Comparative Study on Wound Healing Using Potash-table Salt Mixture and Honey on Albino Rats.

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ABSTRACT

Background: *Honey is produced by bees and is widely consumed in Nigeria. It is used in wound management. Potash salt and table salt refer to potassium chloride (KCL) and sodium chloride (NaCl) respectively.*

Objective: *This study was undertaken to compare the rate of wound healing using a mixture of potash-table salt and honey on albino rats.*

Methods: *Twenty four healthy adult albino rats of Wistar strain weighing between 180-220g were used in the study. They were randomly assigned into three groups of 8 rats each. Group A served as control and received normal saline only. Group B received topical application of honey. Group C was treated with a mixture of potash-table salt. Two ml of blood samples were collected by cardiac puncture at the end of one month and the following haematological tests were carried out: total white blood cell count (WBC), platelet count and white blood cell differentials.*

Results: *Results showed that potash-table salt healed the wound faster than honey when applied on wound. The WBC count in test groups (B & C) were elevated with values of 4,995 ± 563 in group B and 5,337 ±44 in group C compared with3,716 ± 435 for control. Platelet count in test rats were also elevated with values of 201.3 ± 2.9 (Group B), 193.8 ± 13.0 (Group C) compared with 168 ±76 (control). The white blood cell differential count showed significant increase in neutrophil and monocyte, a significant decrease in lymphocyte and eosinophil compared with the control group. There was no change in basophil.*

CONCLUSION: *It is concluded that wound healing is faster in potash-table salt treated group than in honey treated group.*

Keywords: *wound healing, honey, potash, table salt.*

INTRODUCTION

Honey is produced by bees using nectar from flowers. It derives its sweetness from the monosaccharide fructose and glucose. It has beneficial effects on wound healing[1,2]. Honey has been reported to have an inhibitory effect to around 60 species of bacteria including aerobes and anaerobes, gram-positive and gram-negatives[3].These antibacterial properties help to sterilize the wound and accelerate wound healing.

Potash refers to potassium compounds and potassium bearing materials, the most common being potassium chloride (KCL). The term 'Potash' comes from the old Dutch word potaschen, later, "potash" became the term widely applied to naturally occurring potassium salts and the commercial product derived from them. Table salt is refined salt which contains about 97 to 99% sodium chloride. Some ethnomedical practitioners use a mixture of potash and table salt in treating a variety of ailments including wounds.

Wound healing is the process of repair following injury to the skin and other soft tissue. Initial stages of wound healing involve an acute inflammatory phase followed by synthesis of collagen and other extracellular matrix which are later remodeled to form a scar.[4] Wound healing is influenced by many factors including the kind of agent used in dressing the wound. The use of some substances in dressing wounds is to accelerate the wound healing process and to prevent infection [5].

The healing response is characterized by the movement of specialized cells into the wound site. Platelets and inflammatory cells are the first cells to arrive at the site of injury and they provide key functions and "signals" needed for the influx of connective tissue cells and formation of a new blood supply. These chemical signals are known as cytokines or growth factors[6].

This study was undertaken to compare the rate of wound healing using honey and a mixture of potash-table salt.

MATERIALS AND METHOD

This prospective study was carried out in the Department of Physiology, Faculty of Basic Medical Sciences, Anambra State University, Uli.

ANIMALS: Twenty-four healthy adult albino rats of Wistar strain weighing between 180-220g were used in the study. The animals were housed under standard conditions of temperature (23 ± 2^0C), humidity, and 12hour light (7.00am-7.00pm).

They were kept in wire-meshed cages and fed with commercial rat pellets and allowed water adlibitum. The animals were handled in accordance with National and Institutional Guidelines for the Protection of Animal Welfare.

Experimental design**:** The animals were randomly assigned into three groups of 8 rats each. Group A

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served as control and was treated with normal saline. Groups B and C were the test groups(treated with honey and a mixture of Potash-table salt respectively).

Inflicting Wounds on Albino Rats

The animals were made to acclimatize to the housing conditions in animal house for one week and were fed very well. Prior to the commencement of the experiment, the test rats were injected with 0.4ml of thiopentone injection to anaesthetize them. The area for wound infliction was chosen preferably on the back. The hairs were shaved off with scissors and lancet was used to cut the skin. The wound was in form of square (the length and width of the wound were measured and the result expressed in centimeter. Equal area of wound was given to both the control and the test rats. Measurement was taken on the first day the wound was inflicted.

The control rats wounds were rubbed with normal saline. Honey was applied on the wounds of test animals in group B. Potash and table salt were measured in equal weight of 5g each, they were ground together and used to apply on the wounds on the rats in group C. The wounds were treated everyday and the areas measured to check difference in size in all the animals.

Other parameters measured in this study were total white blood cell count (WBC)[7], white blood cell differentials [7], platelet count[8]. Two ml of blood samples were collected by cardiac puncture at the end of one month and the haematological tests were carried out.

Statistical analysis

The data obtained were expressed as Mean ± SD. The student's t-test was applied and P-values were determined. Differences were considered significant at $P<0.05$.

RESULTS

Table 1: Shows the effect of honey and a mixture of potash-table salt on duration (in days) of wound healing on albino rats.

