

# Development of edible and medicinal mushrooms as functional foods in Ghana

Mary Obodai, Matilda Dzomeku, Linda L Hagan, Robin Raltson, Matthew Teegarden, Steven J Schwartz, Deborah L. Narh Mensah, Juanita Prempeh, Richard K. Takli.

Project Grant number : 251



Food Research Institute

## Introduction

Across the world, including Ghana, edible wild mushrooms are commonly collected when in season. Mushrooms are low in fat and sugars, a good source of protein, vitamins and minerals and most importantly, are the only vegetable that contains all nine essential amino acids. Edible mushrooms have attracted much interest as functional foods due to their antimutagenic, anti-tumor and anti-viral properties. Many consumers seek optimal health through diet and nutrition, and urbanization has increased consumer demand for more sophisticated healthy foods. Food product development must address these changing consumer demands; the development of a convenient mushroom-based functional food is one example. Thus, the goals of this project are to: (1) develop methods to cultivate different mushrooms in Ghana and assess nutritional quality, (2) develop a mushroom-based infant functional food and (3) assess the consumer acceptability of the new mushroom product. Product development will initially focus on infant food. Unemployed women and rural groups will be targeted as the workforce for production. The anticipated outcomes of the project include four mushroom species available for use and further product development, a new market-tested mushroom-based product ready for commercialization, and a trained workforce to grow and produce the initial mushroom product. Ultimately, it is hoped that expanding children's diets to include mushroom products will reduce the burden of malnutrition and improve food security in Ghana and throughout Africa.

Consistent with USAID's Feed the Future Initiative aimed at reducing undernutrition, poverty and hunger in Africa, this project addresses malnutrition in African children, especially in Ghana. Undernutrition is a serious and widespread nutritional disorder, affecting an estimated 16% of young children globally from 2005-2011. Protein energy malnutrition increases systemic inflammation, severely compromises immune systems, complicates all infectious diseases, and kills about 10 million children under age five years annually. In Ghana, 15% of children under age five are underweight, and malnutrition is the sixth leading cause of death. In addition, according to USAID, crop yields in Africa have been unchanged for the past 40 years – no recent agricultural advances have adequately tackled food security and malnutrition. Mushrooms are nutrient-dense and a desirable functional food ingredient. Cultivation and consequent increased consumption of mushrooms and mushroom-based functional foods have potential to play an important role in improving the nutritional and health status of children in Ghana and other developing countries.

## Objectives

- To cultivate four different species of edible mushrooms, *P. ostreatus*, *P. tuber-regium*, *Ganoderma* sp. and *Termitomyces* sp.
- To develop new mushroom-based food products
- To assess the consumer acceptability of the new mushroom-based products

## Activities

### YEAR 1

- First-hand experience on the use of the sensory lab techniques and the use of a virtual laboratory for sensory science and consumer studies
- Attended various courses and seminars eg. Agilent Technologies Emerging Omics Research Seminar, Advances in Metabolomics and Lipidomics on 7<sup>th</sup> October 2014
- Quality and Innovation Management Course, 8<sup>th</sup> -12<sup>th</sup> September 2014 at Blackwell Inn
- Familiarization tour to the Abbott Laboratories, Ross Park, Columbus Ohio on the 26<sup>th</sup> of August 2014
- Collection of mushroom samples from Ghanaian forests



Mushroom sample collections from the wild

### YEAR 2

- Laboratory extraction of 57 different strains of indigenous Ghanaian mushrooms were carried out
- Beta-glucan analysis of 57 mushroom samples were analysed using the Megazyme procedure (McCLEARY Method)
- Analysis of Vitamin D in the 57 mushroom samples using High Performance Liquid Chromatograph
- Development of mushroom based infant foods: Orange fleshed Sweet potato mushroom mash, mushroom soup and mushroom cerealmix from two mushroom varieties: *Pleurotus ostreatus* strain EM-1 and *Pleurotus sajor-caju* strain PScW

