DAFTAR PUSTAKA

Agatha, F. S., Mustahal, M., Syamsunarno, M. B., & Herjayanto, M. (2021). Early study on embryogenesis *O. woworae* at different salinities. *Jurnal Biologi Tropis*, *21*(2), 343–352.

Alves, R. N., & Agustí, S. (2020). Effect of ultraviolet radiation (UVR) on the life stages of fish. In *Reviews inFish Biology and Fisheries* (Vol. 30, Issue 2, Pp. 335–372). Springer. https://doi.org/10.1007/s11160-020-09603-1

Ansori, M. R. (2020). Perbandingan uji toksisitas akut sediaan *self-nanoemulsifying drug delivery system* (snedds) ekstrak etanol daun pegagan (*Centella asiatica l)* dengan ekstra etanol daun pegagan pada embrio ikan zebra (*Danio rerio*).

Bik, E., Ishigaki, M., Blat, A., Jasztal, A., Ozaki, Y., Malek, K., & Baranska, M. (2020). Lipid droplet composition varies based on medaka fish eggs development as revealed by nir-, mir-, and raman imaging. *Molecules*, *25*(4). https://doi.org/10.3390/molecules25040817

Cahova, J., Blahova, J., Plhalova, L., Svobodova, Z., & Faggio, C. (2021). Do single-component and mixtures selected organic uv filters induce embryotoxic effects in zebrafish (*Danio rerio*)? *Water*, *13*(16), 2203.

Chen, J. C., Chen, M. Y., Fang, C., Zheng, R. H., Jiang, Y. L., Zhang, Y. S., Wang, K. J., Bailey, C., Segner, H., & Bo, J. (2020). Microplastics negatively impact embryogenesis and modulate the immune response of the marine medaka *Oryzias melastigma*. *Marine Pollution Bulletin*, *158*. Https://doi.org/10.1016/j.marpolbul.2020.111349

Cho, J. G., Kim, K. T., Ryu, T. K., Lee, J. W., Kim, J. E., Kim, J., Lee, B. C., Jo, E. H., Yoon, J., Eom, I. C., Choi, K., & Kim, P. (2013). Stepwise embryonic toxicity of silver nanoparticles on *Oryzias latipes*. *Biomed Research International*, *2013*. https://doi.org/10.1155/2013/494671

Chou, Y., Zhu, P., Huang, X., Lin, J., Liu, J., & Gu, Y. (2018). Comparison between heart rate variability and pulse rate variability for bradycardia and tachycardia subjects. *2018 International Conference on Control, Automation and Information Sciences (ICCAIS)*, 1–6.

Damayani, I. A., Kurniawan, A., & Yaqin, K. (2022). Pengaruh paparan logam timbal terhadap kematian embrio ikan medaka embrio (*Oryzias celebensis* Weber, 1894) Di Indonesia. *SIGANUS: Journal Of Fisheries and Marine Science*, *3*(2), 215–221.

Dharma, T. S. (2015). Embryo development and endogenous nutrient absorbtion of sea silver pompano fish larvae from natural spawn of broodstsock, *Trachinotus*

*bloci*i, (LACEPEDE). *Jurnal Ilmu dan Teknologi Kelautan Tropis*, *7*(1), 83–90. http://itk.fpik.ipb.ac.id/ej_itkt71

Fachruddin, L., Yaqin, K., Rahim, S. W., Rauf, Y., & Suriyani. (2022). Laporan akhir deteksi dini efek pencemaran plastik dengan menggunakan embrio ikan endemik sulawesi *Oryzias celebensis* untuk analisis risiko ekologis.

Gonzaíez-Doncel, M., Okihiro, M. S., Villalobos, S. A., Hinton, D. E., & Tarazona, J. V. (2005). A quick reference guide to the normal development of *Oryzias latipes* (*Teleostei, Adrianichthyidae*). *Journal Of Applied Ichthyology*, 1–14. https://doi.org/https://doi.org/10.1111/j.1439-0426.2004.00615.x

Harahap, R., Alat, R., Pahrinal Napitupulu, W., & Pelawi, Z. (2022). Rancang alat pengolah limbah cair dan penetralisasi udara dalam ruangan dengan pemanfaatan ozon generator. In *Cetak) Journal of Electrical Technology* (Vol. 7, Issue 3).

