# SELAMAT DATANG

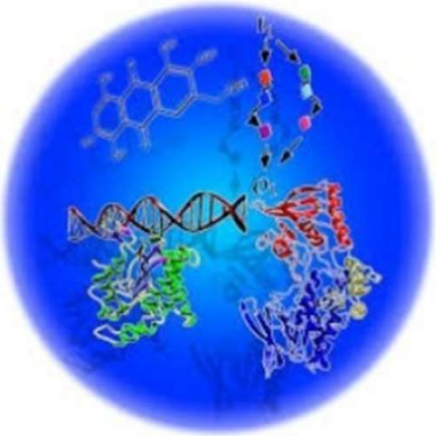
## WebSkul BIOKIMIA
## DEPARTEMEN BIOKIMIA FMIPA IPB

Dr. Mega Safithri, S.Si., M.Si

# PERAN BIOKIMIA DALAM PENGEMBANGAN PANGAN FUNGSIONAL ANTIDIABETES

# TAK KENAL MAKA TAK SAYANG

***What is Biochemistry?***

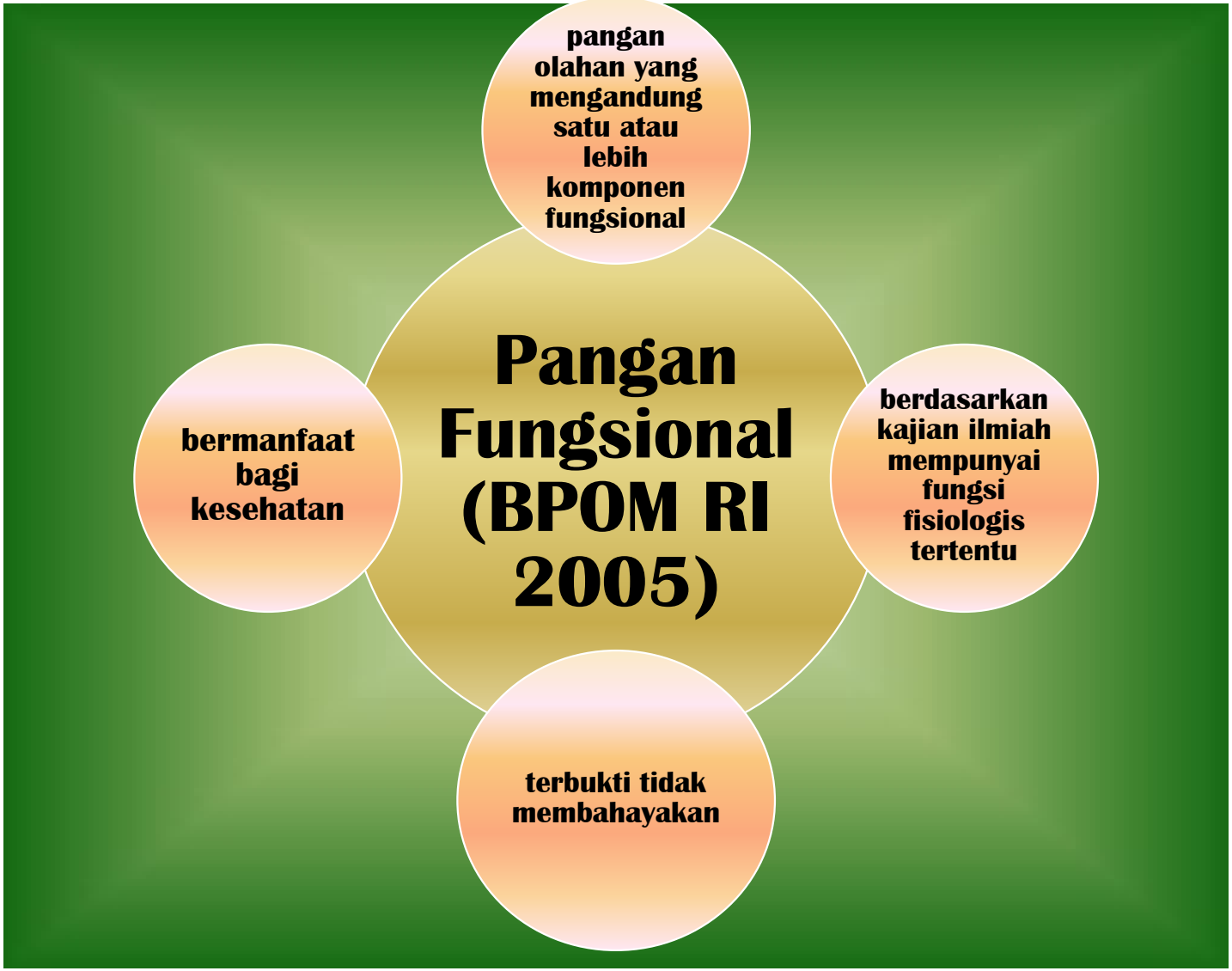


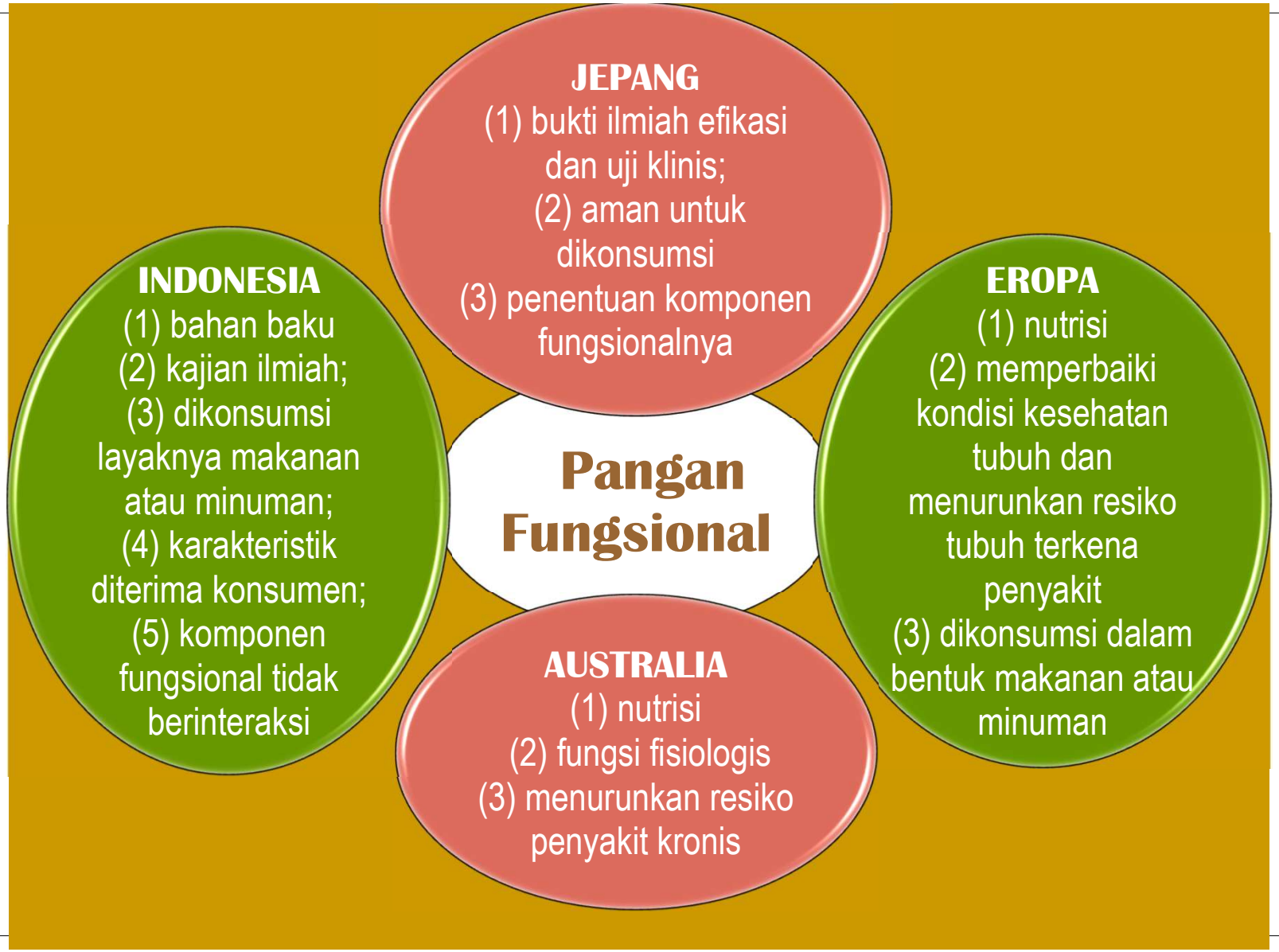
*Biochemistry is the study of the structure, composition and chemical reactions of substances in living systems*

