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Coconut Water as Enhancer Productivity of Labor Exposured to Heat

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Abstract
The work environment is one of the conditions that affect the productivity of labor. Work conditions of heat causes thermal stress on the workforce so the impact on the decline in productivity and cause health problems and accidents. Hot environmental conditions make the human body to sweat a lot, so the body loses sodium. Last survey at home Industry ladies accessories showed the temperature in the room reach 30,20C, the workers sweat a lot, do not even wear while working, they complained so quickly exhausted. This study aimed to analyze the effectiveness of coconut water as enhancing the productivity of exposed to heat labor. Experimental study with One group pre test and post test design take the population of labor with sample size of 9. The independent variable are mineral water and coconut water, the dependent variable is labor productivity, namely the womb sodium (Na +) in the blood of workers. Most of the worker are young age (<40 years) and has normal nutritional status, most of the pulse has decreased, there is an increase the sodium content in the blood before and after consuming mineral water and coconut water, there is no difference the sodium content in the blood of workers before and after consuming mineral water (p=0.813), there is no difference in workers pulse before and after consuming mineral water (p=0.526) and coconut water (p=0.363), there is a difference the sodium content in the blood of workers before and after consuming coconut water (p value = 0.030), coconut water is able to improve the productivity of the workforce compared to mineral water. Coconut water was suitable to be consumed by workers exposed to heat as a replacement ion electrolytes in the body. To avoid radiation workers should wear clothing on the job.
Keywords: Coconut Water, Heat Stress, The Sodium Content, Productivity.

1. INTRODUCTION

Heat stress in the workplace is a condition that interferes with the activity of labor. Several factors affect the productivity of education, level of knowledge, skill, discipline, environment and climate work, nutrition and health. Anggaraini (2010) suggests there is a relationship hot working environment will create thermal stress on the workforce, causing productivity to decline. Heat stress in the work environment makes labor should consume drink enough to replace the fluids lost, because the temperature of the human body can be influenced by the temperature of the surrounding environment. Normal human body temperature ranges from 36-37°C, when the temperature changes of the ring normal, human body can affect the hypothalamic set point, where this change is associated with the production of heat, causing the temperature of the human body into abnormal, below 3500 C it will experience hypothermia and when above 40,60C it will experience hyperthermia. Although humans are creatures that can maintain body temperature with a neighborhood called homeoterm, but when exposed to continuous heat can lead to reduced productivity and ultimately impact the health and labor accidents (Siswanto, 2000). Precautions taken to avoid the health effects of labor, they have to work comfortably and not get tired. Comfortable working environment must have a relative humidity of 40-50%. Humans get 20% of energy from food. Energy will be issued in the form of work, while 80% of the energy that would be released by the body into heat which is released by the body. If a neighborhood has a temperature range from 33-35°C, while the body temperature ranges from 370C then the difference between the temperature is not so great, so the skin feels comfortable in the heat in the environment, but if differences in ambient temperature and the body temperature is very remote, one way used by the body to control temperature by way of evaporation, so the body becomes cold, the hypothalamus gland will raise glands sweat, the heat exchange in the environment have always happened and the temperature of the environment always plays an important role, from the mechanism of heat exchange, namely conduction, convection, evaporation and radiation were most responsible are convection and evaporation (Giancoli, 2001).

The health impacts caused by environmental overheating one of which is fatigue, it is evident from the results of L.O.C. Rodrigues (2003) research showed that fatigue affected by increasing heat stress environment. Wira, Lisrianti A (2012) mentioned fatigue may occur in the workforce by age over 30 years, and labor is working with over 4 hours of work a long time, in addition to the workforce who used to drink with an average of over 4 glasses, is also experiencing job burnout with percentage amounted to 91.5%. According to Muizzudin (2013) research which proves the productivity of labor will decline in result of the workforce is experiencing mental and physical fatigue. Hot environment will make your body sweat, so the body will lose ion electrolytes containing the elements sodium and chloride, therefore workers who suffered heat stress must obtain intake of fluid into the blood in order to replace the sodium ions and chloride are already exit. Research conducted by Jamaludin, J et al (2012), disclose less labor consuming liquid it will have an impact on fatigue and exhaustion is power in result of a lack of sodium consumption.

