

"Evaluation of 5% Robusta Coffee Extract Gel in Enhancing Angiogenesis, Collagen Deposition, and Wound Texture During Skin Graft Healing in Long Evans Rats."

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ABSTRACT

Skin grafting remains a fundamental reconstructive technique for covering tissue defects, particularly in extensive wounds. Postoperative management typically involves the application of topical agents or modern wound dressings; however, these interventions often present limitations, such as high costs and limited availability—especially in resource-constrained settings. As a result, there is growing interest in exploring natural-based therapeutic alternatives. Among these, *Coffea canephora* (Robusta coffee) has emerged as a promising candidate due to its rich phytochemical profile, including chlorogenic acid (CGA), flavonoids, and saponins—compounds known for their antioxidant, anti-inflammatory, and pro-angiogenic properties. This study aimed to evaluate the efficacy of a 5% Robusta coffee extract gel (RCEG) in promoting wound healing in a split-thickness skin graft model using *Rattus norvegicus* (Long Evans strain). Thirty male rats were randomly assigned to three experimental groups: a negative control group receiving gel base only, a positive control group treated with 1% kojic acid gel, and a treatment group administered 5% RCEG. A standardized 2 × 2 cm split-thickness skin graft was harvested from the dorsal region and transplanted onto the donor site. Histopathological samples were collected on postoperative days 7, 14, and 21 to assess angiogenesis and collagen density. Histological analysis revealed that the treatment group exhibited a statistically significant increase in neovascularization, along with enhanced collagen deposition and density, compared to both control groups at all time points ($p < 0.05$). Furthermore, macroscopic assessment of wound texture—based on visual evaluation of wound color and surface morphology using ImageJ—showed notable improvement in the RCEG group, indicating better wound integration and maturation. In conclusion, topical application of 5% Robusta coffee extract gel significantly accelerates the wound healing process in skin grafts by enhancing angiogenesis, increasing collagen synthesis, and improving wound surface characteristics. These findings suggest that RCEG is a promising, cost-effective natural adjunct for postoperative wound care.

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Two Live Surgery & Conference	☐ LS1&LS3 ☐ LS2&LS3	IDR 11.000.000	IDR 12.000.000	USD 700	USD 800
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DAY 2 CONGRESS FRIDAY, AUGUST 1 ST , 2025					
08.00 - 09.00	Plenary Lecture 2 Moderator: Budiman Suhara - Jakarta Ballroom				
08.00 - 08.30	TBA Arya Tjipta - Medan				
08.30 - 09.00	The Updates on Tendon Healing and Repair Theddeus O.H. Prasetyono - Jakarta				
09.00 - 10.00	Nusantara Track 4 - Sumatera 2 Moderator: Eliza Nindhita - Medan Ballroom	Nusantara Track 5 - Java 2 Moderator: Ali Sundoro - Bandung Washington Room	Nusantara Track 6 - Bali-Nusra 2 Moderator: I Nyoman Putu Riasa - Denpasar New York Room	Nusantara Track 7 - Sulawesi Moderator: Mendy J. Hatibie - Manado California Room	Free Paper & Research Presentation Matlyland Room & Florida Room
09.00 - 09.15	Embracing the Concept of Functional Anatomy to Manage Hand Trauma Eliza Nindhita - Medan	09.00 - 09.12 Techniques for Bilateral Cleft Lip at Best Ali Sundoro - Bandung	09.00 - 09.12 Embracing the Advanced Techniques for Post Burn Reconstruction Under the BPJS Limitation I Nyoman Putu Riasa - Denpasar	Avoiding and Managing Complications in Flap Surgery Mendy J. Hatibie - Manado	
09.15 - 09.30	Embracing Aesthetic Concept in Reconstructive Works for the Face Ferdinand - Pekanbaru	09.12 - 09.24 Best Possible of Microtia Reconstruction Under the Public Insurance (BPJS) Policy Kristaninta Bangun - Jakarta	09.12 - 09.24 Developing Cleft and MaxilloFacial Surgery Service in Lombok Umu Istikharoh - Lombok	Non-Surgical Aesthetic Practices in Makassar Vini TIP Tango - Makassar	
09.30 - 09.45	Embracing Like with Like Concept in Microsurgical Soft Tissue Reconstructions Mufida Muzzakie - Palembang	09.24 - 09.36 Tissue Allograft Use in Public Hospital Based Practice Lynda Hariani - Surabaya	09.24 - 09.36 Writing and Teaching as Personal Documentation of Continuing Professional Development Robertus Arian Datusanantyo - Kupang	Teaching Plastic Surgery in General Surgery Training Program Bridges the Plastic Surgery Service in Eastern Indonesia I Nyoman Putu Riasa - Denpasar	
09.45 - 10.00	Discussion	09.36 - 09.48 Surgical Tips and Tricks for ZMC and Orbital Fracture? Vika Tania - Jakarta	09.36 - 09.48 Managing Minor and Moderate Acute Burn Wounds I. GST. PT. Hendra Sanjaya - Denpasar	Discussion	
		09.48 - 10.00 Discussion	09.48 - 10.00 Discussion		
10.00 - 11.00	Teatime Talk with Journal Editors & Coffee Break Moderator: Robertus Arian Datusanantyo - Kupang Ballroom				
10.00 - 10.30	Evidence and Quality of Published Article Kevin C. Chung - Michigan				
10.30 - 11.00	Discussion				

