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Study and Evaluation of the Oxidative, Inflammatory, and Microbial Activity of Anthocyanin Pigment in Purple Rice

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Abstract:

Samples are collected, which represents taking varieties of purple sticky and non-glutinous rice, where the samples are extracted using an ethanol solution employing high-performance lipid chromatography and (TPC), (TFC), (the content of flavonoids, antioxidants, and antibacterial) against food-borne diseases. The extract contains high levels of High cyanidin 3-0 cyanidin 3-O-glucoside.In addition, by studying their activity of antioxidants through a test ABTStest (524.26 4.63, mg L-ascorbic-ascorbic/g extract), oxidative stress (IC50 = 19.70 0.31 g/mL), radical (IC50 = 11.20 0.25 g/mL), nitric oxide (IC50 = 17.12 0.56 g/ml), a nitric oxide inhibition action (IC50 = 18.32 0.82 g/mL), and in Monocyte lymphocytes from animals Furthermore, KGLP shown antibacterial efficacy towards pathogenic organisms such as Staphylococci, E. coli, Salmonella, and Vibrio. Their findings suggest that Thai sticky violet wheat-grown highlands might be a valuable biodiversity source of bioactive compounds, pro-government, and antimicrobials suitable for usage as a natural active drug component in healthy ingredients and nutritional solutions.

Keywords:rice violet; anthocyanin, ABTS, TPC, TFC, E. coli, Salmonella, LC50,

Introduction:

Oxidative stress is atoms that have one maybe more unattached electrons in the outermost valence and are highly reactive to biomolecules such as lipid, Genetic material, or peptides. [1]Oxidizing agents harm physiological functioning, as well as generate substances such as metals and poisonous chemicals [2]. Reactive Oxygen Types and Volatile Nitrogen Types Diabetic, atherosclerotic & inflammation illnesses, brain conditions, tumors, as well as other illnesses are all examples of chronic diseases [3]. Antibodies are thought to be extremely efficient in controlling either ROS or RNS activities [4]. It plays critical functions in a variety of biochemical functions by initiating change chemicals such as hydrogen peroxide, peroxides, oxidants soluble result in producing fringe groups, and nitric oxide.According to the potential development of radicals to combat the radicals existing in the system of the living thing, including such glutathione, ubiquinone, superoxide, catalase, and so on, or from food and pharmaceutical applications [3-5]. Oxidation found in plants it is mostly made up of polyphenols, flavonoids, carotenoids, and vitamins [6]. Antioxidant compounds abound in traditional medicines. Therefore, chemicals generated by diverse bacteria are exploited as a biological action. Nutritional and Pharmacological Substances (APIs) to Optimize Health of individuals [7-8], Vitamins, generally, pro agents, anti-microbial agents, and pro agents are examples [9], Rice has more proteins, vitamins, elements, and beneficial compounds than other grains. Rice is

comparable. Therefore, the concentration of bioactive metabolites varies by location. [10] Varietal and varietal Violet rice is regarded as a healthy meal, particularly in Thailand. It is regarded as a rich potent antioxidant and health-promoting chemicals [11]Anthocyanin, tocopherols, tocopherols are all antioxidants. These areautomobiles. It has been shown to regulate and mitigate disorders in public health, including oxidationincluding cancer, through a range of biochemical actions. [Purple rice is believed to have superior nutritional and health advantages versus colored rice. fixed Cambodia, like other Asian nations, grows and consumes huge amounts of food. Resources of antioxidants for research and development refer to biological constituents and physiological activities [12-13].The goal of this research is to demonstrate that Thai blue rice is a naturally derived source of natural antioxidants for preventing disease. The objective is to move from roots that were oxidizing to the end goal of some other antioxidants. Analysis results from anthocyanin and their composition, as well as doing cell-based studies on anti-inflammatory and antibacterial action versus food-borne pathogens.

2. Results and Discussion: -

2.1. Anthocyanin Levels:

Anthocyanin is a source of anti-inflammatory and oxidative stress, which is the anthocyanin pigment found in the outer shells of grains, where the concentration of the purple-colored anthocyanin in this research, as well as cyanidin glucoside, peonidin -glucoside as shown in the table1 below.C3G, P3G, and D3G are the abbreviations for C3G, P3G, and D3G, respectively. According to research, paddy that appears persistently black has higher levels of pigment [17-18]. The nutritive benefits of northern Thai violet rice grown at different altitudes were studied. In the highlands, someGrain varieties create grains with increased color and production.

