Research Journal of Medicine and Pharmacy
Abbr. Title: Res J Med Pha
ISSN*(Online)***: XXXX-XXXX**

OPEN ACCESS

Research Article Volume-01 | Issue-01 | 2022

Enlightening the Future on the Nutrional Values of Edible Insects to Man's Health and As Analternative Source of Food

*Isah Umar Usman*1, Mohammed Abdullahi1*

1Biological Sciences Department, Federal Polytechnic Bida, Niger State, Nigeria

Received 10-04-2022

Accepted 26-04-2022

Published 02-05-2022

Abstract: Edible insects are important natural protein resource that can contribute to resilient food security. Edible insects not only play an important role in traditional diets, but are also an excellent source of protein in traditional dishes in the world nowadays. Therefore the principal aim of this paper is to portray and enlighten the future on the nutrional values of edible insects to man's health and as an alternative source of food considering the low economic situation that the world has found itself. Edible insects could be use due to their high excellent nutrional content, potential socio-economic benefits. The method adopted for this research is using content analysis. During which different search strategies were used to access published articles to review literatures of some other authors in the field of applied entomology in order to trace significant value of edible insects as an alternative source of food to man and their values to his health as well. The search terms includes but not only limited to the following: what are edible insects, Are the edible insects valuable to man at all, do the edible insects contribute to bio economic growth etc. Lastly References in the identified articles were used, reviewed to draw conclusion that the edible insects have nutrional values to man's health and also can serve as an additional alternative source of food to him and could be use for an economic growth as well. The results of this study confirm the fact that insects are indeed a good source of protein and other nutrients. Therefore consumption of non-toxic insects, should be encouraged, as they serve as an alternative nutrition source in human diets like protein supplements, have much nutrients to offer and economic growth as well.

Keywords: Edible insects, Economy, Food, Health, Nutrition

INTRODUCTION

Insects are a class of animals within the arthropod phylum. The total number of insect species on Earth is estimated to be 2-3 million and the class probably represents more than 90% of all animal Species. Insects can be found in nearly all environments, although only a few species occur in the oceans. Spiders and scorpions, which can also be eaten by humans, are not insects but belong to the arthropods. Insects share the nutritional benefits of animal-source foods and can provide valuable nutrients as a part of a varied diet. Edible insect species may be a source of novel bioactive compounds addressing the enormous global health challenges in low- as well as high-income countries.

What is an Entomophagy?

The practice of consuming insects is called entomophagy, from the Greek *éntomon*, insect, and *phagein*, to eat.

What are edible insects?

Are all the insect types which are considered edible for human consumption consisting of about 2000 species.

Examples of Commonly Consume Edible Insects

The insects most commonly consumed worldwide are beetles (Coleoptera, 31% of all insect species consumed), caterpillars (Lepidoptera, 18%) and bees, wasps and ants (Hymenoptera, 14%). Moreover, grasshoppers, crickets and locusts (Orthoptera, 13%) and cicadas, leafhoppers, planthoppers, scale insects and true bugs (Hemiptera, 10%) are consumed. Termites (Isoptera), dragonflies (Odonata), flies (Diptera) and other insects each comprise less than 3% of insects consumed.

***Corresponding Author:** Isah Umar Usman

LITERATURE REVIEW

Insects are institutionally accepted as a food in many regions and historically consumed (Bukkens, 2005), providing sufficient nutritional value for humans. The use of insects as a viable food group can be attributed to their nutritional, environmental, and economic value (Bukkens, 2009). The increased scrutiny of edible insects is part of a multifaceted strategies for achieving global food security. In general, insects have high protein content and excellent production efficiency compared with other conventional food groups; (Calderone, 2012). This characteristic is particularly valuable given that future protein consumption is expected to increase, but food supply declines. Moreover, it is recognized that a steady increase in the global market size of the insect industry, with applications reaching beyond food into material and drug development (DeFoliart, 2015). An interest in edible insects has increased rapidly because the Food and Agriculture Organization (Oonincx & van der Poel, 2011.) has begun promoting insects as viable dietary options for humans (Parajulee, M.N., DeFoliart, and G.R., Hogg, D.B. 2014). Globally, the edible-insect market is expected to exceed USD 522 million by 2023 (Chittavong *et al.,* 2017).

RESEARCH METHODS

The method adopted for this research was using content analysis. During which different search strategies were used to access published articles to review literatures of some other authors in the field of applied entomology in order to trace significant value of edible insects as an alternative source of food to man and their values to his health as well. The search terms includes but not only limited to the following: what are edible insects, Are the edible insects valuable to man at all, do the edible insects contribute to bio economic growth etc. Lastly References in the identified articles were used, reviewed to draw conclusion that the edible insects have nutrional values to man's health, his economic growth and as an additional alternative food source to him.

Research Questions

The following important search questions could be asked in the course of this research:

- What are edible insects?
- What is an entomophagy?
- What are the nutritional compositions of insects that enable them to be used as human food supplements?
- Are the insects important to human health?