Free Paper & Research Presentation
Matlyand Room & Florida Room

Scientific Schedule

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DAY 2 CONGRESS FRIDAY, AUGUST 1 ST , 2025					
11.00 - 12.00	Lunch Symposium by DARYA VARIA Moderator: Selective. Proven. Reliable: HYALO4START for Effective Wound Bed Preparation Ballroom				
11.00 - 11.20	David S. Perdanakusuma - Surabaya				
11.20 - 11.40	Arya Tjipta - Surabaya				
12.00 - 13.30	Friday Prayer & Lunch Break Exhibition Area				
13.30 - 14.30	General Track 1 - Hand Surgery 1 Moderator: Agus R R Hamid - Denpasar Washington Room	Nusantara Track 8 - Java 3 Moderator: Almahitta Cintami Putri - Bandung New York Room	Nusantara Track 9 - Sumatera 3 Moderator: Mendy J. Hatibie - Manado California Room	Video Parade 3 - Breast Augmentation-Implant or Autologous Technique Moderator: David S. Perdanakusuma - Surabaya Florida Room	Free Paper Matland
13.30 - 13.42	Considerations For Flap Selections in Digital Defects Rebecca Lim - Singapore	Strategy to Speedy Healing for Functional Outcome of Burn Patients Almahitta Cintami Putri - Bandung	13.10 - 13.45 Reliable Technique I Used for Unilateral Cleft Lip Surgery Frank Buchari - Medan	13.10 - 13.45 Inframammary Approach Pre-Pectoral Breast Augmentation David S. Perdanakusuma - Surabaya	
13.42 - 13.54	Planning And Management Of Major Hand Trauma David B. Lumenta - Graz	Soft Tissue Reconstruction for Hand Dorsum Betha Egih Riestiano - Bandung	13.45 - 14.00 Choices of Skin Flaps for Most Efficient Facial Reconstruction Mulyadi - Pekanbaru	13.45 - 14.00 The Future of Breast Surgery: Integrating Augmented Reality and AI for Precision Surgical Planning Mohamad Rachadian Ramadan - Jakarta	
13.54 - 14.06	Assessing the Outcome of Corrective Surgery for Swan Neck and Boutonniere Deformities Kevin C. Chung - Michigan	Developing Outcome Measure for Burn Cases in the Era of BPJS Limited Resources M. Rosadi Seswandhana - Yogyakarta	14.00 - 14.15 Speeding Up Burn Care in Using Limited Resources Provided by Public Insurance (BPJS) Syamsul Rizal - Aceh	14.00 - 14.15 Algorithm for Implant based Augmentation - Mastopexy Jaejin Ock - Seoul	
14.06 - 14.18	Does It Worth Applying Dorsal Pentagonal Island Flap in Apert Hand? Theddeus O. H. Prasetyono - Jakarta	All Tissue or Staged Repair in Replantation and Revascularization? Yuanita Safitri Dianti - Surabaya	14.15 - 14.30 Discussion	14.15 - 14.30 Discussion	
14.18 - 14.30	Discussion	Discussion			

