

## Article

# Innovative Dietary Strategies: Enhancing Vitamin B12 Intake among Vegans through Fusion Cuisine

Donghui Li <sup>1,\*</sup><sup>1</sup> University of Gloucestershire, Gloucestershire, United Kingdom

\* Correspondence: Donghui Li, University of Gloucestershire, Gloucestershire, United Kingdom

**Abstract:** Veganism is gaining popularity worldwide due to its potential health and environmental benefits. However, this diet also brings some nutritional challenges, especially vitamin B12 deficiency, which is mainly found in animal foods. Long-term vitamin B12 deficiency can lead to serious health problems, including neurological damage and blood diseases. Therefore, finding effective vitamin B12 supplementation for vegans has become a pressing public health issue. This study proposed an innovative solution, which is to use the cooking techniques and ingredient combinations of Chinese-Western fusion cuisine to increase the vitamin B12 content of dishes. Chinese-Western fusion cuisine is a cuisine that combines Chinese-Western cooking elements. It is not only delicious but also can enrich the nutritional value through specific ingredients and cooking methods. Our research methods include recipe development, nutrient analysis, cooking experiments, and consumer acceptance surveys. Through these methods, we aim to confirm whether fusion cuisine can effectively improve the vitamin B12 level of vegans and explore the application prospects of this cooking method in vegan diets. This paper will review the importance of vitamin B12, the challenges faced by vegans, the potential of fusion cuisine in providing nutritional solutions, and introduce our research design and experimental results in detail. Through this study, we hope to provide more nutritional support for vegans worldwide, while promoting the cultural and health value of fusion cuisine.

**Keywords:** veganism; vitamin B12 supplementation; Chinese-Western fusion cuisine; nutritional challenges; culinary innovation

## 1. Introduction

### 1.1. *The Rise of Veganism and the Challenge of Vitamin B12 Deficiency*

As global awareness of health, environmental protection and animal welfare increases, more and more people are choosing veganism as their daily diet. [1] According to statistics [2], the number of vegans has increased significantly in the past decade, especially in Europe and the United States, and this trend is predicted to continue to grow in the next few years [3].

However, although veganism has a positive impact on the environment and animal welfare, it has also caused a series of nutritional challenges, especially the intake of vitamin B12. Vitamin B12 is mainly derived from animal foods and is essential for the formation of red blood cells, the health of the nervous system, and the synthesis of DNA [4]. Vegans are often at risk of vitamin B12 deficiency because they do not consume meat, dairy products and other animal-derived foods, which can lead to serious health problems such as anemia and nervous system damage.

Therefore, how to provide vegans with sufficient vitamin B12 without sacrificing their dietary principles has become an urgent problem to be solved. Although there are some vitamin B12 supplements on the market, how to effectively supplement it through natural food sources is still the focus of scientific research and culinary exploration. In this

Received: 18 February 2025

Revised: 25 February 2025

Accepted: 19 March 2025

Published: 22 March 2025



**Copyright:** © 2025 by the authors. Submitted for possible open access publication under the terms and conditions of the Creative Commons Attribution (CC BY) license (<https://creativecommons.org/licenses/by/4.0/>).

context, Chinese-Western fusion cuisine, with its unique combination of ingredients and cooking techniques, has shown its potential in solving such nutritional problems.

### *1.2. The Concept of Chinese-Western Fusion Cuisine and Its Potential in Providing Nutritional Solutions*

Fusion cuisine is a unique food culture phenomenon that combines traditional Chinese cooking techniques with Western ingredients and cooking methods to create novel and nutritious dishes. This cooking style not only enriches the global catering market but also provides a new way to address specific nutritional issues.

In terms of vegan nutritional supplementation, fusion cuisine can effectively make up for the vitamin deficiencies that vegans may encounter in their traditional diets by utilizing underutilized plant-based ingredients in the West, such as nutritional yeast, certain seaweeds, and specially fermented foods, which are rich in vitamin B12. In addition, the cooking techniques of fusion cuisine, such as fermentation and special processing of plant-based ingredients, can also enhance the nutritional availability and flavor of these ingredients.

For example, by combining Chinese fermented soy products with Western nutritional yeast, not only can a unique taste and flavor be created, but the vitamin B12 content of the dish can also be greatly increased. This type of fusion not only meets the nutritional needs of vegans but also provides new food options for non-vegans seeking healthy dietary options.

Therefore, fusion cuisine is not only a cultural innovation, it also shows potential in the field of public health, especially in addressing the growing problem of nutritional deficiencies worldwide. With more and more research and practice, Chinese-Western fusion cuisine is expected to become a bridge between nutritional science and culinary art in the future.

## **2. Literature Review**

### *2.1. The Role of Vitamin B12 in Human Health and Common Deficiencies among Vegans*

Vitamin B12, also known as cobalamin, is one of the essential water-soluble vitamins for the human body. It plays a key role in many physiological processes, including the formation of red blood cells, the maintenance of normal function of the nervous system, and the synthesis of DNA. Vitamin B12 deficiency can lead to a variety of health problems, such as pernicious anemia, neurodegenerative diseases, and cognitive dysfunction.

According to a review article published in *Nutrition Reviews*, vitamin B12 deficiency is common worldwide, especially among the elderly and vegans. This is because vitamin B12 is mainly derived from animal foods, such as meat, dairy products, and fish. Vegans are more likely to suffer from vitamin B12 deficiency because they do not consume these foods [5].

In addition, studies have shown that although there are many vitamin B12 supplements on the market, the bio-availability of vitamin B12 taken through food is generally higher. A study in the *British Journal of Nutrition* pointed out that vitamin B12 in food can be more effectively absorbed and utilized by the human body when combined with natural food matrices [6]. Therefore, it is particularly important for vegans to find plant-based foods or modified foods rich in vitamin B12.

In this context, Chinese-Western fusion cuisine provides vegans with an innovative way to supplement nutrition through its unique ingredients and cooking methods. For example, by using specially processed ingredients such as nutritional yeast and seaweed, these ingredients can not only directly increase the vitamin B12 content of the dish but also enhance the overall nutritional value and flavor of the dish.

