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FOREWORD

Agriculture as one of leading economic sectors in some countries, is currently facing many problems. This situation could be overcomed by policy and institutional environment which is condusive to increase agricultural productivity while maintaining a sustainable agriculture development and food security. According to this, it is required to develop strategies, ane w paradigm, and holistic approach to support the agricultural growth continuum.

In order to make a significant contribution to the better understanding of sustainable *agriculture for meeting food security needs and addressing climate change challenges*, an International Conference on Sustainable Agriculture and Food Security was held in Bandung Indonesia on 27-28 September 2011. This conference was organized by collaboration of four faculties in Universitas Padjadjaran: Faculty of Agriculture, Faculty of Animal Husbandry, Faculty of Fishery and Marine Science, and Faculty of Agricultural Industrial Technology. Ministry of Agriculture of Republic Indonesia and internationally well-known experts from USA, Finlandia, Singapore, Germany, Malaysia, Romania, Republic of Serbia, China as well as Indonesia were invited as resource speakers.

More than 250 participants from 15 countries attended the conference. The conference shared experiences and views regarding agricultural production in a changing environment towards sustainable agriculture development to maintain food security, and stimulated cooperative research among participating institutions.

About 180 papers are presented and the committee hopes that these papers will be a lsating record of the contributions to this conference and a useful reference for all practitioners in the fields of agriculture in general. Some of the topics presented include critical issues dealing with sustainable agriculture and food security, agrosocio-economy, agritechnology, plant sciences, animal production, and food technology. The committee would like to thank the many reviewers of the papers for their contribution to these proceedings.

The conference and proceeding would have not been accomplished without the support of many individuals, groups and academic units. We owe our gratitude to those who commit and dedicate their self to this conference.

Benny Joy
Chair of ICSAFS

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Glucose and Triglycerides Content of Duck Blood as The Effect of Kombucha Fermentation

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Abstract

Inhibition of the body's synthesis of cholesterol in the liver and muscle tissue will determine the content of glucose and triglycerides in the blood. Previous research showed that Kombucha fermentation to 100ml or about 25% of drinking water can increase high-density lipoprotein (HDL), lowering low density lipoprotein (LDL) and also total cholesterol of duck blood. Kombucha tea is a fermented tea beverage produced by fermenting sugared black tea with tea fungus (kombucha). Kombucha is tea polyphenols which includes epicatechin glucoronate acid and niacin that have been reported to possess various biological activities. The objective of this study was to test the influence of Kombucha fermentation of glucose and triglycerides content of duck blood. This research was conducted using experimental methods arranged in Completely Randomized Design (CRD). Rations and drinking water provided ad libitum. Kombucha fermentation as treatment was fed orally for 30 days (8 a.m.). There were five treatments (control = R0 (normal), R1=40ml, R2=60ml, R3=80ml and R4=100ml doses of Kombucha fermentation)each treatment was replicated four times. The results showed that blood triglycerides were significantly decreased by all treatments compared to control. The lowest blood triglycerides were found in R4 or by increasing doses of Kombucha fermentation about 100 ml is about 107.47 mg/dl. However, there were no significant difference of blood glucose value among treatments. It can be concluded that Kombucha fermentation could reduce the synthesis of lipid in general including cholesterol, lipoprotein, and triglycerides.

Keywords: kombucha fermentation, glucose, triglycerides, duck's blood

Introduction

Kombucha is a fermented tea or a health drink that contains multiple species of yeast and bacteria and produces organic acid like glucoronate acid, lactic acid, active enzymes and niacin. Kombucha is a symbiotic growth of bacteria such as *Acetobacter xylinium, gluconicum bacterium, Acetobacter ketogenum* etc. Moreover, Kombucha contains yeast fermentation such as *Candida albicans, Sacharomyces cerevisiae,* and *Pichia fermentans* (Williams, 2001). The inoculums of the tea fermentation will determine the exact microbiological composition in Kombucha fermentation. Kombucha culture is often called as SCOBY (Symbiotic Culture of Bacteria and Yeast). SCOBY gelatinoids consist of clay layers, white membrane, and rubbery texture (Nainggolan, 2009).

