Research Journal of Physical Education Sciences _____E-ISSN 2320–9011
Vol. **4(5),** 1-4, June **(2016)** *Res. J. Physical Education Sci.*

Development of Performance Enhancing Drink using for Endurance Sport Athletes

Rohit Chaudhary[1*], Gurjeet Kaur Chawla[1] and Jonathan Marc Gillam[2]
[1]Department of Nutrition and Dietetics, Manav Rachna International University, Faridabad, India
[2]Department of Physiotherapy, Manav Rachna International University, Faridabad, India
just.rohit28@gmail.com

Available online at: www.isca.in, www.isca.me
Received 7th June 2016, revised 16th June 2016, accepted 22nd June 2016

Abstract

Presently in the beverage industry, the mixture of products became an alternative to increase the nutritional value or even to develop new flavours in the formulation of mixed drinks. The purpose of the study was to develop a blended beverage based on Cocos nucifera, Ananas comosus, Citrus sinesis and Nelumbo nucifera, which could be used as a performance booster by endurance athletes as an alternate to caffeinated energy drinks, supplying perfect balance of carbohydrate (energy), thiamine (carbohydrate metabolism), ascorbic acid (anti-oxidant), sodium and potassium (electrolyte balance) and magnesium (metabolic reactions). Formulated product was subjected to organoleptic evaluation and proximate analysis; along with a standard drink i.e. Red bull. The two samples were evaluated on the basis of sensory attributes such as, appearance, odour, consistency, taste, mouthfeel and overall acceptance. With a mean overall acceptability score of 8.4 ± .68 on a 9 point scale, applying ANOVA, test product was more acceptable and showed statistically significant difference (at p<.05). Proximate analysis result showed a high increase in attributes as, 130 Kcal – 210 Kcal, 30g – 51g, 0.1mg – 0.4mg, 0 – 50µg, 0 – 150mg, 7.8mg – 284mg, 7.8mg – 40mg for energy, carbohydrate, thiamine, folates, ascorbic acid, potassium and magnesium respectively in test product compared to standard product. When applied t-test, statistically significant difference were seen (at p<.05) for thiamine, folates, vitamin c, potassium and magnesium.

Keywords: Endurance athletes, Energy drink, Organoleptic evaluation, Proximate analysis.

Introduction

During exercise the requirement for fluid replacement has been a topic of much debate over years. Opinions have differed and recommendations have often moved along a continuum from not drinking at all during exercise to drinking as much as is tolerable[1]. Maintaining proper hydration before, during, and after training and competition will help reduce fluid loss, maintain performance, lower submaximal exercise heart rate, maintain plasma volume, and reduce heat stress, heat exhaustion, and possibly heat stroke[2]. Energy drinks are non-alcoholic beverages containing stimulants like caffeine, herbal extracts (guarana, ginseng, yerba mate, ginkgobiloba), gluconolactone, taurine, inositol, L-carnitine and B-vitamins as the main ingredients to enhance physical and mental endurance[3].

The ingestion of low to moderate doses of caffeinated energy drinks has been associated with adverse side effects such as insomnia or increased nervousness. According to a study conducted by Salinero J.J. et al., it was seen that the ingestion of an energy drink with 3 mg/kg of caffeine increased the prevalence of side effects. The presence of these side effects was similar between male and female participants[4]. Consuming sugar-free Red Bull energy drink before exercise has become increasingly popular among exercising individuals. In a study conducted by Candow D et. al, it was observed that sugar-free Red Bull energy drink did not influence high-intensity run time to-exhaustion in young adults[5].

Carbohydrate ingestion during prolonged exercise has been shown to improve performance by maintaining blood glucose levels[6]. A study conducted by Khanna and Manna (2005) showed that total endurance time at 70% VO2max was significantly higher after ingestion of a 5% CHO drink at 15 min intervals during exercise compared to a placebo in endurance trained individuals[7]. Impaired energy metabolism is considered a possible cause of fatigue. The thiamine derivative, thiamine tetrahydrofurfuryldisulfide (TTFD), is prescribed and is also an over the-counter drug for the attenuation of fatigue[8]. In a study, conducted by Choi SK et. al., it was observed that thiamine intake during exercise positively benefits carbohydrate metabolism in a way that will decrease lactate concentration, ammonia concentration, and anti- fatigue by reducing the Rate of Perceived Exertion (RPE)[9].

Methodology

The developed product was standardized through repeated organoleptic evaluation performed in order to check the overall acceptability with key attributes such as appearance, taste, mouthfeel, odour, consistency and overall acceptability. The final formulated product comprised *Citrus sinesis* (orange juice)

60 ml, *Ananas comosus* (pineapple juice) 90 ml, *Cocos nucifera* (coconut water) 100 ml, *Nelumbo nucifera* (lotus seeds puree) 50 ml and 10 g sugar. The developed product (test), along with the standard, i.e. Red bull, was subjected to proximate analysis for nutrient content. Standardized testing methods for food testing laid down by AOAC were followed for proximate analysis.

Thiamine (B1), Ascorbic acid (C), Folates (B9) content was analysed using HPLC (High Performance Liquid Chromatography), Sodium, Potassium, Magnesium content were analysed by AAS technique (Atomic Absorption Spectrophotometer), Carbohydrate and total Energy content by calculation.

