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Phenolic derivative of polyglyceric acid from medicinal plants its synthetis monomer and their anticancer efficacy

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According to data of different techniques of NMR spectroscopy 13C, 1H NMR, 2D heteronuclear 1H/13C HSQC, 1D NOE and 2D DOSY experiments the main chemical constituent of high molecular preparations from medicinal plants of different species of two genera *Symphytum and Anchusa (Boraginaceae family) Symphytum asperum, S. Caucasicum (caucasicum endemic), S.grandiflorum (Georgian endemic), S. officinale* and *Anchusa italica* was found to be poly[oxy-1-carboxy-2-(3,4-dihydroxyphenyl) ethylene] or poly[3-(3,4-dihydroxyphenyl)glyceric acid] (PDPGA). The polyoxyethylene chain is the backbone of this polymer molecule and 3,4-dihydroxyphenyl and carboxyl groups are regular substituents at two carbon atoms in the chain. The repeating unit of this regular polymer is 3-(3,4-dihydroxyphenyl)glyceric acid residue. In order to compare biological properties of natural polymer with its synthetic analogs, racemic and pure enantiomeric forms of PDPGA, as well as a methylated analog of PDPGA, were synthesized. The racemic monomer rac 2,3-dihydroxy-3-(3,4-dihydroxy-phenyl)propionic acid (DDPPA) and its pure enantiomers (+)-(2R,3S)- DDPPA] and (-)-(2S,3R)-DDPPA] were synthesized via sharpless asymmetric dihydroxylation of trans-caffeic acid derivatives using an potassium osmiate catalyst, a stoichiometric oxidant N-methyl morpholine-N-oxide and enantiocomplementary catalysts cinchona alkaloid derivatives (DHQ)2-PHAL and (DHQD)2-PHA as chiral auxiliaries. Methylated PDPGA was obtained via ring-opening polymerization of 2-methoxycarbonyl-3-(3,4-dimethoxyphenyl)oxirane using a cationic initiator. PDPGA is endowed with intriguing pharmacological activities as anticomplementary, antioxidant, anti-inflammatory, burn and wound healing and anticancer properties. PDPGA and its synthetic monomer exerted anticancer activity *in vitro* and in vivo against androgen-dependent and -independent human prostate cancer (PCA) cells via targeting androgen receptor, arrest and apoptosis without any toxicity, together with a strong decrease in prostate specific antigen level in plasma. However, the anticancer efficacy of PDPGA against human PCA cells is more compared to its synthetic monomer. Methylated PDPGA did not show any activity against PCA. Overall, this study identifies PDPGA as a potent agent against PCA without any toxicity and supports its clinical application.

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