ORIGINAL ARTICLE

Impact of Eel Flour (*Monopterus albus*) on the Acceleration of Fracture Healing Process in *Rattus norvegicus* Wistar Albino Rat

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ABSTRACT

Introduction: Worldwide fractures among individuals are a major public health problem. As a result, fracture are the most common cause of severe enduring pain and physical disability, and they affect innumerable globally. It has been studied that nutrients that contain high protein helps in the fracture healing process. Eels contains many nutrients, such as phosphate, calcium, protein, collagen and amino acids that can help bone growth. The aim of this study was to examine the effect of eel flour (*Monopterus albus*) at multilevel dose content to accelerate the healing process of fracture in male *Rattus novergicus* Wistar Albino rat. **Methods:** This study design include experimental study with post-test only on controls group. The wok was conducted from May-June 2019 in the Laboratory of Anatomy of Stikes Piala Sakti Pariaman. The sampling was purposive sampling technique with a sample size of 24 rats. **Results:** The results of the ANOVA test have proved that administration of eel flour accelerates the healing process of the fracture showing 0.000, followed by Post Hoc LSD to determine the test of significant differences between groups. **Conclusion:** It was observed that with the increase in the dose of flour given to Wistar Albino rat fracture healing process became faster. From the present study it was evident that consumption of eel flour can accelerate the process of fracture healing. But there is need for further testing on humans as an effort to test the safety of the dose.

Keywords: Eel flour, Fracture, Healing Process

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INTRODUCTION

World Health Organization (WHO) reported that more than 2 million people suffered from fracture in 2017 (1). In some parts of the world, like Africa, the incidence of fractures due to traffic accidents are high (26.6%), while some regions of Europe has the lowest accident incidence (9.3%) (2). The study by Resikadas reported the prevalence of fractures in Indonesia to be 15.3%, in South it was Sulawesi (12.8%) and the least in Jambi (4.5%), in West Sumatra itself it was 5.8% (3). Comparison of the results of Riskesdas 2007 with Riskesdas 2013 showed a tendency of increase of the prevalence of fractures from 7.5% to 8.2% (4). Data from the Health Department of West Sumatra Province (West Sumatra Health Office) in 2014 found that around 2700 individuals experienced a fracture incident, 24% experienced death, 15% were cured and 5% experienced a psychological disorder or depression in the incident of a fracture (5).

A bone fracture is a medical disorder causing partial or complete break in the continuity of the bone. In worst condition, the bone may be broken into numerous pieces (6). Fractures can be caused by traumatic injuries, traffic accidents and can be caused by degenerative factors (7). The impact of fracture is impairment of mobilization, stress, mental disorders, compartment syndrome, arterial damage and others (8).

According to Townsend (2017) (9) fracture management can be done by detection, reduction, retention and rehabilitation. The steps are to restore the fragments in the previous position, hold bone fragments, and restore bone as much as possible. This can only be done in the hospital under the supervision of specialized person. According to Faizah (2015) (10) the nutrients containing high protein can help in the fracture healing process (11).

Wild edible vertebrates mainly those inhabiting aquatic environments, are utilized in the treatment of various health conditions (12). Fish are extensively used as traditional remedies in Zootherapeutic practices in many parts of the world. Efficient management will lead to the

development of traditional medicines from different fish species (13).

High-protein food like tryptophan can increase brain serotonin secretionas shown from many clinical trials (14). High amount of protein like tryptophan is present in eel's head powder is found to be beneficial in many respect (15). Eels contains lot of nutrients, such as phosphate, calcium, protein, collagen and amino acids that can help bone growth. Amino acids can help the process of activating osteoblasts. Calcium and phosphate can accelerate bone reabsorption for the formation of fibrous connective tissue (16)

The results of this study are expected to provide information in nursing as a primitive and preventive aid in helping accelerate the fracture healing process and can be used as a foundation for further testing on humans.

MATERIALS AND METHODS

This type of research is an experiment based with a posttest only. Control group design is a research that is used to measure the effect of treatment in the experimental group by comparing treatment results with the treatment period of control group. The treatments consisted of control group and the treatment groups of P1, P2, and P3. The control group as a group without treatment. In P1 eel flour was administered at a dose of 50 mg / kg BW, P2 eel flour was given at a dose of 100 mg / kg BW, P3 eel flour at a dose of 200 mg / kg BW.

The study was conducted between May-June 2019. The population of this study was rats (*Rattus novergicus* Strain Wistar) obtained from the experimental animal rearing unit. Work was done with a large sample of 24 rats. To avoid reduction in sample size due to drop out during treatment, 10% of the total sample was taken as extra in each treatment group so the number of rats was 28 initially. Before the research began, the preparation of tools included materials as follows: eels, rats, cages, drinking water, feed, surgical sets, chloroform, syringes, husks, gastric sonde and digital scales.

As many as 28 male rats about 2-3 months of age, body weight 200-4 grams with broken bones were used. Rats that met the criteria were adapted in the laboratory by being caged, fed and drinking water was provided *ad libitum*.

For the eel flour preparation, the eel is cleaned and cut into 3 cm pieces. Eels that have been cut are dried in the sun. After drying, the eel meat is crushed using a grinder. When smooth, the eel was dissolved with flour by adding hot water.

