13 was 4.56±1.15mg/100 g, while the lowest in salinity 23 was 3.85±1.39mg/100 g, and there was no remarkable difference between the two.

The fluctuations of Thr content were as follows: on the 1st day, the highest content in salinity 13 was 11.19±1.55mg/100 g, while the lowest in salinity 23 was 8.81±0.44mg/100 g, and there was no remarkable difference between the two. On the 3rd day, the highest content in salinity 3 was 9.23±1.5mg/100 g, while the lowest in salinity 23 was 7.96±1.57mg/100 g, and there was no remarkable difference between the two. On the 7th day, the highest content in salinity 13 was 11.59±1.42mg/100 g, while the lowest in salinity 23 was 8.08±2.3mg/100 g, and there was significant difference between the two. On the 15th day, the highest content in salinity 13 was 9.52±0.67mg/100 g, while the lowest in salinity 23 was 7.12±2.34mg/100 g, and there was no remarkable difference between the two.

The fluctuations of Ala content were as follows: on the 1st day, the highest content in salinity 13 was 27.12±5.92mg/100 g, while the lowest in salinity 3 was 24.28±4.02mg/100 g, and there was no remarkable difference between the two. On the 3rd day, the highest content in salinity 13 was 31.74±3.1mg/100 g, while the lowest was 26.74±4.52mg/100 g, and there was no remarkable difference between the two. On the 7th day, the highest content in salinity 23 was 52.12±12.31mg/100 g, while the lowest in salinity 13 was 23.96±1.51mg/100 g, and there was significant difference between the two. On the 15th day, the highest content in salinity 23 was 56.56±21.47mg/100 g, while the lowest in salinity 3 was 27.68±10.77mg/100 g, and there was significant difference between the two.

The content of bitter amino acid (Fig. 2, Table 1 and Table 2) in muscle fluctuated more obviously than that in hepatopancreas.

In muscle (Fig. 2), when time points were set to be 1, 3, 7 and 15 respectively, the content in salinity 3 increased on the 1st, 3rd and 7th day and decreased on the 15th day, but in salinity 13 and 23, it decreased on the 1st day, increased on the 3rd and 7th day and dropped back on the 15th day. The fluctuation rule of the influence of three salinities was not consistent, and the content in salinity 13 on the 1st day was the highest.

The fluctuations of Arg content were as follows: on the 1st day, the highest content in salinity 3 was 161.79±15.54mg/100 g, while the lowest in salinity 13 was 107.71±7.31mg/100 g, and there was significant difference between the two. On the 3rd day, the highest content in salinity 3 was 173.47±5.08mg/100 g, while the lowest in salinity 23 was 115.51±44.98mg/100 g, and there was significant difference between the two. On the 7th day, the highest content in salinity 3 was 166.42±36.68mg/100 g, while the lowest in salinity 23 was 144.71±41.05mg/100 g, and there was significant difference between the two. On the 15th day, the highest content in salinity 3 was 170.7±33.63mg/100 g, while the lowest in salinity 23 was 134.3±24.14mg/100 g, and there was no remarkable difference between the two.

The fluctuations of Trp content were as follows: on the 1st day, the content was almost the same, the highest content in salinity 3 was 0.4±0.19mg/100 g, while the lowest in salinity 13 was 0.28±0.04mg/100 g, and there was no remarkable difference between the two. On the 3rd day, the highest content in salinity 3 was 0.52±0.33mg/100 g, while the lowest was 0.28±0.11mg/100 g, and there was no remarkable difference between the two. On the 7th day, the highest content in salinity 3 was 0.7±0.23mg/100 g, while the lowest in salinity 23 was 0.29±0.18mg/100 g, and there was significant difference between the two. On the 15th day, the highest content in salinity 13 was 0.57±0.23mg/100 g, while the lowest in salinity 23 was 0.26±0.06mg/100 g, and there was no remarkable difference between the two.

The fluctuations of Ile content were as follows: on the 1st day, the highest content in salinity 23 was 0.9±0.37mg/100 g, while the lowest in salinity 13 was 0.58±0.15mg/100 g, and there was no remarkable difference between the two. On the 3rd day, the highest content in salinity 3 was 2±0.69mg/100 g, while the lowest in salinity 13 was 0.82±0.59mg/100 g, and there was no remarkable difference between the two. On the 7th day, the highest content in salinity 13 was 4.32±0.99mg/100 g, while the lowest in salinity 23 was 1.6±1.2mg/100 g, and there was significant difference between the two. On the 15th day, the highest content in salinity 13 was 2.34±1.09mg/100 g, while the lowest in salinity 23 was 0.81±0.05mg/100 g, and there was no remarkable difference between the two.

The fluctuations of Leu content were as follows: on the 1st day, the highest content in salinity 23 was 2.62±0.75mg/100 g, while the lowest in salinity 3 was 1.58±0.54mg/100 g, and there was no remarkable difference between the two. On the 3rd day, the highest content in salinity 23 was 5.84±0.18mg/100 g, while the lowest in salinity 13 was 2.54±2.45mg/100 g, and there was no remarkable difference between the two. On the 7th day, the highest content in salinity 13 was 12.15±3.39mg/100 g, while the lowest in salinity 23 was 4.53±3.7mg/100 g, and there was significant difference between the two. On the 15th day, the highest content in salinity 13 was 5.39±2.26mg/100 g, while the lowest in salinity 23 was 2.39±0.31mg/100 g, and there was no remarkable difference between the two.

In hepatopancreas (Fig. 2), time points were set to be 1, 3, 7 and 15 respectively. The content in salinity 3 increased on the 1st and 3rd day, decreased on the 7th day and then increased on the 15th day. In salinity 13, it increased on the 1st day, decreased on the 3rd day, and then increased on the 7th day and dropped back on the 15th day. In salinity 23, it decreased on the 1st day, increased on the 3rd day, and then decreased on the 7th and 15th day. The fluctuation rule of the influence of three salinities was different, and the content in salinity 13 on the 15th day was the highest.

In which, the fluctuations of Arg content were as follows: on the 1st day, the highest content in salinity 3 was 52.8±5.67mg/100 g, while the lowest in salinity 13 was 49.15±3.39mg/100 g, and there was no remarkable difference between the two. On the 3rd day, the highest content in salinity 23 was 60.4±24.94mg/100 g, while the lowest in salinity 13 was 46.58±10.23mg/100 g, and there was no remarkable difference between the two. On the 7th day, the highest content in salinity 3 was 53.17±5.1mg/100 g, while the lowest in salinity 23 was 42.49±8.64mg/100 g, and there was no remarkable difference between the two. On the 15th day, the highest content in salinity 23 was 69.81±24.7mg/100 g, while the lowest in salinity 13 was 51.59±3.47mg/100 g, and there was no remarkable difference between the two.

The fluctuations of Trp content were as follows: on the 1st day, the highest content in salinity 3 was 8.5±1.26mg/100 g, while the lowest in salinity 23 was 4.57±1.34mg/100 g, and there was no remarkable difference between the two. On the 3rd day, the highest content in salinity 3 was 9.81±1.82mg/100 g, while the lowest was 6.44±2.9mg/100 g, and there was no remarkable difference between the two. On the 7th day, the highest content in salinity 3 was 8.37±2.36mg/100 g, while the lowest in salinity 23 was 4.73±2.63mg/100 g, and there was no remarkable difference between the two. On the 15th day, the highest content in salinity 3 was 10.1±4.12mg/100 g, while the lowest in salinity 13 was 6.61±2.32mg/100 g, and there was no remarkable difference between the two.

The fluctuations of Ile content were as follows: on the 1st day, the highest content in salinity 13 was 12.35±2.84mg/100 g, while the lowest in salinity 23 was 8.32±2.4mg/100 g, and there was no remarkable difference between the two. On the 3rd day, the highest content in salinity 13 was 8.12±2.72mg/100 g, while the lowest in salinity 23 was 6.77±2.69mg/100 g, and there was no remarkable difference between the two. On the 7th day, the highest content in salinity 13 was 10.26±2.09mg/100 g, while the lowest in salinity 23 was 5.98±2.76mg/100 g, and there was no remarkable difference between the two. On the 15th day, the highest content in salinity 3 was 6.36±1.92mg/100 g, while the lowest in salinity 23 was 3.57±1.44mg/100 g, and there was no remarkable difference between the two.

