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ANTIMICROBIAL ACTIVITY OF PARTIALLY PURIFIED PEPTIDES ISOLATED FROM THE SKIN SECRETIONS OF BORNEAN FROGS IN THE FAMILY OF RANIDAE

MUNA SABRI[1,2], ELIZABETH JEGA JENGGUT[1], RAMLAH ZAINUDIN[3] and ZUNIKA AMIT[1*]

[1]Department of Basic Medical Sciences, Faculty of Medicine and Health Sciences, Universiti Malaysia Sarawak, 94300 Kota Samarahan, Sarawak, Malaysia
[2]Centre of PreUniversity Studies, Universiti Malaysia Sarawak, 94300 Kota Samarahan, Sarawak, Malaysia
[3]Department of Zoology, Faculty of Resource Science and Technology, Universiti Malaysia Sarawak, 94300 Kota Samarahan, Sarawak, Malaysia
[*]E-mail: zunika@unimas.my

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The emergence of drug resistant bacteria has now become a major public health problem worldwide (Cohen, 2000; Kumarasamy *et al*., 2010; Sengupta *et al*., 2013). WHO report (2017) on global surveillance of antimicrobial resistance revealed a widespread development of resistance in both gram positive and gram negative bacteria which had threatened millions of people worldwide. A rapid increase in number of drug-resistant bacteria and incidence nosocomial infections pose a challenge to conventional therapies using existing antibiotics, leading to the need in finding alternative microbicides to control these infections (Lakshmaiah *et al*., 2015). Thus, a discovery of new and effective treatments that can replace current available antibiotics has become a critical area of research globally.

Anurans inhabit a wide variety of habitat types from barren deserts to deep freshwater lakes and may spend most of their life underground or high in the cloud of a forest canopy. They are vulnerable towards injuries, predators, parasitisation, microorganism's infections and wounds (Clarke, 1997). The frog skin plays key roles in the everyday survival of the amphibians and contributes to their ability to exploit a wide range of habitats and ecological conditions. Upon stress or injuries, frogs secrete secretion from the glandular gland as their first line host defense system against penetrating infectious microorganisms (Schadich, 2009, Hancock and Diamond, 2000). Glandular gland also serves as a toxic gland containing antimicrobial peptides (AMPs) and can be found concentrated at the head and neck of the frogs (Rollin-Smith *et al*., 2002). Most AMPs are cationic in nature and share a net positive charge at neutral pH with the high content of hydrophobic residues and an amphipathic character (Galdiero *et al*., 2013; Power & Hancock, 2003). These characteristics allow the frog skin peptides to kill bacteria through cell lysis by binding to negatively charged components of charged bacterial membrane (Schadich *et al*., 2013). The AMPs attract attention due to their effectiveness in killing both gram-negative and gram-positive bacteria, without any of the undesirable effects of antibiotic resistance (Conlon and Sonnevand, 2011; Galdiero *et al*., 2015; Schadich, 2009). Thus, amphibian's skin secretions have become the target for the screening and subsequent development of AMPs.

The Borneon frogs are the endogenous frogs that inhabit Borneo, an island divided between Indonesia, Brunei and East Malaysia (Sabah and Sarawak). Approximately, more than 150 species of frogs occur in Borneo (Inger and Stuebing, 2005) and are widely distributed throughout the island. Their habitats range from peat swamps, terrane, waterfalls, streams, high altitudes to the forest floors of the tropical rainforest. There are seven families of Bornean frogs present in the island which are Bombinatoridae, Bufonidae, Ceralobatrachidae, Dicroglossidae, Microhylidae, Ranidae and Rhacophoridae.

The current study focuses on the individuals belonging to the family of Ranidae, which is often referred to as 'true frog' under the suborder Neobatrachia. It has been documented that the skin secretions from frogs in the Ranidae family contained brevinin, esulentin, and ranateurin that are

* To whom correspondence should be addressed.