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Study of active components in different parts of fruiting bodies of varieties of *Agaricus bisporus* (white mushroom)

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Abstract

The fruiting bodies of white *Agaricus bisporus* were the subject of the study. The amount of bio elements and organic compounds in the prepared caps and stipes of mushrooms was measured. We discovered that the A. *bisporus cultivars* have more nutritional value. According to results, plieus and stalk contain a large number of bioactive chemicals that are indicated by FTIR and UV analyses in addition to GC-mass it was revealed that the plieus and stalk contain, respectively, 27 and 26 distinct chemicals. Because of this, we will be focusing our future study on accurately determining the molecules that are released and determining the percentage of these physiologically-active compounds.

Key words- *Agaricus bisporus*, white mushroom, active components, GC-mass

Introduction

Interest in cultivating mushrooms and using them as a food source has grown along with the global population. Since 1990, the mushroom industry has gained attention globally, resulting in an increase in production. [1,2]. In recent times, mushrooms have emerged as an important food and functional medicine source [3,4]. The taste, flavor, and nutritional value of edible mushrooms have led to a rise in demand [5, 6]. Numerous previous research have demonstrated that mushrooms are better alternatives for animal proteins and other animal products [7,8,9]. Numerous vitamin types found in mushrooms help to improve health by

lowering the risk of a number of diseases in people [10]. Agaricus is one of the largest genera of macro fungi, having various edible species that have medicinal and high nutritional benefits [11]. The most highly cultivated fungus in the Agaricaceae family, *Agaricus bisporus*, is highly regarded for its edible qualities. Owing to its edible and medicinal properties, it is regarded as one of the most significant mushrooms [12]. Button mushroom is another name of *A. bisporus* and it is a great source of food and several important bioactive chemicals [14]. Over the past few years, *A. bisporus* has yielded several significant bioactive chemicals that have been identified [15]. The bioactive substances of nutritional value in A. bisporus contribute to human health. Numerous investigations have also documented the role of this mushroom in the cosmetics sector, given that it includes certain components that improve the appearance of the face by managing a range of skin issues. [16,17,18]. In this study, the active compounds found in the parts of the fruiting body (cap or pileus and stem or stalk) of this fungus were highlighted using GC-mass technique.

Material and Methods

Fungal strain- *Agaricus bisporus* was obtained from Al-Wadaq farm for the production of mushrooms located in Baghdad**.**

Preparation of the alcoholic extraction of mushroom

After washing the mushrooms in both plain and distilled water, the pileus and stalk were separated. every one of them separately. Using a clean knife, each component was cut into small pieces, dried, and then ground to produce a powder. The alcoholic extract was prepared using 400 ml of (80%) methanol alcohol as a solvent for 100 gm of dry powder utilizing a Continuous Soxhlet Extraction apparatus. [19].

Identification of Phytochemical components

Liquid state assays in methanolic extract were used to identify the phytochemical components present in the mushroom extract. The extract of the mushroom contained steroid, flavonoid, saponins, terpenoids, tannin, and alkaloids, which were identified by [20]. using phytochemical screening.

UV-spectroscopy of methanolic extract

The absorption spectrum of ultraviolet radiation of methanolic extract was studied using a spectrophotometer (U-V-Vis spectroscopy) at room temperature.

GC-MS of for chemo profiling analysis

GC-MS analysis of the extract was performed with a Perkin–Elmer G C Clarus 500 system and gas chromatograph connected to a mass spectrometer (GC-MS) equipped with an Elite-1fused silica capillary column (30 mm × 0.25 mm 1DX 1 µM df, made of 100% dimethyl poly siloxane). The GC ran for thirty-six minutes in total. The Turbo mass software, which is intended to handle mass spectra and chromatograms, was used to calculate the relative percentage of each component by comparing its average peak area to the total area.

Results and Discussion

alcoholic extraction of mushroom

Fig.1. show the scheme of alcoholic extraction of mushroom. Alcohol is used as a solvent on the mushroom material rather than water. Since ethanol is derived from plants and is non-toxic, it is typically utilized. The alcohol separates the raw material from the alcohol-soluble chemicals. After that, the alcohol may be eliminated, leaving only the bioactive substances.

