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DOMASSOF22

SYMPOSIUM : DEVELOPMENT OF MUSHROOMS AS SUSTAINABLE SUPERFOODS OF THE FUTURE 2022

Pre-10TH International Conference on Mushroom Biology and Mushroom Products (10THICMBMP)

Organized by:

Universiti Teknologi MARA | Fakulti Sains Gunaan

PERSATUAN TEKNOLOGI MAKANAN

Collaborators:

Universiti Malaya | UNIBZA | USM | 筑波大学 University of Tsukuba | IPB University | UMS | Mushroom Research Centre | Universiti Sains Malaysia | Mae Fah Luang University | UNS

Foreword by the Dean

بِسْمِ اللَّهِ الرَّحْمَٰنِ الرَّحِيمِ

UNIVERSITI TEKNOLOGI MARA

Welcome to the Symposium: Development of Mushrooms as Sustainable Superfoods of the Future 2022 (DoMaSSoF22). This program is organized by students' association of Food Science and Technology (PERTEMA) in conjunction with The 10^{th} International Conference on Mushroom Biology and Mushroom Products (10^{th} ICMBMP). Our collaborators include Bachelor of Food Science and Technology Association Fakulti Sains Gunaan UiTM Kuala Pilah, Branch Campus (BFOST), Mushroom Research Centre, Universiti Malaya, Persatuan Penyelidik dan Pengusaha Cendawan Malaysia (Malaysian Mushroom Researcher and Growers Association) and Universiti Program ASEAN International Mobility Students (AIMS). The program is implemented as part of the i-FSG project to satisfy the Strategic Action Plan initiative (FSG SciTech and FSG Talents). This program involves participation of final-year undergraduate and postgraduate students in the field of food science and technology in all IPTA/IPTS in the country and partner universities under the ASEAN International program Mobility Students. DoMaSSoF22 held on Saturday, December 10, 2022. The one-day program includes oral presentation sessions by guest speakers and participants and sessions on food innovation and product development. It is anticipated that this program will meet the demands of cultivators, researchers, students, and even mushroom industry enthusiasts. It is hoped that the DoMaSSoF22 program would increase students' knowledge of mushrooms and develop more entrepreneurs in Malaysia. To all attendees, I wish you a successful seminar, a pleasant exchange of ideas and excellent networking opportunities.

Profesor Dr. Hajah Faridah Zuraina Mohd Yusof
Dean
Faculty of Applied Sciences, Universiti Teknologi MARA, Shah Alam, Selangor, Malaysia

Foreword by the Chairman

It is with great pleasure that I would like to welcome all of the speakers and delegates to DOMASOFF 2022. Although we have shifted from pandemic situation to endemic era, conferences and seminars are still conducted on an online platform, and that would not halt the process of knowledge sharing. This Symposium brings together two renowned invited speakers from Asian International Mobility Students (AIMS) partners (from Thailand and Philippines) who will be sharing various topics relevant to mushroom industry from cultivation, processes involved while valorising agri-litters as substrate to promote sustainable farming culture. Additionally, the health benefits of edible mushrooms will be explored too. We have also lined up a Forum session involving four prominent experts in the mushroom industry to discuss topics related to cultivation, types of mushroom, health benefits, nutritional composition and other current issues. Apart from the invited speakers, we also have oral presenters to tackle and bring close to current research being carried out in this field. Additionally, competition on food product development related to mushroom enables undergraduates to showcase the ability of incorporating the knowledge they obtained to develop new and innovative food products. Hence, I hope that participants would have a fruitful discussion among each other to subsequently lead the mushroom as a superfood and research to meet the consumer demand in Malaysia.

Assoc. Prof. Ts. ChM. Dr. Raseetha Vani Siva Manikam

Chairman

Symposium: Development of Mushrooms as Sustainable Superfoods of the Future 2022

Faculty of Applied Sciences, Universiti Teknologi MARA, Shah Alam, Selangor, Malaysia.

Foreword by the Program Director

بسم الله الرحمن الرحيم

Greetings from UiTM. Food Technology Student Association (PERTEMA), UiTM Shah Alam Faculty of Applied Sciences are delighted to invite and welcome all to the SYMPOSIUM: DEVELOPMENT OF MUSHROOMS AS SUSTAINABLE SUPERFOODS OF THE FUTURE 2022 (DoMaSSoF22). The DoMaSSoF22 will feature the theme of Development and Innovation on Mushrooms. The aim of the symposium is to provide the opportunity for undergraduate students to showcase their research work to an international audience in a professional and supportive environment. To begin with forum session panels by Prof Dr Umah Rani Kuppusamy from Universiti Malaya and Mr Nabil Sanusi from Nas Agro Farm together with Ts ChM Dr Khalisanni Khalid from Malaysian Agricultural Research and Development Institute (MARDI) as moderator. Followed by special keynote speakers Mr Arce Defeo Bellere from Central Bicol State University of Agriculture then Dr Narisatda Thongklang from Mae Fah Luang University will present their topic on related mushrooms.

Muhammad Qahhar Zulqarnain bin Dzulkifly

Program Director DoMaSSoF22

Faculty of Applied Sciences,

Universiti Teknologi MARA, Shah Alam, Selangor, Malaysia.

Foreword by the Collaborator

بسم الله الرحمن الرحيم

PERSATUAN PENYELIDIK DAN PENGUSAHA CENDAWAN MALAYSIA – PPPCM

Welcome to the "Symposium: Development of Mushrooms as Sustainable Superfoods of the Future 2022 (DoMaSSoF22)" conference. This conference is organized by Food Technology Association (PERTEMA), Faculty of Applied Sciences, UiTM Shah Alam, Malaysia, with the collaboration of Persatuan Penyelidik dan Pengusaha Cendawan Malaysia (Malaysian Mushroom Researcher and Growers Association). PPPCM, previously registered in 1999 as PPCM, was formed to facilitate and serve mushroom industries. Its establishment is to assist mushroom growers in increasing crop yields, obtaining technical information, sales network and raw resources, encouraging mushrooms as a food source, promoting mushroom as hobbies, solving problems in mushroom industries and introducing new varieties to mushroom growers.

As a non-profit organization, our purpose is to benefit the public, especially those in the mushroom industry. Hence, PPPCM is very supportive of getting a Malaysian Incentive Community Empowerment (MyICE), one of the initiative grants given to the organization registered under the Malaysian Organization Registration Department (JPPM). Congratulations to PPPCM, who have achieved and managed to get a MyICE grant for DoMaSSoF22.