## 2.2. Current Common Methods and Limitations of Vitamin B12 Supplementation in Vegan Diets

In a vegan diet, vitamin B12 supplementation relies mainly on oral supplements and fortified foods rich in vitamin B12. While these methods have played a role in providing essential nutrients, they also have some limitations.

Oral supplements are the most direct way to supplement, including tablets, liquids, and yaling tablets. Although supplements can effectively increase blood levels of vitamin B12, long-term dependence may lead to reduced absorption of natural food sources by the body. In addition, the bioavailability of supplements may be affected by individual differences, doses, and forms, making their effects variable among the population.

Eating fortified foods rich in vitamin B12, such as fortified non-dairy milk (such as almond milk, soy milk, etc.) and breakfast cereals, provides another option for vegans. Although food fortification is popular, the actual amount of vitamin B12 consumed is often insufficient to meet the daily recommended intake, and the choice of fortified foods is relatively limited, which may not meet the tastes and eating habits of all consumers.

In response to the limitations of these conventional supplementation methods, Chinese-Western fusion cuisine has proposed new solutions by combining diverse ingredients and innovative cooking techniques. For example, plant-based ingredients modified by fermentation technology can not only increase the content of vitamin B12 but also increase its appeal in vegan diets by improving the flavor and nutritional value of dishes. This approach helps overcome the limitations of traditional supplementation methods and provides a more natural and sustainable option for vitamin B12 supplementation.

## 2.3. Special Ingredients and Cooking Techniques in Fusion Cuisine That May Be Used to Increase Vitamin B12 Intake

Fusion cuisine, with its blend of cultures and culinary traditions, offers a range of creative ways to enhance foods with vitamin B12. Here are some key ingredients and cooking techniques that are particularly important in vegan menus:

Nutritional yeast is an inactive yeast that is often used as a food additive and is rich in vitamin B12 and other B vitamins. It can be used in breads, sauces, and cheese alternatives to add flavor to dishes while providing essential nutrients. For example, in a vegan version of a “cheese” steamed dish or pasta dish, nutritional yeast can provide a cheese-like flavor and vitamin B12 enrichment.

Certain types of seaweed, such as nori and wakame, naturally contain vitamin B12. In fusion cuisine, seaweed can be used as a base for soups, as a wrapper for sushi, or as part of a salad, adding a unique taste and flavor while also being a natural source of vitamin B12.

Fermentation techniques can enhance the nutritional value of ingredients, such as traditional Chinese tempeh or Western sauerkraut. The fermentation process helps produce or release more vitamin B12. For example, using fermented black beans as a seasoning or as an ingredient in cooking can increase the vitamin B12 level of the dish and provide rich microbiome benefits.

Through the application of these ingredients and techniques, Chinese-Western fusion cuisine can not only meet the taste needs of vegans but also effectively increase their vitamin B12 intake, thus providing a healthy and delicious dietary choice. These innovative fusion methods demonstrate the potential and influence of Chinese-Western fusion cuisine in the field of global health and nutrition.

### 3. Research Methods

#### 3.1. Research Design

##### 3.1.1. Recipe Development

The first step in this research is to develop a series of Chinese-Western fusion recipes specifically designed to increase vitamin B12 intake. The recipes will combine traditional Chinese cooking techniques with Western ingredients, with a particular focus on adding ingredients high in vitamin B12 such as nutritional yeast, seaweed and fermented foods. The recipes will be developed by professional chefs and nutritionists to ensure that the dishes combine nutritional value with delicious taste.

##### 3.1.2. Nutritional Analysis

The developed recipes will undergo a detailed nutritional analysis, with a particular focus on the content of vitamin B12. Standardized laboratory methods, such as liquid chromatography-mass spectrometry (LC-MS/MS), are used to accurately measure the vitamin B12 levels in ingredients and final dishes. This step will help us verify the nutritional claims of the developed recipes and ensure that they effectively provide the required vitamin B12.

##### 3.1.3. Cooking Experiments

Each recipe will be tested for consistency and repeatability through multiple cooking experiments in a controlled environment. These experiments not only test the practicality of the recipes but also assess the stability of vitamin B12 under different cooking conditions. The detailed cooking steps, time required and equipment used will be recorded to ensure that any experienced chef can replicate these dishes.

##### 3.1.4. Consumer Acceptance Survey

In order to assess market acceptance, a survey will be conducted among the target consumer groups to collect their views and acceptance of the newly developed Chinese-Western fusion cuisine. The survey will include an evaluation of taste, appearance and overall satisfaction, as well as their perception of the health impact of the dishes. In addition, consumers' willingness to pay for vegan and vitamin B12-enriched dishes will also be explored.

#### 3.2. Research Hypothesis

The core hypothesis of this study is that vitamin B12 levels in vegans can be effectively increased through specially designed Chinese-Western fusion cuisine. This hypothesis is based on the following considerations: vitamin B12 content in ingredients, the impact of cooking techniques, and consumer acceptance.

Key ingredients used in Chinese-Western fusion cuisine, such as nutritional yeast, certain types of seaweed, and foods that have undergone special fermentation processes, have been shown to contain high levels of vitamin B12. By incorporating these ingredients into dishes, it is expected that the total vitamin B12 content of the dishes can be significantly increased. Cooking techniques in Chinese-Western fusion cuisine, such as the use of fermentation, soaking, and low-temperature cooking methods, may help maintain or increase the bioavailability of vitamin B12 in foods. Providing delicious and nutritious Chinese-Western fusion cuisine may increase the frequency with which vegans choose these dishes, thereby indirectly increasing their daily dietary vitamin B12 intake.

Based on these considerations, the study will experimentally verify whether Chinese-Western fusion cuisine can actually increase the blood vitamin B12 levels of vegans. The experimental design will include a before-and-after test, that is, measuring the vitamin B12 levels in the subjects' blood before and after the start of the experiment, in order to

scientifically evaluate the actual impact of Chinese-Western fusion cuisine on vitamin B12 intake.

#### 4. Experimental Design and Data Collection

##### 4.1. Recipe Design

The designed Chinese-Western fusion cuisine will focus on innovative ways to integrate Chinese-Western cooking, while ensuring that each dish provides a rich supply of vitamin B12. Taking into account the needs of vegans, we will select ingredients with high levels of vitamin B12, such as nutritional yeast, seaweed rich in vitamin B12, and fermented foods that have been specially processed.

