

Qualitative Screening of Food Safety Using Parameters Based on Natural Plant Materials

Alinea Dwi Elisanti

Politeknik Negeri Jember

Corresponding Author: Alinea Dwi Elisanti alinea@polije.ac.id

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ABSTRACT

The community as consumers has a role in ensuring food safety. The use of kits has been widely used to identify food additives (BTP) in food ingredients in the community. Currently, a simple, cheap, and easy test tool is needed to screen food ingredients. The purpose of this study was to conduct qualitative screening of food safety using natural plant ingredients, namely turmeric extract and dragon fruit skin. This type of research is a laboratory survey using 30 food samples sold during the fasting month. The results showed that 13.3% of food types were suspected of containing borax and 68.75% were suspected of containing formalin. Food ingredients containing borax are raw wet noodles, skewered meatballs, salted fish and salted squid, while those containing formalin are raw wet noodles, cooked noodles, skewered meatballs, cilok, raw tofu, salted fish, bakpau, pukis, chicken nuggets, petulo, and salted squid. Food ingredients containing borax and formalin are raw wet noodles, skewered meatballs, salted fish and salted squid

INTRODUCTION

Food safety is a crucial issue in food security. According to Law No. 7 of 1996, food safety is defined as the conditions and efforts required to prevent food from possible biological, chemical and other contaminants that can disrupt, harm and endanger human health. Furthermore, in Government Regulation No. 28 of 2004 concerning Food Safety, Quality and Nutrition, it is stated that food safety requirements are standards and other provisions that must be met to prevent food from possible dangers, either due to biological, chemical and other contaminants that can disrupt, harm and endanger human health (Government Regulation of the Republic of Indonesia, 2004; Law of the Republic of Indonesia No. 7 of 1996 concerning Food, 1996).

Food safety in Indonesia tends to be still low. Food is said to be safe if it is free from dangers that may arise due to the presence of biological, chemical and physical contaminants. The results of the latest study have identified 21.2% of school children's snacks containing prohibited food additives (BTP) (Asyfiradayati et al., 2024). The impact of low food safety can not only cause chemical hazards but also cause the emergence of foodborne diseases. Although many cases are not detected and not reported, the cases that appear in the field are clear evidence that food safety should be a primary concern. It was recorded that cases of food poisoning in the period 2021-2023 reached 1,110 cases (64.46%) (Khusnul Khotimah, Elsadora Reapina Malthaputri, Fairuz Murti, Kenya Lintang Wienantu, Septia Chandra Kesi, Mazidah Imanuna, Ervira Sufia Rahmawati, 2025). Another danger is the threat of chemical hazards originating from dangerous BTP, but is usually rarely watched out for because the impact rarely occurs immediately because it is accumulative, although there are some that have direct impacts such as irritation to the throat or symptoms of other common diseases (Eryani, 2022). Several studies have shown the large use of hazardous materials that are prohibited for use as BTP but are often used, namely formalin, borax and rhodamin B. In general, consuming dangerous BTP will have a negative impact on health in the long term, such as cancer. In fact, consuming dangerous BTP in high doses can cause direct negative effects on health, such as poisoning and even death (Wahyudi, 2017).

LITERATURE REVIEW

The community as consumers has a role in ensuring food safety. To build an intelligent society as the end consumer of food products, it is necessary to maintain food safety. In its implementation in the community, it is undeniable that many foods are identified as containing several BTPs using several test techniques, namely laboratory tests, or using several natural ingredients or using sensor devices, such as a study on 66.7% of snacks contaminated with chemicals carried out using purple trumpet flowers (Hastuti & Rusita, 2020), GY-ML8511 Sensor in Formalin Detection (Ramadhan et al., 2024). Several BTP detection techniques have several weaknesses, in addition to being more expensive, natural sources of ingredients that are difficult to obtain, so there needs to be an alternative testing technique that is simpler and easier to apply in the community. So this study aims to conduct qualitative screening of food safety (formalin and borax) in snacks and takjil sold during fasting in several street

foods and vegetable stalls using simple, cheap and easily obtained natural plant ingredients.