In the lowlands, only a few plants had polymeric anthocyanin concentrations [19]. Anthocyanin content was calculated in 25 ricerecommendations from 25 different rice cultivars. The outcomes the largest anthocyanin discovered is cyanidinglucoside (82.3 percent) [17-25].C3G and P3G levels including whole grains KGPEK, KGDSK, and KHN were found to be 89and 33, 50 and 49, and 135 and 22 mg/100 g dried materialsequally [20–22]. Furthermore, C3G and P3G levels in KGLP and KHN wheat grainwere observed to be 2277 and 792 mg/100 g tests, correspondingly [24-26].According to research, the anthocyanin content of violet rice increases exponentially. So, while most violet rice types are conventional rice throughout regions and growth [27-28]. Shows Table 1 the anthocyanin level in violet rice extracts.

Table 1 the anthocyanin level in violet rice extracts.

Samples	Cyanidin 3-*O*-Glucoside (mg/g Extract)	Peonidin 3-*O*-Glucoside (mg/g extract)	Delphinidin 3-*O*-Glucoside (mg/g Extract)
KGLP	55.26 ± 0.71^{a}	14.24 ± 0.46^{b}	1.95 ± 0.13^{a}
KGPEK	52.20 ± 0.89^{b}	15.91 ± 0.47^{a}	1.55 ± 0.12^{b}
KGDSK	29.62 ± 0.80^{c}	10.48 ± 0.38^{c}	ND
KND	28.91 ± 0.74^{cd}	10.70 ± 0.40^{c}	ND
KHN	27.04 ± 0.68^{d}	8.54 ± 0.31^{d}	ND

study and evaluation of the oxidative, inflammatory, and microbial activity of anthocyanin pigment in purple rice

2.2. Total Phenolic and Total Flavonoid Content:

Grain is high in polyphenolic compounds. Hyperpigmented wheat includes solely phenolic acids, but colored rice includes more compounds than polyphenols [13]. In Table 2. Vital, TPC and TFC levels differed amongst5 rice varieties. KGLP has been demonstrated, TPC and TFC had considerably greater (p 0.05) GAE/g isolate (595.53 7.36 mg GAE/g extracts and 379.35 4.26 mg QE/g extraction) than KGPEK, which had 570.49 6.53 mg GAE/g extract of TPC and 340.24 3.64 mg QAE/g remove of TFC. Although KHN has the least TPC while KGDSK has the highest TFC.

The findings coincide also with the total flavonoids identified inHighlanders rice isolates (KGLP and KGPEK) that have had more TFC than lowlands rice extracted (KGDSK, KGPEK).(KND and KHN) Furthermore, sticky rice isolates (KGLP, KGPEK, KGDSK, etc.) KND) has more TPC & TFC than non-glutinous rice extract (KHN). TPC, as well asTFC, was greater in KGLP than the one in KGDSK and KHN, which is consistent with the prior study [25,23] The study found Obtains of sticky violet rice bran TPC levels were greater in KGLP than in KHN, a non-glutinous violet modified rice extraction. TFC levels appear to be greater in KHN rice bran concentrate than in KGLP rice isolated Gallic acid was the most prevalent phenolic chemicals [29], whereas anthocyanin is now the most common flavonoid in colored rice. Furthermore, and flavonoids were shown to be the least prevalent, but eugenol was revealed to be the most prevalent flavone element in pigmented rice [30]. See Table 2.The value of the variable the phenolic compounds and flavonoids levels in pigmented grain separates. Integrating many avatars in almost the same game provides significant competition.

Table 2. The value of the variable the phenolic compounds and flavonoids levels in pigmented grain separates.

Samples	Total Phenolic Content (TPC) (mg GAE/g Extract)	Total Flavonoid Content (TFC) (mg QE/g Extract)
KGLP	595.53 ± 7.36^{a}	379.35 ± 4.26^{a}
KGPEK	570.49 ± 6.53^{b}	340.24 ± 3.64^{b}
KGDSK	489.39 ± 5.16^{d}	291.93 ± 3.99^{d}
KND	533.91 ± 5.54^{c}	323.21 ± 4.74^{c}
KHN	451.81 ± 4.85^{e}	286.40 ± 3.82^{d}

2.3. Test for Antioxidants:

ABTS evaluates the ascorbic acid content for a well-extracted microbiological analysis component [31]. Whereas Figure 1 indicated that KGLP and KGPEK had considerably greater radical action on ABTS • +, Fig.2 revealed that substantially lower radicalisolate.These findings are comparable with those of prior research by Pramai [25]. The activities stated by KGLP also have much greater ABTS • + Total antioxidant activities than KGDSK& KHN. Show in figure1.