Home accessories industry is an industry of women engaged in women's accessories / jewelry woman. Using the product raw materials recycled from broken glass is melted into ingots of glass which is further processed into finished materials in the form of beads, in the production process required a very high heat to melt glass, so that shards of glass into one and can be formed. The production room I with an area of 20 m2, while the production halls II and III measuring 40 m2, production rooms I and II, brick and production III partly made of brick, floor space in the form of ground with a roof made of asbestos, except production II of tile. The ventilation in the room spacious enough ± 15% of the area of the room, but there was no wind flow that goes in that space. Results of work climate measurements at the site by using the WBGT (Wet Ball Temperature Index) gained 31,80C with the workload in the lightweight category that is simply moving the hand skills to work times for 8 (eight) hours per day, while working climate standards for work environment by the Minister of Manpower and Transmigration Republic of Indonesia No. PER.13/ME /X/2011 on the threshold value factors of physics and chemical factors in the workplace, to workers who work in a light load and work continuously limit is 310C.

Hot working atmosphere coupled condition of the building is simple, using asbestos roof, no air flow in the room, causing excessive sweating labor, so that they feel thirsty. To dissipate the labor thirst to consume coffee and mineral water, for them if it does not consume coffee tasted bad, because they feel less comfortable, if not a sweet drink it, they could spend as much coffee during the work a maximum of 3 times. Impact of labor that occurs will be frequent urination, so it will be spilled electrolyte apart from sweat. From the above explanation, the researchers are interested to analyze the use of coconut water as enhancing the productivity of the labor exposure to heat.

3. RESEARCH METHODS

This research is a pre-experimental One group pre test and post test design. The population is a labor from the production process I, II and III women's accessories manufacture of home industries. Samples were taken with the criteria of male sex, respondents have done work breaks of at least 1 x 24 hours, not being ill. The sample size met the study criteria for 9 samples. Independent variable research that fluid intake include mineral water and coconut water as much as 1300 ml per day, while dependent variable is the content of sodium (Na +) in the blood as an indicator of labor productivity and pulse, confounding variable in this study is the age and nutritional status. Data were analyzed by paired sample t test and are presented in tables and graphs.

4. RESULTS AND DISCUSSION

Description of Production Room Conditions.

Accessories production space is divided into 3 (three) rooms. 1 (one) production halls namely the process raw materials into semi-finished materials. The room has an area of 20 m2, has a vent in the form of a window with an area of 2 m^2, bamboo-walled with a floor that is a land and roofs that use asbestos. The results of measurements taken at 10.00 am at get relative humidity of 46% with a wind speed of 43 m/s and a WBGT of 33.9°C. Production halls II and III is the production space of semi-finished materials into finished materials in the form of beads. This space has an area of 40 m^2, dirt floors. Production halls II roof tiles, brick-walled half with a height of 1.2 m and a half from the bamboo slightly open, with humidity 42%, wind speed of 22 m/s with a temperature index is to be 32.9°C. Asbestos-roofed production space III, right-hand wall of brick, while the left half of brick and half open. Wind speed of 29 m/s, humidity of 42% with a temperature index was 32.6^0 C else is to be wet. These jobs involve hands-on skills alone, for that workload is in charge of the labor force in the low category, with working time diving 8 (eight) hours in a day, a time of cooling or rest given over 1 hour.

The difference in the sodium content of coconut water and mineral water

Sodium content in drinks varies greatly as the table below, can be seen there are five types of beverages that will be compared to sodium content.