**BIOLOGY** + **CHEMISTRY**

↓

**BIOCHEMISTRY**


pangan olahan yang mengandung satu atau lebih komponen fungsional
Pangan Fungsional (BPOM RI 2005)
bermanfaat bagi kesehatan
berdasarkan kajian ilmiah mempunyai fungsi fisiologis tertentu
terbukti tidak membahayakan


JEPANG
(1) bukti ilmiah efikasi dan uji klinis;
(2) aman untuk dikonsumsi
(3) penentuan komponen fungsionalnya
INDONESIA
(1) bahan baku
(2) kajian ilmiah;
(3) dikonsumsi layaknya makanan atau minuman;
(4) karakteristik diterima konsumen;
(5) komponen fungsional tidak berinteraksi
Pangan Fungsional
EROPA
(1) nutrisi
(2) memperbaiki kondisi kesehatan tubuh dan menurunkan resiko tubuh terkena penyakit
(3) dikonsumsi dalam bentuk makanan atau minuman
AUSTRALIA
(1) nutrisi
(2) fungsi fisiologis
(3) menurunkan resiko penyakit kronis

# LATAR BELAKANG

**Indonesia urutan ke-7 terbesar dalam jumlah penderita diabetes melitus (IDF 2015)**

**12,8 juta/tahun (2013)** **[KEMENKES 2014]**

**Masalah kesehatan masyarakat Indonesia**

| | |
|---|---|
| **Penderita diabetes dapat mengalami komplikasi kronis** | **Radikal bebas selama keadaan hiperglikemia** |

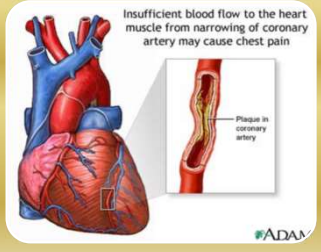
**Perlu Pencegahan dan Pengobatan**

| | |
|---|---|
| **Pengembangan Produk Pangan Fungsional** | **Berbahan baku SUMBER DAYA HAYATI Indonesia** |

# DIABETES MELLITUS

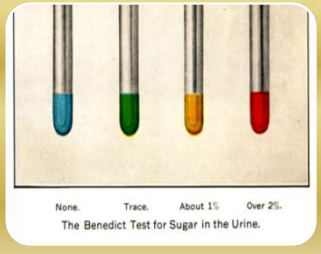

**Kelompok penyakit metabolik**

- **Ditunjukkan dengan keadaan hiperglikemik**
- **Akibat dari sekresi insulin yang rendah, aktivitas kerja insulin yang rendah, maupun keduanya(IDF 2015)**




**Keadaan hiperglikemia yang kronis dapat menyebabkan**

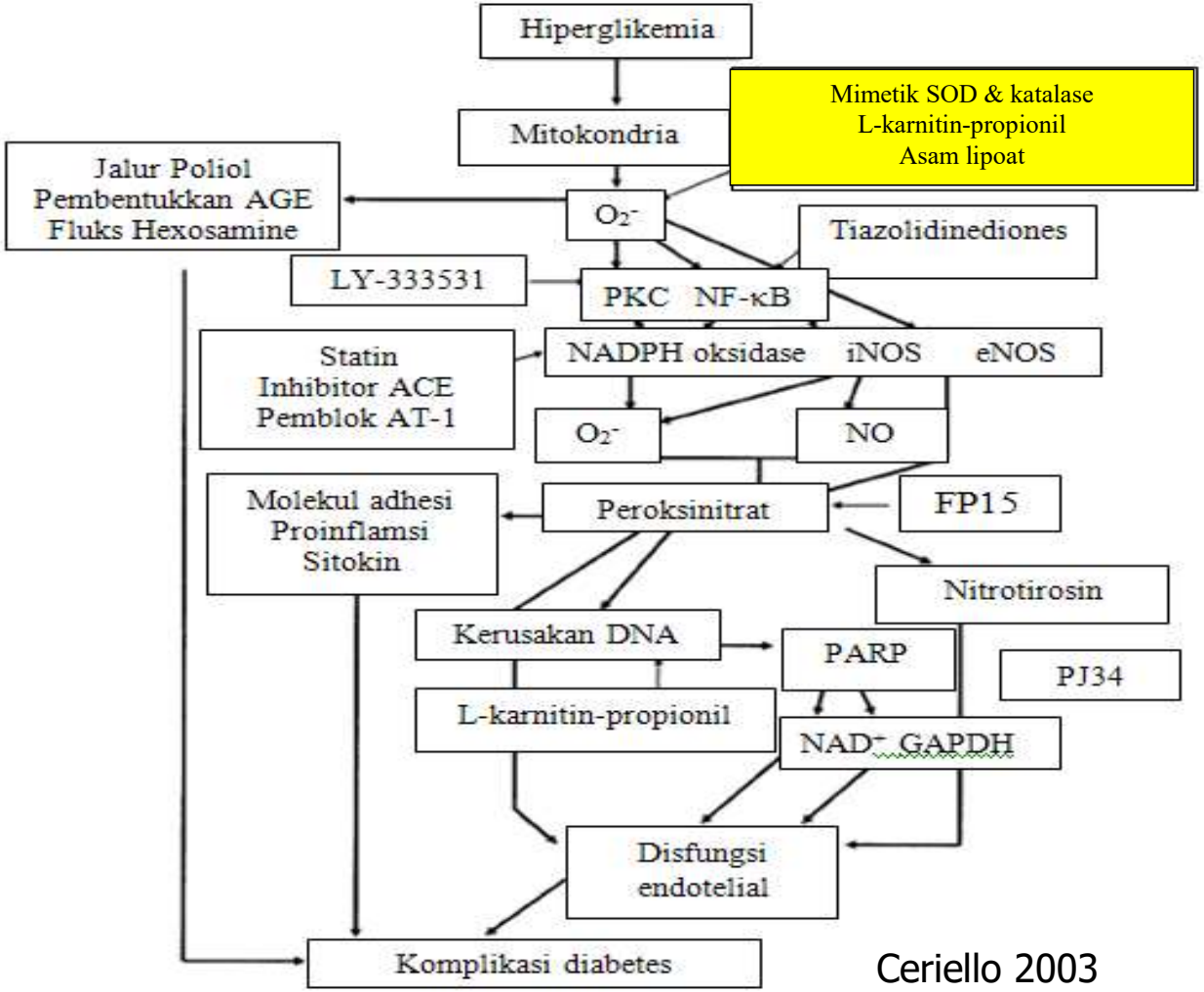
- **kerusakan, disfungsi, maupun kegagalan kerja beberapa organ seperti pembuluh darah, mata, ginjal, syaraf, dan jantung (IDF 2015)**