Hendriyanto, C. (2011). *Pengaruh intensitas sinar ultraviolet dan pengadukan terhadap reduksi jumlah bakteri E. coli*.

Holmquist, L. M., Ray, A. M., Bancroft, B. A., Pinkham, N., & Webb, M. A. H. (2014). Effects of ultraviolet-B radiation on woundfin embryos and larvae with application to conservation propagation. *Journal Of Fish and Wildlife Management*, *5*(1), 87–98.

Hurem, S., Fraser, T. W. K., Gomes, T., Mayer, I., & Christensen, T. (2018). Sub-lethal uv radiation during early life stages alters the behaviour, heart rate and oxidative stress parameters in zebrafish (*Danio rerio*). *Ecotoxicology and Environmental Safety*, *166*, 359–365.

Icoglu Aksakal, F., & Ciltas, A. (2018). The impact of ultraviolet b (uv-b) radiation in combination with different temperatures in the early life stage of zebrafish (*Danio rerio*). *Photochemical & Photobiological Sciences*, *17*, 35–41.

Idris, A. R. (2023). Pengaruh paparan sinar ultraviolet terhadap embrio ikan medaka (*Oryzias celebensis*). Universitas Hasanuddin.

Ishigaki, M., Kawasaki, S., Ishikawa, D., & Ozaki, Y. (2016). Near-infrared spectroscopy and imaging studies of fertilized fish eggs: in vivo monitoring of egg growth at the molecular level. *Scientific Reports*, *6*. https://doi.org/10.1038/srep20066

Ismail, A., & Yusof, S. (2011). Effect of mercury and cadmium on early life stages of java medaka (*Oryzias javanicus):* a potential tropical test fish. *Marine Pollution Bulletin*, *63*(5–12), 347–349. https://doi.org/10.1016/j.marpolbul.2011.02.014

Iwamatsu, T. (2004a). Stages of normal development in the medaka *Oryzias latipes.* In *mechanisms of development* (Vol. 121, Issues 7–8, Pp. 605–618). https://doi.org/10.1016/j.mod.2004.03.012

Iwamatsu, T., Muramatsu, T., & Kobayashi, H. (2008). Oil droplets and yolk spheres during development of medaka embryos. *Ichthyological Research*, *55*, 344–348.

Jain-Schlaepfer, S., Fakan, E., Rummer, J. L., Simpson, S. D., & Mccormick, M. I. (2018). Impact of motorboats on fish embryos depends on engine type. *Conservation Physiology*, *6*(1), Coy014.

Kamler, E. (2008). Resource allocation in yolk-feeding fish. *Reviews In Fish Biology and Fisheries*, *18*, 143–200.

Kataba, A., Botha, T. L., Nakayama, S. M. M., Yohannes, Y. B., Ikenaka, Y., Wepener, V., & Ishizuka, M. (2022). Environmentally relevant lead (Pb) water concentration induce toxicity in zebrafish (*Danio rerio*) larvae. *Comparative Biochemistry and Physiology Part C: Toxicology & Pharmacology*, *252*, 109215.

Kawaguchi, M., Okazawa, Y., Imafuku, A., Nakano, Y., Shimizu, R., Ishizuka, R., Jiang, T., Nagasawa, T., Hiroi, J., & Yasumasu, S. (2021). Pactacin is a novel digestive enzyme in teleosts. *Scientific Reports*, *11*(1). https://doi.org/10.1038/s41598-021-86565-9

Kemmler, C. L., Riemslagh, F. W., Moran, H. R., & Mosimann, C. (2021). From stripes to a beating heart: early cardiac development in zebrafish. *Journal of Cardiovascular Development and Disease*, *8*(2), 17.

