

## DAFTAR PUSTAKA

1. Simon S, Tomson PL, Duncan HF. Management of deep caries and the exposed pulp. 2019;353(0):949–73.
2. Rosa WLO, Cocco AR, Silva TM, Mesquita LC, Silva AF, Piva E. Review Article Current trends and future perspectives of dental pulp capping materials : A systematic review. 2017;1358–68.
3. Tomson PL, Duncan HF. Pulp Capping Materials for the Maintenance of Pulp Vitality. 2021;15–45.
4. Cushley S, Duncan HF. Efficacy of direct pulp capping for management of cariously exposed pulps in permanent teeth : a systematic review and meta-analysis. 2021;556–71.
5. Alex G. Direct and Indirect Pulp Capping: A Brief History, Material Innovations, and Clinical Case Report. 2018;(March).
6. Yaemkleebua K. Analysis of hard tissue regeneration and Wnt signalling in dental pulp tissues after direct pulp capping with different materials. 2019;1605–16.
7. Kashyap N. A Review of Direct Pulp Capping: New Treatment Approaches and Modalities. 2020;(January).
8. Zaen AM, Din E, Hamama HH, Abo MA, Elaa E, Grawish ME, et al. The effect of four materials on direct pulp capping : An animal study. 2020;(3):249–56.
9. Yamamoto S, Han L, Noiri Y, Okiji T, Sciences D, Dental Y, et al. Evaluation of the Ca ion release, pH and surface apatite formation of a prototype tricalcium silicate cement. 2016;
10. Hanada K, Morotomi T, Washio A, Yada N, Matsuo K, Teshima H, et al. In vitro and in vivo effects of a novel bioactive glass-based cement used as a direct pulp capping agent. 2018;161–8.

11. Nurdin D, Primathena I, Alma R, Adang F, Cahyanto A. Comparison of Chemical Composition between Indonesian White Portland Cement and MTA as Dental Pulp Capping Material. 2020;829:34–9.
12. Primathena I, Nurdin D, Hermawan H, Cahyanto A. Synthesis, Characterization, and Antibacterial Evaluation of a Cost-Effective Endodontic Sealer Based on Tricalcium Silicate-White Portland Cement. *Materials (Basel)*. 2021;
13. Djustiana N, Padjadjaran U, Padjadjaran U, Padjadjaran U. *Journal of International Dental and Medical Research* ISSN 1309-100X <http://www.jidmr.com> Electrospun PMMA-Silica Nanofiber Nina Djustiana and et al. :975–8.
14. Shahhosseinia M, Bazgir S. *Materials Science & Engineering C* Fabrication and investigation of silica nano fibers via electrospinning. 2018;91(September 2017):502–11.
15. Catauro M, Barrino F, Dal Poggetto G, Milazzo M, Blanco I, Vecchio Cipriotti S. Structure, drug absorption, bioactive and antibacterial properties of sol-gel SiO<sub>2</sub>/ZrO<sub>2</sub> materials. *Ceram Int*. 2020;46(18):29459–65.
16. Sloan AJ. *Biology of the Dentin-Pulp Complex* [Internet]. *Stem Cell Biology and Tissue Engineering in Dental Sciences*. Elsevier Inc.; 2015. 371–378 p. Available from: <http://dx.doi.org/10.1016/B978-0-12-397157-9.00033-3>
17. Rotstein I, Ingle J. *Ingles Endodontics 7*. 7th ed. Vol. 45, *Journal of Endodontics*. North Carolina: PMPH USA; 2020. 1015–1016 p.
18. Berman LH, Hargreaves KM. *Cohen's Pathways of the Pulp*. 12th ed. *Cohen's Pathways of the Pulp*. Canada: Elsevier Health Sciences; 2021.
19. Torabinejad M, Fouad AF, Shabahang S. *Endodontics Principles and Practice*. 6th ed. London: Elsevier; 2021. 63 p.
20. Machla F, Angelopoulos I, Epple M, Chatzinikolaidou M, Bakopoulou A. *Biomolecule-Mediated Therapeutics of the Dentin – Pulp Complex*: A

