Scholar of Tomorrow

Plant-Based Artificial Meat Product for the Elderly

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Abstract

The purpose of this research is to create a form of plant-based artificial meat that is beneficial to the health of elders. Currently, many meat products in the market for elders are unhealthy as they often contain high levels of sugar and calories. Furthermore, animal meat has become more and more difficult to produce due to its requirement for large areas of pasture, animal feed, and the harmful methane that the production process releases into the atmosphere. Therefore, this research aims to create plant-based artificial meat that contains abundant nutrients for elders and is much more environmental-friendly to produce. We first conducted an online survey and a series of interviews with elderly populations on their preferences and opinions for plant-based meat and traditional meat. The results show that plant-based artificial meat has a large potential market, and that many elders are willing to accept plant-based artificial meat. After analyzing the results, we proceeded to prepare plant- based artificial meat. In order to make this type of meat, our group focused on a variety of proteins such as soy protein isolate. We further added gels and soy sauce, and most importantly, the unique ingredient arabinose that is not found in traditional meat. Arabinose is a type of sugar that can reduce the risk of endocrine diseases, type 2 diabetes, and many other health conditions that are commonly found in elderly populations. The general steps for producing our plant-based artificial meat are by adding and mixing the ingredients and then putting them into a mold which makes the meat similar to a burger patty. We also conducted a series of lab tests which determined that the product is safe and contains adequate amounts of nutrition, followed by a taste test to see if our product will be accepted by the elderly population. The results show that out plant-based artificial meat contain more protein and energy compared to beef, and have lower amounts of substances that might be

harmful to the health of elders, such as sodium and cholesterol. Our project created a plant-based artificial meat that contains special health benefits to elders and is faster and more environmental- friendly to produce.

Keywords: Plant-based artificial meat, elderly populations, soy protein isolate, arabinose

1. Introduction

1.1 Project Review

Many elderly people may develop diseases as they age, including hypertension, diabetes, hypercholesterolemia, amongst other diseases. Yet, most food products in the market are not healthy for them as they contain high levels of sodium(salt), sugar, oil, calories, etc. They may also suffer from nutritional deficiencies and degeneration of the digestive system that leads to decreased function and efficiency which makes digesting meat difficult for them. Some older members in our own families suffer from the same conditions, which inspired us to address this issue by creating a special food that tailors to their needs. Our goal is to create a plant-based meat product that suits the tastes of the elderly population while also satisfying their nutritional needs.

1.2 Literature Review

1.2.1 The Plant-Based Meat Market and Consumer Choices

The global plant-based meat market is estimated to be at 12.1 billion USD according to a study by “Markets and Markets", and is expected to grow at a compound growth rate of 15% per year[1]. In addition, China is the world’s largest consumer of pork and pork-related products, which renders it a promising market for meat alternatives in the future due to increasing environmental and nutritional pressures.

In a study based in Wuhan, consumer choices are determined mainly by the price, taste, flavoring, and technical risks of the plant-based meat product. In a study by Zhang M, Li L, Bai J in 2019 with a sample space of 1009 people from Beijing, Qingdao, and Tai’an, only 12% of the

interviewed population claimed to support artificial meat, with 50% neutral and 22% against it. However, after the participants read related information about artificial meat, more than 45% of the interviewed population claimed to support the industry, and more than 70% of the interviewed population were willing to try and purchase related products[2]. This shows the Chinese consumers' acceptability of plant-based meat and the promising market for plant-based meat both globally and in China.

1.2.2 The Nutritional Effects of Plant-Based Meat and its Components

Overall, the nutritional value of plant-based meat is equivalent or even better than that of its meat counterparts. In a metabolomics comparison of plant-based meat and grass-fed meat, it is revealed that the plant-based meat alternative is complementary in terms of provided nutrients, and some metabolites were found exclusively or in greater quantities in the plant-based meat alternative[3]. On the other hand, red meat, especially processed meat, are associated with health issues often found in elderly populations, such as type 2 diabetes, cardiovascular disease, and certain cancers[4]. From a macro perspective, the nutritional effects of plant-based meat surpasses red meat.

As seen in Figure 1, Quorn and Impossible (two brands that sells plant-based meat) have significantly lower levels of cholesterol, total fat, and calories compared to beef, pork, and chicken. Moreover, Quorn and Impossible have significantly higher or equivalent amounts of protein, vitamin B12, dietary fiber, sodium, iron, and zinc, nutrients that are needed in elderly populations. Thus, it can be concluded that plant-based meat provided equivalent if not more

nutrients than animal meat, yet is low-fat, low-cholesterol, and low-calorie compared to animal meat, making it a healthier option.

