Original Research Article

Effect of Coconut Water on Measures of Hydration and Physical Performance in Athletes

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ABSTRACT

Rehydration after exercise requires replacement of electrolyte. Recently, attention has been given to coconut water, a natural attentive to manufactured sports drink. The study aimed to find out the effect of coconut water (CW) on measures of hydration and physical performance of athletes. The study was conducted in NIT, Faridabad. The purposive sampling was done in which 8 male athletes aged 18-30 years were selected. Anthropometric measurement, biochemical measurements were measured by standardized process. Blood pressure and heart rates were measured by electric BP machine. The results revealed that regarding treadmill performance test, mean and standard deviation of total exercise time hydrated by Plain water was 43.62 ± 5.92 and CW was 44.00 ± 5.65 but the difference was not statistically significant. The study concluded that coconut water has a better effect on the performance as compared to plain water, more sample can be included to have better results.

Key words: Dehydration, coconut drink, heart rate, treadmill test

INTRODUCTION

Coconut (*Cocos nucifera* L.) has been described as the most important and extensively grown palm tree worldwide. The particular mineral composition and reasonable total sugar content make coconut water a natural isotonic liquid. The characteristics of coconut water make it an ideal rehydrating and refreshing drink after physical exercise (Reddy P, 2003). Coconut water has reported to provide hydrating effects similar to those of carbohydrate – electrolyte sport drink. It also has an antioxidant property. Recently, attention has been given to coconut water, a natural attentive to manufactured sports drink, within initial evidence indicating efficacy with regard to maintaining hydration. Rehydration after exercise requires replacement of electrolyte, primarily sodium lost in sweat. Rapid and complete restoration of fluid balance after exercise is an important part of the recovery process. Heavy sweating during exercise can cause body fluid losses in excess of 1 liter per hour. Individual must ingest sufficient fluid to recover from their dehydrated state (Bourdeix, R, 2005). The goal of rehydration is full replacement of any fluid and electrolyte deficits resulting from a previous event. Successful rehydration can be achieved by applying appropriate rehydration methods using an adequate supply of fluids. Such a method depends on the speed with which rehydration must be accomplished as well as the magnitudes of the fluid and electrolyte deficits (Singh R, 2003).

METHODS

The present study was done to find out the effect of coconut water on measures

of hydration and physical performance of athletes. The study was conducted in NIT Faridabad, Haryana, and North India. Purposive sampling was done to select 8 adult (18 – 30 years) athlete subjects of endurance sport to conduct the present study. Inclusion criteria was, subject engaged in a program of regular exercise for a minimum of past six months, no difficulty in walking and running, do not use any new supplements, males were included in the study and subject willing to participate in the study. Exclusion criteria was - females were excluded, those who were not willing to participate, Smokers, Reported the history of cardiovascular, metabolic, neurological, orthopedic disorder, use of any new nutritional supplements. The standardized questionnaire entitled as Physical Activity Readiness Questionnaire [PARQ], was used to collect health history. Anthropometric measurements were done by using standardized tools, which include weight via digital scale. The biochemical measurements were measured by standardized process. The biochemical parameters include Urine gravity Blood Pressure and head rate was measured by electric BP machine. The study was divided into 3 phases: Dehydration phase, Hydration phase and Physical performance test.

DEHYDRATION PHASE

The dehydrating exercise consisted of two stages - 30-minute bouts of walking/jogging, interspersed with a 10 minute rest period. Specifically, subjects walked/jogged at 2, 3, 4, 5, 6 and 7 miles per hour on a motorized treadmill, using a grade of 0%. Five minutes of exercise was performed at each speed. Following the initial 30 minutes of exercise, a 10-minute break was allowed, during which time subjects walked around and/or remained

seated. Subjects then repeated the above sequence of speeds for an additional 30 minutes of exercise. Hence, a total of 60 minutes of exercise was performed within the 70 minute period.

HYDRATION PHASE

Subjects received their assigned condition (beverage), cross-over assignment to one of the following three conditions - plain water, coconut water coconut water and a carbohydrate-electrolyte sport drink. The amount of each beverage was determined based on the total amount of body mass lost during the dehydrating exercise protocol using the equation: 1300 mL · kg-1 × kg loss = amount of beverage consumed (mL). Subjects were allowed 60 minutes to consume the entire volume of beverage. Each condition was consumed on a different test day, with a minimum of five days separating test visits.

EXERCISE PERFORMANCE PHASE

Three hours after the completion of the dehydrating exercise test (and two hours after subjects consumed their assigned condition), a test of physical performance was conducted using a treadmill as previously done. Specifically, subjects began walking on a motorized treadmill at a self-selected comfortable speed (0% grade) for five minutes. At the conclusion of the five-minute period, the actual performance test began. The protocol involved an increase in intensity every three minutes. While the speed of the treadmill remained constant at 4.2 miles per hour throughout the test, the grade increase in the following manner: min 1-3, 0%; min 4-6, 2.5%; min 7-9, 5%; min 10-12, 7.5%; min 13-15, 10%; min 16-18, 12.5%; min 19-21, 15%. Subjects exercised until volitional exhaustion and the total exercise time was recorded.

