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Borax Content of Meatballs in Market X Area Surabaya, Indonesia

Liza Fajrin Zukrisningtyas, Narwati, Pratiwi Hermiyanti, and Marlik
Department of Environmental Health, Poltekkes Kemenkes Surabaya, Surabaya, Indonesia

Corresponding author: Narwati (e-mail: narwati@poltekkesdepkes-sby.ac.id)

ABSTRACT Borax was still utilized in the process of making food, one of which was making meatballs. Meatball traders added borax to extended the short shelf life of meat and increase the chewy texture, as well as to gave the meatballs a more white color. The researched objective was to analyze the borax content of meatball samples in market X Surabaya, Indonesia in 2023. Analytical observational researched method, the variables studied was the physical quality of meatballs and borax content in meatballs. The objected of this researched was 12 meatballs sold by all vendors in Market X Surabaya, Indonesia. The results of the organoleptic test researched obtained 4 meatball samples (34%) with good assessment criteria, most of the 7 meatball samples (58%) with sufficient assessment criteria, and 1 meatball sample (8%) with poor assessment criteria. Laboratory test results 1 meatball sample (8%) contained borax, with physical characteristics of chewy texture, pale gray color, tart taste, and fishy smell. The conclusion of this studied was that 1 out of 12 samples had physical characteristics of meatballs containing borax and borax content was related to the organoleptic test with a significant valued of p-value = 0. 032. Suggestions for traders to used alternative ingredients to replaced borax, namely carrageenan (seaweed) to improved the physical quality of meatballs in terms of texture, color, and smell.

INDEX TERMS Meatball Texture Quality , Meatball Vendor , Organoleptic Test

I. INTRODUCTION

Meatball was a culinary food that had many enthusiasts in various circles of society, because it was quite practical, easy to found, and affordable. The raw material for making meatballs came from poultry meat or other farm animals. Meatballs were processed from rounded or other-shaped meat mixed with starch, spices, and other fillers [1].

Borax was a germ killer and antiseptic. Borax was commonly used to removed or prevent mold in wood, made detergents, pesticides, and the textile industry. On the other handed, borax was a typed of food additive that was prohibited from being used in food manufacturing [2].

Borax generally entered the body through oral and inhalation routes [3] And when borax was absorbed in the blood it had been stored in the liver. Boron that was not metabolized would spread throughout the human body and react with biomolecules due to its high affinity for hydroxyl, thiol and amino groups [27]. Consuming borax had an impact on human health, because the accumulation of borax in organs caused gastrointestinal irritation such as vomiting, dizziness, diarrhea, fever, and abdominal cramps or pain [4]. The lethal dosed for adults was 10-20 gr/kgbb and 5gr/kgbb for children [5]. Consuming meatballs the dosed for children was the same as for adults so that the high risk factor was children, because they experience poisoning and death faster than adults [6].

The results of laboratory testing conducted by BBPOM in Surabaya, Indonesia in 2021, explained that out of 5 types of food samples, 1 of them contained borax, namely meatball samples. This indicates that the used of borax in making meatballs was still found. The results of the preliminary surveyed in January 2023 found that there were 12 meatball vendors who lived in the Market X area of surabaya, Indonesia.

The results of preliminary tests on meatball vendors who sold meatballs in the Market X area of Surabaya, Indonesia found that 5 meatball samples 1 of which had physical characteristics with a chewy texture, pale gray color, fishy smell, and had a savory taste. Laboratory test results used the curcumin paper method found 5 meatball samples 8% of which was positive for borax. This researched variable measures the physical quality of the meatballs and the borax content in the meatballs. The purpose of this studied was to qualitatively analyze the borax content of meatballs and

assess the organoleptic test of meatballs in the Market X area of Surabaya, Indonesia. The hoped of this researched was that people had been aware and not added dangerous additives to food and the impact that if consumed by humans continuously would result in disease.

II. METHODS

The researched design used was analytic observational. The researched started in january and finished in June 2023 in Market X Surabaya, Indonesia. The objects of this studied was 12 meatballs sold by all meatball vendors who sold their meatballs in Market X Surabaya, Indonesia.