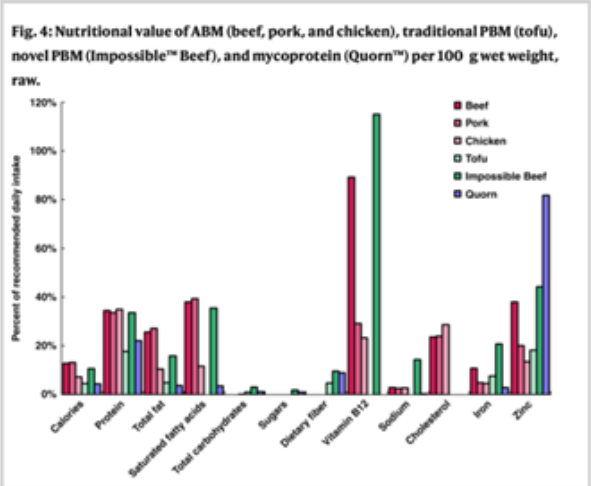

Figure 1: The Nutritional Values of Different Types of Animal Meat and Plant-Based Meat[5]

On a micro scale, plant-based meat provides nutrients such as protein, fats, vitamins, fiber, etc. In general, plant-based meat for elderly populations should have low levels of fats, sugars, and salts, and high levels of vitamins, calcium, iron, etc[6]. Elderly populations also need to have a balanced amount of potassium and sodium ions[7]. The recommended nutrient intake (RNI) can also be a reference material when considering the nutrient intake of elderly populations and the nutrients of the artificial meat[8].

There are many types of proteins, namely soy protein, pea protein, fungal protein, and wheat protein. Fungal protein is not necessarily meat derived protein, but functions similarly as a protein. It can lower cholesterol levels, and is beneficial for the environment[9].

Soy protein has abundant amounts of amino acids and has an equivalent nutritional value as protein found in animal meats. In addition, soy protein can also lower cholesterol levels, blood

lipids, increase insulin sensitivity, inhibit inflammatory responses, improve intestinal environment, and play a moderately beneficial role in bones[9]. It also functions well during food processing, rendering it an essential component in plant-based meat products. Soy protein isolate (SPI) is often used in the food industry[10]. Due to these benefits, many findings shows soy protein as the major and even sole source of protein for plant-based meat[11]. A drawback of soy protein is that it has a higher chance to cause allergies. However, due to its many benefits, soy protein will still be an important component of our plant-based meat product.

Wheat protein has a great effect in creating the fibrous structure of artificial meat. Gabowska et al. have found that adding wheat protein to SPI can create a fibrous structure whilst SPI alone cannot form this fibrous structure in artificial meat. Chiang et al. also concluded that using 30% of wheat protein in plant-based meat can create the optimum hardness, chewiness, and fiber structure of artificial meat. Thus, wheat protein plays a great role in the formation of the meat structure in plant-based meat[10].

Peanut protein has comparable oil biding and foaming capacity to SPI. In addition, it has higher viscosity and gel formation after heating when compared to SPI. Thus, it is also a great ingredient to be used and has certain effects that are even better than soy protein[12].

Dietary fiber intake is associated with decreased risks of cardiovascular disease, and has protective effects against chronic diseases, including diabetes, colorectal cancer, etc. In addition, water-soluble fibers have been shown to lower cholesterol and promote digestive regularity. Elderlies should regularly consume 25-38 grams of dietary fiber, yet most are under the mark. Therefore, in our product, dietary fiber may be added to adjust the nutrient intake of elderly populations[13].

Vitamin A plays an important role in the elderly populations, especially beta-carotene, which has a strong antioxidant effect. Vitamin E is also an effective antioxidant that specifically prevents the oxidation of unsaturated fatty acids, prevents aging, and improves life expectancy. Vitamin can inhibit the formation of nitric acid and reduce the carcinogenic effect of nitric acid. Vitamin C deficiency also increases the risk of blood vessel rupture, causing detrimental effects[14]. Many aging-related diseases are correlated with a lack of vitamin intake, especially water-soluble B vitamins, vitamin D, and vitamin E. Both water-soluble and fat-soluble vitamins will be added into our team's formula for plant-based meat to improve the diet of elderly populations[15].

Fats play an important role in both the nutritional effects and the flavoring of plant-based meat. Due to the health conditions of the elderly populations, artificial meat should avoid using animal fats, substituting it with peanut oil, soy oil, olive oil, etc. Furthermore, olive oil poses positive effects to gut microbiota and provides important nutrients such as lutein, beta-carotene, and provitamin A[16]. Other meat replacers include hydroxypropyl methylcellulose (HPMC) oleo gels. Compared to its meat counterpart, HPMC oleo gels have a greater resistance to oxidation, and has a significant effect in the reduction of the saturated unsaturated fat ratio. Thus, HPMC oleo gels can produce artificial meat with nutritional superiority when compared with animal meat[17].

