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Multiple Facets of Edible Insect Utility as Nutrient Power Pack and Economic Empower Bank

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ABSTRACT: Entomophagy offers dietary foods of less environmental effort, support livelihood and plays an important ecological role in nature. These in-exhaustible supports are less recognized and treated as primitive behavior. Edible insects as the nutrient power pack (NPP), represent a significant biological resource comprising of complete nutritional package. Showing concern of entomophagy in FAO and western countries, many business sectors begins the momentum of launching value-added food for consumption purposes and gained the opportunity of being the economic power bank (EPB). An increase in 10% production of animals protein supply in the world through edible insect mass production could reduce the malnutrition problem and pressure on other conventional protein sources. Significant associations of edible insects with human advancement are presented in two forms; NPP and EPB. Development and utilization of value-added products of edible insects in the form of Protein concentrate powder as a nutrient supplement will be a good scope for future promotion. Optimizations in quality and value addition with appropriate technology are the need of the hour for good products development for scaling of economic empowerment and mass production.

Keywords: Entomophagy, Economic power bank, Insect resources, Nutrient power pack.

INTRODUCTION

Edible insects are treated as inexhaustible resources because of their easy availability from natural habitats through harvesting. These are found in diverse habitats, terrestrial, grasslands, swamps, wetlands, agricultural farmed lands, and deep forests ecosystems etc. From time immemorial, insects have been eaten across the world in different parts as their regular dietary items. Above 2000 species of edible insects have been eaten in 113 countries by more than 300 ethnic communities (MacEvilly, 2000). The eating of insects by the native population of the human being as a food item is termed Entomophagy. Knowingly or unknowingly edible insects offer dietary foods with less environmental effort, support livelihood, and play an important ecological role in nature. However, the inexhaustible supports from entomophagy are less recognized by the common people as it is associated with their traditional culture and customary practices. At this juncture too, in marry parts of the world, people view eating insects with disgust and primitive behavior. This outlook has induced a huge negative impact in promoting scientific research tempo in young minds.

Apart from having age-old culture, entomophagy practices could now only started capturing slowly the eyes of the public interest worldwide. Food and Agricultural Organization (FAO) along with the western countries now approaches showing concern to include the edible insect in their menu thereby gaining momentum (FOA, 2013). Many business sectors and companies have begun producing insect food for the consumption of humans. In the United States, crickets are used in the processed products and marketed as protein bars. In different countries, in the supermarkets, value-added products of insect foods are sold indicating the attention of the general public interest, thus providing the opportunities to serve as THE ECONOMIC EMPOWER BANK. Edible insects in other words, also represent a complete nutritional

package, THE NUTRIENT POWER PACK, thereby representing significant biological resources comprising of nutrient-rich components such as carbohydrate, protein, fat, including minerals, vitamins, and amino acids (Shantibala *et al.*, 2014; Xiaoming *et al.*, 2010). An increase in 10% production of animals protein supply in the world through edible insect mass production could reduce the malnutrition problem and the pressure of protein production on other conventional protein sources. To emphasize the inevitable relationship between human civilization and edible insects, it has been presented in two broad categories such as nutrient power pack and economic empower bank.

MATERIALS AND METHODS

Edible aquatic insect samples were collected from different water bodies and wetland areas of Manipur. The macro-nutrients and mineral composition present in *Laccotrephes maculatus* (adult), *Lethocerus indicus* (adult), *Crocothemis servilia* (nymphs) and *Antheraea proylie* (pupae) were analyzed by following the methods given below in Table 1.

Table 1: Analysis of Nutrient and Mineral content in edible insects.

Sr.No.	Components	Methods
1	Protein	Micro-Kjeldahl method, (Pearson, 1976)
2.	Carbohydrate	Anthrone method, (Dubois *et al.*, 1956)
3.	Lipid	Folch *et al.*, (1956)
4.	Ash	Muffle Furnace
5.	Crude Fiber	AOAC (1990)
6.	Energy	Digital Bomb Calorimeter
7.	Minerals (Fe, Ca & K)	Atomic Absorption Spectrophotometer.

At first, Nitrogen content was determined by using the Micro-Kjeldahl method. To achieve true protein content, the non-protein nitrogen was extracted with ice cold 10% TCA and titration against the standard acid. From the total nitrogen value, the non-protein nitrogen content was deducted and multiplied by the factor, 6.25, to get the actual crude protein content. The carbohydrate was estimated by the Anthrone method. Total crude fat content was determined by homogenizing and soaking the sample for about 3-4 hours with the chloroform methanol mixture (2:1 v/v) following the method described by Folch *et al.*, (1956). The crude fiber content was estimated in the muffle furnace at 600° C following the AOAC method, 1990. In the digital bomb calorimeter, the energy deliberation was evaluated (Model: RSB-3/5/6/6A)

The mineral content was estimated after wet digestion of the sample with a mixture of sulfuric, nitric, and perchloric acids at the ratio of 1:10:4 using an atomic absorption spectrophotometer.