- Systematic Review. 2022;1–18.
21. Iaculli F, Javier F, Wolf TG, Spagnuolo G, Rengo S. Vital Pulp Therapy of Permanent Teeth with Reversible or Irreversible Pulpitis : An Overview of the Literature. 2022;
  22. Duncan HF. Present status and future directions—Vital pulp treatment and pulp preservation strategies. *Int Endod J* [Internet]. 2022 May 1;55(S3):497–511. Available from: <https://doi.org/10.1111/iej.13688>
  23. Outcomes T. Vital Pulp Therapy in Permanent Mature Posterior Teeth with Symptomatic Irreversible Pulpitis : A Systematic Review of Treatment Outcomes. 2021;1–14.
  24. Document AT. AAE Position Statement on Vital Pulp Therapy. 2021;
  25. Philip N, Suneja B. Minimally invasive endodontics : a new era for pulpotomy in mature permanent teeth. 2022;233(12):1035–41.
  26. Vieira CC, Pappen FG, Kirschnick LB, Cademartori MG, Nóbrega KHS, do Couto AM, et al. A Retrospective Brazilian Multicenter Study of Biopsies at the Periapical Area: Identification of Cases of Nonendodontic Periapical Lesions. *J Endod*. 2020;46(4):490–5.
  27. Ahuja DR, Gupta DS, Nikhil DV. Bioceramics in Vital Pulp Therapy. *Int J Res Rev*. 2022;9(5):141–5.
  28. Das S. Pulp Capping Agents: An Evolutionary Review. *Int J Dent Sci Innov Res* [Internet]. 2020;3(6):240–51. Available from: [www.ijdsir.com](http://www.ijdsir.com)
  29. Noor A, Afzal J, Mahmood A, Hyder M, Sajid M, Jamil M. Effectiveness of mineral trioxide aggregate (MTA) as direct pulp capping agent in mandibular molars. *Pakistan J Med Heal Sci*. 2021;15(1):120–2.
  30. Gasperi TL, da Silveira J de AC, Schmidt TF, Teixeira C da S, Garcia L da FR, Bortoluzzi EA. Physical-mechanical properties of a resin-modified calcium silicate material for pulp capping. *Braz Dent J*. 2020;31(3):252–6.
  31. Widyastuti NH, Nurwita AR. A Review on Dental Material with Regard to

- Biocompatibility Properties. *J Med Chem Sci*. 2022;5(5):695–702.
32. Peskersoy C, Lukarcanin J, Turkun M. Efficacy of different calcium silicate materials as pulp-capping agents: Randomized clinical trial. *J Dent Sci* [Internet]. 2021;16(2):723–31. Available from: <https://doi.org/10.1016/j.jds.2020.08.016>
  33. Kunert M, Lukomska-Szymanska M. Bio-Inductive Materials in Direct and Indirect Pulp Capping - A Review Article. *Materials (Basel)*. 2020;13(5).
  34. Pedano MS, Li X, Yoshihara K, Van Landuyt K, Van Meerbeek B. Cytotoxicity and bioactivity of dental pulp-capping agents towards human tooth-pulp cells: A systematic review of in-vitro studies and meta-analysis of randomized and controlled clinical trials. *Materials (Basel)*. 2020;13(12):1–42.
  35. Franzin NRS, Sostena MMDS, Dos Santos AD, Moura MR, de Camargo ER, Hosida TY, et al. Novel pulp capping material based on sodium trimetaphosphate: synthesis, characterization, and antimicrobial properties. *J Appl Oral Sci*. 2022;30:1–8.
  36. Ashi T, Mancino D, Hardan L, Bourgi R, Zghal J, Macaluso V, et al. Physicochemical and Antibacterial Properties of Bioactive Retrograde Filling Materials. *Bioengineering*. 2022;9(11).
  37. Al-Sherbiny IM, Farid MH, Abu-Seida AM, Motawea IT, Bastawy HA. Chemico-physical and mechanical evaluation of three calcium silicate-based pulp capping materials. *Saudi Dent J* [Internet]. 2021;33(4):207–14. Available from: <https://doi.org/10.1016/j.sdentj.2020.02.001>
  38. Ranjbar Omrani L, Moradi Z, Abbasi M, Kharazifard MJ, Tabatabaei SN. Evaluation of Compressive Strength of Several Pulp Capping Materials. *J Dent (Shiraz, Iran)* [Internet]. 2021;22(1):41–7. Available from: <http://www.ncbi.nlm.nih.gov/pubmed/33681422> <http://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=PMC7921770>
  39. Docimo R, Carrante VF, Costacurta M. The physical-mechanical properties