1.2.3 Methods to Improve Plant-Based Meat

The stability of artificial and plant-based meat under heating and cold situations has always been a concern of the food industry. Jiménez-Colmenerod et al. reported that a composite taro

gum created by taro gum, keratin gel, and corn starch powder has a high stability in the freezing and heating process of plant-based meat and can also decrease the water loss rate. Thus, it can be used as a fat substitute in plant-based meat to improve its stability[18]. Starch can also be added as a thickener and enhancer to stabilize the extrusion process[19].

The flavor of the artificial meat is also a large challenge for the food industry. In a study about artificial seafood, nutrients were extracted to the surface of the food. When the people tasted the artificial seafood, the flavors were immediately tasted. Most elderly populations have poor teeth and taste insensitivity, thus, this method can effectively improve the taste for elderly populations[20]. The leghemoglobin protein (legH) from soy expressed in *Pichia pastoris* gives a meat-like flavor to plant-based food products. A safety evaluation was done with legH and the results reveals it to be a promising ingredient to improve artificial meat flavor[19].

Furthermore, certain measures can be done to improve plant-based meat in general. Increasing the temperature above 80 degrees Celsius can significantly reduce both bean and non-bean odors of the artificial meat [21]. Carrageenan increases the viscosity of the mixture when in the extruder, resulting in a more uniform and dense protein structure [22].

1.2.4 Technology Used in the Production of Plant-Based Meat

There are namely three technologies used to manufacture artificial meat: extrusion, electrostatic spinning technology, and 3D printing. Extrusion is a thermal manufacturing process. Under a high-temperature and high-pressure condition, extrusion technology completes the mixing, hydration, shearing, homogenization, compression, degassing, sterilization, alignment, molding, expansion, and drying process in a short period of time. Electrostatic spinning

technology is a nano technology that produces continuous, directional fibers from protein solutions. 3D printing is a rather new technology used in the production of plant-based meat. It prints plant-based meat based on information from computational models and solidifies it into a meat-like layer structure [23].

1.3 Research Background

1.3.1 Analysis of Survey Results

This questionnaire was designed to better understand the overall attitudes of middle- aged and older population towards plant-based meat, their taste preferences, and their needs. We collected 56 questionnaires from middle-aged individuals (40-49 years old) as well as older people (50 years old and above) with 53 of them being valid. The questions asked in the survey collected their basic information, health condition, their willingness to buy the product, taste preferences for plant-based meat, and how often they consume meat products. The results show that around 80% of people eat animal meat frequently, which demonstrates that plant-based meat would have a large potential market if they can replace some of the needs for animal meat.

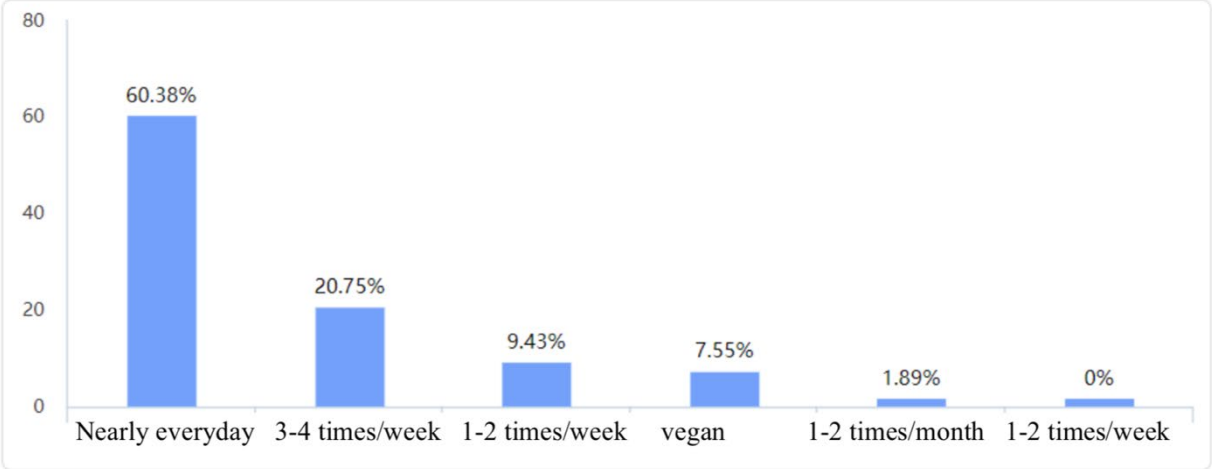

Figure 2: The Frequency of Meat Consumption in the surveyed population

We also collected information on the taste preferences and standards of the elderly population for plant-based meat. It was found that the majority of the population wanted the meat to be pre-prepared and ready-to-eat. The majority of the population preferred a milder taste. This provided us with clear requirements and goals which helped us develop our product.