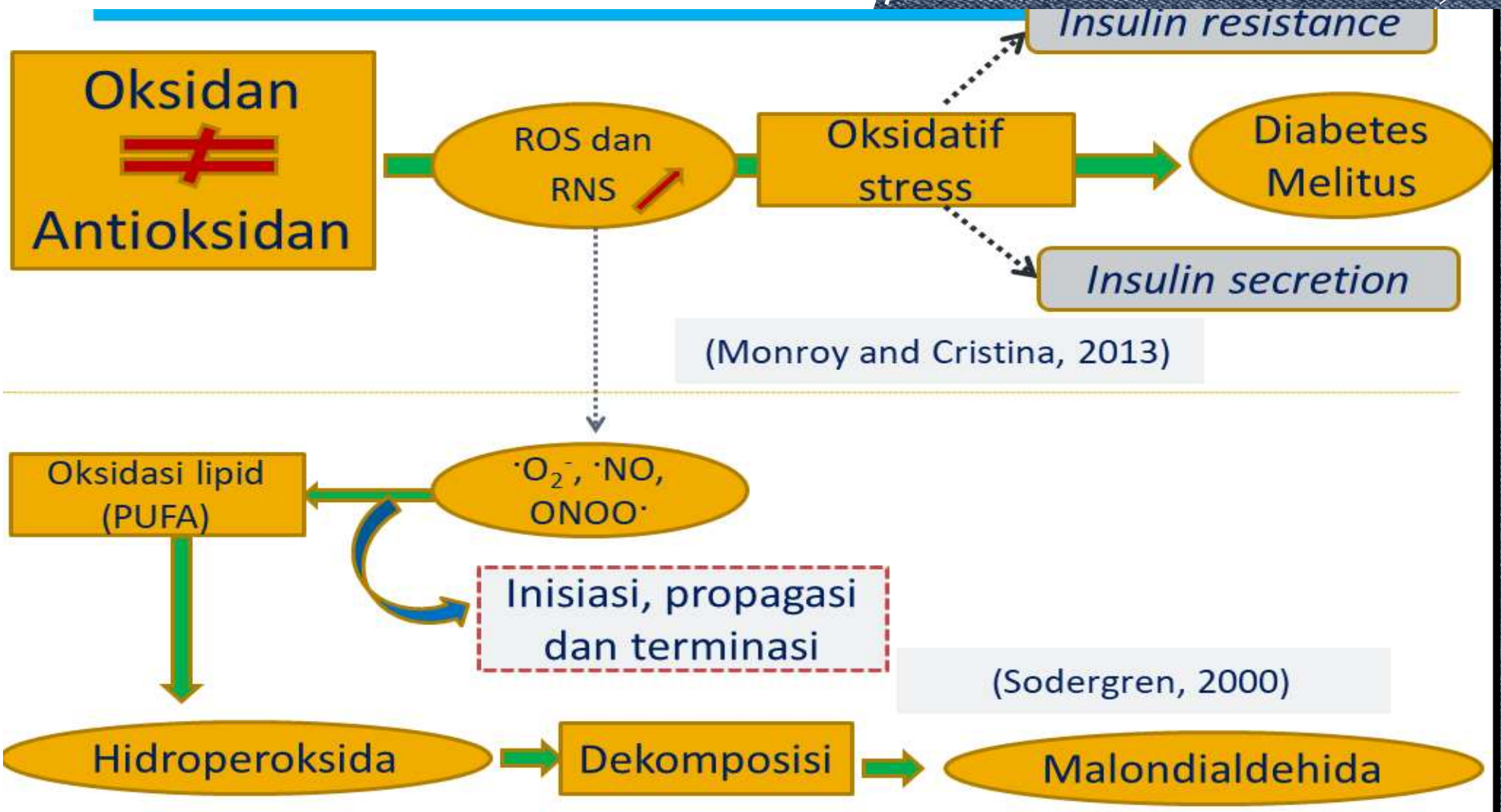

**FPG ≥ 126 mg/dl dan 2-h PG ≥ 200 mg/dl (pada manusia) (Carolyn *et al* 2007)**

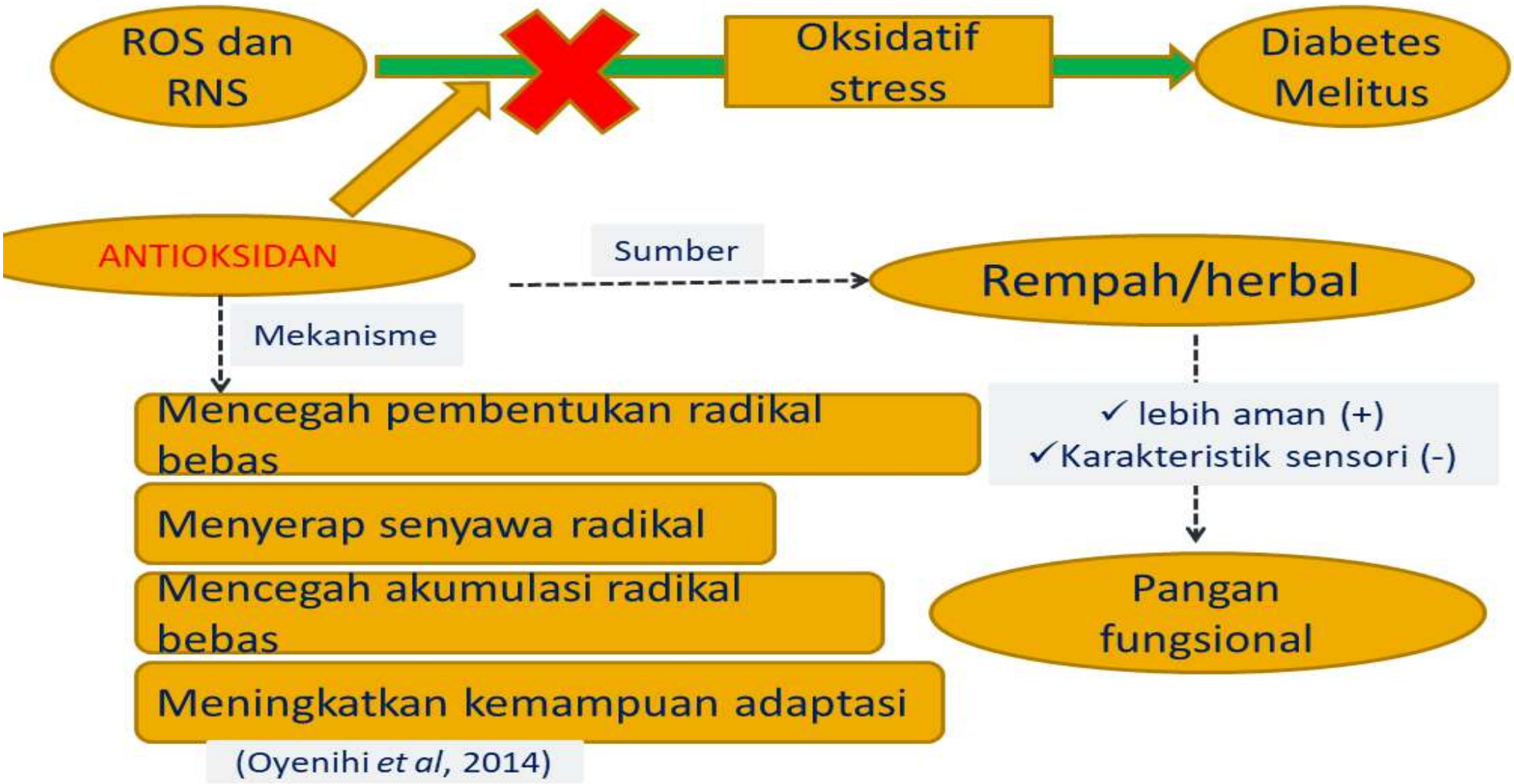
**FPG ≥ 135 mg/dl dan 2-h PG ≥ 187 mg/dl (pada tikus) (Wang *et al* 2010)**

