



## THE EFFECT OF ALOE VERA TOWARD THE NUMBER OF FIBROBLASTS ON THE WOUND INCISION OF WISTAR RAT'S (RATUS NORVEGICUS)

Research Report

Chusnul Nur Fatmawati<sup>1</sup>, Ekowati Retnaningtyas<sup>2</sup> and Tavip Dwi Wahyuni<sup>3</sup>  
<sup>1,2,3</sup> Politeknik Kesehatan Kemenkes Malang

### ABSTRACT

**Introduction:** Incision is a wound caused by a sharp object, for example in surgery. The characteristics of the wound are pain, open wounds, and the length of the wound is greater than in it. Handling the wound there are various ways, one of which is using Aloe Vera. The aim of this study was to determine the effect of topical Aloe vera gel concentration of 10%, 20%, and 40% to determine the amount of fibroblast tissue in wistar strain rats (*Rattus norvegicus*) in incisions.

**Methods:** This study uses an experimental design with a sample of 75 rats divided into 5 groups; 0.9% NaCl group, 1% tulle-framycetin sulfate group, 10% Aloe vera group, 20% Aloe vera group and 40% Aloe vera group. Samples of incisional wound skin were performed on days 3, 7, and 12. All data were processed and analyzed statistically using SPSS 20. Based on microscopic observations at 10 times per field of view, the highest number of fibroblasts given at NaCl was given on the day 12th is 28.98 per field of view, treatment using tulle-framycetin sulfate 1% is 34.5 per field of view, treatment using Aloe vera 10% is 17.32 per field of view, treatment using Aloe vera 20% is 33, 9 per field of view while the treatment using Aloe vera was 40% ie 18.7 per view.

**Results :** The results of the study with the Independent T-test and Paired T-test showed that the results of fibroblast tissue between 0.9% NaCl group, 1% tulle-framycetin sulfate, 10% Aloe vera, 40% Aloe vera with 20% Aloe vera there were differences which were significant ( $p < 0.05$ ) where 20% Aloe vera gave effective results in the wound healing process.

**Conclusion :** This study concluded that 20% of Aloe vera can be used as an alternative choice of wound healing. In the next study it is expected to examine the variable TGF (Transforming Growth Factor) that affects cell growth in wound healing.

### ARTICLE INFO

Received 21 December 2019

Accepted 8 May 2020

Online 29 May 2020

\*Correspondence:  
Chusnul Nur Fatmawati

\*Email:  
chusnulnur9@gmail.com

**Keywords:**  
Aloe Vera Gel, Incision Wounds,  
Number of Fibroblasts

### INTRODUCTION

Injury is damage to somebody tissue caused by sharp or blunt trauma, changes in temperature, chemicals, explosions, electric shock, or animal bites. Various forms of wounds - for example cuts or vulnus scissum wounds caused by sharp objects, while stab wounds are also called vulnus laceratum caused by spiky objects (Sjamsuhidajat & de Jong, 2017). Wounds can also be intentionally made for specific purposes such as incised wounds or incisions in surgery and are also caused by trauma such as injuries resulting from accidents (Doherty, 2015).

Based on data obtained from the American wound association in 2009, 110.30

million cases of surgical wounds, 1.60 million cases of trauma wounds, 20.40 million cases of blisters, 10 million cases of burns, and 8.50 million cases of pressure ulcers (Diligence, 2009). In addition, according to the Indonesian Ministry of Health (2008) the prevalence in Indonesia for open wound injuries was 25.4% with the highest prevalence in Central Sulawesi at 33.3%. Based on the age group of open travel most frequently found was in the age group of 25-34 years (32.0%).

Wound care is needed to prevent infection in the wound. Wound care can use tulle as a dressing and 0.9% NaCl as washing fluid. The use of tulipamycetin sulfate 1% in wound care can cause allergic reactions and

systemic absorption in wounds that cover the surface of the body 30% or more. While NaCl 0.9% is a wound wash that has no side effects on healthy tissue so it is widely used in clinical services (Maryunani, 2015). In this era, people are heading back to nature because herbal medicines have no side effects if used according to their dosage. The phenomenon of the community's need for drugs today encourages the development of natural material research in wound care by minimizing the effects that arise on the body (Yovita, 2010 in Prasetyo., Et al. 2010).

