

Impact of supplementation of functional beverage on the physical performance of sportswomen

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Received: 20.04.2012; Revised: 14.07.2012; Accepted: 15.09.2012

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■ **ABSTRACT** : Thirty sportswomen in the age group of 16 to 18 years from Punjab Agricultural University, Ludhiana were selected to determine the impact of supplementation of functional beverage on the physical performance of sportswomen. Functional beverage was prepared by using whey water, pearl millet [*Pennisetum typhoideum*], cauliflower [*Brassica oleracea* var. *botrytis*] leaf powder, banana and jaggery at three different levels *i.e.* S₁, S₂ and S₃. The developed functional beverage was organoleptically evaluated by a panel of judges and students by using nine-point hedonic scale. Both the panels gave the highest overall acceptability scores to the S₁ level which was prepared by using 2.5 g cauliflower leaf powder, 5 g pearl millet, 10 g jaggery, 20 g banana and 63 ml whey water per 100 ml. The most acceptable level was chemically analyzed. The study was divided into two periods *i.e.* control and experimental. During control period, the subjects were observed without supplementation for a month while during experimental period the subjects were supplemented with 200 ml developed functional beverage for 3 months. The run time, heart rate and blood pressure of the subjects were measured. It was observed that run time for 'Cooper's 1.5 mile run test' and rise in heart rate after the test reduced significantly ($p \leq 0.01$) *i.e.* 15.95 per cent improvement in their average run time and 7.67 per cent decrease in heart rate after the experimental period. Hence, it can be inferred from the results that supplementation of functional beverage before the sports training improved physical performance of the sportswomen. Therefore, the consumption of the underutilized foods like pearl millet, whey water and cauliflower leaf powder should be encouraged.

■ **KEY WORDS** : Functional beverage, Pearl millet, Cauliflower, Leaf powder, Whey water, Physical performance

■ **HOW TO CITE THIS PAPER** : Singh, Anupriya and Kochhar, Anita (2012). Impact of supplementation of functional beverage on the physical performance of sportswomen. *Asian J. Home Sci.*, 7 (2): 260-263.

Sports drinks are much relevant to Indian sports scenario because of the fact that many of the Indian sportswomen are generally undernourished and anemic. Being a tropical country, athletes tend to get exhausted quickly particularly during summer and this affects their performance. Consuming adequate fluid and carbohydrates before, during and after exercise can help in maintaining blood glucose levels during exercise, maximize exercise performance, decrease the risk of dehydration and improves recovery time (Kanabur and Devi, 2005).

Maintenance of water balance is of primary concern when profuse sweating accompanies prolonged strenuous exercise.

Some athletes lose as much as 2-4 litres of sweat per hour, in addition, with heavy exercise, respiratory loss of water may exceed 130 ml/hour compared to the normal 15 ml/hour. Athletes, therefore, need to be encouraged to drink fluids prior to or during an event since vigorous exercise may blunt thirst mechanism.

Keeping in view, the importance of supplementation of carbohydrate-protein in combination and fluid intake in sports nutrition, the present study was planned to access the impact of supplementation of functional beverage developed by using underutilized foods on the physical performance of sportswomen.

RESEARCH METHODS

Development and organoleptic evaluation of functional beverage:

Functional beverage was developed at three different levels *i.e.* S₁, S₂ and S₃ using pearl millet, cauliflower leaf powder, banana, jaggery and whey water. The developed functional beverage was organoleptically evaluated by a panel of judges from the department of food and nutrition and students by using nine-point hedonic scale to judge the acceptability of the product.

Chemical analysis of the developed functional beverage:

Most acceptable level of the developed functional beverage was chemically analyzed for proximate composition (AOAC, 1990), total soluble sugars (Dubois *et al.*, 1956), iron (AOAC, 2000), calcium (AOAC, 1980), ascorbic acid (AOVC, 1996) and beta-carotene (Rao, 1967).

Selection and feeding of the subjects:

Thirty sportswomen in the age group of 16 to 18 years were selected from Punjab Agricultural University, Ludhiana. General and sports information pertaining to age, religion, residential status and menstruation was recorded for all the subjects through questionnaire schedule. The whole study was divided into two periods *i.e.* control period and experimental period. All the observations were recorded before the study, after one month of control period and after three months of experimental period. During control period, the subjects were observed without the supplementation for a month while during experimental period, the subjects were supplemented with 200 ml of developed functional beverage for a period of three months. The beverage was given half an hour before their sports activity.

