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Original Research Article

The Impact of Varied Light Intensity Treatments on the Growth, Yield, and Quality of Grey Oyster (*Pleurotus pulmonarius*) and Black Jelly (*Auricularia auricula-judae*) Mushrooms

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Abstract: Research efforts have been directed towards mitigating various mushroom varieties' inadequate and inconsistent supply. Light is a pivotal factor in mushroom cultivation, influencing both the quantity and quality of grey oyster (*Pleurotus pulmonarius*) (GOM) and black jelly (*Auricularia auricula-judae*) (BJM) mushrooms. This study delves into the effects of different light intensities on these mushrooms' growth, yield, and quality. During the spawning period, various light intensities (1500 lux, 2000 lux, and a control group with no treatment) were administered to both mushroom species. Parameters analysed included growth performance (mycelium growth rate, morphology), yield (total weight of fruiting bodies), and quality (pileus size, colour, texture). Findings indicate that light-treated bags exhibited accelerated mycelium colonisation compared to the control, with light-treated GOM and BJM taking only 29 days and 50 days, respectively, compared to their control counterparts at 33 days and 66 days. Furthermore, high-light-intensity treatment positively influenced both species' pinhead emergence and fruiting body formation. Treated mushrooms also displayed increased yields and improved quality attributes. Grey oyster and black jelly mushrooms subjected to different light intensities yielded significantly more (with increases of 71.8% and 33.7%, respectively), with the 2000 lux treatment yielding the most promising results. Physicochemical distinctions were observed, with light-treated mushrooms exhibiting larger pileus sizes, slightly darker colour, and firmer texture than their controls. In conclusion, the 2000 lux light intensity emerged as the most effective treatment in enhancing production efficiency for both mushroom species.

Keywords: Light intensity; grey oyster mushroom (*Pleurotus pulmonarius*); black jelly mushroom (*Auricularia auricula-judae*); growth performance; yield

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1. Introduction

The photoperiod is crucial for forming mushroom primordia for mushroom fruiting bodies. Recent advances in fungal photobiology using molecular tools and genomic analysis have identified specific light-sensitive proteins and genes that regulate mushroom development and spore viability (Baars *et al*., 2020; Bellettini *et al*., 2019). Some mushrooms require darkness, while others need partial light, with all light-dependent mushrooms likely following a common regulatory pathway for their development (Li *et al*., 2023).

Pleurotus pulmonarius, commonly known as the grey oyster mushroom, gets its name from its resemblance to an oyster shell. Originally isolated from India, this strain is considered one of the easiest to cultivate in tropical and subtropical regions (Raman *et al*., 2021). In Malaysia, oyster mushrooms are commonly consumed in soups, grilled, or deep-fried and are highly sought after as local street food due to their distinctive aroma and taste (Mohd Rashidi & Yang, 2016).

Another mushroom species studied was *Auricularia auricula-judae*, also known as the black jelly mushroom, which is one of the easiest mushrooms to cultivate on a large scale in Asia. The black jelly mushroom, valued in Asia, can be grown in temperate and tropical regions (Samsudin & Abdullah, 2019). It is protein-rich, fat-free, and contains various minerals and vitamins. This mushroom has a long history in traditional Chinese medicine for its purported benefits in improving blood circulation and other health advantages (Zhang *et al*., 2016).

Light plays a crucial role in mature mushrooms' growth and morphological characteristics, affecting factors such as stem development, growth, and colouration. Low light intensity or absence of light can result in pale, deformed mushrooms with elongated stalks and reduced cap colour. Some mushrooms, like those of the *Pleurotus* species, require light for primordial formation (Abdullah *et al*., 2023).

Regarding mycelial growth, *Auricularia auricula-judae* thrives better under artificial light than in darkness (Priya & Geetha, 2016). Farmers have even observed increased mushroom growth around lightning-stricken areas (Shimizu *et al*., 2020). Optimal light intensity and duration significantly affect the yield and characteristics of mushroom growth. There are two proposed mechanisms for mushroom outbreaks: the propagation of cracks in mycelium hyphae due to lightning and enzyme activity stimulated by physical factors, such as pulse electric fields, leading to increased fruiting body formation (Mohd Jamil *et al*., 2020).