Kimmel, C. B., Ballard, W. W., Kimmel, S. R., Ullmann, B., & Schilling, T. F. (1995). Stages of embryonic development of the zebrafish. *Developmental Dynamics*, *203*(3), 253–310. https://doi.org/10.1002/aja.1002030302

Kinoshita, M., Murata, K., Naruse, K., & Tanaka, M. (2009). *Medaka: biology, management, and experimental protocols*. https://doi.org/10.1002/9780813818849.

Leaf, R. T., Jiao, Y., Murphy, B. R., Kramer, J. I., Sorensen, K. M., & Wooten, V. G. (2011). Life-history characteristics of japanese medaka *Oryzias latipes*. *Copeia*, *4*, 559–565. https://doi.org/10.1643/ci-09-190

Lee, C., Kwon, B.-O., Hong, S., Noh, J., Lee, J., Ryu, J., Kang, S.-G., & Khim, J. S. (2018). Sub-lethal and lethal toxicities of elevated co2 on embryonic, juvenile, and adult stages of marine medaka *Oryzias melastigma*. *Environmental Pollution*, *241*, 586–595.

Liao, P.-H., Hwang, C.-C., Chen, T.-H., & Chen, P.-J. (2015). Developmental exposures to waterborne abused drugs alter physiological function and larval locomotion in early life stages of medaka fish. *Aquatic Toxicology*, *165*, 84–92.

Liu, K., Song, J., Chi, W., Liu, H., Ge, S., & Yu, D. (2021). Developmental toxicity in marine medaka (*Oryzias melastigma*) embryos and larvae exposed to nickel. *Comparative Biochemistry and Physiology Part - C: Toxicology and Pharmacology*, *248*. https://doi.org/10.1016/j.cbpc.2021.109082

Liu, K., Yu, D., Xin, M., Lü, F., Zhang, Z., Zhou, J., Liu, T., Liu, X., Song, J., & Wu, H. (2023). Exposure to manganese (ii) chloride induces developmental toxicity, oxidative stress and inflammatory response in marine medaka (*Oryzias melastigma*) embryos. *Aquatic Toxicology*, *261*, 106622.

Manantung, V. O., Sinjal, H. J., & Monijung, R. D. (2013). Evaluasi kualitas, kuantitas telur dan larva ikan patin siam (*Pangasianodon hiphopthalmus*) dengan penambahan ovaprim dosis berbeda. *E-Journal BUDIDAYA PERAIRAN*, *1*(3).

Merino, M., Mullor, J. L., & Sánchez-Sánchez, A. V. (2020). Medaka (*Oryzias latipes*) embryo as a model for the screening of compounds that counteract the damage induced by ultraviolet and high-energy visible light. *International Journal ff Molecular Sciences*, *21*(16), 1–12. https://doi.org/10.3390/ijms21165769

Miller, B. S. (2009). Early life history of marine fishes (Vol. 364). *University Of California Press.*

Mulyani Sri Agnes. (2021). *Pemanasan global, penyebab, dampak dan antisipasinya*.

Nafiyanti, N., Mustahal, M., Syamsunarno, M. B., & Herjayanto, M. (2021). Incubation of *Oryzias woworae* eggs at different temperature on embryo development and hatching performance. *Jurnal Biologi Tropis*, *21*(2), 315–323.

Padilla, S., Cowden, J., Hinton, D. E., Yuen, B., Law, S., Kullman, S. W., Johnson, R., Hardman, R. C., Flynn, K., & Au, D. W. T. (2009). Use of medaka in toxicity testing. In *Current Protocols in Toxicology* (Issue SUPPL. 39). https://doi.org/10.1002/0471140856.tx0110s39

Pandiselvam, R., Sunoj, S., Manikantan, M. R., Kothakota, A., & Hebbar, K. B. (2017). Application and kinetics of ozone in food preservation. In *ozone: Science and Engineering* (Vol. 39, Issue 2, Pp. 115–126). Taylor And Francis Inc. https://doi.org/10.1080/01919512.2016.1268947