Results and Discussion

The developed product along with the standard product (Red bull) was subjected to organoleptic evaluation and was evaluated on attributes appearance, odour, consistency, taste, mouthfeel and overall acceptability. With higher mean acceptability scores compared to standard, developed product was more acceptable.

Table-2 shows the proximate mean analysis scores of standard drink i.e. Red bull and the developed drink. When t – test was applied statistically significant difference was seen in the parameters i.e. Thiamine, Folates, Ascorbic acid, Potassium, Magnesium at $p < 0.05$.

Table-1
Mean scores of organoleptic evaluation

Attributes	Standard (Red bull)	Test (Developed)	t - value	significance
Appearance	5.1 ± 1.5	8.1 ± 0.80	-9.5	.081
Odour*	4.7 ± 1.4	8.0 ± 1.0	-10.3	.041
Consistency	6.1 ± 1.0	7.8 ± 0.89	-6.6	.458
Taste	4.3 ± 1.4	7.9 ± 1.1	-10.5	.246
Mouthfeel	4.1 ± 1.1	7.9 ± 0.85	-14.7	.054
Overall acceptability*	4.7 ± 1.1	8.4 ± 0.68	-15.6	.022

Significant at $p < 0.05$

Table-2
Proximate analysis results of Standard drink and developed drink

Parameters	Standard (Red bull)	Test drink (Developed)
Energy (Kcal)	130	210
Carbohydrate (g)	30	51
Thiamine (mg)	0.1	0.4
Folates (µg)	0	50
Ascorbic acid (mg)	0	150
Sodium (mg)	214	112
Potassium (mg)	7.8	284
Magnesium (mg)	7.8	40

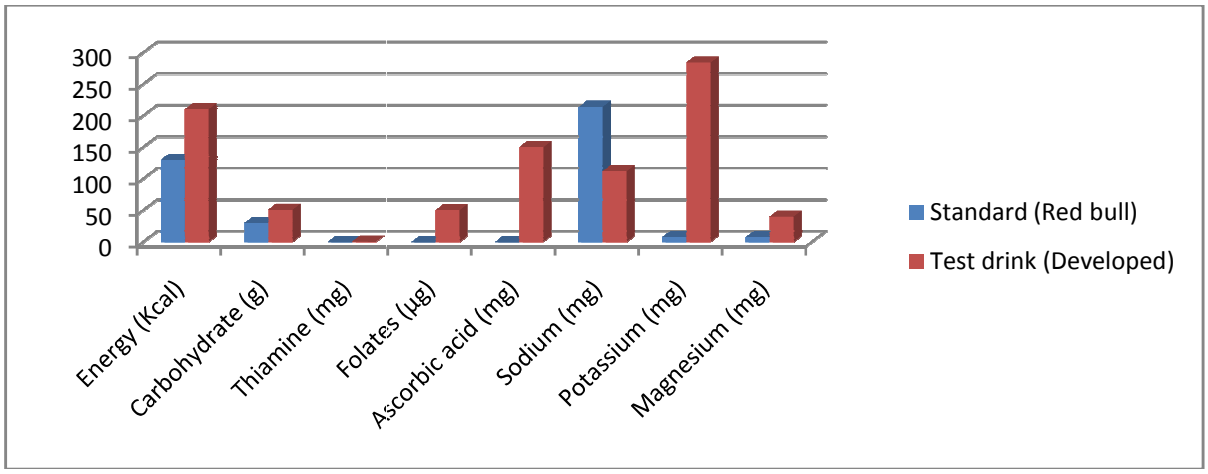

Figure-1
Graphical representation of proximate analysis results

Discussion: Carbohydrate is a critical fuel for majority of activities undertaken by endurance athletes as carbohydrate from blood glucose and muscle glycogen is fuel for contracting muscles[10]. This study showed a high increase in carbohydrate content in developed drink than Red bull. A previous study conducted by Khanna and Manna showed that total endurance time at 70% VO2max was significantly higher after ingestion of a 5% CHO drink at 15 min intervals during exercise compared to a placebo in endurance trained individuals[7]. Another study claimed that thiamine intake during exercise positively benefits carbohydrate metabolism in a way that will decrease lactate concentration, ammonia concentration, and anti- fatigue by reducing the Rate of Perceived Exertion, which was the other nutrient which showed increased amount in developed drink[9]. According to a study, conducted by Jung A.P and his associates, consumption of a carbohydrate-electrolyte beverage before and during exercise in a hot environment delay the onset of Exercise associated muscle cramps (EAMCs), thereby allowing participants to exercise longer[11].

Conclusion

The present study was carried to develop a performance enhancing drink made of 100% natural ingredients, without any additives and preservatives as an alternate of energy drinks and sports drinks available in Indian market which contain high amount of caffeine, taurine, preservatives and other additives which are not good for one's health. The purpose of adding coconut water was to supply electrolytes, pineapple and oranges to supply ascorbic acid which acts as a natural preservative, and lotus seeds for carbohydrate, thiamine and other minerals required by an athlete. Mixing all ingredients in exact proportions enhanced the product's nutrient content and made it more acceptable and a healthy option. This study demonstrates that the developed drink could be a healthy substitute of energy drinks available in Indian market and could confer beneficial performance results for a sportsperson.

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