METHODOLOGY

This study uses a laboratory survey method. The materials used are turmeric, dragon fruit peel, 25% formalin solution, 25% borax solution. While the tools used are graters, blenders, mortars, filter paper, sieves, small bottles, test tubes, pipettes, 95% distilled water. The samples in this study were 30 samples of food ingredients and ready-to-eat foods obtained from street food vendors selling breaking-the-fast menus along Jalan Kalimantan, as well as vegetable stalls around Jl. Sumatera, Jl. Mastrip and Jl. Karimata, Jember Regency. The research was carried out for 2 weeks, starting from the 2nd and 3rd weeks of March 2025. Samples were collected for 4 days and immediately tested quantitatively using natural plant ingredients in the form of turmeric extract and dragon fruit peel extract. The testing stages are first making turmeric extract by grating 100 grams of turmeric and mixing it with 100 ml of distilled water and then filtering it, then making dragon fruit skin extract in the same way (100 grams of dragon fruit skin and 100 ml of distilled water). The second way is to prepare the sample extract by weighing 10 grams of each sample, then crushing it with a mortar and 20 ml of distilled water until smooth, then filtering it with filter paper. The third way to make a positive control for borax testing is by mixing 10 drops of 25% borax solution and 2 drops of turmeric extract and shaking it, a positive control for formalin testing by mixing 10 drops of 25% formalin solution and 2 drops of dragon fruit skin extract. The fourth way is to test all samples. The qualitative parameters of food ingredients suspected of containing borax are if the results change color from yellow to orange the same as turmeric, then it is suspected that they do not contain borax, while the color of the sample is brownish red, then it is suspected that it contains borax, while it is suspected that it contains formalin if the results show a fading color change (from purple to faded purple).

RESULTS

The results of the study have obtained 30 samples of food ingredients, namely meatball skewers, cilok (meatball skewers made from starch), tofu, raw wet noodles, salted fish, bakpau, pukis, cooked noodles, rolled omelettes, dimsum, wet pandan cakes, raw kwetiaw, nuggets, petulo, cenil, salted squid. After the samples were collected, the preparation of materials for testing was carried out as in Figure 1. Furthermore, qualitative testing was carried out using natural plant materials, then the results of the borax test were obtained as in Table 1 and the formalin test as in Table 2.



Figure 1. Preparation of Natural Plant Materials

Table 1. Borax Content Based on Food Type

Types of Food	Number of Samples	Positive Amount	Negative Amount
Raw Wet Noodles	1	1	0
Cooked Noodles	1	0	1
Skewered Meatballs	4	1	3
Cilok	4	0	4
Raw Tofu	4	0	4
Salted Fish	4	2	2
Bakpau	2	0	2
Pukis	2	0	2
Rolled Omelette	1	0	1
Dimsum	1	0	1
Wet Pandan Cake	1	0	1
Kwetiaw	1	0	1
Chicken Nuggets	1	0	1
Petulo	1	0	1
Cenil	1	0	1
Salted Squid	1	1	0
Total	30	5	25

Qualitatively, from 30 food samples, there were 5 (16.6%) types of food containing borax, namely raw wet noodles, meatballs on skewers, salted fish and salted squid. While those that did not contain borax were 25 samples (83.4%).

Table 2. Formalin Content by Food Type

Types of Food	Number of Samples	Positive Amount	Negative Amount
Raw Wet Noodles	1	1	0
Cooked Noodles	1	1	0
Skewered Meatballs	4	2	2
Cilok	4	1	3
Raw Tofu	4	1	3
Salted Fish	4	3	1
Bakpau	2	1	1
Pukis	2	1	1
Rolled Omelette	1	0	1
Dimsum	1	0	1
Wet Pandan Cake	1	0	1
Kwetiaw	1	0	1
Chicken Nuggets	1	1	0
Petulo	1	1	0
Cenil	1	0	1
Salted Squid	1	1	0
Total	30	14	16

Qualitatively, out of 30 food samples suspected of containing formalin, 14 (46.6%) were raw wet noodles, cooked noodles, meatballs on skewers, cilok, raw tofu, salted fish, bakpau, pukis, chicken nuggets, petulo, cenil and salted squid. Meanwhile, 16 samples (53.4%) were suspected of not containing formalin.

DISCUSSION

The results of qualitative screening research on food ingredients containing borax reached (16.6%) samples with types of food containing borax, namely raw wet noodles, meatballs on skewers, salted fish and salted squid. Of the types of food containing borax, the most is salted fish. Meanwhile, food ingredients suspected of containing formalin were 14 samples (46.6%) with details of the types of food, namely raw wet noodles, cooked noodles, meatballs on skewers, cilok, raw tofu, salted fish, bakpau, pukis, chicken nuggets, petulo, and salted squid. Meanwhile, those suspected of not containing formalin were 16 samples (53.4%). The types of food that contained the most formalin were salted fish and meatballs on skewers (pentol). The use of natural plant ingredients as detectors of the presence of borax and formalin in food has the potential to be applied in Indonesia, besides being easily obtained, turmeric and dragon fruit skin can also be an alternative choice of relatively cheaper ingredients because they can utilize dragon fruit waste and turmeric itself can be grown independently at home. Turmeric extract contains curcumin compounds, this compound is able to break down borax bonds into boric acid (Grzegorz Gryniewicz, 2012) and bind them into a brownish red complex, borax is a weak base, curcumin is yellow in acidic conditions and brick red in alkaline conditions. So the positive color of borax will be brick red. Dragon fruit skin contains

