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Assessment of the health risk by eating insects and legislative documents

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Abstract

Nowadays a practice called Entomophagy is being spread in different locations on the earth. Important to highlight that it tends to be popular in Africa, Latin America and of course Asia. In Europe this kind of phenomena is not yet developed, due to specific EU regulation and the general population acceptance for such concept of dietary intake, since it's not an integral part of traditional eating habits in Europe (Skotnicka et al., 2021; Żuk-Gołaszewska et al., 2022; Ianniciello et al., 2024; Pali-Schöll et al., 2018; Pinheiro et al., 2025). One of the challenges according to United Nations Food and Agriculture Organization (FAO) is challenge of feeding the planet, this was one of the reasons why UNFAO endorsed a broad format of insects farming (Da Silva Lucas et al., 2020). Insect agriculture is one underexplored and innovative approach (Patel et al., 2019). In this scientific review will be discussing, general publications about edible insects, policies and priorities for edible insects and legislation comparison between Europe and Africa as well as going through chances and challenges of such food design for the future.

Keywords: *entomophagy, insects, food, risks, legislation*

Introduction

Sustainability is becoming an increasingly critical issue in today's world, necessitating the search for alternative food sources to replace traditional, less sustainable ingredients. One potential solution is incorporating proteins, lipids, and fibers derived from edible insects into food products as substitutes for existing components. Edible insects offer a viable alternative to meet the growing demand for animal protein while mitigating deforestation for pastureland. Additionally, they demonstrate high feed conversion efficiency compared to conventional livestock and produce relatively low greenhouse gas and ammonia emissions (Ojha et al., 2021; Awobusuyi et al., 2020; Stull & Patz, 2019; Köhler et al., 2019).

Insects have an excellent nutritional profile, not only due to their rich content of protein sources but also for their alignment with sustainable, healthy, affordable, and palatable dietary principles (Prabhu, 2018; Nowakowski et al., 2021; Ruzengwe et al., 2022).

The production, commercialization, and regulation of edible insects as food and feed involve multiple regulatory bodies responsible for ensuring product safety, quality, and environmental sustainability (Wade & Hoelle, 2020; Montanari et al., 2021; Guiné et al., 2021; (Usman & Yusuf, 2020).Consumer acceptance is likely tied to effective processing techniques, such as extracting and refining insect proteins for use as food additives Developing a standardized protocol for insect protein processing is challenging due to species-specific differences, including size, life cycle, reproduction, protein content, digestibility, and amino acid availability (Stull & Patz, 2020). This review, therefore, aims to examine and assess the health risk by eating insects and legislative documents.

Objective of the scientific review

This Scientific review aims to summaries the most recent scientific literature on Entomophagy of edible insects, in Europe and south Africa regarding their potentiality to

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reach food safety as well as legislation processes in both regions, taking into consideration populations acceptance of those regions, as well as highlighting the potential chances and challenges of adopting such an innovative and unique food pattern.

Edible insects' protein bioavailability

Insects' high protein level is making it more appealing and interesting for the human consumption. However, there are some already acquired information and studies that they have also a sufficient content of lipids and other nutrients that are essential for the dietary intake of a human being (Ojha et al., 2021; Awobusuyi et al., 2020). Animal studies concerning feeding have provided lots of evidence that demonstrated a high biological value of protein in edible insects. A study was conducted on rats where two groups of rats were assigned to divergent source of proteins compared to standard chow as a control group in 28 days diet trial. The first group of rats was assigned to giant grasshopper (Zonocerus vagiegatus) compared to cray fish and soy-beans diets (Ojha et al., 2021). To evaluate food efficacy ratio, protein efficacy ratio and weight gain in general. After evaluation the values were compared to the standard chow on the same protein intake and calorific basis. 80- 100% higher weight gain, food efficacy ratio and protein efficacy ratio were resulted in giant grasshopper when compared to chow standard. Moreover, the giant grasshopper protein showed superiority also against the second group of the study that was assigned on soybeans and crayfish diet, when the weight gain, food efficacy ration and protein efficacy ration were measured (Ojha et al., 2021).

Research and policy priorities for edible insects in Asia, Africa and Europe

As was previously mentioned that sustainable alternative of animal protein replacement with insects showed superiority in protein bioavailability (Ojha et al., 2021). in Asian and African countries this diet already adopted, since this pattern of diet is and was a big part of the culture in these countries, that makes it easier to observe and integrate it on a satanized level in the local markets. For example, the government ministries operate under common nation acts in south Africa, the studies have concluded that in south Africa is conductive in the promotion of edible insects (Niassy et al., 2018). However, it's still not clear if European food market will adopt such nutrition way, since the technological, ecological, economical, health related aspects should be clear and safe when it comes to standardization of a food product on a European market (Skotnicka et al., 2021). From the technological point of view the methods of farming, breeding, preparing insect for end consumers, packaging techniques, distribution and sales plans need to be provided since the economical prerequisite are especial to be provided and adopted, since it should provide adequate amount of food of a required quality and efficiency, that is in most of the cases very difficult to achieve and to make clear before the big machine of European Bureaucracy chicks off. And the finally are the costs and their effectiveness, that could tur out into a big problem to bring such farm in a European marketplace (Stull & Patz, 2020).