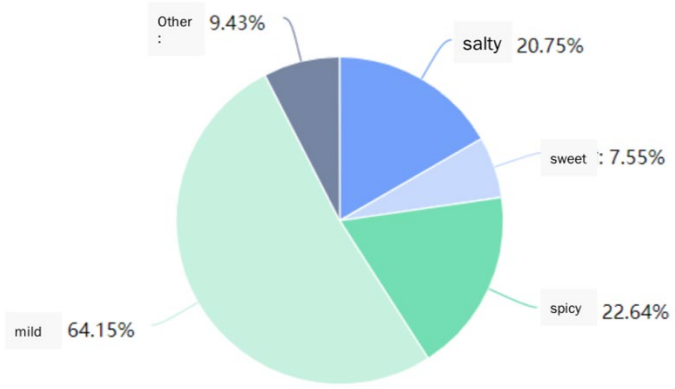

Figure 3: The taste preferences of the surveyed population

For the color, smell, and taste of the meat, we asked each participant to give a score that adds up to 10 for the categories based on how important they perceive the category to be. The average values for each category are around 3, with the highest value of 3.72 for the chewiness of meat. After breaking down the data, we also found that the majority of respondents were most concerned with the texture of the meat, about 30% even rated the chewiness of the meat with a score higher than 5, indicating that they felt that the chewiness of the meat determined 50% or more of the eating experience. Overall, it can be seen that the texture of meat is more important than the other aspects.

Choice	Average
Importance of chewiness. 1: no importance 5: best to be chewy, but other aspects are also important 10: chewiness is everything	3.72
Importance of color. 1: no importance 10: ugly colors decrease appetite	3.08
Importance of smell. 1: no importance 10: extremely important, a bad/no fragrance decreases appetite	3.21

Table 1: The average scores given to the color, chewiness and flavor in terms of significance

In order to understand what motivates the public to buy a specific product, our team examined the public's expectations of plant-based meat in terms of price and preferences. If the prices for regular meat and plant-based meat were similar, the number of respondents that would rather buy plant-based meat and regular meat are similar. 22.64% of the respondents chose to

buy artificial meat "depending on the situation", but when plant-based meat is slightly more expensive than regular meat, less people choose to buy artificial meat.

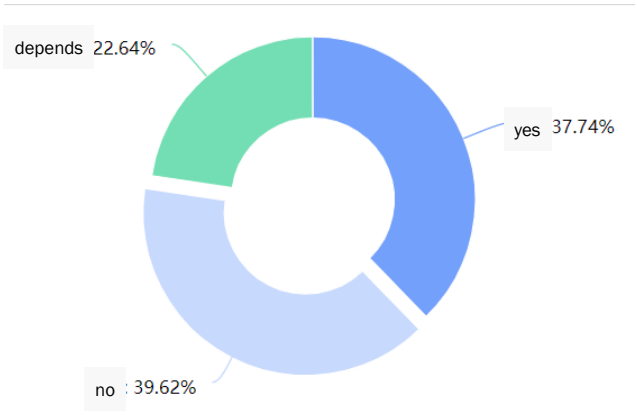

Figure 4: Willingness of people surveyed to buy artificial meat at similar prices

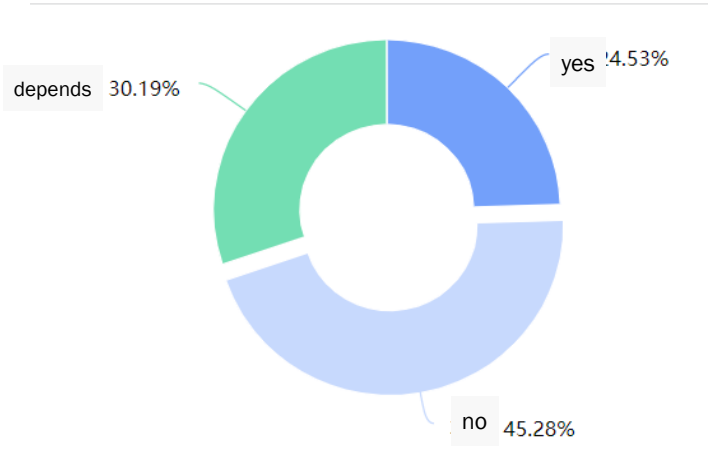

Figure 5: Willingness of people surveyed to buy artificial meat when it is slightly more expensive

1.3.2 Analysis of Interview Results

In order to gain a better understanding of the needs and preferences of the older population, we conducted detailed interviews on 2 individuals that are aged above 50. They both suffered from some of the common diseases of the older population such as high blood cholesterol and diabetes. Both participants had some understanding of plant-based meat and have tried some other products before. After explaining the intention of our plant-based meat product, both expressed willingness to buy our product and consume them in their daily life in the hopes of improving their health. They also preferred mild flavors that are not very salty or spicy and lighter colors, which helps us design our product according to their taste. Taste and food safety was what they cared the most when choosing food products, they were willing to buy plant-based meat products even if they are at a higher price because of the other benefits they have, such as being environmentally friendly and more nutritious. Overall, the older population were willing to accept plant-based meat products as long as it is safe, suits their taste, and reasonably priced.