### YEAR 3

- Soil samples of anthills were collected and analysis of its micronutrients carried out
- Fruit bodies of *Termitomyces* mushrooms were collected from the wild, cultured and stored in the mycelium bank
- A 3-day workshop was each organized in two regions for three Trainer of trainees and 64 care givers
- Poster presentation on "MUSHROOMS OF GHANA: AN OVERVIEW" at the International Society of Mushroom Science (ISMS) 2016, Amsterdam, 29<sup>th</sup> May-2<sup>nd</sup> June
- New *Ganoderma* spp. identified as *Ganoderma mbrekobenum*.

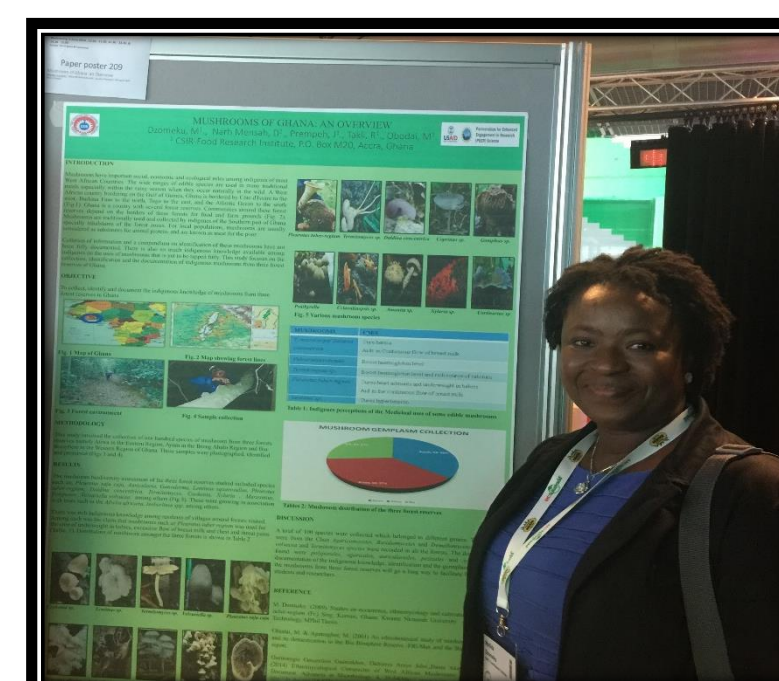
## Results



Care giver feeding a toddler with the mushroom cerealmix



Dissemination workshops



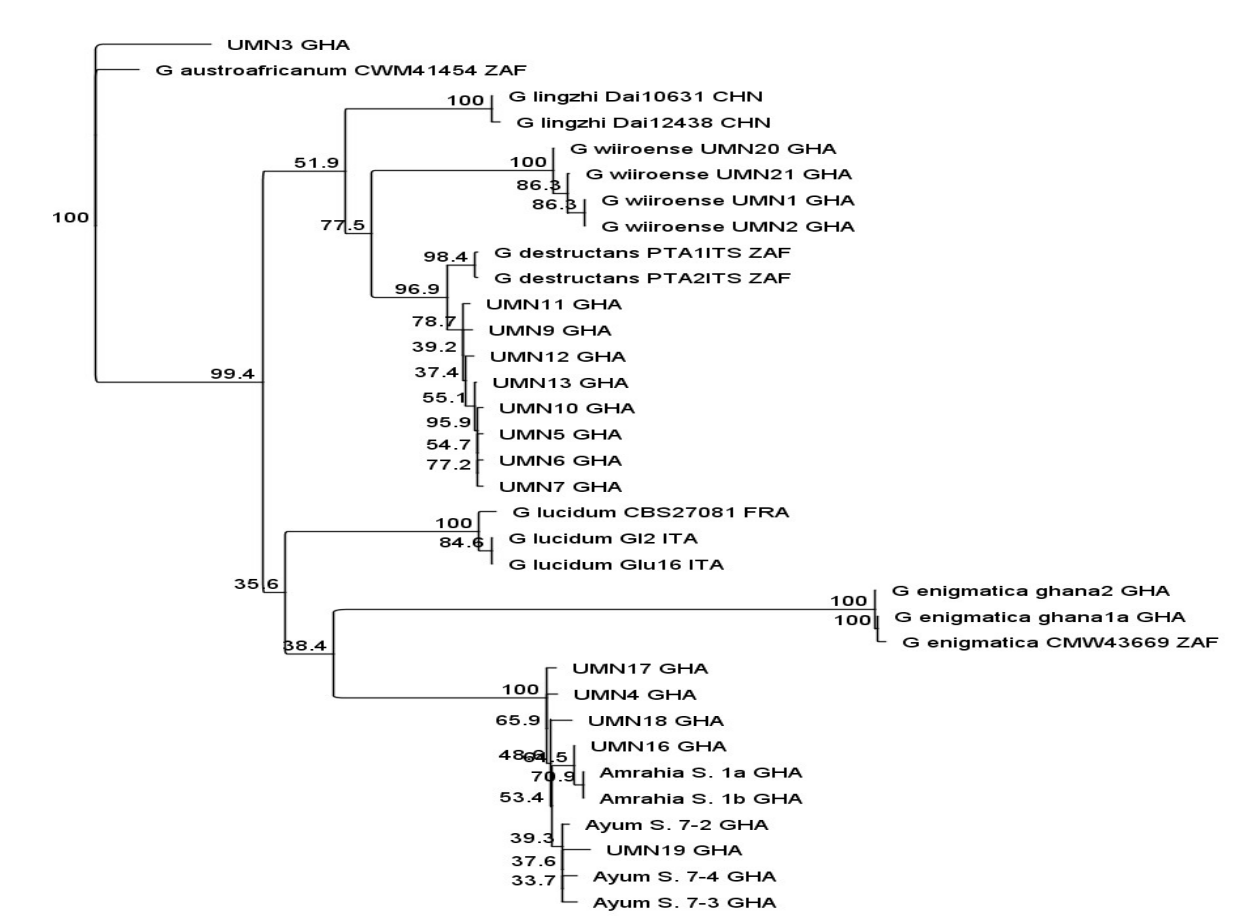
Poster presentation at ISMS16

Members at IFT-16 Chicago

Final project meeting with partners at OSU



New *Ganoderma* spp. identified



Dendrogram showing the relationships of 27 *Ganoderma* spp.

## Conclusions

- Fifty seven (57) mushroom samples were analysed for secondary metabolites
- Appreciable amounts of Vitamin D and Beta-glucans were found in some of the mushrooms
- A new *Ganoderma* spp. was identified and named as *Ganoderma mbrekobenum* from the Ayum forest
- Mushroom based cerealmix was more acceptable to caregivers than the mushroom based orange fleshed sweet potato mash
- Three papers published in peer reviewed journals

## References

- Garcia-Lafuentea A., Carlos Moro, Ana Villares, Eva Guillamon, Mauricio A. Rostagno, Matilde D'Arrigo and Jose Alfredo Martinez (2011). Mushrooms as a Source of Anti-Inflammatory Agents. *Anti-Inflammatory & Anti-Allergy Agents in Medicinal Chemistry*, 9(2): 125-141..
- Mary Obodai, Isabel C.F.R. Ferreira, Ângela Fernandes, Lillian Barros, Deborah L. Narh Mensah, Matilda Dzomeku, Arailde F. Urben, Juanita Prempeh and Richard K. Takli (2014). Evaluation of the Chemical and Antioxidant Properties of Wild and Cultivated Mushrooms of Ghana. *Molecules* 19(12), 19532-19548.

## Acknowledgement

USAID-PEER Science Project.  
OSU- Food Science Department, USA  
CSIR-Food Research Institute, Ghana