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Traditionally available street food the market free from harmful chemical additives

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Abstract

All living organisms, including humans, require food to sustain life. Unsafe food leads to health problems. Therefore, this study evaluates the chemical parameters of commonly consumed food items. The research was conducted in a laboratory using a descriptive observational approach to analyze chemical components in selected food samples. A purposive sampling method was employed for sample selection. Testing for borax using the ethanol method, while testing for formalin, rhodamine B, and methyl yellow using a test kit. The results revealed that all tested food samples were free from harmful chemical additives. Specifically, salted fish and wet noodles tested negative for formalin; meatballs and cilok were free of borax; chicken noodle sauce and red sausage did not contain rhodamine B; yellow crackers and yellow tofu tested negative for methyl yellow. The conclusion of this study was that all food samples tested were safe for consumption

Keywords: Borax; Food; Formalin; Methyl Yellow; Rhodamine B

1. Introduction

All living organisms, humans foremost among them, are utterly dependent on food for their existence. With the global population skyrocketing at an unprecedented rate, the demand for food is reaching critical levels that threaten to overwhelm Earth's finite resources. Vast expanses of fertile land are being relentlessly devoured by sprawling urbanization and industrialization, pushing the limits of agricultural production to a breaking point. This alarming scarcity forces the food supply chain into an excessively complex and fragile system, where even the slightest disruption could cascade into catastrophic shortages. Alarmingly, crucial safety protocols such as HACCP (Hazard Analysis and Critical Control Points) and GMP (Good Manufacturing Practices), which are essential to prevent foodborne illnesses and ensure quality, are frequently neglected, especially in home-based industries and small enterprises, exposing millions to potentially severe health risks.

HACCP and GMP are critical guardians of food safety, designed to shield consumers from invisible yet deadly threats. Proper food safety demands eliminating microbiological, chemical, and physical hazards, each capable of unleashing devastating health consequences. Among these dangers, microbiological and chemical contaminants pose the most insidious and pervasive risks in food production. Particularly alarming are chemical contaminants introduced through illicit food additives (BTP), often lurking undetected in everyday food items. The presence of highly toxic substances such as borax, formalin, rhodamine B, methyl yellow, and other banned chemicals represents a grave public health crisis, capable of causing acute poisoning, chronic illnesses, and widespread outbreaks of disease.

Vigilance in monitoring and controlling these hazards is not just necessary, it is imperative for the survival and well-being of the population.

Numerous scientific investigations have uncovered a disturbing prevalence of hazardous chemicals in everyday foods consumed by the public. In one alarming study using qualitative tests with a borax detection kit, a staggering 66.7% of food samples ranging from pentol and meatballs to crackers and tahu walik were found to be contaminated with borax, a substance banned for human consumption due to its toxic effects [1]. Even more concerning, only 33.3% of the samples, including various crackers, meatballs, and cimol, were borax-free.

Formalin contamination paints an equally dire picture. Using phenylhydrazine for qualitative detection and spectrophotometry for quantitative analysis, researchers discovered that 30% of tofu samples were tainted with formalin, with concentrations reaching up to 10 ppm levels that pose serious long-term health risks, including cancer and organ damage [2]. Even more disconcerting is the near-universal presence of illegal synthetic dyes in school snacks. A study revealed that over 99% of these products were suspected to contain rhodamine B, a dye classified as hazardous and carcinogenic, with only a mere 0.7% testing negative [3]. However, there was one small glimmer of relief: none of the 15 samples tested for methylene blue showed signs of contamination, as no color change was observed during testing [4]. This research aims to uncover the presence of hazardous chemicals in commonly consumed foods, focusing on identifying substances that pose significant health risks through frequent daily intake.

2. Method

The research employed a descriptive study design with purposive sampling. Each sample was tested in triplicate to ensure reliability. The tools and materials used included writing instruments, food samples, and various testing materials specific to each sample, such as distilled water (aquadest), ethanol, and appropriate reagents.

The borax test was conducted on meatball and cilok samples. The procedure involved the following steps:

1. The samples were blended until smooth.
2. The homogenized sample was placed in a porcelain dish.
3. A volumetric pipette added 5 mL of 70% ethanol to the sample and thoroughly mixed it.
4. The mixture was ignited using a match.
5. The flame color was carefully observed.
6. A green-colored flame indicated a positive result for the presence of borax in the sample.

The formalin detection assay was meticulously carried out using salted fish and wet noodles as representative test specimens. The procedure unfolds through the following precision-driven steps:

1. Precisely 25 grams of the sample were introduced into 50 mL of distilled hot water (aquadest). The mixture was finely shredded and homogenized using a glass stirrer to ensure complete dissolution of analytes. (Note: This step is excluded for pre-liquid samples.)
2. Three drops of Reagent-2 were added to the pre-treated solid sample, initiating a targeted chemical reaction to reveal formalin trace levels.
3. For liquid samples, an equivalent three-drop addition of Reagent-2 was administered directly into 50 mL of the fluid matrix to achieve comparable reactivity.
4. A test tube was prepared with 1–3 mL of the processed sample. Subsequently, three drops of Reagent-1 were added, and the solution was thoroughly mixed to ensure optimal reagent interaction.
5. The mixture was allowed to stand undisturbed for approximately 5 to 15 minutes. The emergence of a distinct purple hue ranging from pale violet to deep purple served as a qualitative confirmation of formalin presence. In contrast, the absence of any color change indicated a negative result, confirming the sample was free from formalin contamination.