Fig.1-scheme of extraction

Identification of Phytochemical components

To identify the bioactive chemical components in the mushroom samples, phytochemical assays were used. Table (1) show the results of this test numerous secondary metabolites, such as Tannins, Alkaloids, Terpenoids, are accumulated by mushrooms (pileus, stalk). Most of these phytochemicals have been identified by Unekwu *et al*. [21] as potential components in a variety of medicinal mushrooms.

Table 1: Phytochemical analysis of methanolic extract of pileus and stalk

Phyto constituent	Biochemical test	pileus	stalk
steroid	Libermaan-brurchards test	-	-
Flavonoids	Alkaline Reagent Test	+++	+++
Saponins	Emulsion Test	-	-

Tannins	Lead Acetate Test	+	+
Alkaloids	Mayer's Test	++	++
Terpenoids	Llibermaan- Burchard's Test	+++	+++

UV-spectroscopy of methanolic extract

Fig 2. appear uv spectroscopy of alcoholic extraction of pileus and stalk**.** **Its** show prominent absorption bands that were typical of phenolic chemicals, with the absorption maxima occurring in the spectral range between 250 nm. The presence of phenolic chemicals and their derivatives in the mushroom was shown by the absorption peaks in the aforementioned spectral bands**.** [22] were consistent with previously released information. [23,24]

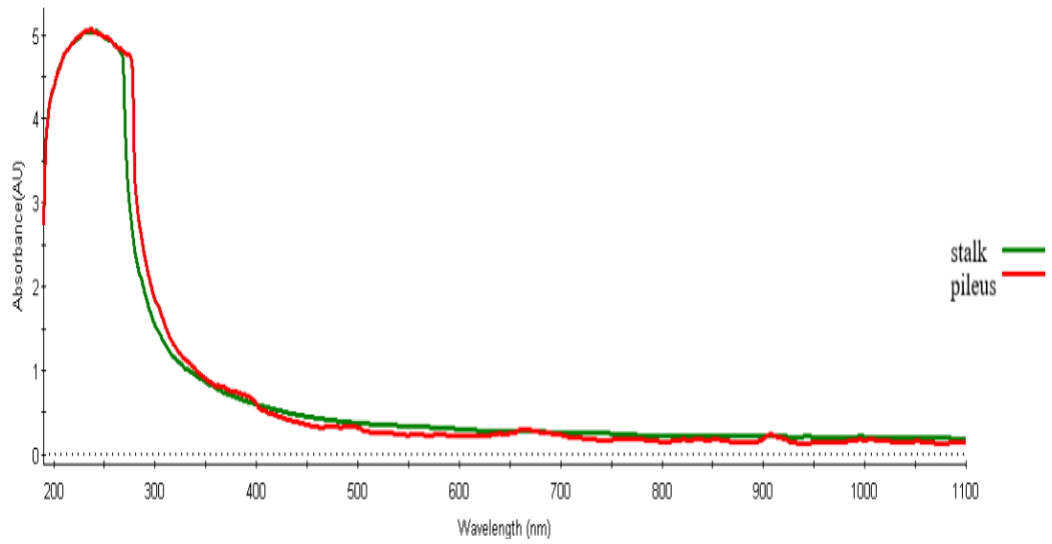

Fig 2. UV spectroscopy of alcoholic extraction of pileus and stalk

FT-IR extract analyses

The alcoholic extract's FT-IR spectra for pileus and stalk Fig.3, Fig 4, showed absorption bands that were typical of the functional groups of the constituents. The presence of N-H vibration and OH stretching in hydrogen bonds was attributed to the strong broad band at 3294 cm−1. Absorption peaks in the 2930 cm−1 range were associated with aliphatic C–H groups' stretching frequencies. Additionally, aliphatic groups were also responsible for the signal at 1456 cm−1. A band of absorption at 1631.66 cm−1 in this spectrum indicated the stretching frequencies of an esterified

C=O group. The absorption peak located at 1456 cm−1 indicated the existence of C=C stretching vibrations in phenol. [25]

