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Development and quality evaluation of mushroom *Gravy*

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Abstract
Mushrooms are credible source of nutrients including considerable amounts of protein, dietary fibre, minerals, and vitamins. Aim of this study is to evaluate the nutritional quality and sensory quality of prepared mushroom *gravy*. The selected TNAU mushroom varieties are (Ooty-1button mushroom, CO-1 oyster mushroom, APK-2 milky mushroom) which are commercially available in Madurai. CO-1 oyster mushroom contains (92.1 %) of moisture, antioxidants activity (276 mg/100g), ascorbic acid (3.62 mg/100g), iron (4.3 mg/100g) and calcium (11 mg/100g). Ooty-1 button mushroom had high protein, phosphorus (3.3 g/100g, 88 mg/100g) and APK-2 milky mushroom contained high amount of fibre and ash. In the developed mushroom *gravy* the addition of ingredients increased the nutritional quality of the product. Among the three TNAU mushroom varieties CO-1 oyster mushroom was highly suitable for the preparation of mushroom *gravy*.

Keywords: antioxidants activity, mushroom varieties, physicochemical, sensory quality

Introduction
Edible mushrooms are the fleshy and edible fruit bodies of several species of fungi. Mushrooms belong to the macro fungi, because their fruiting structures are large enough to be seen with the naked eye. They can appear either below ground (hypogeous) or above ground (epigeous) where they may be picked by hand. Edibility may be defined by criteria that include absence of poisonous effects on humans and desirable taste and aroma [19].
Wild mushrooms are becoming more and more important in our diet for their nutritional [17] and pharmacological characteristics. The high protein and low fat/energy contents of wild edible mushrooms, reported by many workers including our research group, make them excellent foods for use in low caloric diets. Concerning the pharmacological potential such as antimicrobial [4]. Mushrooms have also become attractive as a functional food, antiviral, antitumor, antiallergic, immunomodulating, anti-inflammatory, antiatherogenic, hypoglycemic, and hepatoprotective properties, and as a source for the development of drugs and nutraceuticals. Among them, phenolic compounds exhibit potent antioxidant activities [28]. Antioxidants can scavenge free radicals and increase shelf life by retarding the process of lipid peroxidation (LPO), and the consumption of antioxidant-rich foods could bring diverse physiological benefits to the consumer, such as protection against human diseases associated with oxidative stress, like coronary heart disease and cancer [4].
Mushrooms are recognized worldwide as medicinal foods rich in nutrition by doctors. The Food and Drug Administration (FDA) has officially designated mushroom as "Healthy foods" [3]. Nutrient content of fresh mushroom were as follows: moisture 88.15-91.64%, protein 4.22-5.89 %, crude protein 18.46-27.78 %, carbohydrate 4.54-4.68 %, fat 1.49-1.90, ash 1.6-2%, energy value 310-352.32 kcal/100g [12]. The objective of this study was development and quality evaluation of mushroom *gravy* from TNAU three mushroom varieties (Ooty-1button mushroom, CO-1 oyster mushroom, APK-2 milky mushroom).

Materials and Methods
Three TNAU mushroom varieties were purchased from three different mushroom farms in Madurai (figure 1). Raw ingredients were purchased from local departmental stores for preparation of mushroom *gravies*.

V_1 - Ooty-1Button mushroom, V_2 -CO-1 Oyster mushroom, V_3-APK-2 Milky mushroom

Fig 1: Selected TNAU mushroom varieties

Preparation of mushroom *gravy*

Mushroom, onion, tomato, ginger garlic paste, cinnamon, cumin powder, coriander powder, anise powder, turmeric powder, chilli powder, pepper, oil salt ingredients were used to prepared the mushroom *gravy* (figure 2).

Fig 2: Prepared mushroom *gravy*

V_1 T_1- Ooty-1Button mushroom *gravy*
V_2 T_2 -CO-1 Oyster mushroom *gravy*
V_3 T_3 - APK-2 Milky mushroom *gravy*

Chemical composition

The general compositions of mushrooms and mushrooms *gravies* were determined using standard methods. Moisture contents of the sample were determined by the AOAC (1995) [1]. pH by Hart and Fisher (1971) [13]. Protein were determined using a Kjeldahl digestion system (Ma and Zuazaga., 1942) [16]. Crude fiber content by Maynard (1970) [20]. Fat contents were determined by extraction with petroleum ether for 2h using a Soxhlet apparatus Cohen (1917) [8]. Total Antioxidant activity was determined as per the method described by Goupy *et al.*, (1999) [11]. Ash by Hart and Fisher (1971) [13]. The titratable acidity, calcium and phosphorus contents was analysed by the method described by Ranganna (1995) [22]. The Iron content of the sample was estimated by the method described by wong (1928) [27].

