

Food Test at Warung X and Y Using Total Plate Count (Study on Food Safety for Female Santri Yogyakarta)

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ABSTRACT

The goal of sustainable development point 2 is to end hunger by 2030 and one of its main targets is safe food. Food safety is one of the efforts to meet the food needs of female students at Komplek Q Yogyakarta. This study aims to determine the content of bacteria and the level of food safety bacteriologically in food stalls X and Y. The design of this research is descriptive observational with laboratory examination using total plate count (TPC). The food samples studied were incubated in the laboratory for 2x24 hours using PCA media to see the bacterial content. The findings are calculated using a colony counter and compared with the 2009 BPOM RI standards. Research result show that as many as 14 food samples tested there is 5 samples that are not meet the requirements for microbial contamination limits in food according to BPOM RI in 2009, namely: 1) egg stew $Y=3,4 \times 10^6$; 2) long bean vegetable $X=6,0 \times 10^4$; 3) green bean vegetable $Y=2,6 \times 10^4$; 4) fried bakwan $X=2,5 \times 10^7$; and 5) fried bakwan $Y=1,2 \times 10^7$. Several types of food in stalls X and Y are indicated to be less biologically safe. So that special attention is needed from the government and boarding school administrators in the local area in tackling the problem of food consumption safety for students.

Keywords: SDGs Strategy, Food Safety, Total Plate Count

INTRODUCTION

One of the goals of sustainable development is *reduce hunger by end hunger*, achieve food security, improve nutrition, and promote sustainable agriculture. The ultimate goal is to eliminate hunger and ensure access for all to safe, nutritious and sufficient food by 2030.¹

Food is said to be safe if it is free from all physical, chemical and microbiological contamination that can endanger the safety of the body, and there is no conflict from the surrounding community. Food will be said to be spoiled if all or part of the food contains dirt or decaying materials, or food which is in preparation, packaging, and handling is not clean and has been contaminated with impurities that can threaten health.²

Previous research stated that there was a bacterial contamination in 10 samples of household processed food and 8 samples of factory processed food in the form of pempek which were at risk of being contaminated with *Escherichia coli*, *Salmonella*, and *Staphylococcus aureus* bacteria and after being examined using Plate Count Agar (PCA) media, it showed that the presence of bacterial contamination was high. height is equal to (>

5×10^4).³ A similar study in Bali on traditional food products in the form of lawar also showed that 100% lawar did not meet the requirements of *Escherichia coli* in processed meat that was processed with heat in Indonesia.⁴

Unhealthy food can cause disease in the body. One of the causes of food being unhealthy is due to bacterial contamination that damages or contaminates the food substance. One of the diseases caused by bacterial contamination of food is diarrhea. Diarrhea is a global health problem, caused by unhealthy food consumption behavior. The prevalence of diarrhea is more common in developing countries such as Indonesia than in developed countries, which is 12,5 times. Diarrhea is a disease caused by bacterial contamination which is mostly transmitted through infection through human or animal feces, food, water, and the main box in humans.⁵

Santri is a student who lives in a boarding school with a heap of very busy routines throughout the day. The activities and solid activities that are owned by students should be balanced with healthy nutritional intake. Healthy nutritional intake will balance the body to increase the students' immune system so they are not easily attacked by

diseases that can hinder all routines owned by students.

The need for good food is also important for students so that they do not experience malnutrition. The nutritional and energy needs of each student are different based on the age group of adolescents and adults. In students who are still teenagers, nutritional and energy needs are influenced by the condition of physical maturity and activities carried out every day,⁶ as well as rapid growth when entering puberty, the occurrence of menstruation, food consumption patterns, and dietary patterns that occur in adolescence. Thus, the calculation of good nutritional needs must be adjusted to the body condition experienced by paying attention to the main nutritional needs of young female students, especially in their nutritional preparation before marriage.⁷

Meanwhile, the nutritional needs of adult students will be emphasized more on patterns of disease prevention and improvement of health status. Food is a human need and is a source of happiness in life. Choosing food wisely in adulthood will support the individual's ability to maintain his health both physically, emotionally, and mentally. Nutritional health in adults is more aimed at improving health comprehensively for disease prevention and the process of slowing down aging.⁸

Pondok Pesantren Komplek Q Yogyakarta is one of the Islamic boarding schools specifically for female students with an average age range of 15-20 years and above. Santri aged 15-18 years can be grouped as adolescent students and have entered a phase of rapid development both physiologically, psychologically, and socially. In this phase, the growth of the santri will reach its peak by showing changes in behavior that are increasingly independent and accompanied by the ability to carry out adult roles. In general, students will try to take even greater responsibility for their lives, including their decisions in choosing food. Food choices are usually influenced by family eating habits, relationships,⁸ appetite, media, and food presentation.