Piatkowska, A. M., Evans, S. E., & Stern, C. D. (2021). Cellular aspects of somite formation in vertebrates. In *Cells and Development* (Vol. 168). Elsevier B.V. https://doi.org/10.1016/j.cdev.2021.203732

Sayed, A. E. D. H., & Mitani, H. (2016). The notochord curvature in medaka (*Oryzias latipes*) embryos as a response to ultraviolet a irradiation. *Journal of*

Photochemistry and Photobiology B: Biology, *164*, 132–140. https://doi.org/10.1016/j.jphotobiol.2016.09.023

Sayed, A. E. D. H., Soliman, H. A. M., & Mitani, H. (2019). Uva-induced neurotoxicity in japanese medaka (*Oryzias latipes*). *Photochemical And Photobiological Sciences*, *18*(1), 71–79. https://doi.org/10.1039/c8pp00169c

Schwartz, A. V., Sant, K. E., Navarrete, J., & George, U. Z. (2021). Mathematical modeling of the interaction between yolk utilization and fish growth in zebrafish, *Danio rerio*. *Development (Cambridge)*, *148*(9). https://doi.org/10.1242/dev.193508

Sejati, A. W. (2019). Pengaruh perubahan tutupan lahan terhadap emisi grk pada wilayah cepat tumbuh di kota semarang. https://www.researchgate.net/publication/332233851

Sulistiawan, S. N., & Rukoyah. (2014). Pengaruh pemberian lama waktu kejutan suhu terhadap tingkat keberhasilan ginogenesis ikan koi (*Cyprinus carpio*). *Journal Of Chemical Information and Modeling*, *7*, 42–50.

Van Leeuwen, T. E., Killen, S. S., Metcalfe, N. B., & Adams, C. E. (2017). Differences in early developmental rate and yolk conversion efficiency in offspring of trout with alternative life histories. *Ecology Of Freshwater Fish*, *26*(3), 371–382. https://doi.org/10.1111/eff.12281

Vásquez, P., Llanos-Rivera, A., Castro, L. R., & Fernandez, C. (2016). Uv radiation effects on the embryos of anchoveta (engraulis ringens) and common sardine (*Strangomera bentincki*) off central chile. *Marine And Freshwater Research*, *67*(2), 195–209. https://doi.org/10.1071/mf14038

Wahyuni, H., & Suranto, S. (2021). Dampak deforestasi hutan skala besar terhadap pemanasan global di Indonesia. *JIIP: Jurnal Ilmiah Ilmu Pemerintahan*, *6*(1), 148–162. https://doi.org/10.14710/jiip.v6i1.10083

Wang, R. F., Zhu, L. M., Zhang, J., An, X. P., Yang, Y. P., Song, M., & Zhang, L. (2020). Developmental toxicity of copper in marine medaka (*Oryzias melastigma*) embryos and larvae. *Chemosphere*, *247*. https://doi.org/10.1016/j.chemosphere.2020.125923

Yam, J. C. S., & Kwok, A. K. H. (2014). Ultraviolet light and ocular diseases. In *international ophthalmology (Vol. 34, Issue 2, Pp. 383–400). Kluwer Academic Publishers.* https://doi.org/10.1007/s10792-013-9791-x

Yamagami, K. (1981). Mechanisms of hatching in fish: secretion of hatching enzyme and enzymatic choriolysis. *American Zoologist*, *21*(2), 459–471.

Yaqin, K. (2021). Mengenal dengan cepat embriogenesis ikan binisi*, Oryzias celebensis* untuk studi ekotoksikologi*. (1st Ed.). Deepublish.*

Yaqin, K., Lalombo, Y. I., Omar, S. Bin A., Rahim, S. W., & Sari, D. K. (2022). Survival rates of *Oryzias celebensis* embryo reared in different media in an attempt to provide embryos for ecotoxicological studies. *International Journal on Advanced Science, Engineering and Information Technology*, *12*(5), 2008–2014. https://doi.org/10.18517/ijaseit.12.5.16297

Yaqin, K., & Rahim, S. W. (2021). Dry transportation of oryzias wolasi embryo for ecotoxicological studies. *IOP Conference Series: Earth and Environmental Science*, *860*(1), 012102.

