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Influence of *Hibiscus sabdariffa* Linn. calyces drink on fitness and blood parameter on Thang- Ta athletes from Manipur

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Abstract

The influence of supplementation of *Hibiscus sabdariffa* Linn. dry calyces drink was studied on Thang - Ta athletes from Manipur. Totally 30 athletes in the age group of 15-19 yrs doing regular practices and willing to participate in the study were selected. They were divided into two groups i.e experimental (E) and placebo group (P) (of 10 male and 5 female each). *Hibiscus sabdariffa* Linn. drink (salted and sweetened with MTC) was supplemented at (240 ml) before and during practices for group E. Placebo group was provided 240 ml (of salted and sweetened with MTC) water. Physical fitness parameters i.e., 30 meter flying start test, standing broad jump, vertical jump, push- ups, sits ups, 6 X 10 meter shuttle run and VO₂ max were assessed through different intervals i.e. 0 days, 30thdays, 60thdays and 90th days. Blood parameters i.e., Haemoglobin, glucose, serum ferritin and lactate dehydrogenase levels were analyzed. It was observed that no effect was found on vertical jump on both male and female athletes, during the entire periods. But, statistically significant improvement ($p<0.05$) was found on 30 meter flying start test, VO₂ max ($P<0.05$) in both the genders in group E. In group P there was beneficial to male athlete (sits up, push- ups, 30 meter fly and 6X10 meter shuttle run than female athletes. On biochemical parameters, blood Haemoglobin, was significantly improved ($p<0.05$), serum ferritin levels at ($p<0.05$) but serum lactate dehydrogenase decreased at ($p<0.05$) among group E male athletes. Among female (group E), Serum ferritin level alone improve at 5% level on 60th and 90th days of supplementation. From the results, it can be concluded that *Hibiscus sabdariffa* Linn. juice improve performance as well as blood / serum parameters. Hence it can be used as/incorporated into many sports drinks to benefit the athletes.

Keywords: Thang Ta athletes, *Hibiscus sabdariffa* Linn, fitness

Introduction

India is making rapid strides in the field of sports and Indian Athletes are endeavoring their best to excel in the national and International arena. Though rigorous training is given to athletes, yet their performance is often obstructed by nutritional deficiency and disorders. Sports scientists and nutritionists alike, now realize that adequate nutrition coupled with scientific training alone can give the winning edge to athletes. Hence, there is a dire need for sports scientists and nutritionists to arrive at a common consensus to tap the maximum performance potential of athletes. Thang-Ta is the traditional martial art of Manipur. The name denotes a set of armed and unarmed fighting techniques developed by the Meitei people of the state. Traditional athletes are always often pushed to the back seat and nutritional status of traditional athletes is neglected.

From time immemorial athletes are engaged in the quest for that magic 'potion' that would give them the winning edge back of over their opponent. Commercial sports drinks are expensive and make the athlete apprehensive about their composition. Herbal drinks are safer than synthetic concoctions. With the rich floral diversity in India, several indigenous, safe, nutritious and healthy sports supplements could be formulated, standardised, and patented and popularised. The present study attempts to develop a sports which could benefit the athletes nutritionally and ergogenically.

Hibiscus sabdariffa Linn., locally known as Silog-Sougru in Manipur is one of the common food consumed with other accessories to meet the daily nutritional requirements. Wild edible flowering plants are inexpensive, locally available and have a great socio-economic significance because of their food and medicinal values. In most of the houses these plant is planted as in kitchen garden. It is also reported that *Hibiscus sabdariffa* drink can safely be used in the prevention and management of anemia and cardiovascular disease (Ghislain *et al.*,

