

OXALATE REDUCTION OF *Amorphophallus* Sp. TUBERS  
THROUGH FERMENTATION AND ITS UTILIZATION  
AS BROILER CHICKEN FEEDSTUFF

**ABSTRACT**

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This research were divided into three studies : 1) Selection, optimization of growth and production of microorganisms enzyme that can decrease oxalate content, 2) Effect of fermentation on nutrient and oxalate content of *Amorphophallus* sp., 3) Utilization of fermented *Amorphophallus* sp.in broiler feed. First study was conducted to select the microorganisms that had the highest activity of decarboxylase enzyme and to determine the optimum growth conditions that produce the highest activity of oxalate decarboxylase. In the first study, the oxalate degrading activity of four bacterias were tested. Data were analyzed by descriptive statistic. The optimum condition for growth and the maximum oxalate decarboxylase activities were measured from selected bacterias. Data were analysed by one way analysis of variance and followed by Duncan's new Multiple Range Test (DMRT), and each treatments were reapedted 4 times. The result indicates that *Bacillus subtilis* bacteria produced the highest oxalate decarboxylase enzyme activities, from four sellected bacterias. Maksimum activities of oxalate decarboxylase enzyme occured at log phase after 24 hours incubation. Incubation of *Bacillus subtilis* at 24 hours produced higher oxalate decarboxylase enzyme activity ( $P<0.05$ ) compare to another incubation time. The highest oxalate decarboxylase enzyme activity were reached at 5.5 pH of the medium and 37° C temperature of incubation ( $P<0.05$ ). The data showed that the difference in oxalate decarboxylase enzyme activities and microorganisms growth were affected by incubation period, pH and temperature of incubation. Second study was aimed to know the optimum condition in fermentation of *Amorphophallus* sp. tubers using oxalate degradation bacteria to produce low oxalate fermentation product without reduction on the nutrient quality. *Amorphophallus* sp. tubers were fermented with difference level of *Bacillus subtilis* as inoculant (0, 10, 20, 30% of dry matter) and three fermentation periods (7, 14, 21 days), each treatment were replicated 3 times. Data was analyzed using two way analysis of variance and followed by DMRT. The results of second study showed that fermentation of *Amorphophallus* sp. tubers using 20% inoculum level of *Bacillus subtilis* and 7 days incubation periods has the highest reduction ( $P<0.05$ ) of oxalate content. Difference level of inoculum and incubation periods negatively affected the dry matter, crude protein, crude fat, crude fiber, calsium and phosphorous of *Amorphophallus* sp. tubers. The third study were performed to investigate the optimum utilization level of fermented *Amorphophallus* tubers by oxalate degrading bacteria to increase the performance and carcass of broiler chickens. The study were done for 35 days using one hundred and ninety six (196) New Lohmann male broiler chickens which were randomly assigned in 7 dietary treatments (containing 0, 5, 10 and 15% of unfermented or fermented *Amorphophallus* sp. tubers). Each treatments replicated 4 times and each replications contained 7 birds. The histopathology data of liver and renal were described, while the data of inclusion level of *Amorphophallus* sp. in broiler feed on production performance, carcass quality, calcium and phosphor content in blood and bone were analyzed with one way analysis of variance analysis, continued with orthogonal contrast test. Result indicated that fermented *Amorphophallus* sp. by *Bacillus subtilis* up to 15% had no negative impact on feed intake, body weight, feed conversion, slaughter weight, carcass weight, length and weight of tibia bone. While giving unfermented *Amorphophallus* sp. tubers as much as 5% decreased ( $P<0.05$ ) feed consumption, body weight, feed conversion, slaughter weight, carcass weight, length and weight of tibia bone of broiler chicken. Inclusion of *Amorphophallus* sp. in broiler feed could cause liver inflammation and histopathological changes in broiler chicken kidneys such as inflammation, necrosis and congestion. In conclusion, fermentation with 20% *Bacillus subtilis*



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for 7 days incubation can reduce oxalate content of *Amorphophallus* sp. tubers, and the fermented *Amorphophallus* sp. tubers can be use up to 15% in broiler diets.

Keywords : Oxalate decarboxylase enzyme activity, *Bacillus subtilis*, *Amorphophallus* sp. tubers, oxalate, broiler performance