- and biocompatibility of Biodentine™: A review. *J Osseointegration*. 2021;13(1):47–50.
40. Motwani N, Ikhar A, Nikhade P, Chandak M, Rathi S, Dugar M, et al. Premixed bioceramics: A novel pulp capping agent. *J Conserv Dent* [Internet]. 2021;24(2):124–9. Available from: <http://europepmc.org/abstract/MED/34759576>
  41. Hanafi MGS, Izham A, Harismanto H, Bahtiar EW. BIODENTINE™: A REVIEW. *Cakradonya Dent J*. 2021;13(1):14–21.
  42. Moussa SA. Mineral Trioxide Aggregate (MTA) vs Calcium Hydroxide in Direct Pulp Capping – Literature Review. *Online J Dent Oral Heal*. 2018;1(2).
  43. Series C, Clinici C, Internazionale C, Vincitore R, Giorgio P, Aggregate T, et al. ScienceDirect Mineral Trioxide Aggregate ( MTA ) direct pulp capping : 10 years clinical results. *G Ital Endod* [Internet]. 2017;31(1):48–57. Available from: <http://dx.doi.org/10.1016/j.gien.2017.04.003>
  44. Silva GF, Guerreiro-Tanomaru JM, da Fonseca TS, Bernardi MIB, Sasso-Cerri E, Tanomaru-Filho M, et al. Zirconium oxide and niobium oxide used as radiopacifiers in a calcium silicate-based material stimulate fibroblast proliferation and collagen formation. *Int Endod J*. 2017;50:e95–108.
  45. Shayegan A, Petein M. The use of beta-tricalcium phosphate , white MTA , white Portland cement and calcium hydroxide for direct pulp capping of primary pig teeth. 2009;413–9.
  46. Ishwarya R, Arangannal P, Amudha S, Vijayakumar M. Portland Cement – An Effective And Cheap Alternative To Mta. 2020;07(2):6502–8.
  47. Gandolfi MG, Siboni F, Prati C. Chemical – physical properties of TheraCal , a novel light-curable MTA-like material for pulp capping. 2012;571–9.
  48. Bakır EP, Yıldırım ZS, Bakır Ş, Ketanî A. Are resin-containing pulp

capping materials as reliable as traditional ones in terms of local and systemic biological effects ? 2021;

49. Guerreiro-Tanomaru JM, Trindade-Junior A, Cesar Costa B, Da Silva GF, Drullis Cifali L, Basso Bernardi MI, et al. Effect of Zirconium Oxide and Zinc Oxide Nanoparticles on Physicochemical Properties and Antibiofilm Activity of a Calcium Silicate-Based Material. *Sci World J.* 2014;2014.
50. Saghiri MA, Morgano SM, Kazerani H, Jiang S, Gutmann JL, Momeni K, et al. Radiodensity of Various Dental Biomaterials for Endodontics: The Role of Particle Size. *J Clin Diagnostic Res.* 2020;14(August 2018).
51. Bumajdad A, Nazeer AA, Sagheer F Al, Nahar S. Controlled Synthesis of ZrO<sub>2</sub> Nanoparticles with Tailored Size , Morphology and Crystal Phases via Organic / Inorganic Hybrid Films. *Sci Rep [Internet].* 2018;(February):1–9. Available from: <http://dx.doi.org/10.1038/s41598-018-22088-0>
52. Li Q, Coleman NJ. Impact of Bi<sub>2</sub>O<sub>3</sub> and ZrO<sub>2</sub> radiopacifiers on the early hydration and C–S–H gel structure of white Portland cement. *J Funct Biomater.* 2019;10(4):1–15.
53. Ding Y, Li B, Wang M, Liu F, He J. Bis-GMA Free Dental Materials Based on UDMA/SR833s Dental Resin System. *Adv Polym Technol.* 2016;35(4):396–401.
54. De Angelis F, Mandatori D, Schiavone V, Melito FP, Valentinuzzi S, Vadini M, et al. Cytotoxic and genotoxic effects of composite resins on cultured human gingival fibroblasts. *Materials (Basel).* 2021;14(18):1–15.
55. Pérez-Mondragón AA, Trejo-Carbajal N, Cuevas-Suárez CE, Donado F, Herrera-González AM. Effect of replacing UDMA by a new tetramethacrylate monomer on the properties of dental resin composite. *J Appl Polym Sci.* 2022;139(31):9–11.
56. Alizadehgharib S, Östberg AK, Dahlstrand Rudin A, Dahlgren U, Christenson K. The effects of the dental methacrylates TEGDMA, Bis-GMA, and UDMA on neutrophils in vitro. *Clin Exp Dent Res.* 2020;6(4):439–47.