Yudasmara, G. (2014). Biologi perikanan.

Zhang, F., Han, L., Wang, J., Shu, M., Liu, K., Zhang, Y., Hsiao, C., Tian, Q., & He, Q. (2021). Clozapine induced developmental and cardiac toxicity on zebrafish embryos by elevating oxidative stress. *Cardiovascular Toxicology*, *21*, 399–409.

Zhang, Y., Song, X., Yu, Z., Zhang, P., Cao, X., & Yuan, Y. (2019). Impact assessment of modified clay on embryo-larval stages of turbot scophthalmus maximus l. *Journal of Oceanology And Limnology*, *37*(3), 1051–1061. https://doi.org/10.1007/s00343-019-8043-y

Lampiran 1. Data kelangsungan hidup embrio *Oryzias celebensis*

Embrio	Hidup	Mati
A1	1	
A2	1	
A3	1	
A4	1	
A5	1	
A6	1	
A7	1	
A8	1	
A9	1	
A10	1	

Embrio	Hidup	Mati
B1	1	
B2	1	
B3	1	
B4	1	
B5	1	
B6	1	
B7	1	
B8	1	
B9	1	
B10	1	

Embrio	Hidup	Mati
C1	1	
C2	1	
C3	1	
C4	1	
C5	1	
C6	1	
C7	1	
C8	1	
C9	1	
C10	1	

Embrio	Hidup	Mati
D1	1	
D2	1	
D3	1	
D4	1	
D5	1	
D6	1	
D7	1	
D8	1	
D9	1	
D10	1	

Perlakuan	Kelangsungan hidup(%)
A (15 menit)	100%
B (30 menit)	100%
C (60 menit)	100%
D (Kontrol)	100%

Lampiran 2. Hasil dan data statistik pengukuran volume kuning telur embrio Oryzias celebensis

Fase	15 min	30 min	60 min	kontrol
17	0,89	0,74	0,77	0,82
18	0,8	0,69	0,74	0,82
19	0,71	0,63	0,7	0,8
20	0,76	0,57	0,88	0,75
21	0,79	0,59	0,62	0,81
22	0,77	0,54	0,61	0,75
23	0,65	0,54	0,58	0,62
24	0,56	0,41	0,45	0,65
25	0,56	0,38	0,43	0,55
26	0,51	0,36	0,39	0,56
27	0,54	0,32	0,41	0,55
28	0,48	0,31	0,3	0,59
29	0,47	0,28	0,27	0,41
30	0,39	0,24	0,26	0,33
31	0,34	0,27	0,18	0,24
32	0,26	0,19	0,18	0,22
33	0,2	0,17	0,14	0,2
34	0,16	0,13	0,11	0,14
35	0,12	0,12	0,1	0,11
36	0,07	0,02	0,03	0,13
37	0,07	0,02	0,01	0,05

Table Analyzed	Volume kuning Telur
Kruskal-Wallis test	
P value	0.2867
Exact or approximate P value?	Approximate
P value summary	ns
Do the medians vary signif. (P < 0.05)?	No
Number of groups	4
Kruskal-Wallis statistic	3.776

Dunn's multiple comparisons test	Mean rank diff.	Significant?
15 min vs. 30 min	11.17	No
15 min vs. 60 min	8.405	No
15 min vs. Kontrol	-0.7143	No
30 min vs. 60 min	-2.762	No
30 min vs. Kontrol	-11.88	No
60 min vs. Kontrol	-9.119	No

Lampiran 3. Hasil dan data statistik pengukuran laju penyerapan kuning telur embrio Oryzias celebensis

