Biochem. Cell. Arch. Vol. 21, No. 2, pp. 3345-3353, 2021	www.connectjournals.com/bca	*ISSN 0972-5075*
DocID: https://connectjournals.com/03896.2021.21.3345		*eISSN 0976-1772*

THE USE OF COMBINATION NANOPARTICLE BETA TRICALCIUM PHOSPHATE (BETA-TCP) TO PROMOTE SCAFFOLD ACTIVITY FOR BONE REGENERATIONS

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(Received 29 May 2021, Revised 16 July 2021, Accepted 28 July 2021)

ABSTRACT : Various biomaterials have been developed to be used as bone substitutes or materials to stimulate bone growth such as beta Tricalcium phosphate (beta-TCP). In addition to the selection of biocompatible materials, any technological developments have led to the project of making substitute materials leading to the manufacture of nano-sized materials. The combination of biomaterials types and size modification aims to obtain materials with biodegradability and biocompatibility abilities. The purpose of this scooping review was to get the latest description of beta tri calcium phosphate nanoparticles as scaffold combination material to increase bone formation. To obtain the data, a search was conducted using three databases, they were PubMed, Science Direct and Scopus. From all three databases, 259 articles were found. Data were then selected based on the inclusion and exclusion criteria. The title, abstract and full text of each study were carefully analyzed. Data extraction was made based on cell proliferation, cell toxicity, and new bone formation process. There were 33 selected articles and the results displayed that there were 15 other combinations of biomaterials used with beta-TCP. The *in vitro* studies revealed the increase in cell proliferation and the absence of toxicity from the combination of beta-TCP/hydroxyapatite and beta-TCP/Platelet Rich Plasma. While *in vivo* studies revealed the new bone formation from the combination of beta-TCP/hydroxyapatite and beta-TCP/gelatin. In conclusion, the comparison of ingredients combined with beta-TCP in this scooping review were hydroxyapatite, platelet rich plasma and gelatin. Various combinations of these biomaterials with beta-TCP had high cell proliferation ability, no cell toxicity and good new bone formation ability.

Key words : Beta tricalcium phosphate, beta-TCP, nanoparticle, combination, scaffold, medicine.

How to cite : Fredy Mardiyantoro, Resgita Nadila Masya, Cindy Ramadhan, Indah Kartikasari, Lucindari Gea Permata, Vitra Nuraini Helmi, Nastiti Faradilla Ramadhani, Anita Yuliati, Elly Munadziroh, Intan Nirwana, Asti Meizarini, Priyawan Rachmadi and Anisa Kusumawardani (2021) The use of combination nanoparticle beta tricalcium phosphate (beta-TCP) to promote Scaffold activity for bone regenerations. *Biochem. Cell. Arch.* **21**, 3345-3353. DocID: https://connectjournals.com/03896.2021.21.3345

INTRODUCTION

The development of research in biomedical engineering field leads to many biomaterials. Biomaterials are materials that are applied and interacted with the human body. Biomaterials have been widely used to replace and restore the function of tissues that have experienced trauma or degeneration due to pathological any conditions, thus, they can make a better quality of life (Rezaie *et al*, 2015). In general, the types of biomaterials based on the material are bio-composites, biopolymers, bio-ceramics and bio-metals. Furthermore, a material when implemented in the tissue, it will cause a response categorized into four reactions. The first response happens if the material is toxic which results in cell death, while the second response occurs if the material is biologically inert in which new tissues will appear around the implanted material tissue, especially the materials made from polymers and metals. The third response appears, if the material is resorbable then the tissue will dissolve. Lastly, the fourth response exists if the material is bioactive which can form an interfacial