The fluctuations of Leu content were as follows: on the 1st day, the highest content in salinity 13 was 44.4±6.62mg/100 g, while the lowest in salinity 23 was 32.24±7.62mg/100 g, and there was no remarkable difference between the two. On the 3rd day, the highest content in salinity 3 was 31.61±7.69mg/100 g, while the lowest in salinity 13 was 26.95±8.29mg/100 g, and there was no remarkable difference between the two. On the 7th day, the highest content in salinity 13 was 33.45±3.83mg/100 g, while the lowest in salinity 23 was 43.52±5.39mg/100 g, and there was significant difference between the two. On the 15th day, the highest content in salinity 23 was 43.52±5.39mg/100 g, while the lowest in salinity 3 was 24.33±11.71mg/100 g, and there was no remarkable difference between the two.

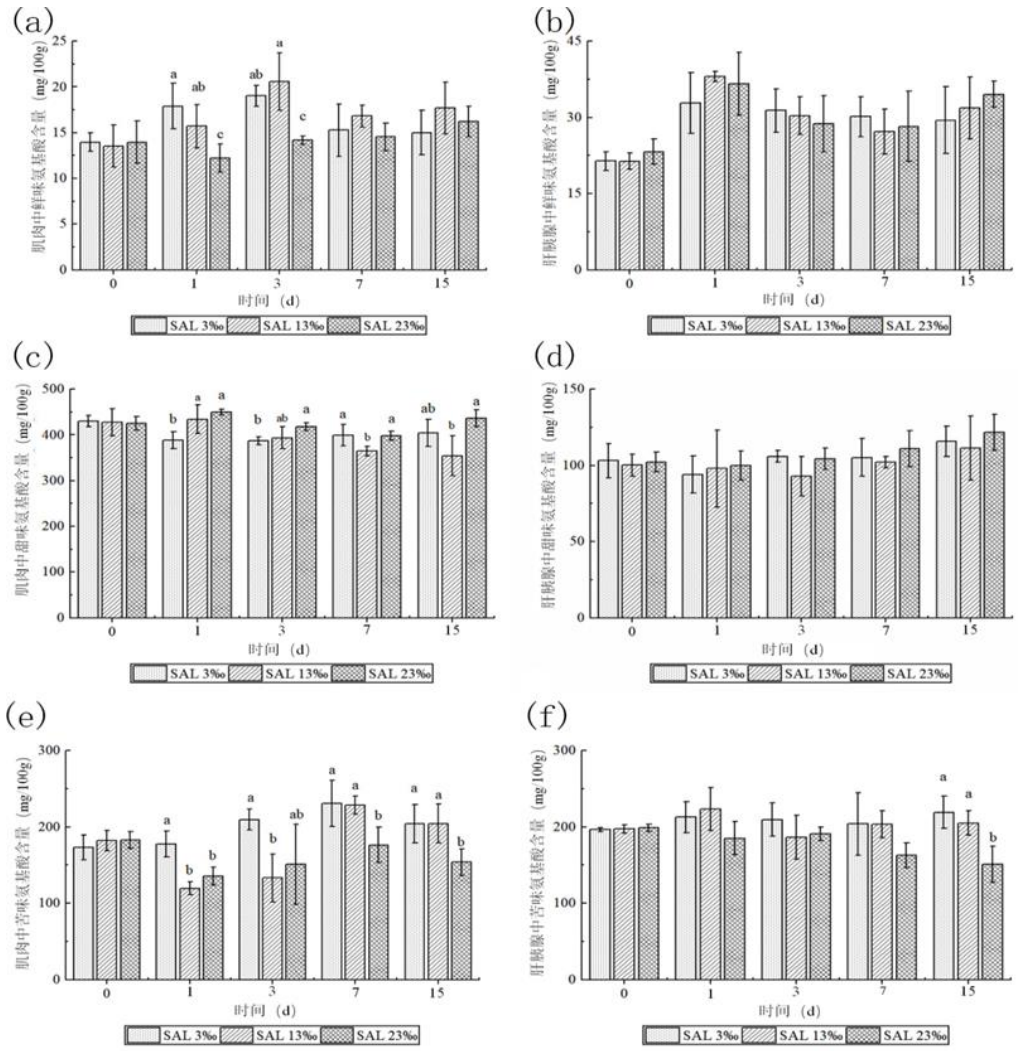

Fig. 2. Change chart of delicious, sweet and bitter amino acids at different time points

Table 2. Content of free amino acid in muscle under the influence of different salinities

		CK	Salinity(3SAL-ppt)				Salinity(13SAL-ppt)				Salinity(23SAL-ppt)			
FAA	Taste	SM-M-0d	SM3-M-1d	SM3-M-3d	SM3-M-7d	SM3-M-15d	SM13-M-1d	SM13-M-3d	SM13-M-7d	SM13-M-15d	SM23-M-1d	SM23-M-3d	SM23-M-7d	SM23-M-15d
asp*	Umami (+)	3.14±1.12a	1.94±0.42ab	3.04±0.18a	2.5±1.8ab	2.67±0.26ab	1.91±0.29ab	2.01±1.43ab	1.18±0.05b	3.4±1.69a	1.94±0.73ab	3.11±1a	3.62±0.54a	2.73±0.5
glu*	Umami (+)	10.83±1.18ab	15.96±2.31a	15.99±1.16a	11.01±3.46ab	11.34±2.16ab	16.24±6.29a	15.61±7.59a	7.62±1.21b	14.29±3.29ab	10.28±1.55ab	11.06±1.11ab	10.9±1.92ab	11.69±4.25ab
asn	tasteless	3.43±1.3abc	1.72±0.42cd	2.92±0.53abcd	4.21±2.06ab	3.67±1.44abc	0.67±0.21d	1.94±1.38bcd	5.2±1.19a	3.31±0.41abc	1.4±1.29cd	3.32±1.37abc	2.64±1.68bcd	2.99±0.87abc
ser*	Sweet (+)	1.08±0.1c	6.29±1.83bc	3.27±1.59bc	9.05±0.72bc	11.73±8.54b	5.64±3.37bc	4.84±1.53bc	24.68±11.22a	2.62±1.37bc	1.98±1.3bc	6.4±2.1bc	12.09±11.74b	1.14±0.75c
gln	tasteless	64.4±16.81ab	36.08±12.03ab	48.77±21.79ab	54.99±28.17ab	70.11±28.35a	22.98±8.95b	48.27±46.28ab	47.36±13.46ab	52.3±7.77ab	36.73±24.12ab	45.52±23.25ab	40.4±24.5ab	49.06±15.58ab
his	Bitter (−)	4.92±1.39bc	3.11±0.21bc	5.56±1.06bc	7.21±5.31b	6.09±2.59bc	1.82±0.86c	2.88±1.31bc	6.17±1.52bc	11.51±3.49a	3.58±1.73bc	5.53±1.62bc	4.44±3.15bc	3.36±0.22bc
gly*	Sweet (+)	218.36±46.05abcd	194.44±31.82bcde	224.53±48.94abcd	178.44±34cde	206.93±15.77abcde	281.57±31.21a	255.98±45.24ab	140.36±4.65e	158.49±40.1de	279.32±33.61a	270.17±39.27a	212.88±68.43abcde	245.87±17.04abc
thr#/*	Sweet (+)	7.38±1.8cde	5.29±0.99de	8.34±0.7cde	14.32±2.47b	9.3±3.48cde	7.25±1.78cde	4.62±2.21e	21.12±5.55a	7.97±1.88cde	6.85±1.48cde	10.13±1.45bcd	11.04±3.46bc	9.27±1.75cde
arg	Bitter (−)	140.81±13.04abcd	161.79±15.54abc	173.47±5.08a	166.42±36.68ab	170.7±33.63a	107.71±7.31d	116.55±22.49cd	161.49±16.32abc	152.29±19.16abcd	117.44±5.15bcd	115.51±44.98cd	144.71±41.05abcd	134.3±24.14abcd
ala*	Sweet (+)	46.49±1.3bcd	35.38±8.14cde	37.48±12.5cde	47.09±11.16bcd	49.18±19.9bcd	20±2.22e	29.62±3.14de	40.96±0.45bcd	85.28±7.36a	26.19±7.62de	38.04±7.23	54.67±10.94bc	69.51±32.94ab
tyr	Bitter (−)	4.08±0.77abc	1.94±0.93abc	4.77±2.86a	5.11±3.53a	2.39±0.83abc	0.88±0.08c	1.04±0.63bc	3.37±0.49abc	4.05±1.76abc	2.44±1.19abc	4.33±1.9ab	2.74±2.34abc	1.46±0.44bc
cys-s	tasteless	0.07±0	0.09±0.01	—	—	—	0.08±0.04	—	—	—	0.08±0.02	—	—	—
val#	Bitter (−)	3.33±0.52cd	1.32±0.11d	3.13±0.73cd	7.05±1.54b	3.4±1.89cd	2.4±0.77cd	1.47±1.05cd	9.52±2.14a	3.76±1.25cd	2.88±1.26cd	4.11±0.45c	3.69±3cd	2.16±0.7cd
met#	Bitter (−)	4.53±1.03bcd	1.74±0.54de	4.65±1.43bcd	7.87±3.17a	4.49±1.89bcd	0.61±0.17e	1.86±1.46de	5.76±1.01ab	2.63±0.88bcde	2.03±1.54de	5.43±2.45abc	2.91±2.57bcde	2.35±1.55cde
trp#	Bitter (−)	0.49±0.08abc	0.4±0.19abc	0.52±0.33abc	0.7±0.23a	0.4±0.05c	0.28±0.04c	0.28±0.11c	0.66±0.18ab	0.57±0.23abc	0.28±0.05c	0.37±0.13bc	0.29±0.18c	0.26±0.06c
phe#	Bitter (−)	1.42±0.51abc	0.76±0.29bc	1.68±0.81ab	2.13±1.22a	0.95±0.26bc	0.51±0.12c	0.89±0.36bc	2.34±0.46a	2.17±0.26a	0.92±0.33bc	1.4±0.5abc	1.25±1.03abc	0.64±0.16bc
ile#	Bitter (−)	1.89±0.62bc	0.6±0.26c	2±0.69bc	3.78±1.85a	1.64±0.74bc	0.58±0.15c	0.82±0.59bc	4.32±0.99a	2.34±1.09b	0.9±0.37bc	1.92±0.32bc	1.6±1.2bc	0.81±0.05bc
leu#	Bitter (−)	4.21±1.41bc	1.58±0.54c	3.77±0.91bc	10.04±1.72a	4.57±2.81bc	2.32±0.56bc	2.54±2.45bc	12.15±3.39a	5.39±2.26bc	2.62±0.75bc	5.84±0.18b	4.53±3.7bc	2.39±0.31bc
lys#	Bitter (−)	7.41±1.43bc	4.53±2.42bc	9.89±2.47b	20.23±1.72a	9.69±2.93b	2.42±0.8c	4.83±1.96bc	22.5±4.95a	19.49±4.91a	2.76±1.67c	6.57±0.76bc	10.22±6.78b	5.94±1.24bc
pro*	Sweet (+)	123.6±10.49ab	146.78±19.65a	129.64±19.51ab	150.61±28.08a	126.96±22.61ab	91.06±27.44b	98.58±19.91b	137.16±9.41ab	99.94±7.16b	110.93±11.85ab	93.07±20.62b	107.37±53.84ab	134.12±23.98ab
EAA	–	30.66±1.74bc	16.22±3.64c	33.98±6.91bc	66.12±12.53a	34.44±13.33bc	16.37±2.89c	17.31±8.92c	78.37±18.01a	44.32±8.26b	19.24±5.97c	35.77±5.75bc	35.53±21.81bc	23.82±4.63c
TAA	–	651.87±49.87ab	621.74±17.39ab	683.42±15.21a	702.76±97.17a	696.21±36.78a	566.93±75.15b	594.67±27.07ab	653.92±28.15ab	631.8±26.52ab	611.55±67.67ab	631.83±68.61ab	632±99.64ab	656.37±59.73ab

