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Short Communication
The effect of banana flour as an isotonic drink to maintain hydration status

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Abstract: Hot temperatures increase the risk of dehydration. Fluid with certain osmolarity and contain of electrolytes can prevent dehydration. Banana isotonic drinks (BID) was developed for rehydration. This study aims to determine the difference effect of BID and plain water (PW) of body hydration. Experimental research using a cross over design involved 16 subjects and divided into two groups. After undergoing two days of quarantine, each subject was administrated with 500 ml of fluid. Wash-out period between treatments was 7 days. Indicator of hydration of hemoglobin, HCT, and urine volume are assessed before and after intervention. The result showed that indicator of hydration differed significantly after receiving the intervention ($P < 0.05$) although there was no difference between groups ($P > 0.05$). However, urine volume formation was higher on the PW than BID group. BID is able to improve the hydration of the body through the mechanism of maintaining body volume and slowing down the urine formation.

Keywords: Banana, isotonic drink, hydration

Introduction

Isotonic drink is needed for people who live in tropical countries and its market is still widely open (Purnomo, 2009). In addition, banana yellow kapok containing carbohydrates and electrolytes like sodium and potassium in sufficient quantities could be used as a material for isotonic drink (Wesley, 2006). These contents were increased after the flouring process and it were very stable and safe to develop drinks (Dosumu *et al*., 2009). The formulation of these drinks have been successfully meet the osmolarity standard of isotonic drink. These drinks can be developed with the basic materials of banana yellow kapok age of 105 days. Each 100 ml of water was added with 24% of banana flour, salt, and sugar in small amounts. These drinks have the osmolarity of 269 mOsm. The drink is simply made by dissolving the ingredients into the cold water. In order to complete the development of this product, testing the effects of rehydration fluids is highly needed. When these two things give satisfactory results, this research product can give beneficial for health (Penggalih *et al*., 2010).

Materials and Methods

The research is conducted at the Laboratory of Abadan Life of Support. All the experimental treatments were performed in the morning at 09:00 to 12:00 (Schroeder, 2002). This study involved cross over experimental design. Sixteen subjects were chosen based on criterias such as: male with a maximum 20 years old, do not smoke, and do not suffer from chronic diseases. Subjects were divided into two groups, namely those treated with plain water (PW) as control group and those treated with Banana isotonic drinks (BID). Subjects were made to adapt to the program for two days. The program includes the provision of standard diet and the maintenance of hydration program (does not consume caffeinated beverages, alcohol and does not consume vitamin or mineral supplements). Subjects were asked to fast overnight. To control the adaptation process, the whole subjects were subjected to quarantine during the night.

Rehydration tests were carried out on by placing the subjects in a comfortable room temperature for 15 min, and then venous blood was taken on the arms. Urine is collected from morning until before the intervention. Orthostatic measurements were performed after 15 min. Subjects were asked to consume 500 ml of fluid. Fluids should be consumed within 5 min. The second orthostatic measurements were taken for 15 min after fluid ingestion. Blood samples and orthostatic measurements were taken again after two hr of rehydration period. Urine collected from drinking up to 2 hr after rehydration was recorded in ml volume. Blood sampling was

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done to check for the hemoglobin and hematocrit level. Two experimental treatments were conducted separately with 7 days washout periods. Drinks are given in cold conditions and assigned randomly. This study is approved by the ethics committee, Faculty of Medicine Gadjah Mada University.

Test for normality were used with Kolmogorov-Smirnov test. If the data are normally distributed (P> 0.05), the data were further processed using paired t-test test (to know the difference after the treatment) and independent t-test to determine the differences among the treatments. Stata version 10 was used to analyze statistically. Consideration of significant differences is p <0.05. Results are expressed as mean ± standard deviation (SD).

Results

Distribution of respondents can be seen in Table 1. Variant homogeneity test showed that age, weight, height, nutritional status with indicator body mass index (BMI), systolic, diastolic and heart rate of all the subjects were homogeneous (p >0.05).

Table 1. Distribution of subject

Variable	Mean	Std. Deviation	p-Value*)
Age (years)	19.00	0.632	0.522
Bodyweight (kg)	59.18	11.48	1.000
Height (cm)	169.63	5.45	0.614
Body Mass Index(kg/m2)	20.48	3.31	0.580
Systolic (mmHg)	117.13	7.06	0.590
Diastolic (mmHg)	65.13	4.98	0.317
Pulse	70.13	14.02	0.131

*)Test for Homogeneity of variance

Results of normality test data based on biochemistry parameters showed that the data are normally distributed (P >0.05). The results based on Table 2 showed that there was no significant difference in hemoglobin, hematocrite and urine volume between PW and the BID groups. However, the average difference indicates that hemoglobin, hematocrite level was higher in BID compared with PW groups. Hemoglobin and hematocrite level increased successively at 0: 24 g/dl and 0: 34% in BID groups. The volume of urine indicates that PW group produced 25.375 ml higher level of urine compared with the BID groups.