The conference aims to serve as a forum where the challenges and latest development in the mushroom industry will be presented and discussed among the researchers, academicians and entrepreneurs from the government, higher institutions and private sectors. It is hoped that at the end of the conference, new ideas and practices for developing mushrooms as sustainable superfood will be achieved. I wish all delegates a fruitful conference, and may all your efforts bring benefit to the mushroom industry.

Ts. Dr. Azhar Mohamad
President
Malaysian Mushroom Researcher and Growers Association

Foreword by the Collaborator

Mushroom Research Centre
UNIVERSITI MALAYA

Congratulations to the students' association PERTEMA from Universiti Teknologi MARA and their co-organisers for organising DOMASSOF 2022. The event is well supported by AIMS partners too. I take this opportunity to thank all involved - organisers as well the student teams who have been diligently working to bring this symposium to us. I am glad that this Symposium is a great success as it is one of the pre-events being organised in conjunction with the 10th International Conference of Mushroom Biology and Mushroom Products (10th ICMBMP 2023) which will be held on 15-18 March 2023.

There has been a renewed interest in mushroom research worldwide including mushrooms to mitigate lifestyle ailments. A Symposium like this will bring the message to the consumers why adding mushrooms to our diet is a must. Not only are mushrooms good food but mushrooms may help to mitigate several lifestyle and aging related ailments of humans. Further, several mushrooms used by our indigenous folks have potential to be developed for treatment, management of ailments as well as for overall health and well-being. What we need to do is validate scientifically the traditional claims. DOMASSOF 2022 provides the platform for all researchers and mushroom industry players to interact and network to bring mushrooms to our tables.

I welcome all participants to this Symposium. Hope this interaction will contribute to spreading the goodness of mushroom message. To our international delegates, I wish you Selamat Datang and hope our network grows to endorse mushrooms as superfood.

Prof. Dr. Vikineswary S , FASc
Chairperson, 10th ICMBMP 2023
Mushroom Research Centre,
Institute of Biological Sciences,
Faculty of Science, Universiti Malaya, Malaysia

Fakulti Sains Gunaan

TENTATIVE SYMPOSIUM: DEVELOPMENT OF MUSHROOMS AS SUSTAINABLE SUPERFOODS OF THE FUTURE 2022 (DoMaSSoF22)

TIME	DETAILS
8:00 AM	Entry of lecturers, attendees, participants, speakers, and guests into Cisco Webex.
8:30 AM	**Opening Ceremony** 1. The singing of Lagu Negaraku 2. The singing of Lagu Wawasan Setia UiTM 3. Prayer recitation 4. Opening speech from **Assoc. Prof Dr. Adi Md Sikin** (Programme Coordinator of Food Science and Technology, UiTM Shah Alam) 5. Opening Gimmick
9:00 AM	**SESSION 1 (Talk)** Title: Mushroom as a Resilient Crop: An Approach for a Paradigm Shift from Agri-litters to Sustainable Healthy Food Production. Speaker's name: **Mr Arce Defeo Bellere** (Central Bicol State University of Agriculture)
10:00 AM	**Presentation** of food innovation and product development (FPD) by Undergraduate participants.

11:05 AM	**SESSION 2 (Talk)** Title: Edible Mushrooms: Improving Human Health and Promoting Quality of Life Speaker's name: **Dr Narisatda Thongklang** (Mae Fah Luang University)
12:00 PM	**Judges briefing (Oral)** ● Judges break out room
12:05 PM	**Oral presenter,** judges, participants, attendees, time keepers, collectors, photographers, and backup slides presenter will each join a breakout room to begin the oral presentation.
12:10 PM	**Oral presentations** by Postgraduate students
1:20 PM	Break time

2:00 PM	**SESSION 3 (Forum)** Title: Possibilities, challenges, and prospects of bringing mushrooms as a superfood ● PANEL: ■ Prof Dr Umah Rani Kuppusamy ■ Ts ChM Dr Khalisanni Khalid ■ Mr Nabil Sanusi ■ Mr Arce Defeo Bellere
4:00 PM	**Closing Ceremony** 1. Closing speech from **Prof. Dr. Hjh Farida Zuraina Mohd Yusof** Dean of the Faculty of Applied Sciences UiTM Shah Alam 2. Gimmick Video 3. Prize Presentation 4. Photography session
4:30 PM	End of Symposium

Tracks

Track 1	Mushroom supply chain
Track 2	Mushroom cultivation
Track 3	Mushroom post harvest method
Track 4	Mushroom processing techniques
Track 5	Mushroom nutrition
Track 6	Bioactive composition in mushroom
Track 7	Downstream product from mushroom

ABSTRACT FOR INVITED SPEAKERS

Mushroom as a Resilient Crop: An Approach for a Paradigm Shift from Agri-litters to Sustainable Healthy Food Production

Arce D. Bellere1,2, Sarang Oh1 , Shengdao Zheng1 , Myeongju Kim1 , Duna Yu1 , Eun-ji Yi1 , Trang Thi Minh Nguyen1 ,
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Mushrooms have been considered a food with significant nutritive values. More so, it plays a vital role in the degradation of organic matter making it an ideal decomposer of agricultural and forest litter. Nutrient deficiency remains prevalent in low- and middle-income countries. Furthermore, in developed countries the fast phase of the standard of living and the growing population relies on fast and processed foods to couple up their daily nourishment. However, constant consumption of processed foods has been linked to chronic diseases. The unhealthy results of convenient foods serve as an eye-opener for the population to demand availability of healthy food. Mushrooms have been utilized as food and drugs since time immemorial. These are obligatory saprophytic, spore-forming eukaryotic organisms belonging to fungal groups which can be harnessed mostly in a healthy environment; due to its purpose as medicinal food gained global traction to be cultivated worldwide. Among other beneficial nutrients, vitamins, nucleic acid, and minerals; mushrooms contain β –D- glucan which is prebiotic, has immunomodulatory and anti-inflammatory effects, and serves as an adjuvant of conventional chemotherapy. Furthermore, mushroom increases food palatability and its protein and carbohydrate qualities are ideal counterparts of muscle food from meat and fish. With significant benefits from mushrooms as combinations of food and medicine and since it is grown in an environmentally friendly approach, these edible macrofungi can be considered a superfood with a vast number of biological potentials.

