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The bionic of isotonic safety with the addition of Arabic gum

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ABSTRACT

Background. Endurance sports greatly affect fluid requirements. The exercise that is too heavy will cause a lot of body fluids to come out. Providing sports drinks with carbohydrate and electrolyte content has more benefits for athletes. One of them is an isotonic drink formula with the addition of gum arabic. The food safety factor in isotonic drink formulas is very important to prevent side effects due to the contamination of food or beverages that can endanger health. **Objectives** to determine the food safety of the isotonic drink formula with the addition of gum arabic. **Methods** This study is the pre-experimental. Food safety, which includes microbial and metal contaminants, was analyzed at the Makassar Health Laboratory Center. The results showed that the isotonic beverage formula with the addition of gum arabic was safe from metal contamination. **Results** of the microbial contamination test shows that F1 is an isotonic drink formula with the addition of safe Arabic gum, while other formulas still exceed the quality requirements of isotonic drinks in Indonesia based on ISN 01-4452-1998.

Keywords: Gum Arabic, Food Safety, Isotonic Beverage Formula

INTRODUCTION

Performance in sports is the main objective of a competition. Maximum achievement can be obtained if the athlete is in good nutrition. Exercise requires energy that is obtained from nutrients in the food or drinks consumed. So achievement and energy are inseparable. Nutritional needs for adolescent athletes are relatively greater in nutritional needs, because adolescents still experience a period of physical growth and development of very fast behaviors such as lifestyle, eating habits, eating behavior disorders, physical activity, and the frequency and duration of exercise [1]

Endurance sports greatly affect fluid requirements. The exercise that is too heavy will cause a lot of body fluids to come out. Nearly 70% of the human body consists of fluids. Although it does not contain energy, it is very important to improve sports performance and is needed to help the body's metabolism to produce energy. The intake of fluids in an athlete's body needs to be balanced by drinking drinks containing electrolytes[2].

Giving fluids to athletes is a form of prevention of dehydration and maintaining body fluid balance. Dehydration means the lack of fluids in the body because the amount that comes out is greater than the amount that is entered. Dehydration can result in hyponatremia, hypoglycemia, hypokalemia so that athletes feel nauseous, dizzy, tired, and reduce the concentration (performance) of athletes during training or competitions. Sports drinks containing carbohydrates and electrolytes have even more benefits. In addition to providing a sweet taste, carbohydrates such as glucose, sucrose, and fructose are also useful for increasing energy, preventing hypoglycemia (decreased blood glucose), preventing weakness, and reducing stress hormone levels in the body. While the electrolyte content in it such as sodium, potassium, and chloride can prevent muscle cramps[3]

Food safety is a condition and an effort needed to prevent the possibility of contamination of biological, chemical, and other objects that can disturb, harm, and endanger human health. One aspect of food safety is carried out through food sanitation as an effort to create and maintain food conditions that are healthy, hygienic, and free from the danger of contamination. The food safety factor is very important for a food product, both food and beverage to prevent side effects due to food contamination that can endanger health[4]

Security dap is defined as a state free from the danger of injury or damage to the wearer. If the security aspect is not considered, then food or drink can turn into a source of disaster, a source of disease and death. There are three important things that can cause contamination in food and beverages. The first is handling food ingredients that do not comply with hygiene requirements. Second, in the processing process and the use of processing equipment and unclean presentation. Finally, when the food or drink is left idle or stored for too long at an inappropriate temperature.[5]

The number of isotonic beverage products on the market has attracted researchers to determine the safety of isotonic drink formulas that use local food ingredients, namely purple sweet potatoes. This isotonic drink formula is a development of Justin's research results (2019), to produce a *sports drink* formula based on purple sweet potato, there is still starch deposits in the resulting drink, so the addition of a stabilizer is required in the manufacturing process. One of the stabilizers that meet these requirements is gum Arabic. This study aims to determine the food safety of the isotonic drink formula with the addition of gum Arabic. Food safety in question is metal contamination and microbial contamination[6]

MATERIAL AND METHOD

This research is pre-experiment with a completely randomized design (CRD) that there are three treatment addition of gum Arabic, which is 0 .1 %, 0 .2 %, and 0 .3 % in the isotonic drink made from 75 grams of purple sweet potato. This research was conducted at the Food Technology Laboratory the Health Polytechnic of Makassar in February-September 2020.