Table 1. Sodium Content in Drinks

No	The Number of drink	Sodium content (mg / l)
1	Young Coconut Water	78.14
2	Old Coconut Water	89.26
3	Aqua Mineral Water	138.2
4	Club Mineral Water	162.8
5	Recharge Mineral Water	178.5

Sodium content between young and old coconut water is greatest old coconut water, while the sodium content in the mineral water of the three types of this so close to the old coconut water is aqua.

Age and Nutritional Status of Labor

Labor on the accessories home industry mostly aged under 40 years, which is above 25 years and below 39 years,

the owner of the home industry is very precise in putting labor in production, mostly young age, according to WHO that an older person will decreased endurance, because older people more difficult in adapting the work environment, the parents will be more difficult to compare the sweat on the young. The nutritional status of labor in general is ideal, there are 33 % of the nutritional status with underweight, 22% of the labor is overweight and no obese. Nutritional status conditions of workers due to their energy has been burned during the production process, although the workload they did in the lightweight category, but the environment in which work is very hot, in which heat exceeding the threshold value. According to John R et al (2006) describes the extreme heat conditions, a worker will sweat more than 1 liter of fluid per hour, while every 1 liter will put out 580 Kcal.

The content of sodium, labor Pulse before and after exposure to heat

Before the work carried out measurements and heart rate measurements were taken again after they are exposed to heat, the pressure difference can be seen in the following graph.

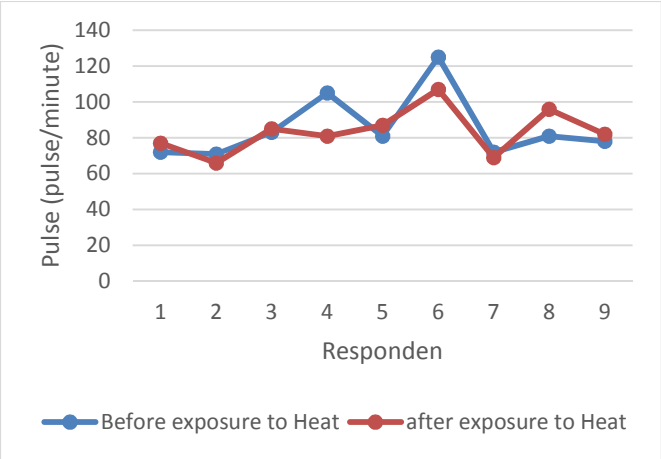


Figure 1 Pulse Labor before and after exposure to Heat

Nurmianto, E (1998) explains the pulse rate will increase influenced by several factors such as temperature or ambient temperature factor, the static muscles geting a high load, use a little muscle work. In this study there was no difference, but in view of the results of the percentage there is 56% of the pulse of the labor force has increased, although the increase is not so great. The workload that earned home industry ladies accessories included in the lightweight category. They only use a hand in the work. Although the environmental conditions in the production room ranges I to III of 32.6^0C–33^0C, while the extent permitted by the Minister of Manpower and Transmigration Republic of Indonesia is the time to work for 8 hours a day with a light workload, Wet Ball Temperature Index was 310 ^{0}C.

The increase in the pulse rate is not extremely high because labor can feel enjoy the work, so there is no pressure at work, stress at work will make the pulse of getting up. The pulse of labor does not depend on the age, Siskawati, F.A, (2010) research states that there is no relationship between age and pulse, but it also does not affect the nutritional status of a person's pulse. Relative humidity of the room also affects the pulse workers. The relative humidity chamber at the work place is 42% and 46%. Giancoli (2001) states that the relative humidity of the most good for the health of the range 40-50%. If the humidity in the workroom in accordance with health, even though they work on a hot day, the body will be able to regulate the evaporation of liquid on the skin and body temperature are balanced so that the temperature will not rise and pulse rate will not rise. The sodium in the blood is an indicator of a person, when exposed to heat for a long time can be lost through sweat and urine.