Keywords: obligate saprophytic, spore-forming eukaryotic organisms, β –D- glucan, macrofungi, and superfood

Edible Mushroom: Improving Human Health and Promoting Quality Life

Naritsada Thongklang

1 Center of Excellence in Fungal Research, Mae Fah Luang University, Chiang Rai 57100, Thailand
2 School of Science, Mae Fah Luang University, Chiang Rai 57100, Thailand

Mushrooms have long been used for consumption due to their nutritional and medicinal proportions. Recently, many edible mushrooms have been considered food, functional food, or nutraceutical. Edible mushrooms have been consumed as food because of their nutritional value and pleasant taste. Mushrooms are the perfect dietary supplement because they are rich in proteins, fiber, and vitamins. Many studies have reported the medicinal properties of mushrooms both in vivo and in vitro trials. Bioactive compounds for example polysaccharides, proteins, fats, phenolic compounds, and vitamins found in mushrooms. Therefore, mushrooms have been recognized as a source of functional foods or nutraceuticals.

Keywords: edible mushrooms, nutritional value, medicinal properties

Grey oyster mushroom for prevention of metabolic syndrome and related complications

Professor Dr.Umah Rani Kuppusamy
Department of Biomedical Science
Faculty of Medicine, Universiti Malaya

The grey oyster mushroom (*Pleurotus pulmonarius*) is packed with phytonutrients and is known to have anticancer, immunomodulatory as well as bacterial and anti-parasitic properties. However, it is most well-known for its effects on metabolic syndrome and related complications. Metabolic syndrome is a cluster of conditions such as increased blood pressure, high blood sugar, excess body fat around the waist, and abnormal cholesterol or triglyceride levels that occur together, increasing the risk of heart disease, and type 2 diabetes. A sedentary lifestyle, unhealthy eating habits and unfavourable genotypes may lead to obesity especially visceral obesity (excess fat around the abdomen). The over-expanded fat cells in an obese individual will cause a disturbance in the secretion of certain hormone-like substances known as cytokines which lead to a disturbance in glucose and lipid metabolism and regulation. Thus, increasing the risk of developing diabetes and cardiovascular disease. Inherent to visceral obesity and metabolic dysregulation is oxidative stress and inflammation that triggers a vicious cycle of increasing the risk of developing diabetes and cardiovascular disease. Oxidative stress has been implicated in the etiology of most diseases and it is closely related to the inflammatory state of the body. Knowing that there is a high prevalence of obesity and related complications such as diabetes and cardiovascular disease worldwide, every possible means of managing or alleviating it should be explored. The grey oyster mushroom is rich in glucans which are non-digestible carbohydrates. When included in a meal, the beta-glucans result in a slower rate of carbohydrate and lipid absorption, and may also serve as a novel source of prebiotics. Our research team investigated the antiobesity and antidiabetic and antioxidative stress potential of glucan-rich polysaccharides isolated from the grey oyster mushroom. We found that the glucan-rich polysaccharide from the grey oyster mushroom was able to prevent high-fat diet-induced obesity, diabetes and oxidative stress. Overall it has the potential to combat metabolic syndrome and the efficacy was comparable to metformin. Currently, the benefit of whole mushroom powder for the prevention of obesity-induced metabolic syndrome and its mechanism is being explored through in vivo studies by our research team. Several other species of oyster mushrooms have been used in human clinical trials which

showed weight-reducing efficacy but so far, the grey oyster mushroom has not been assessed. Overall, the grey oyster mushroom has very promising benefits for improvement prevent metabolic syndrome

MR. NABIL SANUSI

In Malaysia, mushroom cultivation has started since the late 1960s. Reported to be one of the seven high-value crops that are cultivated intensively with grey oyster mushroom as the main variety. With the increase in population and consumption per capita, demand for mushrooms is projected to increase due to higher health concerns. In recent years many new species such as split gills and black jelly are being cultivated for their higher economic values and health benefits. However, some challenges such as high cost of production and shortage of labour, have to be dealt with for the industry to be more competitive

List of Oral Presenters

ID NO	PRESENTER
OR01_01	***The addition of Aspergillus flavus on Composting Process of Cotton Waste for Cultivation of Paddy Straw Mushroom (Volvariella volvacea (Bull.) Singer 1951)*** Dr. Iwan Saskiawan, Research Center for Applied Microbiology, National Research and Innovation Agency, Indonesia, Indonesia
OR01_02	***Characterisation And Phytochemical Profile Of Sunlight Exposed Freeze Dried Oyster Mushrooms Powder (Pleurotus ostreatus)*** Nongmaithem Babita Devi, Avinashilingam Institute for Home Science and Higher Education for Women, Coimbatore, India
OR01_03	***Effective Microorganism (EM) Pre-treatment on Oil Palm Empty Fruit Bunch (EFB) fiber for cultivation of Volvariella volvacea (Bull.) Singer*** Noor Azrimi Umor, Universiti Putra Malaysia, Malaysia
OR01_04	***Effect Of Black Jelly Mushroom (Auricularia Polytricha) And Olive Oil As Fat Replacers On The Physicochemical And Microstructural Properties Of Chicken Meat Emulsion*** Faridah Mohd Razali, Universiti Putra Malaysia, Malaysia

ID NO	PRESENTER
OR02_05	***Mushroom Bioreactor-Biomass As Bioactive Protein Source: Synergy Of Mushroom Rural And Urban Cultivation*** Nur Asyiqin Zahia Azizan, University Malaya, Malaysia
OR02_06	***Incorporation Of Shiitake (Lentinula Edodes) And Brown Button Mushroom (Agaricus Bisporus) As Fat Replacers In Meatballs Processed With Different Mixing Durations*** Asyrul Izhar Abu Bakar, Universiti Putra Malaysia, Malaysia
OR02_07	***Utilization Of Spent Mushroom Compost From Volvariella Volvacea Cultivation As A Plant Substrate For Capsicum Annuum*** Afiq Aizan Hamsun, Universiti Teknologi MARA, Malaysia
OR02_08	***Fungal Wonders: A Review On Various Fungal Benefits To Mankind*** Trang Nguyen Thi Minh, Kyunghee University, Vietnam
OR03_09	***Knowledge, Attitude, And Practice (Kap) Toward Mushrooms As Food And Food Supplements Among Klang Valley Residents*** Lim Wen Qing, Taylor's University, Malaysia