Wound healing is a complex and dynamic process with predictable patterns. The physiological process of wound healing is divided into 3 phases, namely the inflammatory phase, the polyphase phase, and the maturation or remodeling phase. Between one phase and another phase has overlapping and overlapping time. The process of wound healing depends on the depth of the wound and through a simple process, beginning with cleaning (debris) the wound closes. (Arisanty, 2014). According to Morison (2014) states that in the inflammatory phase occurs at the beginning of events from day 0 to day 3. The proliferation phase occurs on the 3rd day until the 24th day. While in the remodeling or maturation phase occurs on the 24th day to one or two years, namely the phase of strengthening new skin.

One of the herbs that have the potential to heal wounds is Aloe Vera. Aloe vera plants consist of anthracene hydroxyl derivatives including aloin A and B2 in the amount of 25% - 40% of chromone compounds, and their derivatives such as aloin A, B2, and C. resin Other important compounds contained in aloe vera include glucose, mannose, and cellulose and various enzymes, oxidase, amylase, and catalase as well as vitamins B1, B2, B6, C, E and folic acid and minerals such as calcium, sodium, magnesium, zinc, copper, and chrome. Aloe vera mucus consists of several glycoproteins which prevent inflammation, pain, and accelerate wound repair. Glucomonants found on aloe vera affect the growth factor of fibroblasts and stimulate cell activity and proliferation and increase collagen production and secretion (Wilksman, 2007).

Based on research conducted by Ruaww (2016) which tested the effect of aloe vera (Aloe Vera) on the closing time of the cut in the oral mucosa of the wistar rat the results obtained that the average amount of wound closure time in the treatment group given topical aloe vera was faster with 8 days compared with a control group that was not given aloe vera topically with 12

days. Therefore researchers, conducting research by using aloe vera gel on the cut.

In addition, research conducted by Dewi (2018), which tested the effectiveness of aloe vera gel on the number of fibroblast cells in the healing process of guinea pig incision states that aloe vera gel 75% can increase the number of fibroblasts compared to the control group. Whereas research in rat Wistar strain (Ratus norvegicus) has never been studied. Previous studies have been conducted on guinea pigs with 75% aloe vera gel. Therefore, researchers are interested in conducting wound healing studies of wistar strain rats using aloe vera gel with concentrations of 10%, 20%, and 40%.

According to Agung (2018) in the study the difference in the number of wistar strain mouse fibroblasts between those given using NaCl 0.9%, Silver Sulfadiazine 1%, Aloe vera 10% and Aloe vera 20%, that based on the analysis obtained did not have a significant difference in the number of fibroblasts. This means that the trial has the same results between Aloe vera 10% and Aloe vera 20% with Silver Sulfadiazine 1% as the golden standard in the hospital as a drug for burns. Therefore, the researchers intend to use the concentration of Aloe Vera gel (Aloe Vera) 10%, 20%, 40%, and the comparison uses tulle as the golden standard in the treatment of cuts.

Based on research conducted by Ainingsih (2018) on the formulation performed ointment extracts of aloe vera on the healing of cuts in the rat (Rattus norvegicus) that give ointment aloe vera extract by treatment by applying a 1x daily to the spine of rats with concentration ointment 10%, 30%, 50% betadine (positive control) and ointment base (negative control), the results of this study showed that the aloe extract ointment was able to accelerate my wound healing in white rats and had a healing percentage of 64.3%. Therefore, researchers intend to conduct research with different preparations, namely by using aloe vera gel. This was also supported by previous studies using aloe vera gel with a concentration of 10% and 20% of burns, but in this study the wound healing process observed was in the wound. In aloe vera gel or ointment there are active substances that can accelerate wound healing namely saponins, tannins, and flavonoids. However, the advantages of aloe vera gel preparations there are active ingredients of glycerin which more quickly increase the effectiveness and acceptability in the wound healing process (Aprilia, 2007).