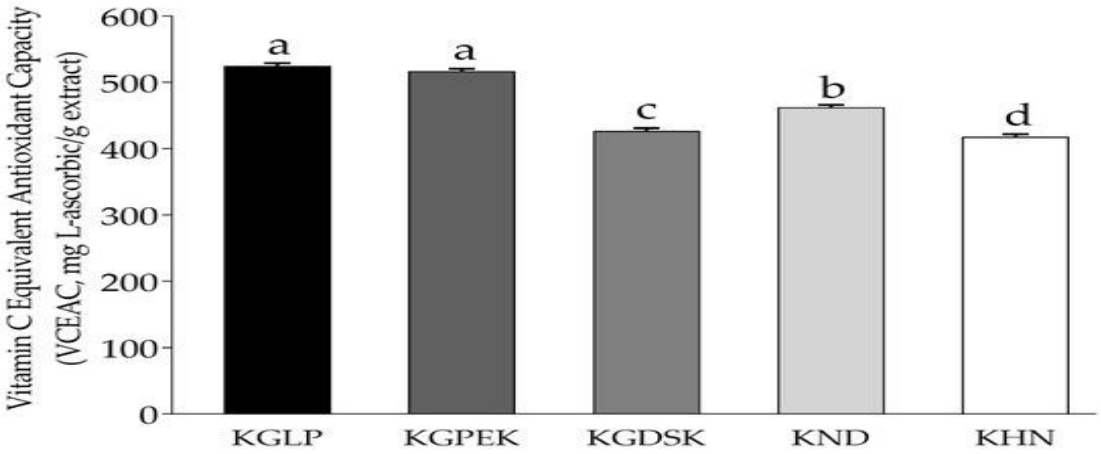

Fig. 1 Illustrates the oxygen radical absorbance ability of violet rice isolates against ABTS.

Material 2021, 26, x for peer riverTable 3 reveals that KGLP exhibited the strongest peroxidation and nitric oxide reduction ability, with Ic50 of 19.70 0.31 and 17.12 0.56 (g/ml), respectively, and the results were not radically different forKGLP and KGPEK demonstrated considerably greater with IC50 values of 11.20 0.25 and 11.96 0.65 (g/mL), correspondingly. ABTS • + maximum removal was revealed to have a proportional connection utilizing r2 0.960, 0.935, 0.893, 0.826, and 0.916; P 0.01, correspondingly. Such findings might imply that radicals ABTS • + and nitric oxide and supercharged ionic cleansing capabilities, as well as an inhibitory impact on lipid peroxidation in violet rice isolates, correlate with anthocyanin, TPC, and TFC. [32]. Arrived out a similar investigation.KGDSK and other sticky rice varieties from Thailand were tested.Show Table 3:IC50 for oxidative damage inhibition via nitric oxide all parameters are presented as an average absolute variation. Various letters within every approach imply a significant variation of less than 0.05.

Table 3: IC50 for oxidative damage inhibition via nitric oxide all parameters are presented as an average absolute variation.

Samples/ Positive Control	Lipid Peroxidation	Superoxide Anion	Nitric Oxide
KGLP	19.70 ± 0.31 c	11.20 ± 0.25 c	17.12 ± 0.56 c
KGPEK	21.45 ± 0.38 b	11.96 ± 0.65 c	18.81 ± 0.33 b
KGDSK	21.62 ± 0.37 b	14.78 ± 0.30 ab	19.38 ± 0.38 b
KND	25.00 ± 0.31 a	15.60 ± 0.45 a	22.31 ± 0.36 a
Cyanidin-3-O-glucoside	16.64 ± 0.38 d	9.55 ± 0.34 d	17.54 ± 0.30 c
L-ascorbic acid	ND	7.55 ± 0.31 e	ND
Curcumin	ND	ND	6.68 ± 0.28 e

TPC and TFC content as well as antimicrobial properties versus Nitric oxide, peroxide, researchers discovered that the proportion of TAC, TFC, and TPC linked with extraction and antioxidant effects. Phenols function as reductants, predators of free radicals, and oxygen generators. In contrast to a greater amount of flavonoids and polyphenols, colored grain variants demonstrated

significant[33].Past research has shown that ant oxidative capabilities are sensitive to TPC and TFC in tests. The heritable traits of various varieties, storage temperature, and measurement methodologies are all major contributors to the wide range of powerful antioxidants [34].

2.4. Anti-Inflammatory Activities Assay:

Purple rice's impact on iNOS generation in concurrent lipopolysaccharide (LPS)-interferonactivation Table4 illustrates this. KGLP inhibited both intracellular NO and the most (p 0.05), with IC50 values of 18.32 0.82 and 23.43 1.21 g/mL, respectively.

There was also a link discovered between TPC and peonidin 3-O-glucoside resistance. Impact of coupled LPS-IFN on NO and iNOS production cells as seen in Table S1.AR C3G and its metabolic products isolated from rice were found to inhibit the manufacturing of inflammatory cytokines such as tumor necrosis component, chemokines (NO and prostaglandin E2) expression in molecules [35]. It has been demonstrated that 9 flavonoids impede activity. It contains tumor necrosis factor B (NF-B), a transcription factor necessary for the iNOS pathway. It has also triggered the signal transducers and regulators [36].