Table 3. Content of free amino acid in hepatopancreas under the influence of different salinities

		CK	Salinity(3SAL-ppt)				Salinity(13SAL-ppt)				Salinity(23SAL-ppt)			
FAA	Taste	SM-H-0d	SM3-H-1d	SM3-H-3d	SM3-H-7d	SM3-H-15d	SM13-H-1d	SM13-H-3d	SM13-H-7d	SM13-H-15d	SM23-H-1d	SM23-H-3d	SM23-H-7d	SM23-H-15d
asp*	Umami (+)	4.29±0.61b	4.58±0.68b	4.32±1.57b	6.18±1.93ab	4.87±1.21b	6.3±0.6ab	5.1±1.66ab	7.84±2.27a	5.52±2.15ab	4.47±1.22b	5.24±1.19ab	5.29±1.69ab	4.1±0.92b
glu*	Umami (+)	18.96±4.89c	28.23±6.33abc	27.03±2.73abc	27.96±2.99abc	24.58±5.39bc	31.74±6.45ab	25.2±2.04bc	19.39±2.16c	26.32±9.91abc	32.14±5ab	23.51±4.36bc	22.92±6.22bc	35.43±4.69a
asn	tasteless	4.53±0.8	4.78±1.1	4.49±0.57	5.27±1.44	4.8±1.74	4.68±0.95	3.55±0.6	5.56±0.88	5.56±0.69	4.32±0.48	4.48±0.9	4.77±2.61	3.73±0.74
ser*	Sweet (+)	7.9±1.82abc	9.16±2.99a	8.57±4.58ab	6.58±1.94abcd	4.43±0.52cd	5.38±0.75bcd	4.83±1.26bcd	5.87±1.22abcd	4.56±1.15cd	6.59±0.13abcd	6.7±2.1abcd	5.98±0.53abcd	3.85±1.39d
gln	tasteless	19.69±1.72	20±5.97	14.97±1.23	30.89±4.93	25.91±8.11	18.55±3.65	21.77±3.58	30.65±7.97	25.64±6.27	20.41±2.15	37.21±37.79	34.44±5.91	19.98±10.49
his	Bitter (−)	7.49±0.37b	7.72±0.85ab	8.02±0.86ab	7.01±1.5bc	8.29±0.98ab	7.46±0.96b	6.7±0.77bc	8.3±1.11ab	7.75±0.76ab	6.19±1.23bc	6.14±0.57bc	4.22±2.12c	10.72±4.61a
gly*	Sweet (+)	31.42±9.78	31.1±13.55	34.12±7.45	29.56±4.09	33.06±13.64	35.91±11.7	30.52±13.56	21.12±0.63	28.93±7.56	32.44±2.15	36.28±11.92	47.91±38.87	48.41±4.07
thr#/*	Sweet (+)	9.59±1.14abcd	9.42±1.6abcd	9.23±1.5abcd	11.45±2.4ab	8.17±2.37bcd	11.19±1.55abc	8.18±1.51bcd	11.59±1.42a	9.52±0.67abcd	8.81±0.44abcd	7.96±1.57cd	8.08±2.3cd	7.12±2.34d
arg	Bitter (−)	55.82±5.15ab	52.8±5.67ab	53.42±6.57ab	53.17±5.1ab	67.81±26.28ab	49.15±3.39ab	46.58±10.23ab	43.97±6.93ab	51.59±3.47ab	49.65±1.57ab	60.4±24.94ab	42.49±8.64b	69.81±24.7a
ala*	Sweet (+)	25.77±1.84b	24.28±4.02b	30.65±7.45b	34.23±6.22b	27.68±10.77b	27.12±5.92b	31.74±3.1b	23.96±1.51b	39.46±34.56b	26.56±2.62b	26.74±4.52b	52.12±12.31a	56.56±21.47a
tyr	Bitter (−)	15.39±0.93abc	19.85±2.38abc	19.3±2.65abc	18.42±5.33abc	23.99±5.02a	20.92±3.62ab	17.15±3.09abc	19.26±1.52abc	18.05±7.07abc	16.63±4.3abc	17.04±3.81abc	14.15±8.16bc	11.64±5.47c
cys-s	tasteless	4.17±0.18a	3.11±1.37ab	2.61±0.29abc	2.91±0.74ab	2.58±1.17abc	2.04±0.98bc	2.25±0.47bc	2.95±0.32ab	2.26±1.39bc	1.63±0.73bc	1.94±0.49bc	2.35±1.35bc	0.96±0.25c
val#	Bitter (−)	9.07±1.17bc	10.37±2.52ab	9.13±2.27bc	10.95±2.98ab	7.53±2.16bc	14.14±3.31a	8.79±2.28bc	11.41±1.9ab	7.52±0.69bc	10.38±2.03ab	8.49±2.64bc	7.76±3.2bc	4.98±1.51c
met#	Bitter (−)	8.9±1.18ab	9.51±1.48a	9.44±2.07a	8.99±2.82ab	8.3±3.18ab	11.09±1.74a	7.91±1.94ab	10.07±1.47a	7.62±2.96ab	8.95±1.56	9.3±2.73ab	7.5±4.19ab	4.7±1.75b
trp#	Bitter (−)	8.65±3.19ab	8.5±1.26ab	9.81±1.82a	8.37±2.36ab	10.1±4.12a	6.41±0.12ab	7.88±3.22ab	7.64±1.05ab	6.61±2.32ab	4.57±1.34b	6.44±2.9ab	4.73±2.63b	6.87±2.87ab
phe#	Bitter (−)	16.59±0.59bcd	17.98±3.17bcd	17.28±3.22bcd	19.1±5.13bc	16.28±3.07bcd	21.68±3.74ab	16.28±5.31bcd	26.81±3.71a	15.91±8.17bcd	14.94±3.22bcd	15.04±3.66bcd	11.61±6.37cd	9.86±1d
ile#	Bitter (−)	6.88±0.83bc	8.79±2.62ab	7.78±2.3bc	10.03±3.35ab	6.36±1.92bc	12.35±2.84a	8.12±2.72abc	10.26±2.09ab	5.88±1.55bc	8.32±2.4ab	6.77±2.69bc	5.98±2.76bc	3.57±1.44c
leu#	Bitter (−)	29.46±1.47ab	33.34±9.3ab	31.61±7.69ab	29.63±8ab	24.33±11.71bc	44.4±6.62a	26.95±8.29bc	33.45±3.83ab	25.21±9.34bc	32.24±7.62ab	27.3±7.6bc	25.14±11.58bc	43.52±5.39c
lys#	Bitter (−)	38.2±3.08abc	43.79±6.99ab	43.81±6.44ab	38.37±7.66abc	46.09±6.58a	35.81±3.13abc	40.24±4.51ab	32.33±1.95bcd	43.52±7.84ab	33.41±5.95bcd	34.07±7.91abcd	23.28±9.15d	37.18±7.34cd
pro*	Sweet (+)	28.41±5.04b	19.9±1.58b	23.31±8b	23.34±7.24b	17.35±8.42b	18.22±6.05b	17.7±3.17b	19.48±3.05b	17.85±10.21b	25.35±9.29b	26.61±4.69b	21.82±9.96b	28.09±20.48a
EAA	−	127.34±4.23	141.7±16.04	138.09±25.11	136.89±32.03	127.16±19.60	157.07±21.80	124.35±23.42	143.56±14.42	121.79±31.41	121.62±18.00	115.37±27.59	119.08±42.03	117.8±13.05
TAA	−	351.18±5.28	367.21±11.49	368.9±25.66	382.41±37.03	372.51±51.46	384.54±59.56	337.44±20.11	351.91±16.44	355.28±11.09	348±28.82	367.66±35.96	377.54±6.03	391.08±80.54