FINDINGS AND DISCUSSION

Nutrient Composition of An Edible Insects that make them Valuable to Man

The nutrient content of insects varies considerably between species and also between the different development phases. The amino acid profile differs between insect species, but it appears that many species may contribute well to an optimal diet for humans, even in very small children. Nevertheless, researchers generally agree that insects are extremely rich in protein, fat, and vitamins, as summarize as follow: On average, the protein content of edible insects ranges 35%–60% dry weight or 10%–25% fresh weight, which are higher than plant protein sources, including cereal, soybeans, and lentils. At the upper range, insects provide more protein than even meat and chicken eggs. Edible insects in Orthoptera (crickets, grasshoppers, locusts) are particularly protein-rich. However, insect protein digestibility is highly variable due to the presence of a hard exoskeleton. Orthoptera, Lepidoptera (caterpillars), cockroaches (blattodea), Isoptera (termites), Hemiptera, and Coleoptera (beetles, grubs) have the averaged fat content of 13.41%, 27.66%, 29.90%, 32.74%, 30.26%, and 33.40%, respectively. Larvae and pupae have more fat than adult insect. In addition, females are fatty than males. The averaged carbohydrate content of edible insects ranges from 6.71% (stink bug) to 15.98% (cicada). Some insects (e.g., grasshoppers, crickets, termites, and mealworms) are rich in iron, zinc, calcium, copper, phosphorus, magnesium, and manganese. It has been found that consuming insects can provide the high proportions of daily mineral recommendations for humans, particularly in terms of iron. It has also been found that edible insects contain carotene, vitamin B1, B2, B6, C, D, E, and K.

Medicinal applications of Edible insects To Man's Health

Antioxidants

Several studies have reported antioxidant activity in insect species. Antioxidants, in principle, have the potential to prevent molecular damage in the human body, and foods rich in antioxidants have been considered potentially beneficial in the prevention of cardiovascular and other diseases.

Hypertension

High blood pressure is one of the leading preventable risk factors for premature death and disability worldwide, affecting up to one third of the world's population. Angiotensin is a peptide

hormone that causes vasoconstriction and a subsequent increase in blood pressure. An enzyme converts the hormone angiotensin I to the active vasoconstrictor angiotensin II. As a result, the angiotensin-converting enzyme (ACE) causes blood vessels to constrict, which is why ACE inhibitors are used as pharmaceutical drugs for the treatment of cardiovascular diseases. ACE inhibitory activity is widely distributed in mammalian tissues, and has also been identified in a number of insects. Species such as wax moth *Galleria mellonella,* the yellow mealworm *Tenebrio molitor* and the silkworm *Bombyx mori* have been found to have levels of ACE inhibitory activity comparable with other food sources.

Obesity and type 2 diabetes

Studies in mice models have indicated bioactive compounds in insects, which may be effective in weight control. Study showed that the daily intake of yellow mealworm larvae powder by obese mice attenuated body weight gain by reducing lipid accumulation and triglyceride content in adipocytes, thus indicating the potential of a bioactive compound to induce weight loss. Another pathway of bioactivity investigated entails a reduction in endoplasmic reticulum (ER) stress. ER is a cellular condition found in obese as well as type 2 diabetes patients causing a function failure of cells, including insulin-producing beta cells.

Chitin and Immunity

Chitin, a primary component of the exoskeletons of arthropods, represents the second-most abundant polysaccharide in nature, after cellulose. Humans do not synthetise chitin. Therefore, chitin-containing protozoa, fungi, arthropods, and nematodes are targeted for recognition by the immune system. Chitin and its degradation products are sensed primarily in the lungs or gut, where it activates a variety of innate and adaptive immune cells. Chitin induces cytokine production, recruits leukocytes, and activates macrophages. Chitin can be degraded by chitinases identified in the human digestive fluid. The function of chitinases is not only to catalyse the hydrolysis of chitin-producing pathogens, but seems to include a crucial role in bacterial infections and inflammatory diseases.

Vitamin B12

Cobalamin – or vitamin B12 – is synthesised by certain bacteria and algae and accumulates in meat, milk and other animal-source food, as the only natural food source of vitamin B12 for humans. Vitamin B12 plays a key role in the functioning of the brain and nervous system and in the formation of red blood cells. Few insects have been analysed for vitamin B12. Among them house cricket *Acheta domesticus*, yellow mealworm *T. molitor*, wax moth *G. mellonella*, and silkworm *B. mori*.

Parkinson's disease and silkworm

Parkinson's disease affects 6 million people each year, resulting in more than 100,000 deaths each year. Study found that when boiled and freeze-dried powder of the silk worm *B. mori* was fed to *Drosophila* flies, lifespan increased, while symptoms of rotenone-induced Parkinson's disease were reduced.

