

# **LAPORAN AKHIR**

## **LAPORAN KEGIATAN**

### **MIE DAN BERAS SEHAT FUNGSIONAL DARI UMBI- UMBIAN LOKAL INFERIOR SEBAGAI ALTERNATIF PENGANTI BERAS DAN MIE TERIGU**

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## RINGKASAN EKSEKUTIF

### Mie Sehat Fungsional dari Umbi-umbian Lokal Inferior sebagai Alternatif Pengganti Mie Terigu

Penelitian ini bertujuan untuk menghasilkan mie sehat berbahan dasar tepung umbi-umbian lokal inferior yang dapat diterima secara organoleptik dan mempunyai fungsi terhadap kesehatan. Khasiat terhadap kesehatan harus dibuktikan secara ilmiah melalui serangkaian pengujian *bioassay* sebagai penurun kolesterol, penurunan kadar gula darah, penurun tekanan darah, serta antioksidan dan pelindung hati (hepatoprotektor).

Luaran penelitian ini berupa teknologi tepat guna produksi mie sehat dan produk mie sehat diharapkan dapat diaplikasikan secara komersial. Harapannya ketersediaan produk ini di pasar dapat meningkatkan konsumsi umbi-umbian yang dapat mengurangi konsumsi terigu dan meningkatkan skor pola pangan harapan (PPH).

Penelitian meliputi pembuatan mie dari 5 jenis umbi-umbian lokal inferior yaitu kimpul, garut, gembili, gadung, dan ubi kelapa meliputi formulasi, karakterisasi, pengujian daya terima, dan pengujian khasiat sebagai penurun kolesterol pada kondisi hiperkolesterolemia, penurun kadar gula darah pada kondisi hiperglikemia (diabetes), penurun tekanan darah pada kondisi hipertensi, antioksidan, dan hepatoprotektor. Juga dilakukan analisis senyawa bioaktif meliputi serat pangan, polisakarida larut air (PLA), jenis-jenis gula pada polisakarida larut air, dioscorin, dan diosgenin pada umbi segar.

Umbi-umbian ditepungkan dengan teknik yang sesuai untuk masing-masing jenis umbi untuk mendapatkan tepung dengan karakteristik baik. Khusus untuk gadung dilakukan proses detoksifikasi untuk menurunkan kadar sianida. Tepung yang dihasilkan dianalisis komposisi nutrisi dan senyawa bioaktif meliputi PLA, serat pangan, dioscorin, dan diosgenin.

Pengujian deskriptif dilakukan pada masing-masing jenis mie umbi untuk dilakukannya perbaikan formula. Selanjutnya dilakukan pembuatan mie untuk masing-masing jenis umbi-umbian dengan mengkaji jenis mie (mie basah, kering, dan instan) serta tingkat penambahan gluten (5, 10, 15, dan 20%). Mie terbaik dari masing-masing jenis umbi dianalisis kandungan nutrisi dan bioaktifnya. Selanjutnya dilakukan pengujian khasiat sebagai penurun kolesterol, penurun kadar gula darah, penurun tekanan darah, antioksidan, dan hepatoprotektor.

Hasil penelitian menunjukkan umbi-umbian lokal inferior yang digunakan pada penelitian ini, yaitu umbi kimpul, garut, gembili, gadung, dan ubi kelapa putih, mempunyai karakteristik umbi yang berbeda. Penepungan untuk masing-masing umbi juga berbeda dan pada gadung harus dilakukan detoksifikasi terlebih dahulu. Uji deskriptif untuk membandingkan mie umbi-umbian dengan kontrol tepung terigu menunjukkan kualitas mie umbi masih di bawah mie terigu sehingga perlu dilakukan perbaikan proses pengolahan mie. Perbaikan proses pengolahan mie dapat meningkatkan daya terima terhadap mie umbi-umbian. Tepung umbi-umbian lokal inferior dapat dioleh menjadi mie kering, mie basah, dan mie instan dengan sifat fisik yang bervariasi bergantung pada tingkat penambahan gluten. Mie terbaik untuk mie kimpul adalah mie instan dengan tingkat penambahan gluten 15%. Mie terbaik untuk mie garut adalah mie instan dengan penambahan gluten 20%. Mie terbaik untuk mie gembili adalah mie kering dengan penambahan gluten 20%. Mie terbaik untuk mie gadung adalah mie

instan dengan tingkat penambahan gluten 20%. Yang terakhir, mie terbaik untuk mie umbi kelapa adalah mie kering dengan penambahan gluten 10%.