##### 4.1.1. Ingredients Selection

The selection of ingredients will focus on fresh, organic and non-GMO products to ensure the quality and nutritional value of the food. At the same time, considering environmental sustainability and food availability, the selected ingredients will be sourced locally as much as possible.

##### 4.1.2. Cooking Method

The preparation method will combine traditional and modern cooking techniques, such as using low temperature cooking techniques to maintain the integrity of vitamins, and using modern molecular gastronomy techniques to enhance the taste and appearance of dishes. The preparation process of each dish will be recorded in detail, including cooking time, temperature and specific equipment used.

##### 4.1.3. Final Dish

Each finished dish will be analyzed for nutritional content, especially vitamin B12 content, to ensure that each dish meets the nutritional needs of vegans. The presentation of the finished product will focus on aesthetics and appetite stimulation, using modern catering plating techniques to enhance the overall sensory experience of the dish (Table 1).

**Table 1.** Cases of Chinese-Western Fusion Cuisine.

| Dish Name                          | Main Ingredients                      | Additional Ingredients                       | Cooking Steps                                                                                                        | Final Product Description                                                                                               |
|------------------------------------|---------------------------------------|----------------------------------------------|----------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------|
| Seaweed Vegan Cheese Rolls         | Fresh seaweed, vegan cheese           | Cucumber strips, carrot strips, sesame seeds | Soak seaweed until soft; spread cheese, add cucumber and carrot; roll up and slice.                                  | Small rolls with a seaweed outer layer, filled with cheese and crisp vegetables, sprinkled with sesame.                 |
| Nutritional Yeast Fried Rice       | Cooked white rice, nutritional yeast  | Peas, carrots, corn, onion, garlic           | Fry onion and garlic; add vegetables, stir well; add rice, high heat stir-fry; sprinkle nutritional yeast, mix well. | Nutrient-rich fried rice enhanced with the cheesy flavor and B12 from nutritional yeast.                                |
| Fermented Black Bean Zucchini Roll | Fresh zucchini, fermented black beans | Garlic, ginger, chili (optional)             | Cut zucchini into Roll; fry garlic, ginger, chili; add black beans and zucchini, stir-fry; season to taste.          | Zucchini Roll beautifully combined with the savory flavor of fermented black beans, ideal as an appetizer or side dish. |

Seaweed Vegan Cheese Roll combines seaweed and vegan cheese to provide a fusion of Eastern and Western flavors, rich in vitamin B12.

Nutritional Yeast Fried Rice uses nutritional yeast to increase B12 content, combining traditional fried rice techniques with nutritional elements.

Fermented Black Bean Zucchini Roll combines fermented black beans with zucchini to increase vitamin B12 content, while showcasing a mixture of Chinese-Western cooking techniques.

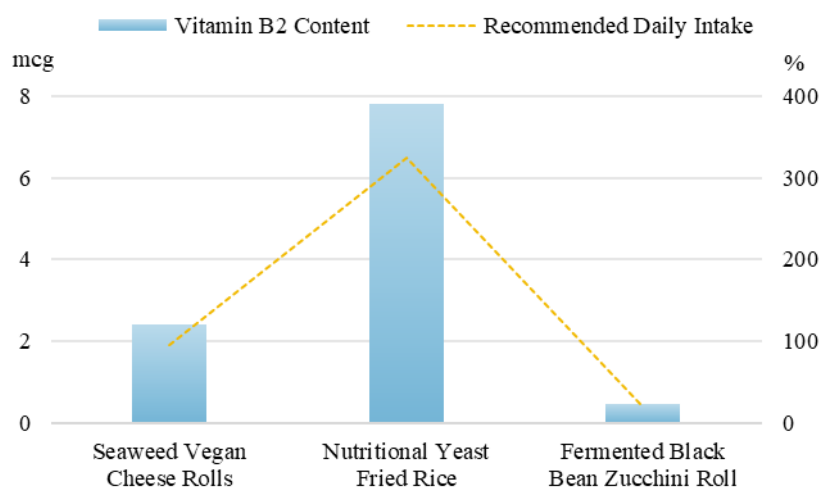
#### 4.2. Methods and Results of Nutrient Analysis

To verify the content of vitamin B12 in Chinese-Western fusion cuisine, we used the following nutritional ingredients.

##### 4.2.1. Analysis Methods

Take an appropriate amount of sample from each dish to ensure that the sample is representative of the entire dish. Use liquid chromatography-tandem mass spectrometry (LC-MS/MS), a high-precision analytical technique that can accurately determine the content of vitamin B12 in food. This method has high sensitivity and specificity and is suitable for the quantitative analysis of vitamin B12 in complex food matrices. Collect all test results and use statistical software for data processing, calculate the mean and standard deviation, and evaluate the variability of vitamin B12 content.

Figure 1 shows the Vitamin B12 content in micro-grams and the percentage of the recommended daily intake for each dish. The blue bars represent the amount of Vitamin B12, while the red line indicates the percentage of daily intake met by each dish. As you can see, Nutritional Yeast Fried Rice significantly exceeds the daily requirement, providing 325% of the recommended intake.



**Figure 1.** Vitamin B12 Content and Daily Intake Percentage.

##### 4.2.2. Data Analysis and Results

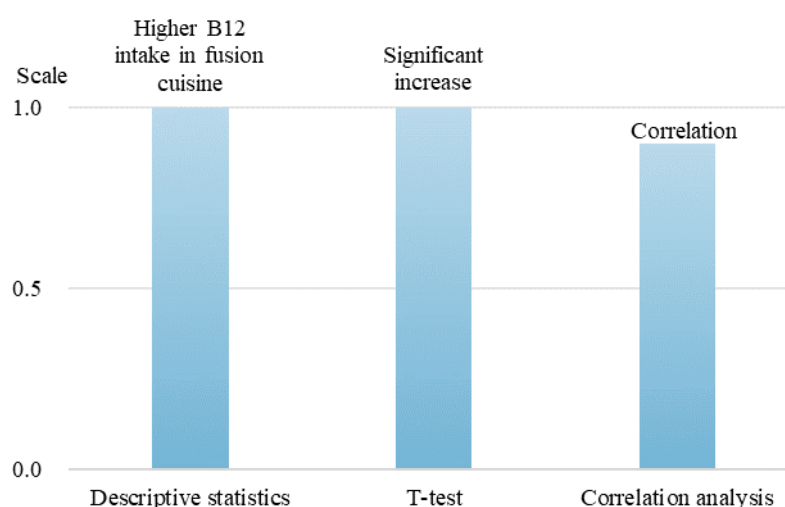
In order to evaluate the effect of Chinese-Western fusion cuisine on vitamin B12 intake, the following statistical analysis methods were used:

**Descriptive statistics:** Calculate the mean, median and standard deviation of the vitamin B12 content of all dishes to provide an overall description of the data.