SCOBY will metabolize sugars and produce organic acids comprising; gluconic acid, acetate, lactate, and folate (Frank, 1995). Glucose liberated from sucrose is metabolized for the synthesis of cellulose and gluconic acid by *Acetobacter* strains (Sreeramulu *et al*, 2000). Fructose is metabolized into ethanol and carbon dioxide by yeasts. Ethanol is oxidized to acetic acid by *Acetobacter* strains (Liu *et al.*, 1996). Acetic acid bacteria convert glucose to gluconic acid and fructose into acetic acid. Organic acids are produced during fermentation shield the symbiotic colony from contamination with unwanted foreign microorganisms that are not part of the tea fungus (Blanc, 1996; Greenwalt *et al.*, 1998). An optimum fermentation time is required for the production of a drinkable Kombucha. Longer fermentation often results in the production of too high levels of acids that may pose potential risks when consumed. Thus, it suggested controlling the pH and ideal temperature in kombucha preparation.

Frank (1995) stated that the optimum process of Kombucha fermentation is about 8 until12 days with pH of 2.70 to 3.20 with ideal temperature is about 23-27°C. The results of the fermentation are the various organic acids and vitamins. Nutrient ingredients per 120ml of Kombucha fermentation are total carbohydrate 8000 mg, vitamin C 0.12 mg, niacin 0.64 mg, folic acid 0.28 mg and riboflavin 1.16 mg (Novar, 1996).

As a result of secondary metabolic process of fermentation Kombucha fermentation also produced chemical constituents. The result of secondary metabolic compound has function and different roles to the body. Those compounds are gluconic acid, gluconate, acetate, oxalate, lactate, butyrate and natural antibiotic ingredients or they called organic compounds. Besides producing some organic acids, it also produces various kinds of vitamins such as vitamin B1, B2, B3, B6, B12, B15, Vitamin C, minerals, folic acid and enzymes (Naland, 2008).

Supplementation of fungal phytase and kombucha tea in human and poultry have been reported by some researchers. Supplementation of fungal phytase in broiler diet, improved the growth performance and phosphorus (Broz *et al.*, 1994; Zyla *et al.*, 2000; Viveros *et al.*, 2002). Supplementation of kombucha fermentation (kombucha tea) increased high density lipoprotein, lowered low density lipoprotein and total cholesterol level in duck bloods (Kurniawan *et al*, 2010 unpublished). Based on the biochemical constituents of the kombucha fermentation, the present study was carried out to investigate its glucose and triglycerides on duck blood as a supplementary drink.

Materials and Methods

One and half years of twenty ducks were used in this experiment. The uniformity of the body weight is determined by coefficient variable is about 8.30% (average 1.8kg). The cages used five flocks. The feed composition was formulated based on duck nutrient requirement basis for ducks (protein 16% and metabolism energy 2900 kcal/kg). Rations and drinking water provided ad libitum.

Table 1. Nutrient composition of the diet (Wahju, 1997)

Diet	DW	CP	CFat	CF	EM
		(%)			(Kcal/kg)
Maize	88.05	8.60	7.42	2.86	3,370
Soybean meal	89.98	41.13	4.06	6.13	2,240
Coconut cake	94.12	17.67	11.68	15.33	2,212
Fine Bran	92.81	11.00	11.33	11.75	1,630
Fish meal	94.58	60.00	6.00	1.31	3,080
Oil	-	-	100	-	8,600
Premix	100	-	-	-	-

Table 2. Rations Formulation

Diet	Formulation	CP	CFat	CF	EM
				(%)	(Kcal/kg)
Maize	56.00	4.82	2.18	1.12	1,889.20
Soybean meal	13.00	5.33	0.53	0.80	211.90
Coconut cake	12.00	2.23	1.51	1.85	265.44
Fine Bran	11.00	1.32	1.25	1.29	179.30
Fish meal	5.00	3.00	0.30	0.05	154.00
Oil	2.50	-	2.50	-	215.00
Premix	0.50	-	-	-	-
Total	**100**	**16.70**	**8.26**	**5.11**	**2,912.84**

Notes : DW = Dry weight; CP = Crude Protein; CFat = Crude Fat; CF = Crude Fiber;
EM = Energy Metabolism

Kombucha fermentation was fed orally for 30 days (8 am). There were five treatments which consist of five different doses of Kombucha fermentation (R1 : 0 ml, R2 : 40 ml, R3 : 60 ml, R4 : 80 ml, and R5 : 100 ml of kombucha fermentation).