In Malaysia, the mushroom industry has expanded due to the growing demand for fresh or processed mushrooms driven by their perceived health benefits. However, local growers face challenges in efficiently meeting this demand. They often use traditional methods without effective management, leading to inconsistent production. Mushroom cultivation is susceptible to contamination risks due to its extended growth period and sensitivity to environmental factors like humidity, moisture, and airflow. This instability, combined with the lack of research on optimising growth conditions, results in unpredictable supplies (Abu Shamsi *et al*., 2023).

Additionally, there is a gap in research on physical stimulants, such as light intensity, to enhance mushroom growth. Existing studies provide varying recommendations, but no specific optimal light intensity has been identified. Addressing these gaps could improve cultivation practices and reduce costs associated with high-intensity lighting.

2. Materials and Methods

The mushroom bags were prepared using a standard substrate mixture of sawdust, rice bran, and calcium carbonate in a ratio of 100:10:1. After bagging, sterilization, and spawn inoculation, all the inoculated bags were vertically arranged on racks in a spawning room with a temperature maintained around 25–30°C and only 10% of light allowed (Ibrahim *et al*., 2020a). High light intensity treatments (1500 lux, 2000 lux, and no treatment as control) were applied to the mushroom bags after 5 days of spawn inoculation. These treatments were repeated at 5-day intervals until the mycelium filled the bags. The treatment was not applied daily to allow time for the mushrooms to recover from the stress. Parameters studied included growth performance (mycelium growth rate, morphology), yield (total weight of fruiting bodies), and quality (pileus size, colour, texture). Five mushroom bags represented each treatment.

2.1 Conditions for High Light Intensity Treatment

The surrounding environment's light intensity near the mushroom bags was regulated not to surpass 3 lux. A 10-watt spotlight was positioned, and the distances for achieving light intensities of 1500 lux and 2000 lux were measured using a Lux meter and marked accordingly. Mushroom bags were then vertically positioned at these marked spots and exposed to 10 brief flashes of bright light, each lasting 2 seconds. This process was repeated on the opposite side of the mushroom bags, turning them to face the spotlight.

2.2 Analyses During Vegetative and Reproductive Stages

Following inoculation, all the bags were placed in a dark spawning room with approximately 10% light exposure. To expedite mycelium growth, the mushroom bags were vertically arranged. The bags were then kept at a temperature ranging from approximately 25 to 30°C during incubation.

2.2.1 Determination of mycelium growth rate

The length of mycelium growth along the length of the bag was measured and recorded. A ruler was employed to measure this distance travelled by the mycelium at five-day intervals.

2.2.2 Determination of growth morphology performance

The duration taken for the mycelium to fill the bag (fully colonise) until reaching the bottom was recorded for each treatment. Upon complete colonisation, the bag caps were opened for the grey oyster mushroom as the mycelium entered the reproductive stage. Meanwhile, for the black jelly mushroom, four longitudinal slits were made on the bag to allow the fruiting of the mushroom. The number of days for pinhead emergence was recorded, followed by the formation of fruiting bodies (when the mushrooms are fully developed and ready for harvest).

2.2.3 Determination of total fresh weight

The harvested mushrooms from each bag were weighed, and their weights were recorded. This process was repeated for up to five harvesting cycles.

2.2.4 Determination of pileus size

The pileus diameter from each harvested fruiting body was measured using a ruler and recorded from each end side. This was done for fruiting bodies harvested from different treatments.

2.2.5 Determination of pileus colour

Colour analysis of the harvested mushroom's pileus was conducted using a Minolta Chromameter, measuring CIELAB colour parameters L*, a*, and b*. This analysis occurred immediately after harvesting, with three different points sampled from the same surface of the mushroom pileus. The L* parameter represents the monochrome scale, indicating the amount of light reflected (lightness). A 'L*' value of 100 denotes pure white, while 0 signifies matte black. The 'a*' values represent the range from greenness (-) to redness (+), while the 'b*' values represent the range from blueness (-) to yellowness (+).