The data collection technique of this studied, namely the organoleptic test, observed the physical quality of meatballs including texture, color, taste, and smell used a checklist sheet by 30 non-standard panelists. Selection of non-standard panelists with the conditions that the panelists were healthy, did not reject the food tested (not allergic), and were consistent in making decisions. The limits of the organoleptic test assessment in the instrument sheet were the physical assessment of meatballs including texture, color, taste and smell.

The laboratory test for borax content at the Surabaya city regional health laboratory, Indonesia used the tumeric paper test method on 250 grams of meatball samples. The working method of the tumic paper test was that the sample was added 2-3 ml of watered, put into a test tube, added 10-20 dropped of borax reagent i, dipped the tip of borax reagent ii (paper) into the test tube, let the paper (reagent ii) stood for 10 minutes, and the paper (reagent ii) if it changes color to reddish then the sample contains borax. Data from the analysis of borax content and organoleptic test on meatball samples was presented in table form and analyzed used *kendall tau-b*.

III. RESULT

The organoleptic test of the physical quality of texture meatballs could been described in FIGURE 1:

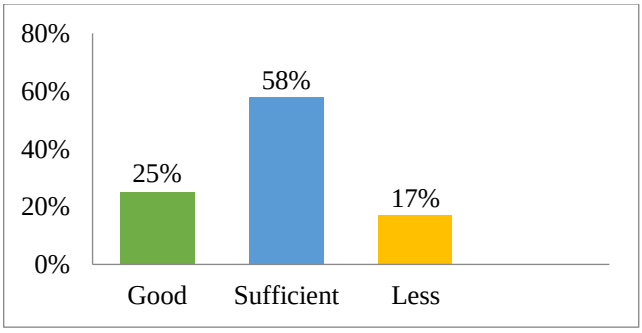

FIGURE 1. Results of Meatball Texture Inspection in Market Area X Surabaya, Indonesia Year 2023

The results of the examination of meatball texture figure 1 conducted by 30 panelists, namely 12 meatball samples, most of the 7 meatball samples (58%) with sufficient assessment criteria, namely the texture was not chewy. The quality of meatball texture that was less fulfilled was the fibrous and chewy texture category.

The organoleptic test of the physical quality of color meatballs could been described in FIGURE 2:

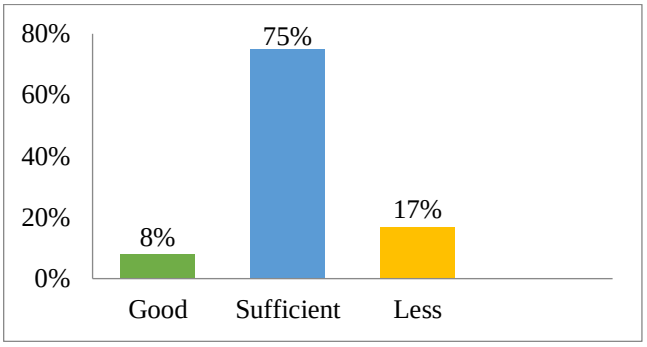

FIGURE 2. Results of Meatball Color Inspection in Market Area X Surabaya, Indonesia Year 2023

The results of the meatball color examination in figure 2 conducted by 30 panelists, namely 12 meatball samples, mostly 9 meatball samples (75%) with sufficient assessment criteria, namely the color was more likely have been gray. The meatball color quality that was less fulfilled was the reddish brown and pale gray color categories.