Kombucha preparation

Kombucha was prepared by adding 100 g/L (10%) weight/volume sucrose and tea leaves of desired dry weight to boiling water. Normal drinkable tea of 4.4 g/L (0.44%) weight of dry tea per volume of boiled water, and increased levels of 8.7 g/L, 17 g/L, 35 g/L, and 70 g/L were prepared in duplicate. The fermentation time is in average twelve days at 25°C (average of room temperature).

Statistical analysis

To assess the significant level of effect caused by Kombucha fermentation supplementation in drinking water in duck on glucose and triglycerides, Complete Randomized Design continued with Duncans Multiple Range Test were used. A probability level of $P \leq 0.05$ was accepted as significant.

Parameters

On day 30 of the treatment blood was collected by venipuncture of the ulnar vein in determination and in 3.0-ml syringes fitted with twenty-gauge, 1-inch (2.54-mm) needles to obtain samples for blood determinations. Approximately 3 ml of whole blood was transferred to EDTA treated Vacutainer (Sakura) tubes for glucose and triglycerides analysis.

Result and Discussion

Glucose

This study shows that the treatment of Kombucha fermentation in general is not significant difference on glucose parameter or relative compared to the control. Moreover, the highest result of glucose blood was found in R4 or about 100ml doses of kombucha fermentation about 161 mg/dl. In additions, the control was the lowest glucose compared to other treatments. It predicted that total carbohydrate and some symbiotic bacteria on kombucha fermentation associated with glucose production, thereby could keep blood glucose. It is known that glucose liberated from sucrose is metabolized for the synthesis of cellulose and gluconic acid by *Acetobacter* strains (Sreeramulu *et al*, 2000).

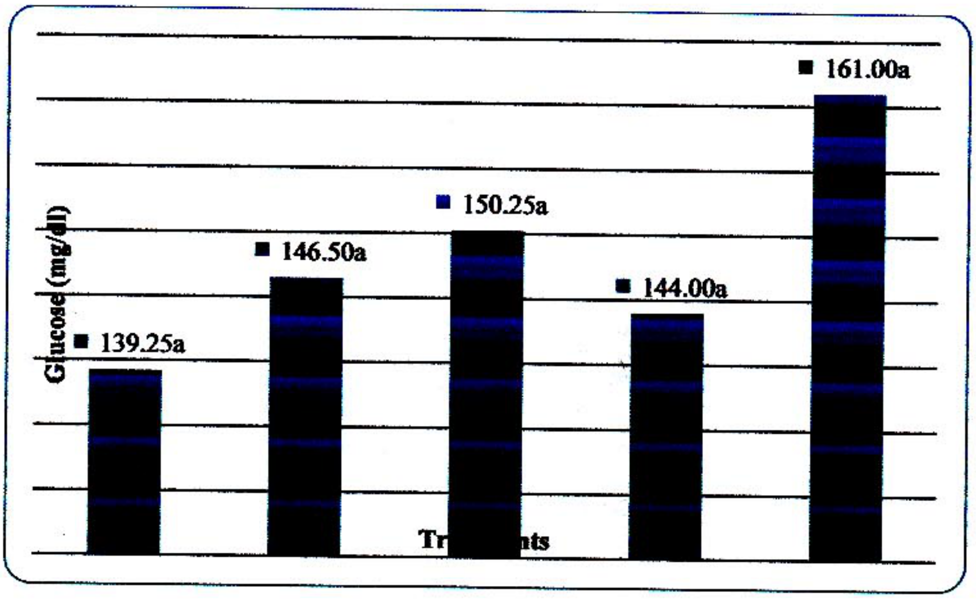

Figure 1. The mean glucose blood of duck dosed with kombucha fermentation (R0:0ml, R1:40ml, R2:60ml, R3:80ml, and R4:100ml) ($^{a,b}P \leq 0.05$)