Sensory evaluation

The prepared samples were analysed for organoleptic evaluation by 15 semi trained panelists using 9-point hedonic scale as appearance, colour, flavour, texture, taste and overall acceptability [21].

Statistical analysis

Data from all experiments were performed in triplicate for each sample. The results of the three replicates were pooled and expressed as mean ± standard deviation. Data were analyzed using Data Entry Module for AGRES Statistical Software (Version 3.01).Analysis of variance (ANOVA) was used to compare fresh and TNAU mushroom gravies by using Factorial Completely Randomized Design (FCRD) method as described by Gomez and Gomez (1984) [10].

Results and Discussion

Chemical composition and nutrient content of fresh mushroom varieties

The chemical characteristics *viz.*, moisture, pH, acidity, protein, fat, crude fiber, ash, calcium, phosphorus, iron, ascorbic acid and total antioxidant activity of fresh TNAU mushroom varieties were analyzed and the data are presented in table 14.

The moisture content of fresh mushroom of (V_2) CO-1 oyster mushroom variety was 92.1, (V_1) Ooty-1 Button mushroom variety91.1 and (V_3) APK-2 Milky mushroom variety 89.0 per cent. The moisture content of 14 edible mushrooms ranged from 40.07 to 92.92 % reported by Singh *et al.*, (2003) [24]. Hung & Nhi., (2012)[15] reported about the moisture contents of the fresh oyster (*Pleurotus ostreatus*) mushroom as 90.1 per cent.

The per cent acidity of fresh V_1, V_2 and V_3 mushroom varieties were 0.04, 0.03 and 0.05, respectively. pH were recorded as 6.81, 7.03 and 6.71 respectively in V_1,V_2 and V_3 varieties. Statistical analysis of data showed acidity was highly significant in the $P \leq 0.01$ among varieties. No significant change was observed in pH at $P \geq 0.05$.

The highest protein content was recorded in V_1 variety (3.3g/100g) followed by V_2 and V_3 varieties (2.60 and 1.91g/100g respectively). Similar results were found by Manzi *et al.*, (2004) [18] reported the protein content of oyster mushroom to be varied from 1.5 to 7.9 g/100 g. Gupta *et al.*, (2004) [12] reported that protein content of fresh mushroom 4.22-5.89 %.

Fat content was highest in V_3 (0.83 g/100g) followed by V_1 (0.73) and V_2 (0.51 g/100g). Similar results were observed by

Gupta *et al*., (2004) [12] fat content of fresh mushroom was ranged from 1.49 to 1.90 g/100g. Fresh oyster mushroom had 0.33 g/100g of fat [14]. Similar results were obtained in the present study i.e. V_2 mushroom contain low amount of fat compared to other varieties.

The variety V_3 had the highest crude fiber and ash (1.67 g/100g and 0.75%), when compared to V_1 (1.56 g/100g and 0.69 %) and V_2 (1.23 g/100g and 0.67%). Cheung in (1998) [7] reported that the fresh mushrooms contain a relatively high amount of fibre which may be responsible for its relatively high amount of ash. Similar results was obtained in the present study, as the fibre content was higher in V_3 variety, its ash content was also higher among all the varieties. Haytowitz, (2006) [12] studied that the fresh oyster mushroom had 0.77 % of ash and 2.10 g of dietary fiber /100g.

The ascorbic acid and total antioxidant activity was higher in the V_2 variety which was recorded as (3.62 and 276 mg/100g) followed by V_1 (3.01and 246 mg/100g), V_3 (2.91 and 212 mg/100g). Similarly Furlani *et al.*, (2008) [9] reported that the ascorbic value of fresh mushroom was 6.67 mg/100 g.

The variety V_2 had the highest iron and calcium (4.3 mg/100g and 11 mg/100g) when compared to V_1 (1.6 and 6.2 mg/100g) and V_3 (1.71 mg/100g and 5.9 mg/100g). Buwjoom *et al*., (2004) [6] indicated that calcium level in fresh mushroom to be varied from 0.46 to 0.47%.

The highest phosphorus content was recorded in V_1 variety (88 mg/100g) followed by V_3 and V_2 varieties (67.9 and 18mg/100g) respectively. Furlani *et al*., (2008) [9] study shows that the phosphorus values on a wet weight basis were 104.13 mg/100 g which was similar to the present study.

