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Zebra Fish Lab Report

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How Much Does a Zebra fish Embryo's Exposure to Ethanol Affect its Development?

Abstract:

Researchers have learned that zebra fish exposed to greater concentrations of ethanol formed more abnormal physical distortions including a smaller eye diameter, than those of zebra fish exposed to less ethanol. I hypothesized that if ethanol affects the development of zebra fish embryo, and if I place embryos in different concentrations of ethanol, then the embryos placed in higher concentrations of ethanol will develop a smaller eye diameter and retain a larger yolk sac size than those placed in lower concentrations of ethanol. In the procedure, I created four solutions of ethanol: 0% (the control), 0.5%, 1%, and 2% in which four zebra fish embryos were placed and developed in three days. My results showed that embryos placed in higher concentrations of ethanol had a smaller eye and yolk sac size than those placed in lower concentrations of ethanol. My data supported my hypothesis; although the eye sizes were as expected, the yolk sac size of the zebra fish embryos placed in higher concentrations of ethanol was smaller than those of the other embryos. The average yolk sac size of an embryo in an ethanol solution of 0% over the course of three days shrank 56.4% of its original size, while the average yolk sac size of an embryo in an ethanol solution of 2% shrank by only 38.7%.

Introduction:

The purpose of this experiment was to determine whether the amount of ethanol a zebra fish embryo is exposed to will affect its development. Researchers have found that zebra fish that were exposed to 3% ethanol over a long period of time formed abnormal physical distortions and had higher mortality rates than other groups. Furthermore, those zebra fish that were exposed to 1.5% ethanol over a short period of time developed a smaller eye diameter and a lower heart rate than the control zebra fish (Bilotta, 2004). I tested the effect of 0.5%, 1.0%, and 2% concentrations of ethyl ethanol on eye size and yolk size of developing zebra fish embryos. I began this experiment because this research could eventually enlighten us about the possible effects of ethanol on human embryonic development.

Hypothesis:

If ethanol affects the development of zebra fish embryo, and if I place embryos in different concentrations of ethanol, then the embryos placed in higher concentrations of ethanol will develop a smaller eye diameter and retain a larger yolk sac size than those placed in lower concentrations of ethanol.

Materials:

- 16 zebra fish embryos
- 4 Petri dishes
- Parafilm
- Fish water
- Ethanol
- Microscope and camera attachments
- Computer with Image J software
- Incubator (or a warm captivity of about 29.5°C)

Procedure:

I first prepared four solutions with different concentrations of ethanol, 2%, 1%, 0.5%, and 0% (being the control). Each Petri dish was then filled halfway with one of these solutions and

yolk size of a zebra fish embryo in a 2% concentrated solution of ethanol was bigger than that of a zebra fish embryo in normal water, the control water.

In this experiment, I might have unintentionally tested whether the amount of time an embryo is exposed to a certain solution can make a difference in the overall development of the fish. On the second day two of my embryos in the solution 2% were lost and had to be replaced with two new ones that had for one day been developing in normal fish water. I might also have unintentionally tested whether the temperature of the water makes a difference in their development. Each sample was under the microscope for different amounts of time and was therefore exposed to different amounts of heat and light. Lastly, I might have unintentionally tested whether jostling and moving around the embryos as they were developing made a difference in their development.

I think my experiment did not work out the way I thought it did because the embryos that were exposed to higher concentrations of ethanol used their yolk sac more quickly to try and compensate the effects of the ethanol. If I were to repeat this experiment, I would first make sure to keep the embryos at a constant temperature throughout the entire experiment. I would also try to limit the amount of human inflicted movement on the embryos, and I would make sure to not lose any of my embryos.

New Hypothesis:

If zebra fish embryos develop best in still or slow moving water, and if I shake the embryos for the same amount of time at different rates, then the embryos that were shaken the hardest will be the most undeveloped and deformed.

Conclusion:

My data did not fully support my hypothesis. The embryos placed in a higher concentration of ethanol developed a smaller eye diameter, but did not retain a larger yolk sac size than those embryos placed in a lower concentration of ethanol.