# PATOGENESIS KOMPLIKASI DIABETES

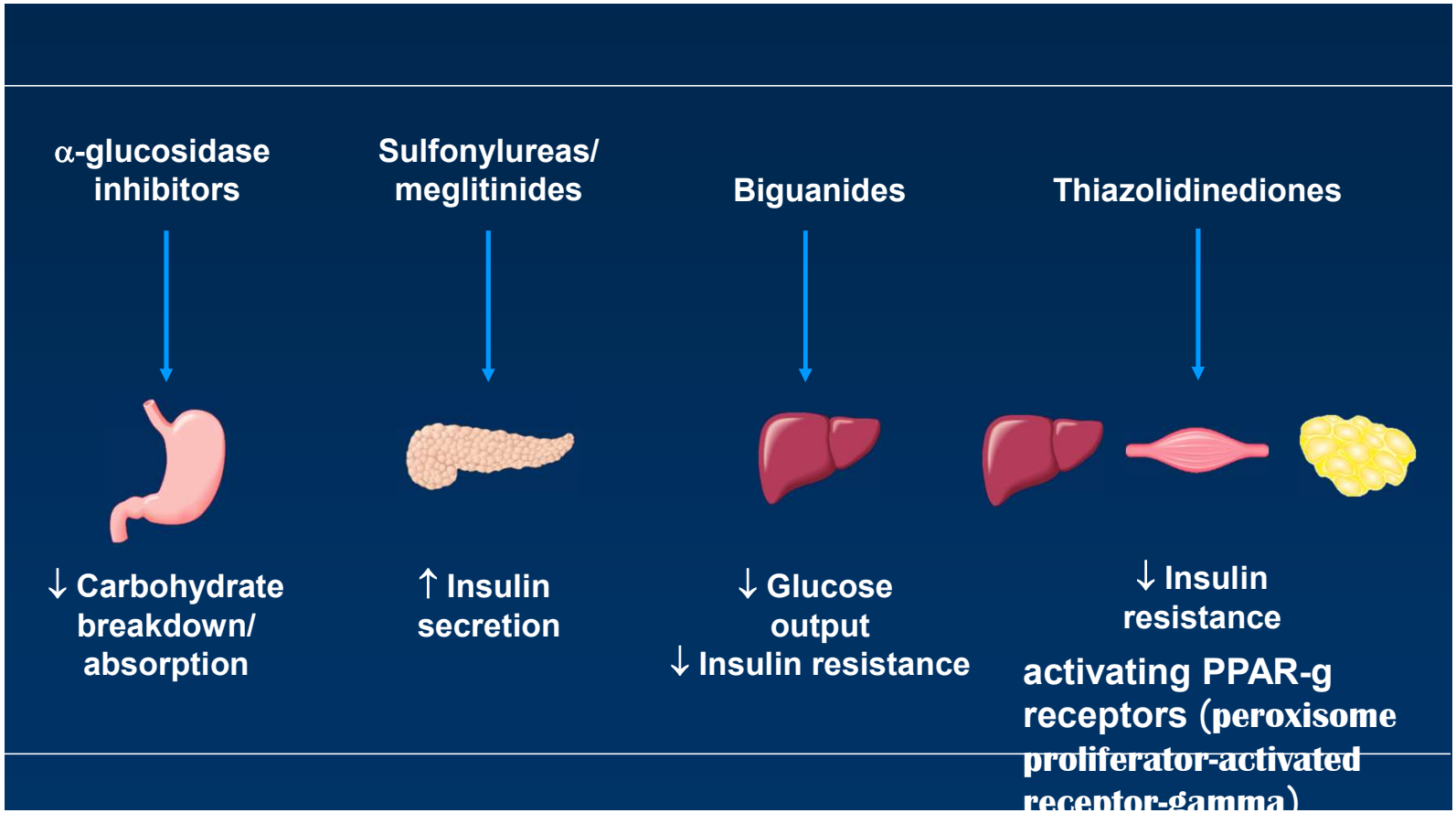



Ceriello 2003


Insulin resistance
Oksidan
≠
Antioksidan
ROS dan
RNS
Oksidatif
stress
Diabetes
Melitus
Insulin secretion
(Monroy and Cristina, 2013)
Oksidasi lipid
(PUFA)
·O2-, ·NO,
ONOO·
Inisiasi, propagasi
dan terminasi
(Sodergren, 2000)
Hidroperoksida
Dekomposisi
Malondialdehida


ROS dan RNS
Oksidatif stress
Diabetes Melitus
ANTIOKSIDAN
Sumber
Rempah/herbal
Mekanisme
Mencegah pembentukan radikal bebas
Menyerap senyawa radikal
Mencegah akumulasi radikal bebas
Meningkatkan kemampuan adaptasi
(Oyenihi et al, 2014)
✓ lebih aman (+)
✓Karakteristik sensori (-)
Pangan fungsional

# Primary sites of action of oral antidiabetic agents



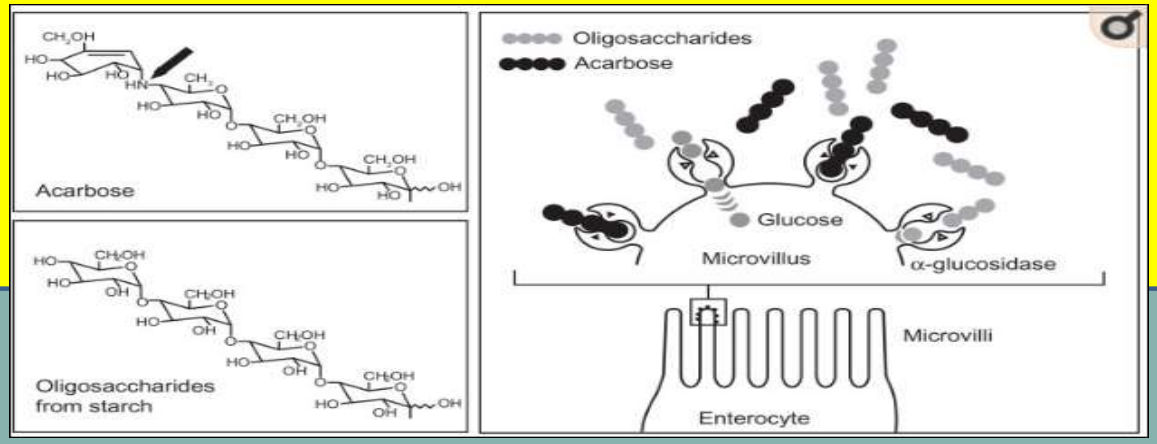
# RUANG LINGKUP PERAN BIOKIMIA

# Penelitian Tahap Pertama

## AKTIVITAS ANTIOKSIDASI DAN INHIBITOR ENZIM $\alpha$-GLUKOSIDASE CAMPURAN ESKTRAK SIRIH MERAH DAN KAYU MANIS

# Penghambat α-Glukosidase

**Mekanisme Penghambatan Akarbosa (Christoph 2012)**




**Bekerja secara kompetitif terhadap penghambatan enzim alfa-glukosidase**

**Menurunkan kadar glukosa darah postprandial**

**•Flatulentsi**
**•Gejala Gastrointestinal**

# STUDI *IN VITRO* DAN PENAMBATAN MOLEKULER SENYAWA BIOAKTIF EKSTRAK DAN FRAKSI DAUN SIRIH MERAH (*Piper crocatum*) SEBAGAI INHIBITOR α-GLUKOSIDASE


MUSTIKA WENI

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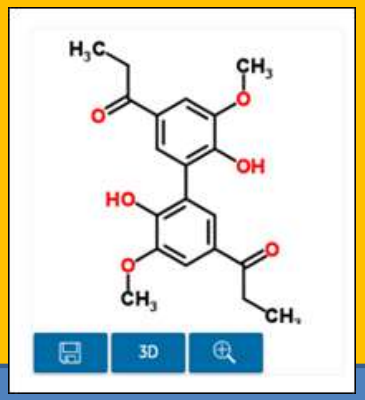
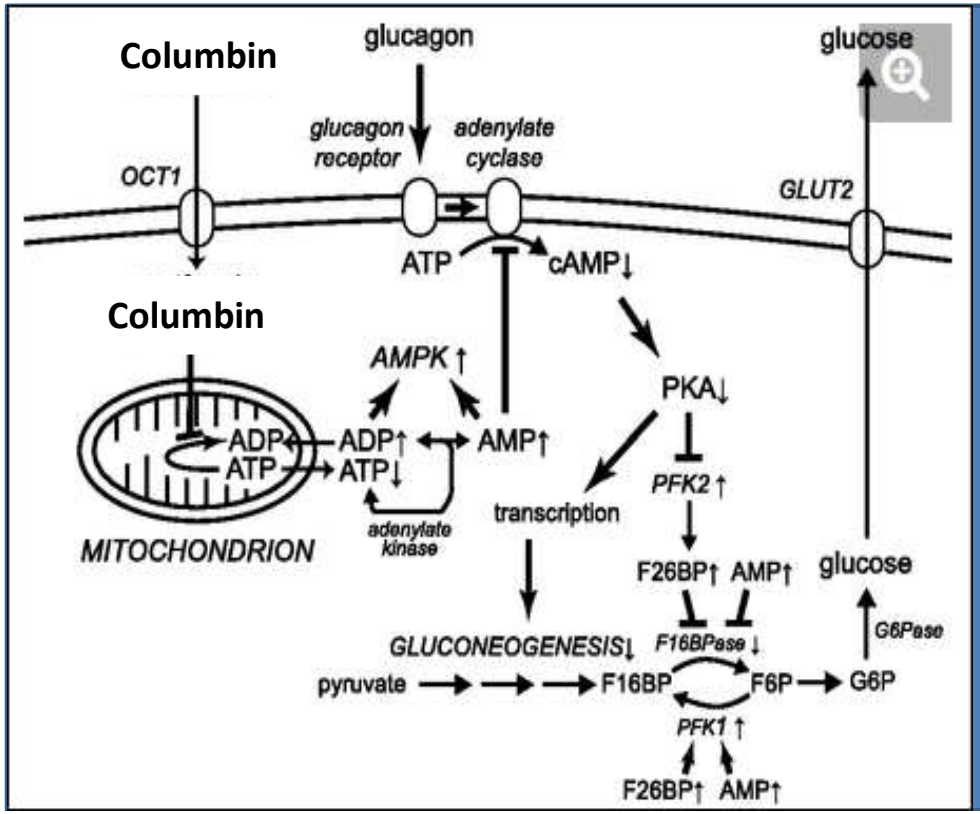
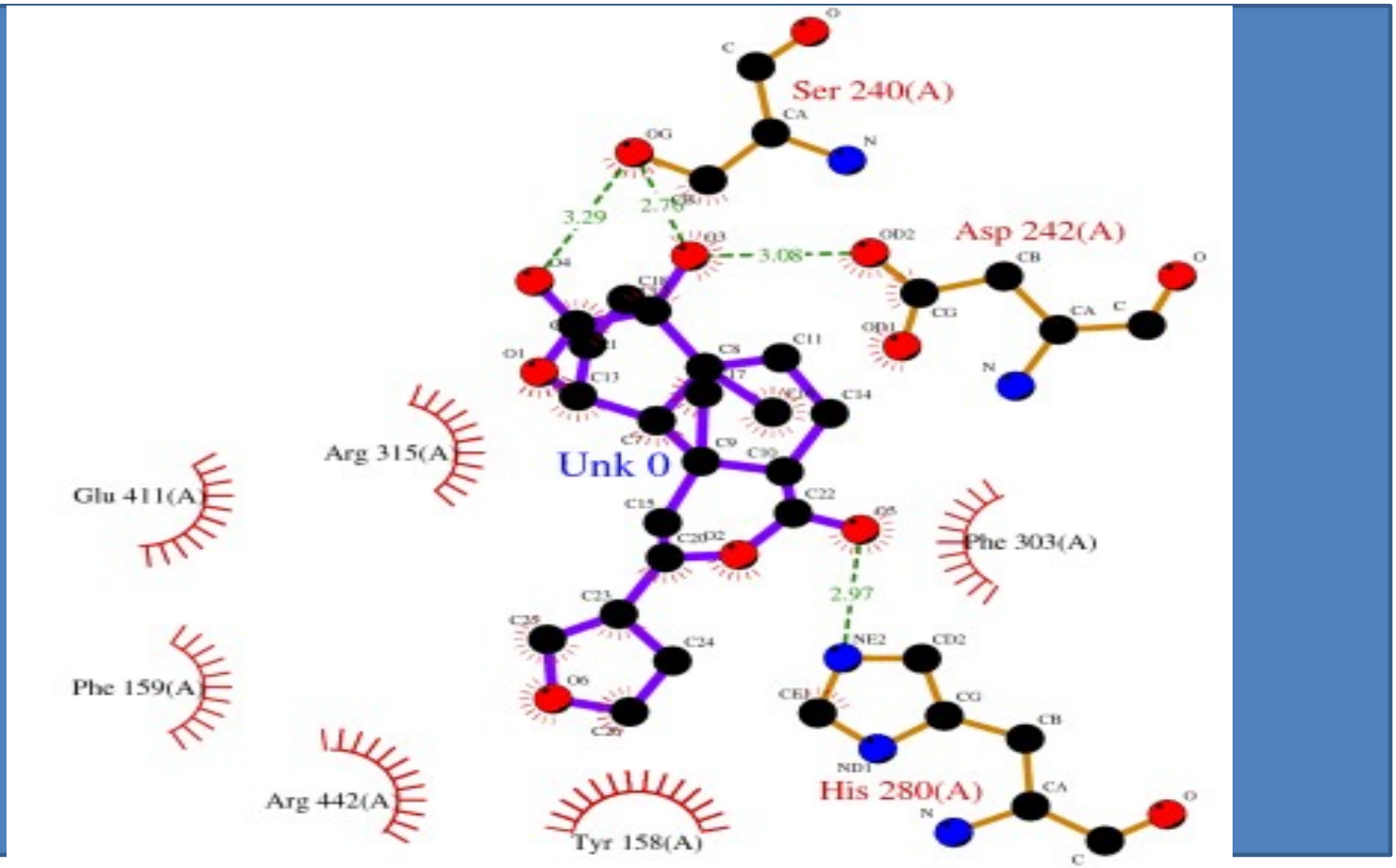
DEPARTEMEN BIOKIMIA
FAKULTAS MATEMATIKA DAN ILMU PENGETAHUAN ALAM
INSTITUT PERTANIAN BOGOR

