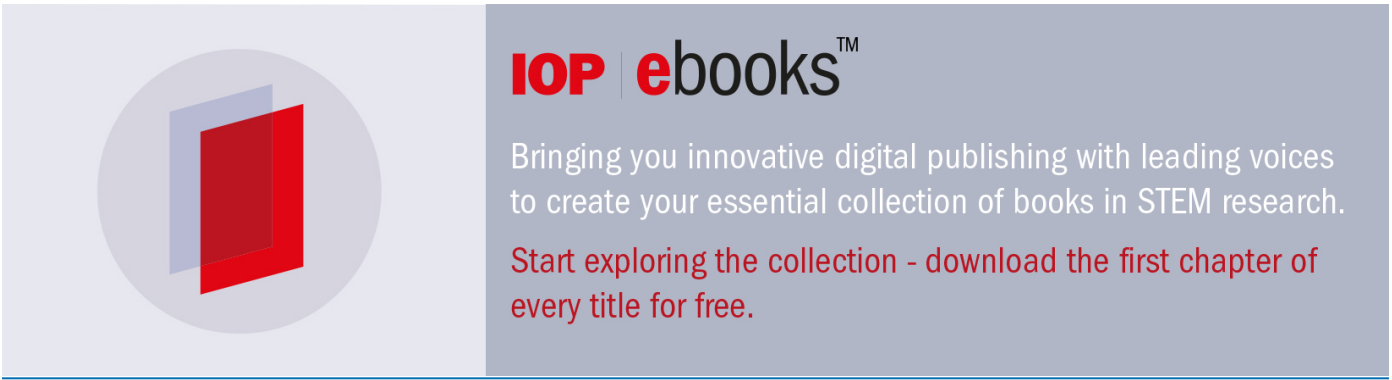
PAPER • **OPEN ACCESS**

The study of rice bran oil emulsions beverage intervention on inflammation status among metabolic syndrome adult subjects

To cite this article: D Alamsah *et al* 2018 *IOP Conf. Ser.: Earth Environ. Sci.* **196** 012036

View the article online for updates and enhancements.



This content was downloaded from IP address 103.10.104.46 on 13/02/2019 at 07:52

The study of rice bran oil emulsions beverage intervention on inflammation status among metabolic syndrome adult subjects

D Alamsah[1], **E Damayanthi**[1], **and C M Dwiriani**[1]

[1]Department of Community Nutrition, Faculty of Human Ecology, Bogor Agricultural University, IPB Darmaga Campus-Bogor 16680, Indonesia

Email: deni.alam@gmail.com

Abstract.*The inhibition of the oxidation reaction through dietary therapy is expected to prevent from the emergence of metabolic disorder e.g. obesity-related complications, insulin resistance, and dyslipidemia. One of the food commodities that can be utilized is rice bran due to oryzanol content.The objective of this study was to analyze the effect of*intervention of*ricebran oil (RBO)emulsionbeverageon inflammatory biomarkersof High SensitivityC-Reactive Protein (*Hs*CRP) and Interleukin-6(IL-6)among metabolic syndrome (MS) adult subjects.This study used a randomized single blind controlled trial design.Thirty five adult subjects (age 34-57 years) with MS are divided into 2 groups.Treatmentgroup (n=18)was givenRBO emulsion beveragefor 4 weeks.The controlgroup (n=17) wasgiven placebo emulsion beverage (withoutRBO). Nutrition intake wasassessedby 24 hours recalls method everyweek. HsCRPand IL-6 levelswere analyzed at pre and postintervention.After4weeks intervention,there was a significant change of theHsCRPlevel ($p<0.05$)in both groups, while for IL-6 serum levels a significant change only in control groups.However, the level of HsCRPand IL-6 serumin the treatment group no significant difference ($p>0.05$). The intervention ofrice bran oilseems give benefit for inflammation state on MS subject.*

1. Introduction

Dietary and human activity are currently changes e.g. excessive energy intake and increased sedentary behavior (lack of physical activity) [1]. These will lead to obesity and metabolic syndrome (MS). Metabolic syndrome incident mostly was caused by insulin resistance and the presence of flux due to excess fatty acids. Inflammation was suspected to play a role in the syndrome [2]. International Diabetes Federation (IDF) recommends that central obesity criterion as the main criterion plus 2 of 4 other criteria i.e. low HDL levels, high triglycerideslevels, hypertension, and high fasting blood glucose level [3].