1.4 Project Purpose

In recent years, rising population has led to increased stress on agriculture and with rising demands for livestock and crops. Meat is an important source of proteins for people. However, raising livestock not only produces a lot of pollution, such as the contamination of water resources and the production of greenhouse gases, but it also consumes a lot of resources in the form of animal feeds and land. In addition to the high land and water consumption for raising livestock, it is estimated that in the United States, over 70 percent of soybean harvest goes to producing animal feeds. [24] This is an inefficient way of producing food, and causes significant

stress on the limited natural resources and the environment. Plant-based meats is a good alternative due to the following reasons. It utilizes materials such as soybean proteins, starch, combined with a variety of dietary fibers. It can also produce and imitate the taste and texture of animal meat. Thus, plant-based meat not only conserves valuable crops for food, agricultural resources, and land, but also have significant nutritional value to help balance the meat-heavy diets that people are increasingly prone to having.

Consuming too much meat can be harmful to a person's health, especially for the elderly. The consumption of red and processed meat has been associated with obesity, type 2 diabetes, cardiovascular disease, and some cancers. [4] Although plant-based meat cannot replace animal meat in people's diets, it can act as a supplement meat to help people lower their dietary intake of meat to a healthy amount while also providing a variety of nutrients that animal meats do not have. For example, studies have found that about 30 types of metabolites, such as ascorbate (vitamin C), phytosterols, and several phenolic anti-oxidants, which are found exclusively in plant-based animal meat as opposed to real meat and several others metabolites that exists in greater quantities. [25] Soy protein, the main ingredient for plant-based meat is also shown to have many health benefits, such as lowering blood cholesterol levels, improving the immune system's function, improving gut health and can also help the elderly recover from osteoporosis. [9] In addition, plant-based meat can be engineered to suit the needs of a particular population, such as the elderly, unlike traditional meat. The elderly population are prone to have vitamin and nutrition deficiencies [14], so including supplements such as dietary fibers, vitamin A, and calcium can help improve their overall health and prevent certain diseases caused by nutrient deficiency.

1.5 Project Uniqueness

Artificial meant has become a popular research topic among both researchers in China as well as those internationally, since it has become more difficult to produce traditional meat due to the diminishing natural resources and harmful environmental impacts that its processing causes. Our team also notice that the older population often experiences nutritional deficiencies and digestive function problems. Therefore, our team chose to focus on plant-based artificial meat to help solve those issues. Despite numerous articles written about plant-based meat, many of the researches that were conducted only carried out of the process of creating plant-based meat or examined ways of manufacturing plant-based meat without actually creating a finished product. By building our research upon previous compositions that other researches have devised, we tried to create a recipe that is the most healthy for elderly populations, while also incorporating important aspects such as taste and appearance. Currently, research across the globe have emphasized that plant-based meat is seperated from traditional meat as its color often lack vibrancy and its taste is rather dull, making it less accepted than it could be. Therefore, our research aims to make the plant-based artificial meat not only more healthy but also closer to traditional meat. Our product also differs significantly with other plant-based meats that already exist in the market, such as impossible foods and beyond meat that focuses on recreating the experience of eating real meat, since we also aim to maximize the nutritional value and health benefit of our plant-based meat.

Devising a better plant-based artificial meat product based on previous compositions has many important applicational meanings in conserving resources and reducing pollution to the

environment. For example, raising livestock produce a substantial amount of methane which is one of the primary greenhouse gas that contributes to global warming. On the other hand, the production of plant-based artificial meat has none of these effects, making it a much more environmental-friendly alternative. Many elderly populations have many health conditions such as cardiovascular diseases and diabetes. Investing in the production of plant-based artificial meat – a type of meat that contains a variety of nutrients ranging from crucial proteins and dietary fiber – will be greatly beneficial to elderly populations. The nutrients that we included in our recipe will make our product a healthy alternative of traditional meat. It can also act as a significant source of proteins and other nutrients for populations that are allergic to traditional meat, or cannot consume traditional meat due to their religion. The advancements in research of plant-based artificial meat will help other researches to build healthier compositions and authentic traditional meat characteristics, accelerating the perfection of plant-based artificial meat and pushing it towards the larger market.