# Mekanisme senyawa Columbin dalam menurunkan kadar glukosa darah



# Interaksi senyawa columbin dengan enzim alfa glukosidase



# Penelitian Tahap Kedua

## KAJIAN TOKSISITAS CAMPURAN EKSTRAK SIRIH MERAH DAN KAYU MANIS

# Rancangan Percobaan

Fourty *Sprague dawley* rats (male and female)

- A cekok akuades
- B cekok 630 mg/kg campuran ekstrak
- C cekok 1260 mg/kg campuran ekstrak
- D cekok 1890 mg/kg campuran ekstrak

- Pemberian campuran ekstrak sirih merah dan kayu manis selama 28 hari
- Pengamatan jumlah hewan mati, berat badan, dan konsumsi ransum
- Analisis hematologi, biokimia klinis, histopatologi organ

# Penelitian Tahap Ketiga

## AKTIVITAS ANTIHIPERGLIKEMIK CAMPURAN EKSTRAK SIRIH MERAH DAN KAYU MANIS PADA TIKUS DIABETES YANG DIINDUKSI STREPTOZOTOSIN

# RANCANGAN PERCOBAAN

24 *Sprague dawley* male rats (200-270 g)

| KN | KP | SMKM 1 | SMKM 2 | SMKM 3 | SM |
|---|---|---|---|---|---|
| (induksi 0.9% NaCl dan cekok akuades ) | (induksi 50 mg/kg bb STZ dan cekok akuades ) | (induksi 50 mg/kg bb STZ dan cekok campuran ekstrak 630 mg/kg bb ) | (induksi 50 mg/kg bb STZ dan cekok campuran ekstrak 1260 mg/kg bb ) | (induksi 50 mg/kg bb STZ dan cekok campuran ekstrak1890 mg/kg bb) | (induksi 50 mg/kg bb STZ dan cekok ekstrak sirih merah 1350 mg/kg bb) |
| Kontrol negatif diabetes | Kontrol positif diabetes | Campuran ekstrak dosis berbeda | | | Ekstrak pembanding |

- Pemberian campuran ekstrak selama 14 hari
- Analisis profil darah , yaitu gula darah, lipid darah, dan insulin darah
- Analisis aktivitas antioksidasi enzimatis (SOD dan katalase) di darah
- Analisis histopatologi organ pankreas

# SIRIH MERAH

Empiris masyarakat Yogyakarta (2005)
Komoditas unggulan POKJANAS TOI (2010)

toksisitas akut menunjukkan praktis tidak toksik; senyawa bioaktif flavonoid, alkoloid, dan tanin; menurunkan glukosa darah tikus 37,4% (Safithri dan Fahma 2005 & 2007)

menghambat oksidasi asam lemak 80,40% dan bersifat *radical scavenger* dengan nilai $IC_{50}$ 85,82 ppm (Alfarabi *et al.* 2010)

# KAYU MANIS

Sinnamaldehida memiliki aktivitas hipoglikemik dan hipolipidemia pada tikus diabetes yang diinduksi STZ (Babu *et al.* 2006)

asupan 6 g kayu manis menurunkan kadar glukosa darah *postprandial* dan menunda pengosongan lambung (Hlebowicz *et al*. 2007)

aktivitas antibakteri, terhadap *B. cereus* (15.4 mm), *L. monocytogenes* (11.5 mm), *S. aureus* (15.7 mm), *E. coli* (8.7 mm) and *S. anatum* (12.1 mm) (Shan *et al.* 2007).

# UCAPAN TERIMA KASIH

**Kementrian Pendidikan**

1. Program BPPS 2008-2011
2. Hibah Doktor No kontrak.
   22/I3.24.4/PK/PDD/2011
3. PUPT 2013 No Kontrak 2013.089.521219

Kementrian Pertanian

Program KKP3T

No Kontrak.

891 / LB.620/I.1/3/2011.

HAYATI Journal of Biosciences, March 2008, p 45-48 Vol. 15, No. 1
ISSN: 1978-3019

## SHORT COMMUNICATION

# Potency of *Piper crocatum* Decoction as an Antihiperglycemia in Rat Strain *Sprague dawley*

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**Current researches for appropriate hypoglycemic agents focused on plants for traditional medicine. Traditionally in diabetic treatment, people used decoctions of *Piper crocatum* (Piperaceae). However, there is no phytochemical data of decoctions extract of *P. crocatum*. Hence, the aims of this study were to explore the phytochemical of *P. crocatum* decoctions and its antihyperglicemic activity. Fresh leaves of *P. crocatum* were boiled in water to obtain decoction and were examined phytochemical compounds by using Harbone assay. Antihyperglicemic activity of *P. crocatum* decoction extract was orally fed to alloxan induced diabetic rats. Results showed that *P. crocatum* decoction extract contained flavonoids, tanins, and alkaloids. Ten days of daily treatment of various doses decoction extract of *P. crocatum* led to reduce blood sugar level by 10-38% and prevent fall in body weight level by 5-52%. This result showed the same activity as Daonil treatment, which was the diabetic drug. Hence, this extract showed antihyperglicemic activity in alloxan-induced diabetic rats and increasing of their body weight.**

Key words: *Piper crocatum,* antihyperglicemic, phytochemical

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Jurnal Gizi dan Pangan, Maret 2012, 7(1): 43-48