Triglycerides

The highest kombucha fermentation-dosed for ducks that died prior to day 30 lower up to 70% of their triglycerides blood compared to the control group of duck. However, Kombucha fermentation doses from 40 ml until 100 ml shows significant different to the control group of duck. It predicted the addition of kombucha fermentation products such as soluble fiber, polyphenol, and niacin in high level could decrease the triglycerides by some metabolic processes. The soluble fiber has function in reducing the absorption of fat in the intestine so that it will stimulate the secretion of bile acids and digest more fats, thereby reducing triglycerides. Soluble fiber could stimulate the liver to release more bile salts into the duodenum to the liver cholesterol needs to produce more bile salts by taking cholesterol in tissues (Astuti, 2004). Moreover, the physicochemical properties of soluble fiber result in the intestinal lumen, which will alter metabolic pathways of fat metabolism, resulting in lowering blood triglycerides.

Niacin component as kombucha fermentation products also plays a role in lowering fats digestion. Niacin inhibits reform and reducing fat tissue retrieval of free fatty acids by the liver, so the cholesterol synthesis in the liver is reduced, and circulating cholesterol into the body tissues will decrease (Naland, 2008). Shoba *et. al* (2003) stated that niacin could reduce triglycerides and apolipoprotein-B containing lipoproteins (e.g., VLDL and LDL) are mainly through: a) decreasing fatty acid mobilization from adipose tissue triglyceride stores, and b) inhibiting hepatocyte diacylglycerol acyltransferase and triglyceride synthesis leading to increased intracellular apo B degradation and subsequent decreased secretion of VLDL and LDL particles. Moreover, polyphenol could decrease fat metabolism especially on cholesterol levels in the blood through the mechanism of inhibition of an enzyme activities that involved in cholesterol biosynthesis (3-hydroxy 3 metilglutaril CoA reductase) or through the mechanism of bile acid synthesis.

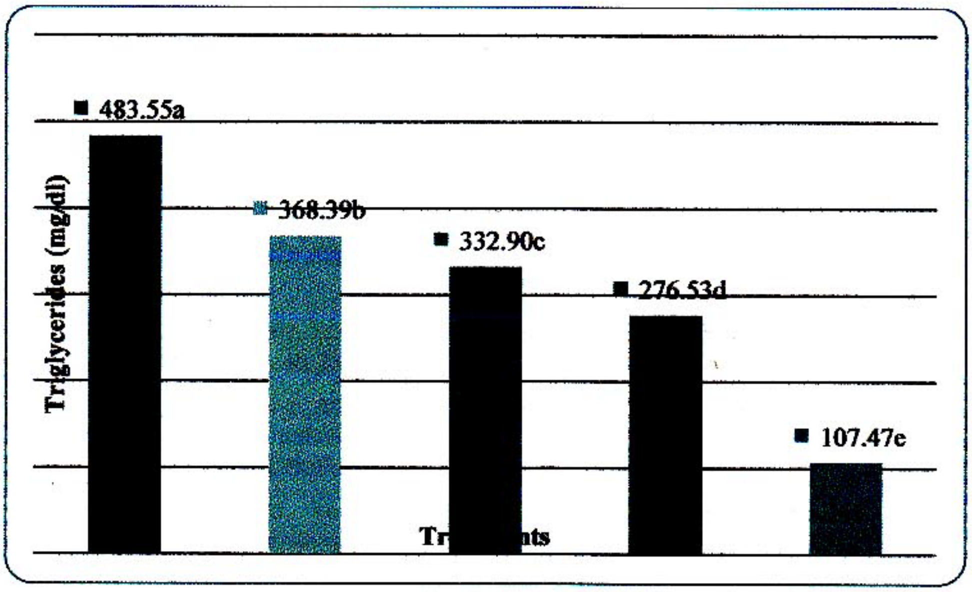

Figure 2. The mean triglycerides blood of duck dosed with kombucha fermentation (R0:0ml, R1:40ml, R2:60ml, R3:80ml, and R4:100ml) ([a,b]$P \leq 0.05$)

Conclusion

Kombucha fermentation up to 100 ml could keep glucose content in the blood but reduces triglycerides up to 70% compared to the control.

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