The Rhodamine B assay was rigorously conducted on chicken noodle sauce and red sausage samples to detect trace contamination of this hazardous dye. The highly sensitive procedure includes the following steps:

1. Exactly 25 grams of the sample were introduced into 50 mL of distilled or hot water. The mixture was finely shredded and homogenized with a stirrer until complete dissolution of the analytes was achieved, ensuring maximal extraction of Rhodamine B compounds. (Note: This step is bypassed for already liquid samples.)
2. A test tube was prepared with 1 to 3 mL of the sample. One precise drop of Reagent Rhodamine–1 was added and mixed thoroughly to initiate the complexation reaction, followed by three drops of Reagent Rhodamine–2 to amplify the detection sensitivity.
3. The sample's rapid transformation to a vivid purple color served as a definitive visual marker for the presence of Rhodamine B, confirming contamination with high specificity. The absence of any color change indicated a negative result, certifying the sample as free from Rhodamine B adulteration.

The Methyl Yellow assay was meticulously performed on yellow crackers (krupuk kuning) and yellow tofu (tahu kuning) samples to detect the presence of this potentially harmful synthetic dye. The highly sensitive and precise procedure involved the following stages:

1. Precisely 25 grams of the sample were immersed in 50 mL of distilled or hot water. The mixture was finely shredded and vigorously homogenized with a stirrer until complete dissolution was achieved, ensuring maximal extraction of any Methyl Yellow compounds present. (This step is omitted for liquid samples).
2. In a prepared test tube, 1 to 3 mL of the processed sample was combined with a single drop of Reagent Methanil Yellow–1 and thoroughly mixed to initiate the chemical detection process. Subsequently, three drops of Reagent Methanil Yellow–2 were added to enhance reaction sensitivity.

The immediate emergence of a reddish-purple coloration was a definitive visual confirmation of Methyl Yellow contamination, signaling a positive result with high specificity. Conversely, the absence of any color change indicated a negative result, confirming the sample's purity from this toxic dye.

3. Results and Discussion

The research outcomes unequivocally demonstrate that all tested samples were utterly devoid of borax, formalin, rhodamine B, and methyl yellow contamination. These results highlight the exceptional safety and compliance of the food samples with stringent chemical safety standards, underscoring the reliability and precision of the detection methods employed.

Table 1. Results of food chemical parameter tests

Parameter	Sample	Test Trial			Picture
		1	**2**	**3**	
Borax	Meatball and cilok	Negative	Negative	Negative	 Figure 1. meatball

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Parameter	Sample	Test Trial			Picture
		1	**2**	**3**	
					 **Figure 2.** Cilok
Formalin	Salted fish and wet noodle	Negative	Negative	Negative	 **Figure 3.** salted fish, yellow crackers, chicken noodle sauce
Rhodamine B	Chicken noodle sauce and red sausage	Negative	Negative	Negative	
Methyl yellow	Yellow crackers and yellow tofu	Negative	Negative	Negative	 **Figure 4.** wet noodle, red sausage, yellow tofu

Based on the meticulous observations presented in Table 1, it was unequivocally established that all samples tested yielded consistently negative results across three successive repetitions. This remarkable consistency underscores the reliability of the testing protocol and the integrity of the samples analyzed.

These findings are strongly concordant with a growing body of research related to borax detection parameters. For instance, a qualitative assessment by [1] confirmed that several meatball (bakso) samples were negative for borax contamination, highlighting a reassuring trend in food safety compliance. Supporting this, further borax testing utilizing the curcumin paper method also produced negative results in meatball samples, as documented by [5] , thus validating the efficacy and sensitivity of the analytical technique. Similarly, formalin detection tests revealed congruent outcomes. In line with

[6] findings, applying Schiff reagent to three yellow noodle samples resulted in negative formalin detection. An identical outcome was obtained using $FeCl_3$ reagent, demonstrating both reagents' robust and consistent performance in detecting formalin absence. Further corroboration is provided by [7], who examined a range of food items, including cilok, tofu, salted fish, wet noodles, and crackers, ultimately reporting that 11 samples were confirmed negative for formalin.