Many studies reported that there were high prevalence of MS in several regions in Indonesia. Soewondo *et al.*[4] reported that prevalenceMSin Jakarta using ATP criteria III of Asia at the age of 25–64 years was 28.4 %. Other research in Jakartareported that the prevalence of MS in elderly men (55–85 years) was 6.6% [5]. While in the Bogor region the prevalence of MS in adults reached 36.2%, where the proportion of men (44%) was greater than women (28.6%)[6].

People with MS conditions, theinflamationshowed by the high level of the cytokine (e.g.*tumor necrosis factor*and interleukin-6) and also by theincreasing level of acute phase reactants, e.g. C-reactive protein (CRP). High concentration of CRP is an indicator for inflamatory state and related

Content from this work may be used under the terms of the Creative Commons Attribution 3.0 licence. Any further distribution of this work must maintain attribution to the author(s) and the title of the work, journal citation and DOI.
Published under licence by IOP Publishing Ltd

with higher risk of heart disease and diabetes [7]. The presence of inflammation will result in an increase in CRP concentration up to 1000 times [8]. Otsuka *et al.*[9] reported that in adult men (>35 years) CRP levels are related with enhancement of metabolicsyndrome risk. In addition, other studies had shown that therewas an increasing of IL-6 levelsin MS men[10].

The inhibition of the oxidation reaction through dietary therapy is expected to prevent from the emergence of metabolic disorder e.g. obesity-related complications, insulin resistance, and dyslipidemia[11],[12]. One of the food commodities that can be utilized is rice bran. The major bioactive components in rice bran are γ-oryzanol and ferulic acid which an antioxidant and anti-inflammation[13],[14]. Xu *et al.*[15] showed that the antioxidant activity of γ -oryzanol was higher than that of vitamin E.

The γ -oryzanol compound presented in the rice branoil fraction has been developed in the form of a RBO emulsion beverage. It has a better acceptance compared to rice bran powder beverage. Damayanthi *et al.*[16]reported that rice bran oil emulsion beverage intervention lowered total cholesterol and LDL cholesterol levels in obese adult subjects significantly.The studyabout the effect of γ-oryzanol in inflammatory status in human subjects with metabolic syndrome is still very limited. The purpose of this study was to studythe effect of RBO emulsion beverage intervention for the inflammatory biomarkers of High sensitive C-reactive protein (HsCRP) and interleukin-6 (IL-6) on metabolic syndrome subjects.

2. Method

2.1. Design, location, and time

This study used a randomized single blind controlled trial design. The productions of the RBO emulsion beverage were conducted at the Laboratory of the National Institute of Pharmaceutical Navy, Jakarta. This study was conducted in Mintohardjo Navy Hospital and Headquarters of NavyJakarta. The analysis of inflammatory biomarkers (HsCRP and IL-6) was conducted at the Integrated Laboratory of Faculty of Medicine University Indonesia. This studywas conducted from June 2015–June 2016. These research passed ethical review conducted by Ethics Committee of Faculty of Medicine, University of Indonesia Number: 870/UN2.F1/ETIK/2014.

2.2. Material and equipment

The materials used in the production ofRBOemulsions beverage were RBO commercial, emulsifiers (sugas ester), flavors, low-calorie sweetener, salt, and water.For analysis of HsCRP levels used the HsCRPHuman ELISA brand DRG ® kit and for IL- 6 levels used the Quantikine® ELISA Human IL-6 Immunoassay R & D ™ brand kit.

The equipment used in the production ofRBOemulsions beverage were bottle plastic, large pan, homogenizer, and scales. Equipments for sampling of the subject's blood were a syringe, blood tube, cotton, gauze and plaster. While for analysis of HsCRP and IL-6 levels were used Micro plate, micro pipette, and ELISA reader.

2.3. Research subjects

Target population was men with waist circumference ≥90 cm who worked at Mintohardjo Hospital Navy and Navy Headquarters Jakarta. Subjects were selected based on inclusion criteria: 1) aged 34–60 years old; 2) waist circumference ≥90 cm; 3) had two of the four criteria of MS, i.e. triglyceride levels>150 mg/dL, HDL levels <40 mg/dL, blood pressure ≥130/85 mm/Hg and fasting blood glucose ≥100 mg/dL and <126 mg/dL. While the exclusion criteria were: 1) suffering from diabetes mellitus; 2) regularly taking cholesterol-lowering drugs or hypertension medications; 3) suffering from chronic illness; and 4) smoking. Subjects that met the inclusion criteria were then randomized to determine the type of treatment to be accepted for each subject.