Meanwhile, students aged 19-20 years and above can be grouped as students who are entering adulthood. During the entry into adulthood, growth and practical development no longer occurs in students. The nutritional needs of students at this age are more needed to maintain body health, one of which is replacing damaged cells in the body. The nutritional needs of students entering adulthood will not change as much as when they were teenagers. However, during this period the nutritional needs of students will be more

influenced by family conditions and lifestyle from environmental factors, work, responsibilities and financial adequacy. This situation then affects the food chosen and eating habits in the long term. Nutritional needs at this age should be focused on preventing chronic diseases and improving health status by regulating the food that will be consumed. The main source of nutritional needs for the human body is a source of macronutrient nutrients, namely carbohydrates, fats, and proteins. A person who consumes 1 gram of carbohydrates will produce 4 kilo calories, 1 gram of protein will produce 4 kilo calories, and with the consumption of 1 gram of fat produces 9 kilo calories for the body. All sources of these nutrients are needed by the body for its survival. A person who consumes 1 gram of carbohydrates will produce 4 kilo calories, 1 gram of protein will produce 4 kilo calories, and with the consumption of 1 gram of fat produces 9 kilo calories for the body. All sources of these nutrients are needed by the body for its survival. A person who consumes 1 gram of carbohydrates will produce 4 kilo calories, 1 gram of protein will produce 4 kilo calories, and with the consumption of 1 gram of fat produces 9 kilo calories for the body. All sources of these nutrients are needed by the body for its survival.⁸

Activities and activities carried out by female students of Pondok Pesantren Komplek Q are studying religious knowledge in the cottage and studying formal education/schooling outside the cottage (SMA, MAN, and College). Santri are not only active in the cottage in full, but also complete school activities outside which also drain the energy and minds of the students. So to keep the body healthy, students need all sources of macronutrient nutrients in sufficient quantities and are safe for consumption. The hope is that the students have a strong immune system and are able to carry out their activities better because they have a healthy body.

Based on observations made by researchers previously, it showed a phenomenon of food consumption behavior for female students in this area, namely having the habit of buying food at food stalls X and Y. However, it has never been known with certainty the level of food safety sold in these stalls by bacteria. Therefore, researchers are interested in conducting a research on food safety testing at X and Y stalls as one of the strategies to support sustainable development in ending hunger by 2030 with one of the main targets being to consume safe food.

This study aims to determine the level of content and food safety bacteriologically by

conducting a bacteriological test using the total plate count (TPC) method. The total plate count (TPC) method is a method of calculating cells by culturing a number of materials on culture media in a petri dish by taking into account the number of cells present and expressed as CFU (Colony Forming Unit) per gram.⁹

METHOD

Research design

This study uses an observational descriptive design with laboratory examinations using the total plate count (TPC) method with the findings compared to regulatory standards. BPOM RI 2009 concerning the determination of the maximum limit of microbial and chemical contamination in food.

Data collection

The research was carried out on November 5, 2018 to January 5, 2019 by taking food samples at food stalls X and Y which are located in around the Islamic boarding school Komplek Q and tested in Laboratory of the Faculty of Public Health, Ahmad Dahlan University, Yogyakarta. The research population was food stalls X and Y. Sampling was done by non-probability sampling using purposive sampling by taking several types of food menus that were most often purchased by students. There are 14 food samples tested, namely: white rice, white noodles (vermicelli), yellow noodles, crispy chicken, fried eggs, fried tofu, long bean vegetables, green beans and fried bakwan. The parameter of this research is the amount of bacteria contained in food samples adjusted to the standards according to BPOM RI in 2009 regarding the determination of the maximum limit of microbial contamination in food.