Semua kelompok tikus yang mendapat pakan mie umbi-umbian menunjukkan penurunan kadar gula darah. Urutan tertinggi penurunan kadar gula darah adalah kelompok tikus yang mendapat mie gadung > mie ubi kelapa > mie kimpul > mie garut > mie gembili > mie terigu. Mie terigu tidak mempunyai kemampuan menurunkan kadar gula darah yang ditunjukkan setelah konsumsi mie terigu selama 4 minggu, tikus tetap berada pada kondisi hiperglikemia. Urutan kemampuan mie umbi-umbian dalam menghambat peningkatan kadar gula darah adalah mie gadung > mie ubi kelapa > mie kimpul > mie gembili > mie garut > mie terigu.

Penurunan total kolesterol darah setelah 4 minggu pemberian mie umbi-umbian menunjukkan asupan mie gadung, mie kimpul, dan mie garut menyebabkan kadar total kolesterol darah yang normal. Mie gembili dan ubi kelapa setelah 4 minggu pemberian mie menunjukkan kadar total kolesterol darah masih di atas normal. Urutan mie umbi-umbian dalam menurunkan kadar total kolesterol darah adalah mie gadung > mie kimpul > mie garut > mie ubi kelapa > mie gembili > mie terigu.

Kelompok tikus yang diberi mie gadung dan mie ubi kelapa menunjukkan tekanan darah yang sama dengan kelompok tikus normal setelah 4 minggu perlakuan pemberian mie. Urutan kemampuan mie umbi-umbian dalam menurunkan tekanan darah adalah mie gadung > mie ubi kelapa > mie garut > mie gembili > kimpul > mie terigu.

Pemberian mie umbi-umbian menyebabkan penurunan kadar MDA serum darah. Urutan kemampuan mie umbi-umbian dalam menurunkan kadar MDA dari yang tertinggi adalah mie gadung > mie kimpul > mie garut > mie gembili > mie ubi kelapa > mie terigu. Pemberian mie umbi-umbian menyebabkan peningkatan aktivitas SOD dibandingkan pemberian pakan standar atau mie terigu. Mie umbi-umbian mengandung fenol yang dapat berperan sebagai antioksidan. Kemampuan meningkatkan aktivitas SOD dari yang tertinggi adalah mie gadung > mie kimpul > mie garut > mie gembili > mie ubi kelapa > mie terigu. Pemberian mie gadung selama 4 minggu menyebabkan aktivitas SOD yang mendekati aktivitas SOD tikus normal. Setelah 4 minggu pemberian mie umbi-umbian pada kondisi peroksidasi, tikus menunjukkan aktivitas katalase yang hampir sama dengan tikus normal dan jauh lebih tinggi dibandingkan tikus yang diberi pakan standar dan mie terigu. Kemampuan meningkatkan aktivitas katalase dari yang tertinggi adalah mie gadung > mie garut = mie kimpul > mie gembili > mie ubi kelapa > mie terigu.

Kemampuan menurunkan MDA hepar oleh mie umbi-umbian dari yang paling tinggi adalah mie gadung > mie kimpul > mie garut > mie gembili > mie ubi kelapa > mie terigu. Pemberian mie umbi-umbian selama 4 minggu belum menunjukkan kadar MDA hepar yang mendekati kadar MDA hepar kelompok tikus normal yang tidak mengalami peroksidasi dan diberi pakan standar. Kemampuan meningkatkan aktivitas SOD hepar oleh mie umbi-umbian dari yang paling tinggi adalah mie gadung > mie kimpul > mie garut > mie gembili > mie ubi kelapa > mie terigu. Pemberian mie umbi-umbian selama 4 minggu belum menunjukkan aktivitas SOD yang mendekati aktivitas SOD hepar kelompok tikus normal. Kemampuan meningkatkan aktivitas katalase hepar oleh mie umbi-umbian dari yang paling tinggi adalah mie gadung = mie kimpul > mie garut > mie ubi kelapa > mie gembili > mie terigu.

Perlakuan mie umbi-umbian menghasilkan histopatologi hepar yang beragam bergantung jenis mie. Mie gadung menunjukkan susunan hepatosit yang teratur tetapi sinusoid bersifat longgar. Mie gembili menunjukkan hepatosit yang teratur dan sinusoid yang cukup rapat. Mie ubi kelapa menunjukkan susunan hepatosit yang kurang teratur

dan sinusoid yang agak longgar. Adapun mie kimpul dan garut menunjukkan hepatosit yang teratur dan sinusoid yang rapat.