ID NO	PRESENTER
OR03_10	***Characterization of Enzymes During Cultivation Of Volvariella volvacea*** Muhammad Ikram Latif, Universiti Teknologi MARA (UiTM), Malaysia
OR03_11	***Stability of Termite Mushroom (Termitomyces sp), Yellow Oyster (Pleurotus citrinopileatus), and Pink oyster (Pleurotus djamor) Mushroom Pigments*** Nurulain Syuhada Binti Mohamad Yazid, Universiti Teknologi MARA, Malaysia
OR03_12	***Effect Of Spent Oyster Mushroom Substrate On The Growth And Yield Of Schizophyllum Commune*** Syaliyana Khairudin, University Putra Malaysia UPM, Malaysia
OR04_13	***Spawn Production and Cultivation Technology for Volvariella volvacea : a brief review*** Nur Fariha Amir, Universiti Teknologi MARA, Malaysia
OR04_14	***Grey Oyster Mushroom Burger – Patties for Health*** Mohd Irwani Hafiz Sahid, MARDI/UM, Malaysia

ID NO	PRESENTER
OR04_15	***Sous-vide processing technique: The Influence on Pleurotus Ostreatus Sensory, Textural and Color Properties*** Ana Doroski, Universiti/institut: Institute for Food Technology and Biochemistry, University of Belgrade, Serbia
OR04_16	***Effect of Organic Fertilizer on Volvariella Volvacea Cultivation to the Yield and Fruiting Body Quality*** Muhammad Izzat Luqman Bin Abdul Latif, Universiti Teknologi MARA, Malaysia

Abstract For Oral Presenters

NO 1

The Addition of *Aspergillus Flavus* on Composting Process of Cotton Waste for Cultivation Paddy Straw Mushroom (*Volvariella Volvacea* (BULL.) SINGER 1951)

Iwan Saskiawan[1]*, Wibowo Mangunwardoyo[2], Netty Widyastuti[3], Dono Tjokrokusumo[4]

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Paddy Straw mushroom (*Volvariella volvacea* (Bull.) Singer 1951) is a tropical edible mushroom and commonly cultivated in Indonesia. Composting process for preparation substrate play an important role during mushroom cultivation. The purpose of this study is to investigate the effect of the addition *A. flavus*, the lignocellulolytic fungi in the composting process of cotton waste for cultivation of *V. volvacea*. The result showed that there was an increase in temperature of compost of 27-58°C and pH of 7-8 for seven days observation. The highest concentration of glucose was 0.089 mg/mL without addition of *A. flavus* and 0.143 mg/mL with the addition of *A. flavus.* Furthermore, the highest concentration of xylose was 0.070 mg/mL without addition of *A. flavus* and 0.157 mg/mL with the addition of *A. flavus*. The concentration of cellulose, hemicelluloses and lignin was decrease from the 2nd days of composting process in both the addition and without the addition of *A. flavus*. The number of fruiting body of *V. volvacea* was 1,766 and 1,715 as well as 8,700 g and 8,395 g of fresh weight of mushroom of the addition of *A. flavus* and without the addition of *A. flavus* respectively.

Keywords: Aspergillus flavus, composting, paddy straw mushrooms, *Volvariella volvacea*

NO 2

Characterisation and Phytochemical Profile of Sunlight Exposed Freeze Dried Oyster Mushroom Powder (*Pleurotus ostreatus*)

Nongmaithem Babita Devi[1*] and Chinnappan A. Kalpana[2]

[1]Research Scholar & [2]Professor

[1 & 2] Department of Food Science and Nutrition, School of Home Science, Avinashilingam Institute for Home Science and Higher Education for Women, Coimbatore, Tamil Nadu, 641043, India,

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Mushrooms are Vitamin B and D rich fungi which belong to the division Basidiomycota. Oyster mushroom (*Pleurotus ostreatus)* has distinct flavour, contains high nutrients and phytochemicals. Phytochemicals are naturally existing compounds which play with nutrients to act against diseases or protect against diseases. The aim of the study is to characterise and compare the phytochemical profile of sunlight exposed freeze dried oyster mushrooms (SEFDOM) powder and non-sunlight exposed freeze dried oyster mushrooms (NSEFDOM) powder. The phytochemical constituents of both SEFDOM & NSEFDOM powder were extracted using aqueous, methanol and ethanol. Eighteen metabolites were screened for all the three solvents for both the samples. The phytochemical screening showed that the presence of alkaloids, flavonoids, sterols, proteins, carbohydrates, saponins for both samples were detected while other remaining metabolites were not detected in the phytochemical screening. The results showed that the metabolites such as alkaloids, sterols, anthraquinones and carbohydrates were appreciable amount in NSEFDOM powder group when compared to SEFDOM powder group. Protein content was found to be high in SEFDOM powder group with ethanol extraction. The overall phytochemical extraction efficiency is high in methanol solvent. This study found that the amount of phytochemical content in non-sunlight exposed freeze dried oyster mushrooms powder was higher than sunlight exposed group.

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Keywords: Oyster mushrooms, sunlight exposed mushrooms, freeze dried oyster mushrooms, mushroom powders, phytochemicals.

NO 3

Effective Microogranism (EM) Pre-treatment on Oil Palm Empty Fruit Bunch (EFB) Fiber for Cultivation of *Volvariella volvacea* (BULL.) SINGER

Noor Azrimi Umor [1,2], Sumaiyah Abdullah[1*], Azhar Mohamad[3], Shahrul Ismail[4], Siti Izera Ismail[1], Azizah Misran[1] and Mahmud Tengku Muda Mohamad[1]

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Pre-treatment with effective microorganisms (EM) for the cultivation of *Volvariella volvacea* using oil palm empty fruit bunch (EFB) was proposed to increase yield. The effect of different EM doses on the mycelium growth and yield was observed. The treatment was carried out using a combination of two parameters: composting times (5 days (T1), 10 days (T2) and 15 days (T3) and dosages of EM (0% (E1), 10% (E2), 20% (E3) and 30% (E4). While the composition of EFB was analysed to compare the changes before and after the pre-treatments. It was determined that EM pre-treatments of 20% and 30% resulted in significantly faster mycelial growth compared to the other treatments. The highest yield of *V. volvacea* was observed at T2E4 (10d, 30% EM) with 271.5± 57.28 g or biological efficiency (B.E) of 9.11%. The highest average weight per fruiting body (FB) was obtained at T1E3 (5d, 20% EM) with 14 g, while T2E4 (10d, 30% EM) yielded the highest number of harvested FB with 42. Cellulose, hemicellulose and lignin was reduced in all treatments tested. Both EM dosages and composting times significantly affected the yield of *V. volvacea*. EFB fiber was a potential substrate for the cultivation of *Volvariella volvacea*.