Embrio	Kontrol	15 min	30 min	60 min
E1	0,0033	0,0029	0,0032	0,0033
E2	0,0035	0,0033	0,0035	0,0034
E3	0,0032	0,0040	0,0038	0,0033
E4	0,0034	0,0034	0,0041	0,0034
E5	0,0036	0,0043	0,0037	0,0033
E6	0,0041	0,0035	0,0035	0,0033
E7	0,0039	0,0039	0,0035	0,0049
E8	0,0036	0,0034	0,0032	0,0046
E9	0,0039	0,0038	0,0034	0,0031
E10	0,0025	0,0035	0,0038	0,0037

Kruskal-Wallis test	
P value	0.8538
Exact or approximate P value?	Approximate
P value summary	ns
Do the medians vary signif. (P < 0.05)?	No
Number of groups	4
Kruskal-Wallis statistic	0.7819

Dunn's multiple comparisons test	Mean rank diff.	Significant?
Kontrol vs. 15 min	-1.550	No
Kontrol vs. 30 min	-0.8000	No
Kontrol vs. 60 min	2.750	No

Lampiran 4. Data dan hasil uji analisis statistik jumlah somit embrio *Oryzias celebensis*

No.	Embrio	Fase 19	Fase 20	Fase 21
1	A1	4	8	9
2	A2	4	8	8
3	A3	5	5	8
4	A4	5	5	8
5	A5	4	8	8
6	A6	4	6	9
7	A7	4	6	8
8	A8	5	5	8
9	A9	5	6	8
10	A10	5	5	8
11	B1	5	7	9
12	B2	6	7	9
13	B3	6	7	9
14	B4	6	7	9
15	B5	5	6	9
16	B6	5	7	9
17	B7	6	6	9
18	B8	6	6	9
19	B9	4	8	9
20	B10	5	7	9

No.	Embrio	Fase 19	Fase 20	Fase 21
21	C1	4	6	8
22	C2	4	6	8
23	C3	5	6	8
24	C4	5	8	9
25	C5	5	6	9
26	C6	5	8	9
27	C7	5	6	8
28	C8	6	8	9
29	C9	6	6	9
30	C10	5	6	9
31	D1	5	6	8
32	D2	5	7	8
33	D3	4	7	8
34	D4	5	6	8
35	D5	4	5	8
36	D6	5	5	8
37	D7	4	6	8
38	D8	5	6	8
39	D9	5	6	8
40	D10	3	6	8

Kruskal-Wallis test	
P value	
Exact or approximate P value?	
P value summary	
Do the medians vary signif. (P < 0.05)?	
Number of groups	
Kruskal-Wallis statistic	
Data summary	
Number of treatments (columns)	
Number of values (total)	

Dunn's multiple comparisons test	Mean rank diff.	Significant?
kontrol vs. 15 min	-0.6667	No
kontrol vs. 30 min	-1.833	No
kontrol vs. 60 min	-2.833	No
15 min vs. 30 min	-1.167	No
15 min vs. 60 min	-2.167	No
30 min vs. 60 min	-1.000	No

Lampiran 5. Hasil uji analisis statistik detak jantung embrio *Oryzias celebensis*

Stadia 24

Kruskal-Wallis test	
P value	0.0008
Exact or approximate P value?	Approximate
P value summary	***
Do the medians vary signif. (P < 0.05)?	Yes
Number of groups	4
Kruskal-Wallis statistic	16.78

Dunn's multiple comparisons test	Mean rank diff.	Significant?
kontrol vs. 15 min	-7.650	No
kontrol vs. 30 min	-9.700	No
kontrol vs. 60 min	9.550	No

Stadia 25

Kruskal-Wallis test	
P value	0.1357
Exact or approximate P value?	Approximate
P value summary	ns
Do the medians vary signif. (P < 0.05)?	No
Number of groups	4
Kruskal-Wallis statistic	5.550

Dunn's multiple comparisons test	Mean rank diff.	Significant?
kontrol vs. 15 min	1.850	No
kontrol vs. 30 min	-8.400	No
kontrol vs. 60 min	2.350	No

Stadia 26

Kruskal-Wallis test	
P value	<0.0001
Exact or approximate P value?	Approximate
P value summary	****
Do the medians vary signif. (P < 0.05)?	Yes
Number of groups	4
Kruskal-Wallis statistic	23.80

