

Investigation of Borax in Meatball Products Sold in Bengkalis, Riau

Anjeli Cristina Zachawerus¹, Sulistiawati Sulistiawati^{2*}, Ema Qurnianingsih³

¹Faculty of Medicine, Universitas Airlangga, Surabaya, Indonesia.

²Department of Public Health and Preventive Medicine, Faculty of Medicine, Universitas Airlangga, Surabaya, Indonesia.

³Department of Physiology and Biochemistry, Faculty of Medicine, Universitas Airlangga, Surabaya, Indonesia.

ABSTRACT

Introduction: Borax is a food additive that can no longer be used. However, there were still many street food vendors who violated this rule. This study aimed to determine the presence or absence of borax in meatballs and the relationship between meatball sellers' characteristics and knowledge of the use of borax in Bengkalis, Riau.

Methods: This was an observational analytic study with cross-sectional collection. This study collected 40 samples of meatballs and meatball sellers in Bengkalis. The sampling technique used purposive sampling by interviewing meatball sellers and filling out the questionnaire on the spot. Data were analyzed by Chi-Square test.

Results: This study found that all meatballs contained borax with 36 samples found to have borax content above the standard. This study also found no relationship between characteristics (age, level of knowledge, income) and knowledge of meatball sellers with the use of borax ($p > 0.05$).

Conclusion: There was no significant relationship between borax use and meatball sellers' knowledge and characteristics.

Highlights:

1. Borax is still used as a food additive even though it has been banned.
2. There was no relationship between age, income, and knowledge of the meatball sellers and the use of borax in Bengkalis.
3. The risk factors for the widespread use of borax are still unknown.

* Correspondence: sulistiawati@fk.unair.ac.id

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Introduction

Meatballs are products made from ground meat along with flour and other food ingredients, which is a very popular food in Indonesia. Almost everyone loves this food. Meatballs are consumed because of their practical presentation. They are widely available in various places, such as in traditional markets, supermarkets, educational institutions (elementary, junior high, high school, university), and many more, with types and prices that are quite affordable for all people. Several publications stated that borax is often used to make a chewy texture and give a savory taste to meatballs. According to the Regulation of the Minister of Health of the Republic of Indonesia No. 722/MENKES/PER/IX/1988, borax is one of the types of food additives that are prohibited from being used in food products.¹⁻³ Borax and formaldehyde are ingredients that are prohibited from being used for food based on the regulation of the Minister of Health of the Republic of Indonesia No. 33 of 2012.⁴

Boric acid (H_3BO_3) is a boron compound known as borax. Chemical names for borax include sodium borate, sodium pyroborate, sodium tetraborate, borax three elephant, hydrogen orthoborate, NCL-C56417, calcium borate, and sassolite.⁵ Borax is absorbed rapidly by the gastrointestinal tract, burned skin, and injured skin. It is not absorbed well in intact skin. It is distributed throughout the body and has a great affinity for the liver, brain, and kidneys. Hence, it can accumulate in those organs. Borax is excreted mostly through the kidneys and a small part is excreted through the sweat glands.^{6,7} Consumption of foods containing borax will not directly harm health, but this low concentration of borax will be absorbed in the consumer's body accumulatively. Repeated use or excessive absorption can result in toxicity (poisoning).⁸

Since 2009, the Food Safety Surveillance of the Indonesian Food and Drug Authority (POM RI) has found that in 18 provinces in Indonesia, the abuse of borax was still present. Misapplication of borax obtained deviations of 8.80% overall in 18 provinces in Indonesia, including North Sumatra, Riau, South Sumatra, Lampung, the Special Capital Region of Jakarta, West Java, East Java, Bali, and others. Based on POM RI 2017 annual report, 3.16% of the total samples tested were borax in crackers, noodles, tofu, grilled fishcake (*otak-otak*), savory fishcake (*pempek*), rice cake (*lontong*), cuttlefish, rissole, cakes, rice dumpling (*buras*) satay, grass jelly, and meatballs.^{9,10} Based on the results of sampling analysis and laboratory testing in 866 elementary schools spread across 30 cities in Indonesia, 4,808 samples were taken, and 1,705 (35.46%) samples did not meet the quality of safety requirements for food.¹¹

