

Functional food project: A new and enjoyable topic in a food chemistry course

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Abstract. Consuming functional food is believed to avoid the risk of non-communicable and degenerative diseases. Functional food development has attracted the attention of many researchers, but not all food has been explored for its potential. This research aims to determine students' ability and response through food chemistry courses to carry out functional food projects. The method which was used in this research is descriptive methods. Participants consisted of 16 chemistry students of the eighth semester at a university in Mataram city, Indonesia. The research instrument consisted of a project evaluation rubric and a questionnaire. The project material makes use of Lombok's local natural resources and traditional food. The results showed that students were able to perform well functional food projects. The resulting products are diverse, such as anti-obesity soy nuggets and moringa tea as an antioxidant, aloe vera jelly to treat skin, aloe vera cake, and tea as an antioxidant, and ginger green bean porridge as a source of fiber and antioxidant. Students feel enjoyable, motivated, and challenging to carry out project activities. Functional food projects are also as new topics and activities in food chemistry courses.

Keywords: *functional food project, new, enjoyable topic, food chemistry*

1. Introduction

Functional food in various countries has become a trend, and part of a healthy lifestyle [1]. It is believed that consuming functional food is one way of taking care of the body's health and preventing non-communicable diseases (NCDs) such as heart disease, stroke, cancer, and diabetes [2], [4]. As World Health Organization data, NCDs are still causing up to 71 percent of the high mortality rate [5]. The case of NCDs, particularly in Indonesia, also shows a growing trend over time and is forecast to continue [6]. Also, the occurrence of NCDs is triggered by the habit of people eating fast food which can cause obesity [7]. Then aroused the interest of researchers to develop functional food as an alternative in overcoming these health problems.

Functional food development in Indonesia generally utilizes an abundance of local natural resources which are rich with bioactive compounds such as cashew (*Anacardium occidentale*), chekkurmanis (*Saoropus androgynous* (L.) Merr.), horseradish tree (*Moringa pterygosperma* Gaertn.), and pluchea leaf (*Pluchea indica*) [8], [10]. The bioactive compound is the basis for the development of functional food because it can act as an antioxidant, antidiabetic, source of fiber, and other health benefits [11], [13]. Besides that, by utilizing various local and traditional foods such as tempeh and herbs, it can also be develop functional food [14], [15]. However, the development of some functional



foods still has challenges namely the lack of public awareness about the health benefits of diet and not all the functional potential of natural resources and traditional food have been revealed [16]. Some foods also require further processing to become foods that have better nutrition. Therefore, efforts to uncover a variety of food ingredients ' functional potential need to be more massive, one of them through the course of food chemistry.

In principle, food chemistry studies the composition and nature of food ingredients and chemical changes that occur during the process of handling, processing, and storage, [17]. Food composition includes various vitamins, minerals, amino acids, dietary fiber, resistant starch, and other bioactive compounds such as secondary metabolites. But so far, food chemistry course in Teacher Training Institute (LPTK) have not accommodated the teaching of functional food topics based on bioactive compounds. Food chemistry courses are not compulsory subjects but include elective courses with a total of 2 credits without any practical activities. With its characteristics as an elective course, it allows several learning topics to change according to scientific development. It becomes an opportunity to include functional food in the lecture syllabus as a new topic and current issues. In developing functional food, it does require some time to be completed to be done. So we also need an effective and efficient learning model to teach about functional food topics.

One learning model that is suitable and effective for the characteristics of the topic is project-based learning (PjBL). PjBL provides space for students to explore the theme of course in more depth, both with classroom learning and laboratory activities [18]. Through PjBL, chemistry students can independently design their laboratory activities and produce products at the end of the activity [19]. PjBL, which involves the actions of investigating and developing a product, makes learning more exciting and meaningful [20]. The abundance of natural resources and various traditional foods in Lombok will greatly facilitate student activities in doing on functional food projects. The demand for functional food will continue to increase and is very prospective in the future [21]. Thus through this project, students are expected to be able to develop functional foods from various local natural resources and traditional foods with multiple health potentials and make chemistry learning more enjoyable.

2. Research method

The methods which was used in this research is descriptive method [22]. Participants consisted of 16 chemistry students of eighth semester at an university in Mataram city, Indonesia. The students then worked in four small groups. The research was conducted for two weeks in the academic year 2018/2019. The final product of this project activity is functional food which has the potential for physical health. Students must utilize local natural resources and traditional food of Lombok as a source of functional food development. The implementation of this project was supported by teaching materials, student project guides, rubrics for assessing project activities, and questionnaires. Data on the ability of students to carry out projects was assessed with the project appraisal rubric, which was then analyzed in a percentage. While student's responses were analyzed descriptively. Steps of this project might be depicted as in figure 1.

