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New fused imidazo-pyrimidine and imidazo-purine derived from maleimide and nucleobases: One pot synthesis, structure elucidation, antioxidant and antimicrobial evaluation

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A series of novel quinoxalinones, (2,5-dioxoimidazo[1,2-f]pyrimidin-3-yl)acetamide, 8-oxo-3*H*-imidazo[1,2-g]purin-7-yl)acetamide, and 4,7-dioxo-3H-imidazo[2,1-e]purin-8-yl)acetamide, were synthesized by reaction of maleimide derivatives with substituted *ortho*-phenylenediamine or nucleobases. The analytical methods such as FT-IR, ^{1}H and ^{13}C NMR spectroscopy, mass spectrometry, and microanalyses (C, H, N) were utilized to elucidate the structures of the target compounds. These products were tested for their ability to scavenge DPPH$^{\bullet}$ (1,1-diphenyl-1-picrylhydrazyl) and ABTS$^{\bullet+}$ (2,2′-azino-bis(3-ethylbenzothiazoline-6-sulfonic acid) free radicals, as well as for their total antioxidant capacity (TAC). Additionally, antimicrobial activity was screened against four bacterial strains and fungi using the well diffusion method. The results demonstrated that quinoxalinone **1f** exhibited potent free radical scavenging activities against DPPH and ABTS radicals, with IC_{50} values of 1.67 μg mL^{-1} and 20.76 μg mL^{-1}, respectively, compared to the standard antioxidant ascorbic acid (IC_{50} values of 2.82 and 74.22 μg mL^{-1}, respectively). Compound **1f** also displayed the highest TAC with a value of 1303 mg (AAE)/g of dry compound. Furthermore, (2,5-dioxoimidazo[1,2-f]pyrimidin-3-yl)acetamide (**2a**) demonstrated superior antioxidant activity against ABTS radical, with an IC_{50} value of 73.89 μg mL^{-1}, which is lower than that of the ascorbic acid (74.22 μg mL^{-1}). The antimicrobial assay revealed that compound **1f** exhibited potent inhibitory effects against all tested bacterial and fungal strains.

Keywords: Quinoxaline, Imidazole, Nucleobases, Antioxidant activity, Antimicrobial activity