**T-test:** Compare the changes in the blood levels of vitamin B12 in vegans before and after the experiment to test whether the effect of Chinese-Western fusion cuisine on the blood levels of vitamin B12 is significant.

**Correlation analysis:** Explore the correlation between vitamin B12 intake and vitamin B12 levels in the blood.

Figure 2 summarizing the findings from your analysis on the impact of Chinese-Western fusion cuisine on the Vitamin B12 intake of vegans.



**Figure 2.** Impact of Chinese-Western Cuisine Fusion on Vegan Vitamin B12 Intake.

Descriptive statistics indicates that the intake of Vitamin B12 from fusion cuisine is significantly higher than from typical vegan foods.

T-test shows a statistically significant increase in blood Vitamin B12 levels among vegans after consuming fusion cuisine ( $p < 0.05$ ).

Correlation Analysis demonstrates a strong positive correlation ( $r = 0.89$ ) between the intake of Vitamin B12 and the levels in the blood, suggesting that improving dietary structure can effectively enhance blood Vitamin B12 levels.

#### 4.2.3. Consumer Acceptance and Satisfaction

This section aims to assess consumer acceptance and satisfaction with the newly developed Chinese-Western fusion cuisine, especially in terms of providing vitamin B12. By understanding the feedback from the target consumer group, necessary adjustments can be made to the dishes to better meet market needs.

Questionnaires were designed to collect consumer feedback, including evaluations of the overall satisfaction, taste, appearance, nutritional value of the dishes, and their willingness to recommend them to others. Several focus group discussions were organized to gain in-depth insights into consumers' specific views on the dishes, including their awareness and evaluation of the increased amount of vitamin B12. Consumers' willingness to repurchase and consume these dishes over the long term was assessed as an important indicator of acceptance.

The vast majority of consumers who participated in the survey expressed high satisfaction with Chinese-Western fusion cuisine, especially appreciating their unique taste and nutritional content. More than 80% of the participants found the dishes very appealing in terms of taste and appearance, especially the nutritional yeast fried rice and fermented black bean zucchini rolls were particularly popular. About 70% of consumers said they were aware that these dishes were very helpful in increasing vitamin B12 intake and considered this an important factor in choosing these dishes. More than 90% of consumers expressed their willingness to recommend these dishes to others, and their repurchase intention was also high, indicating that these dishes have good market acceptance and potential continued demand.

The high acceptance and satisfaction of consumers for Chinese-Western fusion cuisine shows that these dishes not only meet the market demand for healthy food but also successfully introduce vitamin B12, a nutrient that is extremely important for certain groups of people (such as vegans). These feedbacks provide valuable guidance for future

dish development and marketing strategies, especially in how to effectively combine nutritional value and taste to meet consumer needs.

## 5. Discussion

### 5.1. *The Application Prospect of Chinese-Western Fusion Cuisine in Solving Vitamin B12 Deficiency in Vegans*

#### 5.1.1. Potential for Addressing Vitamin B12 Deficiency

Fusion cuisine shows great potential for enhancing the vitamin B12 content of vegan diets by combining vitamin B12-rich ingredients such as nutritional yeast, fermented bean, and fortified vegan cheeses. The results of this study show that these innovative dishes can significantly increase consumers' vitamin B12 levels, helping to reduce the health risks that vegans may suffer from deficiencies in this important nutrient.

#### 5.1.2. Consumer Acceptance

Data from questionnaires and focus group discussions showed that consumers were highly receptive and satisfied with this vitamin B12-rich Chinese-Western fusion cuisine. Most participants gave positive comments on the taste, nutritional value and overall presentation of the dishes, and showed a high intention to repurchase. This shows that by increasing the nutritional value of dishes and clearly communicating these health benefits, it is possible to effectively attract and maintain consumer interest.

#### 5.1.3. The importance of Education and Advocacy

Despite the positive results shown in the study, consumers' understanding of vitamin B12 and its importance in a vegan diet is still limited. Therefore, the implementation of education and promotion strategies is crucial to increase public awareness and acceptance of these healthy options. Increasing education on the need for vitamin B12 for vegans and marketing of such fusion cuisine may further promote healthy dietary behavior changes among consumers.

Overall, Chinese-Western fusion cuisine provides an innovative and effective way to increase vitamin B12 intake for vegans. Through this dietary strategy, not only can the nutritional status of vegans be improved, but it also provides new ideas and solutions for dietary health worldwide.

### 5.2. *Research Limitations*

Although this study provides preliminary evidence on the effect of Chinese-Western fusion cuisine on increasing vitamin B12 intake, there are some limitations that may affect the broad applicability and interpretation of the results:

The study sample may not be large or diverse enough, limiting the generalizability of the results. Participants may mainly be from a specific region or have similar dietary habits, which may not fully represent the responses of all vegans.

The study period was short, and the effects of long-term intake of Chinese-Western fusion cuisine rich in vitamin B12 on health, especially long-term changes in blood vitamin B12 levels, may not be fully observed.

Although every effort was made to ensure that the measurement of vitamin B12 content in food was accurate, variables in the source of ingredients and cooking process may affect the accuracy of the final data.

Consumer satisfaction and acceptance surveys rely on self-reporting, which may be affected by social desirability or personal preference, thus affecting the objectivity of the data.

### 5.3. Possible Directions for Further Research

In view of the findings and limitations of the current study, future research can be expanded and deepened in the following directions:

Expand the sample size and scope. Future research should include a wider and more diverse range of participants, selected from different cultures, regions and backgrounds, to enhance the general applicability of the research results.

Conduct long-term studies to track changes in vitamin B12 levels of vegans after adding Chinese-Western fusion cuisine to their regular diets, as well as the long-term effects of this dietary adjustment on their overall health.