Borax misapplication in meatballs is still widespread, as stated in a study by Erniati (2017) which found 94 positive samples containing borax from 3,206 samples in wet noodles and snacks, and one of them was meatballs.¹² The abuse of borax is related to the characteristics of meatball sellers and the knowledge of meatball sellers about the use of borax as studied by Hidayati (2013), which found a relationship between the level of education (one of the characteristics of meatball sellers) on the use of borax.¹³

There are no raised cases of borax abuse in meatballs in Bengkalis, which is still widespread in meatballs with food safety that cannot be ascertained, yet. Therefore, this study aimed to determine the food safety in Bengkalis by analyzing the borax content in meatballs and determining whether there was a relationship between meatball sellers' characteristics and knowledge of the use of borax in the environment.¹⁴

Methods

This was an observational-analytic study with cross-sectional collection. The samples used were meatballs and meatball sellers in Bengkalis from June 2020 to January 2021. The sampling technique used purposive sampling by interviewing meatball sellers and filling out a questionnaire on the spot. The examination of borax on meatball samples was performed using the spectrophotometric method at the Technology Laboratory of Fisheries Products, University of Riau, which was collected from 40 meatball samples in Bengkalis. Data were analyzed by the Chi-Square test ($p = 0.05$) to determine a correlation between variables.

Results

This study found that all samples contained borax. Legally, the safe limit for using borax in food is 1 gram per 1 kilogram of food (1/1000).¹¹ Based on the results of the borax level test in meatballs, the lowest boron content was 0.3488 (mg/1000gr), and the highest was 2.1958 (mg/1000gr). The following was the categorization of the safe limits for the use of borax in the 40 samples.

Table 1. Laboratory examination test result on meatball samples in Bengkalis

Category Safe Limits of Borax Use (<gr/1000kg)	n	%
Standard concentration (<gr/1000kg)	4	10
Above standard (<gr/1000kg)	36	90
Total	40	100

The Relationship between the Characteristics of Meatballs Sellers on the Use of Borax

Age

Table 2 showed that meatballs containing borax with standard concentrations in the age category were in 4 samples (10%) and 36 samples (90%). Meatball sellers in the immature category with borax content at standard concentrations were 2 people (20%) and 8 people (80%) were above the standard. While meatball sellers in the mature category with borax content at standard concentrations were 2 people (6.7%), and meatballs with borax content above standard in the adult category were 28 people (93.3%). Based on the Chi-Square test, $p = 0.256$ ($p > 0.05$) meant there was no relationship between age and the use of borax in meatballs in Bengkalis.

Table 2. The relationship between meatball sellers' age and the use of borax in meatballs in Bengkalis

Age Category	The Content of Borax in Meatballs				Total		p-value
	Standard Concentration		Above Standard		n	%	
	n	%	n	%			
Immature	2	20	8	80	10	100	0.256
Mature	2	6.7	28	93.3	30	100	
Total	4	10	36	90	40	100	

Level of Education

Table 3 showed that meatballs containing borax with standard concentrations in the education level category were 4 samples (10%) and meatballs with borax content above standard were 36 samples (90%). Meatball sellers with a low level of education who had meatballs with borax content at standard concentrations were 1 person (7.7%) and 12 people (92.3%) were above the standard. Meanwhile, meatball sellers with a higher education level with borax content at standard concentrations were 3 people (11.1%) and 24 people (88.9%) were above the standard. Based on the Chi-Square test, $p = 1$ ($p > 0.05$) meant there was no relationship between education level and the use of borax in meatballs in Bengkalis.