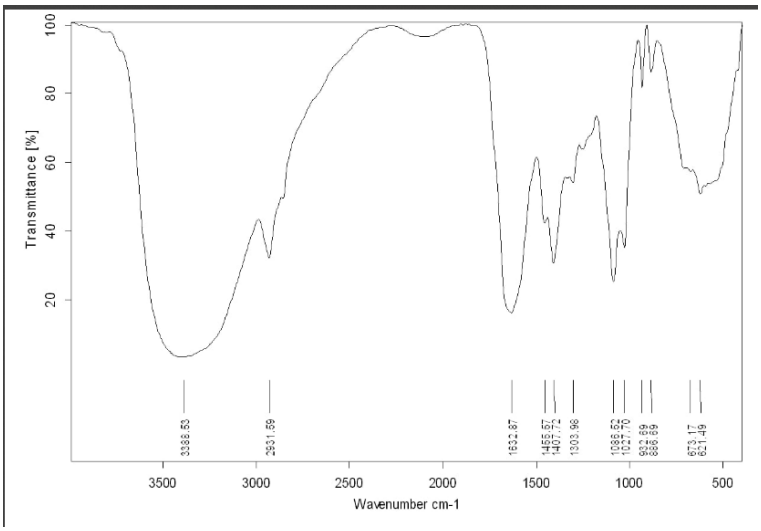

Fig.3- FT-IR extract analyses of pileus

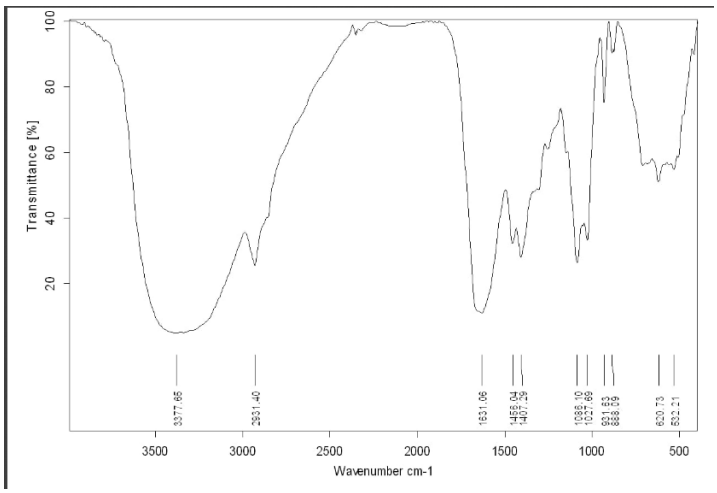

Fig.4- FT-IR extract analyses of stalk

GC-MS for chemo profiling analysis

Our GC-MS analyses of the methanolic extracts revealed the presence of 27 and 26 different compounds, corresponding to the pileus and stalk regions of A. bisporus fruiting body, respectively. These compounds included sugar alcohols, amino acids, and fatty acids and their esters. Additionally, similar chemicals were discovered in the stalk and pileus. Table (2,3), fig (5,6). It is acknowledged that mushrooms are a significant

source of pharmacologically active substances. [26]. Several different chemicals have been found in A. bisporus. [27].