Assessment of physical competence of the subjects:

To assess the physical performance of the subjects, 'Cooper's 1.5 mile run test' (Verma and Mokha, 1993) was conducted. Run time was recorded by using stopwatch, wireless heart rate monitor was used to determine the heart rate and blood pressure was recorded with sphygmomanometer (Maclead, 1984).

Statistical analysis:

The data on all the blood parameters were analyzed statistically. The mean standard error, percentages, paired t-test and their statistical significance were ascertained using a computer programme package (Chemma and Singh, 1990).

RESEARCH FINDINGS AND DISCUSSION

The study was conducted on 30 sports women between the age group of 16 to 18 years studying in Punjab Agricultural University. Majority of subjects (67 %) were Sikh and rest 33

per cent were Hindu. Most of the subjects were hostellers (73 %) while 27 per cent were day scholars. The menstrual flow was normal in 77 per cent of the subjects and rest 23 per cent were having heavy flow (Table 1).

Table 1 : General Information of the subjects

Characteristics	Total (n=30)
Age (years)	
16 -18	30 (100)
Religion	
Hindu	10 (33)
Sikh	20 (67)
Residential status	
Hostellers	22 (73)
Day scholars	8 (27)
Menstruation	
Normal	23(77)
Heavy	7(23)
Duration (Days)	
2-3	8 (27)
4-5	18 (60)
>5	4 (13)

Figures in parenthesis are percentage

The developed functional beverage was organoleptically evaluated by a panel of judges and students by using nine-point hedonic scale and the scores given by the trained panel for colour, appearance, flavour, texture, taste as well as overall acceptability of the developed functional beverage varied from 7.18 to 7.7, 6.7 to 7.70, 6.4 to 7.5, 6.2 to 7.4, 6 to 7.8 and 6.3 to 7.8, respectively. The corresponding scores given by the student's panel varied from 7.5 to 7.7, 6.8 to 7.3, 6.3 to 7.5, 5.8 to 7.4, 6.5 to 7.7 and 6.2 to 7.8, respectively. According to the both panels, the most acceptable level of beverage was S₁, which was having 2.5 g cauliflower leaf powder, 5 g pearl millet, 10 g jaggery, 20 g banana and 63 ml whey. It had the

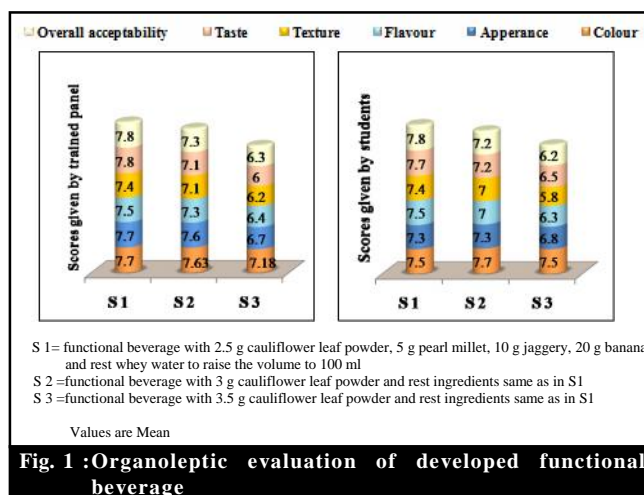


Fig. 1 : Organoleptic evaluation of developed functional beverage

overall acceptability score of 7.8 ± 0.78 (Fig. 1).

One hundred grams of developed functional was analyzed for proximate composition showed that it had 81 g of moisture, 2.8 g of crude protein, 0.4 g of crude fat, 0.9 g of crude fibre, 0.85 g of ash, 14.05 g of carbohydrates and provided 71 Kcal of energy. Developed functional beverage had 11.8 g total soluble sugars. The concentration of minerals iron and calcium in functional beverage was 5.51 mg and 103 mg, respectively. The concentration of vitamins, ascorbic acid and β -carotene was 2.7 mg and 1185 μ g, respectively.

At the end of three months with supplementation of functional beverage the subjects showed a significant ($p=0.01$) reduction in the run time and rise of heart rate (Table 2).

The mean run time taken to complete the test during the control period was 17:06 min:sec. The average value before and after the experimental period was 17.23 and 14:33 min:sec, respectively. A significant ($p \leq 0.01$) difference was observed in running time of the subjects after the experimental period. The difference could be due to the improved blood glucose level of the subjects after the supplementation period. The effect of a pre-exercise drink on aerobic performance was also examined by Byars and Greenwood (2005). They found a significant mean differences in maximal time (minutes) to exhaustion between the placebo ($9.34 + 2.24$) and pre-exercise drink ($10.14 + 2.22$) trials for females ($P < 0.05$). Similarly, Kanabur and Devi (2005) developed four sports drink using mango, honey, lime juice and a commercial carbonated beverage and analyzed its impact on the sports performance of ten well trained male players and reported that there was significant ($p > 0.05$) improvement in sports performance.