2.4. Intervention

Subjects entered a *run-in* period of 1 week, and during this time the subjectswere asked to limited consumption of high antioxidant food and supplements. After the *run in*period, subjects were gathered for blood collection, weight measurement and other data collection. Blood collection wasconducted at 07.30 until 10.00 a.m. by medical personnel. Thirty five adult subjects (age 34–57 years) with MSwere divided into 2 groups.i.e. 18 people in the treatment group who were given RBOemulsion beverage,two bottles (± 200 ml) a day equivalent to 57.6 mg γ-oryzanol and 17 people in the control groupwere given placebo (without RBO) beverage in the same volume for 4 weeks. To monitor compliance, subjects are reminded to consume the product via *short message service* (sms) on a regular basis. After the intervention ended, subjects were asked for fasting for 8 -10 hours and then thebloods were taken for post-intervention.

2.5. Data analysis

Data analysis was conducted by usingmicrosoft excel software. Homogeneity test was conducted on both groups to know the variance of data. The normality test used Kolmogorov-Smirnov's one-simple test. The Mann-whitney test was used to analyzed the level of education subjects. An independent pair t test was performed to test whether there are significant differences before and after the intervention. An independent t test was conducted to find out how much effect of rice bran oil emulsion beverage intervention on metabolic syndrome subject.

3. Results and discussion

3.1. Characteristicssubject

Characteristics subjects are presented in table 1. The age of the subject in this study ranged from 34-57 years old. Based on *independent t-test* there is no difference in age between the control group and the treatment group ($p>0.05$). Most subjects have high school education level. There is no difference in the level of education between the control group and the treatment group ($p>0.05$).

Table1. Characteristics subject.

Variabel	Control group (n=17)	Treatment Group (n=18)	p-value
Age (year), mean±SD	44.6±5.9	43.4±7.0	0.572
Education Level[a]			0.212
Elementary, n(%)	1(5.9)	0(0%)	
High School Junior, n(%)	0(0%)	0(0%)	
High School Senior, n(%)	13(76.4)	12(66.7)	
Diploma, n(%)	2(11.8)	4(22.2)	
Undergraduate, n(%)	1(5.9)	2(11.1)	
BMI ($kg/m^{2)}$, Mean±SD	29.8±4.3	31.7±3.5	0.183
Waist circumference (cm), Mean±SD	100.9±8.4	105.5±7.9	0.105
HsCRP (mg/L),Mean±SD	4.26±3.09	6.90±4.52	0.053

Independent t-test; [a]*Mann-Whitney*

The nutritional status of the subjects was determined using the body mass index (BMI) indicator. The mean BMI subjects in the control group were 29.8±4.3 kg/m^2 and the treatment group 31.7±3.5 kg/m^2,and according to WHO [17] it was included in the category of obese. There was no difference in nutritional status between the two groups ($p>0.05$). Emanuela *et al*. [18] stated that obesity is a risk factor for metabolic and cardiovascular diseases at the population level. Central obesity became a main concern which is a high risk factor for cardiovascular disease [19]. Measurement of waist circumference is one indicator in determining central obesity. All subjects in this study had waist circumference above 90 cm. There was no difference of waist circumference between the two groups.

HsCRP and IL-6 levels before the intervention were not significantly different between control and treatment groups. It means before intervention both of groups had the same characteristic.

3.2.Energy and nutrientsintake

The energy and nutrients intake of the subject was shown in table 2. There was no significant difference ($p > 0.05$) in energy and nutrientsintake before and after intervention. There is no difference energy and nutrients intake during intervention period for treatment group. While for control group there was significant higher protein intake during intervention ($p<0.05$).

Table2. Energy and nutrients intake before and during intervention.

	Control group (n=17)		Treatment group (n=18)	
	Before intervention	During intervention	Before intervention	During intervention
Energy (kcal)	1462±513	1561±333.6	1385±330	1497±315
Protein (g)	41.4±19.5 [a]	48.9±13.4 [b]	41.6±9.2 [a]	44.7±8.6 [a]
Fat (g)	40.5±22.6	45.6±11.2	40.9±15.9	40.4±11.2
Charbohydrate (g)	226.8±69.6	229.6±52.0	208.4±65.8	232.9±61.4

Figures followed by the different letters in the same row showed a significant difference for each groups ($p<0.05$)

3.3. The effect of RBO emulsion beverage intervention on HsCRPlevels

The effect of RBO emulsion beverage intervention on HsCRPlevelswas presented on table 3. Average of HsCRP level on both groups before and after intervention weremore than 3 mg/L, these showed a high risk to cardiovascular disease[7]. Level of HsCRP can be used as a clinical criteria for the metabolic syndrome and part from assessment risk disease cardiovascular.The presence of a high level CRP showed a persistent infection [8].