57. El-Hamid HKA, Radwan MM. Influence of nano-silica additions on hydration characteristics and cytotoxicity of calcium aluminate as biomaterial. *Heliyon* [Internet]. 2019;5(7):e02135. Available from: <https://doi.org/10.1016/j.heliyon.2019.e02135>
58. Salman AD, Jani GH, Fatalla AA. Comparative study of the effect of incorporating SiO<sub>2</sub> nano-particles on properties of poly methyl methacrylate denture bases. *Biomed Pharmacol J*. 2017;10(3):1525–35.
59. Wu M, Wang T, Zha W, Xiang W, Zheng W. Effects of nano-SiO<sub>2</sub> particles on physio-chemical properties of bioactive tricalcium silicate cements. *J Aust Ceram Soc*. 2020 Aug 12;57.
60. Selvarajan V, Obuobi S, Ee PLR. Silica Nanoparticles—A Versatile Tool for the Treatment of Bacterial Infections. *Front Chem*. 2020;8(July):1–16.
61. Ha SW, Neale Weitzmann M, Beck GR. Bioactive silica nanoparticles promote osteoblast differentiation through stimulation of autophagy and direct association with LC3 and p62. *ACS Nano*. 2014;8(6):5898–910.
62. Zych Ł, Osyczka AM, Łacz A, Różycka A, Niemiec W, Rapacz-Kmita A, et al. How surface properties of silica nanoparticles influence structural, microstructural and biological properties of polymer nanocomposites. *Materials (Basel)*. 2021;14(4):1–17.
63. Gao C, Wei P, Feng P, Xiao T, Shuai C, Peng S. Nano SiO<sub>2</sub> and MgO improve the properties of porous  $\beta$ -TCP scaffolds via advanced manufacturing technology. *Int J Mol Sci*. 2015;16(4):6818–30.
64. Zanjani VA, Tabari K, Sheikh-al-eslamian SM, Abrandabadi AN. Physiochemical Properties of Experimental Nano-hybrid MTA. 2018;11(1):51–6.
65. Corral Nunez C, Altamirano Gaete D, Maureira M, Martin J, Covarrubias C. Nanoparticles of bioactive glass enhance biodentine bioactivity on dental pulp stem cells. *Materials (Basel)*. 2021;14(10):1–12.

66. Rouhani A, Azimi N, Akbari M, Ahmadpour A, Ashrafpour E. Effect of adding nano size silica on setting time and porosity of mineral trioxide aggregate. *Iran Endod J.* 2019;14(3):197–201.
67. Aminudin MR, Amaria A. Sintesis dan Karakterisasi Nanosilika dari Abu Sekam Padi (RHA). *Pros Semin Nas Kim.* 2021;17–33.
68. Mirsasaani SS, Manjili MH, Ghomi F, Mousavi SM, Mousavi N, Mozafari M. Biomedical applications of nanosilica. *Silica Nanoparticles Prep Prop Uses.* 2011 Jan 1;205–24.
69. Tabassum N, Kumar D, Verma D, Bohara RA, Singh MP. Zirconium oxide (  $ZrO_2$  ) nanoparticles from antibacterial activity to cytotoxicity : A next-generation of multifunctional nanoparticles. *Mater Today Commun* [Internet]. 2021;26(February):102156. Available from: <https://doi.org/10.1016/j.mtcomm.2021.102156>
70. Lu Z, Wang W, Zhang J, Bártolo P, Gong H, Li J. Electrospun highly porous poly(L-lactic acid)-dopamine-SiO<sub>2</sub> fibrous membrane for bone regeneration. *Mater Sci Eng C* [Internet]. 2020;117:111359. Available from: <https://www.sciencedirect.com/science/article/pii/S092849312033277X>
71. by: ES of E (ESE) developed, Duncan HF, Galler KM, Tomson PL, Simon S, El-Karim I, et al. European Society of Endodontology position statement: Management of deep caries and the exposed pulp. *Int Endod J* [Internet]. 2019 Jul 1;52(7):923–34. Available from: <https://doi.org/10.1111/iej.13080>
72. Sciences O. Analysis of organic components in resin-modified pulp capping materials : critical considerations. 2017;183–94.
73. Garrocho-rangel A. Outcomes of direct pulp capping in vital primary teeth with cariously and non-cariously exposed pulp : A systematic review. 2020;(March 2019):536–46.
74. Hungaro MA, Guerreiro JM. Tricalcium silicate-based cements : properties and modifications Color stability. 2018;32:111–8.

