The biotechnological application of solid state fermentation using mushrooms in the production of animal feed

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Aim

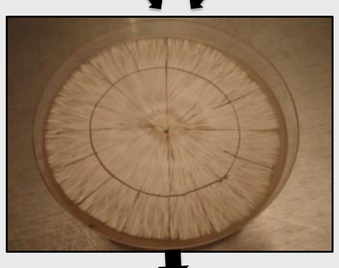
In this work we present the study of the bioconversion of lignocellulosic substrate, *Acacia mellifera,* using solid state fermentation with the edible and medicinal mushrooms *Pleurotus ostreatus* and *Ganoderma lucidum* to increase digestibility and nutritional values for its use as ruminant animal feed.

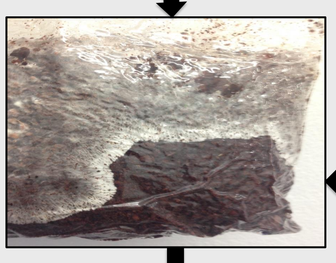
Introduction

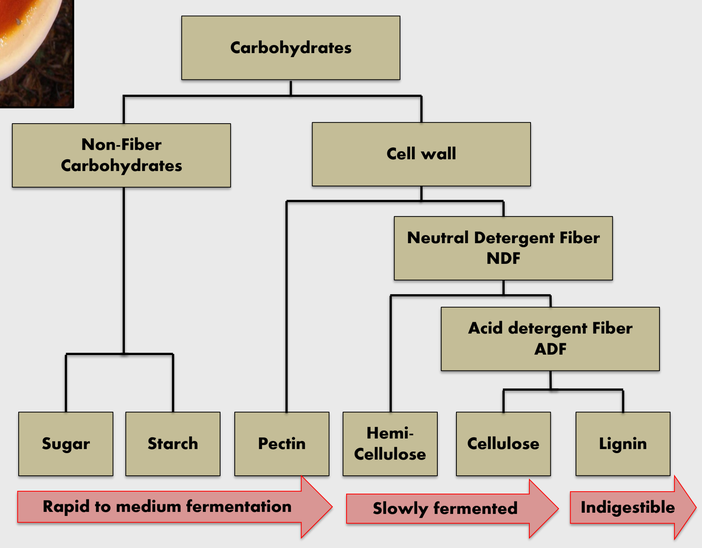
Lignocellulosic materials are the most promising feedstock as natural and renewable resources essential to the functioning of modern industrial societies (Anwer *et al*., 2014). Large areas of farm land in the Northern Cape Province of South Africa, Namibia and Botswana suffer from the encroaching bush Swarthaak (*Acacia mellifera*). The level of lignified cell wall increases as plants mature as lignified secondary cell walls develop. Besides lignin, cell walls also contain hemicellulose and cellulose (Van Kuijk *et al*., 2015). Lignin in wood can be broken down in several ways. The current methods include physical, physicochemical and chemical treatments. Enzyme complexes in mushroom strains from the genus *Pleurotus* and *Ganoderma* include: cellulase, cellobiase, hemicellulase, ligninase, laccase (Platt *et al*., 1984). Conversion of lignocellulose into food and feed rich in protein by fungi offers an alternative for developing unconventional source of proteins as food/feed (Mane *et al*., 2007).

Materials & Methods

Pleurotus ostreatus and *Ganoderma lucidum* are cloned onto PDA and used as inoculum for *Acacia mellifera* substrate







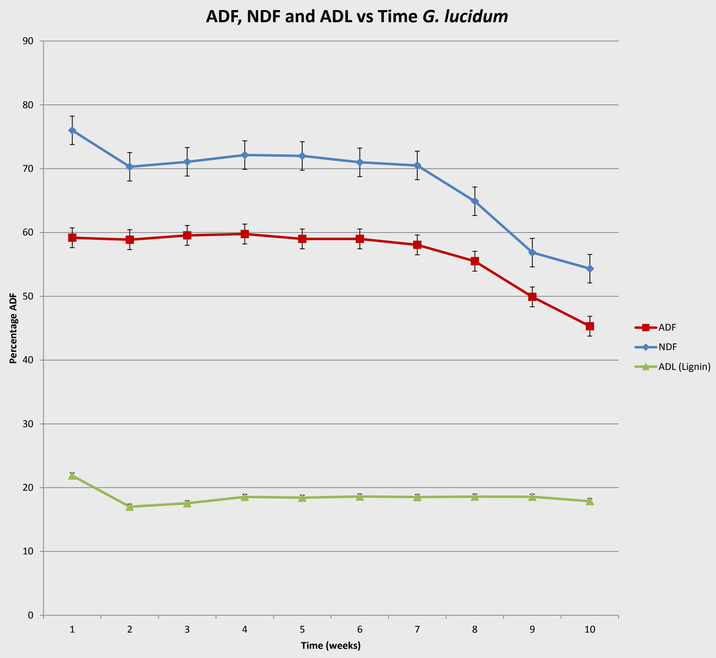
Substrate is incubated at 24°C and sampled at 2 week intervals.

