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Wound Healing Effects of Quail (*Couturnix Couturnix Japonica*) Egg on Surgical Excisional Wound in Rabbits

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Abstract

The rate of wound healing following topical application of quail egg yolk and its oil on surgical excisional wound in rabbits was studied in this research. The main purpose of this research work was to study the healing effects of topical application of quail egg yolk and its oil on surgical excisional wound in rabbits. Sixteen apparently health rabbits of both sexes, weighing between 1.5 and 2.2 kg with an age interval of between 3 and 4 months were used for this experiment. After stabilizing and acclimatizing them to the environment, there were divided into 4 groups (A, B, C, D).The quail egg oil group (A), quail egg yolk group (B), positive control group using penicillin ointment (C) and the negative control group without any agent applied on it (D) and each of the groups contained four rabbits of 2 males (M_1, M_2) and2 females (F_1, F_2). A full thickness surgical skin excision of 2cm x 2cm was created on the right thigh after subcutaneous administration of 2% lignocaine hydrochloride. Wound dressing using quail egg oil extract, quail egg yolk, penicillin ointment as positive control were applied on the wound at 24 hours interval until complete healing was achieved. As healing progressed, the rate of contraction across the groups was measured using a ruler at an interval of 3 days. The result showed a significant increase in the healing and contraction rates in the group A and B compared to C and D. The rate of contraction and healing in group A and B were almost the same with only a slight difference. The findings showed that using quail egg yolk and its oil, had a faster healing rate compared to the conventional penicillin ointment.

Keywords: Excisional Wound; Wound Healing; Quail Egg; Rabbits

Introduction

A wound is a disruption of tissues normal anatomic structure and functions with or without tissue loss [1]. Animal wounds are a common occurrence in veterinary practice and are most likely traumatic or resulting from surgical procedures. Wound healing is an essential physiological process that is important for tissue repair. It is aimed at restoration of lost tissue and tissue integrity [2,3].

Various factors affect wound healing, multiple factors can lead to impaired wound healing. In general terms, the factors that influence wound healing can be categorized into local and systemic factors. Local factors directly control the characteristics of the wound itself example include: oxygenation, infection, foreign body, venous sufficiency, while systemic factors controls the overall health or disease state of the individual that affect his or her ability to heal examples of systemic factors include: medication, disease, immune-compromised conditions, nutrition, stress, obesity, age and gender, sex hormones, ischemia. Many of these factors are related, and the systemic factors act through the local effects affecting wound healing [3,4]. Proper wound treatment with topical agent such as penicillin prevents infection, complications and increases a wound healing process. Excision refers to the act of cutting out or surgical removal of a part or all of a structure or organ [5]. In animals, skin excision is indicated for the removal of skin lesions such as removal of skin cancers including basal cell carcinoma, squamous cell carcinoma, melanoma and removal of frequently infected cyst [6]. Skin excision is also indicated when taking samples for pathological examination in which case an excision biopsy is done [7]. Quail eggs are eggs from a small ground-nesting game bird in the pheasant family Phasianidae [8]. Ancient Egypt, China and Japan have used quail eggs as medicinal agent for the treatment of rashes, eczema, hair loss and skin problems due to its high content of vital nutrient including protein, vitamin A, E, Iron, potassium, phosphorus, and b-vitamins [9]. Quail eggs are also known to stimulate growth, brain functions and generally rejuvenate the body as it is known to be rich in minerals such as magnesium, folic acid, iron and zinc [10]. In another study carried out to determine the wound healing effects of egg yolk oil revealed that egg yolk apart from having anti-inflammatory effects also could facilitate healing in third degree burns in rats [11].

Various agents have been used in the past to enhance wound healing, some of which include honey, moringa oliefera, aqueous pineapple juice, potash-Table salt and oil from chicken egg [3,4,12-14]. To the best of my knowledge, very limited work has been conducted to test the effect of quail egg on wounds, hence the aim of this work is to observe the wound healing effects of quail (*Couturnix couturnix japonica*) egg yolk and its oil on surgical excisional wound in rabbits which will increase the knowledge of quail egg on wounds.

Material and Methods

Sixteen Rabbits (eight males and eight females) obtained from Sokoto live bird market was used for this research. They weighed between 1.5-2.2kg and aged between 3 and 4 months. The rabbits were housed in the small animal pen of the Faculty of Veterinary Medicine, Usmanu Danfodiyo University Sokoto. Prior to the introduction of the experimental animals to the pen, the pen was disinfected and fumigated with acaricide. The rabbits were stabilized and kept for two weeks before the surgery. They were fed with vegetables, table remnants, chicken feed (grower mash) and were provided with clean water ad *libitum*.The rabbits were assigned into four groups (A, B, C and D), each group contained four rabbits of 2males (M_1, M_2) and 2 females (F_1, F_2). The rabbits in group A were managed with quail egg yolk oil extract, group B were managed with raw quail egg yolk, group C (positive control) were managed with penicillin ointment and the last group (negative control) were managed without any agent.