The organoleptic test of the physical quality of flavored meatballs could been described in FIGURE 3:

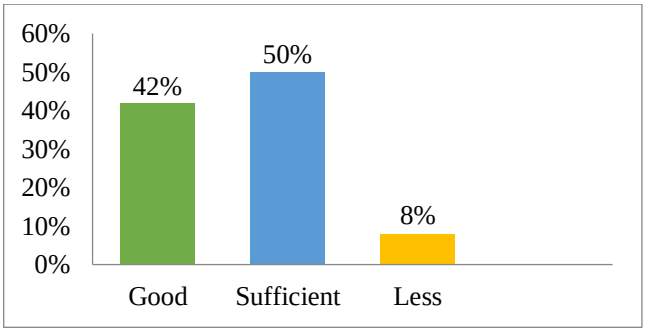

FIGURE 3. Results of Meatball Taste Inspection in Market Area X Surabaya, Indonesia Year 2023

The results of the examination of the taste of meatballs in FIGURE 3 conducted by 30 panelists, namely 12 meatball samples, most of the 6 meatball samples (50%) with sufficient assessment criteria, namely savory taste. The quality of meatball flavor that was less fulfilled was the category of meat flavor and bitterness. The organoleptic test of the physical quality of smelly meatballs could been described in FIGURE 4. The results of the examination of the smell of meatballs in figure 4 conducted by 30 panelists, namely 12 meatball samples, mostly 8 meatball samples (67%) with good assessment criteria, namely smelling typical of meat. The quality of meatball odor that was less

fulfilled was the category of smelling quite sharp spices, unpleasant (stale), fishy, and unnatural odors.

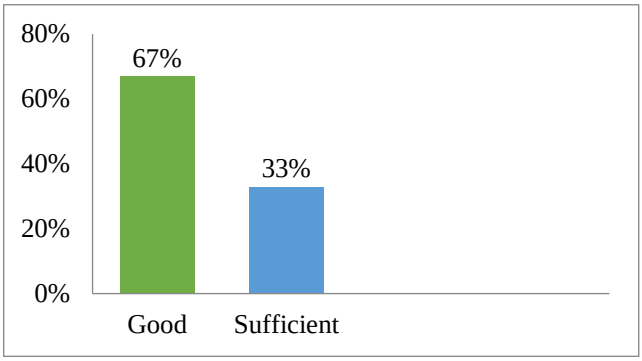

FIGURE 4. Results of Meatball Smell Inspection in Market Area X Surabaya, Indonesia Year 2023

The recapitulation of the organoleptic test of the physical quality of meatballs could been explained in FIGURE 5.

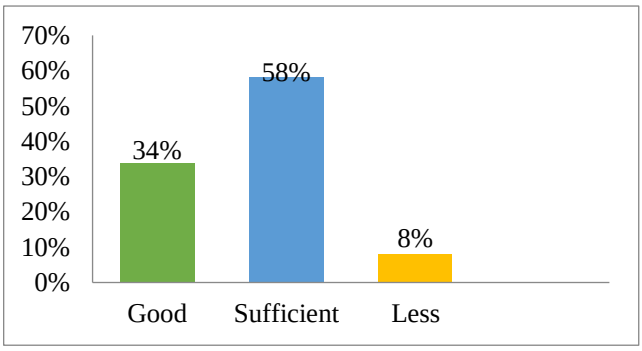

FIGURE 5. Recapitulation of Physical Quality of Meatballs in Market Area X Surabaya, Indonesia Year 2023

The physical quality of meatballs in figure 5 carried out by 30 panelists, namely 12 meatball samples, most of the 7 meatball samples (58%) with sufficient assessment criteria, 4 meatball samples (34%) with good assessment criteria, and 1 meatball sample (8%) with less assessment criteria. The borax content of meatball samples was examined qualitatively by laboratory tests to saw whether or not borax was present. The following were the results of the borax content test.

TABLE 1
Qualitative Test Results of Borax Meatballs In Market Area X Surabaya Indonesia Year 2023

No	Borax Content	Frequency	Precentase
1.	Positive	1	8%
2.	Negative	11	92%
Amount		12	100%

Based on table 1, the qualitative borax test showed that 12 samples of meatballs was positive for borax at 8%.

The relationship between the borax content of meatballs was obtained from statistical analysis used the *kendall tau-b* correlation test that there was a relationship between borax content and the organoleptic test of the physical quality of meatballs (ρ-value 0.032 which was less than α (0.05)) which was 0.55.

