Effect of banana weevil enriched with β-glucan from Saccharomyces cerevisiae on productivity and abdominal fat of broiler chickens

by Shokhirul Imam

Submission date: 05-Nov-2020 11:20AM (UTC+0700)

Submission ID: 1436609018

File name: 3rd_ICoFA_2020_CR_65.docx (30.66K)

Word count: 2445

Character count: 12209

Effect of banana weevil enriched with β-glucan from *Saccharomyces cerevisiae* on productivity and abdominal fat of broiler chickens

S Imam* and U Suryadi

Department of Animal Science, Politeknik Negeri Jember, Mastrip Street PO BOX 164, Jember 68101, East Java, Indonesia

*Email: shokhirul_imam@polije.ac.id

Abstract. The study aimed to evaluate the utilization banana weevil enriched with β-glucan from *Saccharomyces cerevisiae* on performance and abdominal fat of broiler chickens. The research stages were started from fermented banana weevil flour with *Saccharomyces cerevisiae* (Fermipan® from PT Sangra Ratu Boga) with 0.5% administration (pruduced β-glucan content 2240 mg/kg). Dietary treatment was initiated when the broiler was 22-day-old with an initial body weight 459.41±50.71 up to 35-day-old. The feed used BR1 (Patriot Feed) from PT. Panca Patriot Prima. Treatment consisted of T0 (control without β-glucan), T1 (β-glucan administered at 25 ppm), T2 (β-glucan administered at 50 ppm), T3 (β-glucan administered at 75 ppm), and T4 (β-glucan administered at 100 ppm). Parameters observed were feed consumption, feed conversion ratio, final body weight (performance), and abdominal fat. The study was assigned in a completely randomized design (CRD) with 5 treatments and 4 replicates (10 birds each). The results showed that the utilization banana weevil enriched with β-glucan from *Saccharomyces cerevisiae* had no significant effect (P>0.05) on feed consumption, feed conversion ratio, final body weight and abdominal fat of broiler chickens. The use of banana weevil enriched with β-glucan from *Saccharomyces cerevisiae* up to a level of 100 ppm has not been able to improve performance and reduce abdominal fat for broiler chickens that are maintained until 35-days-old.

1. Introduction

The population of broiler chickens in Indonesia is increasing very rapidly. Starting from 2015-2019 which started from 1.5 billion chickens to 3.1 billion chickens. This is as a result of the increasing consumption of broiler chickens, the increase in consumption, which was initially 3.9 thousand kg/year in 2014 to 5.5 thousand kg/year in 2018 [1]. The characteristics of broiler chickens that can grow and produce meat quickly in a relatively short time make broilers still a mainstay to meet the needs of animal protein in Indonesia.

Broiler chickens that have a fast growth rate are always followed by fast fat too. In line with increasing body weight, the accumulation of fat in the body of broilers also increases. High fat broiler chickens are caused by a high appetite, but their movement is limited, so that the excess energy consumed from the feed is converted into fat which is stored in the abdomen and under the skin. This is a problem for consumers who generally want low fat in broilers because they are considered healthier. Therefore, it is necessary to reduce the fat of broiler chickens to make them healthier for consumption. One way is to add β-glucan [2].

β-glucan plays a role in influencing fat absorption by binding to fatty acids, cholesterol and bile salts in the digestive tract. Fatty acids and cholesterol that are bound to fiber cannot form the micelle needed for fat absorption to pass through the unstirred water layer into enterocytes. As a result, the fat that is bound to fiber cannot be absorbed and will be excreted through feces. β-glucan in this process can reduce cholesterol and broiler fat levels [3 and 4]. One of the easily available sources of β-glucan is β-glucan from *Saccharomyces cerevisiae* (*S. cerevisiae*).

Saccharomyces cerevisiae is a type of yeast that can synthesizeβ-glucan from its cell walls. The cell wall structure of *S. cerevisiae* contains proteins that are bound to sugar as glycoproteins and manoproteins, and contains manan, chitin, and polysaccharides types β-1,3-glucan and β-1,6-glucan [5]. β-glucan contained in S. cerevisiae is around 55% -65%. The growth of *S. cerevisiae* in the media requires nutrients consisting of carbon, nitrogen, oxygen, vitamins and minerals. As a source of carbon in the media, glucose is usually used [6]. One cheap source of glucose for *S. cerevisiae* is banana weevil.