Statistical analysis

Statistical analysis revealed that the acidity, protein, fat, crude fiber, calcium, iron, phosphorus, ascorbic acid and total antioxidant activity were highly significant at $P \leq 0.05$ among varieties. No significant change was observed in moisture, pH, ash at $P \geq 0.05$.

Table 1: Chemical composition and nutrient content of fresh mushroom varieties

S. No	Chemical parameters	V_1	V_2	V_3
1.	Moisture (%)	91.1±1.1003	92.1±1.6012	89.0±1.365
2.	pH	6.81±0.207	7.03±0.297	6.71±0.066
3.	Acidity	0.04±0.0011	0.03±0.0083	0.05±0.0081
4.	Protein (g/100g)	3.3±0.112	2.60±0.112	1.91±0.02
5.	Antioxidant activity	246±2.062	276±4.726	212±7.261
6.	Fibre (g/100g)	1.56±0.004	1.43±0.029	1.67±7.261
7.	Fat (g/100g)	0.73±0.008	0.51±0.002	0.83±0.040
8.	Ascorbic acid (mg/100g)	3.01±0.022	3.62±0.061	2.91±0.073
9.	Ash (%)	0.69±0.015	0.65±0.0128	0.75±0.026
10.	Iron (mg/100g)	1.6±0.007	4.3±0.011	1.71±0.169
11.	Calcium (mg/100g)	6.2±0.122	11±0.475	5.9±0.047
12.	phosphorus(mg/100g)	88±3.323	18±0.243	67.9±2.203

Data indicate analyses of triplicates mean ± standard deviation

Nutrient content of mushroom *gravy*

The physicochemical characteristics *viz.*, moisture, pH, acidity, protein, fat, crude fiber, ash, calcium, phosphorus, iron, and total antioxidant activity of mushroom *gravy* were analyzed and the data are presented in table 2.

The moisture content of prepared V_2T_1 mushroom *gravy* was recorded as 83.4±0.375, V_1T_1 as 82±0.340 and V_3T_1 as 80.8±1.540 percent. The per cent acidity of fresh V_1T_1, V_2T_1 and V_3T_1 mushroom varieties were 0.12±0.005, 0.08±0.002 and 0.13±0.003 respectively. pH were recorded as 5.75±0.096, 5.8±0.213 and 5.7±0.005 respectively in V_1T_1,V_2T_1 and V_3T_1 varieties.

Singh *et al.*, (2016) [23] reported that cakes prepared with incorporation of oyster mushroom powder contain lowest moisture (0.98%) compared to control moisture (0.52%).

In the present study prepared mushroom gravies had highest protein content in V_1T_1 variety (7.3±0.177g/100g) followed by V_2T_1 and V_3T_1 mushroom *gravy* (6.69±0.0301 and 6.0±0.091g/100g respectively). V_3 mushroom variety relatively had high amount of fibre content compared to other varieties.

Fat content was highest in V_3T_1 (4.77±0.021g/100g) followed by V_1T_1 (4.63±0.168 g/100g) and V_2T_1 (5.74±0.093g/100g). Addition of oil during cooking process could increase the fat content of mushroom *gravy*.

Singh *et al.*, (2016) [23] reported that Cakes prepared with incorporation of oyster mushroom powder contain highest fat (17.8 g/100g), protein (8.57 g/100g), ash (15.37 %) compared to control cake.

The variety V_3T_1 had the highest crude fiber and ash (6.18 g/100g and 2.53% respectively) when compared to V_2T_1 (5.67 g/100g and2.36 % respectively) and V_1T_1 (5.67 g/100g and2.32 % respectively). Cooking process could possibly reduce the moisture content leads to the increase in the fibre value of mushroom *gravy*.

Singh *et al.*, (2016) [23] stated that Crude protein content in value added biscuits (10.55 % and 9.61 %) was found to be significantly higher as compared to that of value addition (5.74 %) of mushroom powder. Supplementation of biscuits with Shiitake mushroom dried powder significantly increased the ash and crude fibre as compared to control.

The V_2T_1 mushroom *gravy* had the higher amount of iron and calcium (13.8±0.422 g/100g and 213.8±4.047 mg/100g respectively) followed by V_1T_1 (10.9±0.048 mg/100g and 207.9±7.102 mg/100g respectively) and V_3T_1 (11.16±0.140 mg/100g and 208.4±6.950 mg/100g respectively). Phosphorus content highly present in the V_1T_1 (88±3.323 mg/100g) mushroom *gravy* and lowest content were present in the V_2T_1 (18±0.243 mg/100g). Addition of ingredients increased the mineral content of the mushroom *gravy*.