Scientific Schedule

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DAY 2 CONGRESS FRIDAY, AUGUST 1 ST , 2025			
14.30 - 15.30	Aesthetic Track 6 - Breast and Body Contouring 3 Moderator: Lisa Hasibuan - Bandung Washington Room	General Track 2 - Spino-Plastic Surgery Moderator: Vika Tania - Jakarta New York Room	Video Parade 4 - Blepharoplasty and Browlift Moderator: Hardisiswo Soedjana - Bandung Florida Room
14.30 - 14.42	Algorithm to Manage Complications of Implant-Based Augmented Breast David B. Lumenta - Graz	14.30 - 14.45 Techniques of Vascularized Rib Bone Grafting Sebastian Winocour - Houston (Recording)	14.30 - 14.50 Oriental Upper Blepharoplasty--Essentials of Transcutaneous Approach Chang Chien Yang - Taipei
14.42 - 14.56	Modified Self Assembled Endoscopic Assisted Breast Augmentation: Updated Budiman - Jakarta	14.45 - 15.00 Difficult Spinal Problems Requiring Plastic Surgery Michael Bohl - Carolina	14.50 - 15.10 Intraciliary Lower Blepharoplasty with Midface Lifting Effect Teuku Adifitrian - Jakarta
14.56 - 15.06	Updates on The Application of Balanced Female Breast Shape and Body Proportions Jae Jin Ock - Seoul	15.00 - 15.15 Future Treatments in Spino-Plastic Surgery Edward Reece - Arizona (Recording)	15.10 - 15.30 Discussion
15.06 - 15.18	The Vertical Breast Reduction: Understanding The Markings Shah Jumaat Mohd. Yusooif - Kuala Lumpur	15.15 - 15.30 Discussion	
15.18 - 15.30	Discussion		
15.30 - 16.00	Bisono Oration Moderator: Theddeus O. Prasetyono - Jakarta Washington Room		
	Evidence-based Medicine: Integrating the Art and Science of Surgery Kevin C. Chung - Michigan		
16.00	Coffee Break Exhibition Area		
19.00 - 22.00	PERAPI NIGHT Ballroom		

Scientific Schedule

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DAY 3 CONGRESS SATURDAY, AUGUST 2 nd , 2025		
08.00 - 09.00	General Track 3 - Trauma, Regeneration and Laser Moderator: Erythrina Permata Sari - Jakarta Ballroom	Nusantara Track 10 - Borneo Moderator: Ruby R. Asparini - Malang Washington Room
08.00 - 08.15	Current Multidisciplinary Approach for Complex Craniomaxillofacial Cases Magda R. Hutagalung - Surabaya	How I Managed Difficult Cases in Samarinda Beatrix C. Panjaitan - Kutai
08.15 - 08.30	Plastic Surgery in War Zone: Experiences from Gaza Enrina Nurmaerini - Jakarta	Developing Successful Practice of Plastic Surgery in West Kalimantan Doni Setiawan - Pontianak
08.30 - 08.45	Gynecomastia Surgery with 3 rd Generation Laser Zekeriya Tosun - Konya	Plastic Surgery External Genitalia Service with Success in Kalimantan Andi Mohammad Ardan - Samarinda
08.45 - 09.00	Discussion	Discussion
09.00 - 10.00	General Track 4 - Technology and Innovation Moderator: Najatullah - Semarang Ballroom	Video Parade 5 - Body Contouring Moderator: Ferdinand - Pekanbaru Washington Room
09.00 - 09.15	Applicability of Artificial Intelligence in Plastic Surgery David B. Lumenta - Graz	Liposuction for Aesthetic Contouring of the Back Maksut Kadyrov - Bishkek
09.15 - 09.30	Tissue Retraction Using Energy Assisted Technology: The State Of The Art Damiano Tambasco - Rome	Face and Body Sculpting Akhmed Rakhimov - Moscow
09.30 - 09.45	Scarless Breast Reconstruction Technique Using Endoscopic Approach and Aesthetic Evaluation Using 3D Camera Shinsuke Akita - Chiba (Recording)	High-Definition Liposuction: My Personal Approach Bambang Wicaksono - Surabaya
09.45 - 10.00	Discussion	Discussion
10.00 - 11.00	Teatime Talk on Law, Patient Safety, and Ethics & Coffee Break Moderator: Asrofi S Surachman - Jakarta Ballroom	
10.00 - 10.30	Dealing with Litigation in Surgical Practice Andreas A. Lenson - Jakarta	
10.30 - 11.00	Ethical Concerns of Aesthetic and Reconstructive Surgery Theddeus O.H. Prasetyono - Jakarta	
11.00 - 12.00	Plenary Lecture 3 Moderator: Lisa Hasibuan - Bandung Ballroom	
11.00 - 11.30	Beyond the Curve: The Evolution and Refinement of Our Lipoabdominoplasty Technique Damiano Tambasco - Rome	
11.30 - 12.00	Aesthetic Concepts and Trends in Facial Rejuvenation -Fantasies and Fallacies Darryl Hodgkinson - Sydney	
12.00 - 13.00	Lunch Break Exhibition Area	