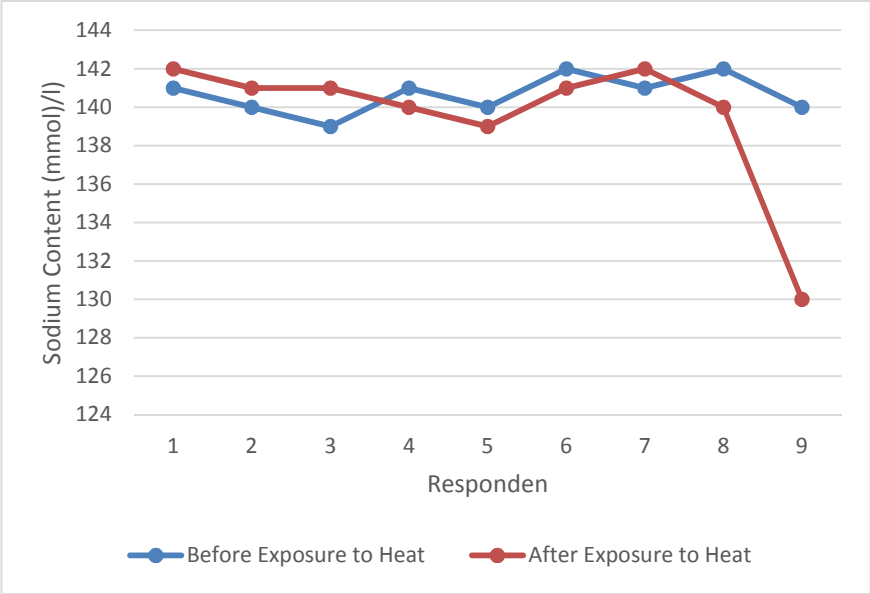


Figure 2 Sodium Content of Labor Before and After Exposure to Heat

The sodium content in the blood of workers before and after exposure to heat is also not any difference, the quantity is no difference, amounting to 45% of the labor has decreased the sodium content in the blood. Even though the value of the Index Temperature Wet Ball exceeds the threshold, but there are wind speed in the room rate, so that the natural cooling process. Although the labor is not wearing clothes, because excessive sweat, the sweat will dry due to the availability of wind in the room.

The content of sodium, labour pulse before and after consuming Mineral Water

Hot environment will make labor excessive sweating and thirst, a step that is usually done to relieve thirst that consumes mineral water. Here will compare the sodium content of labor before and after consuming mineral water.

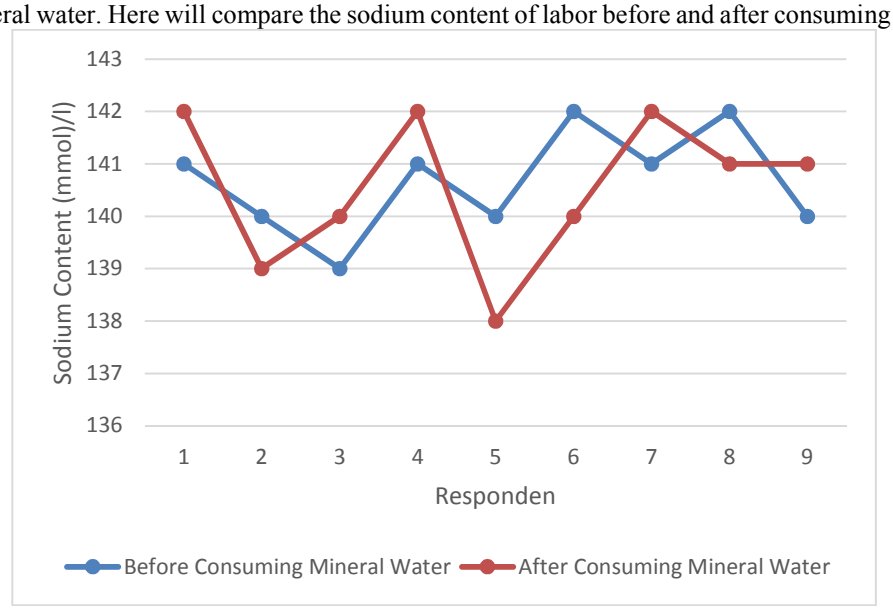


Figure 3 Differences Sodium Content of Labor Before and After Consuming Mineral Water