2.2.6 Determination of Pileus Firmness

A Texture Analyzer, the TA.XTplus from Stable Micro Systems was employed alongside a P/2 stainless steel probe to assess the firmness of freshly harvested mushrooms. The mushroom pileus was placed on the texture analyzer platform, and three distinct points on the same surface were selected for analysis. Utilising a 2 mm diameter cylinder probe, penetration tests were conducted to puncture the mushroom pileus to a depth of 5 mm from the top. The Texture Expert Software was utilised to capture the time, distance, and force exerted during the analysis, thus providing a detailed texture profile of the penetration. The maximum positive force recorded was indicative of the firmness value. Test parameters were aligned with those established by Ibrahim *et al*. (2020a), with pre-, post-, and test speeds set at 3, 5, and 0.5 mm/s, respectively.

2.3 Statistical Analysis

All the data were analysed using Analysis of Variance (ANOVA) with post-hoc Tukey test for significant differences at $p<0.05$ among the treatments. Statistical Analysis System (SAS) software version 9.4 M6 was used.

3. Results and Discussions

3.1. Mycelium Growth Rate

Table 1 shows the effects of different light intensity levels on mycelium growth in grey oyster and black jelly mushrooms. Statistical analysis revealed significant differences in mycelium growth rates among the different light-intensity treatments at a significance level of $p<0.05$. Grey oyster mushrooms displayed a faster mycelium growth rate than black jelly mushrooms. Rout *et al*. (2015) found that continuous exposure to 200 lux was the optimal light intensity for the mycelial growth of ten oyster mushroom species, leading to the highest growth rates. As light intensity increased from 200 to 1000 lux, growth significantly declined, while in total darkness, growth was moderate.

Additionally, the rate of mycelium extension is linked to nitrogen availability in the environment. Kumla *et al*. (2020) also suggested that the composition of the substrate affects its nutritional content and porosity, influencing mycelium growth (Houette *et al*., 2022). Therefore, dietary factors, among others, play a crucial role in influencing mycelium growth for each mushroom species.

The standardised length for grey oyster and black jelly mushroom bags was 23.5 cm. In the case of grey oyster mushrooms, significant differences in mycelium growth rates were observed at a substantial level of $p<0.05$ for both light-treated and control bags. Results indicated that grey oyster mushroom bags exposed to 2000 lux of light had the fastest mycelium growth rate at 0.80 cm/day, followed by those exposed to 1500 lux and the control group, with growth rates of 0.75 and 0.71 cm/day, respectively. This suggests that different light intensities influenced mycelium growth differently. This finding contrasts with the growth pattern of *Pleurotus sajor-caju,* which exhibited a growth rate of 1.2 cm/day under different conditions (Ibrahim *et al*., 2017). Additionally, treatments such as light exposure likely induced stress on the mycelium, potentially shortening the colonisation period and increasing the daily growth rate (Wong *et al*., 2019).

Table 1. The means of mycelium growth rate (cm/day) of grey oyster and black jelly mushrooms subjected to different light intensity treatments.

Different light intensity treatment	Mycelium growth rate (cm/day)	
	Grey oyster mushroom	Black jelly mushroom
Control	0.71 ± 1.41^{b}	0.37 ± 0.13^{b}
1500 lux	0.75 ± 1.52^{ab}	0.47 ± 1.84^{a}
2000 lux	0.80 ± 1.12^{a}	0.41 ± 1.18^{ab}

Note: Values are means of 5 replicates. Means (n=5) ± standard deviation.

a-b: Values with different superscripts within the same column are deemed significantly different at a 5% significance level (p<0.05).

Significant differences were also observed for black jelly mushrooms at a significance level of p<0.05 between bags treated with light and control bags. The highest mycelium growth rate for black jelly mushrooms occurred at a light intensity of 1500 lux, reaching 0.47 cm/day, followed by a light intensity of 2000 lux, with a growth rate of 0.41 cm/day. In comparison, the control treatment, without light exposure, exhibited the slowest mycelium growth rate, completing the colonisation of the 23.5 cm length of the mushroom bag at a rate of 0.37 cm/day. Light is a signal that triggers various biophysical and biochemical processes, leading to morphological and phototrophic reactions (Chauhan & Gupta, 2017). This explains why black jelly mushrooms treated with light showed a faster mycelium growth rate. Continuous exposure to higher light intensity in most mushroom species slows mycelium growth. However, in *Cordyceps militaris*, the effect of light quality is different; mycelia grew faster under white light than in the dark. Despite this, the aerial mycelial density under all light treatments was significantly lower than under dark conditions (Yue *et al*., 2022). The condition was different in this study as the high-light intensity treatments were only imposed for a few seconds.