75. Fan ML, He LB, Li JY. Recent advances in direct pulp capping materials. *Hua Xi Kou Qiang Yi Xue Za Zhi*. 2018;36(6):675–80.
76. Kiranmayi G, Hussainy N, Lavanya A, Swapna S. Clinical performance of mineral trioxide aggregate versus calcium hydroxide as indirect pulp-capping agents in permanent teeth: A systematic review and meta-analysis. *J Int Oral Heal*. 2019;11(5):235–43.
77. Ballal NV, Rao S, Rao N, Urala A, Yoo JS, Husain NAH, et al. Evaluation of two different types of mineral trioxide aggregate cements as direct pulp capping agents in human teeth. *Appl Sci*. 2021;11(21).
78. Dou L, Yan Q, Yang D. Effect of five dental pulp capping agents on cell proliferation, viability, apoptosis and mineralization of human dental pulp cells. *Exp Ther Med*. 2020;(5):2377–83.
79. Orel L, Velea-Barta OA, Nica LM, Boscornea-Puşcu AS, Horhat RM, Talpos-Niculescu RM, et al. Evaluation of the shaping ability of three thermally treated nickel–titanium endodontic instruments on standardized 3d-printed dental replicas using cone-beam computed tomography. *Med*. 2021;57(9).
80. Vilimek VM, Gateva N, Christof BS. Success Rate of Medcem Portland Cement As a Pulp Capping Agent in Pulpotomies of Primary Teeth. *J IMAB - Annu Proceeding (Scientific Pap)*. 2018;24(1):1866–71.
81. Argueta-figueroa L, Jurado CA, Torres-rosas R, Alberto M, Alhotan A, Nurrohman H. Clinical Efficacy of Biomimetic Bioactive Biomaterials for Dental Pulp Capping : A Systematic Review and Meta-Analysis. 2022;
82. Zawadzka-knefel A, Luboja A. Nanomaterials Application in Endodontics. 2021. 1–34 p.
83. Fayyad D. Comparative Evaluation of Bioactive Materials and Their Nano-Counterpart as Pulp Capping Agents i n Dogs ' Teeth. 2018;(January).
84. Fathima JB, Pugazhendhi A, Venis R. \* Corresponding Author Address.

- Microb Pathog [Internet]. 2017; Available from: <http://dx.doi.org/10.1016/j.micpath.2017.06.039>
85. Keiteb AS, Saion E, Zakaria A, Soltani N. Structural and Optical Properties of Zirconia Nanoparticles by Thermal Treatment Synthesis. 2016;2016.
  86. Ochoa-Rodríguez VM, Tanomaru-Filho M, Rodrigues EM, Guerreiro-Tanomaru JM, Spin-Neto R, Faria G. Addition of zirconium oxide to Biodentine increases radiopacity and does not alter its physicochemical and biological properties. *J Appl Oral Sci.* 2019;27:1–10.
  87. Li B, Wang M. COMPOSITES. 2016;35(4):1–6.
  88. Nie E, Yu J, Jiang R, Liu X, Li X, Islam R. Effectiveness of Direct Pulp Capping Bioactive Materials in Dentin Regeneration : A Systematic Review. 2021;
  89. Islam R, Toida Y, Chen F, Tanaka T, Inoue S, Kitamura T, et al. Histological evaluation of a novel phosphorylated pullulan-based pulp capping material: An in vivo study on rat molars. *Int Endod J.* 2021 Oct;54(10):1902–14.
  90. Cobanoglu N, Alptekin T, Kitagawa H, Blatz MB, Imazato S, Ozer F. Evaluation of human pulp tissue response following direct pulp capping with a self-etching adhesive system containing MDPB. *Dent Mater J.* 2021;40(3):689–96.
  91. Meng T, Ying K, Hong Y, Xu Q. Effect of different particle sizes of nano-SiO<sub>2</sub> on the properties and microstructure of cement paste. 2020;833–42.
  92. Yoshida S, Sugii H, Itoyama T, Kadowaki M, Hasegawa D, Tomokiyo A, et al. Development of a novel direct dental pulp-capping material using 4-META/MMA-TBB resin with nano hydroxyapatite. *Mater Sci Eng C* [Internet]. 2021;130(April):112426. Available from: <https://doi.org/10.1016/j.msec.2021.112426>
  93. Swarup S, Rao A, Boaz K, Srikant N, Shenoy R. Pulpal response to nano hydroxyapatite, mineral trioxide aggregate and calcium hydroxide when