IV. DISCUSSION

A. PHYSICAL QUALITY OF MEATBALLS BASED ON ORGANOLEPTIC

Meatballs containing borax had a chewy texture. The texture of meatballs that used bulking agents such as borax had a high protein content because borax was thickening and compacting so that substances including soluble meat proteins were trapped and not much substance was extracted out. Meatballs containing borax had a preservative power derived from the boric acid content in them that would inhibit microbial growth and the watered added in making meatballs could helped microbial growth and chemical reactions that affect food texture [7].

Meatballs with breakable texture were influenced by the boiling process which affects the watered content of the meatballs and affects the texture of the meatballs produced. The process of boiling high temperature meatballs could caused starch granules to expand, starch granules absorb watered so that more watered was absorbed. Long boiling could increase the watered content of meatballs, if short time boiling would result in low watered content, the texture of the meatballs became easily broken [8].

The quality of the meatball texture was not chewy, which was influenced by the ratio of tapioca flour and meat mixed in the meatball dough, because tapioca flour had the benefits of forming texture, improving chewiness, watered binding, and elasticity of meatball products. Types of flour had different gluten content, the higher the gluten content of the flour used, the better the texture of the meatballs produced [9].

The texture quality of chewy meatballs did not contain borax, there was a factor that the chewiness of the meatballs was influenced by the addition of tapioca flour, when mixed with watered it would produced a sticky texture that affects the binding forced of the meatball dough to became chewy. The addition of meat in meatball dough affects the chewiness produced because meat nutrients such as protein content had different levels of meat used in meatball dough. Meat had a protein content with a ratio of adding more tapioca flour in meatball dough, resulting in a chewy meatball texture [10].

Meatballs containing borax were pale gray in color. The color of meatballs was influenced by the color of the meat which was closely related to the myoglobin content of the meat in making meatballs and was influenced by the addition of fillers such as spices [11]. Meatballs not containing borax were reddish brown in color, due to the high myoglobin of the meat.

Gray meatballs were caused by the influence of meat myoglobin concentration, changes in gray meatballs due to the denaturation process of myoglobin during cooking [12].

Meatballs containing borax had a tart taste that was influenced by meat having watered binding capacity and ph to increase meat tenderness. Mixing flour in meatball dough as a filler affects the flavor because amylose in flour could form inclusions with flavor compounds such as spices [13].

Meatballs that did not contain borax had a distinctive meat flavor that was influenced by fillers, namely spices. Meatballs taste savory because different types of meat had different contents such as oleic acid, stearic acid and palmiic acid [14]. Meatballs containing borax smell fishy, the smell of meatballs was influenced by the smell of meat, fillers such as spices. The process of cooking meatballs could affect the smell of meatballs because during cooking there was a reaction between fillers and meat, so that the distinctive smell of meat would decrease during meatball processing [15].

Meatballs smell bad (stale) due to the shelf life of meatballs without preservatives, because the maximum shelf life was one day at room temperature. The nutritional content, pH valued and moisture content of meat caused meatballs to had a short shelf life and the quality of meatballs stored for more than one day results in the growth of mold which would result in an unpleasant or stale meatball smell. Preservation of meatballs by means of low temperature storage, namely cooling and freezing and low temperature food storage could slow down metabolic reactions thereby preventing the growth of microorganisms that caused food spoilage or damage [16].

Alternative ingredient to borax used as a safe food additive, *Sodium Tripolyphosphate* (STPP), was one of the chemicals permitted have been used to made processed meat products, one of which was meatballs. STPP was an antioxidant and inhibits oxidation reactions and improved the quality of meat products. The used of stpp doses for meatball products was 0.2%-0.4% of the dough weight [17]. The physical quality, texture and color of meatball dough could been determined from the raw meat used. For example, meatballs made from 20% chicken and 80% beef were influenced by chewiness, hardness, and compactness, similar to pure meatballs without any meat mixture. Changes in the physical quality of meatballs were influenced by the meat mixture and filling ingredients for the meatball dough [26]. The advantages of used (STPP) were the resulting smoothed texture, gray color, and the resulting meatballs smell typical of meat. On the other handed, there were weaknesses, namely the addition of *Sodium Tripolyphosphate* in meatball dough at the rate of 4gr/kg, resulting in a slightly bitter meatball flavor [18].