Table 2: Nutrient content of TNAU mushroom *gravy*

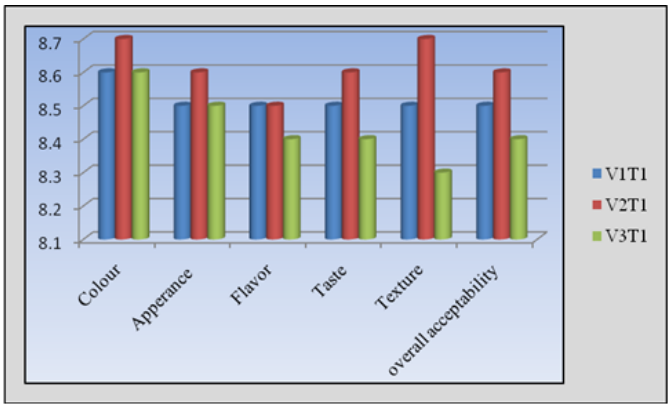
S. No	Chemical parameters		V_2T_1	V_3T_1
1.	Moisture (%)	82±0.340	83.4±0.375	80.8±1.540
2.	pH	5.75±0.096	5.8±0.213	5.7±0.005
3.	Acidity (%)	0.12±0.005	0.08±0.002	0.13±0.003
4.	Protein (g/100g)	7.3±0.177	6.69±0.030	6.0±0.091
5.	Antioxidant activity (mg AAEAA /100g)	2123±48.221	2132±46.124	2019±70.97
6.	CrudeFibre (g/100g)	5.67±0.236	5.74±0.093	6.18±0.005
7.	Fat (g/100g)	4.63±0.168	4.41±0.051	4.77±0.021
8.	Ash (%)	2.32±0.100	2.36±0.055	2.53±0.889
9.	Iron(mg/100g)	10.9±0.048	13.8±0.422	11.16±0.140
10.	Calcium(mg/100g)	207.9±7.102	213.8±4.047	208.4±6..950
11.	Phosphorus(mg/100g)	231.4±5.527	161±6.675	210±5.868

Data indicate analyses of triplicates mean± standard deviation
V_1 T_1- Ooty-1Button mushroom *gravy*
V_2 T_2 -CO-1 Oyster mushroom *gravy*
V_3 T_3 - APK-2 Milky mushroom *gravy*

The total antioxidant activity was higher in the V_2T_1 variety which was recorded in 2132±46.124 mg/100 respectively followed by V_1T_1 (2123±48.221mg/100g) V_3T_1 (2019±70.97mg/100g).
Antioxidant potential (% DPPH inhibition) increased with increasing levels of mushroom powder in noodles [2].

Statistical analysis
Statistical analysis showed that the acidity, protein, fat, crude fibre, calcium, iron, phosphorus were highly significant at P≤0.05 among mushroom gravies. Whereas the pH, ash content and antioxidant activity among mushroom gravies were no significantly different at P≥0.05.

Sensory analysis
The Sensory quality of analysis of mushroom *gravy* using a 9-point hedonic scale score revealed that CO-1 oyster mushroom *gravy* had overall acceptability with the highest score point of 8.7 followed by Ooty-1 button mushroom *gravy* 8.6 and APK-2 milky mushroom *gravy* the lowest score point of 8.4 (Figure 3).



V_1 T_1- Ooty-1Button mushroom *gravy*
V_2 T_2 -CO-1 Oyster mushroom *gravy*
V_3 T_3 - APK-2 Milky mushroom *gravy*

Fig 3

Conclusion
Mushrooms are protein rich and low fat food. Mushroom *gravy* is meat-free alternative for vegetarian offers positive health benefits. CO-1 oyster mushroom *gravy* had highest amount vitamin C, antioxidants and minerals (calcium, iron) content and mushroom *gravy* made with CO-1 oyster mushroom had high overall acceptability then others.