# ANALISIS PROKSIMAT DAN TOKSISITAS AKUT EKSTRAK DAUN SIRIH MERAH YANG BERPOTENSI SEBAGAI ANTIDIABETES

(*Proximate Analysis and Acute Toxicitiy of* Piper crocatum *Leaves Extract as Potential Antidiabetics*)

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*ABSTRACT*

*The aim of this study was to explore the analysis proximate and toxicity of the decoctions of* P. crocatum. *Fresh leaves of* P. crocatum *were boiled in water in order to obtain decoction and were examined for its chemical compounds by using SNI 01-2891-1992 method for proximate analysis. Toxicity of decoction extract of* P. crocatum *was orally fed to rats (*Sprague dawley*). The results showed that* P. crocatum *leaves contains 9.27% water, 14.33% ash, 3.96% fat, 22.63% proteins, and 59.08% carbohydrates. Acute toxicity test showed that all rats were still alive after 7 days treatment with P. crocatum decoction for all dose groups (0, 5, 10, and 20 g/kg BB). $LC_{50}$ value of P.* crocatum *decoction was 544.82 ppm, meaning that the decoction was relatively harmless and bioactive.*

***Key words:*** Piper crocatum, *proximate analysis, toxicity, antidiabetic*

HAYATI Journal of Biosciences March 2012
Vol. 19 No. 1, p 31-36
EISSN: 2086-4094

Available online at:
http://journal.ipb.ac.id/index.php/hayati
DOI: 10.4308/hjb.19.1.31

# Toxicity Study of Antidiabetics Functional Drink of *Piper crocatum* and *Cinnamomum burmannii*

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***Piper crocatum* and *Cinnamomum burmannii* formulations is known to be a new diabetes functional drink. Thus, its toxicological profile needs to be studied. At present, the formulation was evaluated for the repeated dose toxicity study. The *Sprague dawley* albino rats were treated with *P. crocatum* and *C. burmannii* formulations (0, 630, 1260, and 1890 mg/kg) and administered orally for a period of 28 days in albino rats. The effects on body weight, food and water consumption, organ weight, hematology, clinical biochemistry as well as histology were studied. There were no significant differences in the body weight, organ weights and feeding habits between control and treated animals. Hematological analysis showed no marked differences in any of the parameters examined in either the control or treated groups. There were no significant changes that occurred in the blood chemistry analysis including glucose, cholesterol, triglycerides, creatinine, SGPT, and SGOT in experimental animals. Pathologically, neither gross abnormalities nor histopathological changes were observed. The formulation of *P. crocatum* and *C. burmannii* was found safe in repeated dose toxicity studies.**

Key words: *Piper crocatum, Cinnamomum burmannii*, repeated dose toxicity

International Food Research Journal 23(3): 1123-1130 (2016)
Journal homepage: http://www.ifrj.upm.edu.my

# Formula of *Piper crocatum, Cinnamomum burmanii,* and *Zingiber officinale* extracts as a functional beverage for diabetics

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[2]*Department of Agronomy dan Horticulture, Bogor Agricultural University, Bogor, Indonesia*

**Article history**

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**Keywords**

*Antidiabetic*
*Cinnamon*
*Functional beverage*
*Red betel*
*Red ginger*
*Sensory quality*

**Abstract**

Red betel (*Piper crocatum* Ruiz & Pav.), cinnamon (*Cinnamomum burmannii* Blume), and red ginger (*Zingiber officinale* var. Rubrum) were shown to have antidiabetic properties. However, there has been no studies on the antidiabetic activity analysis of that three plants formula in a functional beverage. This study aimed to determine the formula of those plants that had the best sensory quality. This research also analyzed the antioxidant and antidiabetic activity of the favored formula. Plants extracts were made by boiling method, while sensory evaluation was analyzed using acceptance test. Antioxidative activity was measured by 2,2-diphenyl-1-picrylhydrazyl (DPPH) assay and antidiabetic activity was obtained by *in vitro* method. The results showed that the highest acceptance score by the panelists was a formula with the composition of 42%(v/v) red betel leaves, 28%(v/v) cinnamon bark, 15%(v/v) red ginger, and 15% (v/v) lime. The chosen formula had antioxidant activity and α-glucosidase inhibitory activity as much as 873.2 µg/mL and 88.7%, respectively. This antidiabetic activity was higher than 0.01%(w/v) acarbose which had value of 31.1%. Investigation on its water extract showed that red betel contained flavonoids, tannins, and alkaloids. Therefore, it can be concluded that there was a functional beverage possessed high antioxidant and antidiabetic properties which acceptable by the consumers.

J. Math. Fund. Sci., Vol. 48, No. 2, 2016, 178-191 

# Antihyperglycemic Activity of *Piper crocatum* Leaves and *Cinnamomum burmannii* Bark Mixture Extract in Streptozotocin-induced Diabetic Rats

**Mega Safithri Hasibuan[1], Sedarnawati Yasni[2], Maria Bintang[1] & Anna Setiadi Ranti[3]**

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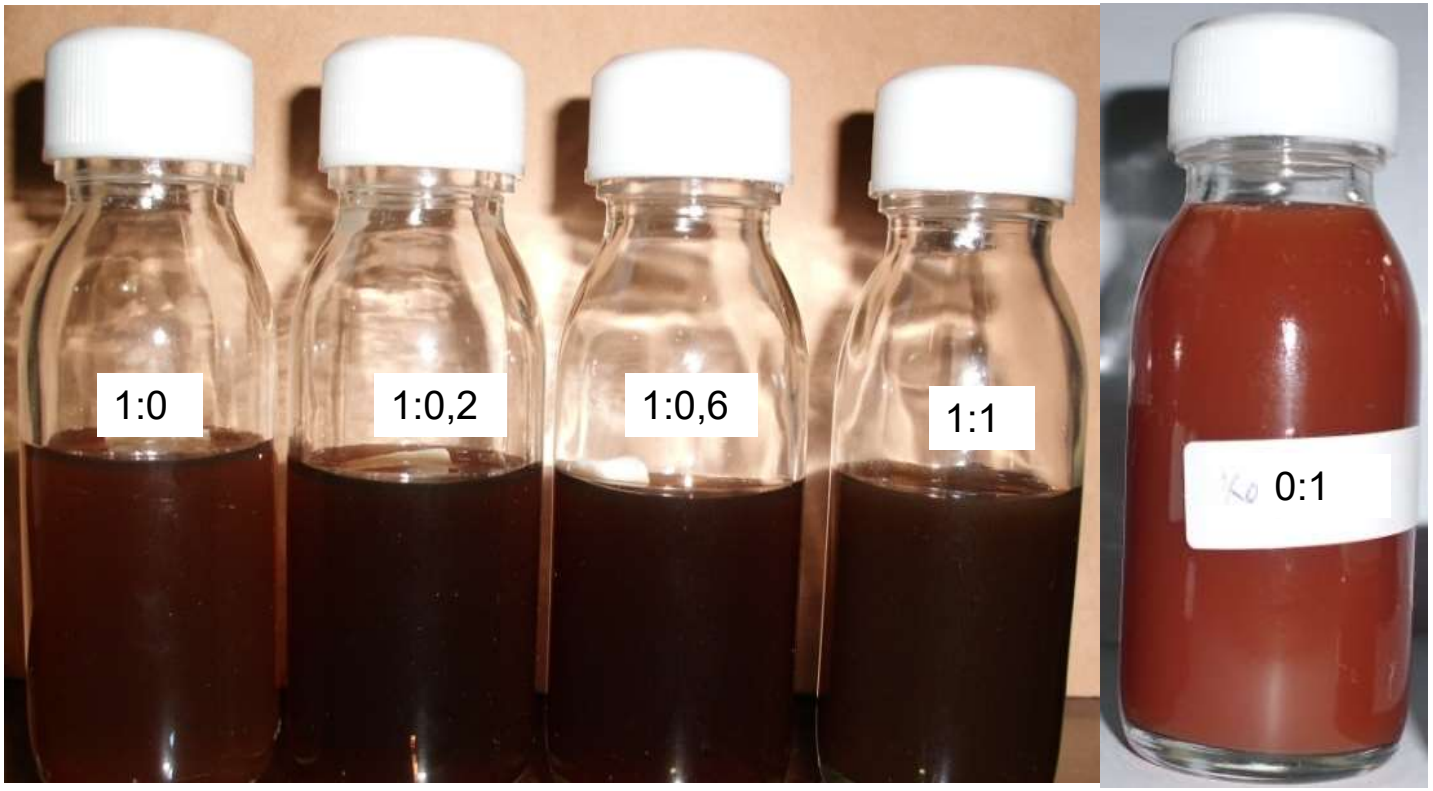
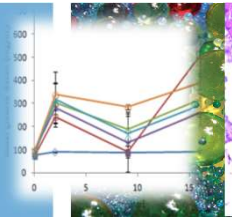
E-mail: mega_safithri@yahoo.com