Dari hasil penelitian ini dapat disimpulkan bahwa umbi-umbian lokal inferior yaitu kimpul, garut, gembili, gadung, dan ubi kelapa dapat diolah menjadi tepung dan tepung umbi-umbian dapat diolah menjadi mie umbi-umbian. Mie umbi-umbian tersebut secara sensoris dapat diterima oleh panelis dan secara ekonomi layak untuk diproduksi skala UMKM. Mie umbi-umbian mempunyai khasiat sebagai penurun kolesterol, penurun kadar gula darah, menghambat peningkatan kadar gula darah, penurun tekanan darah, serta berperan sebagai antioksidan dan hepatoprotektor. Pengujian khasiat mie umbi-umbian secara ilmiah diharapkan dapat menstimulasi pelaku usaha untuk memproduksi mie umbi-umbian skala komersil, dan menarik minat masyarakat untuk mengkonsumsi mie umbi-umbian. Harapannya terjadi peningkatan konsumsi umbi-umbian dan penurunan konsumsi terigu dan berdampak pada peningkatan skor pola pangan harapan (PPH).

Kata kunci: mie, diosgenin, dioscorin, polisakarida larut air, umbi-umbian lokal inferior, khasiat kesehatan

## EXECUTIVE SUMMARY

### Functional Healthy Noodles Based on Inferior Local Tubers as Alternatives for Wheat Noodles Substitution

This research aims to produce healthy noodles based on inferior local tubers that can be accepted organoleptically as well as have functions to health. Health functions should be proved scientifically through bioassay test of tubers based noodles and rice as hypoglycemic, hypocholesterolemic, hypotensive, antioxidant, and hepatoprotective food products.

Noodles processing technology as the output of this research is expected to be applied commercially. These products are expected to increase tubers consumption that imply in increasing desirable dietary pattern score as well as to increase variability of tubers based food products beside to decrease wheat flour consumption.

This research covers the study on healthy noodles processing that used 5 tubers i.e. lesser yam, wild yam, greater yam, arrowroot, and cocoyam; the study on formulation, characterization, and sensory acceptance of tuber based healthy noodles and artificial rice; the study on hypoglycemic, hypocholesterolemic, hypotensive, antioxidant, and hepatoprotective effects of tuber based noodles; and bioactive compounds analysis and elucidation of fresh tubers, their flours, as well as tuber based noodles that includes dioscorin, diosgenin, water soluble polysaccharides, and phenol analysis. The study on health functional properties of tuber based noodles is expected to stimulate production of these products to increase variability of tuber based products and to promote tuber consumption. Finally, it is expected to rise desirable dietary pattern score through shifting rice and wheat consumption into tuber based products consumption.

Local inferior tubers were floured to obtain good performance flour by suitable technique. Wild yam was detoxified to reduce cyanide content. The flouring method was performed in preliminary research. Bioactive compounds of fresh tubers and their flour were analyzed for dioscorin, diosgenin for yam tubers, and water soluble polysaccharides and phenol compounds for all tubers.

Healthy noodle formulation was conducted based on our previous methods and the products were tested organoleptically by descriptive method. Noodle improvement was performed by reformulation of gluten proportion (5, 10, 15, and 15%) and determination of suitable noodle types (instant, dried, and raw noodles) to obtain good characteristics noodles that accepted organoleptically

Healthy noodle from each tuber that have the best formula is further tested by bioassay method to know their hypoglycaemic, hypocholesterolaemic, hypotensive, antioxidant, and hepatoprotective effects, as well as bioactive compounds analysis. Feasibility study was conducted for small medium food industries.

The results showed that inferior local tuber, cocoyam, arrowroot, lesser yam, wild yam, and greater yam had different characteristics. Flour processing for each tubers also differed, and the detoxification was applied to wild yam tuber by soaking and ash rubbing. Descriptive sensory analysis showed that the instant tuber based noodles had worse quality than wheat noodle. Therefore, the improvement in noodle making was conducted by formula repairment. The physical characteristics of various types of tuber based noodled (instant, dried, raw noodles) and gluten proportion showed that increasing gluten enhanced noodle performance. The best formula of cocoyam noodles was instant

noodle with gluten proportion of 15%, arrowroot noodles was instant noodle with 20% gluten, lesser yam noodle was dried noodle with 10% gluten, wild yam noodle was instant noodle with 20% gluten, and greater yam noodle was instant noodle added by 20% gluten.