3.2. Growth Morphology Performance

Figure 1 displays the days taken for the mycelium to fill the bags, for pinhead emergence, and for fruiting body formation in grey oyster and black jelly mushrooms under different light-intensity treatments. Significant differences (p<0.05) were observed among all bags treated with light and the control for both mushroom species. There were also significant differences (p<0.05) in the number of days required for the mycelium to fill up the bags between the two mushroom species and among the different light intensity treatments where black jelly mushrooms took significantly longer (between 50.6 and 66.0 days) to fill up the bags compared to grey oyster mushrooms (between 29.4 and 33.2 days). The shorter time for grey oyster mushroom bags to fill up could be attributed to this species' higher adaptability to different environments and lower requirement for high relative humidity than black jelly mushrooms. Black jelly mushrooms took longer to fill the bags, possibly because they naturally grow in forest environments, thriving on dead logs and branches of indigenous trees (Ibrahim *et al*., 2020b). Therefore, the differences in the genetic makeup of the species, together with the environmental factors, contribute to the different growth morphology performances of grey oyster and black jelly mushrooms.

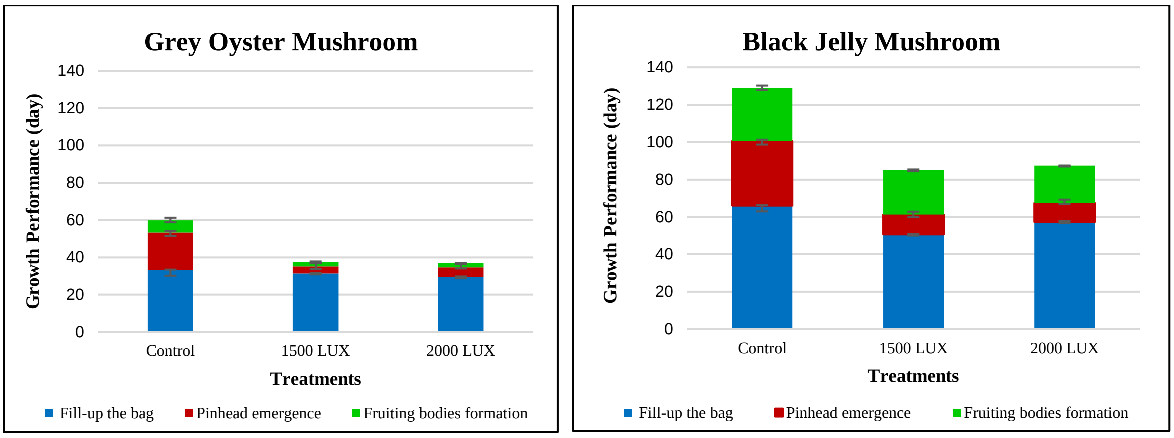

Figure 1. The number of days for the mycelium to fill the bag, pinhead emergence, and fruiting body formation of grey oyster and black jelly mushrooms subjected to different light intensity treatments. Vertical bars represent standard errors.

The results also indicate significant differences ($p<0.05$) for grey oyster mushroom bags treated with light, which had a slightly shorter time for the mycelium to fill up the bag than the control. Specifically, grey oyster mushrooms treated with a light intensity of 1500 lux took 31.4 days to fill the bags, followed by those treated with 2000 lux, which took 29.4 days. In contrast, the control took the longest time at 33.2 days. Meanwhile, light-treated bags showed significantly shorter times for black jelly mushrooms than the dark, indicating critical differences ($p<0.05$) in mycelium filling up the bags. Bags treated with a light intensity of 1500 lux exhibited the shortest time at 50.6 days, followed by those treated with 2000 lux at 57.4 days, while the control took the longest at 66 days. The average time for the mycelium to fully colonise the mushroom bags was reported to be 45 to 90 days, depending on the substrate used, size and length of the bag and the species of mushrooms (Ibrahim & Shaharudin, 2021).