2. Materials and Methods

2.1 Project Proceedings

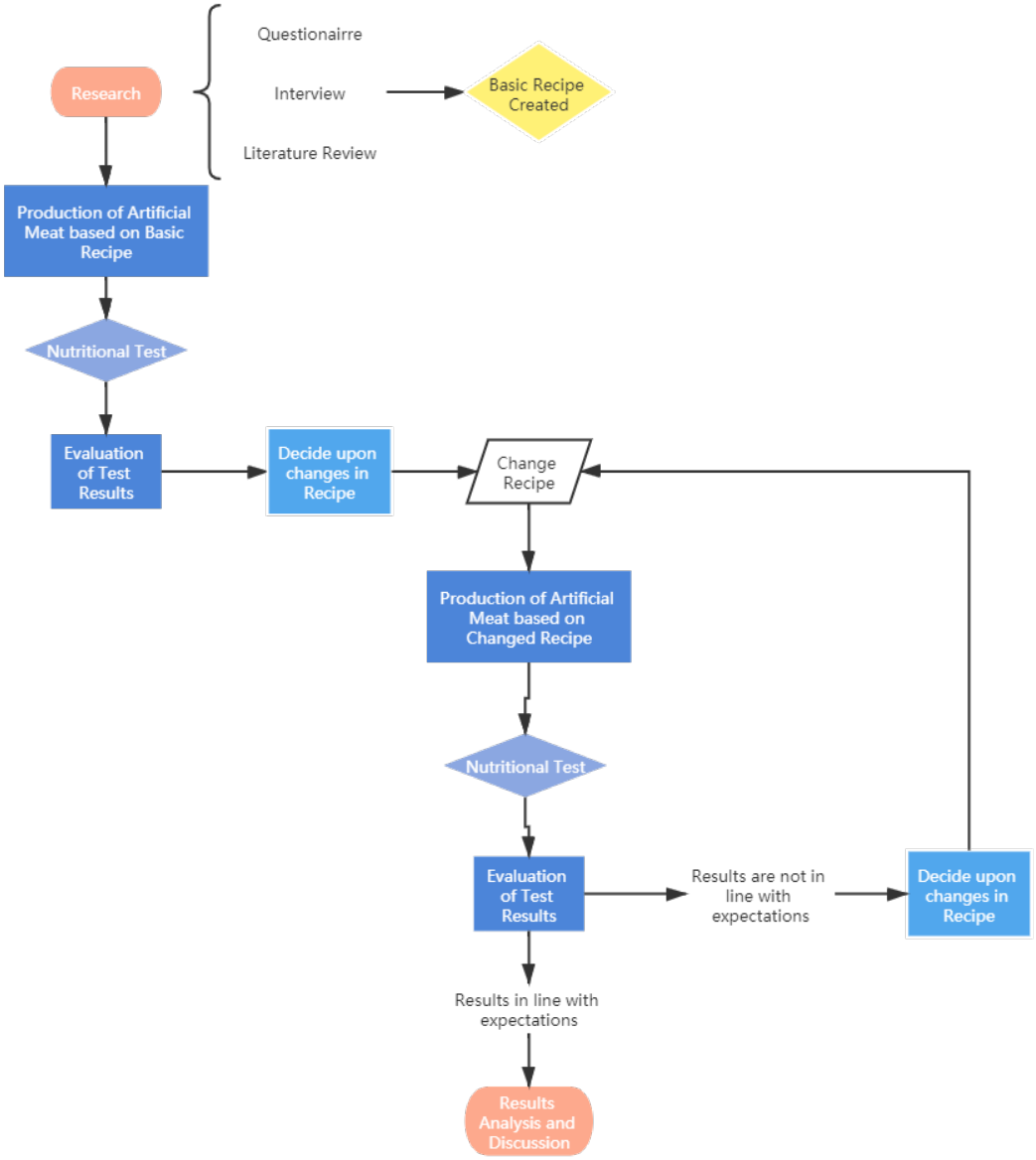

Figure 6: The Proceedings of Our Experiment

In order to design a recipe for the plant-based meat, we searched through the current research and literature on plant-based meats to get a basic understanding of their method of production and their components. Since we are also specifically targeting the elderly population, we also need to understand their preferences and needed. Therefore, we conducted multiple interviews with individuals over 50 years of age and collected data from an online questionnaire, which helped us design our product and make it more acceptable to our target customers.

Once we designed our basic recipe of our plant-based meat and produced some sample, we conducted nutritional testing for different nutritional components such as proteins, lipids, dietary fibers, and vitamins. We also asked volunteers to try our samples and rate them according to taste, color and smell so we can improve on our product in later recipes. After we achieved a to satisfy.