## INTISARI

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Penelitian ini dibagi menjadi tiga tahap : 1) Seleksi, optimalisasi pertumbuhan dan produksi enzim mikroorganisme yang dapat menurunkan kadar oksalat, 2) Pengaruh fermentasi pada kandungan nutrisi dan oksalat *Amorphophallus* sp., 3) Pemanfaatan *Amorphophallus* sp. dalam pakan broiler. Penelitian tahap pertama bertujuan melakukan seleksi beberapa bakteri yang dapat mendegradasi oksalat dan mengetahui kondisi optimum untuk pertumbuhan dan produksi enzim oksalat dekarboksilase maksimum yang dihasilkan oleh bakteri tersebut. Penelitian tahap pertama empat bakteri diukur kemampuannya untuk mendegradasi oksalat. Data dianalisis secara statistik deskriptif. Bakteri terpilih diukur kondisi optimum untuk pertumbuhan dan aktivitas oksalat dekarboksilase. Data dianalisis variansi satu arah dan dilanjutkan dengan *Duncan's new Multiple Range Test* (DMRT) dan setiap perlakuan diulang sebanyak tiga kali. Hasil penelitian menunjukkan bahwa dari empat bakteri yang diseleksi, bakteri *Bacillus subtilis* mempunyai aktivitas enzim oksalat dekarboksilase tertinggi. Aktivitas enzim oksalat dekarboksilase maksimum dihasilkan pada fase log setelah 24 jam inkubasi. Aktivitas enzim oksalat dekarboksilase yang dihasilkan oleh *Bacillus subtilis* pada 24 jam inkubasi lebih tinggi ( $P < 0,05$ ) daripada waktu inkubasi lainnya. Derajat keasaman (pH) medium 5,5 dan suhu inkubasi 37° C menghasilkan aktivitas enzim oksalat dekarboksilase tertinggi ( $P < 0,05$ ). Hasil menunjukkan bahwa perbedaan aktivitas enzim oksalat dekarboksilase dan pertumbuhan mikroorganisme dipengaruhi oleh waktu inkubasi, pH dan suhu inkubasi. Penelitian tahap kedua bertujuan untuk mengetahui kondisi optimum fermentasi umbi *Amorphophallus* sp. dengan bakteri pendegradasi oksalat agar diperoleh hasil fermentasi yang rendah oksalat tanpa menurunkan kualitas nutriennya. Umbi *Amorphophallus* sp. difermentasi dengan level inokulum *Bacillus subtilis* yang berbeda (0, 10, 20, 30% bahan kering) dan tiga waktu inkubasi (7, 14, 21 hari), masing-masing perlakuan diulang sebanyak tiga kali. Data dianalisis variansi dua arah dan dilanjutkan dengan DMRT. Hasil penelitian tahap kedua menunjukkan bahwa penurunan oksalat umbi *Amorphophallus* sp. tertinggi ( $P < 0,05$ ) pada level inokulum *Bacillus subtilis* 20% BK dan waktu inkubasi selama tujuh hari. Level inokulum dan lama waktu inkubasi yang berbeda tidak mempengaruhi kadar bahan kering, protein kasar, lemak kasar, serat kasar, kalsium dan fosfor umbi *Amorphophallus* sp. Tahap ketiga bertujuan untuk mengetahui level yang optimum penggunaan umbi *Amorphophallus* sp. yang difermentasi dengan bakteri pendegradasi oksalat untuk meningkatkan performans dan kualitas karkas ayam broiler. Pada penelitian ini menggunakan 196 ekor ayam broiler jantan New Lohmann yang didistribusikan secara acak ke dalam tujuh perlakuan pemberian pakan (0, 5, 10 dan 15% umbi *Amorphophallus* sp. tanpa fermentasi atau *Amorphophallus* sp. fermentasi), masing-masing empat ulangan dan masing-masing ulangan tujuh ekor ayam yang dipelihara selama 35 hari. Data histopatologi hati dan ginjal dideskripsikan sedangkan data tingkat penggunaan *Amorphophallus* sp. terhadap kinerja produksi, kualitas karkas, kandungan kalsium dan fosfor darah dan tulang dianalisis dengan analisis variansi satu arah dan dilanjutkan dengan uji kontras ortogonal. Hasil tahap III menunjukkan bahwa pemberian umbi *Amorphophallus* sp. fermentasi dengan *Bacillus subtilis* hingga 15% tidak berdampak negatif pada konsumsi pakan, berat badan, konversi pakan, berat potong, berat karkas, panjang dan berat tulang tibia. Sedangkan pemberian 5% umbi *Amorphophallus* sp. tanpa fermentasi menurunkan ( $P < 0,05$ ) konsumsi pakan, berat badan, konversi pakan, berat potong, berat karkas, panjang dan berat tulang tibia ayam broiler. Pemberian umbi *Amorphophallus* sp. menyebabkan terjadinya peradangan pada hati



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dan perubahan histopatologi pada ginjal ayam broiler seperti peradangan, nekrosis dan kongesti. Kesimpulan fermentasi dengan 20% *Bacillus subtilis* dan diinkubasi selama tujuh hari dapat menurunkan oksalat umbi *Amorphophallus* sp. dan dapat digunakan hingga 15% dalam pakan broiler.

Kata kunci : Aktivitas enzim oksalat dekarboksilase, *Bacillus subtilis*, *Amorphophallus* sp., oksalat, performans broiler.



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