Table 3. The relationship between the education level of meatball sellers and the use of borax in meatballs in Bengkalis

Education Level Category	The content of Borax in Meatballs				Total		p-value
	Standard Concentration		Above Standard		n	%	
	n	%	n	%			
Low	1	7.7	12	92.3	13	100	1.000
High	3	11.1	24	88.9	27	100	
Total	4	10	36	90	40	100	

Income

Table 4 showed that meatballs containing borax with standard concentrations in the income category were 4 samples (10%), and meatballs with borax content above standard were 36 samples (90%). Meatball sellers with income <Rp.3,261,357/month had meatballs with borax content above the standard (16 people). Meanwhile, meatball sellers with an income of Rp.3,261,357/month who had meatballs with borax content at standard concentrations were 4 people (16.7%) and 20 people (83.3%) were above the standard. Based on the Chi-Square test, $p = 0.136$ ($p > 0.05$) meant there was no relationship between income and the use of borax in meatballs in Bengkalis.¹⁵

Table 4. The relationship between meatball sellers' income and the use of borax in meatballs in Bengkalis

Income Category	The Content of Borax in Meatballs				Total		p-value
	Standard Concentration		Above Standard		n	%	
	n	%	n	%			
<Rp. 3.261.357 /month	0	0	16	100	16	100	0.136
≥Rp. 3.261.357 /month	4	16.7	20	83.3	24	100	
Total	4	10	36	90	40	100	

The Relationship between Meatballs Sellers' Knowledge of Borax and the Use of Borax

Table 5 showed that meatballs containing borax with standard concentrations at the knowledge level were 4 samples (10%) and meatballs with borax content above standard were 36 samples (90%). Meatball sellers who stated that they were allowed to use borax with meatballs containing borax above the standard was 1 person. Meanwhile, meatball sellers who stated that they should not use borax at standard concentrations were 4 people (10.3%) and 35 people (89.7%) had meatballs with borax content above the standard. Based on the Chi-Square test, $p = 1.000$ ($p > 0.05$) meant there was no relationship between knowledge and the use of borax in meatballs in Bengkalis.

Table 5. The relationship between meatball sellers' knowledge and the use of borax in meatballs in Bengkalis

Knowledge	The content of Borax in Meatballs				Total		p-value
	Standard Concentration		Above Standard		n	%	
	n	%	n	%			
Agree to use borax	0	0	1	100	1	100	1.000
Disagree	4	10.3	35	89.7	39	100	
Total	4	10	36	90	40	100	

Discussion

The results were found quantitatively in all samples of meatballs containing borax, but there were only 4 samples that did not exceed the safe limit for using borax from a total of 40 samples. This is an alarming condition because all samples contained food additives that were prohibited by the Regulation of the Minister of Health of the Republic of Indonesia No.722/MENKES/PER/IX/1988, namely borax. Meatballs are served hot with broth, fried, boiled, or grilled. Cahyadi (2008) stated that borax was a volatile substance due to heating.⁸ However, Rumanta (2016) found that the processing of foods containing boiling and frying can affect the borax content in food samples.¹⁶ Food processing by boiling was quite effective in reducing borax levels in food while heating by frying does not reduce the levels of borax in food. This shows that processing by boiling can reduce borax levels while heating cannot damage borax in food, and does not even cause loss of borax through the frying process. This shows that the borax content can be reduced due to processing. Thus, the use of borax can exceed the results studied.⁸

The effect of consuming borax in the body is not directly toxic. However, the slow excretion of borax also increases the accumulation due to repeated use or excessive absorption which can result in toxicity.⁸ Hence, the effect of borax on the body depends on the amount of borax consumed and the frequency of consumption of borax. From this study, it was known that neither the age of an adult nor an adult determines the use of borax can be controlled. The results of this study were in line with the results of the study of Hidayati (2013), which stated that not only do old age understand borax, but young people also understand borax.¹³ That understanding of borax is

determined by how the person pays attention to borax. It is not always people who are getting older who understand better because they depend on many things such as technology, willingness to learn, etc. Therefore, the problem is the lack of awareness of the dangers of using borax for meatballs.