2011) [3]. *Hibiscus sabdariffa* Linn. have a good nutritional Potential (Morton *et al.*, 2000) [7]. The hypocholesterolemic, antihypertensive, antioxidant, cardio protective, hepatoprotective effects have been investigated in mice, rabbits and rats (Chen *et al.*, 2004; Carvajal-Zarrabal *et al.*, 2005; Hirunpanich *et al.*, 2006; Ologundudu *et al.*, 2009) [2, 8]. However, little studies have been done in humans. The thick, red and fleshy, cup-shaped calyces of the flower are consumed worldwide as cold beverage and as hot drink (sour tea). The phytochemical screening done by Ajala Lo *et al.*, (2013) [1] revealed *Hibiscus sabdariffa* juice contain plant metabolites in moderate quantities. Alkaloids, tannins, flavonoids, cardiac glycosides, anthraquinones and saponins present in the juice extract justify the nutritional potential of the plant calyx. Previous studies on supplementation provide a clear picture of nutritional properties and phytochemical nature of *Hibiscus sabdariffa* Linn. on health benefit. Their study result positive findings in the prevention of anaemia (Tazoho *et al.*, 2016) [14], and its antioxidant properties that allow an increase in antioxidant capacity of both the enzymatic and nonenzymatic systems, in the plasma of the Marfan syndrome (MSF) patients (Soto *et al.*, 2016) [13]. It has potential of lowering serum cholesterol (Lin *et al.*, 2007) [15]. And the beneficial effects on oxidative stress status in male athletes (Hadi *et al.*, 2017) [4]. However, studies on supplementation of *Hibiscus sabdariffa* Linn. on athletes are not available. Because of its nutritional and medicinal potentials, the study is undertaken the supplementation and ascertain its effect

Methods and subject

Subject's background: Thirty Thang- Ta athletes (20 male

and 10 female) who were involved in regular practice and were willing to take part in the supplementation study were selected. These athletes were divided into two groups (experimental and placebo groups) of 15 (10 male and 5 female) athletes. All athletes were provided with an information sheet outlining the procedures, and benefits of the study prior to signing an informed consent agreement to participate. The participants were in the age group of 15-19 years. Before conducting study approval was obtained from the Local Human Ethics Committee from Manipur University (Ref. no. Ac/IHEF/MU/201/2014). Physical fitness test was assessed by using standard protocol from Hunsicker and Reiff, 1976 [5] and methodologies for fitness Assessment (Ray *et al.*, 2010) [10]. Biochemical test was done in Babina Diagnostic Laboratory Imphal, Manipur.

Formulation of Hibiscus sabdariffa Linn. Juice

The fresh calyces of *Hibiscus sabdariffa* Linn. were collected from the local market of Manipur. The calyces were washed with clean water and then sundried for 5 days. Then the calyces were powdered in a mixer grinder to make into powder form. The investigator prepared the sports drink from *Hibiscus sabdariffa* Linn. calyces by different variation given in figure 1. Multiple transportable carbohydrates (glucose: fructose) was also added. The quantity of carbohydrate (glucose and fructose) in the drink was 6-8% as per ideal recommendation. (Sawka *et al.*, 2007; Rodriguez *et al.*, 2009) [12, 11]. After sensory evaluation to a semi trained panel of 18 judo athletes using the 9 point hedonic scale. It was observed that 2.5 g of *Hibiscus sabdariffa* Linn. powder, 14 g glucose, 7g fructose, 0.08g salt with 240ml of water obtained the best score for acceptability.

