Article

Edible insects as a valuable human food resource: A study of the perceptions of young Indian people

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Abstract

The consumption of insects by humans is an age-old practice that is followed by many cultures of the world. Insects are one of the best sources of animal protein and have been the traditional food of many tribes around the world. The provisioning of sufficient food for the growing world population is a serious concern. Raising insects for human and animal consumption has a relatively lower environmental impact, and hence, it could be used as one of the strategies for feeding people. In urban regions, people are mostly repulsed by the prospect of edible insect consumption, which is mainly due to their cultural and religious beliefs. Currently, India has a huge population of young people. This study was conducted to find out the perceptions of young Indians regarding edible insects. It revealed that most of the participants of the study, due to their various beliefs, are not willing to accept insects as human food.

Keywords alternative food source; anthropo-entomophagy; ethnozoology; sustainability.

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1 Introduction

The notion of food security is a global phenomenon that impinges on every human (Rehman et al., 2022). It is estimated that approximately 2.5 billion people will be added to the world's population by 2050 (United Nations, 2018). With a growing world population and increasingly demanding consumers, the production of sufficient protein from livestock, poultry, and fish represents a serious challenge for the future (Huis, 2013). Sustainable and equitable food security will require a multifaceted global strategy (Godfray et al., 2010).

Edible insects are among the natural resources important to life and, up to 2086 species are known to be consumed by 3071 ethnic groups (Ramos-Elorduy, 2009). About 2111 species of edible insects have been recorded from the world (Jongema, 2017). Edible insects can be an alternative protein source not only to improve human nutrition but also to exert positive effects on planetary health (Ros-Baró et al., 2022). Insects are a source of essential nutrients such as proteins, fats, minerals, and vitamins, and of micronutrients such as

copper, iron, manganese, and riboflavin (Altomare et al., 2020). Insects are also used as animal feed and the crude protein contents of insect meal are high, ranging from 42%–63% (Makkar et al., 2014).

Anthropo-entomophagy or the consumption of insects by humans constitutes a major source of nutrition, and edible insects are consumed in 130 countries, with the African and American continents being the most entomophagous (Ramos-Elorduy, 2009). There are 472 edible insect species in sub-Saharan Africa, of which 31% are Lepidoptera and wild harvesting is still the main source of supply for these species (Muya et al., 2022). About 255 species of insects including red weaver ants (Fig. 1) are consumed as food by different tribes of India (Chakravorty, 2014). Silkworms including mulberry and non-mulberry silkworm pupae (Fig. 2), are a typical Asian food consumed from ancient times due to their high protein content (Altomare et al., 2020). Termites (Fig. 3) are an important food source for many human populations around the world, and provide a good supply of nutrients (Schnorr et al., 2019).

India has the highest number of young people in the world, as over half the population of India, about 52% is below the age of 30 years (ENS, 2022). In this context, considering the importance of insects as potential food of the future, this study was conducted to find out whether young Indians are willing to accept edible insects as an alternative food source.

Figs. 1-3 Edible insects. (1) Red weaver ants; (2) Silkworm pupae; (3) Termites.

2 Material and Methods

The data for this study was collected through an online questionnaire contained in a Google form. Undergraduate (B.Sc.) and postgraduate (M.Sc.) students were targeted for the study. A brief description of the practice of anthropo-entomophagy and its benefits along with a few images of edible insect products were provided at the beginning of the Google form to educate the participants. A series of questions followed the description of anthropo-entomophagy to test the perceptions of the participants regarding the consumption of edible insects. The online questionnaire was made available to the participants through WhatsApp mobile application, along with a request to submit prompt and truthful responses. The data obtained was subsequently analyzed to determine the perceptions of the participants regarding the consumption of edible insects.

3 Results

A total of 201 participants submitted their responses for the study. The age of the participants ranged from 17 – 22 years. About 64.2% declared themselves as vegetarians, whereas, 35.8% were non-vegetarians. The results of the study are provided in Table 1.

Table 1 Responses of the participants to the questionnaire.

