**Bidang Unggulan**: Ketahanan pangan secara luas
**Kode/Nama Rumpun Ilmu: 304/Ilmu Biomedik**

# ABSTRACT & EXECUTIVE SUMMARY

## PENELITIAN UNGGULAN PERGURUAN TINGGI

**(UNGGULAN PENGUATAN)**

# KAJIAN EFEK KOPI DAN PERIODONTITIS PADA ATEROSKLEROSIS KORONER

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# PROTECTIVE EFFECT OF COFFEE AGAINST CORONARY ATHEROSCLEROSIS IN PERIODONTITIS RAT MODEL

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## Abstract

**Objectives.** The objective of this study was to conduct an *in vivo* experiment to prove the effect of coffee consumption to reduce coronary atherosclerosis in periodontitis rat model. **Methods**. Twenty one rats (*Rattus norvegicus*) were divided into three groups, i. e. 1) periodontitis, 2) periodontitis + coffee, 3) control group. Periodontitis rat model was created by means of inserting wire ligature around left molar mandibular tooth followed by injecting periodontitis bacteria *Porphyromonas gingivalis* in buccal aspect of its teeth twice a week. One dose of *decocta* coffee (representing one cup) was fed once per day by stomach sondation. The experiment was conducted for 35 days. All rats were fed with normocholesterol standard diet. On the 36$^{th}$ day rats were sacrified. Their hearts which contained coronary arteries were removed and prepared for cross sectional specimens for histopathologic and immunohistopathologic examination. Coronary atherosclerosis markers were intimal thickening, lipids deposit, foam cell and scavenger receptor (Sc-R) expression. **Results**. Arterial wall of rats that consumed coffee demonstrated symmetric intimal thickness and collagen intimal showed intact and dense. Fewer lipid deposit, smaller number of foam cell and Sc-R expression were identified in coffee group compared to periodontitis group. **Conclusions**. One cup coffee consumption per day improved the morphology of coronary artery particularly intimal collagen leading to protect against atherosclerosis and rupture. Effect of coffee consumption on collagen vascular is a novel perspective, further studies are needed particularly focusing on this intimal collagen.

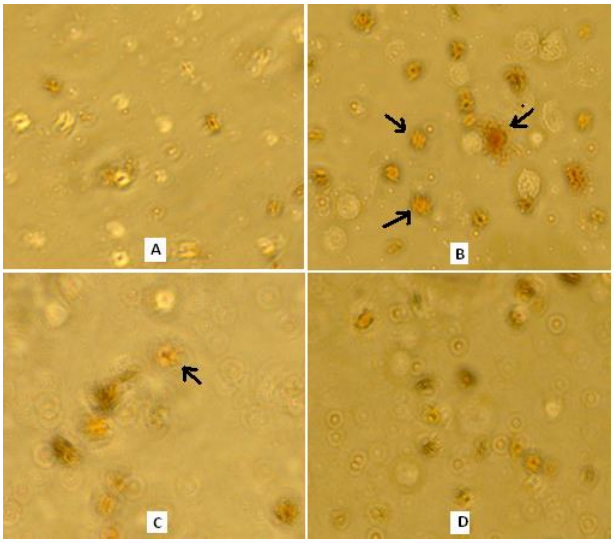
Keywords. Atherosclerosis; Coffee; Periodontitis; Rat.

