

**PENGARUH KARBONAT HIDROKSIAPATIT (CHA) BAHAN IMPLAN
GIGI TERHADAP PERKEMBANGAN EMBRIO ZEBRAFISH (*Danio rerio*
(Hamilton, 1822))**

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ABSTRAK

Karbonat hidroksiapatit (CHA) merupakan salah satu material yang banyak dijadikan sebagai bahan implan gigi. Penggunaan CHA sebagai bahan implan gigi harus memiliki sifat non-toksik terhadap jaringan. Pada penelitian ini, pengujian toksisitas bahan terhadap jaringan dilakukan secara *in vivo* dengan menggunakan hewan model. Penelitian ini bertujuan untuk melihat pengaruh CHA sebagai bahan implan gigi terhadap perkembangan embrio zebrafish (*Danio rerio*). Pemberian perlakuan CHA terhadap embrio zebrafish (*Danio rerio*) dilakukan pada embrio umur 3-3,5 jam setelah fertilisasi (*hpf*) hingga embrio umur 72 *hpf*. Penilaian toksisitas dilakukan dengan melihat sintasan, persentase penetasan, perubahan morfologi embrio dan larva, perkembangan jantung, struktur kartilago kranium, dan aktivitas renang. Sintasan dan persentase penetasan ditentukan melalui jumlah embrio yang hidup dan menetas pada umur 24, 48 dan 72 *hpf*. Perubahan morfologi embrio dan larva diamati dengan melihat beberapa kelainan yang mungkin terjadi selama perkembangan, diantaranya malformasi kepala, edema, malformasi ekor, malformasi yolk, dan akumulasi darah. Perkembangan jantung diamati dengan mengamati morfologi jantung pada larva umur 72 *hpf*, detak jantung diamati pada embrio umur 24, 48, dan 72 *hpf*, dan struktur histologi jantung diamati pada larva umur 30 *dpf*. Pewarnaan ARAB dilakukan untuk mengamati struktur kartilago kranium pada larva umur 6 *dpf*. Beberapa parameter pengamatan diantaranya pengikatan warna, kelengkapan, kecacatan, panjang, dan sudut kartilago penyusun kranium, juga diamati. Pengamatan aktivitas renang dilakukan pada larva umur 30 *dpf* dengan mengamati frekuensi dan pola renang. Data dianalisis secara kualitatif dan kuantitatif. Analisis statistik dilakukan dengan menggunakan aplikasi SPSS 21. ANOVA satu arah digunakan untuk menilai signifikansi pengaruh perlakuan terhadap hasil. Hasil penelitian ini menunjukkan bahwa pemaparan CHA tidak berpengaruh terhadap penurunan sintasan dan persentase penetasan embrio zebrafish (*Danio rerio*). Pengamatan morfologi menunjukkan tidak terdapat malformasi pada embrio dan larva. Hasil pengamatan morfologi, histologi, dan detak jantung menunjukkan jantung berkembang secara normal. Tidak terdapat kecacatan pada kartilago kranium, struktur penyusunnya lengkap, dan tidak terdapat perbedaan panjang dan sudut kartilago kranium antara perlakuan kontrol dan perlakuan CHA. Pengamatan aktivitas renang menunjukkan bahwa ikan mampu berenang secara normal. Hasil penelitian ini menunjukkan bahwa pemaparan CHA tidak berpengaruh terhadap perkembangan embrio zebrafish (*Danio rerio*).

Kata Kunci: CHA, Embrio, Jantung, Kranium, Toksisitas, Zebrafish

THE EFFECT OF DENTAL IMPLANT CARBONAT HIDROXYAPATITE (CHA) ON ZEBRAFISH (*Danio rerio* (Hamilton, 1822)) EMBRYONIC DEVELOPMENT

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ABSTRACT

Carbonate hydroxyapatite (CHA) is one of the most widely used materials for dental implants. The use of CHA as a dental implant material must have non-toxic properties to tissues. In this study, the tissue toxicity test was carried out *in vivo* using animal models. This study aimed to examine the effect of CHA as a dental implant material on the development of zebrafish (*Danio rerio*) embryos. CHA treatment was given to zebrafish (*Danio rerio*) embryos on embryos aged 3-3.5 hours post-fertilization (hpf) to 72 hpf embryos. Toxicity assessment was carried out by studying the survival rate, hatching rate, changes in embryo and larva morphology, heart development, cranial cartilage structure, and swimming activity. Survival rates and hatching rates were determined by the number of surviving and hatched embryos at 24, 48 and 72 hpf. Morphological changes of embryos and larvae were studied by observing several abnormalities that may occur during development, including head malformations, edema, tail malformations, yolk malformations, and blood accumulation. Heart development was studied by observing heart morphology in larvae aged 72 hpf, heart rate was observed in embryos aged 24, 48, and 72 hpf, and cardiac histology structure was observed in larvae aged 30 dpf. ARAB staining was performed to observe the structure of the cranium cartilage in larvae aged 6 dpf. Several observation parameters, including binding color, completeness, defects, length, and angle of the cartilage that make up the cranium, were also observed. Observations of swimming activity were carried out on larvae aged 30 dpf by observing the frequency and pattern of swimming. Data were analyzed qualitatively and quantitatively. Statistical analysis was performed using the SPSS 21 application. One-way ANOVA was used to assess the significance of the effect of treatment on the results. The results of this study showed that CHA exposure did not affect the decrease in survival and hatching percentage of zebrafish (*Danio rerio*) embryos. Morphological observations showed no malformations in the embryo and larvae. The results of observations of morphology, histology, and heart rate showed that the heart was developing normally. There were no defects in the cranial cartilage, the structure was complete, and there was no difference in the length and angle of the cranial cartilage between the control and CHA treatments. Observations of swimming activity showed that the fish were able to swim normally. The results of this study showed that CHA exposure did not affect the development of zebrafish (*Danio rerio*) embryos.

Keywords: CHA, Cranium, Embryo, Heart, Toxicity, Zebrafish,