Dunn's multiple comparisons test	Mean rank diff.	Significant?
kontrol vs. 15 min	1.750	No
kontrol vs. 30 min	22.05	Yes
kontrol vs. 60 min	13.20	No

Stadia 27

Kruskal-Wallis test	
P value	<0.0001
Exact or approximate P value?	Approximate
P value summary	****
Do the medians vary signif. (P < 0.05)?	Yes
Number of groups	4
Kruskal-Wallis statistic	30.88

Dunn's multiple comparisons test	Mean rank diff.	Significant?
kontrol vs. 15 min	-2.550	No
kontrol vs. 30 min	21.85	Yes
kontrol vs. 60 min	15.30	Yes

Stadia 28

Kruskal-Wallis test	
P value	0.2217
Exact or approximate P value?	Approximate
P value summary	ns
Do the medians vary signif. (P < 0.05)?	No
Number of groups	4
Kruskal-Wallis statistic	4.397

Dunn's multiple comparisons test	Mean rank diff.	Significant?
kontrol vs. 15 min	-8.200	No
kontrol vs. 30 min	-9.750	No
kontrol vs. 60 min	-4.250	No

Stadia 29

Kruskal-Wallis test	
P value	<0.0001
Exact or approximate P value?	Approximate
P value summary	****
Do the medians vary signif. (P < 0.05)?	Yes
Number of groups	4
Kruskal-Wallis statistic	26.35

Dunn's multiple comparisons test	Mean rank diff.	Significant?
kontrol vs. 15 min	25.65	Yes
kontrol vs. 30 min	19.10	Yes
kontrol vs. 60 min	15.25	Yes

Stadia 30

Kruskal-Wallis test	
P value	<0.0001
Exact or approximate P value?	Approximate
P value summary	****
Do the medians vary signif. (P < 0.05)?	Yes
Number of groups	4
Kruskal-Wallis statistic	32.78

Dunn's multiple comparisons test	Mean rank diff.	Significant?
kontrol vs. 15 min	-17.10	Yes
kontrol vs. 30 min	-8.600	No
kontrol vs. 60 min	11.30	No

Stadia 31

Kruskal-Wallis test	
P value	0.0001
Exact or approximate P value?	Approximate
P value summary	***
Do the medians vary signif. (P < 0.05)?	Yes
Number of groups	4
Kruskal-Wallis statistic	20.75

Dunn's multiple comparisons test	Mean rank diff.	Significant?
kontrol vs. 15 min	4.550	No
kontrol vs. 30 min	7.600	No
kontrol vs. 60 min	-14.15	Yes

Stadia 32

Kruskal-Wallis test	
P value	0.0031
Exact or approximate P value?	Approximate
P value summary	**
Do the medians vary signif. (P < 0.05)?	Yes
Number of groups	4
Kruskal-Wallis statistic	13.83

Dunn's multiple comparisons test	Mean rank diff.	Significant?
kontrol vs. 15 min	7.650	No
kontrol vs. 30 min	7.700	No
kontrol vs. 60 min	19.05	Yes

Stadia 33

Kruskal-Wallis test	
P value	<0.0001
Exact or approximate P value?	Approximate
P value summary	****
Do the medians vary signif. (P < 0.05)?	Yes
Number of groups	4
Kruskal-Wallis statistic	29.70

Dunn's multiple comparisons test	Mean rank diff.	Significant?
kontrol vs. 15 min	-24.45	Yes
kontrol vs. 30 min	-17.10	Yes
kontrol vs. 60 min	-3.650	No

Stadia 34

Kruskal-Wallis test	
P value	0.0001
Exact or approximate P value?	Approximate
P value summary	***
Do the medians vary signif. (P < 0.05)?	Yes
Number of groups	4
Kruskal-Wallis statistic	20.76

Dunn's multiple comparisons test	Mean rank diff.	Significant?
kontrol vs. 15 min	-9.900	No
kontrol vs. 30 min	13.40	No
kontrol vs. 60 min	3.900	No

