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Insect Alternative Protein Market in China: Current Status and Future Development Pathways

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Abstract:

As the global population grows, the demand for edible meat is expected to rise. However, traditional livestock farming presents numerous challenges. So alternative proteins emerge as a solution to these issues. This paper analyzes the technological advancements of insect processing and the current status of insect protein market. The processing attaches importance to protein extraction for a superior yield ratio and flavor improvement, which effectively influences consumers' acceptance. Given that there is no existing regulation or law for insect alternative protein in China, the paper chooses a document from the European Union as a reference. China's long history of consuming insects provides a favorable environment for the growth of this market. Future development pathways, including the addition of insects to daily recipes, the application of insect-based therapy, and government support, are proposed in this passage. Through these initiatives, insect proteins have the potential to gain wider acceptance and application in the Chinese market.

Keywords: Insect alternative protein; Commercialization; Current status; Predicted development paths.

1. Introduction

The world population reaches 8 billion and is expected to surpass 10.3 billion by the mid-2080s [1]. As a result, the demand for edible meat is likely to rise in the future. However, traditional stock farming brings an array of issues that cover the range of greenhouse gas emissions, social cost, and ethical problems [2]. Alternative protein becomes a substitute for traditional meat in response to these problems.

Plant-based protein is one of the most popular choices, including beans, chickpeas, soy, and so on. Although it is evident that plant-based protein is more environmentally friendly than meat, the taste derived from raw materials is a significant factor hindering its widespread acceptance [3]. Cultivated meat also receives high attention from the academic field. Since it is in early-development stages, there is limited information to prove that cultivated meat is able to reduce environmental impact and be safe enough, resulting in a long way for its commercialization [4]. Insect protein could be an alternative to mainstream

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staples, since it contains healthy, nutritious proteins and provides a more sustainable and durable production process [5].

China has a specificity in opening up a market for insect protein, providing a catalyst for better consumer acceptance. The tradition of eating insects can be traced back 3000 years. In addition, insects are viewed as a source of traditional Chinese medicine [6]. According to the Food and Agriculture Organization (FAO), the species of insects that are eaten in China are up to 300. Given that China provides an advantageous environment for the insect protein market, the Chinese insect protein market is recognized as having great potential. For the Chinese insect alternative protein market, a multifaceted and well-rounded overview is of great necessity. Currently, there is no professional document that specifically researches the Chinese insect protein market. This paper aims to analyze the technological progress and market potential of insect-based proteins in China by reviewing extraction, flavor improvement, and regulatory progress. In addition, this paper points out several possible pathways for future development in the Chinese insect protein market.

2. Technical and Commercial Achievements

Compared with other types of alternative proteins, insect proteins have several unique advantages. First and foremost, insects have been a traditional food source in many regions, especially in Latin America and Asia [7]. Second, the level of greenhouse gas emissions is much lower than traditional livestock farming [8]. Plus, insects offer essential amino acids, which plant-based proteins lack [9]. What's more, the health benefits of eating insects are obvious. It offers functions of antihypertensive, antidiabetic, antioxidant, and anti-inflammatory properties [10]. Last but not least, having insect protein is a global trend that is advocated by FAO.

2.1 Extraction

Before extracting protein molecules from insect raw material, it is necessary to remove lipids. N-hexane, Petroleum, and ethanol are common organic solvents for lipid removal. Each solvent specializes in particular insect species, and they have their advantages and drawbacks in defatting [10]. For protein extraction, pulsed electric fields (PEF) are one of the methods to improve protein yields. With PEF treatment in 4.90 kJ/kg, this non-thermal technology increases the extraction yields of protein (>18%), which reveals the possibility of using PEF in large-scale production [11]. Up to now, wet fractionation is a major protocol for insect protein extraction, which mainly contains alkaline solubilization, salt solubilization, and ultrasound extraction [10].