The materials used to make samples of isotonic drink formulas are purple sweet potato, sweet orange juice, sugar, table salt (NaCl), water, and gum Arabic. The tools used are a blender, cutting board, knife, sieve, scale, basin, gas stove, pan, squeezer, *hand gloves,* measuring cup, spoon, covered container, sample glass.. Prepare all the ingredients and tools needed in the manufacture of an isotonic drink formula. The purple sweet potato is cleaned, then steamed for ± 30 minutes, skinned, and weighed as much as 75 grams for each formula. After the blend by adding m strangers each 250 ml mineral water. Sweet potato filtrate was filtered to obtain purple sweet potato juice. The purple sweet potato juice is heated for 1 minute, then cooled. After that, add 25 ml of sweet orange juice, sugar, table salt, and gum arabic. Stir until smooth, using a boxed bottle of plastic and glass bottles.

FINDINGS

The safety of isotonic drink formulas is tested from metal contaminants and microbial contaminants to comply with SNI 01-4452-1998 regarding the quality of isotonic drinks. The metal contamination of the isotonic drink formula with the addition of gum Arabic which is done twice for each formula.

Metal contamination

The result of metal contamination analysis using the atomization method in the isotonic drink formula with the addition of gum arabic showed that the average results were below the ISN for isotonic drinks, namely for arsenic metal a maximum of 0.1 mg/kg, maximum mercury 0.03 mg/kg, maximum zinc 5.0 mg/kg, stannum maximum 40 mg/kg, maximum copper 2.0 mg/kg and maximum lead 0.3 mg/kg.

Microbial contamination

The results of the Total Plate Count (TPC) of bacteria in the isotonic drink formula with the addition of gum Arabic showed that the TPC of bacteria for all formulas decreased from the results of the I test. The results of the TPC analysis for mold/yeast showed that the second TPC of mold/yeast in the isotonic drink formula decreased the TPC of mold/yeast for the formula. F1 and F3. The increase in mold/yeast TPC was seen in the F0 and F2 formulas in examination II. While the results of the Salmonella

Sp examination showed that no Salmonella Sp content was found in the isotonic drink formula with the addition of gum Arabic.

Table 01. Results of Metal Contamination and Microbial Contamination Analysis are appropriate SNI 01-4452-1998 Isotonic Drinks

No.	Type of Test	Levels				Unit	Requirements
		F0	F1	F2	F3		*)
1	Metal contamination						
	• Lead (Pb)	<0.01	<0.01	0.05	<0.01	mg / kg	max. 0.3
	• Copper (Cu)	0.34	0.24	0.21	0.23	mg / kg	max. 2.0
	• Zinc (Zn)	0.35	1.11	0.20	0.22	mg / kg	max. 5.0
	• Mercury (Hg)	<0.0005	<0.0005	<0.0005	<0.0005	mg / kg	max. 0.03
	• Tin (Sn)	<0.36	<0.01	6.60	<0.59	mg / kg	max. 40 (20 *)
2	Arsenic	<0.08	0.015	<0.01	0.015	mg / kg	max. 0.1
	• Microbial contamination						
	• Total Plate Figures (TPL)	1.35 x 10^2	<3.5	1.15 x 10^2	3.65 x 10^2	colony / ml	max. $2x10^2$
	• Salmonella	negative	negative	negative	negative	/ 25g	negative
	• Mold / Yeast	6.1 $x10^1$	<1	1.3 $x10^2$	<1		max. 50

*)National Standardization Agency of Indonesia

DISCUSSION

Metal contamination

The metal content of arsenic (As) in the isotonic drink formula with the addition of gum arabic. The result of the analysis is still within the recommended threshold in SNI 01-4452-1998, namely Max. 0.1 mg / kg . The concentration of As heavy metal contamination is still accepted in the four isotonic drink formulas with the addition of Arabic gum, making it safe for consumption. The mercury content in the four isotonic drink formulas with the addition of gum arabic was still within the permissible threshold of <0.0005 µg / g on examinations I and II. The maximum allowable limit of mercury/mercury (Hg) contamination is Max. 0.03 mg / kg . The requirements for isotonic drinks according to the Indonesian National Standard (INS) 01-4452-1998, the maximum limit of Zn metal contamination is max. 5.0 mg / kg The results of the analysis show that the average levels of Zn in the four isotonic drink formulas with the addition of Arabic gum are between 0.20 mg/kg to 1.11 mg/kg (< 5.0 mg/kg), meaning that the isotonic drink formula is safe for consumption. The maximum B of Sn metal contamination is max. 40 (25.0 *) mg / kg in isotonic drinks according to INS 01-4452-1998. The analysis showed that the average Sn content in the four isotonic drink formulas with the addition of gum arabic was <40 mg/kg, meaning that the isotonic drink formula was safe for consumption.

