

Chana striata Albumin Gel Accelerate Post tooth extraction Wounds healing on Diabetes Mellitus Rats

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ABSTRACT

Background: Patients with type 2 diabetes often experience slow wound healing due to poor neovascularization, macrophages, and fibroblasts; therefore, medicine is needed to speed up the wound healing process, one of which is albumin. Albumin is a protein that has been shown to have antioxidant properties and also plays a role in accelerating the inflammatory process and stimulating the growth of new cells.

Method: This research used laboratory experiments and a post-test-only control group design. The number of research samples used was 26 Wistar rats. Chana striata albumin gel extract is made by maceration and gelled using CMC (carboxyl methyl cellulose). The assessment method involves observing fibroblasts, neovasculature, and macrophages, which are visible in Hematoxylin, Eosin, and Toluidine blue staining.

Result: The results of the research showed that the group that was given Chana striata albumin extract gel had a higher average number of neovascular, macrophage, and fibroblast values than the group that was not given Chana striata albumin extract gel. The Mann-Whitney test and independent sample T-Test showed that there were significant differences between the two groups.

Conclusion: The conclusion from this research is that there is an effect of giving Chana striata albumin gel on tooth extraction wounds in diabetes mellitus rats.

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INTRODUCTION

Diabetes Mellitus is a disease of abnormal blood sugar levels that disrupts the body's working system, which is characterized by GDS values >200 mg/dL and GDP >130 mg/dL¹, type 2 diabetes mellitus is a metabolic disease characterized by increased blood glucose levels due to reduced insulin secretion by pancreatic beta cells or impaired insulin resistance², the increase in type 2 Diabetes Mellitus, for example, a bad lifestyle such as eating unhealthy food which results in obesity³ This can cause wound healing to be hampered due to damage to the blood vessel walls and there is a risk of infection⁴.

Tooth extraction is the removal of the tooth and tooth root from the socket which involves bone tissue and soft tissue in the oral cavity⁴, diabetic sufferers who have their teeth extracted will result in hypoglycemia, are susceptible to infection because the secretion of the salivary glands is dysfunctional so that there will be a decrease in the rate of saliva and an increase in the number of bacteria and fungi in the oral cavity^{5,6}, this also risks causing dry socket⁷, dry socket occurs because the bone healing process is disrupted⁸.

Therefore, other alternatives are needed to speed up the wound healing process in diabetes mellitus patients. One other alternative to speed up the wound healing process is to use protein⁹. Protein is needed in the wound healing process, an important component of protein is albumin¹⁰.

Albumin can be obtained chemically or from animal sources, albumin obtained chemically is the drug plasmumin, octalbin, this drug has disadvantages such as being expensive¹¹, albumin obtained from animal sources can be taken from various types of animals. In this study, researchers chose *Chana striata* because it has more benefits than synthetic albumin, *Chana striata* are often found and easy to get in the Jepara area and the price is affordable.¹², *Chana striata* have a higher albumin content than eel fish. *Chana striata* have high protein levels¹³, every 100 grams of *Chana striata* is equal to milkfish¹⁴, this fish has a protein content of 42.23%, a water composition of 41.42% and a fat concentration of 2.84%.¹⁵

Most Diabetes Mellitus sufferers experience delays in the wound healing process. Based on the description above, researchers wanted to measure the effect of *Chana striata* albumin extract gel on tooth extraction wounds.

RESEARCH METHOD

This research is included in laboratory experimental research. The samples in this study were male Wistar rats that met the inclusion and exclusion criteria 26 rats. This research design uses Post Test Only Control Group Design. The inclusion criteria in this study were male Wistar rats aged 3 – 5 months, blood sugar levels > 200 mg/Dl. The instruments used are a light microscope, tweezers, glucose test strip, object glass and cover glass. Making *Chana striata* albumin extract gel, male Wistar rats were adapted and grouped into 2 groups, Wistar rat mandibles were taken, histology preparations were made and research results were assessed. The data obtained was quantitative data and the Independent Sample t-test and Mann Whitney test were carried out to determine whether there were significant differences

RESULTS

The research results obtained from the effect of giving *Chana striata* albumin gel to speed up tooth extraction wounds in rats with diabetes mellitus were divided into 2 groups, namely the group given albumin

extract gel and the group not given albumin extract gel. The groups obtained were fibroblast cells, macrophage cells and neovascularization as follows.:

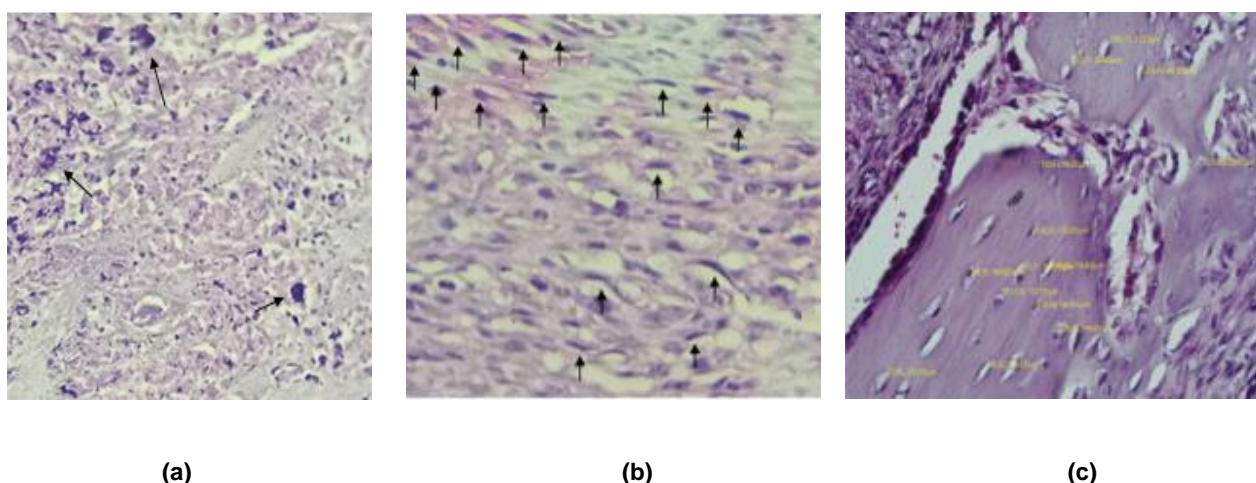


Figure 1. Histological picture of the (A) Macrophages Cell, (B) Fibroblast Cell dan (C) Neovascularization

Table 1. Mean and standard deviation in the treatment and control groups

No	Group	Mean	Std. deviation
1.	Macrophage control	0,953	0,307
	Macrophage treatment	3,800	0,244
2.	Neovascularization control	14,769	1,625
	Neovascularization treatment	18,069	2,311
3.	Fibroblast control	11,523	0,192
	Fibroblast treatment	16,892	0,361

Table 1. Based on table 1, it can be seen that the average number of macrophages, neovascular and fibroblasts in the mandibular central incisor tooth extraction sockets of Wistar rats in the control group had the lowest average compared to the treatment group, namely 0.953 for the average number of macrophages 14.769 for the average number neovascular and 11.523 for the average number of fibroblasts, the treatment group had the highest average, namely 3.8000 for the average number of macrophages, 18.069 for the average number of neovascular and 16.892 for the average number of fibroblasts. Next, the data was subjected to the Shapiro-Wilk test to determine normality.

Table 2. Normality test result

No	Group	Sig.	result
1	Macrophage control	0,042	Data is not normally distributed
	Macrophage treatment	0,271	Data is normally distributed
2	Neovascularization control	0,742	Data is normally distributed
	Neovascularization treatment	0,370	Data is normally distributed
3	Fibroblast control	0,002	Data is not normally distributed
	Fibroblast treatment	0,007	Data is not normally distributed

Table 2. The Shapiro-Wilk normality test was carried out to see the normality of data values resulting from research with a sample size of less than 50. According to table 2, the macrophage control group and all fibroblast groups had a sig value <0.05, meaning the data was not normally distributed, whereas in the treatment group macrophages and all neovascular groups have a sig value > 0.05, meaning the data is normally distributed.

Table 3. Homogeneity Test Result

No	Sig.	Result
1	0,292	Homogeneous data
2	0,123	Homogeneous data
3	0,072	Homogeneous data

Table 3. in all groups there is a significance value (P>0.05), meaning that all data is homogeneous. After obtaining the

normality test results and homogeneity test results, the next step is to continue with the Mann Whitney test and the Independent Sample T-Test.

Table 4. Mann Whitney result

No		n	Median (Minimum-Maximum)	Average \pm s.b.	p
1	Macrophage (control)	13	0,8 (0,6-1,6)	0,9 \pm 0,3	0,000
	Macrophage (treatment)	13	3,8 (3,4-4,2)	3,8 \pm 0,2	
2	Fibroblast (control)	13	11,6 (11-11,8)	11,5 \pm 0,2	0,000
	Fibroblast (treatment)	13	17 (16-17,2)	16,9 \pm 0,3	

Tabel 4. in macrophages results of the Mann Whitney test have a significance value of ($P < 0.05$) meaning that there is a significant difference between groups and in fibroblasts the results of the Mann Whitney test have a significance value of ($P < 0.05$) meaning that there is a significant difference between groups.