Scientific Schedule

*Speaker within confirmation

DAY 3 CONGRESS SATURDAY, AUGUST 2 nd , 2025		
13.00 - 14.00	General Track 5 - Hand Surgery 2 Moderator: Betha Egih Riestiano - Bandung Ballroom	Nusantara Track 11 - Maluku-Papua 1 Moderator: Ulfa Elfiah - Jember Washington Room
13.00 - 13.15	The Current Trends of Managing Mutilated Hands Sandeep Sebastin - Singapore	Autophagy: The Survival Mechanism Of The Flap Rani Septirina - Bandung
13.15 - 13.30	Management of The Degenerative Carpometacarpal Joint of The Thumb David B. Lumenta - Graz	Regenerative Medicine: Challenges in Our Health Insurance System Huntal Napoleon Simamora - Jakarta
13.30- 13.45	Approach To Periarticular Metacarpal and Phalangeal Fractures Sandeep Sebastin - Singapore	Regenerative Medicine: Challenges in Burn Management Karina - Jakarta
13.45 - 14.00	Discussion	Stem Cell Based Therapy for Pathological Scars: The Challenges Theddeus O.H. Prasetyono - Jakarta
		Discussion
14.00 - 15.00	General Track 6 - Flaps and Microsurgery Moderator: Mufida Muzzakie - Palembang Ballroom Room	Nusantara Track 12 - Maluku-Papua 2 Moderator: Pritha Hadi - Jambi Washington Room
14.00 - 14.12	Tounge Reconstruction with Pull Through Approach Koh Khai Luen - Kuala Lumpur	Sidik-Chaula Technique for Hypospadias Surgery Indri Aulia - Jakarta
14.12 - 14.24	Recent Updates on the Development of Iliac Crest Vascularized Bone Graft Sebastian Winocour - Houston (Recording)	Aviar Braca Tecnique for Hypospadias Reconstruction Indri Aulia - Jakarta
14.24 - 14.36	Microsurgical Reconstruction For Cancer-Related Thoracoscaphular Amputation David B. Lumenta - Graz	Transverse Preputial Island Flap in Hypospadias Surgery Yacobda H. Sigumonrong - Deli Serdang
14.36 - 14.48	Hepatic Artery Repair in Liver Transplantation Sandeep Sebastian - Singapore	The Radial Forearm Flap for Penis Reconstruction: A Case Experience Amila Tikyayala Purnomo - Jakarta
14.48 - 15.00	Discussion	Discussion
15.00 -15.30	Closing Ceremony	



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**Evaluation of 5% Robusta Coffee Extract Gel in Enhancing
Angiogenesis, Collagen Deposition, and Wound Texture During Skin
Graft Healing in Long Evans Rats**

Ulfa Elfiah¹, Akbar Fakhrudin Kholid², Amalia Safitri³

BACKGROUND

- Skin grafting is a crucial reconstructive method for large tissue defects.
- Postoperative care typically involves topical agents or advanced dressings.
- However, these options are often expensive and not widely accessible.
- There's rising interest in natural-based therapies.



BACKGROUND

- Robusta coffee contains active compounds like chlorogenic acid (CGA), flavonoids, and saponins known for anti-inflammatory, antioxidant, and antimicrobial properties.
- No prior studies have evaluated the use of Robusta coffee extract specifically in skin graft wound healing.