Banana weevil contains 17.46% dry matter; 16.00% ash; 0.96% crude protein; 14.50% crude fiber; 0.75% crude fat; 67.79% nitrogen free extract; and 3202 kcal of gross energy [7 and 8]. The content of nitrogen free extract/ banana weevil starch allows it as a medium for *S. cerevisiae* to produce β-glucan. From this description, a study was conducted on the effect of banana weevil enriched with β-glucan from *S. cerevisiae* on the performance and abdominal fat of broiler chickens.

2. Materials and Methods

2.1. Preparation β-glucan

The production of banana weevil flour enriched with β-glucan from *S. cerevisiae* is done by chopping small and thin banana weevils, then drying them in the sun until dry then milling them into flour. Banana hump flour added 50% water (volume / weight) and stirred evenly, then steamed for 45 minutes, cooled to room temperature then added a starter of *S. Cerevisiae* 0.5% of the dry weight of banana weevil. The dough was put into black plastic which had been given small holes with a thickness of 2 cm and incubated at room temperature for 2 days. It was dried for 24 hours at 50℃ [9].

2.2. Animal and diets

The livestock used in the study were 200 broiler strains Cobb500™, 22-day-old, with an average body weight of 459.41±50.7[illegible] g. The feed used in this study was primarily the BR1 (Patriot Feed) from PT. Panca Patriot Prima with a crude protein content of 20-22%, a maximum of 5% crude fiber, a maximum crude fat of 6%, calcium content of 0.7-0.9%, phosphor content of 0.7-0.9%, a minimum lysine of 1.20%, a minimum methionine of 0.45%, a minimum methionine + cystine of 0.80%, a minimum threonine of 0.75%, and a minimum tryptophan of 0.19%. The β-glucan content in banana weevil that has been fermented using *S. Cerevisiae* is 0.224%. Banana weevil made from kepok banana weevil that is 6 months old. *S. Cerevisiae* obtained from Fermipan® from PT Sangra Ratu Boga.

When the broiler chickens are 1-21 days old, they are reared in a brooder cage with a temperature of 34°C and given BR1 (Patriot Feed) feed from PT. Panca Patriot Prima. Starting from the age of 22-35 days the chickens are reared in the colony cage with natural temperature environment and put into the cage unit according to the treatment. Feed and drinking water were given ad libitum and the remaining feed was weighed every day. Broiler chickens are given the complete vaccine in the hatchery unit.

2.3. Collection of Data

The research parameters observed were feed consumption, final body weight, feed conversion ratio and abdominal fat which were measured at the end of the 35 day treatment period. Feed consumption is measured by the amount of feed given minus the remaining feed. The final weight was measured by weighing the chickens at the end of the treatment in the morning before feeding. Feed conversion ratio is obtained by dividing the amount of feed consumed by body weight. Abdominal fat is measured by weighing the fat in the abdominal cavity of the chicken after slaughter.

Commented [DP1]: Why not in relative procentage

Commented [si2R1]: because researchers want to see the weight of the abdominal fat as a whole, not the relative weight

2.4. Treatment

This study used a completely randomized design (CRD) with 5 treatments and 4 replications. The research treatments consisted of T0 (control without β-glucan), T1 (β-glucan administered at 25 ppm), T2 (β-glucan administered at 50 ppm), T3 (β-glucan administered at 75 ppm), and T4 (β-glucan administered at 100 ppm). The percentage of β-glucan content in the treatment will be converted into β-glucan content in banana weevil flour enriched with β-glucan from *S. cerevisiae*, so what is given is not pure β-glucan, but banana weevil flour enriched with β-glucan from *S. cerevisiae*. The β-glucan content in banana weevil flour fermented with S. cerevisiae was 0.224% [10].

2.5. Statistical Analysis

The research data were analyzed using the F test of analysis of variance (ANOVA) with $\alpha = 5\%$ and if the effect of the treatment was real ($P < 0.05$), it was followed by the Duncan Multiple Region test [11]. The data obtained were analyzed using SPSS ver. 16.0 [12]

3. Results and Discussion

The results of the research on the performance of broiler chickens which include feed consumption, final body weight, feed conversion ratio, and abdominal fat are listed in Table 1. The results of statistical analysis showed that the provision of banana weevil enriched with β-glucan fiber from *S. cerevisiae* had no significant effect ($P>0.05$) on feed consumption, final body weight, feed conversion ratio, and abdominal fat.