Based on these research data, aloe vera (Aloe Vera) has many benefits in

assisting the wound healing process so that it becomes the reason for researchers to conduct research on the effect of topical administration of aloe vera gel ( Aloe Vera ) on wound healing which includes macroscopic images, total protein, number of fibroblasts, the thickness of the epithelium, germ colonies, the number of leukocytes in rats in the Wistar strain (Rattus norvegicus ). Observations to be made by researchers are the effect of giving Aloe Vera gel to the number of fibroblasts on days 3, 7, and 12 because the 3rd day represents the inflammatory phase, the 7th and 12th days represent the proliferation phase. Aloe vera gel as a treatment group uses concentrations of 10%, 20%, and 40%.

This study aims to determine the effect of aloe vera extract ( Aloe Vera) concentrations of 10%, 20%, 40% on the number of Wistar strain mouse fibroblasts in cut wounds.

## MATERIALS AND METHODS

In this study, researchers used a true experimental research design. The method of observation in this study used the post-test only control group design observation, which was to measure the effect of aloe vera gel with concentrations of 10%, 20% and 40% in the experimental group and compared with the control group using tulle- framycetin sulfate 1% and NaCl 0.9%. In this design there are 2 treatment groups and 2 control groups.

The population in this study used Wistar strain rats ( Rattus Norvegicus ) which fit the inclusion criteria. The number of samples of this study was calculated using the Federer formula so that the number of samples for each group of at least 5 animals was produced.

The examination was carried out three times namely the 3rd day, the 7th day, and the 12th day of each group and there was 1 reserve in each group. So that each observation day needed 25 mice.

So the total sample needed is 80 heads, but the one used for sampling is 75 heads. Researchers made the incision wound by means of the back shaved to the surface of the skin, then disinfected with 70% alcohol then made the incision wound, then the incision wound is made using handvat mess on the right or left back. The length of the wound is made  $\pm$  2 cm, with depth to subcutis. After that, wound care is done every 2 days according to the group.

The instrument in this study was to provide treatment and observation sheets. After administration of aloe vera gel extract, staining of Hematoxylin Eosin to see the number of fibroblasts microscopically after daily wound care. After the wound is treated, skin specimens are taken on days 3,7 and 12 to observe the number of fibroblasts. The results of this observation are attached to the observation sheet to find out the number of fibroblasts in the skin tissue between the control group and the treatment group.

Analysis of the data used for the number of fibroblasts is a bivariate comparison test. Previously the data will be tested for normality using the Kolmogorov Smirnov test. A data is said to have a normal distribution if the value of  $p$  (value)  $>$  0.05 and not normally distributed if the value of  $p$  (value)  $<$  0.05 (Dahlan, 2009). If the data are normally distributed on the number of fibroblasts will be continued with the Independent T-test statistical test and if the data obtained is not normally distributed on the number of fibroblasts will be continued with the Mann-Whitney statistical test.  $P$  (value) is significant if  $<$  0.05 and not significant if  $p$  (value)  $\geq$  0.05. Data processed using SPSS 16.

## RESULTS

The results of this study are the number of fibroblasts based on 10x the point of view observed using a microscope (Figure attached).

### **A. Analysis of the number of fibroblasts rat strain wistar with wounds carved up between the given treatment with NaCl 0.9%, Tulle –framycetin sulfate 1%, Aloe Vera 10%, Aloe Vera 20%, and Aloe Vera 40% day – 3**