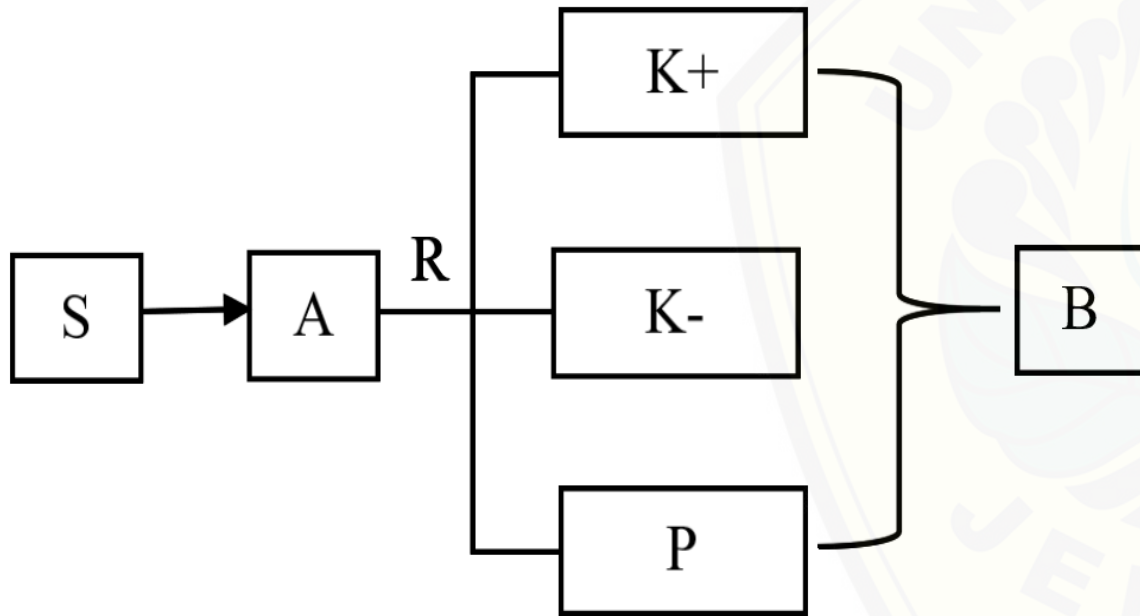
Objective

To evaluate the effectiveness of **5% Robusta coffee extract gel (RCEG)** in improving:

- **Angiogenesis**
- **Collagen deposition**
- **Wound surface texture**

during the healing of skin grafts in Long Evans rats.

Methods – Experimental Design



- Subjects: Long Evans rats with full-thickness skin grafts.
- Groups:
 - 2% Kojic acid gel (positive control)
 - 2.5% Robusta coffee extract gel (RCEG)
 - 3. Placebo gel (negative control)
- Observation and photography on days 0, 7, 14, and 21.
- Wound texture measured using Image J software.
- Histological analysis on days 7, 14, and 21 using H&E and Masson's Trichrome stains.



Skin Grafting Procedure in Long-evans Rats

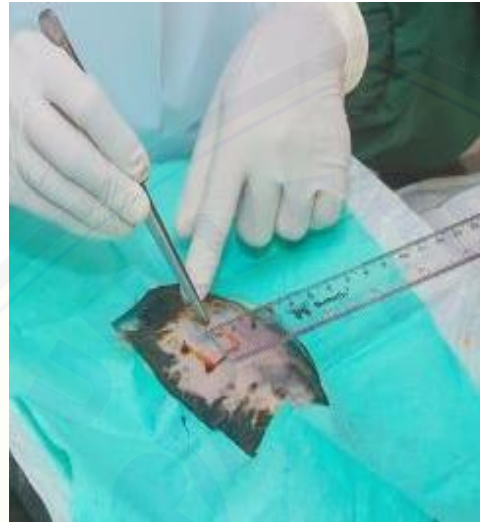


1



Disinfection of the rat's

2



Measuring the graft size

3



Harvesting the graft using a Humby

4



Obtained graft

5



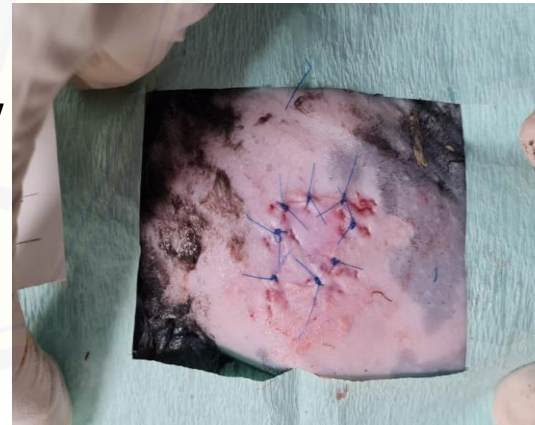
Donor wound

6



Suturing the
graft to the
original
donor site

7



Skin graft on the donor wound
ready for treatment

Data Analysis

- Statistical test: **One-way ANOVA**
 - Post hoc: **Bonferroni test**
 - Software: **SPSS 25.0**
- Significance: **p-value < 0.05**

