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RESEARCH ARTICLE

Synthesis and antiproliferative activity evaluation of imidazole-based indeno[1,2-b]quinoline-9,11-dione derivatives

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Abstract A series of new imidazole substituted indeno [1,2-b]quinoline-9,11-dione derivatives were synthesized and evaluated for their antiproliferative effects on HeLa, LS180, MCF-7 and Jurkat human cancer cell lines. Antiproliferative effects were evaluated using MTT assay. Prepared compounds exhibited weak to good antiproliferative activity in evaluated cell lines. Prepared compounds were more potent in Jurkat cell line when compared to LS180, HeLa and MCF-7 cell lines. Compounds **29** ($IC_{16} = 0.7$ μM) and **31** ($IC_{16} = 1.7$ μM) and **33** ($IC_{16} = 1.7$ μM) were found to be the most potent molecules on Jurkat cell lines. Moreover; it was found that some of the tested compounds bearing imidazole-2-yl moiety on the C_{11}-position of dihydropyridine ring exhibited superior antiproliferative activity in comparison to *cis*-platin especially in Jurkat cell line (compounds **29**, **31**, and **33**). It seemed that the introduction of electron-withdrawing groups on the imidazole ring enhanced the antiproliferative potential of these compounds (compounds **27**, **29** and **31**). The results of this study proposed that some of the imidazole substituted indeno[1,2-b]quinoline-9,11-dione compounds may act as efficient anticancer agents in vitro, emphasizing their potential role as a source for rational design of potent antiproliferative agents.

Keywords Synthesis · Indeno[1,2-b]quinoline-9, 11-dione · Antiproliferative · MTT assay

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Introduction

Dihydropyridines (DHPs) are heterocyclic structures that have found significant attention among researchers. Many efforts on ruling synthetic routes for DHP scaffolds began after the first successful synthesis of symmetric 1,4-DHP derivative via one-pot cyclocondensation reaction of ammonia with alkylacetoacetate and aldehyde more than a century ago (Hantzsch 1882). Since then, a variety of synthetic procedures have been elucidated for preparation of symmetrical and unsymmetrical DHP derivatives (Vanden Eynde and Mayence 2003; Saini et al. 2008; Swarnalatha et al. 2011; Hugel 2009).

Besides synthetic feature, DHPs have been looked upon as one of the most important medicinal scaffolds possessing interesting biological properties such as anti-hypertensive (Nekooeian et al. 2010; Shafiee et al. 2002), calcium channel modulating (Miri et al. 2008; Davood et al. 2006), antituberculosis (Shafii et al. 2008), anticoagulant (Kumar et al. 2011), antidyslipidemic (Kumar et al. 2010), anti-oxidant (Kumar et al. 2010; Leon et al. 2008), and multidrug resistance reversal (MDR) (Tasaka et al. 2001) activities.

In this regard, several reports indicating anti-tumor activity of symmetric 3,5-dicarboxamide (Sirisha et al. 2010), 3,5-diketo (Engi et al. 2006; Bazargan et al. 2008), 3,5-dicarboxylate (Engi et al. 2006; Foroughinia et al. 2008) and 3,5-dicyano (Abbas et al. 2010) derivatives of