The average values for heart rate before and after the run test, at the initial stage study and after the control period

were 99.93 and 150, 100 and 150.13 beats/min, respectively. The corresponding value after experimental period was 91.67 and 137.90 beats/min, respectively. There was a significant ($p < 0.01$) decrease in the heart rate after the experimental period. Goulet *et al.* (2008) compared the effects of pre-exercise hyperhydration and pre-exercise euhydration on the cardiovascular and thermoregulatory systems during prolonged cycling. They concluded that pre-exercise hyperhydration improves endurance capacity and peak power output and decreases heart rate and thirst sensation.

The average values for systolic blood pressure before and after Cooper's mile run test, at initial stage of the study and after the control period were 120.57 and 151.9, 120.6 and 153 mm Hg, respectively. The corresponding value for the experimental period was 120 and 148.50 mm Hg. No significant difference was observed in the rise in systolic blood pressure of the subjects. When the corresponding values were compared with normal value of 120 mm Hg given by Raghuram *et al.* (2007), it was observed that systolic blood pressure after Cooper's mile run test was higher.

The average values for diastolic blood pressure before and after Cooper's mile run test, at initial stage of the study and after the control period were 84.67 and 107.63, 84.70 and 107.70 mm Hg, respectively. The corresponding value for the experimental period was 83.63 and 105.73 mm Hg. No significant difference was observed in the rise of diastolic blood pressure of the subjects. When compared with the normal diastolic blood pressure given by Raghuram *et al.* (2007) *i.e.* 80 mm Hg, It was found that diastolic blood pressure of the subjects was higher at every point of assessment *i.e.* at the initial stage of the study, after control period and at the end of experimental period. Similarly, Silva *et al.* (2010) reported

Table 2 : Physical performance of the subjects assessed by cooper's 1.5 mile run test before and after the supplementation

Parameters	Control period		Experimental period	t-value			Normal range
	0 month (a)	After 1 month (b)	After 3 months (c)	a vs b	b vs c	c vs a	
Run time, min:sec	17.06 \pm 1.25	17.23 \pm 1.23	14.33 \pm 1.15	0.92 ^{NS}	15.8**	15.6**	—
Heart rate, beats/ min							
Before test	99.93 \pm 12.33	100 \pm 12.28	91.67 \pm 10.12	1.44 ^{NS}	8.3**	8.12**	—
After test	150 \pm 15.03	150.13 \pm 15.00	137.90 \pm 17.78	1.00 ^{NS}	7.5**	7.4**	
Rise	50.07	50.13	46.23				
Systolic BP, mm Hg							
Before test	120.57 \pm 11.58	120.6 \pm 11.61	120 \pm 11.32	1.00 ^{NS}	1.12 ^{NS}	1.06 ^{NS}	120 mm Hg#
After test	151.9 \pm 14.18	153 \pm 14.12	148.50 \pm 17.99	1.01 ^{NS}	1.53 ^{NS}	1.49 ^{NS}	
Rise	31.33	31.37	28.5				
Diastolic BP, mm Hg							
Before test	84.67 \pm 11.85	84.70 \pm 11.89	83.63 \pm 8.9	0.29 ^{NS}	1.3 ^{NS}	1.32 ^{NS}	80 mm Hg#
After test	107.63 \pm 20.19	107.70 \pm 20.07	105.73 \pm 20.60	0.70 ^{NS}	1.6 ^{NS}	1.46 ^{NS}	
Rise	22.96	23	22.10				

* and ** indicate significance of values at $P=0.05$ and 0.01 , respectively
NS =Non-significant # : Raghuram *et al.* (2007)

that blood pressure increased significantly ($p < 0.05$) from the start of the exercise and remained elevated without change during all the trials, with no differences in blood pressure between the treatments or sexes.

Conclusion:

The investigation of present study revealed that supplementation of 200 ml developed functional beverage prepared by using 5 g cauliflower leaf powder, 10 g pearl millet, 20 g jaggery, 40 g banana and 126 ml whey before the sports training helped in reducing the fluid loss of sports women and also resulted in the improvement of their physical performance.

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