Table 2-analysis of GC-mass for pileus extract

No.	ID	Ref
1	Hexadecane	289197 000544-76-3 90\87
2	Heptadecane	335192 000629-78-7 87
3	Octadecanoic acid	480969 000057-11-4 90\74
4	Hexadecanoic acid	387925 000057-10-3 76
5	Octadecane	381312 000593-45-3 95\93
6	1-Heptadecene	328549 006765-39-5 98
7	1-Nonadecene	421238 018435-45-5 95
8	Nonadecane	428114 000629-92-5 96
9	7,9-di-tert-butyl-1-oxaspiro[4.5]deca-6,9-diene-2,8-dione	453576 082304-66-3 98
10	7,9-Di-tert-butyl-1-oxaspiro(4,5)d eca-6,9-diene-2,8-dione	453577 082304-66-3 93\90
11	Pentadecanoic acid, 14-methyl-, methyl ester	434765 005129-60-2 99
12	Hexadecanoic acid, methyl ester	434866 000112-39-0 99\98
13	9-Octadecenoic acid, (E)	473919 000112-79-8 93
14	Oleyl alcohol, trifluoroacetate	711941 2000711-94-1 93
15	Oleic Acid	473910 000112-80-1 92
16	n-Hexadecanoic acid	387914 000057-10-3 99
17	Myristic acid	295117 000544-63-8 97
18	Hexadecanoic acid, ethyl ester	480917 000628-97-7 93\91
19	HEXADECANOIC ACID, ETHYL ESTER	480906 000628-97-7 93
20	Eicosane	474187 000112-95-8 97\91\86
21	cis-10-Heptadecenoic acid	427939 029743-97-3 93
22	Oxacyclotetradecan-2-one	242434 001725-04-8 90
23	1-Heptadecene	328549 006765-39-5 59
24	(Z,E)-Farnesal	267006 004380-32-9 83
25	2,6,10,14,18-Pentamethyl-2,6,10,14,18-eicosapentaene	657918 075581-03-2 74
26	2,5-Furandione, 3-(dodecenyl)dihydro	420645 025377-73-5 59
27	9,12-Octadecadienoic acid (Z,Z)-,methyl ester	512998 000112-63-0 99