For both grey oyster and black jelly mushrooms, there were no significant differences ($p>0.05$) in the number of days taken for pinhead emergence, except for the control treatment. Grey oyster mushrooms showed a shorter time for pinhead emergence than black jelly mushrooms. This aligns with findings by Ibrahim & Sharudin (2021), indicating that pinhead emergence typically occurs around 5 days after the spawning period. Regarding fruiting body formation, significant differences ($p<0.05$) were observed, with grey oyster mushrooms taking a shorter time than black jelly mushrooms, likely due to species differences and a smaller number of fruiting bodies requiring less time for harvesting. Light-treated black jelly mushrooms exhibited the shortest time for fruiting body formation, with the intensity of 2000 lux taking only about 20 days compared to the control, which took 28.2 days. The bags treated with light intensities positively affect the aggregation of hyphae and the maturation of the fruiting bodies. In addition, the normal expansion of the pileus requires light, and the formation of spores requires phototropism (Sakamoto, 2018). This statement agrees with the results obtained in this study for black jelly mushrooms. Thus, treated bags have the shortest days for fruiting body formation.

3.3 Yield (Total Fresh Weight of Fruiting Bodies)

According to Kortei *et al*. (2018), the weight of fruiting bodies is influenced by the thickness and diameter of the pileus. The total yield of fruiting bodies for grey oyster and black jelly mushrooms under various light intensities is presented in Table 2. Interestingly, there were significant variations ($p<0.05$) among the treated bags of both grey oyster and black jelly mushrooms.

Table 2. The yield (total fresh weight of fruiting bodies (g)) of grey oyster and black jelly mushrooms subjected to different light intensity treatments after five harvesting cycles.

Different light intensity treatment	Grey oyster mushroom	Black jelly mushroom
Control	289.50 ± 68.32^{b}	267.02 ± 61.02^{b}
1500 lux	443.91 ± 34.35^{a}	330.40 ± 73.37^{a}
2000 lux	497.36 ± 43.39^{a}	357.00 ± 121.48^{a}

Note: Values represent the means of 5 replicates. Means (n=5) ± standard deviation.

a-b: Values with different superscripts within the same column are deemed significantly different at a 5% significance level ($P<0.05$).

Grey oyster mushrooms subjected to high light intensity treatment exhibited higher total weights of fruiting bodies than the control, with significant differences observed at $p<0.05$. Specifically, the total weight of grey oyster mushroom fruiting bodies under a light intensity of 2000 lux was 497.36 g, followed by 1500 lux treatment at 443.91 g, and the control at 289.50 g. White light has a wavelength range from 400 to 700 nm. Cultivating mushrooms under light wavelengths ranging from 340 nm to 520 nm led to increased fruiting body yields due to the activation of ATP synthase in the fruiting bodies (Abdullah *et al*., 2023). Another study by Zawadzka *et al*. (2022) also suggested that the growth of mushroom fruiting bodies depends on both light intensity and the length of the light period within a daily cycle. Adjust the amount of light needed by either shortening the lighting duration and increasing the intensity or by extending and lowering the intensity.

Most importantly, light intensity significantly influences the shape of the oyster mushroom, including cap size and stem length, with higher light intensity leading to larger caps. A similar trend was also observed for black jelly mushrooms; critical differences ($p<0.05$) were observed regarding the total weight of fruiting bodies between light-treated and untreated bags. The control treatment yielded a total weight of fruiting bodies of 267.02 g, and higher values were obtained for 1500 and 2000 lux treatments at 330.40 g and 357.00 g, respectively.

3.4 Pileus Size

Table 3 displays the differences in the average pileus size of grey oyster and black jelly mushrooms under different light-intensity treatments. Both mushroom species showed significant differences (p>0.05) under various light-intensity treatments. For the grey oyster mushroom, treatment at 2000 lux produces a larger pileus size, followed by 1500 lux treatment with 10.30 and 9.81 cm diameter, respectively. Control only had 7.53 cm. Similar results were also obtained for black jelly mushroom, where treatment with 2000 lux and 1500 lux showed larger pileus sizes of 7.35 and 6.87 cm, respectively, with the control producing a smaller pileus of 4.98 cm. Wu *et al*. (2021) mentioned that the pileus of Auricularis is generally between 3 and 8 cm.