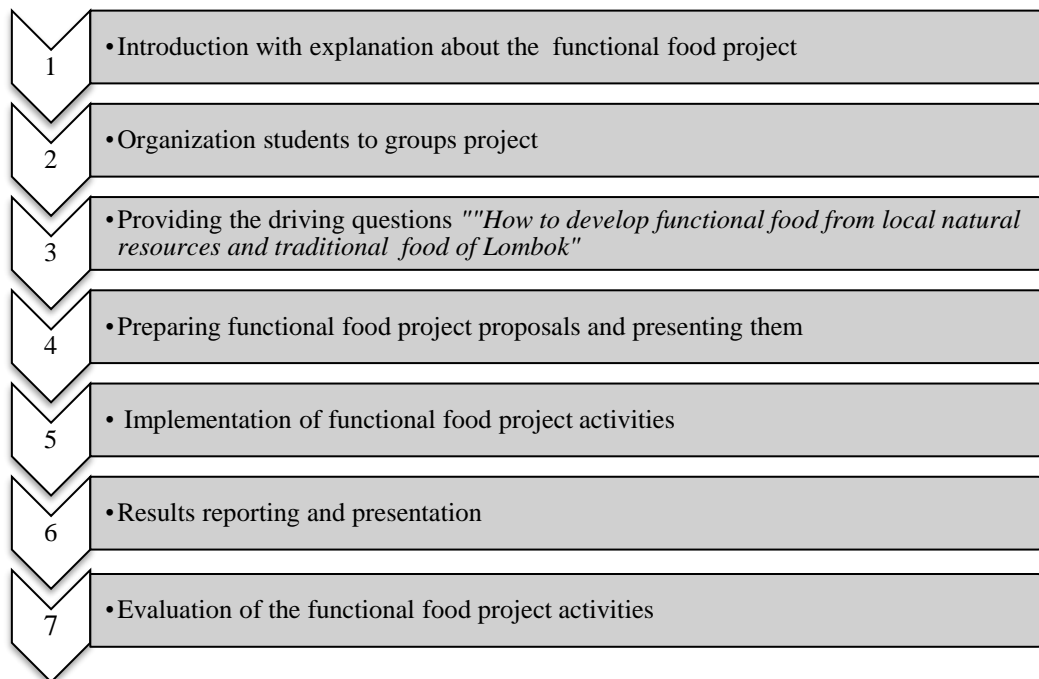


Figure 1. The syntax of functional food project.

3. Results and Discussion

3.1. Student's ability in developing functional food

All groups successfully carried out functional food project activities with each final product produced. The functional food products were soybean nugget and moringa tea, aloe vera jelly, aloe vera cake, and tea, and ginger green bean porridge by groups A, B, C, and D respectively (figure 2). All of these foods include abundant availability and are the raw material components of some traditional foods in Lombok.

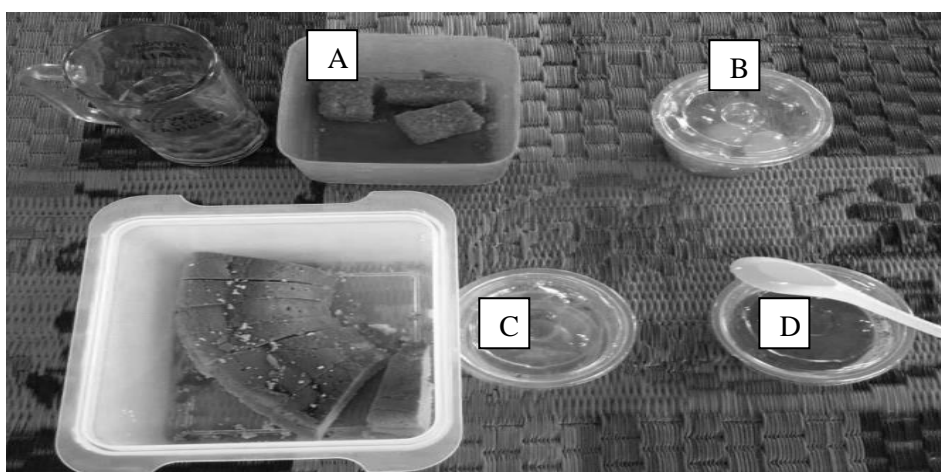


Figure 2. Functional foods produced by students: A) Soybean nugget and moringa tea, B) jelly aloe vera, C) aloe vera cake and tea, D) ginger green bean porridge

Based on the results of the assessment using the rubric, only group A achieved very good results. The other three groups are classified as good. The functional food produced are classified as

development with local raw materials. The use of soybeans and moringa by group A refers to the abundance of these commodities in Lombok island. Groups B and C utilize aloe vera because it is widely planted in the yard of the house and garden while group D employs ginger which is a spice in traditional Lombok dishes such as *ares* and *cengeh* [23], [24].

Table 1. Results of functional food project assessment.