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Keywords: Volvariella volvacea, EFB fibers, composting time, Effective Microorganism

NO 4

Effect of Black Jelly Mushroom (*Auricularia Polytricha)* and Olive Oil as Fat Replacers on The Physicochemical and Microstructural Properties of Chicken Meat Emulsion

Faridah Mohd Razali[1], Nur Aliah Salman[1], Abu Bakar Asyrul-Izhar[1], Siti Aimi Sarah Zainal Abidin[2] and Mohammad Rashedi Ismail-Fitry[1,*]

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This study evaluates the effect of the replacement of chicken skin (CS) at various percentages (0%, 25%, 50% and 100%) of black jelly mushroom (BJM) and olive oil (OO) on the physicochemical and microstructural properties of chicken meat emulsion. Emulsions with 100% CS (Control); 50% CS + 50% OO; 50% CS + 50% BJM; 50% CS + 25% OO + 25% BJM; 100% OO; and 100% BJM were developed. The emulsion stability, cooking loss, pH values, textural and gel strength properties of all fat-replaced samples were comparable to the Control. The most positive results were demonstrated in the emulsion with 50% BJM, 50% CS + 25% OO + 25% BJM and 100% BJM, which had lower fat content and better water holding capacity and moisture content. Furthermore, the colour profiles of these samples were comparable to the Control while their micrographs revealed acceptable structures of most meat emulsion products. In conclusion, the black jelly mushroom is capable to be used as a fat replacer in producing low-fat meat emulsion, however, a combination of 25% BJM and 25% OO has the highest potential considering the positive attributes contributed by olive oil as well.

Keywords: fat replacer; low-fat meat products; meat emulsion; mushrooms

NO 5

Mushroom Bioreactor-Biomass as Bioactive Protein Source: Synergy of Mushroom Rural and Urban Cultivation

Nur Asyiqin Zahia Azizan1 *, Wan Abd Al Qadr Imad Wan-Mohtar1, Zul Ilham2, Adi Ainurzaman Jamaludin2

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Mushroom rural cultivation consumes averagely 6-month period, while urban cultivation takes only 10 days or less. In this study, mushroom biomass was grinded and converted into a flour to produce mushroom- chicken patties using Lingzhi and Enoki. The inclusion of Enoki in chicken patties (10%, 20% and 30%) indicates higher consumer acceptance significantly ($p > 0.05$) compared to chicken patties with Lingzhi (10% and 20%). This analysis validated the concept of mushroom biomass as source of bioactive protein. On the other hand, 3kg dried mushroom-bioreactor biomass was produced using a heterotrophic 1m² fabricated-bioreactor, which answers the minimum requirement for protein content for 1 human per year. Together, these explain the significance of mushroom biomass in food security as a protein source and the synergy of mushroom rural-urban cultivation.

Keywords: Mushroom biomass, Bioreactor, Protein, Urban cultivation, Landless food

NO 6

Incorporation of Shiitake (*Lentinula edodes*) and Brown Button Mushroom (*Agaricus bisporus*) as Fat Replacers in Meatballs Processed with Different Mixing Durations

Abu Bakar Asyrul-Izhar[1], Siti Hajar Masran[1], Faridah Mohd Razali[1], Norizah Mhd Sarbon[2] and Mohammad Rashedi Ismail-Fitry[1,*]

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Shiitake and Brown Button mushrooms have high protein and fibre contents and can potentially be utilised as a fat replacer in meat products like meatballs. Meanwhile, different mixing durations during meatball manufacturing may also influence product quality. The present work investigated the physicochemical, microstructure and sensory properties of fat-replaced meatballs with shiitake (*Lentinula edodes*) and brown button Mushroom (*Agaricus bisporus*) processed at different mixing durations (5, 10 or 20 min) using bowl-cutter. No differences ($p<0.05$) were found for the linear expansion, water holding capacity, texture profile analysis and Warner Bratzler for both types of mushrooms and mixing durations. Shiitake meatballs mixed at 20 min have a higher ($p<0.05$) cooking yield while the total soluble protein is higher ($p<0.05$) regardless of any mixing duration. The redness (a*) value of shiitake meatballs increases ($p<0.05$) as the mixing time increases. Microstructure images showed improved surface compositions of meatballs as the mixing duration increased. Nevertheless, brown button meatballs with a mixing time of 20 min have the highest ($p<0.05$) scores in terms of texture and juiciness. In conclusion, both shiitake and brown button mushrooms are suitable to be used as fat replacers but a longer mixing duration produced better quality meatballs.

Keywords: fat replacer, healthier meatballs, low-fat meat products, meat emulsion, mushrooms

NO 8

Fungal Wonders: A Review on Various Fungal Benefits to Mankind

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Fungi saprophytic way of living can be the basis of its presence during the early ages of life on earth. For many years humanity had explored fungi for technological advancement and economic growth. Hence, this review focuses on listing fungal wonders, which are products of various studies made to alleviate the societal condition of mankind. Among the benefits of fungi, its metabolites and fruiting bodies are considered as food, dietary supplements, furniture and construction materials, and, agricultural pest control. Additionally, its unique natural products are sources of novel chemicals with a higher potential for drug discovery. More so, its ability to decompose organic matter leads to environmental balance for nutrient cycling. Among these, fungi can restore a toxic environment because of their ability to utilize heavy metals such as cadmium, copper, mercury, lead, and zinc. Thus, fungi can be mycofood, mycodrug, mycoorganic materials, mycopesticide, and mycoremediator. With these significant roles of fungi, we can deduce that these organisms can be a crucial factor in the existence of many organisms and at the same time preserve a healthy and balanced environment. Indeed, fungi are highly significant organisms with potential benefits and promising future discoveries of their significance and unique mycochemical attributes.