Tabel 5. Uji Independent Sample T Test result

No		n	Average \pm s.b.	p
1	Neovascularization (control)	13	14,7 \pm 1,6	<0,001
2	Neovascularization (treatment)	13	18,1 \pm 2,3	

DISCUSSION

The results of research conducted on male Wistar rats with diabetes mellitus (DM) induced tooth extraction on the mandibular central incisors, in Table 1 show a higher average number of neovascular, macrophage and fibroblasts in the treatment group compared to the control group, this is because the sufferers Diabetes mellitus experiences a long wound healing process, especially DM patients who undergo tooth extraction due to impaired wound healing⁶, This happens because people with diabetes mellitus have high blood sugar levels resulting in damage to the walls of blood vessels⁴, Apart from that, the increase in glucose levels in the blood will have an impact on changes in Adenosine Triphosphate (ATP) and activation of Caspade-3, these changes result in an increase in the number of proinflammatory cytokines, advanced glycation end-products (AGE's) and reactive oxygen species (ROS), This will cause the number of fibroblast cells in the body to undergo apoptosis so that the number of fibroblast cells in the tooth socket becomes small¹⁶, high blood sugar levels in the body can reduce insulin levels in the body, thereby affecting the function of immune cells such as macrophages to become slow, namely the function of chemotaxis, phagocytosis, activation of antigen presenting cells is disrupted¹⁷

. In tables 4 and 5, it can be seen that there are significant differences between macrophages, neovascular and fibroblasts in the treatment groups. This is because the albumin content in *Chana striata* has various benefits. One of the contents of *Chana striata* albumin is that it has cysteine and thiol bonds, these bonds can accelerate the formation of neovascularization by binding excess reactive oxygen species in the body. ROS is an important stimulator in the angiogenesis process¹⁸, Other ingredients in *Chana striata* include omega-3 fatty acids such as eicopentaenoic acid (EPA), This content functions to help fibroblasts in collagen synthesis and also increases interleukin-6 levels so that it can accelerate collagen production¹⁹, albumin content in *Chana striata* like omega 3 fatty acids function to increase prostaglandin levels, these prostaglandins function to activate macrophages so that the number of macrophages increases^{19,20}.

CONCLUSION

There was an effect of giving Chana striata albumin gel on the tooth extraction wounds of Diabetes Mellitus rats. There was a significant effect in the form of a high number of macrophage cells, fibroblast cells and neovascular cells compared to mice that were not given Chana striata albumin extract gel in the tooth socket area, this proves that the gel Chana striata albumin extract is effective in accelerating the wound healing process.