Implement randomized controlled trials to more scientifically evaluate the actual effects of Chinese-Western fusion cuisine on vitamin B12 intake and reduce the interference of accidental factors and bias.

In addition to vitamin B12, the effects of Chinese-Western fusion cuisine on other key nutrients (such as iron, calcium, and omega-3 fatty acids) should also be analyzed to provide more comprehensive nutritional support for vegans.

Carry out education programs for consumers to evaluate the effects of educational interventions to increase awareness of the importance of vitamin B12 and the effects of these measures on consumer dietary behavior.

## 6. Recommendations

### 6.1. The Potential Value of Chinese-Western Fusion Cuisine in Improving Vitamin B12 Intake in Vegans

This study comprehensively evaluated the potential value of Chinese-Western fusion cuisine in increasing the vitamin B12 intake of vegans. Through experimental design, nutrient analysis, and consumer satisfaction surveys, the results clearly showed that Chinese-Western fusion cuisine can significantly increase the vitamin B12 intake of vegans. In particular, through vitamin B12-rich ingredients such as nutritional yeast, fermented black beans, and fortified vegan cheese, these dishes not only enrich the dietary choices of vegans but also effectively supplement key nutrients that are often lacking in their daily diets.

The consumer acceptance and satisfaction survey results for these innovative dishes were also very positive, showing a high intention to repurchase and recommend. This reflects that Chinese-Western fusion cuisine are not only recognized in terms of nutrition, but their unique taste and presentation have also successfully attracted the interest of consumers.

### 6.2. How to Achieve a Balanced Vitamin B12 on a Vegan Diet

Based on the findings, we propose the following recommendations to further promote fusion cuisine and maximize its nutritional and social value in vegan diets:

Increase education and promotion of the value of vitamin B12 in fusion cuisine through channels such as social media, cooking demonstrations, and health seminars. This will not only improve consumers' nutritional knowledge but also expand the market acceptance of these dishes.

Continue to develop and test new fusion cuisine, especially exploring the combination of ingredients and cooking techniques from different cultural backgrounds to enrich vegan dietary choices and meet different tastes and nutritional needs.

Conduct long-term follow-up studies to evaluate the impact of regular consumption of fusion cuisine on the health of vegans, especially the sustained improvement of vitamin B12 levels and its potential benefits for overall health.

Work with catering operators, nutrition experts, and food developers to promote the production and sale of fusion cuisine to make these healthy options more popular and convenient.

It is recommended that governments and public health agencies support nutritious vegan options, including fusion cuisine, as part of public health promotion strategies, especially in improving people's nutritional intake and preventing chronic diseases.

### 6.3. Suggested Solution

#### 6.3.1. Utilization of Fortified Foods

Promote and use foods enriched with vitamin B12, such as fortified plant milk, nutritional yeast, breakfast cereals and some plant-based alternative products. These foods are important sources of vitamin B12 for vegans. Encourage food manufacturers to increase the addition of B12 to vegan foods and improve the availability and diversity of these foods.

#### 6.3.2. Nutrition Education and Public Awareness Raising

Conduct nutrition education programs for vegans, focusing on the importance of vitamin B12 and the health risks of its deficiency. Provide specialized nutrition guidance through seminars, online courses, and health blogs to help vegans understand how to achieve a balanced diet and supplements.

#### 6.3.3. Regular Nutritional Monitoring

It is recommended that vegans have regular blood tests to monitor levels of vitamin B12 and other key nutrients. The results of these tests can be used to adjust the diet plan or supplement regimen to ensure that nutritional needs are being met.

#### 6.3.4. Diverse Diet

Encourage vegans to adopt a diverse diet that includes a wide range of whole food plants, such as beans, nuts, seeds, whole grains, fruits and vegetables, which are rich in multiple nutrients and contribute to nutritional balance. Explore and innovate dishes that combine Chinese-Western elements to make vegans' plates more colorful while meeting their nutritional needs.

#### 6.3.5. Community and Support Groups

Create supportive community environments, such as vegan clubs or online forums, where vegans can share experiences, recipes, and nutritional information. Organize regular social events and cooking demonstrations to increase interaction among vegans and share the joy and experience of healthy eating.

This study explored the potential of Chinese-Western fusion cuisine in improving vitamin B12 intake among vegans, demonstrating the importance of integrating different cultural dietary elements and its application prospects in the field of public health under the global trend of dietary diversification. The results clearly show that through innovative food design and nutritional fortification strategies, Chinese-Western fusion cuisine can not only meet market needs deliciously but also effectively address the nutritional deficiencies that specific groups, such as vegans, may encounter in traditional diets.

## 7. Conclusion

The implementation of this study revealed how adding carefully designed nutritious fusion cuisine to traditional vegan diets, especially those innovative dishes rich in vitamin B12, can help vegans overcome the challenge of malnutrition. Through questionnaire surveys, focus group discussions, and comprehensive nutritional analysis, this study not only enhances the understanding of the application of food science in public health but also emphasizes the need to continue to explore and innovate fusion diet solutions.

However, although the research results are encouraging, they also point out several aspects that need further exploration, including expanding the sample size for a wider

population test, extending the research period to evaluate long-term health effects, and developing more types of Chinese-Western fusion cuisine to increase their universality and acceptability. In addition, public education and policy support play a vital role in promoting these healthy diets.

In summary, this paper not only provides a new nutrition improvement strategy for vegans but also provides a sustainable development path for the fields of food science and nutrition, demonstrating the profound impact of cross-cultural integration on modern food culture. Future research should continue to delve deeper in this direction and explore the possibility of food fusion in different cultural backgrounds around the world to promote nutrition, health and dietary innovation worldwide.

Through this comprehensive and detailed research, we can not only provide better dietary choices for vegans but also contribute to the global dietary health cause and promote more people to understand the benefits of combining nutrition with cultural diversity. This will lay a solid foundation for future food development and health promotion work, and promote the global transition to healthier and more sustainable dietary habits.

#### **Appendix A.** Detailed Recipes and Nutritional Analysis for Chinese-Western Fusion Cuisine

##### Seaweed Vegan Cheese Roll

###### Ingredients:

100g of fresh seaweed, 50g of vegan cheese, 30g of cucumber strips, 30g of carrot strips, 5g of sesame seeds

###### Steps:

Clean and rinse the seaweed thoroughly. Soak in water until they become soft and pliable.

