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Nutritional assessment of *mycomeat* produced from different agricultural substrates using wild and mutant strains from *Pleurotus sajor-caju* during solid state fermentation

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ABSTRACT

Fermented foods have good nutritional and health benefits, and are produced via solid state fermentation (SSF) technology. This study was carried out to produce a feed variety; *mycomeat* through the solid state fermentation using various agricultural by products for livestock feeding. *Pleurotus sajor caju* was cultured on different agricultural substrates at $27 \pm 2\,^{\circ}C$. The mutant strain was produced using random mutagenesis by exposing the wild strain to ultra violet radiation for 30 min. The moisture content of the different agricultural by products was maintained at 60 mg/g and apportioned into three sets: Treatment 1 contained agricultural substrate by product alone. Treatment: 2, in addition to agricultural by product, contained mutant strain of mushroom exposed to ultra violet radiation for 30 min. Treatment: 3, in addition to agricultural by product, contained wild strain of the mushroom. The set-up was incubated in the dark and monitored daily until full ramification was obtained. Strain improvement enhanced dry matter content of *mycomeat* produced from palm kernel meal (82.81 mg/g), the protein content and fat content followed a similar pattern. Strain improvement significantly ($P = 0.1$) reduced the NDF and ADF contents of *mycomeat* produced from palm kernel meal, while fungal treatment reduced the crude fiber content of *mycomeat* produced from palm kernel meal. *Mycomeat* produced by corn bran and palm kernel meal were adjudged the best.

1. Introduction

Agricultural by products are generated in large tons in developing countries and their disposal is currently a major economic and ecological challenge. In some parts of Nigeria, these agricultural by products are allowed to accumulate in large quantities, allowed to decay or are burnt indiscriminately thereby impacting negatively on the environment by releasing harmful volatile compounds into the atmosphere, water and soil and as a result poses a serious threat to human health.

Mushroom is a general term used mainly for the fruiting body of macrofungi (Ascomycota and Basidiomycota) and represents only a short reproductive stage in their life cycle (Das, 2010). Fermented foods are known for their good nutritional

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and health benefits, and are often produced via solid state fermentation (SSF) technology, a process in which micro-organisms are grown on solid substrates in the absence of free water (Lagemaat and Pyle, 2001). Chang and Miles (1989), coined "mycomeat" to refer to fungal protein obtained through the conversion of food processing biomass by products; most times via SSF. Edible fungi, mainly mushrooms can be cultured for their fruiting body, metabolites such as enzyme, or *mycomeat* (containing both the growth substrate and the mycelial of the fermenting fungi). Okwulehie and Ogoke (2013) reported that mushrooms are good sources of proximate components and minerals needed for good health. Mushrooms are valuable health foods that are low in calories, high in vegetable proteins, chitin, iron, zinc, fiber, essential amino acids, vitamins, and minerals, such as copper that help the body to produce red blood cells (Aina et al., 2012). Mushrooms are often regarded as highly nutritious and having many health benefits (Kumari et al., 2011).

Mushroom is an excellent source of essential amino acids, vitamins, and minerals and can contribute to the formulation of a balanced diet (Manzi et al., 2001; Mattila et al., 2001). Therapeutic properties of mushrooms include enhancement of macrophage function and host resistance to many bacterial, viral, fungal, and parasitic infections; activation of a non–specific immune stimulation; and reduction of blood cholesterol and blood glucose levels (Cheung et al., 2003; Rajarathnam et al., 1998). Mushroom has been found to inhibit aromatase activity and suppress breast cancer cell proliferation (Grube et al., 2001).

For like a decade now, it has been discovered than farmers especially those involve in animal production spend more money on the purchase of animal feed which in turn has an adverse effect on their income. Mushroom is an attractive crop to cultivate in developing countries for many reasons. One of the advantages of mushrooms is that they readily grow on agricultural by products. The use of these substrate materials is both cost effective and environmentally friendly. Further, such substrates are readily available. It enables us to acquire substrate materials at low prices or even for free and to conserve our environment by recycling by products. These by products are produced in big tons during the production of agricultural products every year causing lots of environmental problems in many countries (Belewu and Banjo, 2000). Only a very small part of these agro-wastes have been properly converted into useful or high-value products. Production of edible or medicinal mushroom is a successful example of agro-waste recycling (Chiu et al., 2000).

This research work attempts the production of a feed variety; *mycomeat*, through solid state fermentation using various agricultural by products for livestock feeding.

2. Material and methods

Selected agricultural solid by products were sourced from Omu-Aran Community in Kwara State, Nigeria. *P. sajor caju* LMU 01 were procured from the culture collection bank, Department of Microbiology, NIHORT, Ibadan, Nigeria. The cultures were sub-cultured periodically after every 4 weeks and incubated at $25 \pm 1\,^{\circ}C$ for 10 days on Potato dextrose agar (PDA) slants and stored at $4\,^{\circ}C$.

2.1. Inoculums development

The inoculum was developed by transferring loopful of inoculum into the prepared inoculum medium (0.2 mg/g yeast extract, 1 mg/g feather substrate, pH 6.0). 25 mL of the isolate was dispensed in a 150 mL capacity bottle. Incubation was carried out at ($30 \pm 1\,^{\circ}C$) on a thermostatic shaking water bath at 100 rpm for 24 h.

2.2. Exposure of isolated fungus to UV light to induce mutation

This was carried out by preparation of fresh PDA plate to grow the organisms. After the growth of the organisms, cork borer was used to obtain several mycelia plugs from the culture into a sterile PDA plate. The sterile plate containing several mycelia plugs was placed under UV lamp at 300 nm wavelength at a distance of 30 cm to the plates. At time interval of 30 min, 5 mycelia plugs were withdrawn and used as inoculants for scale fermentation studies. The mycelia plugs from the domesticated type culture served as the control (Adetunji and Oloke, 2013).

2.3. Substrate treatments

The by products were prepared according to the method of Akintunde and Akintunde (2002) with a little modification. The moisture content of the different agricultural by products was maintained at 60 mg/g and apportioned into three sets. Treatment 1 contained agricultural substrate by product alone. Treatment 2, in addition to agricultural by product, contained mutant strain of mushroom exposed to UV 30 min. Treatment 3, in addition to agricultural by product, contained wild stain of the mushroom. They were filled into the wide-mouthed transparent jars in triplicates, corked with cotton wool and sterilized in the autoclave at $121\,^{\circ}C$ for 15 min.

2.4. Experimental set-up

The sterilized substrates were inoculated with the mycelia of the edible mushroom; a slant was washed per jar. The set-up was incubated in the dark and monitored daily until full ramification was obtained. The set- up that produced full