The data obtained for nutrient and mineral values were analyzed with one way ANOVA. Statistics analysis was done with the help of Statistica Version10.

RESULTS AND DISCUSSION

A. Edible insects as nutrient power bank compared with beef and fish

Advances in edible insect research and development approaches indicated entomophagy, a better alternative option of protein sources which is comparable to the conventional protein sources, the meat foods, that can utilize for direct consumption of human beings and in animal food preparation. Certain common edible insects across the world include lepidopteran larva, grasshoppers, coleopteran grubs, termites, ants, wasps, bees, cicadas, and different species of aquatic insects including nymphs of dragonfly, diving beetles, and giant water bugs etc.

The composition of macro-nutrients and minerals content in *L. maculatus* (adult), *L. indicus* (adult), *C. servilia* (nymphs) and *A. proylie* (pupae) were estimated and compared with the data of conventional food, beef and fish of (Williams, 2007). In terms of the nutritional package, these insects revealed comparable and more promising nutritious food sources thereby categorizing itself in a genuine food group (Fig. 1, 2 & 3; Table 1). The protein contains aquatic edible insect falls in the range of 20 to 75 percent (Shantibala *et al*., 2014) while insect protein also possess good digestibility occupying within 77 to 98 percent along with a rich proportion of essential amino acids i.e., 46 to 96 percent (Verkerk *et al*., 2007). Protein production from insects for human consumption would be more effective and consume fewer resources than vertebrate protein. The presence of more nutrients in edible insects, the unconventional food than the conventional foods, like fish & beef has been reported (Lokeshwari and Shantibala, 2010). This makes insect meat more ecological than vertebrate meat. The use of insects particularly locusts and grasshopper as food have been of great significance not only from the nutritional value but also from controlling pests as many ethnic human societies believe. The proportion of fat available in edible insects possesses within 10 to 50 percent (Ying *et al.*, 2001). The high-fat content of the giant water bug, *L. indicus* (20.75%) can contribute to significant sources of oil in diets. The fatty acid of edible insects is different from other animal fats, as it has higher fatty

acids than the human body needs. Many edible insects provide satisfactory amounts of energy and protein, thereby meeting amino acid requirements for humans. Edible insects not only possess rich composition of polyunsaturated and monosaturated fatty acids but content in a high proportion of minerals like iron, phosphorous, copper, manganese, magnesium, zinc, selenium, and vitamins too (Van *et al.*, 2013). Edible insect depicting as Nutrient power pack is worth aphorism.

Table 2: Nutrient composition of unconventional (edible insects) and conventional foods (beef & fish).

Edible insect	Carbohydrate	Fiber	Ash	Fe	Ca	K
	%			(mg/100g)		
L. maculatus	0.05	15.00	3.00	25	66	**550**
L. indicus	3.85	**18.00**	**4.56**	**410**	**96**	170
C. servillia	1.25	9.32	1.08	11	86	286
***A. proylie* (pupae)**	**12.00**	1.92	1.92	34	36	3
Beef (lean red meat)*	—	—	1.2	1.8	4.5	363
Fish (Broiled cod)*	—	—	—	—	—	318

*Williams, 2007

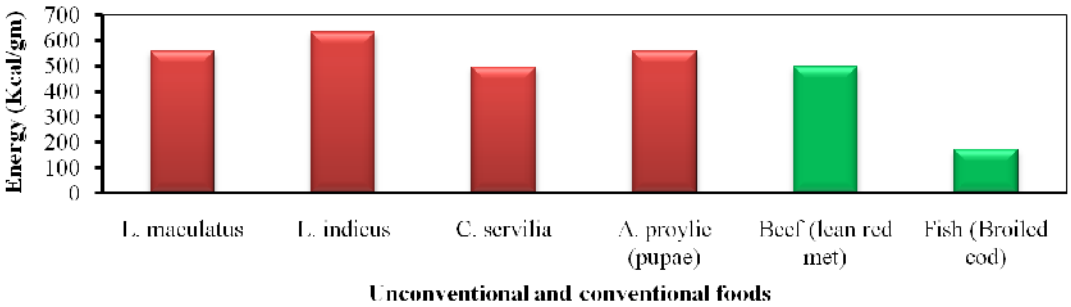

Fig: 1. Comparison of energy (Kcal/gm) content among unconventional food and conventional food.

