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Exploring the Potential of Alternative Protein Sources for Barbecue: Insects, Plant-Based Options, and Cultured Meats

Lim LWK*

Faculty of Resource Science and Technology, Universiti Malaysia Sarawak, Malaysia

***Corresponding author:** Leonard Whye Kit Lim, Faculty of Resource Science and Technology, 94300 Kota Samarahan, Sarawak, Malaysia, Email: limwhyekitleonard@gmail.com

Mini Review

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Abstract

Traditional barbecue has relied heavily on animal-based proteins such as beef, pork, and poultry. However, the environmental impact and ethical concerns associated with conventional meat production have led researchers and food enthusiasts to explore alternative protein sources. This research review highlighted three main categories of alternative proteins: insects, plant-based options, and cultured meats. This mini-review would examine the feasibility of incorporating insect-based ingredients into barbecue recipes and evaluate their acceptability in terms of taste, texture, and consumer perception.

Keywords: Insect Proteins; Plant-Based Proteins; Cultured Meats; Alternative Proteins

Introduction

The global food industry is undergoing a significant shift as consumers increasingly seek sustainable and ethical alternatives to traditional meat products. This growing demand for alternative protein sources has paved the way for innovative research and development in the realm of barbecue. This mini-review aims to investigate and evaluate the viability of incorporating insects, plant-based alternatives, and cultured meats into the realm of barbecue.

Barbecue, a beloved culinary tradition across cultures, has long relied on animal-based proteins for its succulent and smoky flavors. The traditional practice of barbecue has long been centered around animal-based proteins such as beef, pork, and poultry. However, concerns over environmental sustainability, animal welfare, and personal health have driven researchers and food enthusiasts to explore alternative protein sources. This review seeks to explore the potential of three distinct categories of alternative protein sources: insects, plant-based options, and cultured meats.

Insects have gained attention as a sustainable protein source due to their low environmental footprint, high nutritional value, and potential culinary applications. By examining the feasibility of incorporating insects into barbecue recipes, this review aims to shed light on the potential flavor profiles, sensory attributes, and consumer acceptance of insect-based barbecue products.

Plant-based options, such as soy, peas, mushrooms, and grains, offer a diverse range of protein alternatives suitable for barbecue. These plant-based proteins have made significant advancements in terms of texture, flavor, and nutritional composition. Through an exploration of plant-based barbecue products, this review aims to assess their sensory characteristics, nutritional profiles, and consumer perception.

Cultured meats, also known as lab-grown or cell-based meats, involve the production of meat products from animal cells grown in a lab setting. This emerging technology holds promise for revolutionizing the barbecue industry by providing sustainable and ethical meat alternatives. This review aims to investigate the application of cultured meat technology in barbecue cooking, examining the texture, flavor, and structure of cultured meat products for barbecue.

By delving into the potential of these alternative protein sources, this review seeks to contribute to the advancement of barbecue cuisine while addressing the challenges and opportunities associated with incorporating insects, plant-based options, and cultured meats. Ultimately, this exploration aims to pave the way for a more sustainable, ethical, and diverse future for barbecue, catering to the evolving preferences and values of consumers.

Insect-Based Proteins for Barbecue

Insects offer a sustainable and nutritionally dense protein source that has been consumed by humans for centuries in various cultures around the world. With their high protein content, amino acid profiles, and low environmental footprint, insects present a compelling option for diversifying the barbecue landscape. Insects, such as crickets, mealworms, and grasshoppers, have gained attention as a sustainable protein source due to their low environmental footprint and high nutritional value.

Recently, the Singapore Food Agency (SFA) has approved sixteen insect species such as giant rhino beetle, mealworm, grasshopper, silkworm, house cricket as well as the European honey bee for human consumption in the last half of 2023 [1]. Interestingly, on average, the protein content of edible insects ranges up to a quarter of fresh weight as well as up to 60% fry weight [2,3], which are surprisingly higher than that of their plant-based protein counterparts such as lentils, cereal and soybeans [4]. Table 1 summarises some of the edible insect-based protein products that are feasible for barbecue.