This study aligns strongly with prior research on the rhodamine B parameter, wherein approximately 70% of tested samples including es campur (mixed ice dessert), meatball sauces (commonly used for cilok and sempol), red circular crackers, cendol, hard candies, soft candies, grilled sausages, red-white jelly, red jelly in plastic, pearl jelly in plastic, elongated red jelly, red-white chips, and skewered sausages were confirmed to be negative for rhodamine B. Both qualitative and quantitative analyses were employed to ensure the accuracy and reliability of the findings [3]. Further supporting evidence is provided by [8], who, through the use of various analytical techniques, identified several food items such as ground chili paste, bottled sambal, sauces, tomato sauce, and terasi Medan (fermented shrimp paste) as negative for rhodamine B contamination. These findings reinforce the consistency and dependability of the detection methods used across studies. In addition, a separate investigation by [9] reported that all eight tomato sauce samples examined were 100% free of rhodamine B, as confirmed through dual-approach methodologies involving wool thread testing and thin-layer chromatography (TLC), further substantiating the robustness of these detection techniques. Similarly, this study's results of methyl yellow testing fully agree with previous research. Demonstrated that all yellow cracker samples tested yielded negative results for methylene yellow [4].

Several distinctive characteristics may indicate the presence of hazardous chemical substances in food products, such as borax, formalin, rhodamine B, and methyl yellow. One of the hallmark traits of food adulterated with borax is its notably elastic and chewy texture, as documented by [10]. Beyond contributing to an artificially resilient consistency, borax imparts a dense, firm texture and a prolonged savory flavor, particularly in starch or wheat-based foods. This property deceptively enhances palatability and consumer appeal [11]. Moreover, an unusual yet telling indicator of borax presence is the lack of insect activity, specifically the noticeable absence of flies around such food items, an observation supported by [12]. This phenomenon is likely attributable to borax's repellent and toxic nature, making it not only a food adulterant of concern from a human health perspective but also an environmental disruptor in the context of biological interactions. These sensory and ecological cues may serve as critical preliminary markers for identifying food compromised by toxic chemical additives.

Several discernible characteristics may signal the presence of hazardous chemical additives in food, particularly substances such as formalin, rhodamine B, and methyl yellow. Food products contaminated with formalin often exhibit an unnaturally pale or stark white coloration, diminished meat aroma, and a conspicuous absence of insects such as ants and flies, an indication of the chemical's potent preservative and biocidal properties [13]. These sensory anomalies serve as potential red flags when identifying formalin-laced foods. In the case of rhodamine B, a synthetic dye banned for food use, one of the most striking visual indicators is the presence of unnaturally bright, fluorescent coloring. As noted by [3], food products adulterated with rhodamine B typically exhibit an intense, vivid red hue designed to capture consumer attention. This bright coloration, while visually appealing, is in fact deceptive and dangerous, as rhodamine B is known to pose toxicological risks upon ingestion [14].

One example of research on food is the processing of soybeans into tempe. Based on the experiment, the shelf life of tempeh is influenced by the type of bean, the inoculum, the fermentation process, as well as the interactions among these factors bean–inoculum, bean–fermentation, and bean–inoculum–fermentation. Long bean tempe inoculated with yeast and fermented for 24 hours exhibited the best shelf life [15]. Another test chemical parameter of food was traces of formalin and rhodamine B in children's snacks. The research showed that all sample snacks from Elementary School was negative contain formalin and rhodamine B [16].

Similarly, methyl yellow, another illegal food dye, imparts a bold, uniform, and highly stable yellow coloration to food. Notably, its vibrancy persists even after exposure to high temperatures and prolonged processing, making it insidious [4]. Beyond its intense color, the ingestion of food containing methyl yellow may provoke physical discomfort, such as a noticeable itch or irritation in the throat, and may even leave behind residual staining, both indicators of its chemical potency [17]. When taken together, these symptomatic cues provide critical observational markers that can aid in the preliminary identification of food products contaminated with illicit chemical additives.

One of the primary strengths of this study lies in the remarkable simplicity and efficiency of the testing procedures employed. The methods used for food sample analysis were not only highly accessible and user-friendly but also yielded results in a remarkably short period, allowing for rapid preliminary screening of hazardous substances. This rapid turnaround enhances the practicality of the testing protocol, making it suitable for broader applications in fieldwork or routine food safety inspections. However, the study is not without its limitations. The analytical scope was restricted to qualitative assessments specifically, the binary determination of the presence or absence (positive or negative) of hazardous substances such as borax, formalin, rhodamine B, and methyl yellow in the tested food samples. Quantitative data, such as the precise concentration levels of these compounds, could not be obtained within the methodological constraints of the study.

Furthermore, the detection was limited exclusively to the aforementioned substances, leaving the possibility of other potentially harmful food additives undetected. Therefore, this underscores the critical need for continuous and enhanced monitoring and comprehensive evaluation mechanisms to ensure the safety of food additives in consumable products. More advanced analytical methods and broader testing parameters should be employed in future studies to understand food safety risks better and uphold public health standards.

4. Conclusion

Based on the comprehensive analysis conducted in this study, all tested samples unequivocally demonstrated negative results for the presence of borax, formalin, rhodamine B, and methyl yellow. Specifically, salted fish and wet noodles were confirmed free of formalin contamination; meatballs (bakso and cilok showed no detectable borax residues; chicken noodle sauce and red sausages were devoid of rhodamine B; while yellow crackers and yellow tofu exhibited no traces of methyl yellow. These results underscore the absence of these hazardous chemical adulterants across a diverse range of commonly consumed food products, encouraging compliance with food safety standards.

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