Tesfay *et al*. (2020) state that larger pileus sizes contribute to higher yields. This may be attributed to vital contents such as cellulose, hemicellulose, and nitrogen in the substrate, which contribute to larger pileus sizes. This result was also supported by Dubey *et al*. (2019), who stated that the cap's length and the stem's length depend on the light intensity.

Table 3. The average pileus size of grey oyster and black jelly mushrooms subjected different light intensity treatments.

Different light intensity treatment	Grey oyster mushroom	Black jelly mushroom
Control	7.53 ± 0.88^{b}	4.98 ± 1.62^{b}
1500 lux	9.81 ± 1.88^{ab}	6.87 ± 0.79^{ab}
2000 lux	10.30 ± 2.30^{a}	7.35 ± 2.33^{a}

Note: Values represent the means of 5 replicates. Means (n=5) ± standard deviation.

a-b: Values with different superscripts within the same column are deemed significantly different at a 5% significance level (p<0.05).

3.5 Pileus Colour

The L* value in colour represents a monochrome scale that reflects the amount of light, with 100 designated for pure white and 0 for matte black. The a* value ranges from -60 for green and +60 for red, while the b* value ranges from -60 for blue to +60 for yellow. Table 4 depicts the impact of various light intensity treatments on the L*, a*, and b* values of grey oyster and black jelly mushrooms. Table 4 indicates significant differences (p<0.05) among the treatments, concerning the colour L*, a*, and b* values for grey oyster mushrooms. However, critical variables were observed for black jelly mushrooms in terms of a* and b* values, while the colour L* value showed insignificant differences (P>0.05).

Table 4. The colour of grey oyster and black jelly mushrooms was subjected to different light intensities.

Different light intensities treatment	Grey oyster mushroom	Black jelly mushroom
Colour L* value		
Control	66.64 ± 4.97^{a}	31.72 ± 1.36^{a}
1500 lux	57.59 ± 2.93^{ab}	30.16 ± 2.99^{a}
2000 lux	56.03 ± 3.05^{b}	30.65 ± 1.87^{a}
Colour a* value		
Control	4.69 ± 0.78^{b}	7.72 ± 0.90^{b}
1500 lux	5.18 ± 0.55^{a}	7.27 ± 0.42^{b}
2000 lux	5.64 ± 0.21^{a}	8.42 ± 0.91^{a}
Colour b* value		
Control	16.92 ± 1.08^{a}	4.47 ± 1.65^{b}
1500 lux	14.80 ± 0.89^{a}	4.87 ± 0.94^{a}
2000 lux	14.33 ± 0.68^{b}	5.58 ± 0.31^{a}

Note: Values represent the means of 9 replicates. Means (n=9) ± standard deviation.

a-b: Values with different superscripts within the same column are deemed significantly different at a 5% significance level ($p<0.05$).

For grey oyster mushrooms, those treated with 2000 lux light intensity displayed a lower colour L* value (56.03) compared to those treated with 1500 lux light intensity (57.59) and the control (66.64). Additionally, the colour a* value for mushrooms treated under 1500 (5.18) and 2000 lux (5.64) was higher compared to the control (4.69). However, there was a contrast in the colour b* value among different light intensity treatments for grey oyster mushrooms, with the control (16.92) exhibiting the highest value, followed by 1500 lux (14.80) and 2000 lux (14.33).