RESULT AND DISCUSSION

Table 1. Body mass of athletes before and after dehydrating exercise

STAGES	PLAIN WATER	COCONUT WATER	P-value (T - Test)
Pre-dehydrating exercise performance test	60.9±6.24	60.97±6.24	0.00
Immediately post dehydrating test	59.6±6.3	59.4±6.2	
1 hour post dehydrating test	62.1±6.61	62.13±6.57	
2 hour post dehydrating test	61.9±0.0	62.41±7.2	
3 hour post dehydrating test	61.2±6.64	61.64±0.0	

Table no. 1 described the body weight of target subjects. There were two stages in which - plain water and coconut water were given to the subjects. During each experimental day, the Body Weight was measured in 5 stages - pre-dehydrating exercise test, immediately post dehydrating test, one hours post dehydrating test, Two hours post dehydrating test and Three hours post dehydrating test.

During 1st experimental day of 1st week, the mean and standard deviation of body weight of the target group during pre dehydrating phase was 60.9±6.24. After dehydration treadmill test the mean and standard deviation of body mass was reduced by 59.6±6.3. After 1st hour post dehydrating exercise test the mean and standard deviation of body mass was raised by 62.1± 6.61 because of rehydration fluid (PLAIN WATER) given just after treadmill test. In 2nd hour of dehydrating exercise test the mean and standard was 62.41±7.2. In 3rd hour of post dehydrating test the mean and standard deviation was 61.64±6.64.

During the 2nd experimental day of 2nd week, the pre dehydrating exercise test, the mean and standard deviation of body mass was 60.97±0.0. Immediately after exercise the mean and standard deviation was 60.9±6.24 it shows that the subject's body mass was decreased. In 1st hour of post dehydrating exercise test, the mean and standard deviation was 62.13±6.57 because of rehydration fluid (COCONUT WATER) given just after treadmill test. In 2nd hour of dehydrating exercise test the mean and standard was 62.41±7.2. In 3rd hour of post dehydrating test the mean and standard deviation was 61.64±6.64.

Table 2. Urine Specific Gravity of athletes before and after dehydrating exercise

Stages	Plain water	Coconut water	P-value (T - Test)
Pre-dehydrating exercise	1.02±0.0	1.02±0.0	0.00
Immediately post dehydrating exercise	1.03±0.00	1.03±0.00	
3hour post dehydrating exercise	0.35±0.00	0.35±0.00	

The above table 2 described the urine specific gravity of the subjects.

Normal Urine Specific Gravity can range from 1.003 to 1.020, a value of less than 1.010 indicates relative hydration, and a value greater than 1.020 indicates relative dehydration. In the present study, there were two stages in which plain water and coconut water was given to the subjects. During each experiment day, the urine specific gravity was measured in 3 stages - pre-dehydrating exercise test, post dehydrating test, three hours post dehydrating test.

During the 1st experimental day of 1st week, the urine specific gravity was 1.020±0.0 at pre-dehydrating exercise test stage. In second stage, immediately post dehydrating test, the urine specific gravity was increased by 1.030±0.0. This indicates that the subjects were dehydrated. In third stage, after three hours post dehydrating test (after 3 hours of rehydration with plain water), the urine specific gravity was decreased by 1.020±0.0.

During the 2nd experimental day of 2nd week, the urine specific gravity was 1.020±0.0 at pre dehydrating exercise test stage. In second stage, immediately post dehydrating test, the urine specific gravity was increased by 1.030±0.0 this indicates that subject was dehydrated. In third stage, after three hours post dehydrating test (after 3 hours of rehydration with coconut water), the urine specific was decreased by 1.030±0.0.

Table 3. Heart Rate of athletes before and after dehydrating exercise

STAGES	PLAIN WATER	COCONUT WATER	P-value (T - Test)
Pre dehydrating exercise test	67.62±6.13	66.87 ± 6.05	0.00
Immediately post dehydrating exercise test	104.5 ± 9.79	109.87 ± 9.53	
3hour post dehydrating exercise test	72.37 ± 10.51	72.37 ± 10.51	
Immediately post performance exercise test	62.72±50.23	63.50±51.01	

Table no. 3 depicted the heart rate of athletes before and after dehydrating exercise. There were two stages in which - plain water and coconut water was given to the subjects. During each experimental day, the heart rate was measured in 4 stages - pre-dehydrating exercise test, immediately post dehydrating test, three hours post dehydrating test and immediately post performance test.