Day 1-Eye Size
Solution 2%

Area	Mean	Min	Max	Pixels Squared	Solution 2%
1	-	-	-	-	-
2	1919	223.371	162	253	0.01287954
3	451	177.494	133	224	0.003026927
4	1977	197.569	149	247	0.013268813
Average					0.009725093
Solution 1%					
1	3519	214.995	118	253	0.023618084
2	2355	185.636	126	225	0.015805793
3	-	-	-	-	-
4	3238	224.999	141	249	0.021732127
Average					0.020385335
Solution 0.5%					
1	-	-	-	-	-
2	1998	158.936	101	243	0.013409756
3	3026	208.628	131	242	0.02030927
4	2810	213.155	166	241	0.018859567
Average					0.017526198
Control					
1	2849	217.568	138	249	0.019121319
2	3581	228.278	179	253	0.024034202
3	1420	145.162	95	193	0.009530457
4	2466	235.849	206	255	0.01655078
Average					0.01730919

Day 1-Yolk Sac Size
Solution 2%

Area	Mean	Min	Max	Pixels Squared	Solution 2%
1	-	-	-	-	-
2	48522	214.427	110	255	0.325659749
3	45982	179.944	69	253	0.308612312
4	43606	215.054	83	255	0.292665575
Average					0.308979212
Solution 1%					
1	31449	216.375	85	255	0.21107278
2	39911	177.386	56	245	0.267866251
3	-	-	-	-	-
4	35033	205.754	92	255	0.235127118
Average					0.23802205
Solution 0.5%					
1	-	-	-	-	-
2	37186	205.215	44	255	0.24957717
3	34643	221.345	82	255	0.232509598
4	35814	223.221	92	255	0.240368869
Average					0.240818545
Control					
1	34336	218.356	130	255	0.23044914
2	35896	201.292	75	255	0.240919219
3	40983	197.653	93	250	0.275061075
4	35629	225.265	115	255	0.238456066
Average					0.246221375

Day 2-Eye Size
Solution 2%

Area	Mean	Min	Max	Pixels Squared	Solution 2%
1	-	-	-	-	-
2	2539	80.064	62	93	0.017040726
3	3826	113.732	69	214	0.025678542
4	-	-	-	-	-
Average					0.021359634
Solution 1%					
1	5033	98.979	69	177	0.03377943
2	5888	97.329	70	179	0.039517839
3	-	-	-	-	-
4	4510	81.724	49	144	0.030269269
Average					0.034522179
Solution 0.5%					
1	6219	62.141	48	177	0.041739376
2	-	-	-	-	-
3	4496	119.199	81	189	0.030175307
4	5487	114.294	91	186	0.036826492
Average					0.036247058
Control					
1	6620	127.977	91	199	0.044430723
2	6260	91.349	57	237	0.042014551
3	5248	118.382	99	184	0.035222422
4	6219	118.199	87	219	0.041739376
Average					0.040851768

Day 2-Yolk Sac Size
Solution 2%

Area	Mean	Min	Max	Pixels Squared	Solution 2%
1	-	-	-	-	-
2	35255	125.334	40	248	0.23661709
3	22055	173.795	62	248	0.148024108
4	-	-	-	-	-
Average					0.192320599
Solution 1%					
1	24223	214.711	76	255	0.162574834
2	25719	197.72	93	255	0.172615372
3	-	-	-	-	-
4	18150	161.819	75	254	0.121815351
Average					0.152335186
Solution 0.5%					
1	18799	85.523	29	144	0.126171172
2	-	-	-	-	-
3	28259	200.627	68	255	0.18966281
4	21623	206.133	98	255	0.145124701
Average					0.153652894
Control					
1	22164	221.532	95	255	0.148755671
2	23817	202.698	57	255	0.159849929
3	26114	196.655	97	255	0.17526645
4	27472	198.001	74	255	0.184380789
Average					0.16706321