Work procedures

1. Preparation phase

At this stage the researcher begins to prepare the tools and materials that will be used for research in the laboratory. Starting from sterilizing the tools that will be used for research such as measuring pipettes, petri dishes, tweezers, test tubes, blenders, and preparing other tools that do not need to be sterilized such as vortexes, colony counters, scales, Bunsen lamps, stationery, tube racks. reactions and others. And continued by sterilizing PCA media and NaCl solution by inserting it into an autoclave at 121⁰ for 15-20 minutes. In addition, the researchers also prepared equipment and materials to be used during sampling, such as aluminum foil, sample bottles, thermos, plastic, ice cubes and cool boxes.

2. Sampling Stage

Sampling was based on the type of food most frequently consumed by students. The sampling time was divided into 2, namely at 07.00 and 09.00 every day during the study. The consideration of sampling at this time is because it is the time for students to buy food for breakfast. Sampling was taken using plastic from the point of sale which was then transferred into sterile sample bottles that had been given aluminum foil on the sample bottle caps. Then, it is put into a cool box that already contains ice cubes to be taken to the research laboratory.

3. Bacteriological Test Implementation Stage

The bacteriological test was carried out aseptically in the laboratory by the researcher in order to reduce contamination that could affect the results of the study. The steps in carrying out the bacteriological test are as follows:

- a. Take a sample scale and place a sterile petri dish and zero weight of the petri dish.
- b. Food samples were taken using sterile tweezers and placed in a sterile dish on the scale.
- c. Weigh the sample as much as 25 grams.
- d. After being weighed, the food samples were put into a blender which had been washed and sterilized with an alcohol swab as a substitute for a stomacher.
- e. Add 225 ml of physiological 0.9% NaCl and blend until smooth.
- f. Bunsen lamp turned on.
- g. In this study, only 5 test tubes were used.
- h. Arrange 5 test tubes containing 9 ml of 0.9% physiological NaCl.
- i. Beri label 10^{-2} , 10^{-3} , 10^{-4} , 10^{-5} dan 10^{-6} pada semua tabung reaksi. Penggunaan pangkat hanya berhenti pada 10^{-6} hal tersebut ditakutkan jika hanya berhenti pada 10^{-5} hasilnya akan tidak memenuhi syarat dan hal ini merupakan keterbatasan penelitian.
- j. Siapkan dan susun 6 cawan petri steril diatas meja.
- k. Beri label 10^{-2} , 10^{-3} , 10^{-4} , 10^{-5} , 10^{-6} dan kontrol juga pada semua cawan petri dan didekatkan dengan lampu bunsen.
- l. Sampel yang telah diblender diambil sebanyak 1 ml dan dimasukkan kedalam tabung reaksi berlabel 10^{-2} kemudian divortex.
- m. The sample in the 10^{-2} test tube that has been vortexed, is put into a petri dish labeled 10^{-2} as much as 1 ml and put into a 10^{-3} test tube as much as 1 ml and vortexed again then put it also into a petri dish 10^{-3} .
- n. This step was repeated until the test tubes and petri dishes were 10^{-6} .

- o. The process of inserting the sample into a test tube and vortexing is called sample dilution.
 - p. After all the samples were put into a petri dish, 20 ml of sterile PCA media was poured in a lukewarm state. PCA media has a function to provide an estimate of the total number of aerobic microorganisms in food samples. A series of dilutions of food samples mixed with PCA media will be incubated for 2x24 hours and the results will be assumed that each visible colony is the result of cell multiplication on the agar surface (10).
 - q. The sterile petri dish labeled as control was only filled with 20 ml of PCA media. This is intended as a control in the study.
 - r. After all the petri dishes finished pouring PCA. Wait for 15-20 minutes for the PCA media (plate count agar) to solidify. This process is also known as microbiological culture (method of multiplying microbes) using PCA.
 - s. After being solid wrapped using newspaper or paper umbrella.
 - t. Then put in an incubator at 37°C for 2x24 hours.
4. Colony calculation stage (a collection of bacteria).