Test of Flavor Nucleotides and EUC in Edible Parts

In the comparison of free nucleotide level (Fig. 3, Table 4 and Table 5), nucleotide fluctuated greatly in muscle and hepatopancreas at different time points.

In muscle (Fig. 3 and Table 4), when time points were set to be 1, 3, 7 and 15 respectively, the content of total nucleotides dropped on the 1st day, decreased on the 3rd day except for salinity 3, increased on the 7th day and dropped back on the 15th day. The fluctuation rule in three salinities was basically the same, and the highest content was in salinity 13 on the 7th day, 173.03±16.26 mg/100 g, while the lowest content was in salinity 23 on the 7th day, 62.08±37.58 mg/100 g.

When the time points were set to be 1, 3, 7 and 15 respectively, the content of AMP decreased on the 1st day, increased in salinity 3 but decreased in salinity 13 and 23 on the 3rd day, increased on the 7th day, and dropped back on the 15th day. The fluctuation rule of content in three salinities was basically the same, and the highest content was in salinity 3 on the 7th day, 162.67±28.92 mg/100 g, while the lowest was in salinity 23 on the 15th day, 53±35.59mg/100 g.

When the time points were set to be 1, 3, 7 and 15 respectively, the content of GMP decreased in salinity 13 and 23 but increased in salinity 3 on the 1st day, increased in salinity 3, but decreased in salinity 13 and 23 on the 3rd day, increased in salinity 13 but decreased in salinity 3 and 23 on the 7th day, and decreased completely on the 15th day. There were differences in fluctuation in three salinities, and the highest content was in salinity 3 on the 1st day, 9.07±1.45mg/100 g, while the lowest was in salinity 3 on the 15th day, 2.03±0.15mg/100 g.

When the time points were set to be 1, 3, 7 and 15 respectively, the content of IMP increased in salinity 13 and 23 but increased in salinity 3 on the 1st day, increased in salinity 3 and 13 but decreased in salinity 23 on the 3rd day, increased in salinity 13 and 23 but decreased in salinity 3 on the 7th day, and decreased completely on the 15th day. There were differences in fluctuation in three salinities, and the highest content was in salinity 13 on the 7th day, 12.23±5.68mg/100 g, while the lowest was in salinity 13 on the 15th day, 3.4±1.54mg/100 g.

In hepatopancreas (Fig. 3, Table 5), when the time points were set to be 1, 3, 7 and 15 respectively, the content of total nucleotide decreased completely on the 1st day, increased in salinity 23 but decreased in salinity 3 and 13 on the 3rd day, decreased in salinity 23 but increased in salinity 3 and 13 on the 7th day, increased in salinity 23 but decreased in salinity 3 and 13 on the 15th day. There were differences in fluctuation in three salinities, and the highest content was in salinity 13 on the 7th day, 55.17±21.01mg/100 g, while the lowest was in salinity 13 on the 3rd day, 25.1±13.97 mg/100 g.

When the time points were set to be 1, 3, 7 and 15 respectively, the content of AMP increased on the 1st and 3rd day, decreased in salinity 13 but increased in salinity 3 and

23 on the 7th day, decreased in salinity 3 but increased in salinity 23 and 13 on the 15th day. The fluctuation rule in three salinities was basically the same, and the highest content in salinity 3 on the 7th day was 13.4±9.41 mg/100 g, while the lowest in salinity 23 on the 15th day was 1.5±1.16mg/100 g.

When the time points were set to be 1, 3, 7 and 15 respectively, the content of GMP decreased on the 1st day, continued to decrease on the 3rd day except for salinity 3, increased in salinity 13 and 23 but decreased in salinity 3 on the 7th day, decreased in salinity 13 but increased in salinity 3 and 23 on the 15th day. The fluctuation rule in three salinities was basically the same, and the highest content was in salinity 13 on the 7th day 36±27.5mg/100 g, while the lowest was in salinity 23 on the 3rd day, 5.8±1.11mg/100 g.

When the time points were set to be 1, 3, 7 and 15 respectively, the content of IMP increased in salinity 3 but decreased in salinity 13 and 23 on the 1st day, increased in salinity 23 but decreased in salinity 13 and 3 on the 3rd day, increased in salinity 13 but decreased in salinity 3 and 23 on the 7th day, and increased completely on the 15th day. There are differences in fluctuation in three salinities, and the highest content was in salinity 13 on the 7th day, 55.17±21.01mg/100 g, while the lowest was in salinity 13 on the 15th day, 25.1±13.97mg/100 g.

In the comparison of EUC content (Fig. 3, Table 4 and 5), it fluctuated greatly in muscle and hepatopancreas at different time points.

In muscle (Fig. 3 and Table 4), when the time points were set to be 1, 3, 7, and 15 respectively, the content increased in salinity 3 and 13 but decreased in salinity 23 on the 1st day, decreased in salinity 3 and 23 but increased in salinity 13 on the 3rd day, decreased on the 7th day, decreased in salinity 3 and 23 but increased in salinity 13 on the 15th day. The fluctuation rule in three salinities was different, and the highest content was in salinity 3 on the 1st day, 1.14±0.25 gMGS/100 g, while the lowest was in salinity 23 on the 15th day, 0.45±0.25 gMGS/100 g.

In hepatopancreas (Fig. 3 and Table 5), when the time points were set to be 1, 3, 7 and 15 respectively, the content increased in salinity 3 but decreased in salinity 13 and 23 on the 1st day, decreased on the 3rd day, decreased in salinity 3 and 23 but increased in salinity 13 on the 7th day, increased in salinity 3 and 23 but decreased in salinity 13 on the 15th day. The fluctuation rule in three salinities was different, and the highest content was in salinity 13 on the 7th day, 3.25±2.31 gMGS/100 g, while the lowest was in salinity 13 on the 3rd day, 1.09±0.44 gMGS/100 g.

