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RESEARCH ARTICLE

A REVIEW: ASEPTIC PACKAGING OF SNAIL MEAT IN TOMATO SAUCE IN PLASTIC PREFORMED

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ABSTRACT

The nature of snail was reviewed as well as the importance of snail meat was studied from different researches. The preliminary treatments of snail meat were outlined. The recipe for the preparation of snail meat in tomato sauce was listed and the method for its preparation was also well studied. The preformed plastic package was discussed, especially, recyclable and recycled plastics. Aseptic packaging was fully explained and applied in packaging of snail meat in tomato sauce in preformed plastic container. This encourages business in snail meat processing.

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INTRODUCTION

The snail belongs to the phylum *Mollusk* and class *Gastropods*. The gastropods are the largest class of the phylum *Mollusk*. Snails live among wet vegetation in damp and shady places, they are more abundant in rainy seasons and most active at night. The snail's soft body consists of a head, a foot, and a visceral mass or lump, which remains permanently inside a hard protective shell (Jatto *et al*., 2010). They are found predominately in West Africa. All gastropods at some time in their phylogeny and at some stage in their development have undergone torsion. The process does not occur in any other mollusk. It implies that the visceral mass and the mantle shell covering it have become twisted through 1800 in relation to the head and foot. As a result of torsion, all internal organs are twisted into a loop. More than half of all mollusk species are gastropods and encompass a range from marine, zygobranch, which can be numbered among the most primitive of all living mollusks, to the highly evolved terrestrial air breathing slugs and snails (Jatto *et al*., 2010). The species of snails like *Helix spp* and *Achatina spp* are eaten and cultured mainly in the USA, Europe and Far East (Yildirim *et al*., 2004).

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The vineyard snails' species *Helix pomatia L.* are commercially the most important. Every year snails are collected in various geographical regions of Lithuania, prepared and frozen, and snail meat is exported mainly to European countries. A vineyard snail is an exclusive dish in elite restaurants in European Union (EU), and snail meat (foot) is used in food production (Scheifler *et al.*, 2002). Protein malnutrition is a major challenge to most developing countries especially in Africa. This has informed the need for man to explore the use of other sources in the wild in order to meet his body requirements (Ebabhamiegbbho *et al*., 2013). In Nigeria, it is now accepted that the use of mini-livestock such as snails, rodents and other small livestock in the wild can substantially improve the living conditions of people in urban and rural areas by acting as a valuable source of protein supplement to diet as well as generating additional income (Ezeama *et al*., 2007). Snails are usually herbivores with a complex hermaphroditic reproductive system. There is a growing interest in the production and marketing of non-traditional snail meat. Snail meat is a popular food widely distributed in Nigeria especially in the Niger Delta and Upper Cross River Basins. It is also a major source of income to the people (Ezeama, 2000). The snail meat is mainly consumed as delicacy characterized by a high dietetic value and excellent nutritious traits (Cîrlan and Sindilar, 2009).

Research shows that it is rich in protein at the same time being low in lipids (Okonkwo and Anyaene, 2009; Ligaszewski *et al*., 2005). Snail meat has traditionally been a major source of protein in the diet of people living in the forest belt. The edible portion has 88.37% protein (Engmann *et al*., 2013), calcium, magnesium, zinc, iron, with very low fat content (Babalola and Akinsoyinu, 2009; Uboh *et al*., 2010; Adeola *et al*., 2010). Its protein contains all the essential amino acids such as lysine, leucine, isoleucine and phenylalanine which are needed by the body for its metabolic activities (Ebenebe, 2000; Ademolu *et al*., 2004). In addition, there are claims that snail meat has medicinal value and can be used to treat ailments including whooping cough, anaemia, asthma, and high blood pressure due to their relatively low cholesterol level but high mineral content (Ebenebe, 2000). In Nigeria, snails form an essential part of the total animal protein source for the population. It contributes about 1 % of food (Engmann *et al*., 2013). Though snails have been acclaimed to be a rich source of protein and other essential nutrients required for good health, they are not regularly consumed in the diet of many Nigerians (Engmann *et al.,* 2013). Attitudes of people to snail consumption vary within the sub-region. In the southern forest regions, snails are a delicacy for a large number of the populace and people are prepared to pay high prices for them. In the northern areas, snails are a taboo and many tribes will not touch, let alone eat them. This may be due to the fact that, majority of people in northern Nigeria are Moslems, and Moslems do not eat snails (Ebenso, 2003). In between the two extremes are those who take snails when they are in season during which they can be collected freely from the wild or bought cheaply from the market. Ebenso (2003) noted that the consumption of snail meat by rural communities is governed more by culture than by social status.