Q1.	*Are you aware that Entomophagy is a dietary practice that involves humans eating insects?*			Yes (62.2%)		No (37.8%)
Q2.	*Are you aware that insects are considered traditional foods in many countries?*			Yes (89.6%)		No (10.4%)
Q3.	*Are you aware that humans consume thousands of different insect species around the world?*			Yes (88.1%)		No (11.9%)
Q4.	*Are you aware that the gastronomic culture of many countries includes insects?*			Yes (73.6%)		No (26.4%)
Q5.	*Do you believe that consumption of insects can help to meet the increasing global demand for food?*			Yes (51.2%)		No (48.8%)
Q6.	*Do you believe that insects are a good source of protein?*			Yes (51.7%)		No (48.3%)
Q7.	*Are you willing to consume insects as food?*		Yes (3%)	No (66.7%)		Only for survival (30.3%)
Q8.	*What is your inspiration to try insects as food?*	Try new food (10%)	Environment-friendly use of resources: (9.5%)	Sense of thrill (5%)	To inspire others (0.4%)	Not applicable (75.1%)
Q9.	*Which insect form are you most likely to consume?*	Whole insects (3%)	Processed food containing insects (8%)	Insect flour (12.9%)	All of the first three options	Not applicable (71.6%)

					(4.5%)	
Q10.	*If you answered 'No' to Q7, please state the main reason for your unwillingness to try insects as food?*	Revulsion (8%)	Insects are not natural human food (22.9%)	Fear of disease (24.4%)	Immoral to eat insects (11.4%)	Not applicable (33.3%)
Q11.	*Do you feel that raising insects for human consumption requires fewer environmental resources than raising livestock/cattle?*			Yes (59.2%)		No (40.8%)
Q12.	*Did you know that in comparison to other sources of protein for human consumption, insects have a relatively smaller ecological impact?*			Yes (58.7%)		No (41.3%)
Q13.	*If consumption of insects becomes more common in the future, would you then be willing to eat insects?*			Yes (29.9%)		No (70.1%)

4 Discussion

After studying the educative information provided at the beginning of the questionnaire, most participants of the study were aware of the facts that consumption of insects by humans is a widespread dietary practice all over the world, that several species of insects are consumed by humans, that insects are a good source of protein, and that raising insects for human consumption causes a relatively smaller ecological impact. This is evident from the fact that over 50% of the participants responded positively to questions one to six and also questions eleven to twelve. However, in response to the most important question regarding this study, that is question number seven, 3% participants responded positively, showing their willingness to feed on insects. This is despite the fact that 35.8% participants had declared themselves as non-vegetarian. Still, 30.3% participants responded that they would feed on insects only if it was a question of survival, while 66.7% stated that they would not eat insects at all. Among those who provided a negative response to question seven, the highest number of participants stated the fear of disease, followed by insects not being natural food of humans, eating insects being immoral, and lastly revulsion as the main reason for rejecting insects as food. With regards to preference for the edible insect form, most participants preferred insect flour, followed by processed food containing insects, and the least number of participants preferred whole insects. As evident from the response to question thirteen, only 29.9% participants were willing to embrace the practice of eating insects, even if it became more common in urban areas in the future.

For urban people, eating insects is an unfamiliar concept, and can cause fear and revulsion. However, the same people would consume crustaceans like prawns and crabs with relish, as it is considered culturally appropriate. This behaviour of people is nonsensical as both insects and crustaceans are arthropods and similar in many ways. The primary reason people reject insects as food is that they find the prospect disgusting or culturally inappropriate (Ruby and Rozin, 2019). However all around the world, people eat insects unknowingly, as it is almost impossible to avoid contamination by insects or their parts in food (Mitsuhashi, 2010).

Directly and indirectly, edible insects contribute to all four categories of ecosystem services as outlined by the Millennium Ecosystem Services definition: provisioning, regulating, maintaining, and cultural services (Payne and Itterbeeck, 2017). Taking into account feed efficiency, water use, required space, and greenhouse

gas emissions, raising edible insects is much more sustainable as compared to raising commonly consumed animals like cows, pigs, and poultry (Oonincx and de Boer, 2012; Testa et al., 2017). In addition to food source, edible insects can provide livelihood and income, and since, insect farming requires minimal space, it is possible to practice it in urban as well as rural areas (FAO, 2022). Findings suggest that cricket farming has improved the lives of many rural farmers in Thailand not only through the provision of an alternative income source, but through strengthening human and social capital (Halloran et al., 2016).

Overall the results of this study reveal that, presently majority of young Indians are not in a state of mind to embrace the practice of entomo-anthrophagy. This is mainly due to their dietary and cultural perceptions. However, it is still possible to raise edible insects for cattle and poultry feed. This type of cottage industry is fit to be encouraged, since when properly implemented, it could lead to a relatively smaller impact on the environment, and could also provide employment or entrepreneurial opportunities for young Indian people.

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