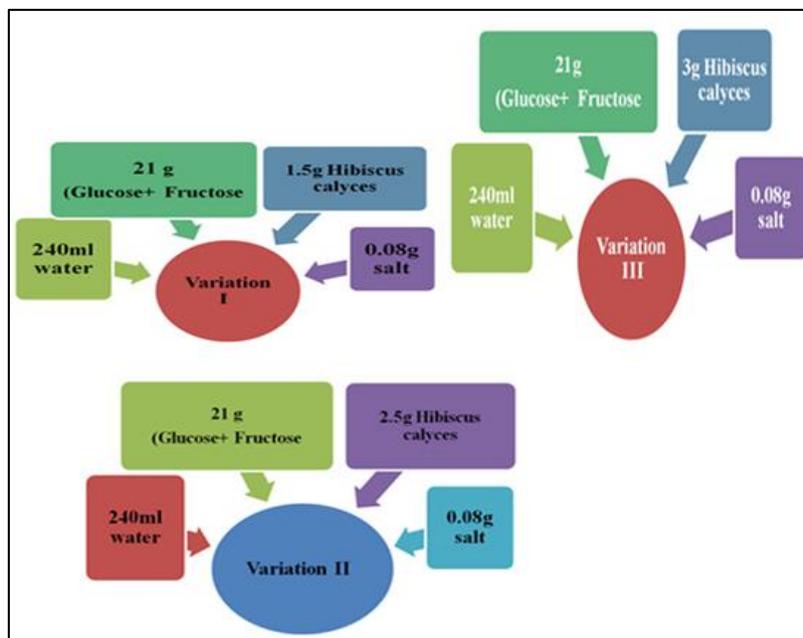


Fig 1: Different Variations of Hibiscus Drink

Treatment: 240 ml @ two bottle of *Hibiscus sabdariffa* Linn. drink was administered to the selected Thang -Ta athletes before and after the practice. Before the practice the athletes have to consume 10- 15 minutes prior the starting for a total 90 days. The same quantity of sweetened salted water i.e., plain water, glucose and fructose in the ratio of 2:1 and 0.08 added salts was administered to placebo group. Fitness parameter (vertical jump, sit ups, standing broad jump, VO₂

max (queen college step test), Blood parameter (haemoglobin, serum ferritin, blood sugar, serum lactate dehydrogenase) were measured at baseline (0th day) followed by 30th day, 60th day and 90th day.

Statistical Analysis

Results are expressed as mean (\pm SD) and were analysed using a repeated measures analysis of variance (ANOVA) to

determine time and interaction effects of Hibiscus drink on measures fitness performance and selected blood parameter. Student Newman-Kouls (S-N-K) Post-hoc test was to determine any differences between periods.

Salient Findings

Table 1 and 2 provide the effect of supplementation on performance parameters of male and female athletes.

Table 1: Effect of Supplementation on mean performance parameters of male athletes n=10

Parameters	0day x̄ ±SD	30 th day x̄ ±SD	60 th day x̄ ±SD	90 th day x̄ ±SD	Anova (F-test)
Vertical jump (cm)	49.90±4.59	50.00±5.27	49.50±3.69	48.00±4.81	1.12 ^{NS}
Experimental					
Placebo	49.00±4.45	49.20±3.61	49.50±4.06	49.60±3.30	0.56 ^{NS}
Standing Broad Jump (cm)	212.00±14.38	212.50±13.79	212.80±17.75	212.50±14.39	0.015 ^{NS}
Experimental					
Placebo	208.80±31.76	208.90±32.63	209.80±32.73	209.80±32.46	1.264 ^{NS}
Sit -ups(count/minute)	20.40±2.72	21.10±1.91	21.30±1.25	21.40±1.84	0.58 ^{NS}
Experimental					
Placebo	20.10±1.66	20.60±1.58	21.30±2.11	21.90±1.91	5.882**
Push -ups(count/ minute)	18.30±2.50	18.90±1.20	19.10±1.52	19.30±2.36	0.77 ^{NS}
Experimental					
Placebo	18.90±2.16	18.20±2.15	19.50±2.07	20.00±1.83	7.800**
30 meter flying start test(sec)	3.99±0.32	3.79±0.23	3.69±0.09	3.91±0.27	3.11*
Experimental					
Placebo	4.01±0.45	3.92±0.45	3.73±0.47	3.65±0.52	6.776**
6X10 meter shuttle run(sec)	15.57±0.61	15.28±0.55	15.11±0.71	15.05±0.58	2.60 ^{NS}
Experimental					
Placebo	16.09±0.99	15.95±0.83	15.70±0.57	15.63±0.79	2.96*
Vo ₂ max(ml/kg/min)	43.48±5.20	46.17±4.48	48.91±3.16	50.19±2.26	8.09**
Experimental					
Placebo	44.25±5.95	44.42±4.81	45.63±4.08	45.44±4.12	1.03 ^{NS}

Table 2: Effect of supplementation on mean performance parameters of female athletes n=5