2.2 Materials Used in the Production of the Plant-based meat

Materials used in the plant-based meat includes the raw material of the plant-based meat and the instruments used during the creation process. In the creation of plant-based meat, many types of protein, gels, and other additives were added. Since protein is the basis of plant-based meat, soy protein isolate, brushed soy protein, and peanut protein is added. Specifically, brushed soy protein is added to imitate the texture and structure of meat. Gels such as carrageenan and guar gum are added to increase the viscosity of the mixture. Soy sauce is added for coloring and taste, turning the mixture's color from light muddy yellow to a brownish color, similar to that of cooked beef. Arabinose, a type of sugar, is added due to its effects in lowering blood sugar. Coconut oil is added as fats. Water is added to soak protein. Instruments such as grinders,

beakers, weighing spoons, plastic gloves, scissors are used to aid the creation of the plant-based meat. A mold is used to shape the mixture into patties.

2.3 Method to Produce the Plant-based meat

First, put both the brushed soy protein and the peanut protein into a big beaker with water so both are soaked. After around 10 minutes, take out both types of proteins and apply pressure to separate the water from the proteins, then separate the two types of proteins into two beakers. Take the peanut protein and beat it into a smooth texture. Measure 200g of it and carefully pour it into a new beaker. The texture of the brushed soy protein is preserved because it is used to mimic the texture of animal meat. After adding the peanut protein, add 50g of carrageenan, 50g of guar gum, 50g of isolated soy protein, and around 20mL of coconut oil. Use hands to press and knead the mixture for around 10 minutes. Then, cut the brushed soy protein into granular pieces and add them to the mixture, allowing the mixture to have a texture similar to that of animal meat. Add soy sauce to mimic the color of animal meat and add flavor, then continue to press and knead the mixture until the texture and color is uniform. After kneading, pour the mixture into the mold and press tightly so the mixture forms the shape of a circular slice that resembles a burger patty. Separate the meat product from the mold and store it in a freezer.

Picture 1: Carefully add in the ingredients to a big beaker

Picture 2: Put the mixture into the mold and press tightly

Picture 3: Molded meat resembles the shape of a burger patty

Picture 4: Final product

2.4 Method to Test the Plant-based meat

The testing of the plant-based meat yields the nutritional results of this product. Thus, we can use these nutritional details to modify our recipe. For our experiment, we tested the concentration of fats, protein, calorie, sodium, vitamin, and dietary fiber levels of the plant-based meat product. It is worth noting that we tested the sodium levels of the plant-based meat. High sodium intake increases the risk of certain diseases, especially for the elderly population. Since our product is focused towards the elderly population and population that are prone to these diseases, a lower sodium level can be beneficial to their health and nutrition condition. The testing procedures follows the National Standards of China. Specifically, GB 5009.5, GB 5009.6, GB 5009.91, GB/Z 21922, and GB 5009.82 currently is used in the nutritional testing process.

A taste test is also conducted to reflect the taste of the product. This can also imply the consumers' behavior since potential consumers will try and give feedback for the taste of our product.

3. Results

3.1 Nutrition

Test Item	Plant-based Meat	Beef
Proteins (g/100g)	37.6	25.2
Fat (g/100g)	0.9	1.3

Sodium（Na）（mg/100g）	3.8	72.1
Vitamin A (μg/100g)	823.9	7.4
Vitamin E (mg/100g)	10.8	0.68
Total Energy （KJ）	1302	468

Table 2: Comparison of the nutritional value of plant-based meat and beef

Our team tested the concentration the nutritional content of our plant-based and compared each category to beef. The result shows that the protein content of our plant-based meat exceeded beef by as much as 12.4 grams and exceeded the total energy of beef by 834 kilojoules for a serving of 100g. On the other hand, the sodium concentration was 68.3% lower while the fat content was 0.4 % lower in plant-based meat as compared to beef. This shows that our plant-based meat product can provide sufficient energy and needed substances in the body such as vitamins and proteins while avoiding the substances that might have a negative effect on the body such as sodium.

3.2 Taste Tests

We also conducted a taste test in which 5 volunteers over the age of 40 participated, our team asked them to rate our product in terms of appearance, flavor, smell, texture, and taste and give us feedback. Overall, the average score for each category was above a score of 7.6, which shows that the overall eating experience for our product is satisfactory.