Meat occupies an important place in human nutrition (Daszkiewicz *et al*., 2005). Meat quality may be influenced by multiple interacting factors before and after slaughter (Olsson and Pickova, 2005; Leikus and Norviliene, 2006; Koopmans *et al*., 2006), feed supplements (Peeters *et al*., 2006; Niculita *et al*., 2007), conditions of meat storage (Jukna *et al*., 2005; 2006) and others. Genetic factors do not show too high effect on meat quality among breeds (Kortz *et al*., 2005). Presently, there is a growing interest in the production and marketing of non-traditional snail meat. Products from snail meat belong to foodstuffs with high nutritional value. The results of several investigations of fresh snail meat and its products have especially been described from the point of their microbiological and toxicological risks to human health (Bohuslava, 2001). Proximate analysis of wild snails (*Helix pomatia L.*) showed that they are rich in major minerals, protein and low in lipids (Özogul & Olgunoglu, 2005). Thus, snail meat gains an advantage over others (Yildirim *et al.,* 2004). Products from snail meat belong to foodstuffs with high nutritional value. Proximate analysis of wild snails (*Helix pomatia L.*) showed that they are rich in major minerals, protein and low in lipids (Özogul and Olgunoglu, 2005). Thus, snail meat gains an advantage over others (Yildirim *et al*., 2004). They are high in protein, low in fat and a source of iron, magnesium, calcium and zinc (Ademolu *et al*., 2004; Cobbinah *et al*., 2008; Babalola and Akinsoyinu, 2009; Adeola *et al*., 2010). Investigation by Emelue *et al.* (2013) revealed that snail meat contains 70% of water while its dry matter is high in essential amino acids such as lysine, leucine, arginine, tryptophan and 30% minerals. Snail is also a source of calcium orthophosphate, a chemical substrate for curing kidney diseases. A recent study has also shown that the glandular substances from edible snails cause agglutination of certain bacteria; this could be of value against a variety of ailments including whooping cough (Cobbinah *et al*., 2008). However, spoilage sets in after 48 hours of harvest while shrinking accelerates the spoilage rate as the meat cannot be kept in acceptable conditions after approximately 12 hours. This is why the preservation of the meat has become a major concern to both processors and consumers. A major traditional method of preserving sea foods is a combination of smoke drying with sun drying which reduces the microbial load, thus increasing shelf life. Some works have combined potassium sorbate treatment and dry curing in reducing the microbial population of freshwater snail and clam meat to extend shelf life (Emelue *et al.*, 2013). This paper discusses the preparation of tomato sauce and aseptic packaging of snail meat in plastic preformed.

Preparation of Snail Meat on Tomato Sauce: Nigerian Snail Stew is one of those food items that gets wiped out at special occasions in Nigeria. Your guest could be really offended if you fail to include Snails on his plate particularly when your menu says so. Nigerian Snail Stew looks simple but could easily go wrong. You have known for how long to cook the snail to have best crunchy texture. In Efik, Snail is called 'Ekwong' and in Yoruba it is 'Igbin'. Some time ago in Lagos, some people felt that just a five letter word to describe this special meat was not enough so they decided to nickname it after a former state governor 'Igbinedion'. Today however it is not going to be barbecue snail, it is Snail stew. I find that snail meat is quite delicate to cook.

When overcooked it is too soft and uninteresting. Depending on what you use to wash the snails, it could turn out to be rubbery when cooked. Frying snails, I feel takes away from enjoying the taste and texture of the meat. Today, it is not much of a problem to prepare snails as you can get it washed for you in the market. You then have to choose the "washing agent". Salt and lime are preferred. These are two natural ingredients that also keep the snail meat firm. It found that alum takes out the slime but lives the snail a bit too soft after a while. If you wash the snails in the market or buy the packaged ones in the shop, it is advisable that you still get some lime to do your last minute cleaning before cooking as the slime tends to remain. The key to enjoying snails whether in stews or soups is the cooking time. About 10-12 minutes cooking is recommendable. This way the snail is cooked but retains that nice crunchiness to the meat and tastes great. Enjoy some Nigerian Snail Stew and plain boiled rice!

Recipe for Nigerian Snail Sauce: Ingredients include the following: 6 Snails cleaned and cut in halves, 4 cups of tomatoes/ pepper/onion blend, 1 large onion, 1 tablespoon curry powder, pepper to taste, 1 yellow Cameroun pepper, 1 cup vegetable oil, chicken seasoning to taste and salt to taste.

MATERIALS AND METHODS

Snails would be placed in a pot and addition of some seasoning, a little salt, some chopped onion, chopped Cameroon pepper, curry powder would be done. About 1/2 cup water would be added. Snails would be heated for 5 minute. Onion is chopped into rings. The oil was heated and the onion was fried for about 2 minutes. The tomato blend was fried till all the liquid dries up. This method makes a lot of difference to the texture of your stew.

Your choice of pepper intensity will depend on your tolerance level. The liquid from the steamed snail was poured and continued to cook the stew until oil starts to appear on top of the stew. Seasoning and salt were added to taste. Snail stew was tasted to be sure the tanginess of the tomato is off. The snails and onion were returned to the stew and the remaining curry powder was added and cooked for another 5 minutes and the Snail stew is ready. Nigerian Snail Stew could be served with plain boiled rice, some side vegetable and fried plantains.