Edible insects as future food: chances and challenges

Like every phenomenon edible insect has also its pros and cons, the pros of this phenomena are nutritional values of insects, environmental sustainability as well as economic benefits, on the other hand the cons are concerns about the safety of food, as well as the acceptance of end costumers to adopt edible insects as a nutritional solution in their daily food intake (Lange & Nakamura, 2021).

Nutritional values

Many studies have shown that insects could be considered as a high nutritious source of food (Ojha et al., 2021) it contains high amount of protein, fat profile and other minerals, the variation of the content depends on the species. However, the nutritional value might change even within the same group of the species, due to many factors such as environmental context such as climate, as well as metamorphic stage where during the developmental changes of a certain species can significantly change its nutrition value and of course the diet of species can play a big role on its content (Lange & Nakamura, 2021). The amount of fat in insects is about 2% to 63% precents. However, the fatty acid profile is comparable and quite like vegetable oils and animal fats, 75% precents of total fatty acids content are unsaturated "good" fatty acids. The finally about fats omega-3 polyunsaturated profile was reported as like fish. As well as the evidence has shown that edible insects can provide good amounts of different water-soluble vitamins, such as Magnesium that was found in crickets and locusts. As well as in a comparison to beef insects in specific grasshoppers and mealworms have shown superiority when it came to Magnesium, Copper and zinc amounts (Ojha et al., 2021).

Food security

Food security is parameter that is tangible with the availability of food its affordability as well as the even distribution is also a metric of food security. Edible insects are one of the suggested solutions from Food and Agriculture Organization (FAO) of the United Nations Due to its availability once needed, affordability and high nutritious value (Imathiu, 2020).

Economic benefits

Edible insects are a potential solution that could provide and economical and environmental advantages. Due to their sustainability and environment friendly nutrients source than other animals like mammal for example (Prabhu, 2018). For example, feed to meet conversion benefit, insects can convert plant-based protein to insects' protein much faster than mammals. When it comes to sustainability insects the advantage of edible insects is that they can be reared on organic side streams, including human and biological wastes. It's also important to mention that this fact makes the farming of insects more profitable. Another environmental economic benefit edible insects can provide is decreased water consumption, sine land and farm productivity are totally dependent on water. Meat production requires large quantities of water. The estimated water volume that is needed to produce 1 kg of meat are 2 300L. The edible insects can affect also the transmission of zoonotic infections to the humans. Since a wide variation of domestic and wiled Carriers from animal species can carry different pathogens like viruses, bacteria and other parasites. Multiple studies were provided to foodborne pathogens, however very minimal amount of data is provided about the edible pathogens regarding this kind of aspect. Further research is required to compare and estimate foodborne pathogens in livestock comparing to the edible insects (Ojha et al., 2021).

Food safety Issues

As any other potential food product edible insects have also disadvantages, the safety of this food source could be influenced by the species of the insect, the stage of harvest, the food of the insect as well as farming conditions (Van Der Fels-Klerx et al., 2018). Immunology shows that every protein containing food can cause allergic reaction. So thus,

arginine kinase, α-amylase and tropomyosine that could be found in edible insects can be considered as allergens (Ribeiro et al., 2021). It's quite important to identify the potential allergens, since the evidence has shown there is a significant number of people who are at risk of developing allergies while consuming crickets and mealworms. Another important fact to mention although there not enough evidence of food safety and allergy related insects, almost a fifth of fatal reactions to food in China were reported as a result from insect consumption (Ojha et al., 2021).

Consumer acceptance of edible insects

The strategies of consumption promotion of edible insects in high income courtiers needs to overcome the factor of disgust and prejudice, to achieve that, securing the food safety could play a role in changing this perception, so it could be promoted easier in the Western part of the globe. Also, further information about environmental benefits could play role in promotion of entomophagy in those countries (Ojha et al., 2021).

Future directions

There are future measures that need to be considered and studied in depth, before adopting edible insects into the food market, such as the environmental impact and sustainability of farming and rearing, harvesting, theses aspects need to evaluate compared to the traditional farming and livestock raising. as well as nutritional values and potential benefits and values of various edible insects' species (Ojha et al., 2021). Another important aspect to study in-depth is a socio-economic aspect and precise, significant benefits that could be achieved on evaluation of food security in low-income settings (Imathiu, 2020). Furthermore, comprehensive legal frameworks at national and international levels in regards of production and promoting edible insects' products are required to secure and show the necessary investment concerning business (Skotnicka et al., 2021).

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