After being in the incubator for 2x24 hours, the colonies are ready to be counted using the colony counter. At this stage the researcher will place the media on the colony counter and direct the light position of the tool on the media. The discovery of bacteria by naked eye can be pinpointed using a marker to simplify calculations and the tool will automatically count the number of colonies in each food sample. With the condition that the colonies can be counted if there are 30-300

colonies. So if it is less or more than this amount, the research sample cannot be used.¹¹

5. Data Collection Stage

The results of bacterial calculations were written using Colony Forming Units (CFU) per gram. The data obtained in this study were in the form of the number of colonies (collections of bacteria) found in food stalls X and Y. The data obtained were presented in tabulated form and processed into tabular form and analyzed descriptively using the standard maximum allowable number of germs in a food according to the Drug Supervisory Agency and Food of the Republic of Indonesia in 2009.¹²

RESULT AND DISCUSSION

Food stalls X and Y are one of the fast food stalls that provide a variety of food needs for female students of Pondok Pesantren Komplek Q. Various types of fast food sold include rice, noodles, various fried foods, vegetables, various types of side dishes ranging from chicken, cakes, fried tofu, fried tempeh, eggs and other menus.

As the goal of sustainable development or SDGs 2030 in ending all forms of malnutrition and hunger and achieving food security. By conducting bacteriological test research, it is hoped that this will be one of the strategies that can support the achievement of the target to end hunger globally.

The results of the bacteriological test at food stalls X and Y used as many as 14 samples of the food studied, including white rice, white noodles (vermicelli), yellow noodles, crispy chicken, fried eggs, fried tofu, long bean vegetables, green beans and fried bakwan. Sample inspection result shows that there are 5 samples that do not meet the limits for microbial contamination in food based on the standards of the Drug and Food Control Agency of the Republic of Indonesia in 2009.¹³

Table 1. Results of Bacteriological Examination of White Rice at Warung X and Y

No	Sample Code	Germ Number (CFU/gram)	Information
1	White rice X	2,0 x 10 ²	Meets the requirements for microbial contamination limits in food based on BPOM RI in 2009 for rice 1x10 ⁶ colonies/g
2	White rice Y	2,5 x 10 ⁵	

Data Source: 2018

The data in Table 1. shows that the bacterial content in white rice in stall Y is 250.000 colonies/g, which is higher than in white rice in stall X, which is 200 colonies/g. The total bacterial content of rice in the two stalls is still considered to meet the

requirements for microbial contamination limits in food based on standards BPOM RI 2009 for standard rice is 1x10⁶ colonies/gso the rice is safe for consumption.

Rice is one source of carbohydrate energy to meet the main energy needs of

students. Rice is usually consumed by students with side dishes as a complement to the taste when eating. Carbohydrates are an ideal source of energy for the body that serves to meet the body's energy needs, feed the brain and nervous system, and help the digestive system to function optimally.¹⁴

The need for carbohydrate nutrition for female students, especially those in their teens,

is to optimize their nutritional status during the growth period at this age. Previous research mentions There is a relationship between energy and carbohydrate intake with nutritional status. So that to achieve the nutritional adequacy rate, adolescents are advised to meet the needs of energy intake and macronutrients such as rice.¹⁵

Table 2. Bacteriological Examination Results of White Noodles (Vermicelli) and Yellow Noodles at Warung X and Y

No	Sample Code	Germ Number (CFU/gram)	Information
1	White Noodles (Vermicelli) X	2,8x10 ⁵	Meets the requirements for microbial contamination limits in food based on BPOM RI 2009 for white noodles (vermicelli) and yellow noodles 1x10 ⁶ colonies/g
2	Yellow Noodles Y	9,0x10 ³	

Data Source: 2018

The data in table 2. shows that the bacterial content of the noodles in stall X was 280.000 colonies/g higher than that of noodles in shop Y, which was 900 colonies/g. The amount of bacteria content in the noodles in the two stalls met the microbial contamination limit requirements in food based on the standard

BPOM RI 2009 for noodle-type food is 1x10⁶ colonies/g so noodles are safe for consumption. Noodles are a source of carbohydrates besides rice which are usually consumed by students as a substitute for rice if they are bored and also as an additional side dish to eat with rice

Table 3. Results of Bacteriological Examination of Crispy Chicken at Warung X and Y

No	Sample Code	Germ Number (CFU/gram)	Information
1	Crispy Chicken X	1,2x10 ³	Meet the requirements for microbial contamination limits in food based on BPOM RI 2009 for chicken 1x10 ⁵ colonies/g
2	Crispy Chicken Y	3,2x10 ³	

Data Source: 2018

The data in table 3 shows that the bacterial content of crispy chicken in stall Y was 3,200 colonies/g higher than crispy chicken in stall X, which was 1.200 colonies/g. The amount of bacterial content in crispy chicken in the two stalls meets the requirements for microbial contamination limits in food based on standards BPOM RI 2009 for chicken meat is 1x10⁵ colonies/g so that chicken meat is safe for consumption.