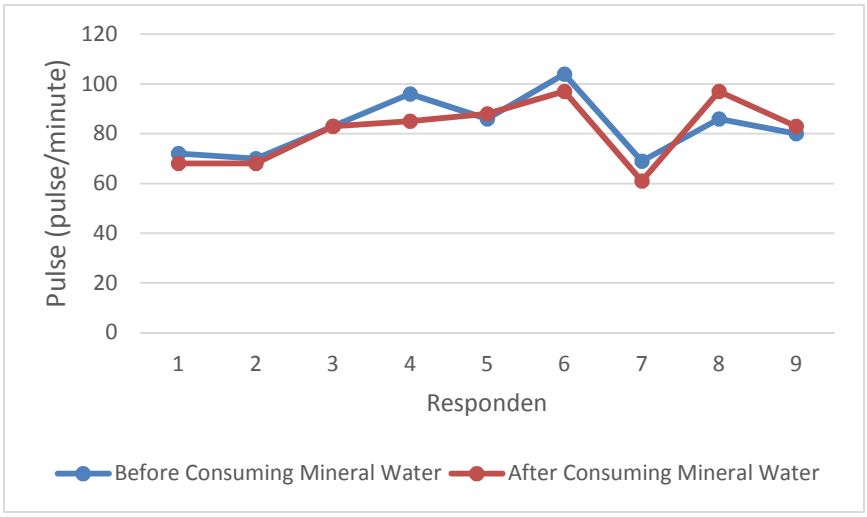


Figure 4. Pulse Workers Before and After Consuming Air Mineral

Mineral water had no impact on the worker pulse, the quantitative decline in the percentage of the pulse rate of 33% and 11% pulse after consuming mineral water. This is similar to the research conducted by Krisnawati, et al (2011) found that the rehydration using drinking water, will give a small increase in pulse rate. Workers who work in hot areas will undergo acclimatization, acclimatization through excessive sweating. To avoid dehydration, the need to consume drinking water, at any time and as often as possible and not have to wait for thirst. There is no difference the sodium content in the blood before and after consuming mineral water, in other words that the sodium content in the blood after exposure to heat and consume mineral water to rise back to normal or slightly higher than early before work, but there are some who tend to fall.

This proves that the mineral water contained in the electrolyte content, according to Arifin Z, (2008) in the mineral water are the elements carbon, hydrogen, oxygen, nitrogen calcium, chloride, sodium, sulfur and glucose. Sweat is issued workforce in the process of acclimatization to the environment, many containing electrolytes, especially sodium, so that by consuming mineral water is enough to restore the body's electrolyte back to normal. Restoration of physical labor could be back as before work, so that productivity can be maintained. Judging from the age and nutritional status of the workforce, age < 40 years or > 40 years, the nutritional status of underweight, normal and fat do not affect the body's physiological reaction.

The content of sodium, Labour Pulse Before and After Consuming Coconut Water

Coconut water contains glucose which is quite a lot compared to mineral water, but the sodium content less than aqua water.