# RINGKASAN

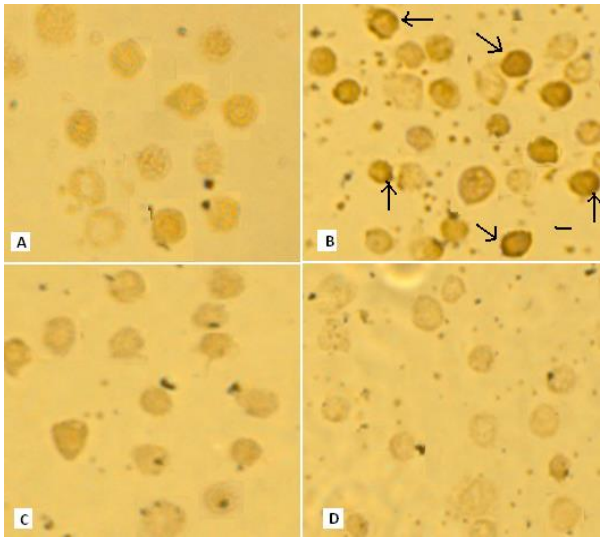
Penelitian yang kami lakukan selama tiga tahun ini mendapatkan hasil penting dan temuan baru, yang bermanfaat meningkatkan pemahaman tentang pathogenesis dan dasar-dasar ilmiah untuk pengembangan metode pencegahan aterosklerosis koroner. Beberapa hasil penting yang didapat adalah sebagai berikut. **1.** Periodontitis, secara in vitro dan in vivo menginduksi aterosklerosis. Hasil penelitian in vitro, bakteri periodontitis *Porphyromonas gingivalis* menginduksi ekspresi marker-marker aterosklerosis. *P. gingivalis* menyebabkan disintegrasi membrane sel (*pheripheral blood monocyte cell, PBMC*), sehingga meningkatkan uptake lipid dan menyebabkan pembentukan sel lemak (*foam cell*). **2**. Hasil penelitian in vivo, induksi periodontitis (model tikus periodontitis) meningkatkan pembentukan lesi aterosklerosis koroner. Tanda-tanda aterosklerosis yang ditemukan antara lain, penebalan dinding arteri (*intima-media thickening*), peningkatan rekrutmen lekosit ke dinding lumen arteri, disintegrasi endotel, deposisi lipid intimal, pembentukan ateroma, stenosis dan disintegrsi/ruptur kolagen intimal. Kemampuan periodontitis menginduksi disintegrasi/ruptur kolagen intimal ini merupakan temuan penting, karena rupture kolagen intimal merupakan proses penting yang mengawali agregasi platelet dan pembentukan thrombus, yang dapat menyebabkan ischemia dan infark miokardial yang bermanifestasi klinis sebagai sindrom koroner akut. Temuan ini kemungkinan menjelaskan mekanisme peran periodontitis pada terjadinya serangan jantung. **3**. Konsumsi secangkir kopi per hari mencegah aterosklerosis. Temuan baru, konsumsi kopi memperbaiki morfologi arteri koroner, khususnya meningkatkan integritas kolagen intimal sehingga membuatnya lebih tahan terhadap resiko rupture, ini berarti pula dapat mencegah atau menurunkan resiko serangan jantung. Penelitian lebih lanjut dibutuhkan untuk mengungkap mekanisme molekuler efek protektif kopi pada aterosklerosis dan penyakit kardiovaskuler.

Kata Kunci: Kopi; Kolagen intimal; Aterosklerosis; Periodontitis, Sindrom koroner.

**1. Hasil Penelitian in vitro**




Gambar 1. Hasil uji foam cell yang diamati menggunakan mikroskup inverted dengan pembesaran 400 kali. Foam cell tampak sebagai sel berwarna merah kekuningan (tanda panah) A. Kontrol negatif, sangat jarang dijumpai foam cell. B. Monosit yang dipapar *P. gingivalis* dan serum normolipid tanpa pemberian filtrate kopi (kontrol positif), menunjukkan pembentukan foam cell yang lebih banyak, C dan D. Pemaparan filtrate kopi menunjukkan foam cell berkurang.




Gambar 4.2. Ekspresi reseptor scavenger (Sc-R) yang diamati menggunakan mikroskup inverted dengan pembesaran 400 kali. Ekspresi Sc-R ditunjukkan oleh sel dengan membran coklat tua (tanda panah) A. Kontrol negatif, sangat jarang dijumpai ekspresi Sc-R. B. Monosit yang dipapar *P. gingivalis* dan serum normolipid tanpa pemberian filtrate kopi (kontrol positif), menunjukkan banyak sel yang mengekspresikan Sc-R.. C dan D. Pemaparan filtrate kopi menunjukkan ekspresi Sc-R berkurang.