2.5.Foodborne Pathogenic Organisms Antibacterial Activities:

Usually, diseases are carried through eating, which is also the major cause of various disorders and, as a consequence, an increase in mortality. The much more prevalent organisms that cause food contamination episodes are S. aureus, E. coli, S. intestinal blockages, (log CFU/ml) of viruses that were cultured at successive dosages throughout 24 hr. Derived using the KGLP method. The results are depicted in Fig. 2. The antimicrobial effect was shown to be related to the quantity of KGLP employed during the study. Alenteritis was significantly (p 0.05) decreased by 90 percent. KGLP at 900 mcg/mL completely reduced E. coli and E. coli even during the test.Purple rice isolation has been proven to be an antibiotic disaccharide that is capable of killing microbes such as S. aureus, E. coli, S. enteritis's, and V. parahaemolyticus [39-42].Gram-positive microorganisms are much more susceptible to anthocyanin impacts than Staphylococci microorganisms. [34]The findings demonstrated that violet grain extraction has the potential to be utilized as a potent antioxidant to suppress the development of bacteria species.

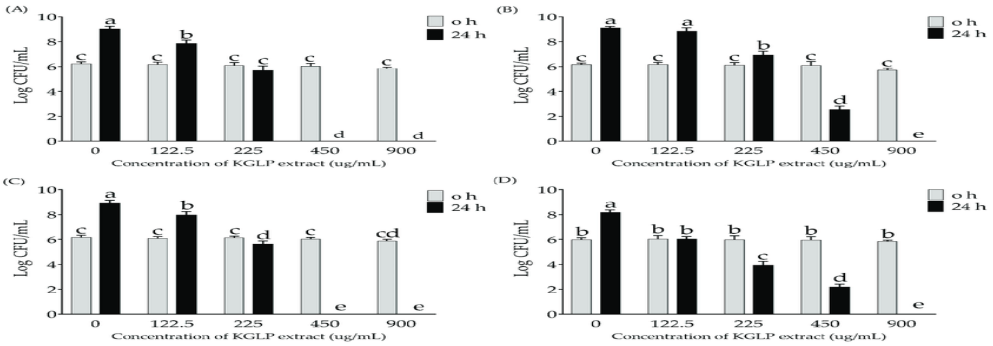

Fig. 2 the antibacterial effect of KGLP isolates against E. coli. S. aureus (A), Escherichia coli (Band Vibrio cholera (D). The characteristics are stated for p 0.05, implementing various letters shows a substantial variation.

Martial and methods: -

3.1. Preparation of Purple Rice Extract:

Plant-derived anthocyanin has effects that interact with microbial cell membranes via ionic bonding and water interactions. It is capable of isolating ions critical to the protein level and has always been removed and kept at -20°C until needed. Grain extracts were prepared using ethanol pH 2.0 1:10 for 120 min at 60 °C while shaken at 180 pm. Samples were concentrated and condensed and also placed before being recovered in the vacuum desiccator. Table 5 illustrates this.

3.2.HPLC Anthocyanin Determination:

In the HPLC system, Symmetric Shields C-18 columns (4.6 x 250 mm) and a multi-wavelength to filter the data from columns yet again, a persistent logistic gradient was applied. The phase lasts between 0 and 30 minutes, with methanol concentrations ranging from 10% to 20%, after which the isolated anthocyanin is detected and evaluated at 520 nm.

3.3. Total Phenolic Contents Assessment:

To analysis is being used to ascertain the density of the product's phenolic content. [45]. 100 L of the test (1 mg/mL) andthe conventional answer was scaled back to 2 mL, utilizing freshwater well mixed with 100 ml of the reaction mixture, and 300 L of 20% (w/v) sodium chloride was added. The solution was incubated at 37 temperatures for 9 min at 37 °C before being measured for absorbance at 725 nm witha spectrometer with Ultraviolet wavelengths. The dry extract sample was obtained.

3.4. Determination of Total Flavonoid Content:

3.5. Antioxidant Assay: -

The flavonoids used in the research were pure [46]. In a nutshell, one milliliter (1 mL) of the substance to be studied is collected. The material was expected to stand for 5 minutes before being tested. Then, 2 ml of NaOH extract was placed, yielding a final book of after ten minutes of mixing, the solution was diluted to 10 ml with ethanol and the absorption at 510 absorbance value was measured. Total flavonoid level the procedure has been used to compute it, and these outcomes are communicated flavonoid Contemporaries per g dry removal**.**

3.5.1. Lipid Peroxidation Assay:

Tris-HCl, a linoleic acid surfactant, Ascorbic acid, flavonoid, and the C3G test were used in reactive mixtures. In addition, ferrous sulfate was added and incubated for 1 at 37 °C than add trichloroacetic acid. A part of 500 l is added to the mixed solution, which is then warmed for ten min at 95 °C until chilling in frizz. The homogenate for fifteen min at 3500 rpm, collected, and the absorbance at 540 nm was determined. Activity that inhibits.