The outer surface of the black jelly mushroom is described as a bright reddish-tan brown with a purplish hint, mostly covered with thin and light grey hairs (Lalrinawmi *et al*., 2017). It can be observed that black jelly mushrooms were treated at different light intensities, and the control showed slight differences in the values of colour a* and colour b*, but no differences in terms of colour L* value. The colour L* values for the control, 1500 lux, and 2000 lux light intensity treatments were 31.72, 30.16, and 30.65, respectively. Regarding colour a* value, light-treated bags under 2000 lux had the highest value at 8.42, followed by the control (7.72) and 1500 lux (7.273). However, concerning colour b* value, light-treated bags displayed the highest values, with 2000 lux (5.58) and 1500 lux (4.87) compared to untreated bags (4.47). Studies by Qiu *et al*. (2023) show that light intensity significantly affects the colour of fruiting bodies. In *Auricularia heimuer*, transcriptional profiles under different light intensities revealed that more genes were differentially expressed as the light intensity varied. The up-regulated genes were mainly linked to light sensing through photoreceptors, signal transduction via the MAPK signalling pathway, and melanin synthesis through the tyrosine metabolic pathway. These genes likely play a role in regulating melanin synthesis under high light intensity. Understanding *A. heimuer's* transcriptional response to light should help clarify the mechanism behind light-induced melanin synthesis, which resulted in higher a* and b* values.

3.6 Pileus Texture

Firmness refers to the force required to break or penetrate the flesh. Master *et al*. (2000) suggest that mushrooms are chosen based on their quality, particularly their texture, which encompasses both physical and chemical properties. Table 5 demonstrates significant variations (p<0.05) among mushroom species and treatments. The grey oyster mushroom exhibits greater firmness than the black jelly mushroom, indicating notable differences in mean values. This disparity may stem from the inherent textural characteristics specific to each mushroom species.

Table 5. The texture (firmness) of grey oyster and black jelly mushrooms subjected to different light intensity treatments.

Different light intensity treatment	Firmness (gF)	
	Grey oyster mushroom	Black jelly mushroom
Control	55.62 ± 19.93^{c}	193.53 ± 22.23^{b}
1500 lux	61.31 ± 6.97^{b}	197.89 ± 61.22^{ab}
2000 lux	70.78 ± 9.31^{a}	247.94 ± 61.37^{a}

Note: Values represent the means of 9 replicates. Means (n=9) ± standard deviation.

a-b: Values with different superscripts within the same column are deemed significantly different at a 5% significance level (p<0.05).

The findings indicate that light-treated mushroom bags exhibited greater firmness compared to untreated bags for grey oyster mushrooms. Among the treatments, bags exposed to 2000 lux light intensity displayed the firmest pileus, at 70.78 gF, followed by 1500 lux at 70.78 gF, and 1500 lux at 61.31 gF. Conversely, the control treatment registered the lowest firmness value at 55.62 gF. This disparity is likely due to the mushrooms' thickness, which could affect penetration during testing. Additionally, because the mushrooms are of the same species, the firmness range for grey oyster mushrooms typically falls between 30 and 80 gF (Ibrahim *et al*., 2017; Ibrahim *et al*., 2020a), further contributing to the observed variations.

Again, a similar trend was observed in black jelly mushroom, where fruiting bodies harvested from bags subjected to 2000 lux light intensity had the highest firmness value of 247.94 gF, followed by bags treated with 1500 lux light intensity at 197.89 gF. The control treatment bags consistently displayed the lowest firmness value at 193.53 gF. Black jelly mushrooms are known for their gelatinous, rubbery texture, which enhances their firmness. Consequently, black jelly mushrooms exhibited triple the firmness reading of grey oyster mushrooms.

4. Conclusions

This study investigated how light intensities impact the growth, yield, and quality of grey oyster (*Pleurotus pulmonarius*) and black jelly (*Auricularia auricula-judae*) mushrooms. Results revealed that mushrooms subjected to varied light intensities showed accelerated growth rates compared to untreated ones. Optimal light intensities were identified at 2000 lux for grey oyster and 1500 lux for black jelly mushrooms, resulting in significant improvements in growth for both species. Light-treated mushrooms at 2000 lux yielded the highest total weight of harvested fruiting bodies, with grey oyster and black jelly mushrooms displaying almost similar pileus diameters. Distinct physicochemical differences were noted, with light-treated mushrooms displaying larger pileus sizes, slightly darker colouration, and firmer texture than their controls. A light intensity of 2000 lux was deemed most beneficial for grey oyster and black jelly mushrooms, resulting in improved growth performance and higher yields.

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