Fermentation strategies for the valorizations of Olive cake to improve their nutritional value in Broiler's feeds

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Introduction

Feeding costs account for about 70% of the total cost of poultry production system. In developing countries, feed resources are limited, and the problem became more critical after recent increase in the price of grains and oilseeds for use in animal feed. Therefore, it became necessary to find alternative non-traditional, low-cost feedstuffs to decrease the overall cost of poultry feed (El-Ghamry & Fadel 2004; Molina-Alcaide & Yanez-Ruiz 2008; Al-Harthi et al. 2011).
The utilization of Olive Cake (OC) as animal feed is undoubtedly a good way of recycling this by-product. However, the Biochemical composition of olive cakes was studied and found to contain a High amount of Insoluble Fibers, such as Lignin, Cellulose, and Hemicellulose which renders it unpalatable and poorly digestible. Our Study Focuses on the possible bioconversion of The OC Via solid-state fermentation through Microbial Fermentation of the OC. Fermentation is a metabolic process that produces Fermentation strategies for the valorisation of Olive cake to improve their value in Broiler's feeds.
In the Case of OC as an Organic Substrate for the Microbial Fermentation Using Solid State Fermentation (SSF), presents many challenges in the Bioconversion of the OC. The low moisture content in the SSF means that fermentation can only be carried out by a limited number of microorganisms that are capable of biodegrading Lignocellulosic complex. At Lab Scale, the Bioconversion of the OC was Established Through three Phases. First Isolation and Characterization of the Most Promising indigenous (From the Olive Cake) Microorganisms which Can Ferment and Degrade the insoluble Fibers, and assign a value to the OC by-Product Sampling and Microbial Isolation. Five Indigenous Bacterial and Two Fungal Isolates were successful Isolated from the OC. The Next Phase was Optimization of fermentation and Valorization of the Olive Cake by the most promising isolate through evaluating the effect of different parameters such as Temperature, PH, aeration, making the Bioconversion of the Insoluble Fibers a valuable tool in presenting Nutrients such as Protein, and how the OC in an available Digestible Form suitable as Animal Feedstuff Especially for the Monogastric. The Third Phase is Scaling up the Fermentation Process Using a Large Solid-State Fermenter to make it more practical field applications.

Material and methods

Four microbial Isolates different between Bacterial and Fungal (mold and yeast) Isolates were isolated from the Olive Cake (OC) in the Research lab at the Faculty of the Organic Agriculture at Heliopolis University for sustainable Development.
The isolation of the microbial isolates was done from the indigenous microbial flora of the Olive Cake (OC), Ten grams of OC was diluted in 90 ml distilled water then 0.1 ml of the suspension was transferred to 9 ml of distilled water to make a serial tenfold dilution. 1 ml from the first suspension and from each dilution was transferred to four replicates of sterilized petri plates, a volume of 15-20 ml of nutrient agar medium transferred to two of the petri plates and the same volume from potato dextrose agar (PDA) medium was transferred to the other two petri plates. The nutrient agar plates were incubated at 30 °C and the PDA plates were incubated at 25 °C, and then the pure single colonies of the isolates were stored on Nutrient agar slants for the bacterial isolates and on PDA slants for the fungal isolates preparing them to the lab scale solid state fermentation.

<u>Solid state fermentation</u>

The culture medium used in the solid state fermentation was present in the OC as a substrate for the fermentation and Mineral Salt Medium (MSM) contacting in g/L, 1 NH_4NO_3, 0.5 $(NH_4)SO_4$, 0.5 NaCl, 0.5 $MgSO_4$, KH_2PO_4 ,1.5 K_2HPO_4 , 0.01 $CaCl_2$, 0.01 $FeSO_4.7H_2O$, with final PH 6.9 and autoclaving at 121 °C for 20 minutes.
Solid state fermentation in the lab was done in 500 ml flasks, each flask contained sterilized 100 gram of the OC, each microbial isolate was activated and inoculated to 10 ml of Sterilized MSM and was shaken for 10 minutes then

added to the fermentation flask, The moisture content was then adjusted to 30% using the sterilized MSM. The flasks were incubated at 30 °C for the Bacterial Isolates to grow at 25 °C for the fungal isolates for 14 days.
Screening and filtering the most promising isolates based on the chemical analysis of the OC.
Based on the chemical analysis (Crude Fiber) of the treated OC the most promising microbial Treatments which have high fiber degradation are Variable between bacterial and fungal isolates.

Results and discussion

Biochemical composition of olive cakes was studied before the fermentation to assess their potential application as fermentation substrates and to check the difference between the olive cakes before and after the process. Dry, organic and nitrogenous matter, crude ashes, fat, hemi-cellulose, cellulose and lignin contents were determined. The olive cake tested contained about 91% of organic matter and 5% of nitrogenous matters. The fermentation process was shown to be optimal between 15 and 22 % in order to modify the native crude fiber and significantly improve the olive cake making it more suitable for use in poultry diet.

Conclusions

According to the findings in this study, it can be concluded that OC is a valuable ingredient and may be included in broiler diets. Furthermore, these findings support modifying composition of an agricultural by-products to make more suitable for use in poultry feed, thus leading to a significant reduction in the feeding cost, and improving the economic returns, while decreasing environmental pollution. However, further studies are required to investigate the possibility of using higher ratios of OC or OC mixed with another by-product for use in poultry diets.
The Solid-state fermentation (SSF) could be an effective pre-treatment for OC, which could significantly improve available nutrient content. In addition, combination of different treatment nay led to higher digestibility and quality processes of the end product. The effect SSF should be considered as a positive contributor to improved economic and environmental conditions of using modified OC in poultry feeding.

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