2.2 Flavor Improvement

As a study shows, insects and insect-based protein are more likely to be evaluated negatively, since they are generally associated with odor and flavor/taste attributes that are related to old/spoiled food. In order to improve the flavor of insects and insect-based protein, defatting is an effective way to make these products easier for consumers [12]. The strategies are mentioned above, applied before protein extraction. The earthy flavor of insect protein is a serious barrier to its food application. Kora et. al used two peptidase preparations (Flavourzyme1000L and ProteaseA "Amano"2SD) to enzymatically hydrolyze insect proteins of cricket Acheta domesticus and mealworm Tenebrio molitor larvae. Then, they added Xylose to facilitate Maillard reactions. They eventually found that this method enables insect protein to have more complex and savory-like taste profiles [13].

2.3 Monitoring Regulation

A new proposal was approved by the European Union on 10 February 2025. Commission Implementing Regulation (EU) 2025/89 of 20 January 2025 authorized the placing on the market of UV-treated powder of whole Tenebrio molitor larvae (yellow mealworm) as a novel food and amending Implementing Regulation (EU) 2017/2470C/2025/172 regulated the condition of insect proteins for food. The regulation seriously requires producers of insect food to clearly label the source of insects and allergy risks. In addition, the definition: the ultra-violet (UVB) light treated powder obtained from whole, thermally treated and ground Tenebrio molitor larvae (yellow mealworm) rigidly limited the range of the application of the new regulation [14].

3. Chinese Insect Protein Market

3.1 The Policy of Insect Protein Market

In some Chinese provinces, eating insects is a custom. Therefore, the acceptance of edible insects is comparatively higher in China than in Western Countries [15]. However, the distribution channel of edible insects is actually narrow, which only concentrates on the traditional catering industry. Most corporations that have an interest in the insect protein market develop animal forage and pet food. For now, the Chinese government attaches great importance to reforming consumers' views of food.

Therefore, it is of great significance for them to research and develop alternative protein industry. The government of Pingu District, Beijing Municipality, attempts to form an industrial system, 3+X. The number "3" refers to three categories of alternative protein: plant-based protein, microprotein, and cultivated meat. And X means other alternative protein, containing synthetic protein and insect protein. The government aims to create an advantageous bio-manufacturing platform for alternative protein. It can ensure that the resources and technical advantages of the Agricultural Zhongguancun Center for Alternative Proteins are entirely used [16].

3.2 Current Industry

Jiminis is a French Corporation that produces insect-based foodstuffs, mostly offering snacks made from insect raw material. Recently, the company attempts to research and develop a new form of insect protein called Insteak. They designed Insteak to be shaped two ways: as a patty, like a traditional burger, or into meatballs. Here are the steps to follow: open the pouch, rehydrate the mix with hot water, and then let it rest for about 15 minutes to achieve the perfect texture. After that, get hands-on and form the mix [17]. Additionally, an enterprise, Protix, focuses on insect feeding and farming applications. With the help of the little black soldier fly, this firm is devoted to transforming a linear food system, which causes plenty of food waste, into a circular system of renewal. For instance, organic waste from industry becomes the feed for insects. In turn, insects are used as feed for animals [18]. Applying insects to animal feeding and farming is a trend to help reduce greenhouse gas emissions. Similarly, there is a firm in China devoted to making forage with little black soldier fly. Blueprotein was set up in 2024. However, the entrepreneur has prepared for this career for many years. It is evident that the basic market structure of the insect-based protein industry is established, but there is a long path to converting insects from forage into human food.

Until now, only Bugsolutely has considered the potential of silkworms, and the company has launched the first silkworm snack in China in 2018, called Bella Pupa, as Fig. 1 [19]. Alternatively, as Fig. 2, Muji started to sell cricket crackers on 20 May 2020 [20].

Fig. 1 Bugsolutely's Bella Pupa [19]

Fig. 2 Muji's cricket crackers [20]

4. Prediction on Future Development Pathways

4.1 Recipe

A nice pairing of foods, combining insect protein with other types of food, can enhance customer acceptance of insect protein [21]. According to Ahn et al., compared with American cuisine, Asian cuisine tends to have more distinct chemical compounds in ingredient pairs [22]. Through this rule, an insect-based recipe can be created. Insects mostly contain proteins, fats, and chitin. To balance nutrition and enhance the flavor of cuisine, adding Starchy foods and vegetables as side dishes to insects is relatively considerable. Making an insect-based recipe is an effective way to integrate insects into daily meals. Nevertheless, the dietary habits of the Chinese should be taken into account. Current cuisines of insects are associated with a salty taste, so the salty insect foods, such as fried silkworms, might be better accepted than sweet-taste ones, like cricket cakes. What's more, the visibility of insects affects consumers' attitudes. The powder of insects is more accepted than the bits. When editing the recipe, the writer should try to increase the level of processing.