Table 1. Performance and abdominal fat of broiler chickens

Parameter	Treatment						
	T0	T1	T2	T3	T4	SEM	P value
Feed consumption (g)	2978.86	3005.87	3045.15	3024.00	3037.25	49.32	0.98
Final body weight (g)	2049.50	1986.75	2041.50	1964.50	1963.75	36.77	0.53
Feed conversion ratio	1.94	2.02	1.98	2.04	2.08	0.05	0.33
Abdominal fat (g)	14.25	13.25	19.75	25.25	24.00	4.12	0.20

SEM : Standard error mean

Feed consumption in the treatment of banana weevil enriched with β-glucan from *S. cerevisiae* did not have a significant effect ($P> 0.05$) at the level of administration of 0-100 ppm. This is possible as a result of not affecting the appetite of broilers. Wahju [13] stated that the factor affecting feed consumption is the energy content in the feed, feed consumption will increase when feed has low energy and consumption will decrease when the feed energy content is high. Besides, the management factors of maintenance, health and drinking water consumption [14]. The results of the same study were shown by Kazempour et al. [15] that the use of β-glucan up to a level of 30 g/kg of feed had no significant effect ($P> 0.05$) on feed consumption. Elrayeh and Yildiz [16] gave β-glucan at the 0.014% level also did not affect ($P> 0.05$) feed consumption. Moon et al. [17] also conducted a study on the provision of β-glucan to a level of 60 ppm, but the results also had no significant effect ($P> 0.05$) on parameters of feed consumption. The same result was obtained by Zhang et al. [18] that the addition of β-glucan in feed to a level of 1 g/kg of feed had no significant effect ($P> 0.05$) on feed consumption. This proves that β-glucan can be used in broiler feed because it does not have a negative or positive effect [19]. As a result of feed consumption that was not significantly different (P> 0.05) in this study, the final body weight was not significantly different (P> 0.05).

The final body weight in this study showed no significant effect (P> 0.05) on the treatment of banana weevil enriched with β-glucan from *S. cerevisiae* at a level of 0-100 ppm. This is thought to be the result of consuming the same feed, resulting in the same final body weight. This is in line with research conducted by Elrayeh and Yildiz [16] that the administration of β-glucan up to the level of 0.014% has not shown a significant effect (P> 0.05) on final body weight. In line with this study, Keser et al. [19] also had no significant effect (P> 0.05) on final body weight at levels of β-glucan administration up to 0.05%. An et al. [21] showed results that are in line with this study, that the addition of β-glucan in feed to a level of 0.1% in feed has not been able to have a significant effect on final body weight. This resulted in the feed conversion in this study also had no significant effect (P> 0.05).

Feed conversion in the treatment of banana weevil enriched with β-glucan from *Saccharomyces cerevisiae* had no significant effect (P> 0.05) at the level of administration of 0-100 ppm. This is because the amount of feed consumption and final body weight have no significant effect (P> 0.05), so that the feed conversion also has no significant effect (P> 0.05). This is in line with the study conducted by Tian et. al. [22] that the addition of β-glucan to the feed to a level of 200 mg/kg of feed had no significant effect on feed conversion (P> 0.05). Previous research conducted by Chae et. al. [22] showed that the addition of β-glucan to a level of 0.04% was not able to reduce feed conversion.

Abdominal fat in broiler chickens given in the treatment of banana weevil enriched with β-glucan fiber from *Saccharomyces cerevisiae* had no significant effect (P> 0.05) at the level of administration of 0-100 ppm. This may be due to the age of the broilers at the time of slaughter was still 35-days-old, so that the fat deposition was still a little in the abdominal/abdominal cavity. Wahju [13] stated that chickens at the age of 4-5 weeks have seen their fat growth, but not much. At the age of 6-7 weeks the fat tissue begins to form rapidly, then from that time the accumulation of fat continues to accelerate, especially abdominal fat at the age of 8 weeks, so that chicken weight increases rapidly [2]. In line with this statement, the provision of β-glucan to a level of 30 g/kg of feed was able to reduce the percentage of abdominal fat in broilers that were slaughter at 42-days-old [15]. However, the study conducted by Elrayeh and Yildiz [16] at the level of β-glucan administration up to 0.014% was not able to reduce abdominal fat which was slaughter at the age of 6 weeks. Zhang et. al. [18] stated that giving β-glucan to a level of 1 g/kg of feed has not been able to reduce abdominal fat in broilers that were slaughter at 35 days old. An et. al. [20] stated the same thing that the administration of β-glucan at the level of 0.1% in broilers that were slaughter at 35-days-old was not able to reduce abdominal fat. This above shows that in addition to the age factor, the factor of the amount of β-glucan given in the feed also affects the reduction of abdominal fat. β-glucan plays a role in influencing fat absorption by binding to fatty acids, cholesterol and bile salts in the digestive tract. Fatty acids and cholesterol that are bound to fiber cannot form the micelle needed for fat absorption to pass through the unstirred water layer into enterocytes. As a result, the fat that is bound to fiber cannot be absorbed and will be excreted through feces. β-glucan in this process can reduce cholesterol and broiler fat levels [3 and 4]

4. Conclusion

The use of banana weevil enriched with β-glucan from *Saccharomyces cerevisiae* up to a level of 100 ppm has not been able to improve performance and reduce abdominal fat for broiler chickens that are maintained until 35 days old.