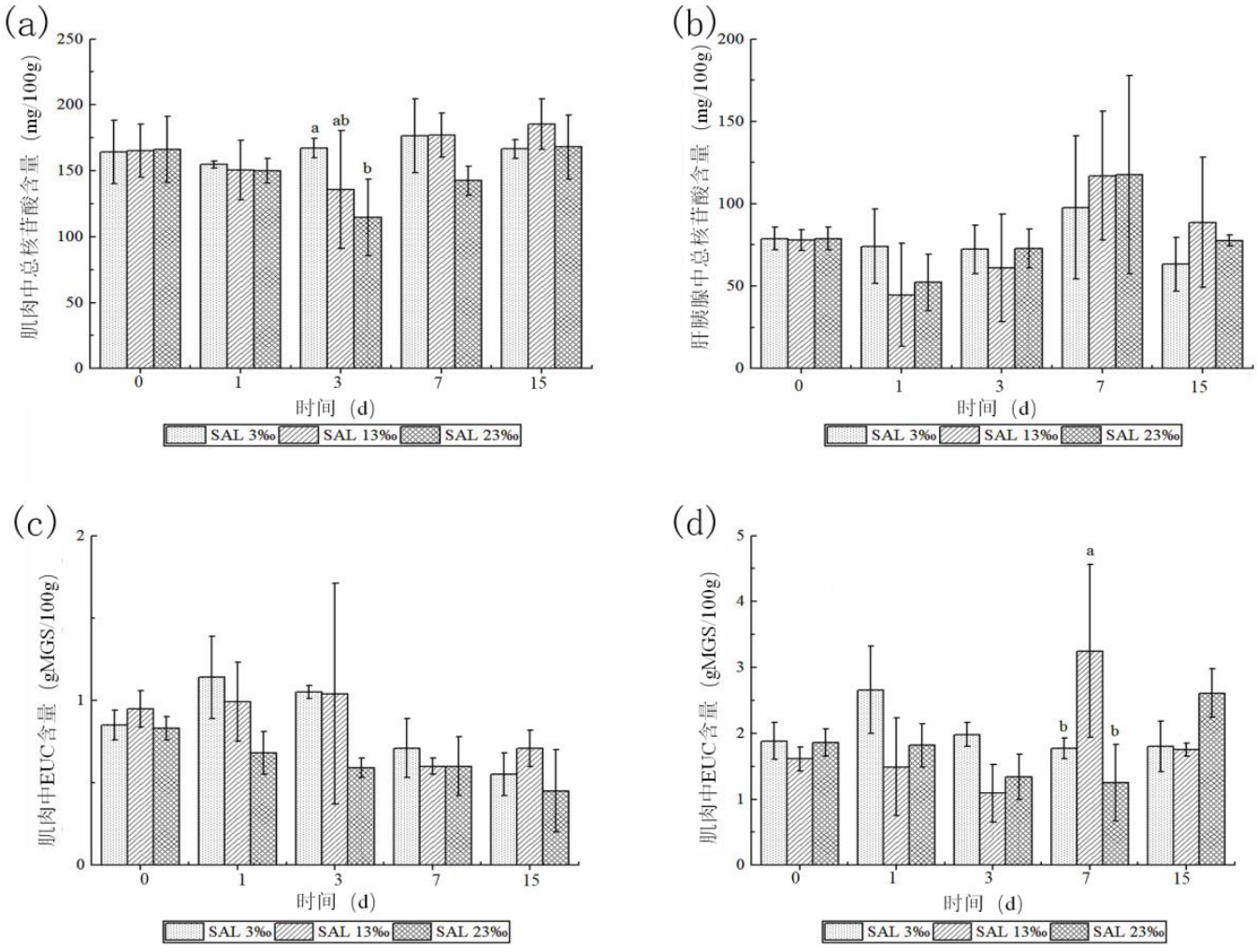

Fig. 3. Change chart of nucleotide and EUC at different time points

Table 4. Content of flavor nucleotide and EUC in muscle under the influence of different salinities

nucleotide (mg/100g)	CK	Salinity(3SAL-ppt)			Salinity(13SAL-ppt)				Salinity(23SAL-ppt)				
	SM-M-0d	SM3-M-1d	SM3-M-3d	SM3-M-7d	SM3-15d-M	SM13-1d-M	SM13-3d-M	SM13-7d-M	SM13-15d-M	SM23-1d-M	SM23-3d-M	SM23-7d-M	SM23-15d-M
AMP	145.67±25.81ab	136.33±2.31ab	153±18.73a	162.67±28.92a	129±9.85ab	133±26.85ab	116±43.09ab	153±17.09a	138.67±6.43ab	119.67±13.5ab	99.67±32.88b	115.67±26.76ab	53±35.59c
GMP	7.63±1.69ab	9.07±1.45a	5.07±2.2bcd	4.6±0.82bcd	2.03±0.15d	5.93±1abc	6.7±2.86abc	7.8±0.95ab	2.3±0.36d	5.63±0.64bc	5.83±1.07abc	4.08±2.99cd	4.21±2.99cd
IMP	8.03±3.17ab	6.97±2.45ab	7.03±2.34ab	5.5±1.32ab	4.7±1.51ab	8.83±6.26ab	9.5±9.12ab	12.23±5.68a	3.4±1.54b	11.77±3.87ab	3.57±0.68ab	6.23±5.91ab	4.87±4.29ab
Total nucleotide	161.33±23.76a	152.37±6.21ab	165.1±23.28a	172.77±29.56a	135.73±9.76ab	147.77±22.89ab	132.2±46.79ab	173.03±16.26a	144.37±4.88ab	137.07±10ab	109.07±31.22b	125.98±31.04ab	62.08±37.58c
EUC	0.85±0.09abcd	1.14±0.25a	1.05±0.04ab	0.71±0.18abcd	0.55±0.13cd	0.99±0.24abc	1.04±0.67ab	0.6±0.05bcd	0.71±0.11abcd	0.68±0.13abcd	0.59±0.06bcd	0.6±0.18bcd	0.45±0.25d

Table 5. Content of flavor nucleotide and EUC in hepatopancreas under the influence of different salinities

nucleotide (mg/100g)	CK	Salinity(3SAL-ppt)			Salinity(13SAL-ppt)				Salinity(23SAL-ppt)				
	SM-H-0d	SM3-H-1d	SM3-H-3d	SM3-H-7d	SM3-15d-H	SM13-1d-H	SM13-3d-H	SM13-7d-H	SM13-15d-H	SM23-1d-H	SM23-3d-H	SM23-7d-H	SM23-15d-H
AMP	1.24±0.85b	1.5±1.16b	2.56±2.28b	13.4±9.41a	4.8±4.39b	1.57±1.06b	7.33±9.27ab	3.23±2.51b	6.17±2.8ab	1.57±0.21b	4.27±1.06b	6.1±1.56ab	9.17±5.8ab
GMP	14.67±5.51b	14±6.93b	9.5±4.45b	7.8±1.82b	12.37±2.83b	8.47±2.4b	7.97±3.91b	36±27.5a	13.73±4.05b	8.37±3.18b	5.8±1.11b	7.13±3.52b	12±1.73b
IMP	35.33±8.33a	35.33±17.04a	30.33±7.09ab	23.67±1.53ab	24±12.77ab	15.53±20.44ab	9.8±6.3bab	15.93±8.79ab	15.97±5.35ab	21.67±13.8ab	25±6ab	21.47±12.27ab	26.67±13.32ab
Total nucleotide	51.24±3.22a	50.83±10.44a	42.4±13.82ab	44.87±12.76ab	41.17±11.62ab	25.57±22.76b	25.1±13.97b	55.17±21.01a	35.87±6.98ab	31.6±11.01ab	35.07±6.05ab	34.7±14.91ab	47.83±8.61ab
EUC	1.88±0.28abc	2.66±0.66ab	1.98±0.18abc	1.77±0.16bc	1.8±0.38abc	1.49±0.74bc	1.09±0.44c	3.25±2.31a	1.75±0.1bc	1.82±0.33abc	1.34±0.34bc	1.25±0.58bc	2.61±0.37ab

Test of Lactic Acid and Taurine in Edible Parts

In the comparison of lactic acid (Fig. 4, Table 6 and 7), it fluctuated greatly in muscle and hepatopancreas at different time points, and it was higher in salinity 3 than that in salinity 13 and 23.

In muscle (Fig. 4 and Table 6), when the time points were set to be 1, 3, 7 and 15 respectively, the content of lactic acid increased on the 1st day, decreased on the 3rd and 7th day, and continued to decrease in salinity 3 and 13 but increased slightly in salinity 23 on the 15th day. The fluctuation rule in three salinities was basically the same, and the highest was in salinity 3 on the 1st day, 1.34±0.08 mmol/g, while the lowest was in salinity 13 on day 0, 0.65±0.04 mmol/g.

In hepatopancreas (Fig. 4 and Table 7), when the time points were set to be 1, 3, 7 and 15 respectively, the content of lactic acid increased on the 1st day and decreased continuously on the 3rd, 7th and 15th day. The fluctuation rule in three salinities was consistent, and the highest content was in salinity 3 on the 1st day, 2.35±0.24 mmol/g, while the lowest was in salinity 13 on the 15th day, 1.42±0.11 mmol/g.