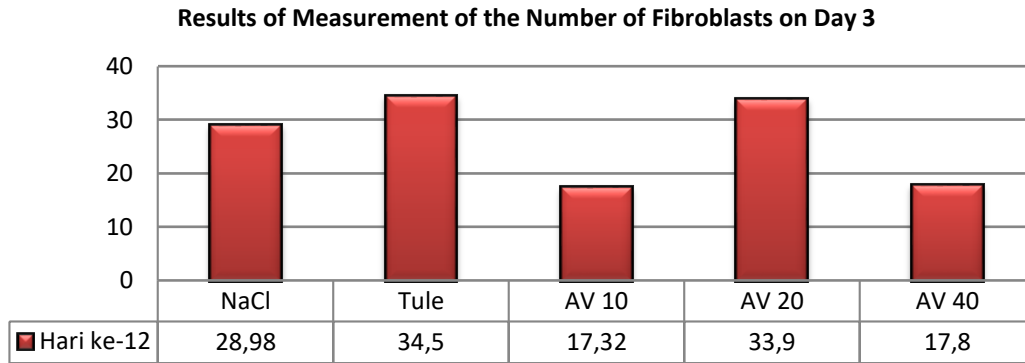


Diagram 1 Based on diagram 1 shows that the highest number of wistar strain mouse fibroblasts with lacerations on the 3rd day of examination was highest in the group treated using Tule -framycetin sulfate 1% by 14.64 per field compared to using 0.9% NaCl, Aloe Vera 10 %, Aloe Vera 20%, and Aloe Vera 40%.

**B. Analysis of differences in the number of Wistar strain mouse fibroblasts between those given treatment using NaCl 0.9%, Tule -framycetin sulfate 1%, Aloe Vera 10%, Aloe Vera 20%, and Aloe Vera 40% on day 7**

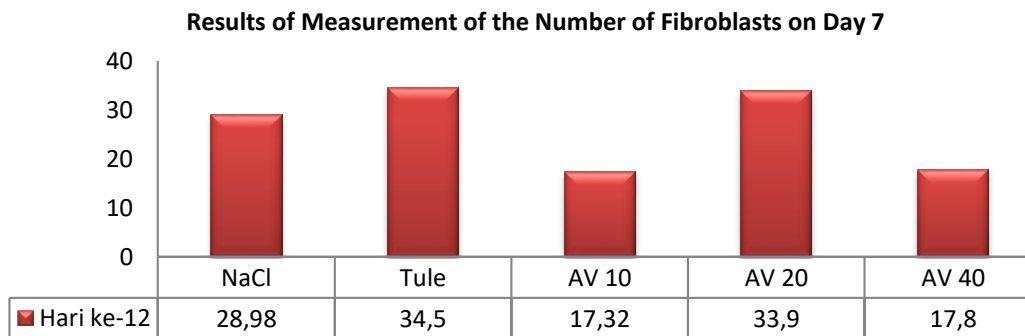


Diagram 2 Based on Diagram 2 shows that the highest number of wistar strain rat fibroblasts with cut wounds on the 7th days' examination was highest in the group treated with Aloe Vera 20% by 21.2 per visual field compared to using 0.9% NaCl, Tule -framycetin sulfate 1%, Aloe Vera 10% and Aloe Vera 40%.

**C. Analysis of the number of Wistar strain mouse fibroblasts among those given treatment using NaCl 0.9%, Tule -framycetin sulfate 1%, Aloe Vera 10%, Aloe Vera 20%, and Aloe Vera 40% on day 12**

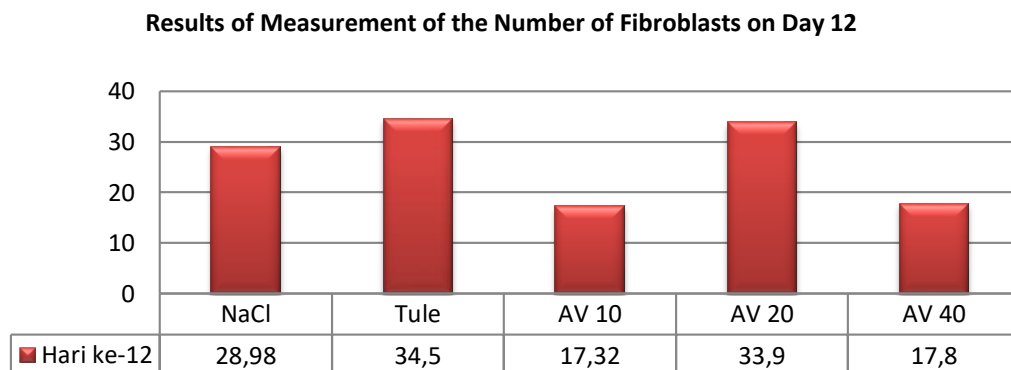


Diagram 3. Based on Diagram 3 shows that the number of Wistar strain mouse fibroblasts with cut wounds on the 12th days' examination was highest in the group treated using Tule -framycetin sulfate 1% by 34.5 per visual field compared to using 0.9% NaCl, Aloe Vera 10%, Aloe Vera 20%, and Aloe Vera 40%.