5. Acknowledgments

The author would like to express his gratitude to the Center for Research and Community Service (*P3M*) , Politeknik Negeri Jember, who has funded this research through Non-Tax State Revenue funding (*PNBP*) with contract number 485 /PL17.4/PG/2020.

Effect of banana weevil enriched with β-glucan from Saccharomyces cerevisiae on productivity and abdominal fat of broiler chickens

ORIGINALITY REPORT

19%	15%	11%	4%
SIMILARITY INDEX	INTERNET SOURCES	PUBLICATIONS	STUDENT PAPERS

PRIMARY SOURCES

1	repository.unsri.ac.id Internet Source	2%
2	www.veterinaryworld.org Internet Source	2%
3	www.abcbodybuilding.com Internet Source	1%
4	sevgiligiyim.com Internet Source	1%
5	M M D Utami, D Pantaya, N Nofida, N H D Larasati, A Agus. "Addition garlic extract in ration on fat deposition of broiler", IOP Conference Series: Earth and Environmental Science, 2018 Publication	1%
6	publikasi.polije.ac.id Internet Source	1%
7	academic.oup.com	

Internet Source

1%

8 www.sokvetjournal.net
Internet Source

1%

9 T Budiati, W Suryaningsih, S. Umaroh, B. Poerwanto, A Bakri, E Kurniawati. "Antimicrobial activity of essential oil from Indonesian medicinal plants against food-borne pathogens", IOP Conference Series: Earth and Environmental Science, 2018
Publication

1%

10 talenta.usu.ac.id
Internet Source

1%

11 Kühlwein, H., D. L. Merrifield, M. D. Rawling, A. D. Foey, and S. J. Davies. "Effects of dietary β-(1,3)(1,6)-D-glucan supplementation on growth performance, intestinal morphology and haemato-immunological profile of mirror carp (Cyprinus carpio L.)", Journal of Animal Physiology and Animal Nutrition, 2013.
Publication

1%

12 Asif Ahmad, Muhammad Kaleem. "β-Glucan as a Food Ingredient", Elsevier BV, 2018
Publication

1%

13 www.neliti.com
Internet Source

1%

14	garuda.ristekbrin.go.id Internet Source	<1%
15	Eva Sonck, Edith Stuyven, Bruno Goddeeris, Eric Cox. "The effect of β-glucans on porcine leukocytes", Veterinary Immunology and Immunopathology, 2010 Publication	<1%
16	garuda.ristekdikti.go.id Internet Source	<1%
17	www.lifesciencesite.com Internet Source	<1%
18	jbcr.co.in Internet Source	<1%
19	mafiadoc.com Internet Source	<1%
20	jurnal.politanikoe.ac.id Internet Source	<1%
21	Marco A. de Paula Brotto, Thomas M. Nosek, Ralph C. Kolbeck. "Influence of Ageing on the Fatigability of Isolated Mouse Skeletal Muscles from Mature and Aged Mice", Experimental Physiology, 2002 Publication	<1%
22	qdoc.tips Internet Source	<1%

23	S Wulandari, T M Syahniar. " The effect of adding probiotic on dietary antibiotic-free on production performance and intestinal lactic acid bacteria growth of broiler chicken ", IOP Conference Series: Earth and Environmental Science, 2018 Publication	<1%
24	"NUTRITION", British Poultry Science, 2001 Publication	<1%
25	repozitorij.unizg.hr Internet Source	<1%
26	D E Putra, A M Ismail. "Development of Agroindustry Based on Region Superiority in The Efforts to Accelerate Economic Growth in Arjasa District", IOP Conference Series: Earth and Environmental Science, 2018 Publication	<1%
27	Hyun Jung Kim, Pamela J. White. "Optimizing the Molecular Weight of Oat β-Glucan for in Vitro Bile Acid Binding and Fermentation", Journal of Agricultural and Food Chemistry, 2011 Publication	<1%

Exclude quotes Off

Exclude matches Off

Exclude bibliography Off