3.5.2. Superoxide Anion Scavenging Activity Assay:

It is made from a non-enzymatic substance. The phenazine meth sulfate-nicotinamide adenine dinucleotide complex is evaluated using nitro blue tetrazolium reduction. The experiment has been conducted in a 96-well plate with 200 l of phosphorus saline at pH 7.4 containing 1.5 NADH, 0.5 M

NBT, 2.5 M EDTA, and different doses of quercetin test. I was in the midst of my menstrual cycle. It is administered to start the procedure, which is then kept at 37c. The resultant combination was then spectrophotometric analyzed at 560 nm to estimate

3.5.3. Test for Nitric Oxide Scavenging Ability:

The activity was assessed by the presence of sodium nitroprusside with oxygen, followed by nitrate ions from the Griess reaction. With a capacity of 200 liters, the reaction mixture comprises 800 liters of sodium nitroprusside and varying concentrations of chemicals such as quercetin, C3G, and curcumin. After heating the reaction mixture for 120 minutes at 37 °C, the sample solutions were mixed with the iodine solution. Absorption of the chromium carrier formed following nitrite diazotization was detected at 540 nm using Griess reagent, and the IC50 was estimated by comparing it to the positive control.

3.6. Anti-Inflammatory Activity Determination:

RAW 264.7 cultures were incubated in Cells that were grown Eagle mixture (DMEM) with 10% serum,100 unit's/ml penicillin, and 100 microgram doses streptomycin. For 24hrs, cells were cultured in 24 well plates to test for anti-inflammatory activity.Sterile media with various amounts of Curcumin, quercetin, and C3G samples were administered to the cells. Introduced after 12 h ofreproduction and maintained for 70 hours. The filtrates were gathered and analyzed for nitric oxide using the Griess reaction. The colonies are also deconstructed to produce cellular lysates, and the amount of iNOS produced is quantified. The mice ELISA for internal iNOS is available on the market.The molecule is generated also examined using Bradford reagent to measure cell survival, and the influence of the samples or standard solution on viable cells following stimulation is assessed. For 72 hours, LPS-IFN-in the condition of violet rice isolates was used as a cell growth assay.Show Table 4. IC50 for nitrite and iNOS reduction, all data are reported as average absolute deviation.

Table 4. IC50 for nitrite and iNOS reduction, as average absolute deviation.

Samples/ Positive Control	IC_{50} (μg/mL)	
	Nitric Oxide	iNOS
KGLP	18.32 ± 0.82^{d}	23.43 ± 1.21^{d}
KGPEK	20.34 ± 0.98^{cd}	24.66 ± 0.87^{c}
KGDSK	24.50 ± 0.97^{b}	29.43 ± 0.98^{ab}
KND	22.54 ± 0.80^{bc}	27.94 ± 1.17^{b}
KHN	29.66 ± 0.91^{a}	31.74 ± 1.32^{a}
Quercetin	15.86 ± 0.67^{e}	20.61 ± 1.18^{d}
Curcumin	12.61 ± 0.74^{f}	14.70 ± 0.91^{e}
Cyanidin-3-glucoside	13.48 ± 0.85^{ef}	16.68 ± 0.92^{e}

3.7. Activity against Foodborne Pathogens:

DeterAnthocyanin was chosen for its anti-inflammatory and antioxidant characteristics, and also its microbiological activity. Broths Staphylococcus, Escherichia coli ATCC 25922, S. adapted to [39]

and Pelyuntha et al. [49] were used to dilute the material. 200 liters of each form of inoculation were mixed with various amounts of samples (1800 liters), yielding final levels sample was a combination of standard broth and the inspected material, which did not contain any pathogens, whereas the control sample was a combination of standard broth. Most of the test materials Cells for Listeria monocytogenes were counted on sterile soy medium at 0 and 24 hours, whereas cell lines for L. monocytogenes were counted were rotated at 180 cycles after being mixed with a standard soup andeach analyzedmicroorganisms Antimicrobial Each minute for 24hrs at 37 degrees Celsius The mitochondria then sprang to life.

4. Conclusions: -

The investigation overview covers purple rice types that are devoid of antioxidants and inflammation as a result of numerous tests, including (TPC, TFC) in which the accompanying variations are included. Grains such as KGLP and KGPEK are the best overall and perform much better than (kGpSK-KNP) and non-glutinous rice types (KHN). The findings of this study revealed a connection seen between components of the factory anti-inflammatory and antioxidants, with purple sticky rice (GLP-KGPEK) being one of the ideal scenarios since that contains a significant proportion of anthocyanin, as well as its energetic activity of TFC, TPC,ABTS•+ and its high performance against Free origins.Additionally, discovered KGLP- is one of the antiviral drugs conveyed by foodsBacterial infections such as Aureus, E. coli, and PseudomonasViolet rice be some of the crops that improve nutritive value, nutraceuticals, and dietary items that are crucial to the individual's health.