Groups	Days Mean ± SD	P-value
A (control) n=8	14 ± 0.75	
B Honey n=8	13.4 ± 35	0.62
C Potash-table salt n=8	10.9 ± 3.9*	0.021

*=Significant ($p<0.05$)

Table 2: shows the effect of honey and a mixture of potash-table salt on white blood cell count of albino rats.

Groups	WBC per mm^3 Mean ± SD	P-value
A control n=8	3, 716 ± 435	
B Honey n=8	4, 995 ± 563	0.66
C Potash-table salt n=8	5, 337 ± 44*	0.034

*=Significant ($p<0.05$)

Table 3: Shows the effect of honey and a mixture of potash-table salt on platelet count. There is significant increase in the platelet count in the test rats compared with the control.

Groups	Platelet count per mm^3 Mean ± S.D	p-value
A control n=8	168 ± 76	
B Honey n=8	201.3 ± 2.9*	0.002
C Potash-table salt n=8	193.8 ± 13.0*	0.013

***=**Significant ($p<0.05$)

Table 4: Shows the effect of honey and a mixture of potash-table salt on white blood cell differentials. There is a significant difference in test rats compared with the control rats (P<0.05)

Groups	N% $\overline{X}$ ±SD	L% $\overline{X}$ ±SD	E% $\overline{X}$ ±SD	M% $\overline{X}$ ±SD	B% $\overline{X}$ ±SD
A control n=8	51.7 ± 5.2	45.5 ± 2.7	13 ± 5.2	1.5 ± 8.5	0
B Honey n=8	71.7 ±3.3*	24.4±4.2*	1.4 ± 1.6*	3.1 ± 1.4*	0
C Potash-table salt n=8	72.4 ± 2.6*	23.6±9.2*	1.4 ± 2.3*	3.9 ± 2.2*	0

*=Significant (p<0.05)

DISCUSSION

The effects of honey and a mixture of potash-table salt on wound healing on albino rats were investigated. The result showed that the mixture of potash-table salt healed wound faster (10.9 ± 3.9 days) than honey (13.4 ± 3.5 days).

Injury elicits inflammatory response. Inflammation is characterized by heat, redness, swelling, pain, and loss of function[9]. The inflammatory response occurs in the connective tissue into which plasma and formed elements of the blood leak from blood vessels damaged by the injury or from vessels that become permeable in response to the injury, particularly the post capillary venules. The neutrophils are the more numerous of the first wave of cells to enter the inflammatory site except, of course, for extravasated red blood cells. They engage in active phagocytosis of bacteria and other foreign organisms and passive phagocytosis of damaged connective tissue cells, red blood cells and fibrin.

Monocytes also enter the connective tissue during inflammation and transform into macrophages that phagocytose cell and tissue debris, fibrin, remaining bacteria and even spent neutrophils. For normal wound healing to occur, it is essential macrophages participate in the inflammatory response; they become the major cell type present at the inflammatory site after the neutrophils are spent. At the same time that the macrophages are becoming active at the site of inflammation, fibroblasts near the site and undifferentiated mesenchymal cells in the adventitia of small vessels at the site begin to divide and differentiate into the fibroblasts that will secrete the fibers and ground substance of the healing wound. Neutrophils and monocytes are attracted to the inflammatory site by chemical factors, a process known as chemotaxis. Lymphocytes, eosinophils, and basophils also play a role in inflammation but they are more associated with the immunologic aspects of the process. Eosinophils and lymphocytes are more commonly found at sites of chronic inflammation.

The exact mechanism of action by which a mixture of potash-table salt accelerates wound healing is not well elucidated. However, the role of honey in wound healing has been widely reported[1,2].

The antibacterial property of honey was first recognized in 1892 by Van Kelel[10] .It has often been assumed that this is due entirely to the osmotic effect of its high sugar content [11, 12, 13, 14, 15, 16] Honey, like other saturated sugar pastes, has an osmolarity sufficient to inhibit microbial growth [17], but when used as a wound contact layer, dilution by wound exudates reduces the osmolarity to a level that ceases to control infection [18]. However, it has been shown that wounds infected with staphylococcus aureus are quickly rendered sterile by honey [19], [20, 21]. Honey contains an enzyme that produces hydrogen peroxide when diluted[22]. Hydrogen peroxide is well known for its antibacterial and cleansing properties [23]. In some honeys treated with catalase to remove the hydrogen peroxide activity, additional non- peroxide antibacterial factors have been identified [24, 25].

The cleaning of infection seen when honey is applied to a wound may reflect more than just antibacterial properties. Recent research shows that the proliferation of peripheral blood B-lymphocytes and T-lymphocytes in cell culture is stimulated by honey at concentrations as low as 0.1% and phagocytes are activated by honey at concentrations as low as 0.1% [26]. Honey (at concentration of 1%) also stimulates monocytes in cell culture to release cytokines, tumor necrosis factor (TNF) – alpha, interleukin (IL) – 1 and IL – 6, which activate the immune system in response to infection[27].

In addition, the glucose content of honey and the acid pH (typically between pH3 and pH4) may assist in the bacteria destroying action of macrophages[28].

CONCLUSION

This study compared effects of honey and a mixture of potash-table salt on wound healing on adult albino rats.The results showed that a mixture of potash-table salt healed the wound faster than honey as evidenced

by reduced number of days, increase in white blood cell and platelet counts.Further studies involving higher animals are recommended with a view to ascertaining the mechanism of action of a mixture of potash-table salt in relation to wound healing.

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