Insect-based food for barbecue	Elaborations
Cricket protein	Crickets are one of the most popular and widely available insect protein sources. Cricket powder or cricket protein isolate can be used as a base for making insect-based barbecue products like burgers, sausages, or kebabs.
Mealworm protein	Mealworms are another commonly used insect for human consumption. Mealworm protein can be used in various barbecue dishes, such as meatballs, skewers, or even as a coating for grilled vegetables.
Buffalo worm protein	Buffalo worms, also known as mini-mealworms, are rich in protein and can be used as a meat substitute in barbecue recipes. They can be used to make burgers, sliders, or marinated skewers.
Grasshopper protein	Grasshoppers are another edible insect that can be used to create protein-rich barbecue dishes. They have a slightly nutty flavor and can be used in recipes such as grilled skewers, tacos, or even as a topping for salads.
Silkworm pupae	Silkworm pupae are commonly consumed in certain cultures and are known for their high protein content. They can be grilled or roasted on the barbecue and used in recipes such as stir-fries, kebabs, or as a crunchy topping for salads.
Black soldier fly larvae protein	Black soldier fly larvae are nutrient-dense and have a mild, nutty flavor. They can be used to make insect-based burgers, sausages, or grilled as skewers. The high fat content in black soldier fly larvae makes them suitable for creating juicy barbecue dishes.
Ant protein	Certain ant species, such as leafcutter ants, are consumed in certain cultures and can be used as a protein source for barbecuing. Ants can add a unique flavor profile to barbecue dishes and can be used in marinades, rubs, or as toppings for grilled meats or vegetables.
Beetle larvae protein	Beetle larvae, such as mealworm beetle larvae or waxworms, can be used as a protein source for barbecue recipes. They can be grilled or roasted and used in dishes like sliders, tacos, or as a crunchy addition to barbecue sides.
Cricket flour-based products	In addition to using whole cricket powder, cricket flour-based products like cricket flour-based burger patties, sausages, or meatballs are available in some markets. These products provide a convenient and easy way to incorporate insect protein into your barbecue without the need for additional preparation.
Cicada protein	Cicadas are large insects that emerge periodically in certain regions. They can be harvested and used as a protein source for barbecuing. Cicadas have a unique flavor and can be marinated, grilled, or roasted whole to create a crunchy and protein-rich barbecue snack.

Locust protein	Locusts are another edible insect that can be used for barbecuing. They have a mild flavor and can be incorporated into various barbecue recipes, such as grilled skewers, stir-fries, or even as a topping for pizzas or flatbreads.
Fly larvae protein	Different types of fly larvae, such as house fly larvae or soldier fly larvae, can be used as a protein source for barbecuing. They can be seasoned, grilled, or roasted and used in recipes like burgers, tacos, or as a filling for stuffed vegetables.
Bee larvae protein	Bee larvae, also known as bee brood, can be harvested sustainably and used as a protein source for barbecuing. They can be added to marinades, grilled, or used as a protein-rich topping for salads or grilled vegetables.
Silkworm larvae protein	Silkworm larvae, also known as silkworm pupae, can be used for barbecuing as well. They have a rich and nutty flavor and can be grilled, roasted, or used in stir-fries and barbecue dishes.
Mopane worms	Mopane worms are a popular edible insect in certain African countries. They are the caterpillar stage of the emperor moth and can be used for barbecuing. Mopane worms can be marinated, skewered, and grilled to create a flavorful and protein-rich barbecue dish.
Palm weevil larvae	Palm weevil larvae, also known as sago grubs, are commonly consumed in Southeast Asian cuisine. They can be grilled or roasted and used in barbecue recipes like skewers, grilled wraps, or added as a protein element to grilled salads.
Waxworm protein	Waxworms are the larvae of wax moths and can be used as a protein source for barbecuing. They have a mild flavor and can be grilled, marinated, or used as a filling for stuffed vegetables or grilled sandwiches.
Dragonfly larvae	In certain cultures, dragonfly larvae are consumed and can be used for barbecuing. They can be seasoned, grilled, or added to marinades and used in recipes like grilled seafood skewers or as a protein addition to grilled vegetables.

Table 1: Insect-based proteins feasible for barbecue.

Plant-Based Proteins for Barbecue

Plant-based options, including products made from soy, peas, mushrooms, and other plant sources, have seen significant advancements in recent years. The development of plant-based barbecue products, such as burgers, sausages, and skewers, have been long established in terms of their sensory attributes and nutritional profiles to ultimately satisfy consumer demand and preferences.

SFA had established a novel food regulatory framework that necessitates the food industry players to conduct pre-market assessment for novel food like the alternative protein products that is not pre-dominantly consumed as food) [5]. An interesting systematic review performed by Romão B [6] compared the nutritional profiles of commercialized plant-based meat. As a result, they discovered that the carbohydrate content of these products is higher than that of their protein counterparts. Besides, they also found out that the sodium concentrations within these meat substitute products are present in excessive amount and thus they suggested sodium-free alternatives as a solution to the concern of high sodium intake by the consumers, especially during barbecue dining. Table 2 presents the plant-based food suitable for barbecue dining.

Plant-based food suitable for barbecue	Elaborations
Tofu	Firm or extra-firm tofu is a versatile protein source that can be marinated, grilled, and added to barbecued dishes. It absorbs flavors well and can be sliced into steaks or cubed for skewers.
Tempeh	Made from fermented soybeans, tempeh has a firm texture and nutty flavor. It holds up well on the grill and can be marinated or seasoned before grilling. Slice it into slabs or cubes for grilling or use it as a patty for burgers.
Seitan	Also known as wheat gluten, seitan has a meaty texture and can be seasoned and grilled to mimic the taste and texture of meat. It works well in kebabs, skewers, or as a burger patty.