All of groups of rats fed by tuber based noodles showed glucose blood reduction. The order of reduction was wild yam noodle > greater yam noodle > cocoyam noodle > arrowroot noodle > lesser yam noodle > wheat noodle. Wheat noodle did not decrease blood glucose level, that after 4 weeks feeding, the rats were still in hyperglycemia condition. The order of the capability in inhibiting blood glucose level rise after noodles consumption was wild yam noodle > greater yam noodle > cocoyam noodle > lesser yam noodle > arrowroot noodle > wheat noodle.

Total cholesterol reduction after 4 weeks tuber based noodles feeding showed that wild yam, cocoyam, and arrowroot noodles feeding decreased blood total cholesterol into normal level. Lesser yam and greater yam noodles still showed blood total cholesterol level above normal level. The order of tuber based noodles in decreasing blood total cholesterol level was wild yam noodle > cocoyam noodle > arrowroot noodle > greater yam noodle > lesser yam noodle > wheat noodle.

The groups of rats that fed by wild yam and greater yam noodles showed blood pressure level that were similar to blood pressure level of normal group after 4 weeks noodle feeding. The order of the ability of tuber based noodle to decrease blood pressure in hypertension condition was wild yam noodle > greater yam noodle > arrowroot noodle > lesser yam noodle > cocoyam noodle > wheat noodle.

Tuber based noodles feeding decreased blood serum MDA level. The order of tuber based noodles to reduce blood serum MDA level was wild yam noodle > cocoyam noodle > arrowroot noodle > lesser yam noodle > greater yam noodle > wheat noodle. Tuber based noodles feeding resulted in increasing serum blood SOD activity compared to standar feeding and wheat noodle. The capability of tuber based noodles to increase SOD activity was wild yam noodle > cocoyam noodle > arrowroot noodle > lesser yam noodle > greater yam noodle > wheat noodle. Wild yam noodle feeding for 4 weeks increase SOD activity to approximately normal level. Afetr 4 weeks feeding in peroxidation condition, catalase activity of tuber based noodles fed group was similar to normal group, meanwhile wheat noodle fed group showed more higher catalase activity. The order of tuber based noodles to incrase catalase activity was wild yam noodle > arrowroot noodle = cocoyam noodle > lesser yam noodle > greater yam noodle > wheat noodle.

The ability of tuber based noodles to decrease hepar MDA level was wild yam noodle > cocoyam noodle > arrowroot noodle > lesser yam noodle > greater yam noodle > wheat noodle. After 4 weeks feeding, the hepar MDA level of groups of rats fed by tuber based noodles were not reach normal hepar MDA level. The ability to increase hepar SOD activity of tuber based noodles were wild yam noodle > cocoyam noodle > arrowroot noodle > lesser yam noodle > greater yam noodle > wheat noodle. Also. After 4 weeks feeding, hepar SOD activity did not reach normal level. The ability of tuber based noodles to increase hepar catalase activity was wild yam noodle = cocoyam noodle > arrowroot noodle > greater yam noodle > lesser yam noodle > wheat noodle.

The tuber based noodles feeding affected liver histopathology variously. Wild yam noodle feeding caused regular hepatocytes arrangement, but the sinusoid was in loose arrangement. Lesser yam noodle feeding made well organized hepatocyte arrangement and dense sinusoid. Greater yam noodle feeding resulted in well organized hepatocytes

and rather dense sinusoid. Meanwhile, cocoyam and arrowroot noodles feeding made well organized hepatocytes and dense sinusoid.

It is concluded that inferior local tuber based noodles from cocoyam, arrowroot, lesser yam, wild yam, and greater yam is feasible to process into flour and the tuber flour can be further processed into noodle. Tuber based noodles is accepted organoleptically and is feasible to produce in small medium food industry scale. These tuber based noodles has health functions as cholesterol, blood glucose level, and blood pressure lowering food products, as well as acts as antioxidant and hepatoprotector. The scientific evidence of tuber based noodles health benefits is expected to stimulate the businessman to produce tuber based noodles and the people to consume these noodles. It is expected to increase tuber consumption and reduce wheat consumption that results in desirable dietary pattern score rise.

Keyword: noodle, diosgenin, dioscorin, water soluble polysaccharide, inferior local tuber, health benefits



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