2. Hasil Penelitian in vivo

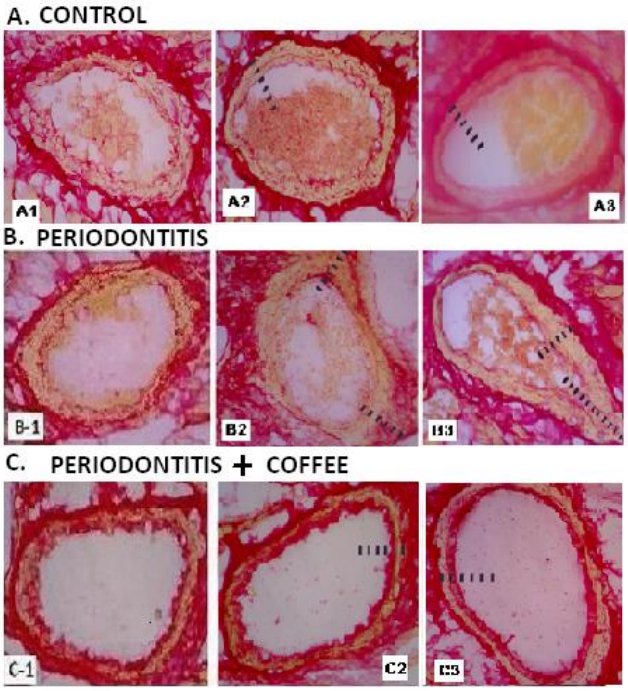



**Figure 2**. Morphology of coronary artery using collagen staining (Picro Sirius Red). A. Non-periodontitis group. B. Periodontitis group. C. Periodontitis + Coffee group. Coronary artery of coffee group demonstrated intact and dense intimal collagen (→)

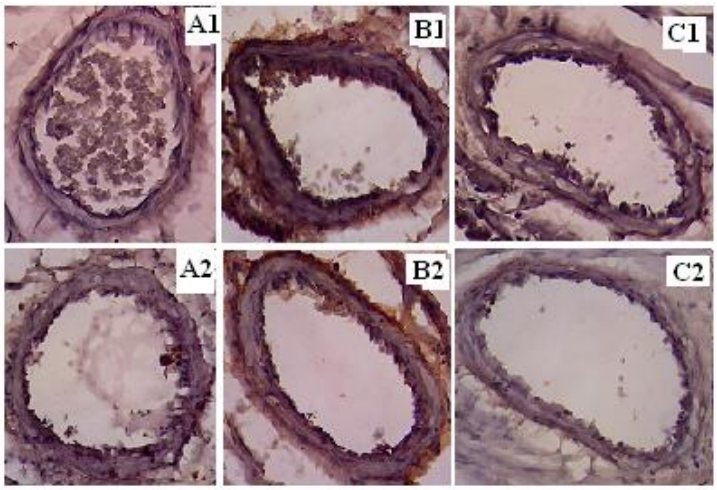



**Figure 4**. Immunohistochemistry of coronary artery: expression of scavenger receptor (CD 163), 100 x magnification. Coffee group (C1, C2) demonstrated lesser expression of Sc-R compared to periodontitis group (dark brown, B1, B2). Control group (A1, A2) demonstrated similar density to coffee group.

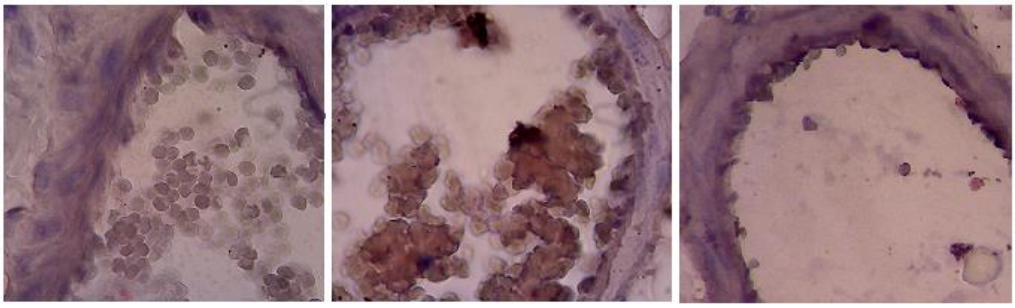


**Figure 5**. Lipid deposition (demonstrated by Oil RedO staning) on endothelial surface and fatty emboli were found in coronary artery of periodontitis rat model (B) compared to control group (A). Fewest lipid deposition and fatty emboli were identified in coffee group (C).

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