Table3. Effect of rice bran oil emulsion beverage intervention on HsCRPlevels.

HsCRP level (mg/L)	Control group (n=17)	Treatment group (n=18)
Before	4.26±3.09[a]	6.90±4.52[a]
After	3.12±2.32[b]	4.87±3.36[b]
Delta	-1.14±2.00	-2.03±3.75

Values followed by the different letters in the samecolumn showed a significant difference for each groups ($p<0.05$)

There was no significant difference ($p>0.05$) of HsCRP level between control and treatment groups at before intervention. After intervention HsCRP level on both group showed a decreased significantly($p<0.05$). When inflammation occurs, there was increasing of oxidative stresscaused immune cells produce free radicals [2]. The rice bran oil contains the bioactive component γ-oryzanol which has high antioxidant activity. Damayanthi's study showed that the administration of31.45 mg γ-oryzanol significantly decreased oxidized-LDLin vitro [20].

3.4. The effect of RBO emulsion beverage intervention on Interleukin-6 levels

Interleukin-6 levels ranged from 0.971-9.952 ρg/mL. After intervention, levels of IL-6 were decreased inboth groups. IL-6 is a mediator produced by macrophage cells, dendritic cells, endothelium or Th2 cells in an inflammatory reaction that serves as a signal between cells to regulate systemic responses [21]. Tanaka and Kishimoto mentioned that IL-6 production related with inflammation on disease chronic [22]. MS is a chronic disease, with decreased IL-6 due to interventions indicating a tendency for improvement in the state of inflammation. But there was no significant difference of IL-6 between control and treatment group after intervention. Other studies reported that in 4 months intervention of

γ-oryzanol combined with niacin significantly decreases TNFα levels [23]. TNFα is one of cytokines that induce the release of IL-6 from several cell types [24].

Table4. Effect of rice bran oil emulsion beverage intervention on Interleukin-6 level.

Interleukin-6 level (ρg/mL)	Control group (n=17)	Treatment group (n=18)
Before	3.287±1.457	3.437±1.914
After	2.617±1.386	2.503±0.778
Delta	-0.670±1.174 [a]	-0.934±1.999 [a]

Figures followed by the same letters showed no significant difference(p>0.05)

4.Conclusion

There was no significant differences characteristics subjectfor age, education, nutritional status, circumference waist, energy and nutrients intakeexcept for protein between treatment and control groups.These intervention has not been showed improvement on HsCRP and IL-6 state due to the length of time of intervention.

References

[1] Popkin BM 2006 Global nutrition dynamics: the world is shifting rapidly toward a diet linked with noncommunicable diseases*Am J Clin Nutr***84** pp 289–298
[2] Eckel RH, Grundy SM, Zimmet PZ 2005The metabolic syndrome*Lancet***365** pp 1415–1428
[3] [IDF] International Diabetes Federation 2006*The IDF consensus worldwide definition of the metabolic syndrome*(Belgium: IDF)
[4] Soewondo P, Purnamasari D, Oemardi M, Waspadji S, Soegondo S 2010Prevalence of metabolic syndrome using NCEP/ATP III criteria in Jakarta, Indonesia: the Jakarta primary non-communicable disease risk factors surveillance 2006*ACTA Med Indones* **42** pp 199–203
[5] Kamso S 2008 Prevalence of metabolic syndrome in older Indonesians Asia Pac *J Public Health***20** pp 244–50
[6] Muherdiyantiningsih, Ernawati F, Effendi R, Herman S 2008 Sindrom metabolik pada orang dewasa gemuk di wilayah Bogor*PGM***31** 2 pp 75–81
[7] Pearson TA, Mensah GA, Alexander RW, Anderson JL, Cannon III RO, Criqui M, Fadl YY, Fortmann SP, Hong Y, Myers GL, *et al* 2003 Markers of inflammation and cardiovascular disease: application to clinical and public health practice: a statement for healthcare professionals from the Centers for Disease Control and Prevention and the American Heart Association*Circulation***107** pp 499–511
[8] Baratawidjaja KG, Rengganis I 2010*Imunologi Dasar* Ed 9(Jakarta: Balai PenerbitFakultas Kedokteran Universitas Indonesia)
[9] Otsuka T, Nishiyama Y, Kachi Y, Kato K, Inagaki H, Kawada T 2014 Predictive value of asymmetric dimethylarginine and c-reactive protein for the risk of developing metabolic syndrome in middle-aged men IJC *Metabolic & Endocrine***5** pp 42–47doi: 10.1016/j.ijcme.2014.10.001
[10] Nishida M, Moriyama T, Ishii K, Takashima S, Yoshizaki K, Sugita Y, Yamauchi-Takihara K 2007 Effects of IL-6, adiponectin, CRP and metabolic syndrome on subclinical atherosclerosis*Clinica Chimica Acta***384** pp 99–104
[11] Riccardi, G, Giacco R, Rivellese AA 2004 Dietary fat, insulin sensitivity and the metabolic syndrome*Clin Nutr***23** pp 447–456
[12] Riccardi G, Rivellese AA 2000 Dietary treatment of the metabolic syndrome—the optimal diet. *Brit J Nutr***83** pp S143–S148
[13] Sakunpak A, Suksaereea J, Pathompaka P, Charoonratanaa T, Sermkaew N 2014 Antioxidant individual γ-oryzanol screening in cold pressed rice bran oil of different Thai rice varieties by HPLC-DPPH method*Int J Pharm PharmSci***6** pp 592–597