Chicken meat is one of the foods that are most liked by students because it is savory and delicious and can be a hunger medicine for students. The nutritional content in chicken meat is one source of important nutritional intake needed by students. One of the content

of these nutrients is essential amino acids which function to replace some of the body's damaged cells. The short fiber content in chicken meat will facilitate the digestive process in the body. The protein content in chicken meat is also equivalent to the protein in beef, fish, nuts, and seeds. Another composition found in chicken meat is the content of heme iron which is needed by the body to store iron reserves. This heme nutrient is needed by female students so as not to experience anemia.¹⁶ This is in line with previous research that protein and enhancer substances are associated with anemia status in adolescent girls who have a habit of consuming animal protein.¹⁷

Table 4. Results of Bacteriological Examination of Stew Eggs at Warung X and Y

No	Sample Code	Germ Number (CFU/gram)	Information
1	Stew Eggs X	$4,8 \times 10^4$	Meet the requirements for microbial contamination limits in food based on BPOM RI 2009 for stewed eggs 5×10^4 colonies/g
2	Stew Eggs Y	$3,4 \times 10^6$	Not mmeet the requirements for microbial contamination limits in food based on BPOM RI 2009 for stewed eggs 5×10^4 colonies/g

Data Source: 2018

The data in table 4. shows that the bacterial content in the stew eggs in stall Y is 3.400.000 colonies/g while the egg stew X is 48,000 colonies/g. The amount of bacteria content in the stew eggs in stall X meets the requirements for the limit of microbial contamination in food based on the standard BPOM RI in 2009 eggs that is equal to 5×10^4 colonies/g so it is safe for consumption. Meanwhile, the egg stew at stall Y does not meet the microbial contamination limit requirements in food based on the standard

BPOM RI 2009 so it is not safe for consumption.

Eggs are a source of animal protein nutrients that are widely consumed by female students as a side dish with rice or a mixture of meals with noodles or other processed forms of eating. Eggs are chosen by students as a side dish because eggs have a fairly high nutritional content, taste good, are easy to obtain, and are relatively cheap when compared to other animal proteins such as beef, chicken or fish.

Table 5. Bacteriological Examination Results Fried Tofu at Warung X and Y

No	Sample Code	Germ Number (CFU/gram)	Information
1	Fried tofu X	$1,8 \times 10^3$	Meet the requirements for microbial contamination limits in food based on BPOM RI 2009 for fried tofu 1×10^4 colonies/g
2	Fried tofu Y	$2,8 \times 10^3$	

Data Source: 2018

The data in table 5. shows the bacterial content of fried tofu in stall Y is 2.800 colonies/g and fried tofu X is 1.800 colonies/g. The amount of bacteria content in fried tofu in food stalls X and Y meets the requirements for microbial contamination limits in food based on the standard BPOM RI 2009 for tofu is 1×10^4 colonies/g so it is safe for consumption. Tofu is one of the sources of vegetable protein needed by students at a price that is relatively much cheaper than animal protein.

Adequate protein nutrition intake for female students is very important to support their health, especially when entering the menstrual period, this is to prevent the risk of anemia. This is in line with previous research which states that insufficient protein intake in the body will cause iron channel inhibition and result in iron deficiency which has an impact on the incidence of anemia.¹⁸

Table 6. Results of Bacteriological Examination of Peanuts at Warung X and Y

No	Sample Code	Germ Number (CFU/gram)	Information
1	Long Bean Vegetable X	$6,0 \times 10^4$	Does not meet the requirements for microbial contamination limits in food based on BPOM RI 2009 for long beans and green beans 1×10^4 colonies/g
2	Peanut Vegetable Y beans	$2,6 \times 10^4$	

Data Source: 2018

The data in Table 6. shows that the bacterial content of peanuts (long beans) in stall X is 60,000 colonies/g and peanuts (beans) in stall Y is 26,000 colonies/g. The amount of bacteria content in the pea vegetables in the two stalls did not meet the microbial contamination limit requirements in food based on the standard BPOM RI 2009 for vegetables of the type of beans is 1×10^4 colonies/g so the vegetables are not safe for consumption.

