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A novel vegetarian food based on Balinese traditional foods: Variety, processing, and nutrition

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Abstract

Changing diet preference to vegetarian is certainly not easy. Most people are very dependent on the delicious taste of meat, so it is very difficult to switch to plant-based foods. In addition, tourists visiting Bali, especially vegetarians, will find it difficult to enjoy Balinese specialties, which are predominantly made from meat. With these issues in mind, and to suit the demands of both local communities and tourists, some vegetarian vendors in Bali started to offer vegetarian versions of traditional Balinese foods. The sample of Balinese traditional plant-based foods was analysed for their nutritional content. The data were analysed using the descriptive qualitative method. The Balinese traditional plant-based foods found in Ubud were *Sate Lilit*, *Kuah Kare*, Balinese soup, *Sayur Urap*, *Betutu*, *Lawar*, *Tum*, *Dendeng/Ati*, *Sisit*, *Sate*, and *Urutan*; which is made similar to Balinese food processing using Balinese spices (*Base Genep*) contains good nutrition.

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1. Introduction

Plant-based eating preference, that emphasizes fruits, vegetables, whole grains, legumes, nuts, and seeds, is known as vegetarian diets (1–3). These diets are frequently thought to be meatless and animal-free. There are many types of vegetarian diets, the most common of which are semi-vegetarian, pescatarian, and vegan (4,5). The reasons for adopting certain eating preferences vary and include ethical considerations, religious convictions, environmental and cultural concerns, as well as health-related considerations (6–10). According to the American Dietetic Association (ADA), over 4.9 million (2.3%) adults in America turned vegetarian in 2006, and approximately 1.4% went vegan, while approximately 900 adults in Canada became vegetarian (7). The result of a survey by the Vegetarian Resource Group (VRG) in 2016 showed that approximately 3,7 million Americans are vegan, and 4.3 million Americans are vegetarian but not vegans (11). In Indonesia, the number of vegetarians registered in the Indonesia Vegetarian Society (IVS) increase significantly (12). In 1998, the number of registered vegetarians was around five thousands and it has increased to sixty thousands registered members in 2007 (13).

Changing diet preference to vegetarian is certainly not easy (14,15). Most people are very dependent on the delicious taste of meat, so it is very difficult to switch to plant-based foods (16,17). Moreover, Balinese traditional foods (18,19), which are generally made from meat with its special spices, are very difficult to replace. The majority of vegetarian stalls, which sell Chinese vegetarian cuisine, are not necessarily accepted by the Balinese in particular. In addition, tourists visiting Bali, especially vegetarians, will find it difficult to enjoy Balinese specialties, which are predominantly made from meat. Moreover, due to religious beliefs, many visitors are not allowed to eat pork or beef.



With these issues in mind, and to suit the demands of both local communities and tourists, some vegetarian vendors in Bali started to offer vegetarian versions of traditional Balinese foods. These vegetarian cuisines are prepared using vegetables and a touch of Balinese culinary arts such as Balinese spices (*Base Genep*), with the result resembling Balinese cuisine. The presence of these stalls can meet all of the community's and tourists' needs.

In our preliminary survey, we found that there is a type of vegetarian cuisine, namely *Tum* that is processed from analog meat made of high protein legumes such as soybeans, mungbeans, etc. combine with Balinese spices. This analog meat looks and tastes similar to *Tum* from meat. In addition, there are several forms of Balinese traditional

Plant-based meals available at vegetarian stalls throughout Bali. As a start, the research was undertaken in Gianyar Regency, specifically in Ubud, where the Ubud area has been declared an International Gastronomic Destination by the UNWTO (16,20,21).

To establish the baseline of nutritional data on some of the most popular vegetable-based traditional Balinese foods, it is important to conduct a nutritional analysis. Therefore, this study aimed to establish the nutritional content of traditional Balinese plant-based foods and compare them to the nutritional value of Balinese meat-based cuisines. Additionally, the authors also conducted a survey on the types or varieties of Balinese vegetarian foods sold in the Ubud area, including the ingredients used and their processing techniques.

2. Materials and Methods

The research was conducted through interviews and observations at all vegetarian food stalls selling traditional Balinese vegetable dishes in the Ubud Gianyar area. The information gathered included the types of vegetarian foods sold at each stall and their processing techniques. The nutritional content (carbohydrates, moisture, protein, fat, and calorie content) was then analyzed using standard methods. Data were analyzed using a quantitative and qualitative approach. The findings from this study were compared to those of previous studies on Balinese specialties (animal-based).