Resource:-

[1] Phaniendra, A.; Jestadi, D.B.; Periyasamy, L. Free radicals: Properties, sources, targets, and their implication in various diseases. Indian J. Clin. Biochem. 2015, 30, 11–26.

[2] Mandal, S.; Yadav, S.K.; Yadav, S.; Nema, R. Antioxidants: A review. J. Chem. Pharm. Res. 2009, 1, 102–104.

[3] Lobo, V.; Patil, A.; Phatak, A.; Chandra, N. Free radicals, antioxidants, and functional foods: Impact on human health. Pharmacogn. Rev. 2010, 4, 118–126.

[4]˙Huyut, Z.; Elmasta¸s, M.; Aboul-Enein, H.Y. Radical scavenging and antioxidant activity of tannic acid. Arab. J. Chem. 2010, 3, 43–53.

[5] Kate, D.; Katyare, S.; Hegde, M.; Bae, H. Significance of antioxidant potential of plants and its relevance to therapeutic applications. Int. J. Biol. Sci. 2015, 11, 982–991.

[6] Xu, D.P.; Li, Y.; Meng, X.; Zhou, T.; Zhou, Y.; Zheng, J.; Zhang, J.J.; Li, H.B. Natural antioxidants in foods and medicinal plants: Extraction, assessment, and resources. Int. J. Mol. Sci. 2017, 18, 96.

[7] Kitts, D.D.; Wijewickreme, A.N.; Hu, C. Antioxidant properties of a North American ginseng extract. Mol. Cell. Brioche. 2000, 203, 1–10.

[8] Noguchi, N.; Niki, E. Phenolic antioxidants: A rationale for design and evaluation of novel antioxidant drug for atherosclerosis. Free Radic. Biol. Med. 2000, 28, 1538–1546.

[9] Manach, C.; Scalbert, A.; Morand, C.; Rémésy, C.; Jimenez, L. Polyphenols: Food source and bioavailability. Am. J. Clin. Nutr. 2004, 79, 727–747. [PubMed]

[10] Bhat, F.M.; Sommano, S.R.; Riar, C.S.; Seesuriyachan, P.; Chaiyaso, T.; Prom-u-Thai, C. Status of bioactive compounds from the bran of pigmented traditional rice varieties and their scope in production of medicinal food with nutraceutical importance. Agronomy 2020, 10, 1817.

[11]Melini, V.; Acquistucci, R. Health-promoting compounds in pigmented Thai and wild rice. Foods 2017.

[12] Golfo, P.; Trindade, H. Rice antioxidants: Phenolic acids, flavonoids, anthocyanin, proanthocyanidins, tocopherols, γ-oryzanol, and photic acid. Food Sci. Nutr. 2014, 2, 75–104.

[13] Seechamnanturakit, V.; Karrila, T.; Sontimuang, C.; Sukhoom, A. The natural pigments in pigmented rice bran and their relation to human health: A literature review. KMUTNB I JUST 2018, 11, 3–13.

[14] Yamuangmorn, S.; Prom-u-Thai, C. The potential of high-anthocyanin purple rice as a functional ingredient in human health. Antioxidants 2021, 10, 833.

[15] Hu, C.; Zawistowski, J.; Ling, W.; Kitts, D.D. Black rice (Oryza sativa L. indica) pigmented fraction suppresses both reactive oxygen species and nitric oxide in chemical and biological model systems. J. Agric. Food Chem. 2003, 51, 5271–5277.

[16] Abdullah Hasan Jabbar, Salim Oudah Mezan, Salih Meri Al Absi et al., Assessment of anticholinesterase effect of polyvinylpyrrolidone/silver nanocomposite biosynthesized by Pandanus Artocarpus extract, Materials Today: Proceedings, https://doi.org/10.1016/j.matpr.2020.12.582

[17] Salim Oudah Mezan, Salih Meri Al Absi, Abdullah Hasan Jabbar et al., Synthesis and characterization of enhanced silica nanoparticle (SiO2) prepared from rice husk ash immobilized of 3-(chloropropyl) triethoxysilanea, Materials Today: Proceedings, https://doi.org/10.1016/j.matpr.2020.12.564

[18]S. Meri Al Absi, A. Hasan Jabbar, S. Oudah Mezan et al., An experimental test of the performance enhancement of a Savonius turbine by modifying the inner surface of a blade, Materials Today: Proceedings, https://doi.org/10.1016/j.matpr.2020.12.309

[19] Turki Jalil, A., Hussain Dilfy, S., Oudah Meza, S., Aravindhan, S., M Kadhim, M., & M Aljeboree, A. (2021). CuO/ZrO2 nanocomposites: facile synthesis, characterization and photocatalytic degradation of tetracycline antibiotic. Journal of Nanostructures.

