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ORIGINAL ARTICLE

Synthesis, characterization, and antimicrobial activity of Schiff bases derived from benzaldehydes and 3,3′-diaminodipropylamine

Suzan A. Matar [a], Wamidh H. Talib [b], Mohammad S. Mustafa [c], Mohammad S. Mubarak [c], Murad A. AlDamen [c,*]

[a] *Department of Biological Sciences, Faculty of Science, The University of Jordan, Amman 11942, Jordan*
[b] *Department of Clinical Pharmacy and Therapeutics, Applied Science University, Amman 11931, Jordan*
[c] *Department of Chemistry, The University of Jordan, Amman 11942, Jordan*

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Abstract Six Schiff bases were prepared by reacting 3,3′-diaminodipropylamine with different benzaldehyde derivatives. The structures of these compounds were confirmed through different spectroscopic methods such as ^{1}H-NMR, ^{13}C-NMR and mass spectrometry. The prepared compounds were evaluated *in vitro* for their antimicrobial activity against a number of pathogenic Gram-positive and Gram-negative bacteria and Candida by the twofold serial dilution method. These compounds showed bacteriostatic rather than bactericidal activities against Gram positive and Gram-negative bacteria. In addition, compound **3c** exhibited significant anticandida activity with an MIC of 24 μg/ml and is, therefore, considered as a promising and potential antifungal agent; further modification can be done on the structure of the compound for a better drug candidate in the future.

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1. Introduction

Nosocomial infections during the past decade have invaded hospitals worldwide by multi drug resistant Gram-positive and Gram-negative pathogens. Searching for novel antimicrobial agents and new microbial targets is in demand to intervene to avert the danger caused by these life-threatening infections (Rachakonda and Cartee, 2004). The treatment of nosocomial infections such as hospital acquired methicillin resistant *Staphylococcus aureus* (MRSA) and biofilm formers has become an important problem to deal with owing to their multidrug resistance (Chen et al., 2012; Maselli et al., 2012). Since the resistance towards the available antibiotics among pathogenic bacteria has grown rapidly, there is a clear need for the development of new and effective antimicrobial agents. Therefore, the success in designing antimicrobial agents which are distinct from those

* Corresponding author. Tel.: +96 26 535 5000/22146; fax: +962 26 530 0253.
E-mail address: maldamen@ju.edu.jo (M.A. AlDamen).
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of the classical antibiotics is the key for treating such infectious diseases known for their chronicity and failure to treat with conventional antibiotics which will eventually lead to death.

Schiff bases have been found to possess pharmacological activities such as antibacterial (Venugopal and Jayashree, 2008), antifungal (Pandey et al., 2003), antitubercular (Bhat et al., 2005), antimicrobial (Wadher et al., 2009), antiviral (Karthikeyan et al., 2006), antimalarial (Li et al., 2003) and anticancer (Villar et al., 2004). They are important compound due to their wide range of biological activities and industrial application. They also serve as a back bone for the synthesis of various heterocyclic compounds (Wang et al., 2008). The condensing protein, (ketoacyl–acyl carrier protein synthase (KAS), is an essential target for a novel antibacterial drug design against multidrug resistant Gram positive pathogens (Lee et al., 2012), (Cheng et al., 2009), impressive efforts have lead to the synthesis of peptide and Schiff bases which can be potential antibiotic agents targeting KAS in Gram positive and Gram negative pathogens.

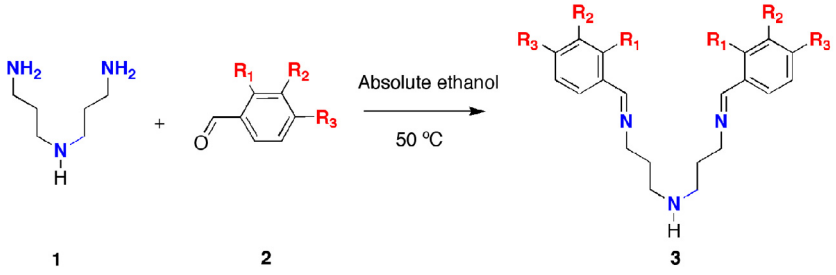
Moreover, Schiff compounds and their metal complexes have been of major interest for a long time because of their ability to bind oxygen to redox systems (Muhammad et al., 2011) exerting their ability to oxidize DNA (Landy, 1989). They showed significant antimicrobial activity due to the free radical scavenging ability of their metal complexes (Al-Amiery et al., 2012). Several research groups have been involved in the synthesis and biological screening of Schiff bases. Kriushnapriya et al. (2009) showed that the aldehyde Schiff base N-aryl thiosemicarbazones had stronger anti-MRSA potency, being effective at half the concentration of the vancomycin. Furthermore, preliminary results revealed that one of the thiazolidinedione-5-acetic acid amide derivatives exhibits promising antimicrobial activity (Shankar and Kallanagouda, 2011). Schiff bases derived from isatin derivatives and N[4-(4′-chlorophenyl)thiozole-2-yl] thiosemicarbazide, have already proved to be potent antimicrobial agents (Pandeya et al., 1999). Similarly, Khanam et al. (2002) discovered that 2,2′-diamino-1-azavinyl aminoamide can be used effectively against a number of both Gram-positive and Gram-negative bacteria. Quite recently (Sadeh et al., 2011), the synthesis and characterization of a number of new Schiff bases derived from metronidazole have been undertaken and their antigiardial and antimicrobial activities were evaluated.

In view of the wide interest in the activity and profile of Schiff bases derived from benzaldehydes due to their pharmacological interest, we described herein the synthesis and characterization of six Schiff bases derived from benzaldehydes and 3,3′-diaminodipropylamine which, some of them are to the best of our knowledge, have not previously been described in the literature. The antimicrobial activity of the synthesized compounds was evaluated. Also, published articles concerning antimicrobial activity sometimes lack containing information about the cytotoxicity of such compounds.

2. Result and discussion

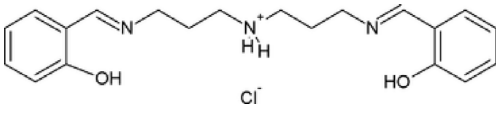
2.1. Chemistry

The Schiff bases **3a–e** were prepared by reacting 3,3′-diaminodipropylamine with different benzaldehyde derivatives in ethanol as shown in Scheme 1. The prepared compounds were checked for purity by TLC using glass plates precoated with silica gel 60 GF254, supplied by Fluka as stationary phase and suitable solvent system as mobile phase. The structures of the prepared compounds were confirmed by NMR, and mass spectrometry. The ^{1}H and ^{13}C-NMR spectra of all prepared compounds are in total agreement with the suggested structures. DEPT experiments were employed to differentiate secondary and quaternary carbons from primary and tertiary ones. Additional supports of the proposed structures come



1 2 3

	R_1	R_2	R_3
3a	OH	H	H
3b	OCH_3	H	H
3c	OH	H	OH
3d	H	H	H
3e	H	H	NO_2
4b	(AlDamen and Haddad, 2012)		



Scheme 1 Synthesis of compounds **3a–e**.

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