Carrageenan (seaweed) was a natural ingredient extracted from red seaweed (rhodophyta) which was hydrocolloid (able to absorb watered). Seaweed was a plant that had a high nutritional valued such as carbohydrates, protein, fat, other micronutrients and dietary fiber content of seaweed was 67.5% so that carrageenan was used as a healthy food [19]. Carrageenan was generally in the form of powder (powder) so that it was easy to used the meatball mixture as a chewy. The usage rate of carrageenan for meatball products was 0.5 gr/kg - 1.5 gr/kg of the total weight of the dough.

The advantage of carrageenan was that it produces meatballs with a chewy texture, grayish white color, and a distinctive smell of meat used in making meatballs [20]. It was suggested that it was better to used alternative ingredients naturally, namely the addition of carrageenan (seaweed) which had no impact on the human body, and improved the physical quality of meatballs in terms of texture, color, and smell [20].

B. BORAX CONTENT OF MEATBALLS USED LABORATORY TEST

The results of the qualitative borax content examination of the meatball samples was subjected to laboratory testing, resulting in 8% of the meatball samples being positive for borax. According to the minister of health regulation No. 033 years 2012 on food additives, borax was a typed of food additive that was prohibited from being used in food preparation.

Laboratory tests of borax content in this studied used curcumin paper. The result of meatball samples containing borax was that the paper turns into a reddish color, because the sample was added 2-3 ml of watered in a test tube and given 10-20 dropped of reagent I borax which was allowed to stood for 10 minutes to saw the results of the color changed of curcumin paper [21].

The results of the statistical analysis showed the kendal correlation test valued of 0.55 and a significant ρ-value = 0.032 (ρ-value <0.05), which means there was a relationship between the physical quality of meatballs and the borax content test. The following relationship identifies the physical characteristics of meatballs containing borax and not containing borax :

Meatballs containing borax had a chewy texture, because it was influenced by the amount of tapioca flour added in making meatballs and the protein content of the meat which produces a chewy texture because it could bound watered, form emulsions and gels [22]. Meatballs not containing borax had a fibrous texture, were easily broken, not chewy, and dense. Meatballs that produced different textures were influenced by the typed of meat texture and the typed of flour used in the meatball dough [23].

Meatballs containing borax were pale gray, because they were influenced by the flour used and other fillers in the meatball dough [11]. Meatballs not containing borax were reddish brown, dark brown, gray. Meatballs produced different colors, due to the influence of meat myoglobin concentration and cooking process [11]. Meatballs containing borax taste bitter, influenced by the binding power of watered in meat. Fillers such as flour could affect flavor, because amylose in flour could form inclusions with flavor compounds such as spices [13].

Meatballs that did not contain borax had a distinctive meaty and savory taste, influenced by dough fillers and different contents found in the typed of meat used such as oleic acid, stearic acid and palmiic acid [14]. Meatballs containing borax had a fishy smell, influenced by the smell of meat and fillers. The cooking process could affect the

smell of meatballs because of the reaction between fillers and meat so that the distinctive smell of meat was reduced [15]. Meatballs not containing borax had a distinctive smell of meat, because the ratio of meat was more with the fillers mixed in the dough [1].

The curcumin paper test was used to determine whether the samples tested were positive for borax or negative for borax. Samples containing borax when reacted with the curcumin paper test produced a brownish red color. This was because borax had alkaline properties, so borax could been detected used an alkaline indicator or curcumin solution that shows brownish red color results [25]. Borax examination of food samples was better analyzed quantitatively used the alkalimetric titration method or spectrophotometric method, so that borax levels in food samples could been measured [21].

V. CONCLUSION

Examination of borax content with laboratory tests resulted in 8% positive for borax which had physical characteristics of meatballs, namely chewy texture, pale gray color, tart taste, and fishy smell. It was recommended for further researchers to analyze quantitatively used the alkalimetric titration test method or the spectrophotometric method because these tests produced the number of borax content levels in the samples tested so as to got more accurate results than qualitatively analyzed used the curcumin paper test method and the flame test which results positive for borax or negative for borax.

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