Rats that met the inclusion criteria were grouped into four groups. Eel flour was administered in rats by using gastric sonde at a dose of 50 mg / kg BW, 100 mg / kg BW, and 200 mg / kg BW in groups P1, P2, and P3. At the end of the study, rats were sacrificed to investigate their bones. Bone is removed by dissection to see the acceleration in the healing process of the fracture. This study protocol was approved by the Head of STIKES Piala Sakti Pariaman (Reference No 133/STIKes-Ps/ VII/2019, dated 13th June 2019) concerning researcher animal research code of ethics.

RESULTS

The results of the study were tabulated, and data analysis was done by computerization with normality testing using Shapiro-wilk, where the data were normally distributed and then One-Way ANOVA test was done.

From the results of analytical tests using ANOVA it was seen that there was acceleration in the average healing process of the fracture between the control group and the treatment group (Table I). After analyzing the data with One Way ANOVA, the p value was calculated as 0.00 showing that there is a significant influence of eel (Monopterus albus) flour administration on rats causing acceleration of the healing process of fracture.

Table I: Average Time to Accelerate the Fracture Healing Process in Rats

Group	Mean±SD	*P* value
Control	15 0.89	0.00
P1 Intervention 1	13 0.89	
P2 Intervention 2	10 0.89	
P3 Intervention 3	7.67 0.81	

From LSD Post Hoc Test it is known that the acceleration of the fracture healing process has a significant difference according to dose of eel flour (Figure 1). The faster healing process of fracture was found in the P3 group with an average of 7.67 days, while the longest healing process was found in the P1 group with 15 days and P2 with 10 days. This means that the greater the dose of eel

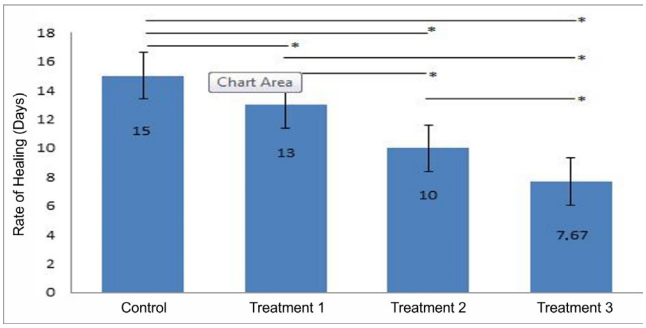

Fig. 1. Bar Diagram showing the Process of Fracture Healing Time in rats (*Rattus novergicus* Strain Wistar)

flour given, the faster the healing process of fracture.

Looking at the results of research statistics there are differences in the mean of each group of each variable. The results of the Post Hoc Test also revealed that there were significant differences in healing process of the control group and the treated group. This result is influenced by variations in the data with the treatment group consisting of 6 samples.

DISCUSSION

It is known that fish collagen *in situ* application may accelerate hard tissue formation acting both as a framework for seeded cells and a nutritional growth factor (17). The results of this study are supported by the results of earlier studies by Manabe *et al*., (2009) (18). This study showed that calcitonin in eels can induce healing of fractures. The effectiveness of healing by eel's calcitonin is known to be higher when compared to salmon and pork. From this study it was also confirmed that the ability of calcitonin was not only to cure but also preventive in action. It was proven that the power of calcitonin acts against fractures due to inductive osteoporosis in experimental animals that had a significant influence in terms of photometric analysis of bone tissue.

According to Karpouzos *et al*., (2017) (19) adequate level of animal protein has a significant relationship with bone density so that it is good for growth and repair of broken bones. Consuming adequate protein can help bone density, while collagen can accelerate the formation of bone matrix and amino acids. This can help the process of osteoblast activation. Calcium and phosphate can accelerate bone reabsorption by the formation of fibrous connective tissue (20).

Protein value in eels (18.4 g / 100 g meat) is higher than egg protein (12.8 g / 100 g) (21) Compared to other types of fish, the digestive power of eel protein is also very high. So, it is suitable protein sources recommended for infants and the elderly (22).

The quality of a protein can be accessed from the amount of amino acids that make up the protein. The results of the analysis of amino acids in fresh eel showed the presence of 15 amino acids consisting of 9 essential amino acids and 6 non-essential amino acids. The essential amino acids found in fresh eels are histidine, threonin, tyrosine, methionin, valine, phenylalanine, I-leucin, leucin, and lysine. Leucine and isoleucine are essential amino acids that are very necessary for the growth in children and maintain nitrogen balance in adults. Leucine is also useful for reforming and building muscle protein (23).

The healing process of fractures includes the process of bone reabsorption by osteoclasts and the formation of bone matrix by osteoblast cells and is assisted with the intake of nutrients such as protein, collagen, calcium, and phosphorus present in eels (24). Effective regenerative therapies are essential for the development of personalized medicine, which will be possible with the understanding of the differentiation and proliferation of progenitor cells or endogenous stem cells (25).

From the description above it can be said that the use of the eel flour accelerates the fracture healing process in case of rats. This is because of increased bone formation because of protein, collagen, amino acids, calcium and phosphate from eel flour and increased performance of osteoblasts that cause the process of bone formation, as a result of which bone matrix also increases.

CONCLUSION

From the present study it can be concluded that eel flour has a significant effect on the acceleration of the fracture healing process. As for the concentration, the dose of 200 mg / kg body weight of eel flour is the highest dose and most affective in accelerating the healing process of fracture compared to a dose of 100 mg / kg body weight, and 50 mg / kg body weight in rats (*Rattus novergicus* Strain Wistar).

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