**D. Analysis of the number of Wistar strain mouse fibroblasts among those given treatment using NaCl 0.9%, Tule- framycetin sulfate 1%, Aloe vera 10%, Aloe vera 20%, and Aloe vera 4 0% on days 3,7 and 12.**

**Results of Measurement of the Number of Fibroblasts on Day3, 7, dan 12**

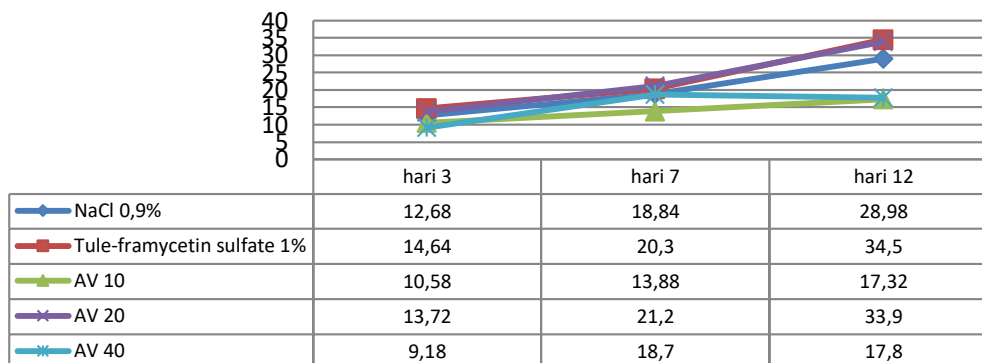


Diagram 4. Based on Diagram 4 shows that the number of fibroblasts with cuts given treatment with NaCl 0.9% average growth occurred with the highest number of fibroblasts on day 12 as much as 28.98 per visual field, to treatments with Tule -framycetin sulfate 1% an average growth occurred with the highest number of fibroblasts on day 12 as much as 34.5 per field of view, for treatment with Aloe vera 10% there was an average growth with the highest number of fibroblasts on day 12 as many as 17.32 per field, for treatment with Aloe vera 20% there was an average growth with the highest number of fibroblasts on day 12 as much as 33.9 per visual field and treatment with Aloe vera 40% had an average growth with the highest number of fibroblasts on day 7 ie 18, 87 per field of view.

Results of analysis The number of fibroblasts on examination after treatment between those using treatments using NaCl 0.9%, Tule -framycetin sulfate 1%, Aloe vera 10%, Aloe vera 20%, and Aloe vera 40% on days 3,7 and 12. The NaCl group showed 0.9%, Tule -framycetin sulfate 1%, Aloe vera 10%, Aloe vera 20%, and Aloe vera 40% on days 3,7 and 12. There were significant differences, so the use of these groups effectively used for wound healing.

**DISCUSSION**

Changes in the number of fibroblasts given treatment using 0.9% NaCl, Tule -framycetin sulfate 1%, Aloe Vera 10%, Aloe Vera 20%, and Aloe Vera 40% on days 3, 7 and 12.

In the group that was given treatment using NaCl, it was seen that there was an increase in the number of fibroblasts on day 7 and 12, which between the NaCl group with Aloe Vera 10% and Aloe Vera 40% obtained a significant value of 0.0001 then there was a significant difference between NaCl and Aloe Vera 10% and Aloe Vera 40%.

In the group that was given treatment using Tule -framycetin sulfate 1% increased on the 7th day, and 12 which between the Tule -framycetin sulfate 1% group with Aloe Vera 10% and Aloe Vera 40% obtained a significant value of 0,000, then there were differences which is significant between Tule -framycetin sulfate 1% with Aloe Vera 10% and Aloe Vera 40%.