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RESULT Angiogenesis

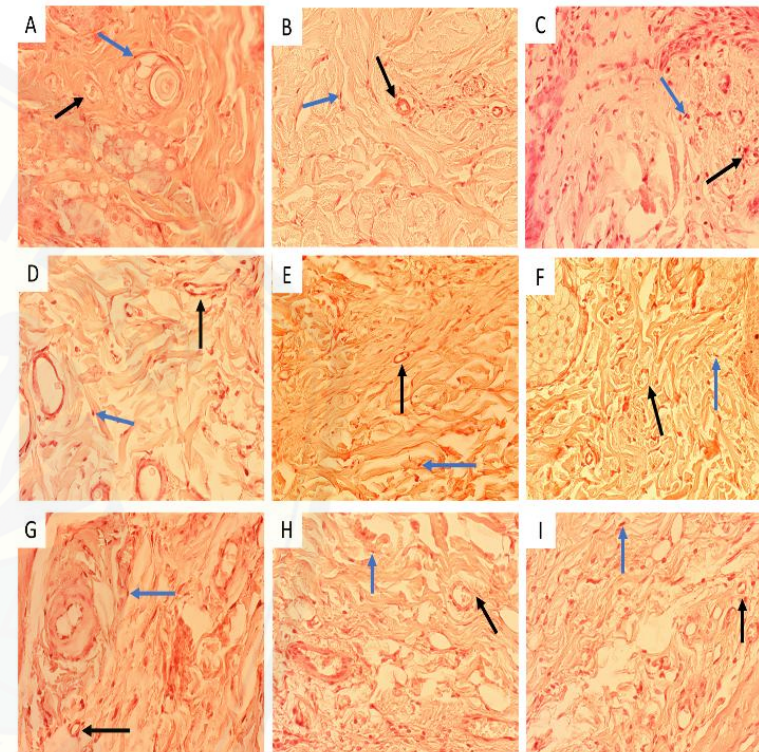
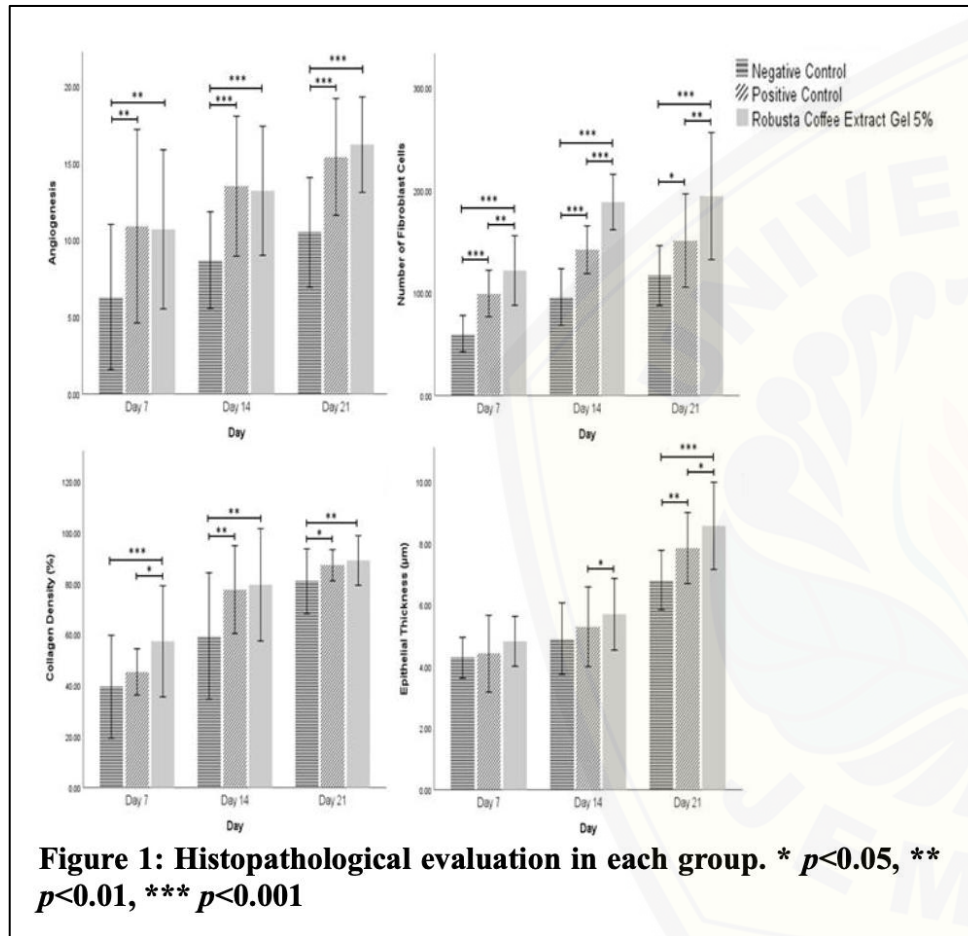