Medicine

The traditional claims of medicinal properties have resulted in multiple studies aiming to empirically determine the properties of edible insects. Cultures that consume insects also tend to associate them with various health benefits beyond nutrition. For example, caterpillar fungus supposedly has immunostimulatory and anti-cancer properties. Some evidence exists to suggest that termites (*Macrotermes annandalei*) may have immunostimulatory effects. Another insect historically considered to have beneficial health effects is the silkworm (*Bombyx mori* L.). Recent analyses have identified a blood glucose- lowering agent, resulting in the development of silkworm powder as a diabetic medicine in Korea.

Recommendation

With the above findings, consumption of non-toxic edible insects by man is encourage as they play an important role in human nutrition and have much nutrients to offer.

CONCLUSION

The results of this study confirm the fact that insects are indeed a good source of protein and other nutrients. Therefore consumption of edible, non-toxic insects, should be encouraged, as they serve as an alternative nutrition source in human diets like protein supplements, have much nutrients to offer and can also be use boost economic growth as well.

Further Research

With these research findings further research is highly recommended more especially

on the chemical composition of edible insects which is not covered in this study.

REFERENCES

1. Broekman, H. C. H. P., Knulst, A. C., den Hartog Jager, C. F., Gaspari, M., de Jong, G. A. H., Houben, G. F., & Verhoeckx, K. C. M. (2014). Risk assessment of novel proteins in food: are insect proteins allergic. In *Abstract book at conference "Insects to Feed the World", the Netherlands* (No. s 47).
2. Bukkens, S. G. (2005). Insects in the human diet: nutritional aspects. *Ecological implications of minilivestock: potential of insects, rodents, frogs and snails*, 545-577.
3. Bukkens, S.G.F. (2005). The nutritional value of edible insects. *Ecology of Food Nutrition, 36*, 287-319.
4. Calderone, N.W. (2012). Evaluation of drone brood removal for management of Varroa destructor (Acari: Varroidae) in colonies of Apis mellifera (Hymenoptera: Apidae) in the Northeastern United States. *Journal of Economic Entomology, 98*(3): 645-650.
5. Chittavong, M., Jansson, A., & Lindberg, J. E. (2013). Effects of high dietary sodium chloride content on performance and sodium and potassium balance in growing pigs. *Tropical animal health and production*, *45*(7), 1477-1483.
6. DeFoliart, G.R. (1999). Insects as food: why the Western attitude is important. *Annual Review of Entomology, 44*, 21-50.
7. DeFoliart, G.R. (2015). An overview of the role of edible insects in preserving biodiversity. *Ecology of Food and Nutrition, 36*, 109-132.
8. Dicke, M., Van Huis, A., Peters, M., & van Gurp, H. (2014). The hockey stick pattern in the acceptance of edible insects in The Netherlands. In *1st International Conference Insects to Feed the World* (pp. 14-17).
9. Livsmedelsverket. (2015). http://www.livsmedelsverket.se/matvanor-halsa--miljo/kostrad- och-matvanor/kott-och-chark/
10. Makkar, H. P., Tran, G., Heuzé, V., & Ankers, P. (2014). State-of-the-art on use of insects as animal feed. *Animal feed science and technology*, *197*, 1-33.
11. Nakagaki, B. J., & Defoliart, G. R. (1991). Comparison of diets for mass-rearing Acheta domesticus (Orthoptera: Gryllidae) as a novelty food, and comparison of food conversion efficiency with values reported for livestock. *Journal of Economic Entomology*, *84*(3), 891-896.
12. Nakagaki, B. J., Sunde, M. L., & DeFoliart, G. R. (1987). Protein quality of the house cricket, Acheta domesticus, when fed to broiler chicks. *Poultry Science*, *66*(8), 1367-1371.
13. Neville, P. F., Stone, P. C., & Luckey, T. D. (1961). Cricket Nutrition: II. An Unidentified Factor in the Nutrition of Acheta Domesticus. *The Journal of Nutrition*, *74*(3), 265-273.
14. Oonincx, D. G. A. B., & Van der Poel, A. F. B. (2011). Effects of diet on the chemical composition of migratory locusts (Locusta migratoria). *Zoo Biology*, *30*(1), 9-16.
15. Oonincx, D. G., & De Boer, I. J. (2012). Environmental impact of the production of mealworms as a protein source for humans–a life cycle assessment. *PloS one*, *7*(12), e51145.
16. Oonincx, D. G., Van Itterbeeck, J., Heetkamp, M. J., Van Den Brand, H., Van Loon, J. J., & Van Huis, A. (2010). An exploration on greenhouse gas and ammonia production by insect species suitable for animal or human consumption. *PloS one*, *5*(12), e14445.
17. Paoletti, M. G., Norberto, L., Damini, R., & Musumeci, S. (2007). Human gastric juice contains chitinase that can degrade chitin. *Annals of Nutrition and Metabolism*, *51*(3), 244-251.
18. Parajulee, M. N., Defoliart, G. R., & Hogg, D. B. (1993). Model for use in mass-production of Acheta domesticus (Orthoptera: Gryllidae) as food. *Journal of economic entomology*, *86*(5), 1424-1428.