Keywords: mycofood, mycodrug, mycoorganic materials, mycopesticide, and mycoremediator

NO 9

Knowlegde, Attitude, And Practice (KAP) Toward Mushrooms As Food And Food Supplements Among Klang Valley Residents

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Cultivation and consumption of the superfood, mushrooms are recommended due to their high nutritive value, medicinal properties, and ease of cultivation. This study was designed to investigate the knowledge, attitudes, and practices toward mushrooms as food and food supplements among Klang Valley residents. Data were collected using a structured questionnaire from a total of 385 respondents. Results revealed that a significant association ($p < 0.05$) was found between level of knowledge and practices towards mushrooms as food and food supplements. Price, taste and health benefits were the top 3 factors affecting participants' preference when choosing mushrooms, processed mushroom food products, and mushroom supplements. Moreover, age and monthly income showed a significant association ($p < 0.05$) with level of knowledge, attitudes, and practices towards mushrooms as food and food supplements while ethnicity was significantly associated ($p < 0.05$) with both level of attitude and practices only. In conclusion, Klang Valley residents exhibited a high level of knowledge towards fresh mushrooms and processed mushroom food products, however the appreciation and utilisation of mushrooms were still lacking as both level of attitude and level of practices were at moderate level. Corrective measures such as increasing public education on mushrooms are hence of top priority.

Keywords: knowledge, attitude, practice, mushrooms, food

NO 10

Characterization of Enzymes During Cultivation Of *Volvariella volvacea*

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Volvariella volvacea (V. volvacea), or also commonly known as paddy straw mushroom, is originally grow in tropical and sub-tropical regions and the growth rate of V. volvacea is normally higher compared to other mushrooms, however, there is an issue that remains vital among researchers which is the mushroom produces low yield during harvesting season. Thus, this study is aimed to characterize the types of different enzymes that present during the cultivation of V. volvacea because the researchers believe that yield production of the mushroom is influenced by the activities of enzymes. For the cultivation process of V. volvacea, the empty fruit bunch (EFB) fibre was used as the substrate and then the samples of substrate were treated by different treatments that includes acetate, foliar, and chitosan during the cultivation process. Beforehand, one sample without any treatments was prepared and used as a control in the experiment. Three assays were being conducted which were cellulase assay, xylanase assay, and FPase assay. The enzymes from the samples were extracted using buffer solution, then analyzed by using dinitrosalicylic acid (DNS) method and the absorbances were measured through UV-VIS spectrophotometer machine. In this study, cellulase enzymes was producing highest activity of enzymes which was at 0.3943 U/ml followed by xylanase as the second highest enzyme activity at 0.2365 U/ml. Meanwhile, the FPase produced the least enzyme activity in the samples which was 0.01008 U/ml. Theoretically, the activities of enzymes play a very critical roles to the development of mushroom fruiting bodies, also the metabolism processes that occurred during the growth of mushroom is mostly facilitated by the enzymes.

Keywords: V. volvacea; Cellulase; Xylanase; FPase; EFB

NO 11

Stability of *Termitomyces* sp (termite mushroom), *Pleurotus citrinopileatus* (yellow oyster) and *Pleurotus djamor* (pink oyster) Mushroom Pigment

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Food colouring has long been used in food products to intensify the natural colour of food, keep uniformity of food colour, and improving product appearance. Synthetic food colouring is the mostly used food colourant because of its cheaper price and greater stability. However there has been increasing concern on the effect of synthetic food colourant to human health. Hence, the use natural food colourant as an alternative to the synthetic ones has been increasingly investigated. Natural food colourant is prone to degradation as it is unstable due to the complex nature of food products. Hence, the objective of this study was to determine the colour stability of Termitomyces sp, (termite mushroom), Pleurotus citrinopileatus (yellow oyster) and Pleurotus djamor (pink oyster) mushroom pigments using the CIELAB colorimeter. The stability of pigments extracted from these mushrooms were evaluated at different pH (3.0, 7.0, and 15.0), and was found to be most stable at pH 7.0. The pigments were also heated at 40℃ to 100℃. The results showed that the yellow pigment from P. citrinopileatus was unstable. Pigments extracted from Termitomyces sp (white) and P. djamor (pink) were stable when heated at 40℃ to 80℃. Pink pigment redness (a* values) was stable and showed no significant differences with ascorbic acid, citric acid and sodium metabisulphite treatments compared to control.

Keywords: mushroom pigment, natural colour, colour stability

NO 12

Effect Of Spent Oyster Mushroom Substrate on The Growth and Yield Of *Schizophyllum commune*

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Treatment and disposal of the spent mushroom substrate (SMS) remain a constraint to most local mushroom growers. About 8 kg of SMS are produced for each kilogram of grey oyster mushroom. More than 8 tonnes of SMS produced yearly will create an environmental issue such as open burning, which can lead to pollution. Therefore, the local mushroom growers must find ways or alternate methods of handling SMS to move towards sustainable agriculture. Due to this, it's possible to turn SMS into a substrate for the production of split gill mushrooms (*Schizophyllum commune*). *S. commune* is one of the popular mushroom biodiversity in Malaysia. One kilogram of *S. commune* can reach RM 35 – RM 50 compared to grey oyster mushrooms, which is around RM 12 – RM 15/kg. The main objective of this study was to determine the best ratio of SMS as a medium substrate for the cultivation of *S. commune*. The mycelium growth (cm) and yield (g/kg) of *S. commune* treatment were recorded. The five treatments were replicated with 12 substrate bags. Four different materials were used, i.e., SMS 10% - 50%, sawdust 90% - 50%, rice bran 50% and agriculture lime maintain 1% for all treatment. The formulation containing 10% of SMS produced the highest fruting bodies yield followed by 50%, 40%, 20%, 30%. Using compost as an alternative substrate for production of *S. commune* would reduce the used of sawdust compared to conventional method. The cost to produce *S. commune* bag can be reduced by using SMS formulation compared to entire conventional practice and formulation in mass production.

*Keywords:*grey oyster mushroom *(Pleurotus pulmonarius), Schizophyllum commune* (split gill mushroom), spent mushroom substrate (SMS).