In the comparison of taurine content (Fig. 4, Table 8 and 9), it fluctuated greatly in muscle and hepatopancreas at different time points, and it was higher in salinity 3 than that in salinity 13 and 23.

In muscle (Fig. 4 and Table 8), when the time points were set to be 1, 3, 7 and 15 respectively, the content of taurine increased in salinity 3 but decreased in salinity 13 and 23 on the 1st day, decreased completely on the 3rd day, decreased in salinity 3 and 13 but increased in salinity 23 on the 7th day, and decreased in salinity 3 and 23 but increased in salinity 13 on the 15th day. The fluctuation rule in three salinities was inconsistent, and the highest content was in salinity 3 on the 1st day, 166.8±26.27 mg/100 g, while the lowest was in salinity 23 on the 3rd day, 34.32±5.74 mg/100 g.

In hepatopancreas (Fig. 4 and Table 9), when the time points were set to be 1, 3, 7 and 15 respectively, the content of taurine stayed the same in salinity 3 and 13 but increased in salinity 23 on the 1st day, increased in salinity 3 but decreased in salinity 13 and 23 on the 3rd day, decreased in salinity 3 and 13 but increased in salinity 23 on the 7th day, and increased completely on the 15th day. The fluctuation rule in three salinities was inconsistent, and the highest content was in salinity 13 on the 1st day, 210.14±30.25 mg/100 g, while the lowest was in salinity 23 on the 3rd day, 145.11±13.6 mg/100 g.

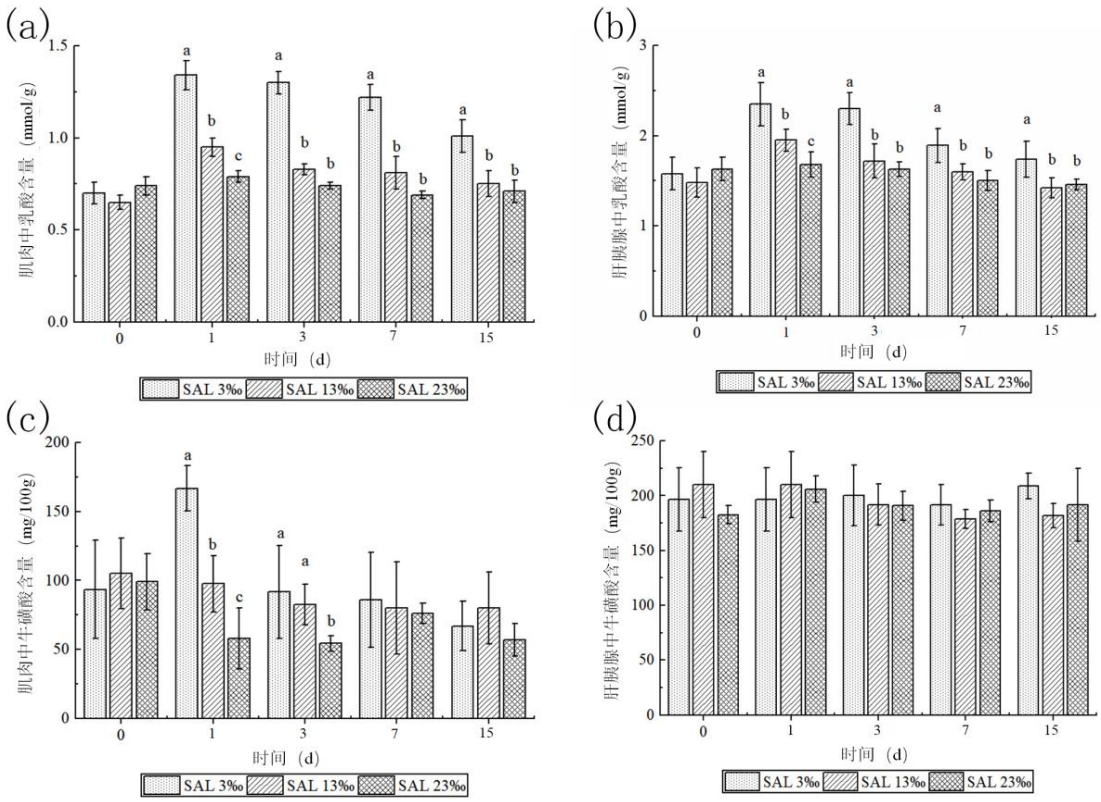

Fig. 4. Change chart of taurine in hepatopancreas at different time points

Table 6. Content of lactic acid in muscle of temporarily reared blue crab in Sanmen (mg/100g)

	SM-0d-M	SM-1d-M	SM-3d-M	SM-7d-M	SM-15d-M
Salinity 3	0.7±0.06	1.34±0.08a	1.3±0.06a	1.22±0.07a	1.11±0.09a
Salinity 13	0.65±0.04	0.95±0.05b	0.83±0.03b	0.81±0.09b	0.8±0.02b
Salinity 23	0.74±0.05	0.79±0.03c	0.74±0.02b	0.69±0.02b	0.71±0.06b

Table 7. Content of lactic acid in hepatopancreas of temporarily reared blue crab in Sanmen (mg/100g)

	SM-0d-H	SM-1d-H	SM-3d-H	SM-7d-H	SM-15d-H
Salinity 3	1.58±0.18	2.35±0.24a	2.3±0.18a	1.89±0.19a	1.74±0.2a
Salinity 13	1.48±0.16	1.95±0.12b	1.72±0.19b	1.6±0.09b	1.42±0.11b
Salinity 23	1.63±0.13	1.68±0.14c	1.63±0.08b	1.5±0.11b	1.46±0.06b

Table 8. Content of taurine in muscle of temporarily reared blue crab in Sanmen (mg/100g)

	SM-0d-M	SM-1d-M	SM-3d-M	SM-7d-M	SM-15d-M
Salinity 3	93.49±45.48	166.8±26.27a	91.68±43.67a	85.89±34.46	66.78±17.96
Salinity 13	105.02±25.48	97.52±40.61b	82.39±14.71a	79.99±43.56	80.15±26.08
Salinity 23	99.02±20.48	57.89±22.1b	34.32±5.74b	75.88±7.4	56.95±11.75

Table 9. Content of taurine in hepatopancreas of temporarily reared blue crab in Sanmen (mg/100g)

	SM-0d-H	SM-1d-H	SM-3d-H	SM-7d-H	SM-15d-H
Salinity 3	196.68±28.97	196.68±28.97	200.4±27.66	191.65±18.34	208.9±11.49
Salinity 13	210.14±30.25	210.14±30.25	191.71±18.76	178.8±8.58	181.9±11.14
Salinity 23	182.5±8.34	206.05±11.94	145.11±13.6	185.94±9.87	191.55±53.14

Discussion

According to chapter 2, 3 and 4, Scylla paramamosain develops its unique flavor quality in low-salinity environment. This research adopted wild Scylla paramamosain taken from the adjacent waters (salinity 23) of Sanmen, Zhejiang for temporary rearing experiment, compared the 15-day salinity stress in salinity 3, 13 and 23, tested such indexes as free amino acid, nucleotide, lactic acid and taurine in three salinities on the 0, 1st, 3rd, 7th and 15th day, and carried out the specific analysis of flavor quality in different salinities at different time points.

Free Amino Acid in Edible Parts

In the comparison of free amino acid level, the change rule in muscle in salinity was similar to that in other salinities. The content of free amino acid decreased on the

1st day, increased on the 3rd and 7th day, and dropped back on the 15th day. The content fluctuated greatly, but the fluctuation rule in three salinities was basically the same. The highest content was in salinity 3 on the 15th day, which was 702.76±97.17mg/100 g. In hepatopancreas, the change rule of content in salinity 3 was similar to that in salinity 13, but differed greatly from that in salinity 23. It reached the highest on the 7th day, which was 382.41±37.03mg/100 g, which was similar to the highest content on the 1st day in salinity 13 (384.54±59.56mg/100 g) on the 1st day, and the highest in salinity 23 (391.08±80.54mg/100 g). It is thus inferred that low salinity is not a decisive factor that impacts the total accumulation of free amino acid.