During the 1st experimental day of 1st week, the heart rate was 67.62±6.13 at pre-dehydrating exercise test stage. In second stage, immediately post dehydrating test, the heart rate was increased by104.5±9.79.In third stage, after three hours post dehydrating test (after 3 hours of rehydration with plain water), the heart rate was 72.37 ± 10.51. In 4th stage, immediately post performance exercise test the heart rate was 62.72±50.23

During the 2nd experimental day of 2nd week, the heart rate was 67.62±6.13 at pre-dehydrating exercise test stage. In second stage, immediately post dehydrating test, the heart rate was increased by109.5±9.53.In third stage, after three hours post dehydrating test (after 3 hours of rehydration with coconut water), the heart rate was72.37 ± 10.51. In 4th stage, immediately post performance exercise test the heart rate was 63.50±51.01

Table 4. Systolic Blood Pressure of athletes before and after dehydrating exercise

STAGES	PLAIN WATER	COCONUT WATER	P-value (T - Test)
Pre-dehydrating exercise test	117.0± 3.80	116.25± 3.80	0.00
Immediately post dehydrating exercise test	140.75± 7.16	141.10 ±7.10	
3 hour post dehydrating test	114.5± 6.41	117.25± 9.16	
Immediately post performance exercise test	136.5 ±8.75	117.25± 9.16	

Table no. 4 depicted the Systolic Blood Pressure of athletes before and after dehydrating exercise. There were two stages in which – plain water and coconut water were given to the subjects. During each experimental day, the systolic was measured in 4 stages - pre-dehydrating exercise test, post dehydrating test, three hours post dehydrating test.

During the 1st experimental day of 1st week, the systolic blood pressure was 117.0± 3.80 at pre-dehydrating exercise test stage. In second stage, immediately post dehydrating test, the systolic pressure was increased by140.75± 7.16. In third stage, after 3 hours post dehydrating test (after 3 hours of rehydration with plain water), the systolic pressure was maintained by 114.5±6.41. Immediately post performance exercise test the systolic pressure was increased by 136.5±8.75

During the 2nd experimental day of 2nd week, the systolic was 116.25± 3.80 at pre-dehydrating exercise test stage. In second stage, immediately post dehydrating test, the systolic pressure was increased by141.10 ±7.10. In third stage, after 3 hours post dehydrating test (after 3 hours of rehydration with coconut water), the systolic pressure was maintained by 117.25± 9.16, in normal range. Immediately post performance exercise test the systolic pressure was increased by 138.25±7.9

Table 5. Diastolic Blood Pressure of athletes before and after dehydrating exercise

STAGES	PLAIN WATER	COCONUT WATER	P-value (T - Test)
Pre-dehydrating exercise test	70.0± 3.89	79.25± 9.49	0.00
Immediately post dehydrating exercise test	87.87 ±12.01	96.12 ±8.91	
3 hour post dehydrating test	81.62 ±12.4	72.87± 6.22	
Immediately post performance exercise test	84.25± 13.93	84.25± 13.93	

Table no.5 depicted the Diastolic Blood Pressure of athletes before and after dehydrating exercise. There were two stages in which - plain water and coconut water were given to the subjects. During each experiment day, the diastolic pressure was

measured in 4 stages - pre-dehydrating exercise test, post dehydrating test, three hours post dehydrating test.

During the 1st experimental day of 1st week, the systolic pressure was 70.0±3.89 at pre-dehydrating exercise test stage. In second stage, immediately post dehydrating test, the diastolic pressure was increased by 87.7±12.01. In third stage, after 3 hours post dehydrating test (after 3 hours of rehydration with plain water), the diastolic pressure was maintained by 81.62±12.4. Immediately post performance exercise test the diastolic pressure was increased by 84.25±13.93

During the 2nd experimental day of 2nd week, the diastolic pressure was 79.25±4.94 at pre-dehydrating exercise test stage. In second stage, immediately post dehydrating test, the diastolic pressure was increased by 96.12 ± 8.91. In third stage, after 3 hours post dehydrating test (after 3 hours of rehydration with coconut water), the diastolic pressure was maintained by72.87± 6.22. Immediately post performance exercise test the diastolic pressure was increased by 84.25± 13.93

Table 6. Total Time of athletes immediately after performance test

Stages	Performance test	P-value (ANOVA)
Plain water	43.62±5.92	0.899
Coconut water	44.00±5.65	

Table no. 6 depicted total time immediately after performance test. After three hours of dehydrating exercise test, a physical performance test was conducted by using treadmill. Regarding treadmill performance, mean and standard deviation of total exercise time in Plain water43.62±5.92 and coconut water44.00±5.65 but the difference was not statistically significant.

CONCLUSION

The study concluded that the coconut water had a better effect on the performance test as compared to other drinks but differences were not statistically significant so, more sample size can be included to have better results.

The limitation of the study might be that the intervention of coconut water was done only once, one time during exercise.

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