In the group that was given treatment using Aloe Vera 20% with Aloe Vera 10% and Aloe Vera 40% obtained a significant value

of 0,000 then there was a significant difference between Aloe Vera 20% with Aloe Vera 10% and Aloe Vera 40%. Whereas in the Tule -framycetin sulfate 1% group and Aloe Vera 20% a significant value of  $p > 0.05$  was obtained, meaning there was no significant difference between Tule -framycetin sulfate 1% and Aloe Vera 20%.

The use of Tule -framycetin sulfate 1% is an antibiotic, this class of drug has low systemic absorption and is used in topical preparations for skin infections. In addition, Tule -framycetin sulfate 1% can reduce bacterial levels and increase healing in wounds. The sterile gauze has two sides, the side that comes in contact with the wound is useful for absorbing wound drainage while the dry side in contact with the wound is useful for absorbing the exudate and debris of the wound.

In Gurnarso's research (2013) the topical use of this antibiotic plays a role both in the rate of epithelialization in superficial wounds and in deeper wounds, moist wound conditions can also help the process of tissue regeneration take place optimally. Wound care with Tule -framycetin sulfate 1% will

accelerate angiogenesis and will stimulate blood vessel formation more quickly.

Wound care using Aloe Vera can increase the number of fibroblasts and there are some ingredients from aloe vera which are saponins. Saponins are steroids. Saponin will activate the function of TGF- $\beta$ . Saponin will increase TGF- $\beta$  expression at fibroblast receptors. TGF- $\beta$  will stimulate migration and proliferation of fibroblasts. Other contents of aloe vera are vitamin C and vitamin E which function as antioxidants that can neutralize free radicals that are the result of neutrophil phagocytosis against a bacterium and debris in the process of wound healing (respiratory burst process). This antioxidant will reduce lipid peroxidation which will slow down cell necrosis and increase vascularity.

So that in this study obtained Aloe Vera 20% and Tulle-framycetin sulfate 1% as the golden standard given in the hospital is effective in increasing the number of fibroblasts with cut wounds.

## CONCLUSION

Aloe Vera gel (Aloe Vera) concentrations of 10%, 20%, and 40% affect the number of fibroblasts on wound healing, but the concentration of Aloe Vera gel (Aloe Vera) 20% is more effective at healing wound cuts on the number of fibroblasts in wistar rats.

This study concluded that 20% of Aloe vera can be used as an alternative choice of wound healing. In the next study it is expected to examine the variable TGF (Transforming Growth Factor) that affects cell growth in wound healing.