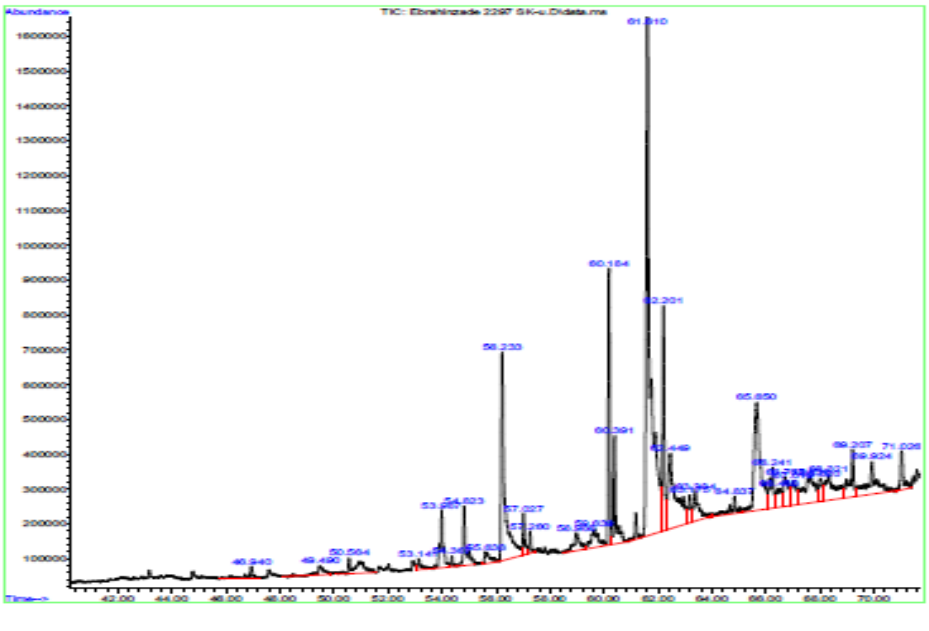

Fig-5- Chromatogram for pileus extract

Table 3- of GC-mass for stalk extract

No.	ID	Ref.
1	1,2,3-Propanetriol, diacetate	133874 025395-31-7 83
2	Triacetin	257999 000102-76-1 83
3	Glycerol 1,2-diacetate	133875 000102-62-5 83
4	Hexadecane	289180 000544-76-3 94\93
5	3-Buten-2-ol, benzyldimethylsilyl ether	265925 2000265-92-5 30
6	Methyl 3-methoxydodecanoate	347638 2000347-63-8 27
7	7-OXA-6,8-DIMETHYL-4,10-DITHIATRID ECANE	366451 2000366-45-1 27
8	Benzophenone	150208 000119-61-9 94\89
9	Methanone , diphenyl	150206 000119-61-9 76
10	Cyclopentadecane	236388 000295-48-7 97
11	Cyclododecane, 1-ethyl-2-methyl	236413 022681-52-3 95
12	Pentacos-1-ene	678391 016980-85-1 93\90
13	Carbonic acid, decyl tetradecyl ester	781218 2000781-21-8 64
14	ICOSANE	474182 000112-95-8 60
15	Docosane	564052 000629-97-0 99
16	Eicosane	474187 000112-95-8 98
17	Heptadecane	335190 000629-78-7 97
18	Octadecane	381301 000593-45-3 93
19	Pentadecanoic acid	341429 001002-84-2 97\96\95
20	Acetamide, 2-(diethylamino)-N-(dimethylphenyl)	2,6 314052 000137-58-6 90
21	7,9-Di-tert-butyl-1-oxaspiro(4,5)deca-6,9-diene-2,8-dione	453574 082304-66-3 97\93\96
22	Bis(2-ethylhexyl) phthalate	766756 000117-81-7 60
23	1,2-Benzenedicarboxylic acid, bis(2-ethylhexyl) ester	766764 000117-81-7 55\53
24	Palmitoleic acid	381037 000373-49-9 99\96
25	cis-Vaccenic acid	473968 000506-17-2 95
26	n-Hexadecanoic acid	387914 000057-10-3 99

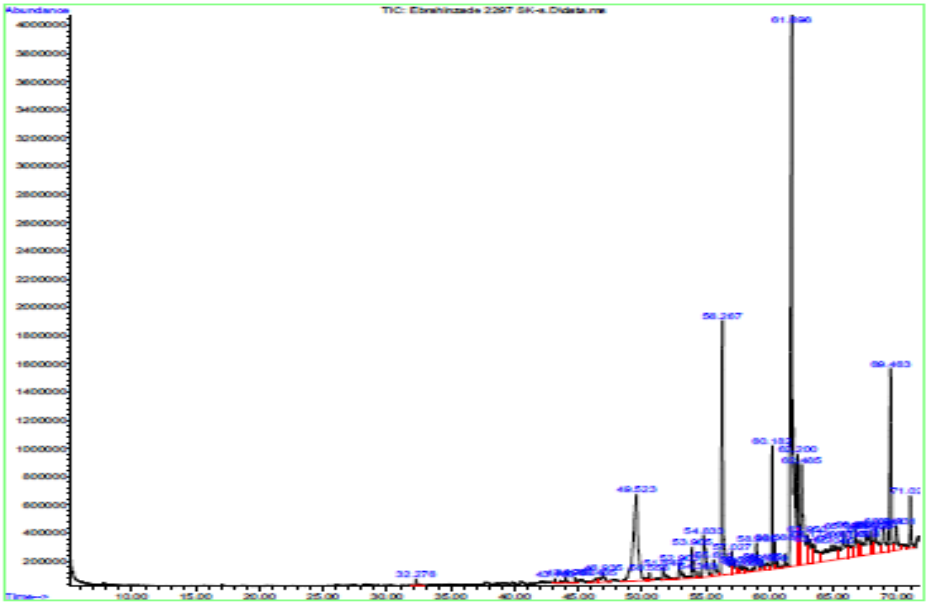

Fig-6- Chromatogram for stalk extract

Nutraceuticals are especially interesting since they can significantly lower the need of antibiotics, which is particularly relevant given the rising life expectancy and rise in lifestyle diseases. The demand for natural alternatives has surged due to growing consumer worries about synthetic ingredients and adverse effects in food. [28,29]. Phenols make up the majority of the phytochemicals in the analyzed extract, which are particularly beneficial. This mushroom presents a promising source for bioactive compounds and the possible therapeutic behavior of these compounds.

Conclusion

For the first time, the variations in the concentrations of specific bio elements and physiologically active chemical compounds in the various parts of the A. bisporus were displayed. The fruiting bodies of A. bisporus, are rich source of bio elements, and phenolic compounds, and their highest quantities are accumulated in the outer part of the fruiting body, this part of the fruiting body contains the largest amounts of valuable examined components.

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