Figure 2: Histopathological images of angiogenesis and fibroblast evaluation in each group. Negative control group on day 7 (A), 14 (B), 21 (C), positive control group on day 7 (D), 14 (E), 21 (F), and 5% RCEG on day 7 (G), 14 (H), 21 (I). Black arrows are indicating blood vessels and blue arrows are indicating fibroblast cells. Using Hematoxylin-eosin staining with 400x magnification.

- Significant increase in blood vessel count in RCEG group vs. negative control ($p = 0.000$).
- No significant difference between RCEG and positive control ($p > 0.05$).

UPT Perpustakaan Universitas Jember RESULT Collagen Deposition

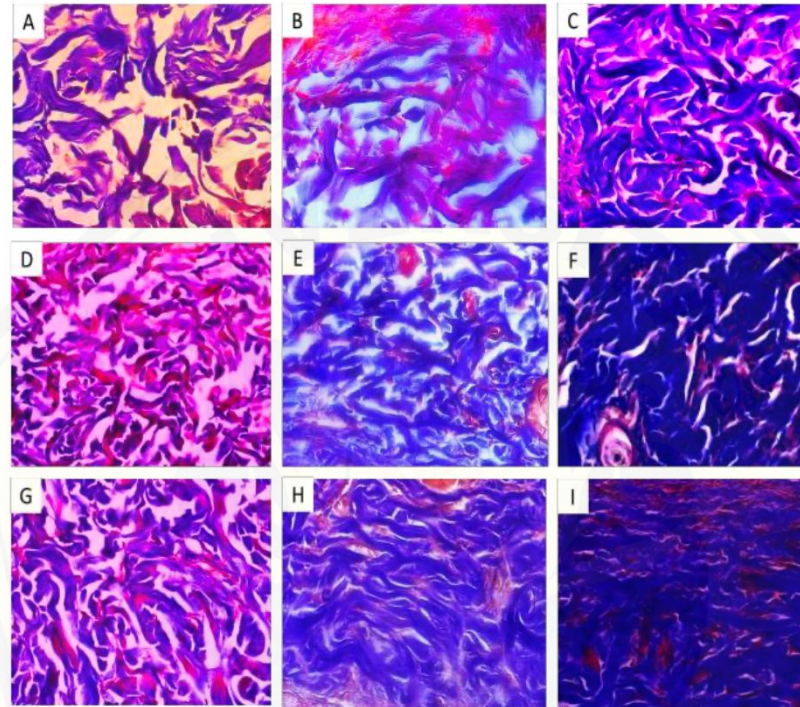


Figure 3. Photomicrograph of the percentage of density collagen in each group. Negative control group on day 7 (A), 14 (B), 21 (C), positive control group on day 7 (D), 14 (E), 21 (F), and 5% RCEG on day 7 (G), 14 (H), 21 (I). Using Mason trichrome staining with 400x magnification.

- The RCEG group showed significantly higher collagen density at all time points (day 7, 14, 21) compared to both controls.
- Suggests enhanced fibroblast activity and matrix formation.