NO 13

Spawn Production and Cultivation Technology for *Volvariella volvacea* : A Brief Review

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Volvariella volvacea is an edible mushroom that grows well in a warm climate and utilizes agricultural waste as its source of food. Although it has a relatively short cropping period, it has a low yield despite multiple flushes. Therefore, over the years, various techniques and strategies were introduced to improve *V. volvacea* cultivation and to overall increase the yield and biological efficiency. In this brief review, both the traditional method and modern strategies will be highlighted. The main focus of this paper would be spawn and substrate improvement, molecular techniques, and analytical strategy.

Keywords: cultivation technology, spawn improvement, biological efficiency, empty fruit bunch fibre, *Volvariella volvacea*

NO 14

Grey Oyster Mushroom Burger – Patties for Health

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Mushrooms have a higher protein content than other vegetable sources, therefore mushroom burgers are a nutritious food. The protein content of mushroom burgers is approximately 8.3 grammes per 100g. Additionally, the mushroom burger has a very low-fat content and is cholesterol-free. Moreover, oyster mushrooms are a good source of fibre and are convinced to have medicinal value known as β-glucan. The β-glucan is an anticholesterolemic fibre found in grey oyster mushrooms. According to animal study conducted on mice, this product can reduce cholesterol levels in the blood. This product is also a weight loss benefit. The animal studies found that mushroom burgers did not increase the body weight of study mice. The grey oyster mushroom is known to boost the immune system, reduce blood pressure, inhibit the growth of cancer cells, reduce inflammation, are rich in antioxidants, effective antidiabetic food and good source of prebiotic. Consumers' increased awareness of the health benefits of mushrooms has increased the demand for mushroom-based food products.

Keywords: Oyster mushroom, Burger, Functional food

NO 15

Sous-vide Processing *Technique:* The Influence on *Pleurotus ostreatus* Sensory, Textural and Color Properties

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The world of gastronomy is enriched with a new culinary method *sous-vide*, which gives the possibility to control the thermal treatment conditions and adjust it in order to get desired changes related to the sensory properties of food. Very important advance of *sous-vide* is the ability of bioactive compounds preservation during the treatment, which is of an additional improtance regarding the mushroom culinary processing. The highlight of this study was the comparison of sensory and physical properties of organic oyster mushroom (*Pleurotus ostreatus*) prepared with the ordinary cooking method (80°C, 30 – 60') and the *sous-vide* culinary method (50 - 90°C, 10'), as the effect of different temperature and time regimes and culinary methods. Results of *sous-vide* treated mushrooms showed exponential changes regarding the physical properties in accordance with controlled and adjusted treatment. Likewise, the evident difference in sensory perception and physical properties results is noticable between two culinary methods. Overall, the *sous-vide* method offered the novel culinary benefit to predict the effect of applied temperature and time regime.

Keywords: Pleurotus ostreatus, sous-vide, mushroom, sensory properties, textural properties, color properties

List of Food Product Development (FPD)

ID NO	PRESENTER
FPD01_01	***MUSHAKSHA, ASAM LAKSA FLAVORED MUSHROOM-BASED SNACK*** Tai Ji Nee,Taylor's University, Malaysia
FPD01_02	***ENOKI MUSHROOM SERUNDING*** Nur Lailatul Syafiqah, Universiti Teknologi MARA, Malaysia
FPD01_03	***MUSHROOM OAT BUBUR LAMBUK*** Ain Nadzirah Mohd Zulkifli, Universiti Teknologi MARA, Malaysia
FPD02_04	***MUSHROOM RENDANG RTH*** Fatin Syazana Mohamad Shamsuddin, Universiti Teknologi MARA, Malaysia
FPD02_05	***MUSHROOM CUBE*** Najihah Mohamad, Universiti Teknologi MARA, Malaysia
FPD02_06	***THE POTENTIAL OF THE UNDERUTILISED SPLITGILL MUSHROOM AS HIGH-FIBRE VEGGIE CHUNKS*** Advina Lizah Julkifle, The University of Nottingham Malaysia, Malaysia

Abstract For Food Product Development (FPD)

NO 1

Mushaksha, Asam Laksa Flavored Mushroom-Based Snack

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Due to the significant increase in health concerns, a shift to a healthier diet has been observed in Malaysia. Snack products are now selected with consideration, avoiding unhealthy components and choosing safer cooking methods like air-frying. Mushrooms, being a nutritious superfood, serve a variety of minerals and are an important source of phenolic compounds, sterols, and triterpenes. Hence, chosen in making a healthy snack, with the option of Asam Laksa flavour as it is highly favoured by the locals. As a solution, Mushaksa, an asam laksa flavoured snack was produced. Three types of commercially cultivated mushroom in Malaysia, Shitake, Enoki, and Oyster mushroom were chosen, sliced, and marinated in vegan asam laksa paste for 30 minutes, and were air fried at 165°C for 8 minutes. This product could be a good substitute for commercial snack products by satisfying the consumer hunger and as well as meeting the nutritional needs.

Keywords: fungus, air fry, king oyster mushroom, shitake mushroom, enoki mushroom

NO 2

Enoki Mushroom Serunding

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Enoki mushroom *serunding* is an innovative product that produces a meatless *serunding* that is made from enoki mushroom to replace the animal meat with the same texture, flavor and appearance. Enoki mushroom not only has a unique characteristic which is long and thin shape that make this *serunding* the best substitute of the meat but also is the cheapest mushroom in the market. Mushroom *serunding* is the nutritious food that is reformulated from usual *serunding* by substituting beef or chicken meat to the Enoki mushroom because it has a similar texture with meat while keeping the price low enough for anyone to buy it. Our *serunding* is a ready-to-eat food product that can be eaten by itself or consumed with other dishes such as lemang, ketupat, rice, topping and also filling in pastries. This product is 100% plant based which is very suitable for vegan people and those who have allergies to animal based protein. It also provides high nutritional value, high in fiber and also contains no synthetic color. Moreover, the enoki mushroom did not have any odor or significant taste like the other mushroom. Therefore, it will provide its consumers with delicious flavors and only high quality items. Convenient packaging which is a ziplock stand up pouch has been provided for this *serunding* so that it is easier for the consumer to carry it and also to consume it anytime and anywhere. Nowadays, society demands for foods that are nutritious with affordable prices. Therefore, our product will definitely fulfill the desires of the society.