[20] Karim, A. H., Ali, A., & Mezan, S. (2021). Synthesis and Characterization of Silica Nanoparticle (Sio2 Nps) Via Chemical Process. Annals of the Romanian Society for Cell Biology, 25(6), 6211-6218.

[21] Turki Jalil, A., Hussain Dilfy, S., Oudah Meza, S., Aravindhan, S., M Kadhim, M., & M Aljeboree, A. (2021). CuO/ZrO2 Nanocomposites: Facile Synthesis, Characterization and Photocatalytic Degradation of Tetracycline Antibiotic. Journal of Nanostructures.

[22] Altajer, A. H., Efendi, S., Jabbar, A. H., Oudah Mezan, S., Thangavelu, L., M Kadhim, M., & F Alkai, A. M. (2021). Novel Carbon Quantum Dots: Green and Facile Synthesis, Characterization and its Application in On-off-on Fluorescent Probes for Ascorbic Acid. Journal of Nanostructures.

[23] Kamel, A. A. K., Hussein, A. T. A., Shekban, A. H., Badr, N. R., Mezan, S. O., & Jabir, W. Q. (2021). Improvement of a New Analysis Technique of phenomenon of bulling and Cyberbullying among Students at different stages. Psychology and Education Journal, 58(4), 2729-2740.

[24] Mezan, S. O., Jabbar, A. H., Hamzah, M. Q., Tuama, A. N., Hasan, N. N., Roslan, M. S., & Agam, M. A. (2019, August). Synthesis, characterization, and properties of polystyrene/SiO2 nanocomposite via sol-gel process. In AIP Conference Proceedings (Vol. 2151, No. 1, p. 020034).

[25] Muayad M. Maseer , Firas Basim Ismail Alnaimi, Rafid M. Hannun, Lim Chin Wai, Kumail Abdulkareem Hadi Al-Gburi , Salim Oudah Mezan.A reviewof the characters of nanofluids used in the coolingof a photovoltaic -thermal collector, Materials Today: Proceedings,

[26] Mezan, S. O. (2021). Silica/Polystyrene Nanocomposite (SiO2/PsNCs) using Sol-Gel Method Drug Delivery System: A Review. Design Engineering, 10175-10181.

[27] Mezan, S. O., Jabbar, A. H., Hamzah, M. Q., Tuama, A. N., Hasan, N. N., & Agam, M. A. (2018). Synthesis and Characterization of Zinc Sulphide (ZnS) Thin Film Nanoparticle for Optical Properties. Journal of Global Pharma Technology, 10(07), 369-373.

[28] Mezan, S. O., Jabbar, A. H, Salih Meri Al Absi, Roslan, M. S., & Agam, M. A. (2021, August). Synthesis and enhancement of morphological and structural properties of zinc sulphide thin films nanoparticle for solar cell application. In AIP Conference Proceedings

[29] Mezan, S. O., Jabbar, A. H., Hamzah, M. Q., Tuama, A. N., Hasan, N. N., Roslan, M. S., & Agam, M. A. (2019, August). Synthesis, characterization, and properties of polystyrene/SiO2 nanocomposite via sol-gel process. In AIP Conference Proceedings (Vol. 2151, No. 1, p. 020034).

[30] Tuama, A. N., Abbas, K. H., Hamzah, M. Q., Jabbar, A. H., & Agam, M. A. (2020). An Overview on Characterization of Silver/Cuprous Oxide Nanometallic (Ag/Cu2O) As Visible Light Photocatalytic. International Journal of Advanced Science and Technology, 29(03), 5008-5018.

[31] Doshi, P.; Adsule, P.; Banerjee, K.; Oulkar, D. Phenolic compounds, antioxidant activity and insulinotropic effect of extracts prepared from grape (Vitis vinifera L) byproducts. J. Food Sci. Technol. 2015, 52, 181–190. [CrossRef]

[32] Ngamdee, P.; Wichai, U.; Jiamyangyuen, S. Correlation between phytochemical and mineral contents and antioxidant activity of black glutinous rice bran, and its potential chemopreventive property. Food Technol. Biotechnol. 2016, 54, 282–289.

[33] Petroni, K.; Landoni, M.; Tomas, F.; Calvenzani, V.; Simonelli, C.; Cormegna, M. Proximate composition, polyphenol content and anti-inflammatory properties of white and pigmented Italian rice varieties. Univers. J. Agric. Res. 2017, 5, 312–321.