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REFERENCES

1. Bathari ACR, Rahmawati F, Sari IP. Hubungan Drug Related Problems (DRPs) Obat Antidiabetika terhadap Ketercapaian Kendali Glikemik pada Pasien Rawat Inap Diabetes Mellitus Tipe 2 dengan Komplikasi Nyeri Neuropati. *J Manaj DAN PELAYANAN Farm (Journal Manag Pharm Pract* 2021;10(4):249–260; doi: 10.22146/jmpf.57829.
2. Fatimah RN. DIABETES MELITUS TIPE 2. *J Major* 2015;4(5):93–101; doi: 10.14499/indonesianjpharm27iss2pp74.
3. Imelda SI. Faktor-Faktor Yang Mempengaruhi Terjadinya diabetes Mellitus di Puskesmas Harapan Raya Tahun 2018. *Sci J* 2019;8(1):28–39; doi: 10.35141/scj.v8i1.406.
4. Himammi AN, Hartomo BT. Ekstraksi Gigi Posterior dengan Kondisi Periodontitis Kronis Sebagai Persiapan Pembuatan Gigi Tiruan Lengkap pada Pasien Diabetes Mellitus. 2020;8(1):6–10.
5. Payung H, Anindita P, Hutagalung B. Gambaran Kontraindikasi Pencabutan Gigi Di Rsgm Unsrat Tahun 2014. *J Kedokt Komunitas Dan Trop* 2015;3(3):170–179.
6. Surachman A, Paramita M, Kurniawan AA. Laporan Kasus: Manajemen Perawatan Gigi pada Pasien dengan Periodontitis Kronis disertai Diabetes Mellitus. *STOMATOGNATIC - J Kedokt Gigi* 2019;16(1):1; doi: 10.19184/stoma.v16i1.19949.
7. Uzmayana SRDSAD. Potensi Kombinasi Saffron Dan Binahong Sebagai. *Pros Dent Semin Univ Muhammadiyah Surakarta* 2019;125–140.
8. Wallace BYTC, Velasco A, Lay T, et al. The Effectivity of Thymoquinone Extract of Black Seeds to Blood Glucose Level and post extraction healing in Diabetic-Induced Rats. *Bull Seismol Soc Am* 2016;106(1):6465–6489.
9. Madiyanti DA, Anggraeni S, Melinda A. Hubungan Asupan Protein Dengan Penyembuhan Luka Pada Pasien Post Op Sectio Caesarea (SC) di Rumah Sakit Umum Daerah Pringsewu Lampung Tahun 2016. *J Asuhan Ibu Anak* 2018;3(6):1–9.
10. Sugiartanti MF, Oesman D, Elfiah U. Pengaruh Kadar Albumin Serum terhadap Penyembuhan Luka pada Pasien Pascaoperasi Laparotomi dan Lumbotomi di RSD dr. Soebandi Jember. *Pustaka Kesehat* 2018;6(3):383; doi: 10.19184/pk.v6i3.9775.
11. Desiyana LS, Husna FA, Vonna A. Evaluasi Penggunaan Human Serum Albumin (HSA) pada Pasien Rawat Inap Penyakit Dalam di Rumah Sakit Provinsi Aceh. *J JIFS J Ilm Farm Simplisia*, Desember 2021;2021(1):74–81.
12. Utomo B, Budiastuty S, Muryani C. Strategi Pengelolaan Hutan Mangrove Di Desa Tanggul Tlare Kecamatan Kedung Kabupaten Jepara. *J Ilmu Lingkung* 2018;15(2):117; doi: 10.14710/jil.15.2.117-123.
13. Utami NK, Amperawati M. Sediaan Nanopartikel Kitosan Ekstrak Ikan Gabus (Channa Striata) Dan Uji Aktivitas Albumin Terhadap Penyembuhan Luka Pasca Pencabutan Gigi. *J Skala Kesehat* 2020;11(1):12–20; doi: 10.31964/jsk.v11i1.233.
14. Wulan M, Juliani S, Arma N, et al. Pemberian Ikan Gabus Dalam Penyembuhan Luka Perineum Pada Ibu Post Partum. *J Kebidanan Malahayati* 2021;7(4):766–771; doi: 10.33024/jkm.v7i4.5238.
15. Sakti H, Lestari S, Supriadi A. Perubahan Mutu Ikan Gabus (Channa Striata) Asap Selama Penyimpanan. *J Teknol Has Perikan* 2016;5(1):11-18–18; doi: 10.36706/fishtech.v5i1.3514.
16. Lukman, Hakim Hidayat Priyo hadi D radhitia. Effect of Topical ZnSO4 1 % on the MMP-9 Expressions and the Number of Fibroblast in Traumatic Ulcer Healing of Diabetes Mellitus Wistar Rats Diabetes

- mellitus is the worldwide metabolic disease and lead to higher mortality in every years around the globe. E-Prodenta J Dent 2018;2(2):163–171.
17. Tiara R, Tri A. Hubungan Antara Diabetes Mellitus Tipe 2 Dengan Risiko Peningkatan Kejadian Tuberkulosis Paru. Semin Nas Ris Kedokt 2 2021;2(1):95.
 18. Royyana A, Carabelly AN, Aspriyanto D. THE INFLUENCE OF TOMAN FISH (*Channa micropeltes*) EXTRACT ON THE NUMBER OF NEOVASCULAR IN DIABETES MELLITUS WOUND HEALING In Vivo Study on the Back of Male Wistar Rat (*Rattus norvegicus*). DENTINO J Kedokt Gigi 2018;3(2):101–107.
 19. Prayugo B, Ichwan M, Yamamoto Z. Potensi Ekstrak Ikan Gabus Terhadap Kesembuhan Luka Diabetes. J Kedokt Syiah Kuala 2021;21(2):172–183; doi: 10.24815/jks.v21i2.20376.
 20. Agustin R, Dewi N, Rahardja SD. Efektivitas Ekstrak Ikan Haruan (*Channa striata*) dan Ibuprofen Terhadap Jumlah Sel Neutrofil Pada Proses Penyembuhan Luka Studi in Vivo pada Mukosa Bukal Tikus (*Rattus norvegicus*) Wistar. Dentino (Jurnal Kedokt Gigi) 2016;1(1):68–74.