Parameters	0day x̄ ± SD	30 th day x̄ ±SD	60 th day x̄ ±SD	90 th day x̄ ±SD	F-test
Vertical jump (cm)	41.82±5.58	41.90±6.13	42.80±4.97	43.46±5.13	1.033 ^{NS}
Experimental					
Placebo	42.60±4.56	41.60±5.50	43.60±6.07	42.80±7.92	0.67 ^{NS}
Standing Broad Jump(cm)	128.80±12.24	129.20±9.52	130.20±11.65	131.30±11.30	1.58 ^{NS}
Experimental					
Placebo	123.20±15.35	122.00±18.23	125.00±18.37	126.00±15.40	2.11 ^{NS}
Sit ups(count/minute)	14.60±3.85	15.00±3.32	15.60±3.44	15.20±3.90	1.31 ^{NS}
Experimental					
Placebo	19.00±4.24	20.20±2.17	20.00±1.41	19.20±1.92	0.41 ^{NS}
Push ups (count/minute)	15.20±3.03	15.40±2.61	15.60±3.51	15.80±3.42	0.61 ^{NS}
Experimental					
Placebo	15.60±1.34	15.20±1.10	16.00±1.22	15.80±1.92	0.51 ^{NS}
30 meter flying start test (sec)	5.12±0.25	4.99±0.33	4.71±0.09	4.68±0.12	6.707**
Experimental					
Placebo	4.40±0.11	4.25±0.22	3.77±0.37	3.68±0.37	12.59**
6X10 meter shuttle run(sec)	16.33±0.41	16.09±0.25	15.77±0.47	15.64±0.50	6.37**
Experimental					
Placebo	15.94±1.15	15.73±0.81	16.11±1.19	15.93±0.88	1.36 ^{NS}
Vo ₂ max ml/kg/min	33.46±0.81	35.04±1.85	36.00±0.67	36.56±1.31	6.49**
Experimental					
Placebo	34.04±1.15	34.18±1.52	35.08±1.13	35.22±1.55	1.94 ^{NS}

On the whole, neither Hibiscus drink nor the placebo had any effect on vertical jump and standing broad jump of both male and female athletes, during the entire period. Among the experimental group of male athletes, there was statistically significant improvement ($p < 0.05$) between 0 and 60 and 0 and 90 days of supplementation for 30m flying start. VO₂ max improved significantly ($p < 0.05$) between 0 and 60, 0 and 90 and 30 to 90 days. In female athletes there was statistically significant ($p < 0.05$) improvement in 30m fly between 0 and 60 and 0 and 90 days of supplementation. VO₂ max was significantly ($p < 0.05$) during 0-60 and 0-90day This

improvement in the VO₂ max in the present study is supported by the findings of Bock *et al.*, (2004) that acute supplementation of 4-weeks with *Rhodiola rosea* increased ($p < .05$) time to exhaustion and VO₂ peak ($p < 0.05$) and VCO₂ peak ($p < 0.05$) also increased. Thus it can be inferred that *Hibiscus sabdariffa* Linn. calyces had beneficial effect on 30m fly (speed) and VO₂ max (cardio respiratory endurance) of athletes (both genders). In the placebo group of male athletes, sit ups improved significantly ($p < 0.05$) at 0-90, 30-90 and 60-90 days; push ups significantly improved ($p < 0.05$) between 0-60, 0-90, 30-

60 and 30-90 days; 30m fly improved significantly ($P<0.05$) during 0-60 and 0-90 days; 6x10m shuttle run improved at 5% level after 90 days. Among female athletes, only 30m fly improved significantly ($p<0.05$) during 30-60 and 0-90 days of intervention. The placebo was more beneficial to male athletes (sit ups –flexibility; push-ups - strength; 30mfly –

speed; 6x10m shuttle run - agility) than female athletes (30mfly - speed). The benefits would be due to the effect of MTC. But there is no improvement in biochemical parameter among placebo group.

Table 3 and 4 represent the effect of supplementation on biochemical parameters of male athletes

Table 3: Effect of supplementation on biochemical parameters of male athletes

Parameters	0day $\bar{x} \pm SD$	30 th day $\bar{x} \pm SD$	60 th day $\bar{x} \pm SD$	90 th day $\bar{x} \pm SD$	F-value
Haemoglobin(g/dl)	14.45±1.24	14.76±1.13	14.87±1.09	15.15±1.03	4.42*
Experimental					
Placebo	14.45±1.08	14.41±1.09	14.42±1.04	14.44±1.04	0.23 ^{NS}
Serum ferritin (ng/ml)	40.37±18.91	40.97±19.17	42.07±19.14	43.51±20.11	5.17**
Experimental					
Placebo	39.83±18.24	39.71±18.35	39.86±18.57	40.35±18.77	1.35 ^{NS}
Blood glucose (mg/dl)	76.36±10.84	76.54±10.01	76.20±10.10	75.97±9.17	0.86 ^{NS}
Experimental					
Placebo	76.26±5.77	76.58±5.74	76.90±6.09	77.03±6.32	2.60 ^{NS}
Serum lactate dehydrogenase (U/L)	289.20±44.37	283.10±50.26	266.40±52.65	249.40±62.84	7.17**
Experimental					
Placebo	275.20±49.75	274.00±49.25	273.10±48.72	272.50±48.37	2.49 ^{NS}