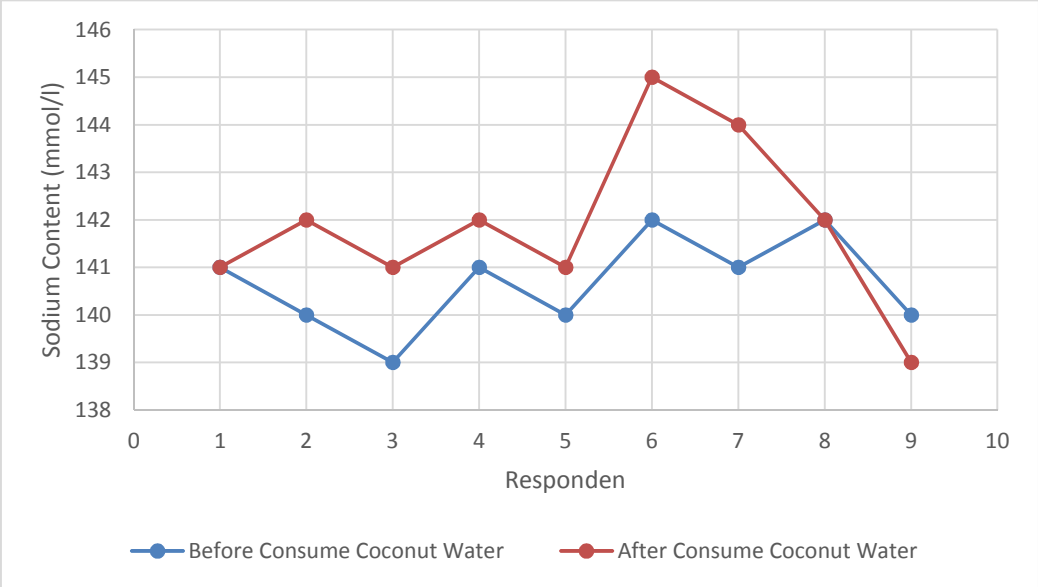


Figure 5 Sodium Content of Labor Before and After Consume Coconut Water

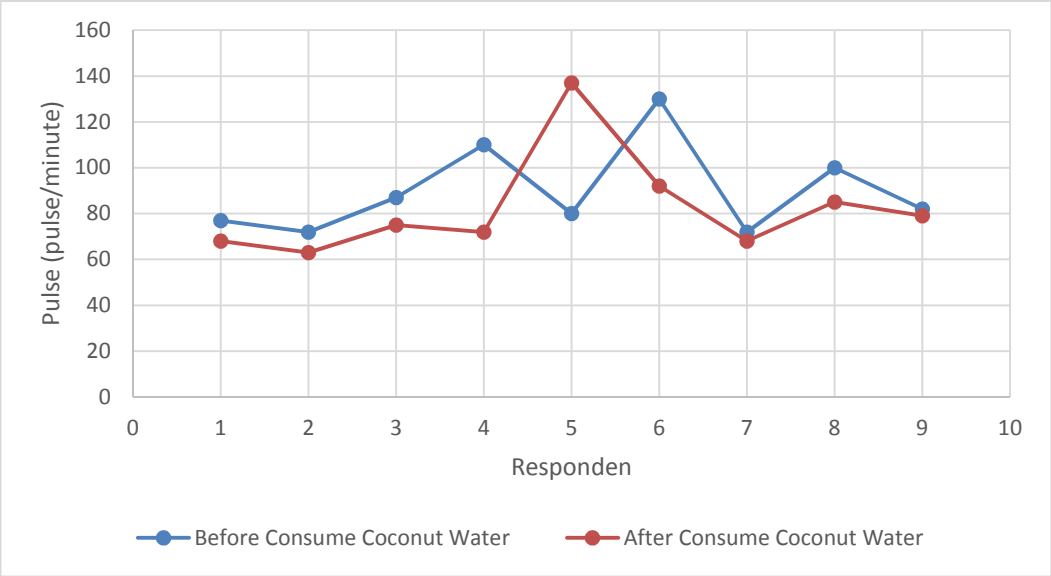
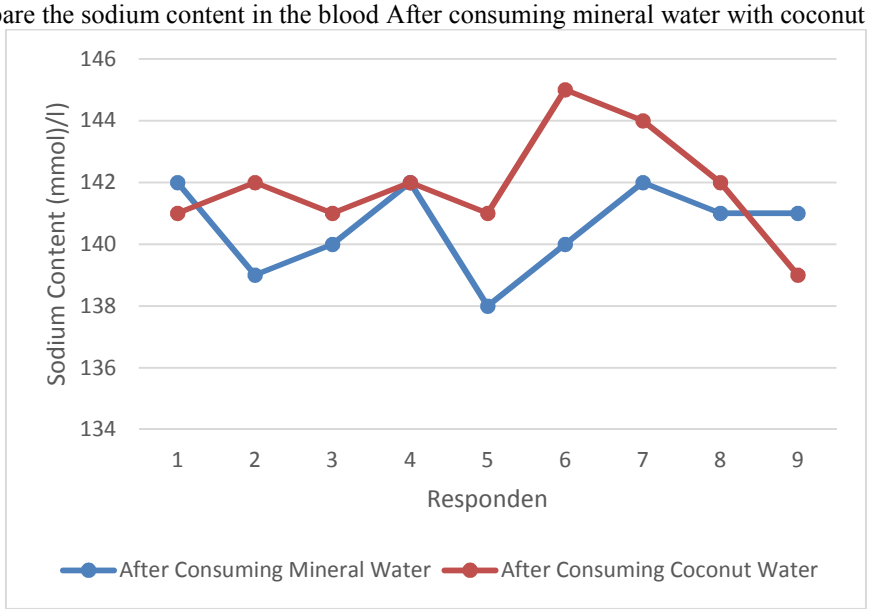