RESULT Wound Surface Texture

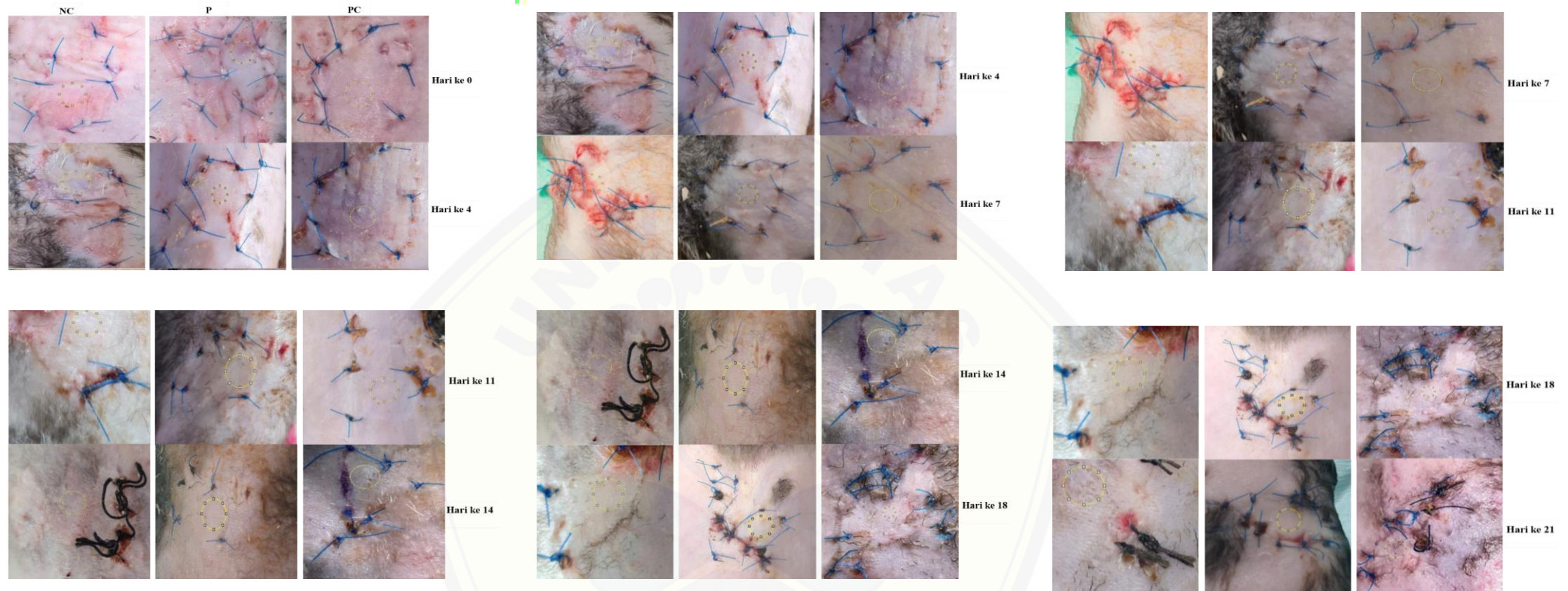


Figure 4. macroscopic assessment of wound texture—based on visual evaluation of wound color and surface morphology using Image J

- Image J analysis showed:
 - Significant improvement in wound surface texture in RCEG vs. both control groups ($p < 0.05$).
 - No significant difference between RCEG and positive control ($p > 0.05$)
- Indicates better wound integration and maturation.

- The healing effect may be attributed to:
 - CGA, flavonoids, and saponins promoting angiogenesis and collagen formation.
 - CGA boosts VEGF expression, enhancing endothelial cell migration and capillary formation.
 - Flavonoids stimulate TGF- β , supporting fibroblast activity and collagen synthesis.
 - CGA may regulate TNF- α to enhance collagen production.
- Supported by prior research (e.g., Kenisa et al.) showing robusta extract improves capillary and fibroblast proliferation in full-thickness wounds.

CONCLUSION

- 5% Robusta coffee extract gel significantly promotes:
 - New blood vessel formation
 - Collagen synthesis
 - Improved wound texture
- **RCEG** presents a cost-effective, natural, and promising alternative for postoperative wound care following skin grafts.

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Pengembangan Keprofesian Berkelanjutan

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ULFA ELFIAH DR.

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Pada 30-07-2025 s/d 30-07-2025

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