In the comparison of essential amino acid, the change rule in muscle in salinity 3 was similar that that in other salinities. The content of essential amino acid decreased on the 1st day, increased on the 3rd and 7th day and dropped back on the 15th day. The content fluctuated greatly, but the fluctuation rule in three salinities was basically the same. The highest content was in salinity 13 on the 7th day, which was 78.37±18.01mg/100 g. In hepatopancreas, the change rule in salinity 3 was similar to that in salinity 13, but differed greatly from that in salinity 23. It reached the highest content on the 1st day, which was 141.7±16.04mg/100 g, between that in salinity 13 (157.07±21.80mg/100 g) and that in salinity 13 (127.34±4.23mg/100 g), and there was little difference. It is thus inferred that low salinity is not a decisive factor that impacts the total accumulation of essential amino acid.

In the comparison of delicious amino acid, the change rule in muscle in salinity 3 was different from that in other salinities. It reached the peak on the 1st and 3rd day and decreased on the 7th and 15th day. In salinity 13, it increased on the 15th day. In salinity 23, it decreased on the 1st day, but increased continuously on the 3rd, 7th and 15th day. The content fluctuated greatly, and the fluctuation rule in three salinities was different. The content in salinity 3 and 13 was significantly different from that in salinity 23 on the 1st and 3rd day. Specifically, the content of Glu in salinity 3 reached the highest on the 3rd day, which was 15.99±3.16mg/100 g, while the highest content of Asp was 3.04±0.18mg/100 g, close to the highest content in salinity 13, and higher than the highest content in salinity 23. It decreased slightly in the 7-15-day temporary rearing, which always ranged between 13-14 mg/100 g. In hepatopancreas, the change rule in salinity 3 was slightly different from that in other salinities. It increased on the 1st day, decreased on the 3rd and 7th day. But it decreased in salinity 3 on the 15th day, and increased in other two salinities, with great fluctuations. Specifically, the content of Glu reached the highest in salinity 3 on the 1st day, which was 28.23±6.33mg/100 g, lower than the highest content in salinity 13 and 23, but there was no remarkable difference. The content of Asp reached the highest on the 7th day, which was 6.18±1.93mg/100 g, lower than the highest in salinity 13 but higher than that in salinity 23, and there was no remarkable difference. It is inferred that in muscle, low salinity is a primary factor that impacts the accumulation of delicious amino acid, and it is especially sensitive to the accumulation of Glu. In hepatopancreas, low salinity is beneficial to the accumulation of delicious amino acid, and it is better in salinity 13.

In the comparison of sweet amino acid content, the change rule in muscle in salinity 3 was different from that in the other two salinities. It decreased on the 1st day, and continued to rise to peak on the 3rd, 7th and 15th day. In salinity 13 and 23, it increased on the 1st day, decreased on the 3rd and 7th day. On the 15th day, it increased in salinity 13 and decreased in salinity 23. The fluctuation rule in three salinities was different, and it ranged between 350-450 mg/100 g. The content in salinity 23 on the 1st day was the highest, while the highest in salinity 3 was on the 7th day, lower than that in salinity 13 and 23, and there was no remarkable difference between the two. Specifically, the content of Gly in salinity 3 reached the highest on the 3rd day, which was 224.53±48.94mg/100 g, lower than that in salinity 13 and 23, but there was no remarkable difference. The content of Pro in salinity 3 reached the highest on the 7th day, which was 49.18±19.9mg/100 g, higher than that in salinity 13 and 23, with a significant difference from the content in salinity 13. The content of Ala in salinity 3 reached the highest on the 3rd day, which was 224.53±48.94mg/100 g, lower than that in salinity 13 and 23, but there was no remarkable difference. In hepatopancreas, the change rule in salinity 3 was similar to that in the other two salinities. It decreased on the 1st day, increased on the third day (decreased in salinity 13), and continued to rise to peak on the 7th and 15th day. The fluctuation rule in three salinities was basically the same, ranging between 80-120mg/100 g, it reached the highest in salinity 23 on the 15th day, and in salinity 3, the highest content also occurred on the 15th day, but it was lower than that in salinity 13 and higher than that in salinity 13, and there was no remarkable difference. The content of Gly reached the highest in salinity 3 on the 3rd day, which was 34.12±7.45mg/100 g, lower than that in salinity 13 and 23, and there was no remarkable difference. The content of Pro in salinity 3 reached the highest on the 1st day, which was 28.41±5.04mg/100 g, higher than that in salinity 13 and 23, but there was no remarkable difference. The content of Ala in salinity 3 reached the highest on the 7th day, which was 34.23±7.45mg/100 g, lower than that in salinity 13 and 23, but there was no remarkable difference. It is inferred that in muscle and hepatopancreas, low salinity is a primary factor that impacts the accumulation of sweet amino acid, and it is beneficial to the accumulation of Gly and Ala, but not Pro.

In the comparison of bitter amino acid, the change rule in muscle in salinity was different from that in the other two salinities. It increased on the 1st, 3rd and 7th day, and decreased on the 15th day, and the peak was on the 7th day, higher than that in salinity 13 and 23. In salinity 13 and 23, it decreased on the 1st day, increased on the 3rd day, and decreased on the 7th and 15th day. The content fluctuated greatly, and the fluctuation rule in three salinities was different. On the 7th day, the content in salinity 3 was the highest, which was in significant difference with that in salinity 23. The content of Arg in salinity 3 reached the highest on the 3rd day, which was 173.47±5.08mg/100 g, lower than that in salinity 13 and 23, but there was no

remarkable difference. The content of other bitter amino acids was below 15 mg/100 g, and it would not be further discussed here. In hepatopancreas, the change rule in salinity 3 was different from that in the other two salinities. It increased on the 1st day, decreased on the 3rd and 7th day, and rose to peak on the 15th day. In salinity 13, it increased on the 1st day, decreased on the 3rd day, increased on the 7th day and decreased on the 15th day. In salinity 23, it decreased on the 1st day, increased on the 3rd day, and decreased on the 7th and 15th day. The fluctuation rule in three salinities was completely different, ranging between 150-220mg/100 g. On the 15th day, the content in salinity 3 was the highest, but it was not significantly different from that in the other two salinities. Specifically, the content of Arg decreased in muscle, while the other bitter amino acids, such as Tyr, Phe, Leu and Lys increased. In salinity, the content of Arg reached the highest on the 15th day, which was 67.81±26.08mg/100 g, between that in salinity 13 and 23, and there was no remarkable difference. The content of Tyr reached the highest on the 15th day, which was 23.99±5.02mg/100 g, higher than that in salinity 13 and 23, but there was no remarkable difference. The content of Phe reached the highest on the 7th day, which was 19.1±5.13mg/100 g, between that in salinity 13 and 23, and there was no remarkable difference. The content of Leu reached the highest on the 1st day, which was 33.34±9.3mg/100 g, lower than that in salinity 13 and 23, but there was no remarkable difference. The content of Lys reached the highest on the 3rd day, which was 43.81±6.44mg/100 g, higher than that in salinity 13 and 23, but there was no remarkable difference. It is inferred that in muscle and hepatopancreas, low salinity is a primary factor that impacts the accumulation of bitter amino acids, and it is beneficial to the accumulation of Arg, Phe and Leu, but not Tyr and Lys.

Flavor Nucleotide and EUC in Edible Parts

In the comparison of flavor nucleotide, in muscle, the change rule in salinity was different from that in the other two salinities. It decreased on the 1st day, continued to rise on the 3rd and 7th day, and reached the peak on the 7th day and dropped back on the 15th day. In salinity 13, it continued to decline on the 1st and 3rd day, rose to peak on the 7th day. In salinity 23, it continued to decrease on the 1st and 3rd day, rose to peak on the 7th day and decreased on the 15th day. The fluctuation rule in three salinities was similar, in declining – rising – declining trend. The content in salinity 3 and 13 was significantly different from that in salinity 23 on the 3rd and 15th day. Specifically, the content of AMP reached the highest on the 7th day in salinity 3, which was 162.67±28.92mg/100 g. The content of GMP reached the highest, namely 9.07±1.45mg/100 g, close to the highest content in salinity 13 and higher than that in salinity 23, and it decreased slightly in the 7-15-day temporary rearing, always staying between 4.5-5.5 mg/100 g. The content of IMP in salinity 3 reached the highest on the 3rd day, which was 7.03±2.34mg/100 g. In hepatopancreas, the content decreased completely on the first day, decreased in salinity 3 and 13 and increased in salinity 23 on the 3rd day, increased in salinity 3 and 13 and decreased in salinity 23 on the 7th day, decreased in salinity 3 and 13 and decreased in salinity 23 on the 15th day. The change rule in salinity 3 and 13 was the same, in declining – declining – rising – declining trend. The content of AMP in salinity 3 reached the highest on the 7th day, which was 13.4±9.41mg/100 g, higher than that in salinity 13 and 23, but there was no remarkable difference. The content of GMP reached the highest on the 15th day, which was 12.37±2.83mg/100 g, lower than the highest in salinity 13, and higher than that in salinity 23. The highest content in salinity 3 was in significant difference with that in salinity 13, but not with that in salinity 23. The content of IMP reached the highest in salinity on the 1st day, which was 50.83±10.44mg/100 g, higher than the highest content in salinity 23 but lower than that in salinity 13, and there was no remarkable difference. It is inferred that in muscle, low salinity is the primary factor impacting the flavor nucleotide, and it is particularly sensitive to the accumulation of AMP. In hepatopancreas, relative low salinity is beneficial to the accumulation of flavor nucleotide, especially in salinity 13.