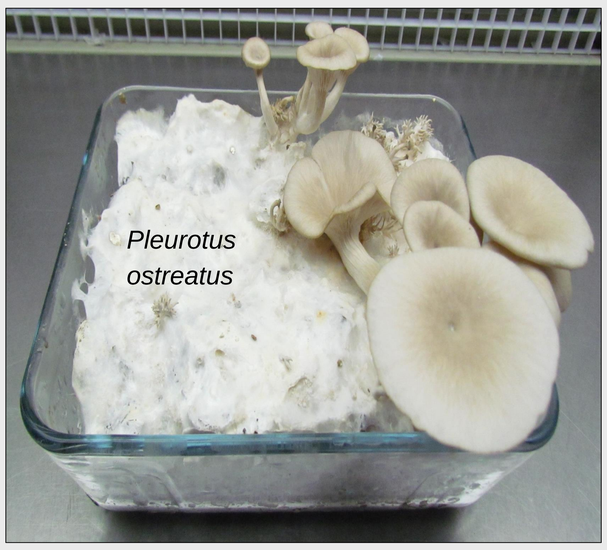
ANKOM 220 Fibre Analyzer (ANKOM Technology Corporation, NY, USA)

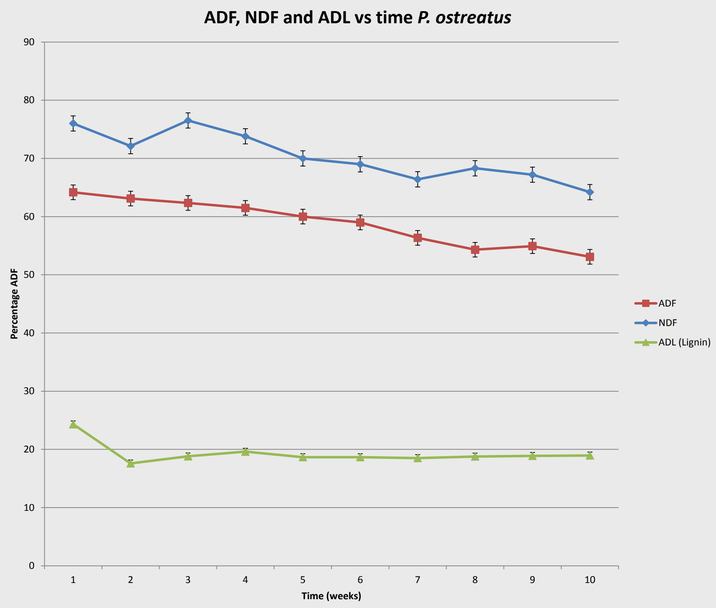
- NDF
- ADF
- ADL

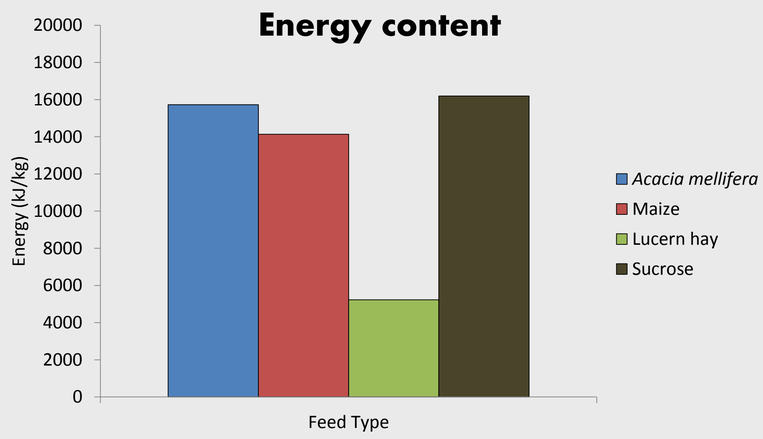
Van Soest and co-workers (1991)

Results









Discussion and conclusions

Brute Energy (BE) analysis showed high latent energy levels stored in *Acacia mellifera* comparable to sucrose (wt/wt). This energy is not utilizable to animal digestion due to the lignocellulose complex which is recalcitrant to digestion. Data showed decreases in ADL, ADF and NDF in all samples analysed. As found in literature (Van Kuijk et al., 2015), lignin (ADL) was decreased during the colonisation phase in the first weeks of incubation. After this initial decrease lignin quantities are not decreased empirically but are modified to enable digestion of cellulose and hemicellulose. ADF and NDF were decreased over time and significant decreases were obtained after 12 weeks of digestion. Decreases of 23%-28% were observed for *Ganoderma lucidum* yet smaller decreased were observed with *Pleorotus ostreatus*. A decrease in the amounts of lignocellulose could lead to increased dry matter digestibility and this will be determined in future work.

Future research

Conclude digestibility studies with *in vitro*, *in sacco* and *in vivo* animal experiments

References

.References available upon request

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