- used as a direct pulp capping agent: An in vivo study. *J Clin Pediatr Dent*. 2014;38(3):201–6.
94. Silva GF, Bosso R, Ferino R V., Tanomaru-Filho M, Bernardi MIB, Guerreiro-Tanomaru JM, et al. Microparticulated and nanoparticulated zirconium oxide added to calcium silicate cement: Evaluation of physicochemical and biological properties. *J Biomed Mater Res - Part A*. 2014;102(12):4336–45.
  95. Szczesio-Wlodarczyk A, Domarecka M, Kopacz K, Sokolowski J, Bociong K. An evaluation of the properties of urethane dimethacrylate-based dental resins. *Materials (Basel)*. 2021;14(11):1–15.
  96. Davaie S, Hooshmand T, Ansarifard S. Different types of bioceramics as dental pulp capping materials: A systematic review. *Ceram Int [Internet]*. 2021;47(15):20781–92. Available from: <https://doi.org/10.1016/j.ceramint.2021.04.193>
  97. Zakaria MN, Cahyanto A, El-Ghannam A. Calcium release and physical properties of modified carbonate apatite cement as pulp capping agent in dental application. *Biomater Res*. 2018;22(1):1–6.
  98. Gandolfi MG, Siboni F, Botero T, Bossù M, Riccitiello F, Prati C. Calcium silicate and calcium hydroxide materials for pulp capping: Biointeractivity, porosity, solubility and bioactivity of current formulations. *J Appl Biomater Funct Mater*. 2015;13(1):1–18.
  99. Peng W, Huan Z, Pei G, Li J, Cao Y, Jiang L, et al. Silicate bioceramics elicit proliferation and odonto-genic differentiation of human dental pulp cells. 2021;
  100. Habib SI, Habib ANA. Physical Evaluation and Bioactivity of Different Pulp Capping Materials in Simulated Dentinal Fluid. 2016;6(September):225–38.
  101. Beegum MSF, George S, Anandaraj S, Sumi Issac J, Khan SN, Ali Habibullah M. Comparative evaluation of diffused calcium and hydroxyl ion release from three different Indirect pulp capping agents in permanent teeth

- An in vitro study. *Saudi Dent J* [Internet]. 2021;33(8):1149–53. Available from: <https://doi.org/10.1016/j.sdentj.2021.02.004>
102. Al-hyali NA, Sc M. Comparison among Comparison among pulp capping materials in : calcium ion release , pH change , solubility and water sorption ( An in vitro study ). 2017;29(September):9–16.
103. Koutroulis A, Kuehne SA, Cooper PR, Camilleri J. The role of calcium ion release on biocompatibility and antimicrobial properties of hydraulic cements. *Sci Rep* [Internet]. 2019;9(1):1–10. Available from: <http://dx.doi.org/10.1038/s41598-019-55288-3>
104. Kim Y, Lee D, Kim HM, Kye M, Kim SY. Biological characteristics and odontogenic differentiation effects of calcium silicate-based pulp capping materials. *Materials (Basel)*. 2021;14(16):1–13.
105. Huang Y, Li P, Zhao R, Zhao L, Liu J, Peng S, et al. Biomedicine & Pharmacotherapy Silica nanoparticles : Biomedical applications and toxicity. *Biomed Pharmacother* [Internet]. 2022;151(April):113053. Available from: <https://doi.org/10.1016/j.biopha.2022.113053>