[34] Wonga, P. Phenolic compounds and potential health benefits of pigmented rice. In Recent Advances in Rice Research; IntechOpen: London, UK, 2020; pp. 1–20

[35] Min, S.W.; Ryu, S.N.; Kim, D.H. Anti-inflammatory effects of black rice, cyanidin-3-O-Beta-D-glycoside, and its metabolites, cyanidin, and protocatechuic acid. Int. Immunopharmacol. 2010, 10, 959–966.

[36] Hämäläinen, M.; Nieminen, R.; Vuorela, P.; Heinonen, M.; Moilanen, E. Anti-inflammatory effects of flavonoids: Genistein, kaempferol, quercetin, and daidzein inhibit STAT-1 and NF-kappaB activations, whereas flavone, isorhamnetin, naringenin, and pelargonidin inhibit only NF-kappaB activation along with their inhibitory effect on iNOS expression and NO production in activated macrophages. Mediators Inflamm. 2007, 2007, 45673.

[37] Saenjum, C.; Chaiyasut, C.; Chansakaow, S.; Suttajit, M.; Sirithunyalug, B. Antioxidant and anti-inflammatory activities of gamma-oryzanol rich extracts from Thai purple rice bran. J. Med. Plants Res. 2012, 6, 1070–1077

[38] Junmarkho, K.; Hansakul, P. Thai pigmented rice bran extracts inhibit the production of superoxide, nitric oxide radicals, and inducible nitric oxide synthase in cellular models. Asian Pac. J. Trop. Biomed. 2019, 9, 291.

[39] Sun, X.H.; Zhou, T.T.; Wei, C.H.; Lan, W.Q.; Zhao, Y.; Pan, Y.J.; Wu, V.C.H. Antibacterial effect and mechanism of anthocyanin-rich Chinese wild blueberry extract on various foodborne pathogens. Food Control 2018, 94, 155–161.

[40] Ma, Y.; Ding, S.; Fei, Y.; Liu, G.; Jang, H.; Fang, J. Antimicrobial activity of anthocyanins and catechins against foodborne pathogens Escherichia coli and Salmonella. Food Control 2019, 106, 106712. [CrossRef]

[41] Chen, H.; Yu, W.; Chen, G.; Meng, S.; Xiang, Z.; He, N. Antinociceptive and antibacterial properties of anthocyanins and flavonols from fruits of black and non-black mulberries. Mol. Cells 2017, 23, 4. [CrossRef]

[42] Sharma, N.; Tiwari, V.; Vats, S.; Kumari, A.; Chunduri, V.; Kaur, S.; Kapoor, P.; Garg, M. Evaluation of anthocyanin content, antioxidant potential and antimicrobial activity of black, purple and blue colored wheat flour and wheat-grass juice against common human pathogens. Molecules 2020, 25, 5785

[43] Cisowska, A.; Wojnicz, D.; Hendrich, A.B. Anthocyanins as antimicrobial agents of natural plant origin. Nat. Prod. Commun. 2011, 6, 149–156.

[44] Sanju, C.; Pattananandecha, T.; Nakagawa, K. Antioxidative and anti-inflammatory phytochemicals and related stable paramagnetic species in different parts of dragon fruit. Molecules 2021, 26, 3565.

[45] Saenjum, C.; Chaiyasut, C.; Kadchumsang, S.; Chansakaow, S.; Suttajit, M. Antioxidant activity and protective effects on DNA damage of Caesalpinia sappan L. extract. J. Med. Plants Res. 2010, 4, 1594–1600.

[46] Shen, Y.; Jin, L.; Xiao, P.; Lu, Y.; Bao, J. Total phenolics, flavonoids, antioxidant capacity in rice grain and their relations to grain color, size and weight. J. Cereal Sci. 2009, 49, 106–111.

[47] Choi, C.; Kim, S.; Hwang, S.; Choi, B.; Ahn, H.; Lee, M.; Park, S.; Kim, S. Antioxidant activity and free radical scavenging capacity between Korean medicinal plants and flavonoids by assay-guided comparison. Plant Sci. 2002, 163, 1161–1168.

48. Sirithunyalug, B.; Saenjum, C.; Charumanee, S.; Sivamaruthi, B.S.; Chaiyasut, C.; Sirithunyalug, J.; Tipduangta, P. Development of colorectal-targeted dietary supplement tablets containing natural purple rice bran oil as a colorectal chemopreventive. Nutrients 2018, 10, 444.

[49] Pelyuntha, W.; Chaiyasut, C.; Kantachote, D.; Sirilun, S. Cell-free supernatants from cultures of lactic acid bacteria isolated from fermented grape as a biocontrol against Salmonella Typhi and Salmonella Typhimurium virulence via autoinducer-2 and biofilm interference. PeerJ 2019, 7, e7555.