CHAPTER 3: MACROSCOPIC EVALUATION OF WOUND HEALING

3.1 INTRODUCTION

Wound healing is a complex biological process of the replacement of injured tissue (Vidinsky et al., 2006). This complicated process has been widely investigated over the years and the major events in the healing process have been discussed in the literature (e.g. Singer and Clark, 1999). However, *in vivo* study of the wound healing process has not been fully investigated and understood due to the lack of standardized model.

3.1.1 WOUND MODELS

There are two types of wound healing models that are usually used for research purposes. These models are *in vitro* wound models and *in vivo* wound models and have become indispensable tools for researchers in scientific discipline (Perez and Davis, 2008).

In vitro wound model involves cell culture method while *in vivo* wound model is involves the healing of wound made on the experimental animal (Grottrup, 2001). Recently, there was a rapid increase in the number of *in vivo* study in wound research (Perez and Davis, 2008). In the *in vivo* wound model, the wounded tissue will be similar to the wound found in clinical practice. This group is then further divided into different types of acute wound models (Grottrup et al., 2000). There are numerous types of *in vivo* wound models namely excisional wounds, incisional wounds, partial thickness wounds, burns wounds and necrotizing wounds (Grottup, 2001; Perez and Davis, 2008;). Each of this model has its unique benefits and also disadvantages.

In vivo wound models involve small mammals such as rodents due to multiple reasons, such as this animal are inexpensive, easily obtains and require less space, food and water. Some small animals can easily be altered genetically and provide a wound model capable of approximating defective human condition such as diabetes, immunological deficiencies, and obesity (Davidson, 1998). Wound is usually made on the back of the small animal as it is reproducible and not easily reached to ensure healing is not due to their licking of the wounded area. The healing process in these models can easily be followed and investigated by the histological analysis (Perez and Davis, 2008).

3.1.2 PARAMETERS OF MACROSCOPIC EVALUATION

Generally, wound healing involves a series of changes in the appearance of the wound. Observable changes on the physical appearance or the characteristics of the wound have made up part of the evaluation methods for wound healing process (Rozaini et al., 2005). These changes are often associated with the severity and infection of the wounds. Macroscopic evaluation of the wounds (e.g. dryness of wound area and exudation), have become the parameters in the assessment of the healing process (Khoo et al., 2010). Other than wound size, wound contraction is also considered as part of the parameters in macroscopic evaluation. Wound contraction is part of the wound healing process, which provides the closure to the wound and it occurs when the wound edges start to move toward each other, thus reducing the wound size (Trajeque, 2001; Rozaini et al., 2005).

3.1.3 EFFECT OF HONEY ON ANIMAL MODELS

There has been a rapidly increasing interest in the use of honey dressing based on existing publications, but there is still some negative impression spread on honey and wound healing among the scientific community.

Animal studies showed the efficacy of honey in promoting wound healing by using normal parameters of wound healing as well as by using histological evaluation. A study done by Olandejo et al. (2003) using $1cm^2$ excisional wound on 30 rats, revealed that the epithelialization in honey treated wound was more rapid compared to the saline treated wound. Less edema and smaller wound area were found in wound under honey treatment. Thicker granulation tissue was observed histologically in honey treated group. Another study done by using 2cm x 2cm excisional wound on 20 rats reported that the mean wound contraction of wound size was found to be greater in honey treatment (80 %) compared to the saline treatment (55 %) (Osuagwu et al., 2004).

Local researches done in animal study on burns wound using topical application of honey (e.g. Manuka honey and Gelam honey) on burn wounds showed significantly stimulated wound contraction based on the observation of gross appearance of the wounds (Rozaini et al., 2005). Another research showed positive effect of Malaysian Tualang honey in the control of *Pseudomonas aeruginosa* infection and on wound contraction of burn wounds (Khoo et al., 2010).

The wound healing effect of honey may be different in different type of wounds. In addition, wound healing activity of honey is also thought to be different depending on the floral sources (Aljady et al, 2000). Thus, wound healing efficacy of honey from different floral sources found in different regions should be investigated. Thus this study was carried out to observe the effect of selected Malaysian honey on excisional wounds.

3.2 RESEARCH OBJECTIVES

Although the various stages of wound healing process have been widely illuminated over the years and those major events that are associated with wound healing have been extensively studied *in vitro* (e.g. Singer and Clark, 1999), the research on wound management still remains a concern issue among scientists all over the world. The in-depth evaluation of the *in vivo* studies is still unavailable due to the lack of standard animal models.

Specific objectives of this part of study are listed below:

1. To establish a suitable *in vivo* animal model that is quantitative, reliable and repeatable for the acute wound healing evaluation based on morphological and macroscopic changes. The data obtained is expected to facilitate the development of novel therapies by delineating their contribution to the wound healing process.
2. To evaluate the morphological and macroscopic changes occurring during the acute wound healing process and also its response to the treatments.
3. To identify and correlate the topical application of both honey treatments to the normal wound healing process based on the morphological and macroscopic changes.