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4.2 Medicative Diet for Food Therapy

Edible insects are widely used in traditional Chinese medicine, so developing a medicative insect-based diet is a feasible method to incorporate insects into ordinary meals. According to traditional Chinese pharmacology, insects are a common material used in therapy. For instance, crickets, Ophiocordyceps sinensis, and Periostracum Cicadae are applied to medicine making. Several bioactive properties including antihypertensive, antidiabetic, antioxidant, anti-inflammatory and anti-obesity properties are also the obvious advantages of edible insect medicine. Research testing the performance of rats fed insect meals from Tenebrio molitor L reveals a significant impact of insect meal on lowering the plasma and liver lipid concentration. The insect meal reduced methionine content, which exhibits a strong hyperlipidemic action. Meanwhile, the concentration of homocysteine in plasma and liver decreased by 25%-30%, lowering the risk of hyperlipidemia. These factors indicate that insect alternative protein certainly contributes to anti-obesity therapy [23]. What's more, there is an experiment on the Ferric-reducing power (FRP), one of the main indices of quantifying oxidation resistance of food samples, of different incest protein processing modes. The FRP of the reactant that goes through hydrolysates processed from the fixed and sweep frequency ultrasonication treatment is 1.49 ± 0.04 [24]. In this way, a proposal to establish a restaurant in cooperation with the Traditional Chinese Medicine Hospital is feasible. The restaurant can offer special dishes for hypertensives and diabetics, using particular medicable insects as raw material. Additionally, insect-based medicative dishes also have a niche market in the health industry. The dishes are highlighted by their function of keeping people healthy and fit. With an aging population, the healthcare industry gradually becomes stronger, so the idea of an insect-based medicative diet for food therapy is very possible to achieve success.

4.3 Political Support

Since firms gather in the forage and pet food industry, it is necessary to bridge the gap between animal feeding insect products and human eating insect products. This process needs the help of the Chinese government and its policy. Firstly, making a nationwide market standard for the selling of edible insects is of great significance. The market standard can use the European Union's standard for Tenebrio molitor larvae. Secondly, the government should give a subsidy to the edible insect companies. The financial support covers at least 40 percent of the initial capital of the companies. Accordingly, the subsidy enables the supply curve of edible insects to move downward so thereby increasing the equilibrium quantity of edible insects. Last but not least, the government should promote the progress of technologies for processing edible insects. To encourage progress, the government needs to set up a specialized laboratory for the research of edible insects.

5. Conclusion

At present, the processing technology of insect-based alternative protein is relatively mature, but there is still room for improvement in protein extraction and flavor enhancement. For protein extraction, PEF technology greatly increases the yield of insect protein. Considering the factors such as cost, scale, and complexity, it is conclusive that PEF is comparatively efficient and could be used in future industrial production. To enhance the flavor of insect meal, de-fatting is a useful strategy. Additionally, traditional cooking methods and applying xylose to promote the Maillard reaction after enzymatically hydrolysis have been researched by predecessors. Due to its unique dietary habits and vast population, China can be regarded as one of the most promising markets for insect-based alternative protein. The properties of insect protein, like antioxidative and anti-obesity potential, provide a possibility for ways of its commercialization. During this process, there are some crucial details worth mentioning. Salty-taste insect meals will be better accepted than those with a sweet taste; besides, the visibility of the insect bit will affect consumers' willingness to eat. The future development of the insect-based alternative protein market in China can be achieved by integrating it into the dietary structure, developing its medicinal value, and transforming it from forage to food. This not only requires strong policy support but also the promotion of the integration of insect-based alternative protein into the diet.

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