Bean vegetables such as long beans and chickpeas are examples of vegetable menus that are consumed by female students every day to meet the nutritional intake of vitamins and minerals for the body. In consuming these vegetables, students will usually prefer ready to eat dishes such as those available at food stalls X and Y compared to cooking themselves which unwittingly have experienced high bacterial contamination and become unsafe for consumption.

Table 7. Results of Bacteriological Examination of Bakwan Fried Food at Warung X and Y

No	Sample Code	Germ Number (CFU/gram)	Information
1	Bakwan Fried X	$2,5 \times 10^7$	Does not meet the requirements for microbial contamination limits in food based on BPOM RI No. HK.00.06.1.1.52.4011 of 2009 for Bakwan fried 1×10^4 colony/g
2	Bakwan Fried Y	$1,2 \times 10^7$	

Data Source: 2018

The data in Table 7 shows that the bacterial content of fried bakwan in stall X is 25.000.000 colonies/g and fried food Y is 12.000.000 colonies/g. The total bacterial content of fried bakwan in the two stalls did not meet the microbial contamination limit requirements in food based on the standard BPOM RI 2009 for fried food is 1×10^4 colonies/gso it is not safe for consumption.

In addition to the Bakwan fried food samples at stalls X and Y, which are not qualified by standard BPOM RI 2009, there were 3 other samples that also did not meet the requirements for safe food for consumption which included stewed eggs Y, long bean vegetables X and green beans Y. The five food samples did not meet the requirements, due to too much bacterial contamination and exceeds the maximum allowable limit of a bacterium in food.

The cause of bacterial contamination in a food is usually caused by various factors, including the way of serving, storing, and processing food that is less safe and clean from stall owners who pay less attention to hygiene and sanitation. Hygiene can be interpreted as a health effort carried out by shop owners by maintaining and protecting personal hygiene from bacterial contamination such as washing hands. Meanwhile, sanitation is the effort of the shop owner to maintain and protect the cleanliness of the environment such as storage and serving of food. Previous research stated that food sanitation is related to hygiene, someone who has good personal hygiene will have good sanitation.¹⁹ This is supported by research by previous research which states

*there is a relationship between personal hygiene of the handler with the presence of the number of bacterial colonies on the tableware.*²⁰

The number of bacteria that exceeds the permissible standard in food can cause food poisoning in a person's body due to infection from bacteria. Previous research mentions during the period 2000-2015, there were 1.176 cases of food poisoning, with the highest cases being found in Central Java and West Java with a total of 163 cases. The number of reported food poisoning cases was 61.119 or (AR: 8,5%) and 291 cases of death (CFR: 0.4%). The incidence of food poisoning is more at risk for women than men with a proportion of 54.6%. The number of poisoning cases was obtained from regular meals (36,6%) and celebrations (29,7%). These two exposures are the types of activities that are most at risk in the highest case areas in homes (48,9%) and schools (13,7%). Meanwhile, household cooking (46,9%) and catering services (18, 9%) which is the highest cause of poisoning with the most common causative agent being pathogenic bacteria (74,9%) and E.coli as the most common cause (20%). The most frequent cause of poisoning is processing and storage of food that is not good and not in accordance with what it be should.²¹

CONCLUSION

There are 4 food samples at stall X and 5 food samples at stall Y consisting of white rice X and Y, white noodles (vermicelli) X and yellow noodles Y, crispy chicken X and Y, fried tofu X and Y, and egg stew Y. which meet the requirements of BPOM RI No.

HK.00.06.1.1.52.40112 in 009, so it is safe for consumption. Meanwhile, 3 food samples at stall X and 2 food samples at stall Y consisting of boiled eggs X, long bean vegetables X, green beans Y, and fried bakwan X and Y did not meet the requirements of BPOM RI No. HK.00.06.1.1.52.4011 in 2009, so it is not safe for consumption. It is important to hold a health education from local health workers regarding proper and correct processing, serving, and storage of food to the owners of food stalls around the Komplek Q, especially food stalls X and Y. Pondok Pesantren center manager in the area to follow up on food safety issues for female students.

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