[14] Islam S, Yoshida H, Matsuki N, Ono K, Nagasaka R, Ushio H, Guo Y, Hiramatsu T, Hosoya T, Murata T, *et al* Antioxidant, free radical–scavenging, and NF-kB–inhibitory activities of phytosteryl ferulates: structure–activity studies*J Pharmacol Sci***111** pp 328–337
[15] Xu Z, Hua N, Godber JS 2001 Antioxidant activity of tocopherols, tocotrienol, and gamma-oryzanol components from rice bran against cholesterol oxidation accelerated by 2,2'-Azobis (2-methyl-propionamidine) dihydrochloride. *J. Agric. Food Chem* **49** pp 2077–2081
[16] Damayanthi E, NirmalaLC, FaigayantiA, SeptiariniR, MuharamN 2013 The use of chocolate in rice bran oil drink and its effect of health status on obese college students*Makalah yang disajikan pada seminar Forum IPIMA (Ikatan Profesor Indonesia Malaysia)*(Pertanian dan Kedaulatan Pangan (Agriculture and Food Sovereignty) di Indonesia dan Malaysia Kerjasama Asosiasi Profesor Indonesia, Majelis Profesor Negara, Institut Pertanian Bogor dan University Putra Malaysia. IICC Bogor) 18-20 November 2013
[17] [WHO] World Health Organization 2000 The Asia-Pacific perspective: redefining obesity and its treatment(Geneva, Switzerland: WHO)
[18] Emanuela F, Grazia M, Marco DR, Paola LM, Giorgio F, Marco B 2012 Inflammation as a Link between Obesity and Metabolic Syndrome*J Nutr Metab***2012** pp 1–7.
[19] Thaman RG, Arora GP 2013 Metabolic syndrome: definition and pathophysiology-the discussion goes on!*J Phys Pharm Adv***3** pp 48–56
[20] Damayanthi E, Muchtadi D, Zakaria FR, Syarief H, Wijaya CH, Damardjati DS 2004 Aktivitas antioksidan minyak bekatul padi awet dan fraksinya secara in vitro*Jurnal Teknol. dan Industri Pangan***15** pp 11–19
[21] O'Gorman MR, Donnenberg AD 2008*Handbook of human immunology* Second edition(CRC Press)
[22] Tanaka T, Kishimoto T 2012 Targeting interleukin-6: all the way to treat autoimmune and inflammatory diseases*Int J Biol Sci***8** pp 1227–1236
[23] Accinni R, Rosina M, Bamonti F, Della Noce C, Tonini A, Bernacchi F, CampoloJ, Caruso R, Novembrino C, Ghersi L, Lonati S 2006 Effects of combined dietary supplementation on oxidative and inflammatory status in dyslipidemic subjects *Nutrition, metabolism and cardiovascular diseases* **16** pp 21–127
[24] Yudkin JS, Kumari M, Humphries SE, Mohamed-Ali V2000Inflammation, obesity, stress and coronary heart disease: is interleukin-6 the link?*Atherosclerosis1***148** pp 209–14