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References
1. AOAC. Official methods of analysis. 14th edn. the association of official agricultural chemists. Washington, D.C, 1995.
2. Arora B, kamal S, Sharma V.P. Nutritional and quality characteristics of instant noodles supplemented with oyster mushroom (P. Ostreatus). Journal of food processing and preservation. 2018; 42(2):e13521.
3. Babu DR, Rao GN. Antioxidant properties and electrochemical behavior of cultivated commercial Indian edible mushrooms.Journal of Food Sciences and Technology. 2013; 50(2):301-308
4. Barros L, Ferreira MJ, Queiros B, Ferreira I, Baptista P. Total phenols, ascorbic acid, betacarotene and lycopene in Portuguese wild edible mushrooms and their antioxidant activities. Food Chemistry. 2007; 103(2): 413-419.
5. Barros, Calhelha RC, Vaz J A, Ferreira ICFR, Baptista P, Estevinho M. Antimicrobial activity and bioactive compounds of portuguese wild edible mushrooms. Eur. Food res. Technol. 2006, in press, doi 10.1007/s00217-006- 0394-x.
6. Buwjoom T, Tangtaweewipt S, Thongwittaya N. and Yamauchi K. Chemical composition, nutrient digestibility and metabolizable energy of shiitake mushroom stalk meal. Journal of Poultry Science. 2004; 41(4): 322-328.
7. Cheung PCK. Functional properties of edible mushrooms. Journal of Nutrition. 1998; 128:1512-1516.
8. Cohen EH, Association of official analytical chemists.1917; 54:212.
9. Furlani RPZ. and Godoy HT. Vitamins B_1 and B_2 contents in cultivated mushrooms. Food Chemistry. 2008; 106:816-819.
10. Gomez KH, Gomez AA. Statistical procedures for agricultural research 2ndedn. 1984: John wiley and sons. New york. 381.
11. Goupy P, Hgue M, Bovin P, Aamiot MJ. Antioxidant composition and activity of barley (*Hordeum vulgare*) of malt extracts and of isolated phenolic compounds. Journal of the science of food and agriculture.1999; 79:1625-1634.

12. Gupta M, Sarma R, Nutrient composition of oyster mushroom grown on different substrates. Journal of Food Science and Technology. 2004; 41(5):584-586.
13. Hart AM, Fisher H, Modern food analysis. springervarley, belrin, Heidelberry. 1971; 64-74.
14. Haytowitz DB. Nutrient content and nutrient retention of selected mushrooms. Nutrient Data Laboratory, Beltsville Human Nutrition Research Center, USDA-ARS, Beltsville, MD, 2006.
15. Hung PV. and Nhi NNY. Nutritional Composition and Antioxidant Capacity of Several Edible Mushrooms Grown in the Southern Vietnam. International Food Research Journal. 2012; 19(2):611-613.
16. Ma T, Zuazaga G, Estimation of protein. In: ranganna, s. (ed), analysis and quality control for fruits and vegetables products. 2nd edn. tata mcgraw hill pub.co. New delhi, 1942; 3-10.
17. Manzi P, Gambelli I, Marconi S, Vivanti V, Pizzoferrato I. Nutrients in edible mushrooms: an interspecies comparative study. Food chem. 1999; 65:477-482.
18. Manzi P, Marconi S, Guzzi A, Pizzoferrato L. Commercial mushrooms: nutritional quality and effect of cooking. Food Chemistry.2004; 84: 201-206.
19. Mattila P, Ko¨nko¨ K., Eurola M, Pihlava JM, Astola J, Vahteristo L. Contents of vitamins, mineral elements, and phenolic compounds in cultivated mushrooms. Journal of Agricultural and Food Chemistry. 2001; 49:2343-2348.
20. Maynard AJ. Methods in food analysis. academic press, 1976; 176.
21. Pal UK, Agnihotrimk. Effect of vegetable oil on the quality of fresh chevon sausages. J applanim res 9:187-191
22. Ranganna S, Manual analysis of fruits and vegetable products. 2nd edn; Tata mcgraw hill pulishing co. Ltd., new Delhi, 1995.
23. Singh J, Sindu SC, Sindu A, Yadav A. Development and evaluation of value added biscuits from dehydrated shitake *(*LENTINUS EDODES) mushroom International Journal of Current Research. 2016; 27155-27159.
24. Singh NI, Singh T C. and Devi MB. Nutritional composition, processing and preservation of the edible mushrooms found in Manipur for sustainable economic development. Journal of Mycopathological Research. 2003; 41(2):243-244.
25. Singh S, Ghosh S, Patil GR. Development of a mushroom whey soup powder. International Journal of Food Science and Technology. . 2003; 38(2): 217-224.
26. Usha S, Suguna V, Investigation on the nutritional value of edible mushrooms viz., *Auricularia Polytricha* and *Pleurotus Ostreatus*. Asian Journal of Science and Technology. 2014; 5(8):497-500.
27. Wong, Estimation of iron. In: Oser, B. K. (Eds), Hawk's physiological chemistry. 1928: 14th edn. P. 1094.
28. Yen GC, Hung CY, Effects of alkaline and heat treatment on antioxidative activity and total phenolics of extracts from hsian-tsao (*Mesona procumbens* Hemsl.). Food res. Int. 2000, 33:487-492.