In preparing the quail yolk oil extract, sixty (60) quail eggs yolk were manually separated from the egg white as described by Warren [15], sundried for a day at 37 °C and subsequently blended till a powdery form was obtained. After blending, 200 g of quail egg yolk powder was obtained, and gentle heating method was used to extract the quail egg yolk oil followed by filtration with Whatman filter paper size 1 [15].

Each rabbit was aseptically prepared for surgery, 2% lignocaine hydrochloride was administered subcutaneously at the surgical site before creating the excisional wound.

Figure 1: Measurement of the area on the skin to be excised using ruler and a marker

The rabbits were positioned on left lateral recumbency and aseptically draped. The area of the wound to be created was outlined using permanent marker and a ruler and a full thickness excision wound of 2cm x 2cm length and breadth respectively was created using toothed forceps, a surgical blade and a scissors. The wounds in each group was dressed and changed every 24 hours. In Group A, quail egg oil extract was topically applied after which a fresh dressing material was used to dress the wound. In group B, quail egg yolk was applied and in group C (positive control), penicillin ointment was applied. The last group (negative control) had its dressing materials changed without applying any agent to it. The length and breadth of the wound was measured as its rate of contraction across the groups using a ruler at an interval of 3 days. The results were analyzed using descriptive statistics and results were presented in Tables.

Results

The surface of the wounds treated with quail egg oil and quail egg yolk dried faster when compared with the other groups. Complete healing was achieved throughout the groups within a period of twenty-two days. The group treated with quail egg yolk oil extract, three healed by day sixteen except for one which healed on day nineteen as shown below.

Animals	Day1		Day4		Day7		Day10		Day13		Day16		Day19		Day22	
	L(cm)	B(cm)	L(cm)	B(cm)	L(cm)	B(cm)	L(cm)	B(cm)	L(cm)	B(cm)	L(cm)	B(cm)	L(cm)	B(cm)	L(cm)	B(cm)
A(F^1)	2.0	2.0	1.7	1.7	1.5	1.5	0.6	0.7	0.5	0.3	0.0	0.0	0.0	0.0	0.0	0.0
A(M^1)	1.9	1.9	1.7	1.6	1.5	1.3	1.0	0.8	0.4	0.3	0.0	0.0	0.0	0,0	0.0	0.0
A(F^2)	2.2	2.2	1.7	1.5	1.0	1.0	0.8	0.7	0.3	0.3	0.0	0.0	0.0	0.0	0.0	0.0
A(M^2)	2.2	2.0	2.0	2.0	2.0	1.8	1.2	1.2	0.7	0.7	0.4	0.4	0.0	0.0	0.0	0.0

Key: 0.0 = healed; L= length; B= breadth; cm= centimeter; F= female; M= male

Table 1: The wound sizes treated with quail egg yolk oil extract at different days (group A)

In the group treated with quail egg yolk, only two of the wounds healed on day sixteen while the remaining two healed by day nineteen as shown below

Animals	Day1		Day4		Day7		Day10		Day13		Day16		Day19		Day22	
	L(cm)	B(cm)	L(cm)	B(cm)	L(cm)	B(cm)	L(cm)	B(cm)	L(cm)	B(cm)	L(cm)	B(cm)	L(cm)	B(cm)	L(cm)	B(cm)
B(M^1)	2.5	2.0	2.5	1.7	1.6	1.5	1.2	1.0	0.6	0.4	0.0	0.0	0.0	0.0	0.0	0.0
B(F^1)	1.9	1.9	2.5	1.5	1.8	1.3	0.8	0.8	0.6	0.5	0.2	0.2	0.0	0.0	0.0	0.0
B(F^2)	1.8	1.7	1.5	1.5	1.2	1.2	1.0	0.5	0.3	0.2	0.0	0.0	0.0	0.0	0.0	0.0
B(M^2)	2.5	1.7	1.8	1.7	1.4	1.3	1.3	1.2	0.7	0.5	0.4	0.3	0.0	0.0	0.0	0.0

Key: 0.0 = healed; L= length; B= breadth; cm= centimeter; F= female; M= mal

Table 2: The wound sizes treated with quail egg yolk at different days (group B)

In the group treated with penicillin ointment, only one wound healed on day sixteen, two healed on day nineteen and one healed on day twenty-two **as** shown below.

Animals	Day1		Day4		Day7		Day10		Day13		Day16		Day19		Day22	
	L(cm)	B(cm)	L(cm)	B(cm)	L(cm)	B(cm)	L(cm)	B(cm)	L(cm)	B(cm)	L(cm)	B(cm)	L(cm)	B(cm)	L(cm)	B(cm)
C(M^1)	2.2	2.2	2.0	1.5	1.5	1.5	1.5	1.2	0.7	0.7	0.3	0.3	0.1	0.1	0.0	0.0
C(F^1)	1.9	1.8	1.5	1.5	1.2	1.2	0.8	0.5	0.4	0.3	0.0	0.0	0.0	0.0	0.0	0.0
C(M^2)	1.9	2.5	2.0	1.8	1.8	1.6	1.5	1.0	0.7	0.6	0.1	0.1	0.0	0.0	0.0	0.0
C(F^2)	2.4	2.0	2.5	2.0	2.3	1.6	1.8	1.2	0.7	0.5	0.5	0.5	0.3	0.3	0.0	0.0

Key: 0.0 = healed; L= length; B= breadth; cm= centimeter; F= female; M= male

Table 3: The wound sizes treated with penicillin ointment at different days (group C)

In the group treated without any agent, only one wound healed on day sixteen while the remaining healed on day nineteen as shown in below.