Many commented that the taste was softer and less chewy than real animal meat, however, some participants did not feel this detract from the taste because they preferred a softer texture. This is because most elderly populations have chewing problems, and they often have to choose to eat food with a softer texture due to these problems. Therefore, it would not be as Overall, the score for taste is the highest of all the categories. The color and appearance of our plant-based meat are darker compared to real animal meat and looked more like cooked meat. Many participants commented that the plant-based meat does not have a similar smell to real animal meat and noticed a mild coconut smell from the coconut oil. Some preferred to have more fat in the plant-based meat while others preferred to have less fat because they felt that it is healthier.

4. Discussion

The plant-based meat that we have created is a healthy alternative to animal meat to the elderly population, they not only contain more proteins and beneficial compounds, also low in fat and sodium compared to animal meat. They also have a large potential in the market, our survey shows that the elderly population is willing to accept plant-based meat as an alternative to real meat or use it as a nutritional supplement. The overall taste, smell and appearance of plant-based meat are also acceptable to the elderly population as demonstrated by the taste test we conducted.

Many ingredients that we added to our plant-based meat are also specially designed to improve the health of the elderly population.

In the recipe, coconut oil is used as the main source for fat, which is a healthy alternative to animal fat. Unlike long-chain fatty acids, coconut oil is composed of middle-chain fatty acids, which makes them easier to absorb in the digestive system. This avoids the buildup of fat in adipose tissue and the deposition in other organs. In addition, coconut oil contains high levels of lauric acid which can avoid fat deposition in organs and blood vessels. Therefore, coconut oil is not considered an atherogenic fat. Moreover, coconut oil only contains trace amounts of cholesterol, thus decreasing the cholesterol intake of the elderly population. High cholesterol intakes may cause cardiovascular diseases, thus decreasing their cholesterol intake contributes to a healthier lifestyle and decreased risks to certain diseases[26]. Coconut oil contains vitamin K, vitamin E, and choline as parts of the fat-soluble vitamins[27]. Overall, coconut oil is a great source of essential fats for the elderly population and has positive health effects to them.

Another important ingredient of our plant-based artificial meat is L-arabinose which has many health benefits to the elderly population and is not found in animal meat. L-arabinose is a non-caloric sugar that is able to affect glucose and lipid metabolism, usually found naturally in the hemicelluloses of fruits and vegetables. When L-arabinose is consumed, it selectively inhibits the sucrase enzyme located in the small intestine. The sucrase enzyme is responsible for breaking down sucrose molecules into glucose and fructose molecules. Once the sucrase enzyme is inhibited, the process of breaking down sucrose is delayed or even stopped, leading to a decrease in the amount of glucose and fructose to the blood. In fact, adding L-arabinose to the diet can lead to a "reduction of the glucose peak level related to sucrose consumption by a maximum of

80%". In addition, L-arabinose is also capable of causing a "suppression of the insulin peak level related to sucrose consumption by a maximum of 80%". A diet with the addition of L-arabinose is able to reduce the risk of getting heart diseases, lowers cholesterol levels in the blood, suppress obesity, and prevent type 2 diabetes [28]. All of these conditions are extremely common in elderly populations and continue to threaten their health. With this addition, our team's plant-based meat will present numerous unique health benefits to elders.

Dietary fiber is also focus of our recipe, which is shown to have many benefits, such as improved intestinal function, cholesterol reduction, and increased microbial biomass. The elderly population often have a degraded digestive system. With dietary fiber, the intestinal function of the digestive system is improved, aiding the elderly population in their daily nutritional intake and digestion. As stated previously, high cholesterol levels result in certain diseases. Along with coconut oil, dietary fiber decreases cholesterol levels, dietary fiber thus decreases the elderly population's risk to certain diseases [29].

The plant-based meat product also has other benefits beyond benefiting the health of the elderly population. Even though plant-based meat is designed for the elderly population, vegans or people from the population beyond elderlies can also consume them and gain health benefits by the intake of vitamins, beneficial compounds and dietary fibers. Their production process is also more environmentally friendly than real meat by reducing methane emission and is a more effective use of agricultural production. Producing animal meat requires extensive land, energy, and animal feed, however, they do not produce great amounts of calories in return. This is because a major proportion of food energy that is fed to animals are used for maintaining their

homeostasis and growth. Therefore, using the agricultural crops to produce food items directly can save significant amounts of energy and have the potential to feed larger numbers of people.

5. Conclusion

Our research's main goal is to prepare a type of plant-based artificial meat that provides unique health benefits to elderly populations. We have achieved this by focusing on different types of proteins, gels, arabinose, dietary fiber, and other significant nutrients. The process of creating this type of plant-based artificial meat is much easier and faster, has less harm on the environment than traditional meat does. Moreover, our test results show that the plant-based artificial meat is safe to consume and has a delicious taste. Once pushed to the market, this type of plant-based artificial meat will create immense value in improving the health of elders, can inspire more research to be done on the topic.

6. Acknowledgements

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