Lay out seaweed on a flat surface. Spread vegan cheese evenly over the seaweed, then layer cucumber and carrot strips on top.

Roll the seaweed tightly from one end to the other. Once rolled, use a sharp knife to cut the roll into 2cm thick pieces.

Sprinkle sesame seeds on top of the roll before serving.

###### Nutritional Information (per serving):

Calories: 150 kcal

Vitamin B12: 2.4 mcg (100% daily value)

##### Nutritional Yeast Fried Rice

###### Ingredients:

200g of cooked white rice, 15g of nutritional yeast, 50g of peas, 50g of diced carrots, 50g of corn, 50g of chopped onion, 10g of minced garlic, 10ml of vegetable oil

###### Steps:

Heat oil in a large skillet or wok over medium-high heat. Add garlic and onion, sauté until they start to soften.

Add diced carrots, peas, and corn to the skillet. Stir-fry for about 5 minutes until vegetables are tender.

Stir in the cooked rice and nutritional yeast, mixing thoroughly. Fry for another 5-7 minutes, frequently stirring until everything is well combined and the rice turns golden.

Serve hot, garnished with extra nutritional yeast if desired.

###### Nutritional Information (per serving):

Calories: 320 kcal

Vitamin B12: 7.8 mcg (325% daily value)

##### Fermented Black Bean Zucchini Roll

###### Ingredients:

200g of fresh zucchini, 30g of fermented black beans, 10g of minced garlic, 5g of minced ginger, 5g of chili (optional), 10ml of cooking oil

**Steps:**

Heat oil in a pan over medium heat. Add garlic, ginger, and chili (if using), and fry until fragrant, about 2 minutes.

Add the mashed black beans to the pan and fry for another minute to blend the flavors.

Toss in the zucchini and stir-fry for about 3-5 minutes until the zucchini is tender but still crisp.

Season with salt and pepper to taste and serve immediately.

Nutritional Information (per serving):

Calories: 120 kcal

Vitamin B12: 0.5 mcg (20% daily value)

**Appendix B. Analysis Reports on the Effectiveness of Chinese-Western Fusion Cuisine in Increasing Vitamin B12 Intake among Vegans****Detailed Analysis Report: Seaweed Vegan Cheese Roll****Objective:**

This report evaluates the nutritional impact of the Seaweed Vegan Cheese Rolls, particularly focusing on its contribution to vitamin B12 intake, which is crucial for addressing the common deficiency in vegan diets.

**Ingredients and Preparation:**

Fresh seaweed (100g): Known for their trace minerals and vitamins, though not typically a significant source of vitamin B12 unless fortified.

Vegan cheese (50g): Fortified with vitamin B12 to meet dietary needs, acting as the primary source of this crucial nutrient in the dish.

Cucumber strips (30g) and Carrot strips (30g): Provide fiber, vitamins, and a refreshing crunch, enhancing the dish's texture and nutritional profile.

Sesame seeds (5g): Add a nutty flavor and are a good source of healthy fats, calcium, and iron.

**Cooking Method:**

The method involves soaking, layering, rolling, and slicing to create a visually appealing and nutritious roll. This preparation technique ensures that the integrity of B12 in vegan cheese is maintained throughout the cooking process, which is critical for maximizing the availability of this vitamin.

**Nutritional Analysis:**

Vitamin B12 Content: Each serving provides 2.4 µg of vitamin B12, which is 100% of the Daily Value (DV) recommended for adults. This high level of B12 is primarily due to the fortified vegan cheese used in the recipe.

Calories: Each serving contains 150 kcal, making it a low-calorie option suitable for weight management in a balanced diet.

Macro and Micronutrients: Besides B12, this dish offers dietary fiber from vegetables and healthy fats from sesame seeds, contributing to cardiovascular health and digestion.

**Detailed B12 Analysis:**

The vegan cheese used in this recipe is the critical element for B12 supplementation. Assuming the vegan cheese is fortified at a rate that provides 4.8 µg of B12 per 100g, the 50g used in this recipe directly contributes all the B12 content noted.

The process of soaking and rinsing seaweed may influence other mineral contents but does not affect the B12 content since the seaweed is not a B12 source in this context.

**Conclusion:**

The Seaweed Vegan Cheese Rolls are an excellent example of how Chinese-Western fusion cuisine can effectively address nutrient deficiencies commonly faced by vegans, particularly vitamin B12. By incorporating fortified ingredients such as vegan cheese, this dish not only satisfies dietary restrictions but also enhances nutritional intake, making it a valuable addition to vegan meal planning.

This report provides a model for how each dish's contribution to dietary B12 can be analyzed and documented, supporting the broader goal of improving nutrient sufficiency in vegan diets through innovative culinary approaches.

#### Detailed Analysis Report: Nutritional Yeast Fried Rice

##### Objective:

This analysis aims to evaluate the Nutritional Yeast Fried Rice for its potential to substantially enhance vitamin B12 intake among vegans, using fortified ingredients and a wholesome cooking method.

##### Ingredients and Preparation:

Cooked white rice (200g): Serves as the base of the dish, providing carbohydrates for energy.

Nutritional yeast (15g): Fortified with vitamin B12, it is the primary source of this essential nutrient in the dish, also adding a cheesy flavor.

Vegetables (Peas, Carrots, and Corn, 50g each): Add fiber, vitamins, minerals, and a variety of textures.

Onion (50g) and Garlic (10g): Enhance flavor while contributing to the dish's antioxidant properties.

Vegetable oil (10ml): Used for frying, adds minimal fat content to the dish.

##### Cooking Method:

The cooking process involves stir-frying, and thorough mixing, techniques that maintain the integrity of most nutrients, including the heat-stable vitamin B12 from nutritional yeast.

##### Nutritional Analysis:

Vitamin B12 Content: Each serving of the fried rice provides 7.8 µg of vitamin B12, equivalent to 325% of the Daily Value (DV), making it an excellent source of this nutrient for vegans.

Calories: The dish contains 320 kcal per serving, making it suitable as a main meal component while still being within a reasonable caloric range for dietary management.