Figure 6 Pulse Workers Before and After Consuming Coconut Water

The results showed that there was no difference labor pulse after consuming coconut water with a pulse after exposure to heat. Judging by the quantity of labor pulse tends to decrease. This is similar to the research conducted by Krisnawati D, et al (2011) states that the electrolyte liquid and glucose can prevent the increase in pulse rate. Hidajah N (2011) explains that the sodium in isotonic drinks, will speed up the recovery, the results of this study are supported by Jamaludin,J (2012) research which proves that 22% of workers packing in Semarang experiencing severe fatigue due to consume less sodium standard, while 14.3% did not fatigue experience because consume sodium accordance with the standard. Coconut water plant species of the cocos genus is a natural isotonic water because it contains protein, fat, carbohydrates, vitamin C and B complex. According Lysminiar, A.N (2010) coconut water can be used as a stamina enhancer or rehydration.

The sodium salt on the human body, especially an adult ranges from 1.3 to 1.6 g/day. The results showed that there was a difference in the sodium content of labor before and after given coconut water. The percentage of workers who had passed the sodium content by 67%. It is due to that in the coconut water contains glucose and salt. Sodium in fruits or vegetables more quickly digested by the body than the salt contained in the drink.

Compare the sodium content in the blood After consuming mineral water with coconut water



Graph 7. The content of sodium in the blood of Labor After Consuming Mineral Water and Coconut Water

There are differences in the sodium content of the blood in the labor who consume mineral water and coconut water. Provision of coconut water to give effect to the increased sodium content in the blood of workers is higher than the consumption of mineral water. Laboratory studies have shown the sodium content in the mineral water is aqua higher than the coconut water. However, when the liquid is consumed by the body actually have an impact on the increase in the sodium content in the blood is a liquid derived from fruits that coconut water. Labor

in the home industry often consume sugary sweet coffee or tea, which increased frequency of urination during labor. This condition causes the labor is getting tired and the impact on productivity is lower. Spending ion electrolytes, especially sodium excreted through excessive sweating and frequency of urination. To meet the psychological needs of the workforce, which would be more comfortable if you eat sweet water, so the coconut water is suitable as a substitute for coffee and tea, in addition to the sweet taste can also add electrolyte ions in the blood and can increase the productivity of workers exposed to heat.

5. CONCLUSION

There is no differences of the sodium content in the blood of labor and also workers pulse before and after consuming mineral water. But there is a difference in the sodium content in the blood of workers before and after consuming coconut water. So coconut water is able to improve the productivity of the workforce compared to mineral water.

6. SUGGESTION

1. Required a recommendation to require workers who work exposed to hot for using clothes to avoid radiation.
2. It is recommended to workers consume drinking water as often as possible while working to avoid dehydration.
3. It is recommended to consume coconut water as a substitute for the electrolyte ions in the blood to increase labor productivity.

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