Table 2. The Differences effect on Hhmoglobin, hematocrite and Urine volume (n = 16)

Variabel	Group	Mean	Std. Deviation	Mean difference	p-Value
Hemoglobin	PW	-.413	.3160	-.2375	.062
	BID	-.175	.3733	-.2375	
Hematocrite	PW	-.638	.9344	-.3375	.386
	BID	-.300	1.2187	-.3375	
Urine Volume	PW	51.84	180.383	25.375	.649
	BID	26.47	126.994	25.375	

Paired T-test was conducted to analyze the difference effect for pre-post trial for Hemoglobin, hematocrite and urine volume. Figure 1 showed that hemoglobin and hematocrite level at PW group was higher than that of BID. they were not significantly difference between groups (P=0.053).

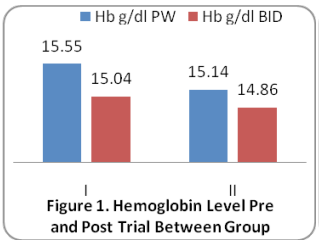

Figure 1. Hemoglobin Level Pre and Post Trial Between Group

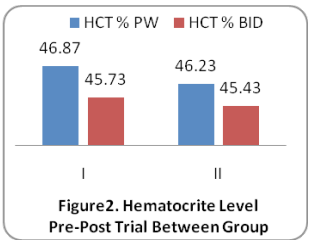

Figure2. Hematocrite Level Pre-Post Trial Between Group

Figure 3 showed that PW group was higher significantly at urine formation compare to BID group (P=0.013). In this study, the urine volume before the intervention was recorded based on the results of urine formation in the morning until before the intervention. The volume of urine after the intervention was the result of urine after consumption of beverage up to 2 hr of rehydration period is completed.

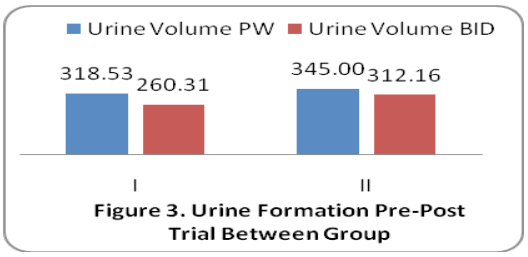

Figure 3. Urine Formation Pre-Post Trial Between Group

Discussion

Hemoglobin and Hematocrite were not significantly difference between the groups, but there were difference levels between groups. According to Maughan (2001), hemoglobin and hematocrite affect blood volume status. Hemoglobin and hematocrite also play a role in regulating movement of fluid plasma and body fluids and electrolytes. The displacement occurs in three phases. The first phase was blood plasma from whole body moving into the circulatory system, nutrients, and oxygen taken from the lungs and gastro-intestinal tractus. The second was the interstitial fluid with a component moving from the blood capillaries and cells. The third phase is fluid and the substance moving from interstitial fluid into the cell. Capillary blood vessels and cell membranes that are semi-permeable membrane were capable of filtering so that not all substances and components in body fluids follow to move. Beverage isotonic able to accelerate the process of fluid movement through diffusion method, filtration, osmosis and active transport (Bohnen, 1992). However, in this result, the plain water seems to play much better compared to BID. According to Maughan (2001) volume of a

healthy person's body fluids and chemical components of body fluids are always in normal conditions. The body response to fluid balance is influenced by various factors (Sherriffes and Maughan, 2001; Sherriffes, 2001), namely age, climate, diet, stress, pain conditions, medical treatment, surgery, and medication (Passe, 2001).

The results showed that urine formation was higher in plain water groups than that in BID. Plain Water or mineral water is also beneficial to the body's fluid balance; however, on the condition of dehydration, the consumption of water will stimulate urine output resulting in a delay in the process of rehydration. An isotonic drink can optimize the hydration through the delay of urine formation (Maughan, 2001).

Conclusion

BID is able to improve the hydration of the body through the mechanism of maintaining body volume and slowing down the process of urine formation. Further research can be done by checking on the outcome indicator of blood electrolytes, urine electrolytes, urine and serum osmolarity. The comparison with gold standard of isotonic drink is needed to be assessed. In addition these products contain enough calories for energy sources, which can be developed to improve the stamina.

Acknowledgement

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