Keywords: *enoki mushroom, meatless serunding, plant-based*

NO 3

Mushroom Oat Bubur Lambuk

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Mushroom Oat Bubur Llambuk is proposed as an alternative to original bubur lambuk which cannot be consumed by people who are on vegetarian diet due to the presence of meat. Mushroom is the perfect ingredient to replace meat in the original *bubur lambuk* due to its meaty taste and texture. In order to make the bubur lambuk more nutritious, the rice used in the original recipe of the bubur lambuk has been replaced with oats. The packaging method used to pack Mushroom Oat Bubur Lambuk was canning method and the packaging material used was can. Technically, during the production of theour product, we discovered many types of mushrooms that can give texture and taste properties similar to meat. However, we decided to use shiitake mushrooms as our main ingredient because the taste and texture of shiitake mushroom is perfect for Mushroom Oat Bubur Lambuk. As our product is known to have novelty, we emphasized the nutrient diet of Mushroom Oat Bubur Lambuk by using mushroom and oat to substitute the original recipe of *bubur lambuk* – rice and meat. The use of oats become fiber source in Mushroom Oat Bubur Lambuk which makes our product a healthy product. Furthermore, in our production, we use retort as our technological technique. Retort method was chosen because the taste and texture of Mushroom Oat Bubur Lambuk can be maintained. Convenience is one of the key points offered by the retort method. This will make our product ready to oat. Consumers also can reheat our product if they prefer to eat our product to served warm.

Keywords: *Vegetarian, mushroom, bubur lambuk, canning*

NO 4

Mushroom Rendang RTH

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Rendang is a dry curry that is cooked for an extended period of time, allowing the meat to absorb all of the flavours that distinguish this cuisine.The spices employed in this cuisine work as natural organic preservatives, and when paired with careful slow cooking of the chicken, this delectable dish may be stored in the refrigerator for up to a month. However, some Malaysians do not consume rendang due to several reasons such as allergic reactions of the meat, religious factors and personal preferences. Hence, in our new product, Ready to Heat (RTH) Frozen *Rendang* Mushroom, king oyster mushrooms will be incorporated as a substitution for meat or chicken protein. It is an extremely versatile product and can be considered a sustainable product with the incorporation of healthy mushrooms. As the name suggests, our ready-to-heat product provides a convenient method of preparation since it just needs to be heated before consumption, thus making it ideal for the consumer with a busy lifestyle. Even though mushrooms do not have comparable protein content to conventional meat, however, mushrooms are capable of outperforming meat in many aspects especially with their good nutritional profile as well as their “meaty” texture and rich in an "umami" flavour that can increase sensory satisfaction and maintain rich flavours and texture. They are also rich in vitamins and minerals such as selenium, zinc, vitamin B1, B2, B5, B6, and B12. Furthermore, our group also emphasises the shelf life and convenience ways to consume the product to attract consumer attention into trying the product. Hence, the mushroom rendang is vacuum packed into a microwavable polypropylene container and stored in a chill temperature to protect and prolong shelf life of the product.

Keywords: *mushroom, rendang, meat substitute, ready-to-heat.*

NO 5

Mushroom Cube

Zaibunnisa Abdul Haiyee, Najihah Mohamad, Nisa Nurdini Mohd Ishak Yeow, Nurshahreen Natasha Mohd Amin, Nur Athirah Auni Jamaludin, Athira Nurhanis Amir Zamree

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Malaysian households consume a lot of stock cubes to increase flavour in their cooking. This plant-based mushroom cube is developed to provide a great combination of unique meaty and umami flavour of mushroom when added in food. This project aims to meet the Malaysian demand for this product and become one of the main national food products distributors by implementing new technology in the food industry through our products. Next is to empower the nation by supporting the people through our products especially towards homemaker and to improve Malaysia's food and beverage industry by creating novelty and unique products at the same time representing local materials. This product is made by grinding the dried mushroom to form mushroom powder. Then, it is mixed with other ingredients such as vegetable shortening, salt, yeast extract, onion powder, garlic powder, sugar, and local spices. The raw materials were inspected for metals and undergo homogenization. The mixture paste was moulded to the cube shape and dried for 12 hours. A few samples from the batch were taken to check for the moisture content of the cube. The finished products were wrapped in aluminium foil as primary packaging and packed into 6 mushroom cubes per box. Mushrooms are easy to grow, and there is abundance which defeats flavouring cube with chicken or beef as their prices are unstable in the market now. Asian taste preference is more likely to be spices rather than herbs, so the mushroom cube blended with various spices are more likely to be accepted by the community in Malaysia. The mushroom cube is 100% plant-based and void of any MSG and chemical flavour enhancer as all the ingredients are all natural and organic which appeal to now-growing health-conscious consumers. The umami taste is completely from the combinations of mushrooms and the spices.

Keywords: *Mushroom, plant-based flavouring cube, natural flavour, local spices, umami taste*

NO 6

The Potential of Underutilised Splitgill Mushroom as High-Fibre Veggie Chunks

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Demand for plant-based protein as healthier food options is gaining traction in Malaysia since the pandemic. The high-fibre veggie chunk was developed to promote the use of the splitgill mushroom, an underutilised species, as an important vegetable dietary fibre and protein source. Splitgill mushroom (Schizophyllum commune), locally known as Cendawan Kukur, is a common fungus in the genus Schizophyllum and is traditionally picked from rotting trees in the forest. The mushroom grows in clusters with small, white, hairy, fan-shaped caps and split gills underneath the cap. Recently, the mushroom is also cultivated in a block system for commercialisation. However, its consumption is still relatively low due to its scarcity in the market and its usage is limited to traditional cooking styles. Its extremely tough texture and strong taste can be unappealing for some people but favourable to others as it offers a similar chewiness and flavour to the meat. For this high-fibre veggie chunk, both the taste and texture of the fungus are beneficial. This product also uses another underutilised crop called the lablab bean (Lablab purpureus) to top up the nutrients lacking in the mushroom including copper, iron and zinc, as well as to hold the product into shape. The product has a texture of falafel or kofta or kebab depending on the cooking method. Its patty-like shape provides shorter cooking time and more versatility in food preparation such as burgers, veggies steak, nuggets, or shawarma. The development method involved roasting, grinding, stir-frying and blending techniques which can be replicated at the household level to encourage production by home-based food entrepreneurs. The preliminary finding shows positive consumer acceptability.

Keywords: *Splitgill mushroom, underutilised crops, food product development, lablab bean*

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