anthocyanins so that it can detect the presence of formalin, formalin and anthocyanins have the same properties, namely acid, so that the color of anthocyanins in dragon fruit skin remains stable, anthocyanins have a pH of around 2-3 the same as formalin, the acidic nature of formalin causes the color of anthocyanins to remain red at pH 1, but at pH above 4 it will give a violet color, so if formalin is detected, the color will fade to violet (Muthi'ah & Qurrota, 2021), (Sinta Ratna Dewi, 2019). Dragon fruit skin can be applied to wet food (Kusumawati et al., 2020). The addition of borax aims to provide a solid, chewy and crunchy texture, while the provision of formalin aims to preserve food ingredients. The results of previous studies reported that turmeric paper can be used for qualitative borax analysis, where the results of observations on 12 cracker samples at Semolowaru Market, Surabaya, 100% showed positive borax content. Likewise with the results of quantitative borax analysis using a UV-vis spectrometer. The Borax content in the samples ranged from 11.80 - 119.90 ppm with the lowest value in "Uyel" crackers, namely 11.80 ppm and the highest borax content in "Puli Galar" crackers, namely 119.90 ppm (Hartati, 2017). The type of food containing borax in this study was wet noodles, this has similarities with the BPOM study reported by previous researchers which stated that wet noodles, meatballs and snacks contain borax. Likewise, the types of food that contain formalin are wet noodles, tofu, fresh fish (Wahyudi, 2017), (Sindi Perdanti Riani, Valoma, Zeti, Nur Fasiha, Rani, 2024). While the results of the borax test research around the campus area in Semarang are meatballs (Aryani & Widyantara, 2018). The addition of certain substances to food has actually been known for a long time. Ancient Egyptians used salt and spices to preserve food. The purpose of adding BTP in general is to increase the nutritional value of food, improve the aesthetic and sensory value of food and extend the shelf life of food (Wahyudi, 2017).

Based on the Regulation of the Minister of Health Number 033 of 2012, there are 2 groups of BTP, namely permitted BTP and prohibited or dangerous BTP for use. For permitted BTP, their use must be given within limits where consumers do not become poisoned by consuming additional substances known as the threshold of use. While boric acid and its compounds (Boric acid) or borax and formalin (Formaldehyde) are categories of prohibited BTP, use in any dose, no matter how small, is still not permitted (Regulation of the Minister of Health of the Republic of Indonesia Number 033 of 2012 concerning Food Additives, 2012).

Borax and formalin are substances that are dangerous to human health if consumed beyond the threshold, in fact various studies show that borax and formalin are still used by processed food industry producers, especially household industries. One of the factors that encourages producers to use food additives beyond the threshold is the need for encouragement to obtain more profit (Eryani, 2022).

Borax and formalin, although useful if used correctly, are very dangerous when used as food preservatives. Many people and manufacturers still use them for profit despite the health risks. These two chemicals are easily available and cheap, and can improve the texture of food and attract children. Consumption of

borax and formalin in small amounts can accumulate in the liver, brain, and testes, and be absorbed through digestion and skin. Borax can interfere with metabolic enzymes and male reproductive organs, and cause dizziness, vomiting, diarrhea, kidney damage, and loss of appetite if consumed in high amounts. Negative effects can last a long time even in small doses. Borax can damage the central nervous system, kidneys, and liver, with the kidneys being the most affected. The fatal dose for adults is 15-20 g and for children 3-6 g (Eryani, 2022).

CONCLUSIONS AND RECOMMENDATIONS

Turmeric extract and dragon fruit skin can be alternative natural plant ingredients that are used to conduct low budget qualitative screening of borax and formalin content in food ingredients. The screening results showed that the types of food suspected of containing borax were identified as 4 types (13.3%) out of 16 types of food, while those suspected of containing formalin were 11 (68.75%) types of food. Food ingredients containing borax include raw wet noodles, skewered meatballs, salted fish and salted squid. Food ingredients containing formalin are raw wet noodles, cooked noodles, skewered meatballs, cilok, raw tofu, salted fish, bakpau, pukis, chicken nuggets, petulo, and salted squid. Meanwhile, the types of food suspected of containing borax and formalin are 4 food ingredients, namely raw wet noodles, skewered meatballs, salted fish and salted squid. There needs to be a continuous follow-up effort involving various sectors from the national food agency, the food and drug monitoring agency, the national nutrition agency and local governments to improve education and evaluation of the use of hazardous BTP in Jember City.

FURTHER STUDY

It can be developed into quantitative test as a golden standard or qualitative screening by utilizing artificial intelligence technology using basic data from previous research.

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