3. Results and discussion

3.1. Types of Balinese traditional plant-based foods in Ubud Gianyar

Table 1 summarizes the types and varieties of Balinese traditional plant-based foods that were sold in the Ubud Gianyar area. In total, there were eleven types of plant-based Balinese traditional foods found in the study area. These include *sate lilit* made from jackfruit meat, *lawar* made from string beans, *tum* and *urutan* made from analog meats, *betutu* and *sisit* made from gluten, *dendeng* made from mung beans, *sayur urap*, *kuah kare*, and Balinese soup, all made from vegetables.

The processing methods and materials used for these plant-based foods are shown in Table 2. The main ingredients for these dishes come from leafy vegetables, beans, coconut milk, jackfruit meat, papaya, mung bean, string bean, gluten, and analog meat.

Table 1. Types of Balinese traditional plant-based foods in Ubud Gianyar.

No	Types of Balinese traditional plant-based foods	Picture
1	<i>Sate lilit</i> vegan	 A photograph of three skewers of golden-brown, cylindrical plant-based patties (sate lilit) resting on green banana leaves. A small white bowl containing a dark, chunky sauce is placed to the left of the skewers.
2	<i>Sayur urap</i>	 A photograph of a white bowl filled with a colorful vegetable salad (sayur urap). The salad consists of shredded green leafy vegetables, orange carrots, and other vegetables, all coated in a light dressing. A wooden spoon is placed on the right side of the bowl.
3	<i>Kuah kare</i>	 A photograph of a white bowl containing a thick, yellowish-orange soup (kuah kare). The soup is filled with various vegetables, including green leafy vegetables and orange carrots.
4	Balinese soup	 A photograph of a white bowl containing a clear, light-colored soup. The soup is filled with various vegetables, including green leafy vegetables, orange carrots, and yellow potatoes.
5	<i>Lawar</i>	 A photograph of a pile of finely chopped, mixed vegetables and herbs, likely a traditional Balinese salad (lawar). The mixture includes green leafy vegetables, orange carrots, and other vegetables, all finely chopped and mixed together.

6. *Tum*



7. *Betutu*



8. *Dendeng/ati*



9. *Sisit*



10. *Sate tusuk*



11. *Urutan*



Table 2. Balinese traditional plant-based Food Processing Method.

No	Type of Balinese traditional plant-based Food	Processing Method
1.	<i>Sate lilit</i>	Young jackfruit meat was boiled, mashed, and combined with a mixture of mung beans, <i>base genep</i> , grated coconut, tapioca flour, salt, pepper, brown sugar, and coriander. This mixture was formed into a dough, shaped, wrapped, and deep-fried.
2.	<i>Sayur urap</i>	Vegetables (spinach, sprouts, string beans) were cleaned, boiled, and drained. The boiled vegetables were added and mixed with grated coconut, <i>sambal embe</i> , fried onions, and limes.
3.	<i>Kuah kare</i>	Vegetables (pumpkin, string beans, and carrots) were cleaned and cooked with spices, and coconut milk, then sprinkled with fried onions.
4.	Balinese soup	Vegetables (pumpkin, string beans, carrots, spinach, and corn) were cleaned and cooked with spices, then sprinkled with fried onions.
5.	<i>Lawar</i>	String beans were cleaned and boiled until cooked (not mushy), then cut into short pieces. Papaya was cleaned, peeled, and cut into matchstick-size, then sprinkle with salt. The matchstick papaya was boiled until cooked (not mushy), drained, and squeezed. The analog meat was used to replace the beef. The analog meat was cleaned, cooked, drained, and coarsely chopped. Cut the small haisom (hysom imitation) lengthwise. The analog meat was mixed with grated coconut, then the <i>base selem</i> and <i>sambal embe</i> were added to the mixture. The mixture was seasoned with salt and lemon juice, squeezed, and mixed well. String beans were added and then stirred until thoroughly blended.
6.	<i>Tum</i>	<i>Base genep</i> was boiled into coconut milk to make <i>Kalasan</i> coconut milk, then mixed with boiled and chopped analog meat and pulverized <i>kluwek</i> . The mixture was added with fried onion sauce, fried onions, salt, and seasonings. The mixture was wrapped in banana leaves and steamed for 45 minutes.
7.	<i>Betutu</i>	Gluten dough was cut and shredded. The shredded gluten dough was mixed with spices and salt. The mixture was wrapped with banana leaves and steamed for 30 minutes.
8.	<i>Dendeng/ati</i>	Mung beans were soaked for a day and drained, then added with coriander, and salt. The mixture was steamed and cooled. The cooled mixture was thinly sliced and added with pulverized garlic, shallots, chilies, tomatoes, candlenuts, and brown sugar which was already sautéed with water until cooked.
9.	<i>Sisit</i>	Gluten dough was boiled, added with soy sauce, stirred, let stand for a while then baked. This dish can be served with <i>sambal matah</i> .
10.	<i>Sate tusuk</i>	Vegetable protein comes from soybean scalded with hot water and drained. The blended garlic, coriander, candlenut, chili, brown sugar, and salt were first stir-fried, then water and vegetable protein were added, and cooked to dry. The seasoned vegetable protein was skewered and grilled. Peanut sauce (fried peanuts were blended, boiled until thickened, and added with soy sauce, fried onions, and lime) was used as a dipping sauce.
11.	<i>Urutan</i>	<i>Base genep</i> sauteed until cooked, mixed with meat analog that has been doused in hot water, and added with 1 tablespoon of wheat flour and 1 tablespoon of tapioca flour. The dough was placed on top of the bean curd, rolled, steamed, and fried briefly.