Stadia 35

Kruskal-Wallis test	
P value	0.3895
Exact or approximate P value?	Approximate
P value summary	ns
Do the medians vary signif. (P < 0.05)?	No
Number of groups	4
Kruskal-Wallis statistic	3.014

Dunn's multiple comparisons test	Mean rank diff.	Significant?
kontrol vs. 15 min	-5.544	No
kontrol vs. 30 min	-8.250	No
kontrol vs. 60 min	-2.750	No

Stadia 36

Kruskal-Wallis test	
P value	0.0005
Exact or approximate P value?	Approximate
P value summary	***
Do the medians vary signif. (P < 0.05)?	Yes
Number of groups	4
Kruskal-Wallis statistic	17.72

Dunn's multiple comparisons test	Mean rank diff.	Significant?
kontrol vs. 15 min	-5.600	No
kontrol vs. 30 min	7.833	No
kontrol vs. 60 min	10.10	Yes

Stadia 37

Kruskal-Wallis test	
P value	0.2909
Exact or approximate P value?	Exact
P value summary	ns
Do the medians vary signif. (P < 0.05)?	No
Number of groups	4
Kruskal-Wallis statistic	3.839

Dunn's multiple comparisons test	Mean rank diff.	Significant?
kontrol vs. 15 min	-3.167	No
kontrol vs. 30 min	1.333	No
kontrol vs. 60 min	5.833	No

Lampiran 6. Hasil perhitungan gerakan rahang embrio *Oryzias celebensis*

kontrol	15 min	30 min	60 min
20	31	36	45
18	22	42	40
31	38	35	39
22	48	48	35
21	47	30	32
8	25	26	36
42		38	29
61		37	40
54		22	39
56		42	

Kruskal-Wallis test	
P value	0.8393
Exact or approximate P value?	Approximate
P value summary	ns
Do the medians vary signif. (P < 0.05)?	No
Number of groups	4
Kruskal-Wallis statistic	0.8424

Dunn's multiple comparisons test	Mean rank diff.	Significant?
kontrol vs. 15 min	-2.333	No
kontrol vs. 30 min	-2.650	No
kontrol vs. 60 min	-4.250	No

Lampiran 7. Hasil analisis waktu penetasan embrio *Oryzias celebensis*

Kontrol	15 min	30 min	60 min
8	9	9	8
9	9	7	8
9	8	7	8
9	9	7	8
9	8	7	8
9	9	8	8
9	8	7	8
9	8	7	8
9	9	8	8
11	9	7	7

Kruskal-Wallis test	
P value	<0.0001
Exact or approximate P value?	Approximate
P value summary	****
Do the medians vary signif. (P < 0.05)?	Yes
Number of groups	4
Kruskal-Wallis statistic	24.10

Dunn's multiple comparisons test	Mean rank diff.	Significant?
Kontrol vs. 15 min	5.450	No
Kontrol vs. 30 min	21.60	Yes
Kontrol vs. 60 min	15.95	Yes

Lampiran 8. Hasil analisis panjang larva awal menetas embrio *Oryzias celebensis*

Kontrol	15 min	30 min	60 min
5.01	4.82	5.07	4.96
5.03	4.79	5.02	4.86
4.92	4.78	5.04	4.77
5.19	4.66	4.95	4.63
4.94	5	4.84	4.55
4.95	4.82	4.94	4.63
5	4.97	5.17	4.9
4.83	5.01	4.91	4.8
4.92	4.95	5.08	4.63
5.35	4.97	4.91	4.98

Kruskal-Wallis test	
P value	0.0040
Exact or approximate P value?	Approximate
P value summary	**
Do the medians vary signif. (P < 0.05)?	Yes
Number of groups	4
Kruskal-Wallis statistic	13.30

Dunn's multiple comparisons test	Mean rank diff.	Significant?
Kontrol vs. 15 min	8.850	No
Kontrol vs. 30 min	-0.2000	No
Kontrol vs. 60 min	15.95	Yes

Lampiran 9. Dokumentasi penelitian