In the comparison of EUC, the change rule in muscle in salinity 3 was different from that in the other two salinities. It increased on the 1st day (but it decreased in salinity 23), decreased on the 3rd and 7th day (but it increased in salinity 23), and decreased on the 15th day (but it increased in salinity 13). The content of EUC rose to peak on the 1st day, which was 1.14±0.25mg/100 g, higher than that in salinity 13 and 23, but there was no remarkable difference. In hepatopancreas, the change rule in salinity 3 was different from that in the other two salinities. It increased on the 1st day (but it decreased on the salinity 13 and 23), decreased completely on the 3rd day, decreased on the 7th day (it increased in salinity 13), increased on the 15th day (but it decreased in salinity 13). The content of EUC in salinity 3 rose to peak on the 1st day, which was 2.66±0.66mg/100 g, lower than that in salinity 13 but higher than that in salinity 23, and there was no remarkable difference. It is inferred that in muscle, low salinity is a primary factor that impacts EUC, and its content would decrease with the increase of salinity; in hepatopancreas, salinity has a small impact on the content of EUC.

Lactic Acid and Taurine in Edible Parts

In the comparison of lactic acids, the change rule in muscle in salinity was similar to that in the other two salinities. The content of lactic acid increased on the 1st day, decreased on the 3rd and 7th day, and continued to decrease on the 15th day (it increased a little in salinity 23). The content fluctuated slightly, and the fluctuation rule in three salinities was basically the same. The highest content was in salinity 3 on the 1st day, which was 1.34±0.08 mmol/g, higher than that in salinity 13 and 23, and there was significant difference. In hepatopancreas, the content increased on the 1st day, and continued to decrease on the 3rd, 7th and 15th day. The fluctuation rule in three salinities

was basically the same, and the highest was in salinity 3 on the 1st day, which was 2.35±0.24 mmol/g, higher than that in salinity 13 and 23, and there was significant difference. It is inferred that in muscle and hepatopancreas, low salinity was a primary factor that impacts the accumulation of lactic acid, and the lower the salinity is, the more lactic acid will be.

In the comparison of taurine, the change rule in muscle in salinity 3 was different from that in the other two salinities. The content of taurine increased in salinity 3 on the 1st day (but it decreased in salinity 13 and 23), decreased completely on the 3rd day, decreased on the 7th day (but it increased in salinity 23), and decreased in salinity 3 and 23 on the 15th day (but it increased in salinity 13). The fluctuation rule in three salinities was inconsistent, and the highest was in salinity 3 on the 1st day, which was 166.8±26.27 mg/100 g, higher than that in salinity 13 and 23, and there was significant difference. In hepatopancreas, the change rule in salinity 3 was different from that in the other two salinities. The content remained unchanged in salinity 3 and 13 but it increased in salinity 23 on the 1st day. On the 3rd day, it increased in salinity 3 but decreased in salinity 13 and 23. On the 7th day, it decreased in salinity 3 and 13 but increased in salinity 23. On the 15th day, it increased completely. The fluctuation rule in three salinities was inconsistent. The highest in salinity 3 was on the 15th day, which was 208.9±11.49, close to that in salinity 13 and 23, and there was no remarkable difference. It is inferred that in muscle and hepatopancreas, low salinity is a primary factor that impacts the accumulation of taurine, and the lower the salinity is, the more taurine will be in muscle.

Conclusion

To sum up, the Research Conclusions are as follows:

(1) Compared with the temporarily-reared Scylla Paramamosain in salinity 13, those in salinity 3 developed unique flavor quality: in the muscle tissue, the total amount of free amino acids of crab in salinity 3 was less than that in salinity 13, but the content of essential amino acids is higher than that in salinity. The content of delicious amino acid Asp, sweet amino acids Ala and Pro, bitter amino acids His, Arg, Tyr, Met, Trp, Asn, Gln, nucleotide AMP, Lactic acid and taurine of crab in salinity 3 was higher than that in salinity 13. The content of bitter amino acids Val and Leu, nucleotide GMP and IMP of crab in salinity 3 was less than that in salinity 13. In hepatopancreas, the content of essential amino acids of Scylla Paramamosain in salinity 3 was higher than that in salinity 13, while the content of sweet amino acids Ser, Gly and Pro, bitter amino acids His, Arg, Trp, Lys, Gln and Cys-s, nucleotide IMP and EUC, lactic acid and taurine in salinity 3 was higher than that in salinity 13, and the content of delicious amino acid Asp, sweet amino acids Thr and Ala, and bitter amino acids Ile and Leu in salinity 3 was less than that in salinity 13. (2) Compared with the temporarily-reared Scylla Paramamosain in salinity 23 (natural salinity), those in salinity 3 developed unique flavor quality: in muscle tissue, the content of essential amino acids of Scylla Paramamosain in salinity 3 was higher than that in salinity 23, while the content of delicious amino acid Asp, sweet amino acids Ala and Pro, bitter amino acids His, Arg,, Tyr, Met, Trp, Asn and Gln, nucleotide AMP, lactic acid and taurine of crab in salinity 3 was higher than that in salinity 23, and the content of delicious amino acid Asp, and bitter amino acids Gly and Ala was less than that in salinity 23. In hepatopancreas, the content of free amino acid and essential amino acid of temporarily-reared Scylla Paramamosain in salinity 3 was higher than that in salinity 23. The content of delicious amino acid Asp, sweet amino acids Ser and Thr, bitter amino acids, Tyr, Val, Met, Trp, Phe, Ile, Leu, Lys, Asn, Cys-s, nucleotide GMP, IMP and EUC, lactic acid and taurine was higher than that in salinity 23, but the content of sweet amino acids Gly, Ala and Pro, bitter amino acid Gln, nucleotide AMP was less than that in salinity 23. (3) During the temporary rearing in salinity 3, the fluctuation rule and peak value of all flavor elements differed from that in other natural salinities slightly, and its performance in muscle tissue and hepatopancreas was also different. In muscle, the fluctuation rule of total free amino acids, essential amino acid, bitter amino acid, lactic acid was similar to that in natural salinity group. Except for lactic acid, which rose to peak on the first day, the other contents rose to peak on the 7th day. The fluctuation rule of delicious amino acid, sweet amino acid, EUC, taurine EUC, and taurine was different from that of the natural salinity group. For instance, the content of delicious amino acid and sweet amino acid rose to peak on the 3rd day, while that of nucleotide occurred on the 7th day, and EUC, taurine occurred on the 1st day. Generally, the flavor quality on the 3rd and 7th day was the highest. Compared with other natural salinity control groups, the peak content of sweet amino acid Pro, bitter amino acids Arg, Tyr, Met, Trp, Gln, nucleotide AMP, GMP and EUC, taurine and lactic acid of Scylla Paramamosain reared for temporary in salinity 3 was higher than that of the natural salinity control group.

In hepatopancreas, the fluctuation rule of sweet amino acid, bitter amino acid and lactic acid was similar to that of natural salinity groups. The total content of free amino acids, delicious amino acid, bitter amino acid, and nucleotide of Scylla Paramamosain reared for temporary in salinity 3 rose to peak on the 7th day, the peak content of essential amino acid, EUC and lactic acid occurred on the 1st day, that of sweet amino acid occurred on the 3rd day, and taurine on the 15th day. Generally, the flavor quality on the 3rd and 7th day was the highest. Compared with other natural salinity control groups, the peak content of sweet amino acid Ser, bitter amino acids Cys-s, Tyr, Trp, Lys, nucleotide IMP and lactic acid of Scylla Paramamosain reared for temporary in salinity 3 was higher than that of the natural salinity control group.

The flavor quality of Scylla Paramamosain reared for temporary in salinity 3 was different from that in low-salinity culture mode in Taishan of Guangzhou, Yanjin of Henan, and Cixi of Zhejiang, and it is inferred that short-term low salinity stress and long-term low salinity adaptation have different effects on the physiological mechanism of Scylla Paramamosain.

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