Several vegetarian stalls and restaurants in Ubud Bali already made an innovation by producing Balinese traditional plant-based Food. Vegetarian cuisine is prepared with vegetable products and infused with Balinese culinary arts such as Balinese spices (*base genep*) (22), with the result resembling a Balinese meal. The existence of these stalls and restaurants can complement all the needs of the community and tourists. Animal-based ingredients in traditional Balinese foods can be replaced with vegetable-based ingredients, such as meat analogs and plant-based flavorings.

The flavoring used includes plant-based materials such as coriander, mushroom, peppers, etc. Meat analog is a food ingredient whose shape, texture, and taste are very similar to meat, but it does not contain animal products at all (23,24). Usually, meat analogs are made from mushrooms, tempeh, tofu, and jackfruit meat (25–27). Some of the most common plant-based ingredients used in plant-based Balinese traditional foods include:

- a. Proteina was known in the market by the trademark Proteina. Proteina contains vegetable protein from pure soybeans, that have been separated from the oil, without the addition of other ingredients.
- b. Haisom is a vegetable-based product that contains vegetable protein, mushrooms, wheat, and vegetable spices. The cooking method is quite easy, namely by sautéing, mixing in capjay, or cooking in vegetarian oyster sauce.
- c. Gluten can be used for vegetarian and vegan dishes. Gluten is an amorphous (irregular form) of protein found in the endosperm (and flour made from it) of certain cereals, most notably wheat, rye, and barley (28). Wheat contains the most gluten of the three. Gluten can account for up to 80% of the total protein in the flour and is composed of gliadin and glutenin proteins. Gluten is used to make dough chewy and expands (29). Gluten can be made by food processors themselves and can be purchased in the market. Gluten can be made by kneading wheat flour with water to form a sticky dough strand. The dough is then rinsed with water while being slowly kneaded to remove the starch. After rinsing, the remaining product is pure gluten with a chewy and sticky texture. To make it more practical, the vegetarian food cook said that they often buy artificial meat or gluten in online or offline markets. Artificial meat available in the market is not only made from wheat flour but can also be made from pure soybeans, what they usually use is a product with the Proteina brand. In addition, vegetarian cooks often use haisom/sea cucumber which is sold under various trademarks.

Tum is traditionally produced using fresh blood as the coloring. In the production of vegan *tum*, fresh blood is substituted using *kluwek*. *Kluwek* fruit meat has the potential to be used as medicine and herbs (30). However, before it is used as food ingredients, *kluwek* must be sliced and soaked in water to remove undesirable compounds such as cyanide, a toxic substance that can be harmful to the body.

3.2. Nutritional Content of Balinese traditional plant-based Food

The nutritional contents of Balinese traditional plant-based foods are shown in Table 3.

Table 3. Nutritional Content of Balinese traditional plant-based foods.

No	Type of Balinese Vegetarian Food	Nutrient Content					
		Water content (%bb)	Ash Content (%bb)	Protein (%bb)	Fat (%bb)	Carbohydrate (%bb)	Calories (kcal)
1.	<i>Sayur Urab Vegan</i>	83.07	1.33	2.61	6.51	6.48	94.93
2.	<i>Balinese Soup Vegan</i>	88.70	1.24	3.21	1.94	4.90	49.93
3.	<i>Kare Vegan</i>	81.28	1.28	6.09	5.20	6.14	95.78
4.	<i>Sate Tusuk Vegan</i>	60.44	2.37	11.75	10.69	14.76	202.23
5.	<i>Tum Vegan</i>	53.31	1.38	7.75	12.97	24.6	246.07
6.	<i>Sate Lilit Vegan</i>	37.74	2.43	5.17	26.69	27.97	372.76
7.	<i>Lawar Vegan</i>	75.25	1.10	2.67	10.95	10.03	149.38
8.	<i>Ati vegan</i>	8.45	3.52	14.47	32.71	40.84	515.68
9.	<i>Sisit Vegan</i>	50.65	1.77	20.05	10.24	17.28	241.48
10.	<i>Betutu Vegan</i>	60.72	1.47	14.6	13.8	9.43	220.12
11.	<i>Urutan Vegan</i>	35.1	2.88	6.58	33.89	21.56	417.59

The results of the nutritional value of Balinese traditional plant-based foods were compared to other studies of Balinese specialties (animal-based).