*- significant at 5% level;** - significant at 1 % level; NS-Not significant

Table 4: Effect of supplementation oh biochemical parameters among female athletes N = 5/group

Parameters	0 th day $\bar{x} \pm SD$	30 th day $\bar{x} \pm SD$	60 th day $\bar{x} \pm SD$	90 th day $\bar{x} \pm SD$	F-test
Haemoglobin (g/dl)	10.80±1.55	11.30±1.69	11.36±1.72	12.30±2.36	1.41 ^{NS}
Experimental					
Placebo	12.64±1.17	12.70±1.13	12.66±1.27	12.62±1.36	0.25 ^{NS}
Serum ferritin (ng/ml)	24.90±12.54	25.84±11.03	27.04±11.30	27.46±11.55	5.17**
Experimental					
Placebo	32.06±15.40	31.96±15.67	32.00±15.21	32.08±14.72	0.07 ^{NS}
Blood glucose (mg/dl)	79.46±8.52	79.12±7.44	78.48±6.25	78.84±5.79	0.24 ^{NS}
Experimental					
Placebo	73.38±6.84	74.42±6.62	75.94±4.79	77.36±2.87	2.61 ^{NS}
Serum lactate dehydrogenase (U/L)	284.80±57.98	280.40±57.68	257.80±52.76	272.40±52.06	2.86 ^{NS}
Experimental					
Placebo	275.80±25.59	274.80±24.95	265.00±15.41	254.60±26.71	1.20 ^{NS}

** - Significant at 1% level; NS – Not significant

The overall effect of supplementation on biochemical parameters of athletes is presented in Table 5.

Table 5: Overall effect of supplementation on biochemical parameters of athletes

Parameters	Male Athletes						Female Athletes						
	30 th day		60 th day		90 th day		30 th day		60 th day		90 th day		
	E	P	E	P	E	P	E	P	E	P	E	P	
Blood Haemoglobin (g/dl)	NS	NS	NS	NS	0-90 th day*		NS	NS	NS	NS	NS	NS	
Serum Ferritin (ng/ml)	NS	NS	NS	NS	0-90 th day* 30-90 th day*		NS	NS	NS	0-60 th day*	NS	0-90 th *	NS
Blood Glucose (mg/dl)	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	
Serum lactate Dehydrogenase (U/L)	NS	NS	NS	NS	0-90 th day* 30-90 th day*		NS	NS	NS	NS	NS	NS	NS

*- significant at 5 % level; NS-Not significant

Statistical analysis of the data on the effect of supplementation on biochemical parameters revealed the edge of *Hibiscus sabdariffa* Linn. drink over the placebo as a food supplement. *Hibiscus sabdariffa* Linn. calyces improved blood haemoglobin of male athletes significantly ($p<0.05$) on 90th days of supplementation, serum ferritin levels between 0th and 90th days; and 30th and 90th days ($p<0.05$). The improvement in haemoglobin level in the present study is supported by Kelker *et al.*, (2008) [6] where the effect of antioxidant supplementation remarkably reduced serum MDA

(Malondialdehyde) level ($p =0.003$) after supplementation also improve hematological status. Parisi *et.al.*, (2010) [9] also supported that the Chronic *Rhodiola rosea* supplementation of 4 weeks on 14 trained male athletes had no effect on blood sugar level. Similar findings are reported in the present study also.

Serum lactate dehydrogenase decreased significantly ($p<0.05$) on 90th days and between 30 and 60days of supplementation. Among female athletes serum ferritin levels alone improved at 5% level on 60th and 90th days of supplementation. The

placebo did not evince any improvement in any of the biochemical parameters.

Conclusion

These findings drive home the fact that *Hibiscus sabdariffa* Linn. calyces has commendable potentials to improve the physical performance as well as blood/serum parameters. Supplementation for a longer duration on a larger group of athletes can further substantiate the benefits of the shrub as an ergogenic aid. Hence it can be used as/incorporated into any sports drink to benefit Thang -Ta athletes of Manipur.

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