## REFERENCES

- Adnan, N.F. 2007. *Tampilan Anak Tikus (Rattus norvegicus) Dari Induk Yang Diberi Bovin Somatotropin (Bst) Pada Awal Kebuntingan*. Skripsi. Fakultas Kedokteran Hewan Intitusi Pertanian Bogor.
- Ainingsih dkk. 2018. *Formulasi Sediaan Salep Ekstrak Lidah Buaya (Aloe Vera) sebagai Obat Luka Sayat Pada Tikus Putih (Rattus norvegicus)*. Dikutip dari [https://www.researchgate.net/profile/Hardani\\_Ahyar/publication/327965945.....](https://www.researchgate.net/profile/Hardani_Ahyar/publication/327965945.....) pada tanggal 21 November 2018.
- Ali Taqwim. 2011. *Peran fibroblas pada proses penyembuhan luka*. Fakultas Kedokteran Gigi Universitas Jember. <https://dentosca.wordpress.com/2011/04/18/peran-fibroblas-pada-proses-penyembuhan-luka/>. Diakses pada tanggal 17 September 2018.
- Ananda, H. & Zuhrotun, A. 2017. *Review: Aktivitas Tanaman Lidah Buaya (Aloe Vera Linn) Sebagai Penyembuh Luka*. Diunduh dari: [jurnal.unpad.ac.id/farmaka/article/viewFile/13011/pdf](http://jurnal.unpad.ac.id/farmaka/article/viewFile/13011/pdf). Diakses pada tanggal 17 September 2018.
- Arifin, Jamal. 2014. *Intensif Budidaya Lidah Buaya Usaha dengan Prospek yang Kian Berjaya*. Yogyakarta: Pustaka Baru Press.
- Arisanty, I. P. 2014. *Manajemen Perawatan Luka: Konsep Dasar*. Jakarta: EGC.
- Buwono, E, A, M. 2018. *Perbedaan Jumlah Fibroblas pada Perawatan Luka Bakar Derajat II Antara Menggunakan NaCl 0,9% dan SSD 1% dengan Gel Lidah Buaya (Aloe Vera) pada tkus Galur Wistar*. Skripsi. Prodi D4 Keperawatan Malang Poltekkes Kemenkes Malang.
- Carlos, L, J. 2007. *Histologi Dasar : Teks & Atlas*, Ed.10. Jakarta: EGC
- Dahlia, FM Delly. 2014. *Pemberian Ekstrak Teh Putih (Camellia sinensis) Oral Mencegah Dislipidemia pada Tikus (Rattus norvegicus) Jantan Galur Wistar yang Diberi Diet Tinggi Lemak*. Tesis. Program Pascasarjana Universitas Udayana Denpasar.
- Dewi, S.P 2018. *Efektivitas Ekstrak Lidah Buaya terhadap Jumlah Sel Fibroblas pada Penyembuhan Luka Incisi pada Marmut*. Dikutip dari <https://isainsmedis.id/index.php/ism/article/viewFile/272/200>. pada tanggal 12 November 2018.
- Djuwita, Harlystiarini, T., dkk. 2010. *Tingkat pertumbuhan dan analisa protein sel-sel fibroblas fetal tikus hasil kultur in vitro*. Diunduh dari: [journal.ipb.ac.id](http://journal.ipb.ac.id). Home. Vol 1. No 2 (2010) Diakses pada tanggal 17 September 2018
- Federer, W. 1963. *Experimental design, Theory and Application*. Mac. Millan, New York.
- Furnawanthi, I. 2002. *Khasiat dan Manfaat Lidah Buaya*. Jakarta: AgroMedia Pustaka
- Hidayat, A. A. A. 2008. *Riset Keperawatan dan Teknik Penulisan Ilmiah*. Edisi 2. Jakarta: Salemba Medika
- Hidayat, A. A. A. 2014. *Pengantar Kebutuhan Dasar Manusia*. Edisi 2. Jakarta: Salemba Medika.
- Maryunani, A. 2015. *Perawatan Luka (Modern Woundcare) Terlengkap dan Terkini*. Bogor: IN MEDIA.
- Messakh, B. D. 2009. *Bahan Mata Kuliah Luka, (Online)*, (<https://fkuwks2012c.files.wordpress.com/2015/09/bmk-luka.pdf>), diakses pada tanggal 17 September 2018.

- Morison, M. J. 2003. *Manajemen Luka*. Jakarta: EGC.
- Nursalam. 2008. *Konsep dan Penerapan Metodologi Penelitian Ilmu Keperawatan*. Jakarta: Salemba Medika.
- Potter & Perry. 2006. *Buku Ajar Fundamental Keperawatan : Konsep, Proses, dan praktik*. Edisi 4. Jakarta: EGC.
- Setiadi. 2013. *Konsep dan Praktik Penulisan Riset Keperawatan*. Ed. 2. Yogyakarta: Graha Ilmu.
- Sjamsuhidajat & de jong. 2017. *Ilmu Bedah*. Jakarta: EGC
- Sumbayak, E. M. 2015. *Fibroblas: Struktur dan Peranannya dalam Penyembuhan Luka*. Dikutip dari <http://ejournal.ukrida.ac.id/ojs/index.php/Ked/article/view/1169>. Pada tanggal 11-10-18.
- Wyat,Jonathan. 2011. *Uji Efek Penyembuhan Luka Sayat Ekstrak Etanol Daun Kecombrang (Etlingera elatior) dalam Bentuk Sediaan Gel terhadap Kelinci (Orytolagus)*. Skripsi S1. Bagian Farmasi Fakultas Kedokteran UIN Alaudin. Di kutip dari [repositori-uin-alaudin.ac.id/6782/1/....](http://repositori-uin-alaudin.ac.id/6782/1/....) Pada tanggal 11-10-18.