Table 4. Comparison of the Nutrient Content of Balinese traditional plant-based Foods with Balinese traditional animal-based Foods.

No	Type of Food	Nutrient Content				Comparison Results
		Protein (%bb)	Fat (%bb)	Carbohydrate (%bb)	Calories (kcal)	
1	<i>Vegan sate lilit</i>	11.75	10.69	14.76	202.23	<ul style="list-style-type: none"> The protein content of <i>sate lilit vegan</i> was higher than <i>sate lilit</i> from beef but lower than <i>pork sate lilit</i> Fat and calories content of <i>sate lilit vegan</i> was higher than <i>pork sate lilit</i>, but lower than beef <i>sate lilit</i> Carbohydrate content of <i>sate lilit vegan</i> lowest compared with beef <i>sate lilit</i> and pork <i>sate lilit</i>
	<i>Beef sate lilit (31)</i>	5.74	23.29	24.89	332.13	
	<i>Pork sate lilit (32)</i>	27.02	2.93	15.64	197.01	
2	<i>Vegan Lawar</i>	2.67	10.95	10.03	149.38	<ul style="list-style-type: none"> Protein, fat, and calories content of <i>lawar vegan</i> was the lowest one. Carbohydrate of <i>lawar vegan</i> was higher than beef <i>lawar</i> but lower than pork <i>lawar</i>
	<i>Beef Lawar (33)</i>	11.14	18.0	6.61	233	
	<i>Pork Lawar</i>	5.74	13.87	11.97	195.67	
3	<i>Vegan Betutu</i>	14.6	13.8	9.43	220.12	<ul style="list-style-type: none"> The protein of <i>vegan betutu</i> was lower than <i>betutu</i> Fat, carbohydrate, and calories of <i>vegan betutu</i> were higher than chicken <i>betutu</i>
	<i>Chicken Betutu (31)</i>	20.6	7.82	4.54	170.98	
4	<i>Vegan urutan</i>	6.58	33.89	21.56	417.59	<ul style="list-style-type: none"> The protein of <i>vegan urutan</i> was lower than beef <i>urutan</i> Fat, carbohydrates, and calories of <i>vegan urutan</i> were higher than beef <i>urutan</i>.
	<i>Beef Urutan (31)</i>	25.66	27.8	1.99	361.53	

5	Vegan <i>Tum</i>	7.75	12.97	24.6	246.07	<ul style="list-style-type: none"> The protein of vegan <i>tum</i> was lower than beef <i>tum</i> Fat, carbohydrate, and calories of vegan <i>tum</i> were higher than beef <i>tum</i>
	Beef <i>Tum</i> (31)	18.25	11.09	4.64	191.37	
6	Vegan <i>sate</i>	11.75	10.69	14.76	202.23	<ul style="list-style-type: none"> The protein of <i>vegan sate</i> was lower than <i>languan</i> (fish) <i>sate</i> The carbohydrate of <i>vegan sate</i> was higher than <i>languan</i> (fish) <i>sate</i>
	<i>Languan</i> (fish) <i>sate</i> (31)	12.50	14.30	12.87	230.18	

According to the data in Table 4, By and large, traditional Balinese foods made with vegetables have a higher calorie content than those made with animal products. It is not certain that meatless and animal-free dishes contain fewer carbs, proteins, fats, or calories. It is material dependent. As with vegan food processed with plant-based materials (gluten), these ingredients are also high in carbohydrates due to their origin in starchy flour.

Additionally, the method of cooking affects the nutritional value of the food (34,35). The calorie content of foods can be increased by processing them with oil or by frying them (36,37). It is impossible to determine which food is superior based on the data above; it all depends on consumer preferences. The nutritional content information can be used to assist the community in making food selections.

4. Conclusions

Balinese traditional plant-based foods, such as *sate lilit*, *kuah kare*, Balinese soup, *sayur urap*, *betutu*, *lawar*, *tum*, *dendeng/ati*, *sisit*, *sate*, and *urutan*, which are made similar to Balinese food processing using Balinese spices (*base genep*) contains good nutrition.

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Author Contributions

For this research, N.P.E.T. in the idea, writing, and coordinating all research processes; For AA.Gd.KP.D. and M.P.D.A. contributed to the survey activities in the field.

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Conflicts of Interest

The authors declare no conflict of interest.

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