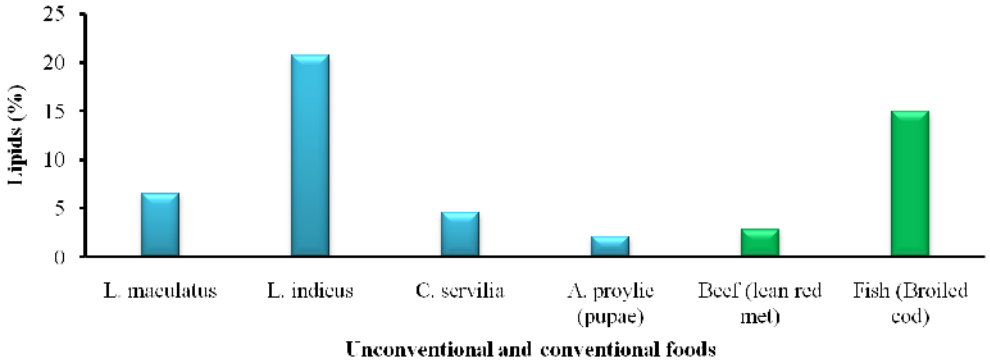

Fig: 2. Comparison of protein (%) content among unconventional and conventional foods.

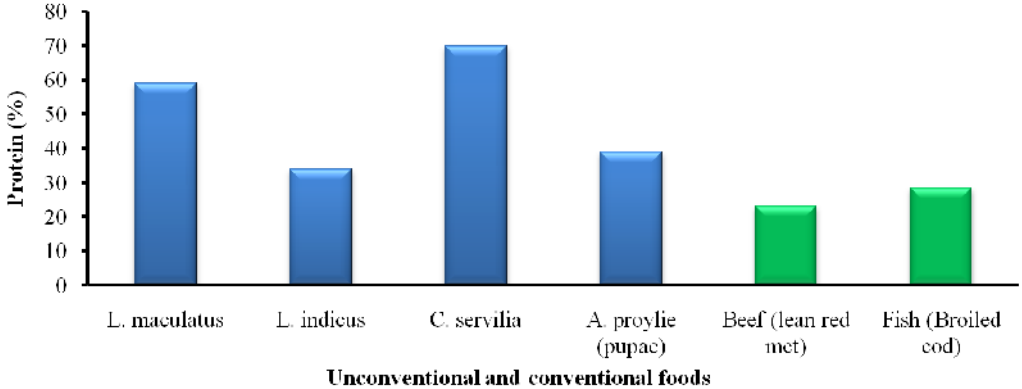

Fig. 3. Comparison of lipids (%) content among unconventional and conventional foods.

B. Edible insects as Economically empowering bank

In entomophagy-practicing countries, edible insects are mostly marketed in the local market either as street foods or dietary food items (Plate 1). Edible insect species that are readily available and easy to capture from natural habited are collected and sold in the local market for an additional economic supplement. It provides inexpensive foods that are ready to eat daily. The economic supports contributed from the marketing of edible insects is noticeable even though generally underestimated and uncountable (Fellows, 2011). Some of the prices of these edible insects are usually high due to their taste & flavor as well as for having traditional cultural customs like giant water bugs (@Rs. 25/50/insect) and bees (@Rs. 500-1000/hive) in Manipur. To a larger extent, in the Northeastern region of India, silkworm rearing emphasizes both commercial purposes as well as a dietary food item. In different markets, value-added products of silkworm items such as eri pupae pickle are available and sell ~ @ Rs. 150-200 per 200gm and dried pupae product of sericulture are also accessible @ Rs. 20 to 60 per kg that to be used in animal feed preparation.

Plate 1. Marketing of edible insect in local market: A-Selling honey comb: B- Fried grasshopper in hotel: C-Dragon fly nymph: D-Eating row comb.

The edible pupae, by-products or felt as wastes can be put into better use by converting value-based products, thereby making the silk industry a more profitable and economically viable spot. The demands of urban consumers are influenced to a great extent in the production systems, intermediaries markets, international and local food industries and livelihoods support (Meer, 2006). Against this globalized and integrated market backdrop, small-scale farmers, women, indigenous peoples, and other vulnerable people face a disadvantage in market participation because they lack access to information, services, technology and credit and the capacity to offer larger volumes of quality products to market agents (Johnson and Berdegué, 2004). Therefore, Food quality and safety and observing hygienic conditions are important elements of a marketing strategy. Therefore, optimizations in quality and value addition with appropriate technology application towards the development of good products are the need of the hour to scale up economic empowerment exploration for mass utilization to a larger extent.

CONCLUSION

The emerging health benefits and documentation of indigenous foods as described in the above paragraphs are the need of the hour for strategic community-based interventions so that it would help to improve food security, nutrition, and health of populations as a whole. The more effective use of such diversity can also serve to be a more sustainable and environmentally friendly solution to the problems of food production. Further, documentation of the nutritional values of insects to promote insects more efficiently as a healthy food source is needful. Utilization of value added products of edible insects in the form of Protein concentrate powder as a nutrient supplement will be a good scope for future promotion. The development of a clear and comprehensive legal framework at the international or national level could pave the way for more investment, leading towards the full development from the household scale to the industrial scale of production as well as trade-in insect products for food and feed internationally. Strengthen the researcher's works in collaboration with food industries and the expansion of entrepreneurship are required for its promotion. The benefits of edible insects if accepted and could firm successfully into the food resources utilization, definitely combat malnutrition and undernourishment.

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Conflict of Interest. None.

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