Low and high education levels cannot determine the use of borax in meatballs. In the study by Erniati (2017), it was found that respondents with low levels of education added borax to meatballs because they did not understand the health effects caused when consumed long-term.¹⁷ The meatball sellers with high levels of education who added borax to meatballs could already know about the prohibition on using borax in food but did not care about the health impacts caused by consuming borax.¹⁴

There was no relationship between income and the use of borax in meatballs in Bengkalis. Low or high economic income cannot determine the use of borax in meatballs. The meatball sellers certainly need funds to prepare meatballs every day. Nevertheless, meatball sellers cannot always ensure that they do not sell well. Sometimes it was no longer suitable for sale and finally just thrown away. If this happens, it can cause losses for the meatball sellers. However, if the meatball sellers add preservatives to the meatballs, then the meatball sellers can get big profits because the meatballs are durable and can be stored for a long time. This was also in line with the opinion of Hidayati (2013), who stated that meatball sellers who added preservatives (borax) to meatballs probably did so due to the relatively cheap price of borax.¹³ The meatball sellers who earned <Rp.3,261,357/month or >Rp.3,261,357/month can buy borax and use it in meatballs. Moreover, this income was obtained every month from the sale of meatballs. Of course, the money was used to meet the needs in one month. Some of the money was used to buy household needs and the other part was set aside to be used as capital to buy back raw materials for processing meatballs and others. This study was in line with the results of the study of Fardiaz (1997), who stated that the lack of adequate funds for small industries, households, and street vendors was certainly a factor causing the use of prohibited food additives, one of which was borax.¹⁴

The results of this study were in line with the results of the study of Mujianto, *et al.* (2005), which stated that there was no relationship between knowledge and the use of borax because not all sellers who had good knowledge did not use borax.¹⁸ Similarly, Hidayati (2013) stated that there were meatball sellers who knew borax well because the meatball sellers used borax in the meatballs they sold.¹³ Conversely, meatball sellers who do not know about borax may not know at all because they have never seen and used it.

This study showed that was possible for meatball sellers to know about the ban on the use of borax in food because it can be seen from 39 meatball sellers, almost all of them stated that they should not use borax, but the results showed that all meatball sellers used borax. Therefore, it was known that meatball sellers did not care about the health impact caused to consumers even though they

already knew the prohibition of using borax in food. Borax was sold on the market in 100-200g packages for Rp.10,00-Rp.200,00.¹⁹

This was possible because they feared the consequences if the meatball sellers answered honestly. We know that information about the ban on the use of borax as a food additive has been widely spread in the public media. Law No. 18 of 2012 concerning food article 136 contained the sanctions for using borax as a food additive.²⁰

Strength and Limitations

Through this study, it was found that all meatballs in Bengkalis contained borax. It is difficult not to find borax in meatballs. However, inevitably, meatballs are still popular with the public. Therefore, we know that the risk factors with the widespread use of borax are still unknown.

Conclusion

It was found that from 40 meatball sellers in Bengkalis, all meatballs contained borax. There was no relationship between age, income, and knowledge of the meatball sellers and the use of borax in Bengkalis.

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Conflict of Interest

The authors declared there is no conflict of interest.

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Ethical Clearance

This study had received ethical clearance from the Research Ethics Commission, Universitas Airlangga (No. 247/EC/KEPK/FKUA/2022) on 7 December 2022.

Authors' Contributions

Designed the study and drafted the manuscript: ACZ, SS. Collected data and performed background literature review: ACZ, EQ. Performed statistical analysis: ACZ. Supervised results and discussion: ACZ, SS, EQ. All authors reviewed and approved the final version of the manuscript.

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