Aspects	Group A	Group B	Group C	Group D
Concept referred	4	4	4	3
Understanding procedure	3	3	3	3
Understanding bioactive compound	3	3	3	3
Product creativity	3	2	2	2
Score total	13	12	12	11
Percentage	81.25%	75%	75%	68.75%

(0-40: poor, 41-55: less, 56-65: pretty good, 66-79: good, 80-100: very good)

The ability of each group to include the concepts referred to in project activities is excellent. This concept has an essential role in project activities as a source of reference in project preparation and implementation. For example, group A, with the theme of the soybean nugget project with anti-obesity potential and Moringa tea as an antioxidant, included all the supporting concepts. These concepts include the idea of nuggets, soy nutrition, and its benefits, obesity, moringa leaves and their contents, and antioxidants. The references referred to also come from various scientific articles which are indexed by Scopus, and there are more than five journal articles [25], [30]. Some other supporting materials they obtained from several textbooks, thesis, and institutional websites such as FAO and WHO [31], [33]. The students' habit of working on written reports on other subjects helps them in this aspect.

The aspect of understanding procedures and bioactive compounds showed good results by all groups. Some women group members do have skills in making food. Generally, they often make snacks and other dishes at home or dormitory. So it is beneficial for them in understanding the procedure. Meanwhile, the previous learning in class about the concept of functional food has strengthened their understanding of the concept of bioactive compounds.

The creativity in producing the functional foods by three groups, namely groups B, C, and D is classified as a formula that is not new, and its characteristics are still dominant old products. While group A is quite good compared to the other three groups with the formula category that is not new, but old products do not dominate its characteristics. Nugget usually sourced from a mixture of chicken and beef. However, soy nuggets substitute meat with soy which later become an advantage. The attributes of nuggets are also quite dry and crispy. The soybean nuggets are served with tea drinks from Moringa leaves as a source of antioxidants.

One of the interesting things from this research is the different ways in which each group designs its project activities. In creating functional food project activities, each group turns out to have a different perspective. Groups A, B, and D, for example, start by determining first the type of functional food to be made and then looking for materials from various plants that are suitable to be added to the product. Their reason is to make it easier for them to determine the intended consumer by considering the food that is often preferred by these consumers. For example, as done by group A, which makes soy nuggets with potential as an anti-obesity. The target for their products is teenagers who like to consume various snacks. They hope by making snacks in the form of soy nuggets, although they are often consumed, it does not make teenagers infected with obesity. The isoflavone content in soy is efficient in reducing lipid accumulation so that it can act as anti-obesity [34].

While another group, group C, did the opposite. They determine the bioactive compounds first from various local natural resources or traditional food and then look for ideas on the types of functional food products to be made. Their reason is that by knowing the functional potential of a

bioactive compound from some local ingredients or traditional food, they will be easier to develop it into various food products. Related products made are aloe vera cake and aloe vera tea, starting from the number of aloe vera plants that grow around the yard of a group member's house. So they then find out the chemical content of aloe vera which has been beneficial both for skin health, digestion and anticancer. After that, they formulate it as a cake by oven processing and avoid frying.

3.2. *Student's responses*

Student responses to functional food project activities were very positive. Some of their responses are listed as follows:

- "This food chemistry activity is enjoyable and useful. Maybe if I have a business spirit, I can develop a functional culinary business that is promising with various innovations after getting functional food material and implementing the project. "
- "I am very pleased with this project program because it made me even more aware of functional food for health and immediately made it."
- "The food chemistry learning that was carried out was very interesting because we could find out more about the traditional and local food of Lombok. Through functional food projects that we make, we can foster motivation for entrepreneurship and creativity to produce snacks that have a sale value that is not only delicious but also good for health. "
- "The food chemistry course is fun, the project is directly related to daily activities, so it is beneficial. It can also be a business opportunity, for functional food, it trains students' creativity."

Positive responses shown by students are caused by the learning atmosphere that makes them comfortable to learn. Hands-on activities and materials related to daily life are also portrayed as some other reasons. Hands-on activity by designing functional food gives them exciting experiences that they have never done before. It is considering that the concept of functional food is the first time they have known through this project in food chemistry lectures. Their interest is further strengthened by the use of traditional food and other local natural resources as a source of project learning. They have just realized that their traditional food and local natural resources can be developed into something of value and health. This finding is consistent with other research in chemistry and food that students who undertake project learning feel motivated, challenged, and enjoyed [35], [36]. Exploring chemistry through food also makes learning fun [37].

Another factor that also influenced the success of this project was the team-building skills of students. Team-building skills become one of the skills needed for the workforce, along with communication skills. As it turns out, team-building skills can be trained through projects that are indicated through the completion of functional food products and final group reports on time. The same thing has also been reported in similar studies that project activities in learning food chemistry are useful for training team-building and communication skills [38]. Also, students find it very helpful to project activities because they provide research experience. Given shortly, they will conduct thesis research for graduate studies. This project allows them to learn responsibility through the role of each group member.

This project activity can stimulate students' high-level thinking skills. The core idea of PjBL is to provoke serious thinking as students acquire new knowledge [39]. Critical thinking skills can be trained, for example, by determining bioactive compounds from food and its potential for health. Besides, it is also possible to practise the creative thinking skills of students recorded through the different ways in which several groups develop functional food.

4. Conclusion

Functional food projects are becoming new topics and activities in food chemistry courses. The ability of students in conducting functional food projects is well and quite well. Student responses to the

project were very positive. They feel enjoyable, motivated, challenging by doing projects that relate directly to their culture and local natural resources.

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