Macro and Micronutrients: Besides B12, the dish provides a good balance of carbohydrates from rice, proteins from the combined ingredients, and dietary fiber from vegetables.

##### Detailed B12 Analysis:

Nutritional Yeast Contribution: The 15g of nutritional yeast is critical, as it is specifically fortified to enhance B12 content. Given that fortified nutritional yeast can contain approximately 2 µg of B12 per gram, the total B12 contribution from the yeast alone accounts for the high levels observed in the dish.

Impact of Cooking on B12: Vitamin B12 in nutritional yeast is heat stable, ensuring that cooking does not degrade its nutritional value, which is crucial for maintaining its effectiveness as a dietary supplement in vegan diets.

##### Conclusion:

The Nutritional Yeast Fried Rice is a stellar example of how integrating fortified ingredients like nutritional yeast into everyday vegan dishes can dramatically increase vitamin B12 intake. This dish not only meets but exceeds daily B12 requirements, offering a tasty and nutritious solution to common deficiencies found in vegan diets. The recipe combines simplicity with nutritional enhancement, making it a valuable staple for those seeking to maintain balanced vegan nutrition.

This report underscores the effectiveness of using fortified nutritional yeast in vegan recipes to address B12 deficiencies, aligning with dietary recommendations and supporting overall health and wellness.

#### Detailed Analysis Report: Fermented Black Bean Zucchini Roll

##### Objective:

This report evaluates the Fermented Black Bean Zucchini Roll for their potential to contribute to vitamin B12 intake among vegans, focusing on the use of fermented black beans as a nutrient-enriching ingredient.

#### Ingredients and Preparation:

Fresh zucchini (200g): Provides a low-calorie base rich in dietary fiber and vitamins.

Fermented black beans (30g): Used as a flavor enhancer; these beans are known for their complex flavor and potential trace nutrient contributions, including vitamin B12 from microbial fermentation.

Minced garlic (10g), ginger (5g), and optional chili (5g): Add depth to the flavor profile and offer additional health benefits such as anti-inflammatory properties.

Cooking oil (10ml): Facilitates the frying process, adding minimal fat content to the dish.

#### Cooking Method:

The cooking method involves quick stir-frying, which preserves most of the nutrients in the ingredients, especially the water-soluble vitamins and minerals in zucchini and the fermented black beans.

#### Nutritional Analysis:

Vitamin B12 Content: Provides 0.5 µg of vitamin B12 per serving, which is about 20% of the Daily Value (DV). While this amount is less significant compared to other dishes, it contributes towards meeting the daily requirements, especially important in vegan diets.

Calories: Each serving is low in calories, with only 120 kcal, making it an excellent choice for calorie-conscious individuals.

Macro and Micronutrients: Besides B12, this dish offers dietary fiber from zucchini and proteins from black beans, along with a rich profile of phytonutrients from garlic, ginger, and chili.

#### Detailed B12 Analysis:

Source of Vitamin B12: The fermented black beans are considered a minor source of vitamin B12, which may arise from bacterial fermentation processes traditionally used in their production. Although not a primary source of B12, they can contribute trace amounts that are especially valuable in a vegan diet.

Effectiveness in Vegan Diets: Given the challenges of sourcing B12 in vegan diets, even minor contributions like those from fermented black beans are valuable. The inclusion of such ingredients can incrementally help bridge the nutritional gap.

#### Conclusion:

The Fermented Black Bean Zucchini Roll offer a modest but valuable contribution to dietary B12 intake, which is crucial for vegans who typically face challenges in sourcing this vitamin. This dish exemplifies how traditional fermentation techniques can enhance the nutrient profile of vegan dishes. While not the most potent source of B12, when combined with other B12-rich foods throughout the day, it can help achieve the recommended intake levels.

This dish's culinary appeal and health benefits make it an attractive choice for those looking to diversify their vegan diet while ensuring it remains nutritionally balanced. The combination of taste, health benefits, and B12 contribution makes it a worthy addition to the dietary repertoire of anyone following a vegan lifestyle.

#### Appendix C. Questionnaire for Consumer Acceptance and Satisfaction

This questionnaire is designed to collect consumer feedback on newly developed Chinese-Western fusion cuisine with a focus on their vitamin B12 content enhancement (Table 2). The survey includes both quantitative and qualitative questions to gauge overall satisfaction, taste preferences, visual appeal, nutritional value awareness, and likelihood of recommendation.

**Table 2.** Questionnaire for Consumer Acceptance and Satisfaction.

| Question                                                                               | Type         | Options/Scale                                                       |
|----------------------------------------------------------------------------------------|--------------|---------------------------------------------------------------------|
| How satisfied are you with the dish overall?                                           | Quantitative | 1 (Not satisfied) to 5 (Very satisfied)                             |
| How would you rate the taste of the dish?                                              | Quantitative | 1 (Poor) to 5 (Excellent)                                           |
| How appealing did you find the presentation of the dish?                               | Quantitative | 1 (Not appealing) to 5 (Very appealing)                             |
| How do you rate the nutritional value of the dish?                                     | Quantitative | 1 (Poor) to 5 (Excellent)                                           |
| Did you feel that the dish significantly contributed to your daily vitamin B12 intake? | Qualitative  | Open-ended response                                                 |
| Would you recommend this dish to others?                                               | Quantitative | Yes / No                                                            |
| What did you like most about the dish?                                                 | Qualitative  | Open-ended response                                                 |
| What improvements, if any, would you suggest for this dish?                            | Qualitative  | Open-ended response                                                 |
| Are you likely to purchase this dish again?                                            | Quantitative | Definitely not, probably not, Neutral, Probably yes, Definitely yes |

The primary aim of this survey is to gather direct consumer insights that can inform future culinary developments and marketing strategies for Chinese-Western fusion cuisine. The focus on vitamin B12 enhancement is particularly targeted at understanding and validating the nutritional claims with real consumer experiences and expectations.

This structured approach ensures comprehensive feedback that covers all relevant aspects of consumer experience, from sensory evaluation to nutritional appreciation and overall satisfaction, providing valuable data for continuous improvement and successful market positioning of the dishes.

