

**PENGARUH MODIFIKASI FERMENTASI GROWOL MENGGUNAKAN
EFFECTIVE MICROORGANISM 4 TERHADAP KADAR AIR, KOMPONEN
KARBOHIDRAT, DAN STRUKTUR PATI TEPUNG GROWOL**

Annisa Usfatun Khasanah¹, Rio Jati Kusuma², Nurina Umy Habibah²

ABSTRAK

Latar belakang: Singkong merupakan sumber karbohidrat lokal potensial yang dapat diolah menjadi growol, namun fermentasi spontan sering menghasilkan mutu yang tidak stabil. Penggunaan *Effective Microorganism 4* (EM-4) menjadi alternatif untuk meningkatkan kualitas dan nilai gizi growol.

Tujuan: Penelitian ini bertujuan mengetahui pengaruh pemanfaatan EM-4 pada fermentasi growol terhadap perubahan kadar air, komponen karbohidrat, serat pangan, dan struktur pati tepung, sebagai upaya untuk mendukung pengembangan pangan fungsional berbasis lokal.

Metode: Penelitian eksperimental dengan desain rancangan acak lengkap 2 faktor yang terdiri dari lama fermentasi (1 hari, 2 hari, 3 hari) dan konsentrasi EM-4 (0%, 2.5%, 5%, 7.5%, 10%). Seluruh analisis laboratorium dilakukan secara triplo. Uji kadar air menggunakan metode *thermogravimetry*, uji karbohidrat menggunakan metode *Nelson Somogyi*, uji amilum menggunakan metode *direct acid hydrolysis*, uji serat pangan total menggunakan metode multienzim, dan gambaran struktur pati menggunakan mikroskop trinokuler Olympus BX43 dan aplikasi CellSens.

Hasil penelitian: Hasil penelitian menunjukkan bahwa lama fermentasi memberikan perbedaan signifikan ($p^t < 0,05$) terhadap kadar air, karbohidrat, amilum, dan serat pangan total, kecuali kadar air EM-4 10% ($p^t = 0,088$). Variasi konsentrasi EM-4 juga berpengaruh signifikan ($p^{tt} < 0,005$) terhadap seluruh parameter tersebut, kecuali serat pangan total hari ke-1 ($p^{tt} = 0,55$). Kadar air meningkat pada seluruh perlakuan EM-4 ($\Delta +0,09\%$ hingga $+2,63\%$), sedangkan kontrol menurun ($\Delta -2,73\%$). Karbohidrat dan amilum menurun pada semua perlakuan, dengan penurunan terbesar pada EM-4 10%. Serat pangan total juga menurun pada semua perlakuan ($\Delta -0,57\%$ hingga $-1,18\%$). Pengamatan mikroskopis menunjukkan perubahan morfologi pati yang semakin jelas seiring peningkatan konsentrasi EM-4, berupa retakan, erosi permukaan, hingga fragmentasi granula.

Kesimpulan: Terdapat perbedaan signifikan ($p < 0,05$) pada kadar air, karbohidrat, amilum, dan serat pangan total, serta perbedaan struktur pati antarperlakuan EM-4. Secara umum, peningkatan konsentrasi EM-4 dan lamanya fermentasi menyebabkan penurunan kadar gizi tersebut, meskipun besar penurunannya bervariasi. Fermentasi 1–3 hari juga memicu degradasi pati yang terlihat dari perubahan morfologi granula, mulai dari retakan halus hingga fragmentasi, dengan kerusakan paling jelas pada konsentrasi EM-4 yang lebih tinggi.

Kata Kunci: *Effective Microorganism 4* (EM-4), fermentasi, growol, komponen gizi, struktur pati.

¹ Mahasiswa Program Studi S1 Gizi, Fakultas Kedokteran, Kesehatan Masyarakat, dan Keperawatan, Universitas Gadjah Mada

² Program Studi, Fakultas Kedokteran, Kesehatan Masyarakat, dan Keperawatan, Universitas Gadjah Mada

THE EFFECT OF GROWOL FERMENTATION MODIFICATION USING EFFECTIVE MICROORGANISM 4 ON THE MOISTURE CONTENT, CARBOHYDRATE COMPONENTS, AND STARCH STRUCTURE OF GROWOL FLOUR

Annisa Usfatun Khasanah¹, Rio Jati Kusuma², Nurina Umy Habibah²

ABSTRACT

Introduction: Cassava is a potential local source of carbohydrates that can be processed into growol, but spontaneous fermentation often produces unstable quality. The use of Effective Microorganism 4 (EM-4) is an alternative to improve the quality and nutritional value of growol.

Objectives: This study aims to determine the effect of EM-4 utilization on growol fermentation in terms of changes in moisture content, carbohydrate components, dietary fiber, and starch structure, as an effort to support the development of locally-based functional foods.

Methods: This was an experimental study with a completely randomized design of two factors consisting of fermentation time (1 day, 2 days, 3 days) and EM-4 concentrations (0%, 2.5%, 5%, 7.5%, 10%). All laboratory analyses were performed in triplicate. Moisture content was tested using thermogravimetry, carbohydrates using the Nelson Somogyi method, amyllum using direct acid hydrolysis, total dietary fiber using a multienzyme method, and starch structure using an Olympus BX43 trinocular microscope and CellSens software.

Results: The results showed that fermentation time had a significant effect ($p^{\dagger} < 0.05$) on moisture content, carbohydrate content, amylose content, and total dietary fiber content, except for the moisture content of EM-4 10% ($p^{\dagger} = 0.088$). Variations in EM-4 concentration also had a significant effect ($p^{\dagger\dagger} < 0.005$) on all parameters, except for total dietary fiber on day 1 ($p^{\dagger\dagger} = 0.55$). Moisture content increased in all EM-4 treatments ($\Delta +0.09\%$ to $+2.63\%$), while the control decreased ($\Delta -2.73\%$). Carbohydrates and amyllum decreased in all treatments, with the greatest decrease in EM-4 10%. Total dietary fiber also decreased in all treatments ($\Delta -0.57\%$ to -1.18%). Microscopic observation showed increasingly clear changes in starch morphology with increasing EM-4 concentration, in the form of cracks, surface erosion, and granule fragmentation.

Conclusions: There were significant differences ($p < 0.05$) in moisture content, carbohydrates, amyllum, and total dietary fiber, as well as differences in starch structure between EM-4 treatments. In general, increasing EM-4 concentration and fermentation duration caused a decrease in these nutrient levels, although the extent of the decrease varied. Fermentation for 1–3 days also triggered starch degradation, as seen from changes in granule morphology, ranging from fine cracks to fragmentation, with the most obvious damage occurring at higher EM-4 concentrations.

Keywords: Effective Microorganism 4 (EM-4), fermentation, growol, nutritional components, starch structure.

¹ Undergraduate Student of Nutrition and Health Department, Faculty of Medicine, Public Health, and Nursing, Universitas Gadjah Mada

² Nutrition and Health Department, Faculty of Medicine, Public Health, and Nursing, Universitas Gadjah Mada