Portobello mushrooms	These large, meaty mushrooms make a fantastic plant-based option for grilling. Remove the stem and marinate them before grilling them whole or in slices. They can be used as burger patties or as a filling for sandwiches.
Veggie burgers	Numerous brands offer plant-based burger patties made from ingredients like black beans, lentils, quinoa, or vegetables. Choose a brand that suits your taste preferences and grill them according to the package instructions.
Veggie skewers	Create delicious skewers by combining various vegetables like bell peppers, zucchini, onions, cherry tomatoes, and mushrooms. Brush them with marinade or olive oil before grilling.
Jackfruit	Young green jackfruit has a texture similar to pulled pork when cooked. It can be seasoned with barbecue sauce and grilled for a tasty vegan alternative.

Table 2: Plant-based food suitable for barbecue.

Cultured Meat Proteins for Barbecue

Cultured meats, also known as lab-grown or cell-based meats, involve the production of meat products from animal cells grown in a lab setting [7]. This review covers the application of cultured meat technology to barbecue, exploring the development of cell-based alternatives to traditional barbecue meats. We would address technical aspects such as texture, flavor, and structure of cultured meat products suitable for barbecue cooking.

Cultured meats, especially cultivated seafood, can be used to produce seafood products from unbreedable, seasonal, and high value seafood that are on the brink of extinction, such as unagi, groupers, striped catfish, salmon, empurau fish and turbot [8-10]. Interestingly, some of the cultivated seafood products do not even involve the killing of a whole organism, instead it can be obtained from fibroblast, scale or tailfin of the seafood species as starting materials. Table 3 summarizes some of the popular cultured meat products feasible for barbecue dining.

Cultivated meat food suitable for barbecue	Elaborations
Cultured Beef or Pork Patties	Cultured meat can be processed into patties suitable for grilling. These patties can be seasoned, shaped, and grilled like traditional meat patties, allowing you to create burgers or sliders on the barbecue.
Cultured Chicken Skewers	Cultured chicken can be grown and processed into small pieces suitable for skewering. These can be marinated or seasoned, placed on skewers with vegetables, and grilled on a barbecue to create flavorful kebabs.
Cultured Sausages	Sausages are a popular choice for barbecuing, and cultured meat can be used to create sausage-like products. They can be seasoned with spices and herbs, placed on the grill, and cooked until browned and cooked through.
Cultured Meat-based BBQ Ribs	Although recreating the complex texture of traditional ribs using cultured meat is currently a challenge, it is a possibility that future advancements may make it feasible. Cultured meat-based ribs could be marinated in barbecue sauce and grilled to create a similar experience to traditional barbecue ribs.
Cultured Steak	As the technology progresses, it may become possible to produce cultured meat that closely resembles traditional steaks in terms of texture and marbling. These cultured steaks could be seasoned, grilled, and served as a centerpiece on a barbecue.
Cultured Lamb Chops	Similarly, cultured lamb chops could be created with the right advancements in cell-based meat production. These chops could be marinated, grilled to perfection, and enjoyed as a flavorful option on the barbecue.
Cultured Turkey Burgers	Cultured turkey meat can be formed into patties suitable for barbecuing. These burgers can be seasoned, grilled, and served as a leaner alternative to beef patties.
Cultured Seafood	While not traditional for barbecuing, cultured seafood options like shrimp or fish could be developed to withstand grilling. These products could be marinated or seasoned and cooked on a barbecue for a unique twist on seafood grilling.

Cultured Pulled Pork	Pulled pork is a popular barbecue dish, and cultured meat could be used to create a plant-based alternative. Cultured pork can be shredded and marinated in barbecue sauce, then grilled until heated through and slightly charred.
Cultured Meat-Based Meatballs	Cultured ground meat can be shaped into meatballs that can be grilled on skewers or directly on the barbecue. These meatballs can be served with barbecue sauce or incorporated into various barbecue recipes.
Cultured Game Meat	Cultured meat technology can also be used to recreate the flavors and textures of game meats like venison or wild boar. These cultured game meats can be grilled and enjoyed as a unique and flavorful addition to your barbecue menu.
Cultured Lobster Tails	Cultured lobster meat can be harvested and formed into tail shapes. These lobster tails can be seasoned, grilled, and served with melted butter for a luxurious and indulgent barbecue experience.

Table 3: Cultured meat products suitable for barbecue.

Conclusion

Overall, this review seeks to broaden the understanding of alternative protein sources for barbecue and assess their potential as sustainable, ethical, and flavorful options. By exploring insects, plant-based alternatives, and cultured meats, we aim to contribute to the advancement of barbecue cuisine while addressing the challenges and opportunities associated with alternative protein production and consumer acceptance [11].

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