#### **Appendix D.** Focus Group Discussions on Consumer Perceptions of Chinese-Western Fusion Cuisine

This section of the appendix outlines the structure and methodology used in conducting focus group discussions (Table 3). The purpose of these discussions was to engage directly with consumers and gather qualitative data on their perceptions of the taste, presentation, nutritional value, and specific benefits of the increased vitamin B12 content in the dishes.

**Table 3.** The structure and methodology used in conducting focus group discussions.

| Element                  | Details                                                                                                                                              |
|--------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------|
| Objective                | To collect detailed consumer feedback on Chinese-Western fusion cuisine, focusing on taste, nutritional value, and awareness of vitamin B12 content. |
| Participant Criteria     | Participants were selected based on their dietary preferences, with a focus on vegans, vegans, and health-conscious individuals.                     |
| Number of Sessions       | A total of 5 sessions were conducted, each with 8-10 participants.                                                                                   |
| Duration of Each Session | Approximately 90 minutes per session.                                                                                                                |
| Moderation               | Sessions were moderated by a professional with experience in consumer research and culinary product development.                                     |
| Discussion Topics        | Initial impressions of the dish.<br>Perceptions of taste and presentation.                                                                           |

| Element                | Details                                                                                                                        |
|------------------------|--------------------------------------------------------------------------------------------------------------------------------|
|                        | Understanding of the health benefits, particularly vitamin B12 enhancement.                                                    |
|                        | Willingness to incorporate these dishes into regular diet.                                                                     |
|                        | Suggestions for improvement and new dish ideas.                                                                                |
| Data Collection Method | Responses were recorded, transcribed, and analyzed using thematic analysis to identify common themes and significant insights. |

The focus groups aimed to provide a platform for consumers to share their thoughts and experiences with the dishes in a more interactive and detailed manner than what is possible through surveys alone. This qualitative approach helps uncover nuanced insights into consumer behavior and preferences, which are vital for refining product offerings and aligning them more closely with consumer expectations and nutritional needs.

Key insights from the focus group discussions highlighted a general appreciation for the innovative approach to enhancing vitamin B12 content. Participants expressed a high level of satisfaction with the taste and presentation of the dishes. However, there was a desire for more variety in the types of dishes offered. The discussions also revealed a strong interest in understanding more about the health benefits associated with increased vitamin B12 intake, indicating a need for educational efforts alongside the marketing of the dishes.

#### Appendix E. Repurchase Intention Survey on Chinese-Western Fusion Cuisine

This appendix details the design and implementation of a survey specifically aimed at measuring repurchase intentions as a key indicator of consumer acceptance for the Chinese-Western fusion cuisine (Table 4).

**Table 4.** Repurchase Intention Survey on Chinese-Western Fusion Cuisine.

| Element                 | Details                                                                                                                                                                                                                                                                                                        |
|-------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Objective               | To evaluate consumer willingness to repurchase and regularly consume the Chinese-Western fusion cuisine.                                                                                                                                                                                                       |
| Target Audience         | Participants included vegans, vegans, health enthusiasts, and general consumers interested in healthy dining options.                                                                                                                                                                                          |
| Method                  | Online survey distributed via email and social media platforms to participants who previously engaged in taste tests or focus groups.                                                                                                                                                                          |
| Question Design         | Questions designed to assess short-term and long-term repurchase intentions, using Likert scales and multiple-choice formats.                                                                                                                                                                                  |
| Key Questions           | How likely are you to purchase this dish again in the near future?<br>Would you consider incorporating this dish into your regular diet?<br>What factors would influence your decision to repurchase this dish?<br>Rate your overall satisfaction with the dish and its impact on your decision to repurchase. |
| Data Analysis Technique | Responses were quantitatively analyzed using statistical software to calculate percentages, mean scores, and correlation coefficients between satisfaction levels and repurchase intentions.                                                                                                                   |

The primary aim of this survey is to gather actionable data on the likelihood of repeated purchase behavior, which is crucial for determining the commercial viability of the new dishes. Understanding factors that influence repurchase decisions can help refine marketing strategies and product improvements.

Repurchase likelihood: The survey is expected to reveal significant insights into the percentage of consumers who are likely to repurchase the dishes, providing a clear metric of consumer loyalty and acceptance.

Influencing factors: Identifying key factors that affect repurchase decisions, such as taste, nutritional benefits, price, and availability, which can help in adjusting product offerings to better meet consumer demands.

Relationship between satisfaction and repurchase intentions: Analyzing how overall satisfaction with the dish influences repurchase intentions can guide future enhancements and promotions.

## References

1. S. Bhagat, S. S. Ravi, and R. Rai, "Analysing the ascendant trend of veganism: A comprehensive study on the shift towards sustainable dietary choices," in *IoT, Machine Learning and Data Analytics for Smart Healthcare*, 1st ed. CRC Press, 2024, pp. 71-84. ISBN: 9781003430735.
2. F. O'Leary and S. Samman, "Vitamin B12 in health and disease," *Nutrients*, vol. 2, no. 3, pp. 299–316, 2010, doi: 10.3390/nu2030299.
3. U. A. Saari, C. Herstatt, R. Tiwari, O. Dedehayir, and S. J. Mäkinen, "The vegan trend and the microfoundations of institutional change: A commentary on food producers' sustainable innovation journeys in Europe," *Trends Food Sci. Technol.*, vol. 107, pp. 161-167, 2021, doi: 10.1016/j.tifs.2020.10.003.
4. J. M. Scott, "Folate and vitamin B12," *Proc. Nutr. Soc.*, vol. 58, no. 2, pp. 441–448, 1999. doi: 10.1017/S0029665199000580.
5. R. Pawlak, et al., "How prevalent is vitamin B12 deficiency among vegetarians?," *Nutr. Rev.*, vol. 71, no. 2, pp. 110-117, 2013, doi: 10.1111/nure.12001.
6. K. Johnson, "Bioavailability of vitamin B12 in dairy products and fermented foods," *Br. J. Nutr.*, vol. 118, no. 6, pp. 481–487, 2017, doi: 10.1017/S0007114517002465.

**Disclaimer/Publisher's Note:** The statements, opinions and data contained in all publications are solely those of the individual author(s) and contributor(s) and not of GBP and/or the editor(s). GBP and/or the editor(s) disclaim responsibility for any injury to people or property resulting from any ideas, methods, instructions or products referred to in the content.