Animals	Day1		Day4		Day7		Day10		Day13		Day16		Day19		Day22	
	L(cm)	B(cm)	L(cm)	B(cm)	L(cm)	B(cm)	L(cm)	B(cm)	L(cm)	B(cm)	L(cm)	B(cm)	L(cm)	B(cm)	L(cm)	B(cm)
D(F^1)	1.8	2.0	1.8	1.6	1.7	1.3	1.5	1.2	0.7	0.7	0.0	0.0	0.0	0.0	0.0	0.0
D(M^1)	2.0	1.9	2.0	1.8	1.8	1.5	1.4	1.0	1.0	0.6	0.4	0.4	0.0	0.0	0.0	0.0
D(M^2)	1.9	1.9	2.0	1.6	1.8	1.7	0.8	1.0	0.5	0.4	0.2	0.2	0.0	0.0	0.0	0.0
D(F^2)	1.7	1.8	2.0	1.7	1.5	1.5	1.5	1.0	0.7	0.5	0.6	0.4	0.0	0.0	0.0	0.0

Key: 0.0 = healed; L= length; B= breadth; cm= centimeter; F= female; M= male**Table**

4: The wound sizes treated with no agent at different days (group D)

	Mean	Std. Deviation
Quail Egg Yolk Oil	1.4778	2.01636
Quail Egg Yolk	1.5194	2.07274
Penicillin	1.6972	2.30962
No Agent	1.6389	2.17518

Table 5: Summary statistics of mean and standard deviation

Discusion

The surfaces of the wound treated with quail egg oil and quail egg yolk group, A and B (Table 1 and 2) were observed to have dried compared to those treated with penicillin ointment (group C) and the negative control (group D), therefore showing a facilitated healing [11]. This result is similar to the work reported by Rastegar, *et al.* who reported a faster healing in third degree burns in rats after using egg yolk oil by showing a dried wound surface. This could be due to the anti-inflammatory properties of quail egg.

A faster rate of healing was observed in group A (Table 1) followed by group B (Table 2). This could probably be linked to a higher anti-inflammatory properties being present in the quail oil extract than in the quail as a whole [11]. Although A and B healed faster than the rest of the groups. This result is similar to the work reported in 2011 by Rastegar, *et al.* who worked on third degree burn in rats. The reason for the fast healing could be due to the anti-inflammatory and analgesic properties of quail egg Mahmoudi, *et al.* [16]. The delayed healing observed in group A (Table 1) (M^2) may be as a result of any of the systemic factors affecting wound healing as this specific rabbit was found to be emaciated during the experiment. The result in group B (F^2) and (M^2) also showed a delay in healing which may be due to local or systemic factors affecting wound healing.

The group treated with topical antibiotics (penicillin ointment) (group C; Table 3) reported delayed healing in 3 groups C (M^1), (M^2), (F^2) only (F^1) which showed healing on the 16th day. This is similar to the work reported by Heal, *et al.* who observed that topical antibiotics such as penicillin ointment when applied on wound causes contact dermatitis, redness, itching and pain at the site which may lead to a delay in healing [17]. This delayed healing time could be because of contact or disturbance of the wound surface during application of the ointment.

In group D (Table 4), it was observed that only one sub group had delay (F^1) in day 16 more subgroups healed (M^1, $M^2$and F^2) in that day (day 16) compared to group C. This group is the third in the rate of healing from our studies. This could probably be due to the fact that the wound was a healthy and clean wound without bacterial infection so the antibiotic ointment (penicillin) had nothing to fight in order to speed up healing. This is in line with the work reported by Bishop [18]; Rodriguez, *et al*. who showed that oxygenation enhanced wound-healing processes by preventing wound infection, inducing angiogenesis, increasing keratinocyte differentiation, migration, re-epithelialization, and promoting wound contraction [19]. This is probably because the wound was able to breathe under a more conducive environment (adequate dressing) without contact disturbances.

Conclusion

Based on the result of this study, quail egg yolk and its oil were relatively faster although egg yolk oil showed faster healing rate and wound contraction followed by egg yolk, then the negative control group as the third. The last to heal was the positive control group. Thus, this finding has provided information on the possibility of utilizing quail egg yolk and its oil for the management of wound even in the rural areas. This study also showed that with an adequate dressing by providing a conducive environment for healing (in the absence of an infection), penicillin can only delay a healthy wound instead of increasing healing.

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