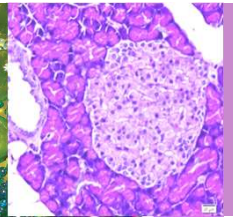
**Abstract.** Indonesia presently has the fourth largest diabetic mellitus prevalence of all countries in the world. In a previous study, a mixture extract of *Piper crocatum* leaves and *Cinnamomum burmannii* bark showed in vitro antihyperglycemic activity. It acted as inhibitor of the α-glucosidase enzyme and had no toxic effect when it was administered orally to male and female rats for 28 days. In the present study, mixture extracts of *P. crocatum* leaves and *C. burmannii* bark were used to observe antihyperglycemic activity in diabetic rats induced with streptozotocin. Mixture extracts of *P. crocatum* leaves and *C. burmannii bark* were orally given to diabetic Sprague Dawley rats at various doses for 16 days. The results showed that the treatment led to a reduction of the blood glucose level, an increase in blood insulin level up to 170.75% at 1260 mg/kg body weight, maintaining the blood lipid level of the diabetic rats at a normal level, and an increase of pancreatic ß cells in the islets of Langerhans up to 2.2-fold at 1260 mg/kg body weight. The mixture extracts of *P. crocatum* and *C. burmannii* have antihyperglycemic activity, which enhances the number of pancreatic β cells.

*Keywords: antihyperglycemic agents; Cinnamomum burmannii; glucose; insulin; lipid profile; Piper crocatum.*

# Foto minuman sirih merah kayu manis







# Aktivitas Antihiperglikemik dan Antioksidan Minuman Nanoenkapsulasi Berbasis Ekstrak Daun Kumis Kucing (*Orthosiphon aristatus* Bl.Miq) pada Tikus Diabetes yang Diinduksi Streptozotosin

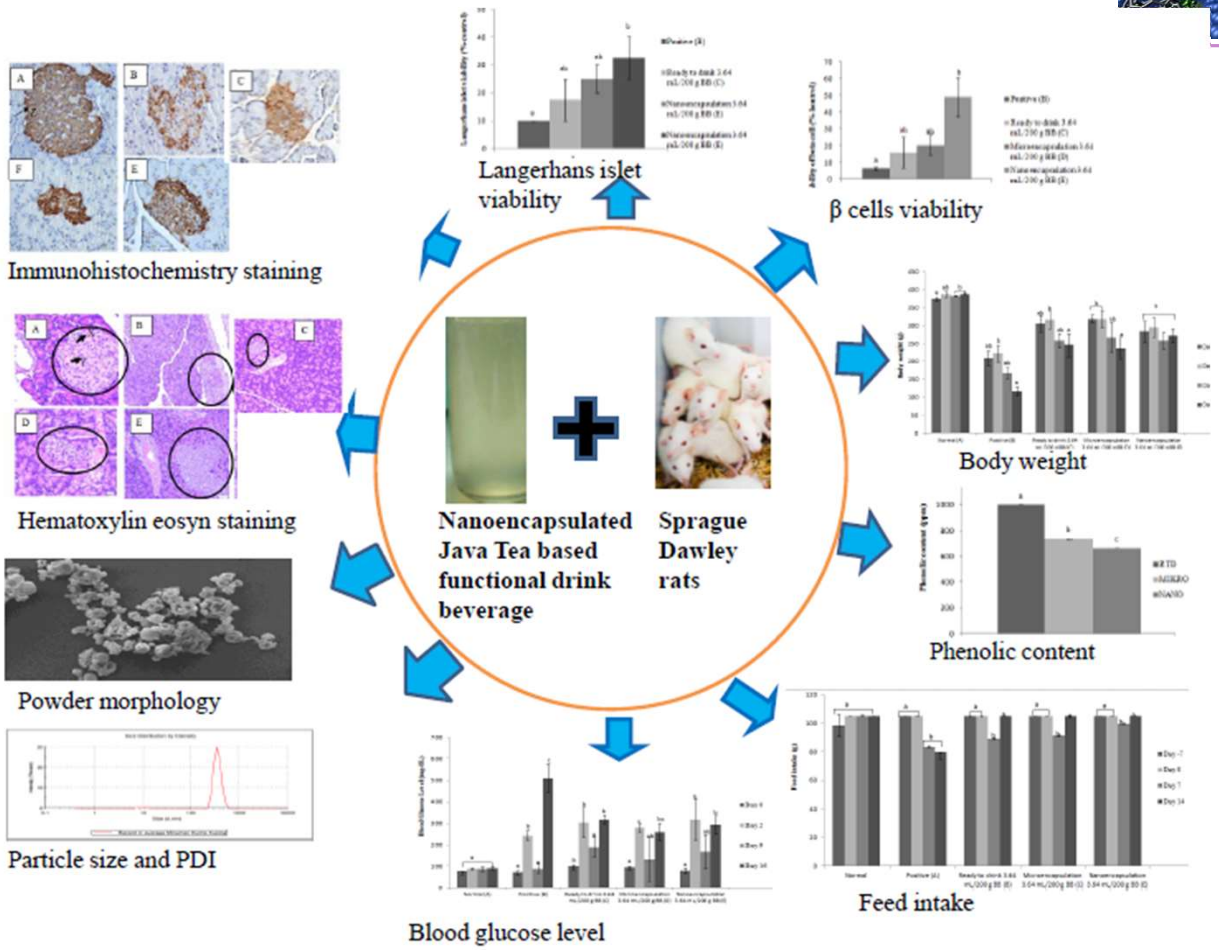

**Khairika Helyuputri, Dewi Esti Restiani, Mutiara, Monita Rekasih, Joncer Naibaho**

**Pembimbing :**

**Prof. Dr. Ir. C. Hanny Wijaya, M. Agr.**

**Dr. Tjahja Muhandri, MT**

**Dr. Mega Safithri, M. Si.**



Langerhans islet viability
β cells viability
Immunohistochemistry staining
Body weight
Hematoxylin eosyn staining
Nanoencapsulated Java Tea based functional drink beverage
Sprague Dawley rats
Phenolic content
Powder morphology
Particle size and PDI
Feed intake
Blood glucose level

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Available online at http://www.japsonline.com
DOI: 10.7324/JAPS.2019.90411
ISSN 2231-3354

# Anti-hyperglycemic activity of encapsulated Java tea-based drink on malondialdehyde formation

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*Key words:*
Diabetes mellitus, Java-tea based drink, micro-encapsulation, nano-encapsulation, lipid peroxidation.

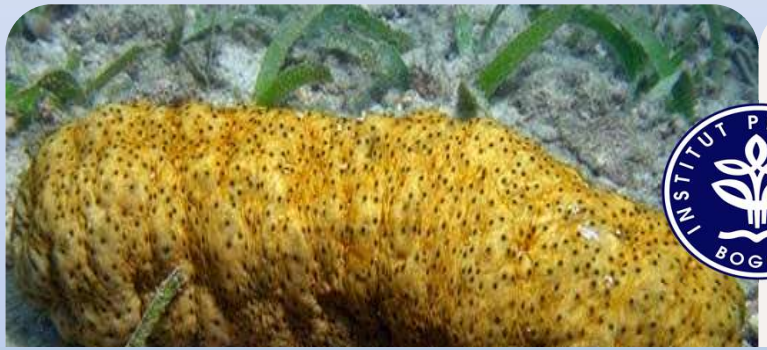
## ABSTRACT

Nano-encapsulated Java tea-based beverage was previously reported capable of demonstrating the highest protective activity for Langerhans and beta-cell. The mechanism of anti-hyperglycemic activity, however, has remained unclear. This research aimed to study the mechanism of the beverage as an anti-hyperglycemic encapsulated functional drink through its role in malondialdehyde formation in *streptozotocin*-induced diabetic Sprague Dawley rats. The rats were divided into four groups: (A) normal rats as negative control, (B) untreated diabetic rats as positive control, (C) diabetic rats treated with micro-encapsulated drink (3.64 ml/200 g), and (D) diabetic rats treated with nano-encapsulated drink (3.64 ml/200 g). The intervention was conducted for 44 days. Malondialdehyde level was measured periodically every 2 weeks, body weight and blood glucose level were measured periodically every week for 6 weeks. Malondialdehyde level analysis *in vitro* was carried out as a comparison. Compared to malondialdehyde (MDA) level on positive control group, encapsulated Java tea-based beverages intervention attenuated the formation of malondialdehyde in diabetic rats from 36.63% to 51.95%. In addition, micro- and nano-encapsulated drink suppressed the fluctuation of blood glucose level and body weight. *In vitro* assessment showed that micro- and nano-encapsulated drink suppressed the formation of MDA at 5.25% and 72.16%, respectively. The anti-hyperglycemic activity of micro- and nano-encapsulated drink is shown by their ability to alleviate the MDA formation both *in vivo* and *in vitro* assessment.

