The Preferences of Artemia for Salinity Levels in Living Conditions

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Abstract

The main point of this study was to discover what salinity content Artemia preferred. If given the choice between 0%, 3%, and 6% salinity, which percentage would the Artemia choose, and does this give us an idea of the best living conditions for Artemia? The experiment was carried out in a lab under controlled conditions, so not all the variables that would presumably affect Artemia in the wild were present.

Introduction

Artemia live in salt lakes of varying salinity content all over the world(Vanhaecke et al., 1984). They're a type of crustacean that has lived since the Triassic period. This particular crustacean was able to survive for thousands of millennia because of its seeming invulnerability to salt. While Artemia are not invulnerable to salt, they can withstand up to 250ppm of salinity(Warren, 2006). They do so by regulating the salt content in their body in a much more effective way than other animals. Their body is covered in a waterproof outer layer(Criel & Macrae, 2002) that makes them impermeable to water, and the salt in it. Salt must enter through the mouth of the Artemia, as it can't enter anywhere else. When the salt enters the stomach, it gets absorbed and pushed out through the Artemia's gills. This allows it to not digest too much salt, enabling it to live in high-salinity water. I want to know how Artemia react to salinity levels. Will higher salinity levels be detrimental, and which will they prefer; higher or lower levels? The hypothesis is that after a given amount of time if given the choice, more Artemia will be found in water with higher levels of salinity. This is because, in the wild, Artemia are found in waters with high salinity concentrations. The purpose of this study is to determine the salinity level preference of Artemia for living conditions.

Material and Methods

Two hundred individual Artemia were used in total in this experiment. My independent variable was salinity levels, so I had to create my solutions. I took two glasses filled with 25ml of distilled water and created one 3% salinity solution and one 6% salinity solution. The 3% solution was made by mixing 0.75g of salt with 25 ml of distilled water. The 6% solution was made by mixing 1.5g of salt with 25 ml of distilled water. There were two separate plastic Tygon tubes. Two 100cm yardsticks will be attached to the tubes with 3 rubber bands each(6 in total). To create the least movement of the tubes, I placed the rubber bands four inches into the yardstick, with one directly in the middle at 50cm. For each tube, I placed two clamps to create three separate sections(I placed them on 30cm & 70cm). I sealed one end of both tubes with a rubber stopper, about 0.5cm in. I kept one stopper on each tube removed until the water and Artemia were added. I filled the controlled tube with 75ml of distilled water, then poured in one-hundred Artemia. I sealed the tube with a rubber stopper and fastened the clamps. In the experimental tube, I filled two sections with my salinity solutions. To do this, I filled the Left section with distilled water, then poured in the artemia(100). I made sure all the Artemia were in the Left section, and then I clamped it shut. I poured out any excess water. I filled the Middle section with my 3% salinity solution and then clamped it shut. Finally, I filled the Right section with my 6% salinity solution and then clamped it shut, and sealed the tube with a rubber stopper. I placed the tubes flat on the yardstick and waited for the Artemia to settle. Then I opened the clamps at the same time for both tubes, and let the Artemia roam for thirty minutes. After thirty minutes, I resealed the clamps and poured out each section one by one into separate cups. Then I counted the Artemia in each cup and recorded the data.

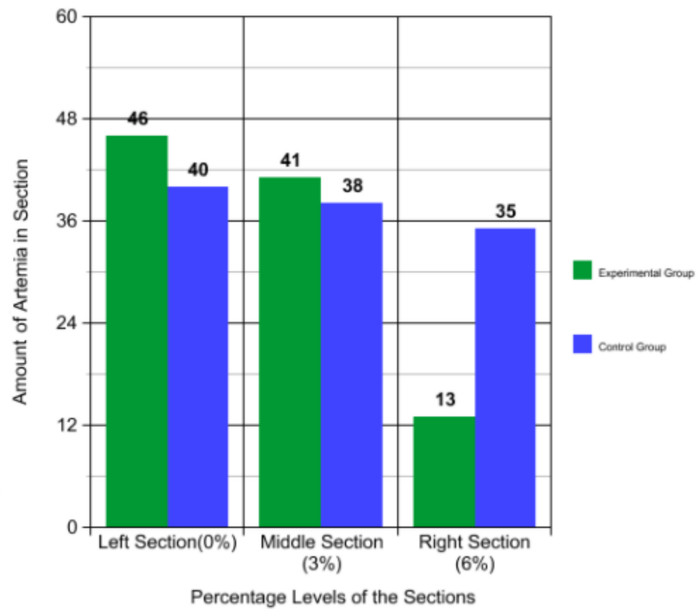

Figure 1. Amount of Artemia in each section after being allowed 30 minutes of free range in the tube.

Results

The results of the experiment showed higher portions of Artemia in the lower salinity solutions than in the higher salinity solutions(figure 1). Only in the controlled tube, where the salinity was consistent throughout the sections, were the Artemia spread out(shown in figure 2). The Artemia were mainly in the 0% salinity section, with the second largest grouping being in the 3% salinity section. It was difficult to remove the Artemia from the tubes without contaminating the other sections. At times the clamps couldn’t be screwed shut completely, allowing for just enough room for water to seep through, but not the Artemia. It was difficult to remove the rubber stopper and pour out the Artemia alone. Some of the Artemia spilled. They were retrieved and put back in their proper section. There were some interesting observations made before the experiment finished. When the Artemia ventured to another part of the tube, they didn’t go back. If an Artemia swam from the left section to the middle, it would not return to the left section. The Artemia would sometimes keep moving until they entered the Right section.

Table 2
Chi-Square Test Results for the Controlled Tube

Tube Sections	CV	χ^2	Statistical Difference?
Left	5.99	1.121	$5.99 > 1.121$ No
Middle	5.99	0.574	$5.99 > 0.574$ No
Right	5.99	0.015	$5.99 > 0.015$ No

Figure 2. All the sections of the tube have no statistical difference when compared to the expected results. The expected results were that the Artemia would equally spread out among the sections. The Artemia in the control tube spread out almost equally in all the sections.

Table 3
Chi-Square Test Results for the Experimental Tube

Tube Sections	CV	χ^2	Statistical Difference?
Left	5.99	17.938	$5.99 < 17.938$ Yes
Middle	5.99	3.761	$5.99 > 3.761$ No
Right	5.99	146.924	$5.99 < 146.924$ Yes

Figure 3. The Left and Right sections of the tube have a statistical difference when compared to the expected results. The expected results were that the Artemia would equally spread out among the sections.

Discussion

The results suggest that the Artemia prefer the lower salinity levels over the higher levels. This goes against my original hypothesis, where I guessed the Artemia would prefer the higher salinity levels. According to George Triantaphyllidis(et al, 1995) and his team's results, more damaging effects are caused to the Artemia the higher the salinity content. This seems to align with the results of my study. While my hypothesis was disproved, the results follow the general stance on Artemia preferences for salinity. The Artemia were more likely to swim in salinity levels of 3% or lower, which is right around the range of salinity for the Artemia's natural habitat. There may be other reasons why more than half of the Artemia stayed within the 3% salinity range in the sections. One could be that after the salinity levels of the sections mixed, the best salinity range would've been the diluted 3% salinity near the connection point between the Left and Middle sections. More research should be done on the effects of salinity levels on Artemia. It would be interesting to use pregnant Artemia and give them a more diverse choice of salinity levels, and see where the majority lay their eggs. Presumably, pregnant Artemia will want to choose the best living conditions for their offspring to hatch in.

List of References

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