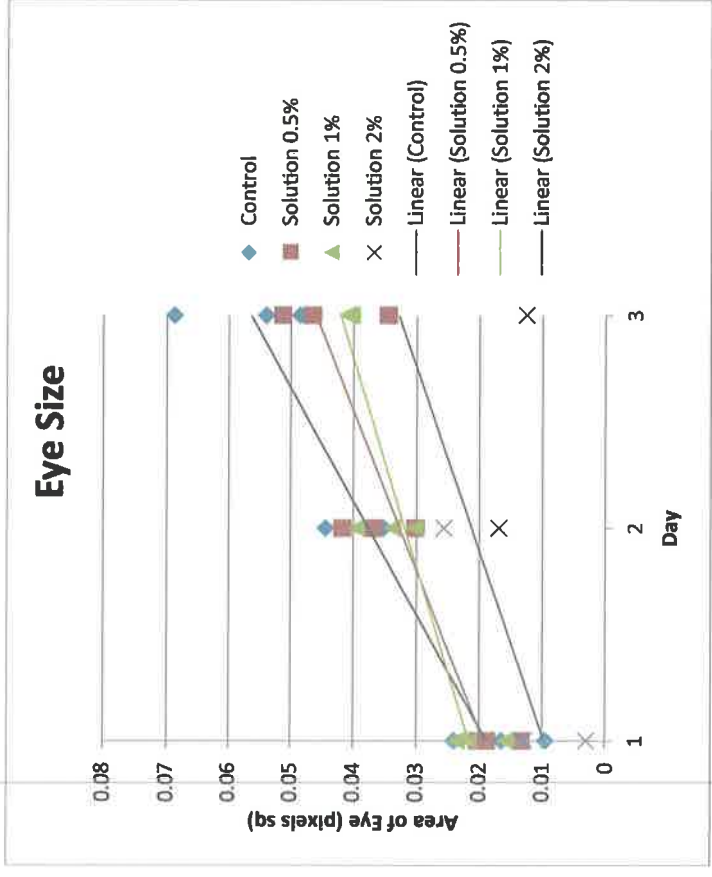
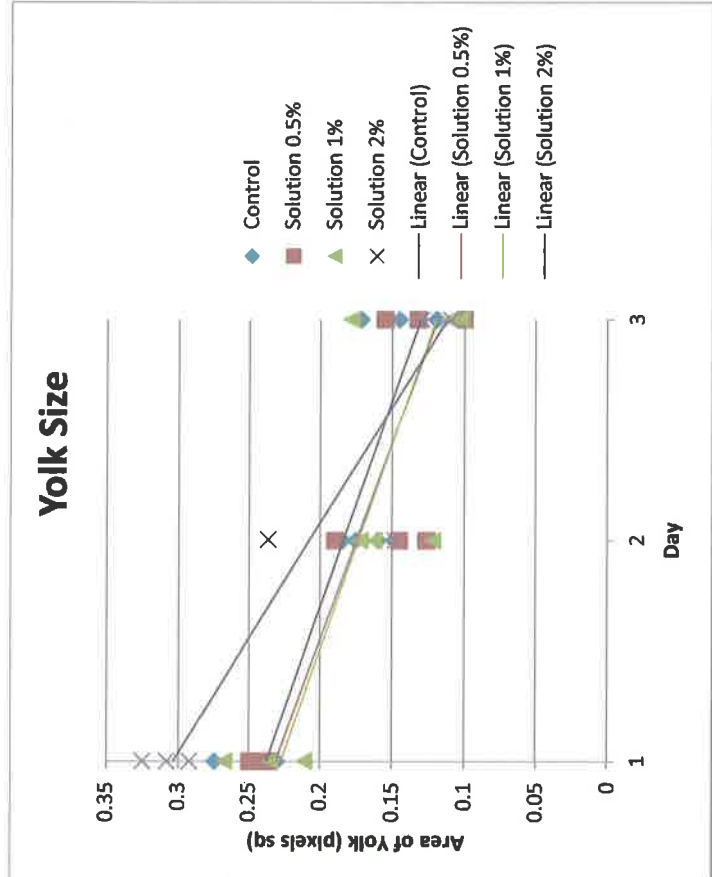
Day 3-Eye Size
Solution 2%

Area	Mean	Min	Max	Pixels Squared	Solution 2%
1	-	-	-	-	-
2	1890	102.466	77	162	0.0126685
3	7878	59.313	32	182	0.052874
4	-	-	-	-	-
Average					0.0327795
Solution 1%					
1	-	-	-	-	-
2	6013	59.109	34	139	0.040357
3	6070	69.776	48	197	0.040739
4	6114	31.379	13	92	0.041035
Average					0.040710333
Solution 0.5%					
1	-	-	-	-	-
2	5146	51.542	25	205	0.034538
3	7652	72.547	45	218	0.051357
4	6934	69.252	37	149	0.046538
Average					0.044144333
Control					
1	8047	73.265	53	243	0.054008
2	7127	67.929	17	213	0.047833
3	7231	61.418	27	156	0.048532
4	10255	48.952	27	168	0.068827
Average					0.0548

Day 3-Yolk Sac Size
Solution 2%

Area	Mean	Min	Max	Pixels Squared	Solution 2%
1	-	-	-	-	-
2	19349	172.969	96	227	0.129863
3	16287	192.795	80	253	0.109312
4	-	-	-	-	-
Average					0.1195875
Solution 1%					
1	-	-	-	-	-
2	16374	165.175	74	253	0.109896
3	26583	164.555	35	255	0.178414
4	15329	120.66	38	244	0.102882
Average					0.130397333
Solution 0.5%					
1	-	-	-	-	-
2	23119	184.244	50	255	0.155165
3	19692	110.146	29	253	0.132165
4	14922	177.534	88	244	0.10015
Average					0.12916
Control					
1	17860	194.925	74	255	0.119869
2	25539	152.113	29	254	0.171407
3	17732	208.206	46	255	0.11901
4	21596	117.627	49	221	0.144943
Average					0.13880725

Zebra Fish Graphs



References

Bilotta J, Barnett JA, Hancock L, Saszik S. 2004."Supplemental Content." *National Center for Biotechnology Information*. U.S. National Library of Medicine. Web. 28 Feb. 2012.<<http://www.ncbi.nlm.nih.gov/pubmed/15451038>>