Reformed Plastic Package: Plastic materials are made up of large, organic (carbon-containing) molecules that can be formed into a variety of useful products, they are fluid, moldable, heat sealable, easy to print, and can be integrated into production processes where the package is formed, filled, and sealed in the same production line (Marsh and Bugusu, 2007).

Recyclable and Recycled Plastics: There are more than thirty different plastics in packaging; the most common are polyolefins, polyvinyls and polyesters. There are possibilities that chemical contaminants in plastic packaging intended for recycling may remain in the recycled material and could migrate into the food. Other aspects of plastics recycling, such as microbial contamination and structural integrity of the recycled plastic, are also important considerations for the safe use of recycled plastics for food contact application.

Plastic recyclers must be able to demonstrate that contaminant levels in the reformed plastic have been reduced to sufficiently low levels to ensure that the resulting packaging is of purity suitable for its intended use. The production of a polymer with the desired qualities will require additional antioxidants, processing aids, or other adjuvants that may need to be added to the recycled polymer (CFSAN, 2006). As petroleum reserves become more limited, new varieties of plastics are likely to increasingly be made from renewable biomass. These will contribute to the already extensive array of mechanical and aesthetic performance properties that plastics are well known for. The utilization of fossil fuels in the manufacture of plastics accounts for about 7% of worldwide oil and gas (Okada, 2002). These resources will arguably be depleted within the next one hundred years, and the peak in global oil production as estimated by some will occur within the next few decades. The plastic industry will be faced with real issues associated with the use of an essentially non-renewable feedstock for the majority of their products and there is an urgent need to develop new synthetic routes to polymeric materials using renewable resources (Williams and Hillmyer, 2008). Current packaging designs are beginning to incorporate recyclable and recycled plastics but the search for reuse functions continues. There are several factors that play into the economic assessment of recycling, including costs for collection, separation, cleaning or reprocessing and transportation.

Aseptic processing: Aseptic processing also known as aseptic packaging or aseptic filling is, without doubt, the most significant of the last developments in food technology. 'Aseptic' processes were developed before World War 2 and commercially applied in the 1950s. The early applications were liquid and semi-liquid foods, such as cocoa drinks, custards and banana puree. The packages were, invariably, metal cans and the process was therefore called 'aseptic canning'.

The pumpable food was continuously heated to sterilizing temperature in heat exchangers and, after holding, continuously cooled. The cans and lids were sterilized with steam or a mixture of superheated steam and air. The sterilized food and the sterile cans met in an aseptic enclosure that contained the filling machine and the seamer, closely coupled. Aseptic conditions were maintained by a number of measures such as disinfectants, a steady stream of superheated steam, UV radiation etc. The aseptic enclosure was kept at slight over pressure to prevent penetration of air from outside. Compared to normally canned foods, the products were of superior quality but the process was cumbersome, slow and expensive (Berk, 2009).

New technologies that allowed aseptic filling into flexible packages were developed in the 1960s. The output of the lines increased steadily. At first, the main product of commercial aseptic processing was UHT (Ultra-High-Temperature) milk in cartons. Gradually, applications expanded to almost any pumpable low or high acid food such as soups, gravy, dairy desert, creams, soy milk, fruit juices, nectars etc. The innovations included in-place formation of the package from laminated paper, plastic sheet or film, sterilization using hydrogen peroxide, followed by hot air, filling and sealing in one machine etc. The packages suitable for aseptic processing now include carton boxes, pouches, trays, cups, large bags in boxes, metal barrels etc. The adaptation of continuous heat exchangers to the specific requirements of aseptic processing is one of the most significant factors for the success of this technology. These requirements relate to the sanitary design as well as to heat transfer and flow characteristics. Tubular, plate and swept surface heat exchangers are used. Residence time distribution in heat exchangers is not uniform, particularly in swept surface exchangers (Tragardh and Paulsson, 1985); consequently, and considering the very high contribution of the holding period to the lethality of the process.

Aseptic Packaging of Snail Meat in Tomato Sauce in Preformed Plastics: The prepared snail meat in tomato sauce is in-flow pumped thermally while the preformed plastic container is sterilized. The pumpable snail meat in tomato sauce was continuously heated to sterilizing temperature in heat exchangers and, after holding, continuously cooled. The preformed plastic containers and lids were sterilized with steam or a mixture of superheated steam and air. The sterilized snail meat in tomato sauce and the sterile preformed plastic container and lids met in an aseptic enclosure that contained the filling machine and the seamer, closely coupled. The packaged snail meat in tomato sauce is distributed for consumption (Berk, 2009).

Conclusion

The aseptic packaging of snail meat is attainable as the snail meats are prepared in tomato sauce. Snail meat is a low acid food while tomato sauce is a high acid food. So, the preparation of snail meat in tomato sauce is suitable for long shelf life. The available of snail meat in our communities in Nigeria requires a suitable preservation technology. The methods employed so far in the work will encourage snail farming as well as processing, distribution, marketing and consumption of snail meats in large quantities. Aseptic packaging of snail meat in tomato sauce in preformed plastic container will promote exportation of this unique meat and improves foreign exchange of our country.

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