# UCAPAN TERIMA KASIH

**HIBAH KOMPETENSI**
**KEMENRISTEKDIKTI 2018**

# AKTIVITAS ANTIDIABETES DAN ANTIOKSIDAN SEDIAAN SPIRULINA (*Spirulina platensis*) DAN TERIPANG (*Stichopus hermanni*) IN VITRO DAN IN VIVO PADA TIKUS DIABETES YANG DIINDUKSI STREPTOZOTOCIN

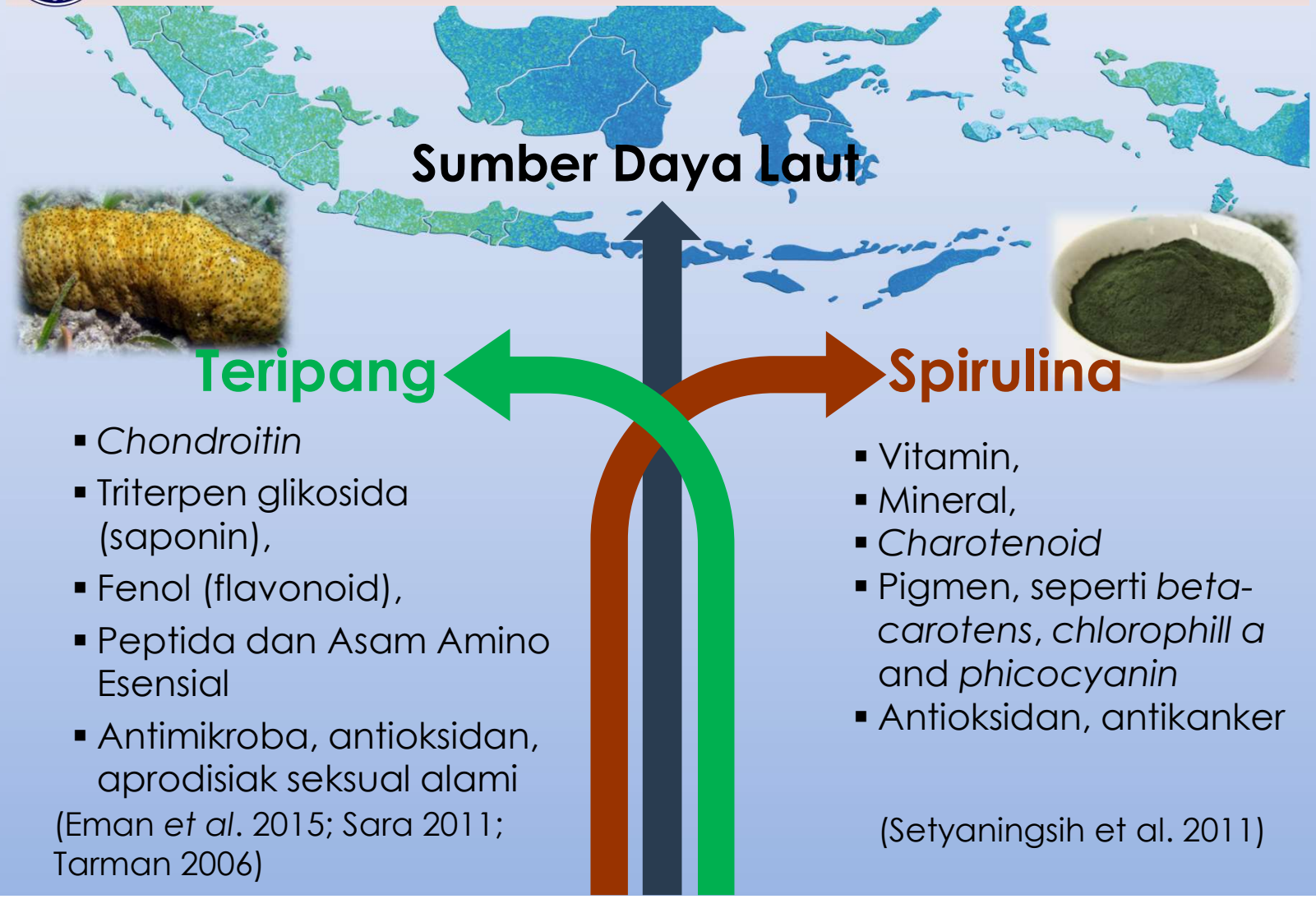


**SITI MARYANTI, ANISA ZHAFIRA GIANTI, YANTI FAJARWATI, HEMA APRILIA SETYO WINDARI DAN IMAROTUL MUA'LIMAH**

**Komisi Dosen Pembimbing** :

1. Dr. Mega Safithri, S.Si, M.Si
2. Dr. Kustiariyah Tarman, S.Pi, M.Si

# PENDAHULUAN




- *Chondroitin*
- Triterpen glikosida (saponin),
- Fenol (flavonoid),
- Peptida dan Asam Amino Esensial
- Antimikroba, antioksidan, aprodisiak seksual alami

(Eman *et al*. 2015; Sara 2011; Tarman 2006)

- Vitamin,
- Mineral,
- *Charotenoid*
- Pigmen, seperti *beta-carotens*, *chlorophill a* and *phicocyanin*
- Antioksidan, antikanker

(Setyaningsih et al. 2011)

# Inhibisi Enzim α-glukosidase

| Jenis Sampel | IC 50 (ppm) |
|---|---|
| Teripang Komersil | 1163.07 |
| Spirulina Komersil | 2214.50 |
| Campuran Teripang dan Spirulina Komersil (10:1) | 927.50 |
| Teripang Indonesia | 80.47 |
| Spirulina Indonesia | 2.26 |
| Campuran Teripang dan Spirulina Indonesia (10:1) | 1022.64 |
| Akarbose | 0.17 |

# % Penurunan Glukosa Darah

| Kelompok Tikus | % Penurunan setelah 7 hari konsumsi | % Penurunan setelah 14 hari konsumsi |
|---|---|---|
| Diabetes Akuades | -9,7* | -22,9* |
| Diabetes Spirulina Komersil | 18,2 | 4,5 |
| Diabetes Teripang Komersil | 15,4 | 5,2 |
| Diabetes Camp Sp-Tp Komersil | 8,7 | 11,4 |
| Diabetes Spirulina Indonesia | -1,4* | 16,8 |
| Diabetes Teripang Indonesia | 5,4 | 3,4 |
| Diabetes Campuran Sp-Tp Indonesia | 13,1 | 1,7 |

*** % Kenaikan Glukosa Darah**

TROPICAL LIFE SCIENCES RESEARCH

# Antioxidant Activity of *Spirulina platensis* and Sea Cucumber *Stichopus hermanii* in Streptozotocin-Induced Diabetic Rats

**Authors:**

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**DOI:** https://doi.org/10.21315/tlsr2019.30.2.9

## Highlights

- Diabetes can cause by the high blood glucose level which have an influence on the imbalance of MDA and antioxidant enzyme (SOD and Catalase).
- Sample of *Spirulina platensis* could reduce MDA of liver in Streptozotocin-induced diabetic rats.
- Sea cucumber *Stichopus hermanii* has antioxidant activity which is reduction of free radicals like MDA in Streptozotocin-induced diabetic rats.

# UCAPAN TERIMA KASIH


PKSPL IPB

PUSAT KAJIAN SUMBERDAYA PESISIR DAN LAUTAN

INSTITUT PERTANIAN BOGOR

# MANFAAT ILMU BIOKIMIA UNTUK PENGEMBANGAN PANGAN FUNGSIONAL ANTIDIABETES

**Menambah ilmu pengetahuan tentang cara pencegahan komplikasi diabetes melalui ilmu Biokimia**

**memberikan nilai tambah ekonomi Sumberdaya Hayati Indonesia**

**bermanfaat bagi penderita diabetes untuk mencegah komplikasi penyakitnya**

# Penghargaan

Tribute to Innovator 2019

IPB University

Nominasi Pemenang

Ristek-MTIC Award 2012

KEMENRISTEK & MARTHA TILAAR INNOVATION CENTER

5 BESAR FINALIS YOUNG SCIENTIST

RISTEKDIKTI-KALBE AWARDS 2016

KEMENRISTEK & PT KALBE FARMA

# Publikasi Populer


Seputar Indonesia RCTI

12 Desember 2012


Green TV IPB

Mei 2012


Jurnal Bogor

April 2009


# TERIMAKASIH

Prof. Dr.drh. Maria Bintang, MS
Dr. Hasim, DEA
Dr. Farah Fahma


ANY QUESTION