The requirement for isotonic drinks in SNI 01-4452-1998, the maximum limit of Cu metal contamination is max . 2 .0 mg/kg. The results of the analysis showed that the average levels of Cu in the four isotonic drink formulas with the addition of Arabic gum were between 0.21 mg/kg to 0.34 mg/kg (< 2.0 mg/kg), which means that the isotonic drink formula is safe for consumption[7].

Lead (Pb) is a metal that has received major attention in terms of health, because of its impact on a large number of people due to poisoning of food or air contaminated with Pb and has dangerous toxic properties. Naturally, lead can be found in the soil, odorless, and tasteless[4]. The INS 01-4452-1998 set of heavy metal contamination limits for lead in isotonic drinks are consumed by humans is a maximum of 0.3 mg/kg. The average value of lead-heavy metal content in the four isotonic formulas with the addition of gum Arabic which has been analyzed is within the threshold so that it is safe for consumption.[5]

Microbial contamination

The results of the analysis showed that the total average value of bacteria in the four isotonic drink formulas at examination I (> 300x10 ^{5} Colonies / g) was much greater than the maximum value of TPC for bacteria (Total Plate Numbers) required in SNI (2x10 ^{2} Colonies / g)[7]. This means that this product is not safe for consumption. This data is the reason for the re-creation of the isotonic drink formula. Unlike the previous one, the formula is made and packaged using glass bottles. Before use, the bottles were sterilized at a temperature of> 100 ◦C for 15 minutes. Then, a microbiological analysis (examination II) was carried out at the Makassar Health Laboratory Center. Microbiology laboratory results showed that there was a drastic decrease in Bacterial TPC in all isotonic drink formulas. It is known that Bacterial TPC in F0, F1, and F2 is smaller than the maximum value of TPC for bacteria required in SNI for Indonesian isotonic drinks. This means that the formula is safe for consumption based on microbiological aspects. Bacteria TTPC F3 (3.65x10 ^{2} colonies / g) has experienced a drastic decline te but still exceeded the quality standard isotonic drinks (2x10 ^{2} colonies / g) if the review of aspects of microbiology.

This research is in line with the research of Rianti A, et al (2018) which showed that the results of TPC testing in green bean drink (GBD) samples showed that the contamination exceeds the maximum limit of microbial contamination. Meanwhile, the sample of soybean drink (SSD) and red bean drink (RBD) did not exceed the maximum limit of microbial contamination. The difference in the process of making SSD, RBD, and GBD samples lies in the type of material used. GBD samples were made with the addition of *pandanus*, while the SSD and RBD samples did not use these materials.[5]

Research on isotonic drink formulas with the addition of gum arabic in their packaging process is not good, so it can cause the risk of bacterial contamination. In making the first formula, drinks are packaged using plastic bottles that have been washed using soap and clean running water, then dried using dry *tissue*. No sterilization process is carried out on the bottles used. Unlike the second formula, the drinks are packaged using glass bottles that have been washed using soap and clean running water, then sterilized at a temperature> 100 ◦C for 15 minutes. The results of the microbiological quality analysis showed that the total fungi/yeast F1 and F3 had met the standards set in SNI for Indonesian isotonic drinks. Microbiologically, the formula is safe for consumption. In contrast to F0 and F2, the amount of mold and yeast in the formula exceeds the set standard (maximum 50 Colonies / g). The quality requirements contained in SNI 01-4452-1998 require negative isotonic drinks *Salmonella Sp*. The results showed that the isotonic drink formula with the addition of gum Arabic was not contaminated with *Salmonella sp*.[1,8]

Ethic

This study has been approved by the Makassar Health Polytechnic Ethics Committee with the reference number:: 0087 / KEPK-PTKMS / III / 2020

Conflict of Interest

The researcher states there is no conflict of interest

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CONCLUSION

The results of the research show that the isotonic drink formula with the addition of gum arabic is safe from metal contamination in accordance with the SNI requirements for isotonic drinks. If assessed based on microbial contamination, F1 is an isotonic beverage formula with the addition of Arabic gum which is safe from microbial contamination.

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