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## Nutritional Status and Impact of Functional Food Supplement on the Performance of Athletes

\* Uma Mageshwari.S \*\* Mary Jenefer Sharmila.P

\*,\*\* Avinashilingam Institute for Home Science and Higher Education for Women- University, Coimbatore

### ABSTRACT

Sports and nutrition are an essential part of a healthy life. Functional foods are added for health promotion and including them in a balanced diet for sports nutrition is well documented. Fifty athletes in the age group of 17 to 26 were divided equally into experimental and control group to assess the nutritional status, sports profile and body composition. The impact of a developed functional food was evaluated on performance with respect to endurance and speed. A toffee was prepared using sweet potato which has quercetin and was analyzed for its nutrient content. Acceptability test were carried out and supplemented to the experimental group for a period of six weeks. A positive impact on the performance of experimental group athletes in endurance was noted from 1min 58 sec to 1min 44 sec and for speed it was 7 min 48 sec to 7 min 21 sec during pre and post performance.

**Keywords : Quercetin, endurance, anthropometry**

### NUTRITIONAL STATUS AND IMPACT OF FUNCTIONAL FOOD SUPPLEMENT ON THE PERFORMANCE OF ATHLETES

Sports are an essential part of a healthy daily routine which delivers freshness and keeps one active. Sports promote worldwide international peace and solidarity and play an important role in the development of human personality. Sportsmen are certainly the backbone of a nation and deserve a place of pride and honour. Athletics is one of the purest and oldest sports relying solely on strength of human body. It has originated in the time of ancient Greeks and is played nowadays in much more modernized forms.

The importance of nutrition in sport has been recognized since the ancient Olympics and its role in improving bone health and sports performance has widespread acceptance. Optimal nutrition is an important pre-requisite for top level performance in sports (Saris, 2004). Emphasis is rightly focused on energy, carbohydrates and fluid intake balance and the role of protein intake in sports is receiving attention. The relationship between nutrition and athletic performance is as certain as the connection between physical training and athletic success. Functional food is a food where new ingredients are added for health promotion. Owing to the role of functional foods in boosting general health, well being and performance the present study was conducted with the following objectives:

- ❖ Assessment of nutritional status and body composition of athletes
- ❖ Formulate a functional food and analyse its nutrient content
- ❖ Evaluate the impact of functional food on sports performance, body weight and haemoglobin status of athletes

#### Material and Method

The experimental procedure adopted for the study is presented under the following headings:

#### A. SELECTION OF ATHLETES AND ELICITING THEIR SPORTS PROFILE

The athletes for the study were selected from Ramakrishna Mission Vivekananda University located at Periyanaikampalayam in Coimbatore city. With due permission from the concerned authorities, fifty male athletes involved in running were selected by purposive sampling and were equally divided into experimental group and control group. Details regard-

ing the athletes' age, residential status whether rural or urban, education knowledge and participation in sports activities and employment and income of their parents was collected using the interview schedule.

#### B. ASSESSMENT OF NUTRITIONAL STATUS AND BODY COMPOSITION OF THE SELECTED ATHLETES

##### 1. Anthropometric Measurement:

Anthropometric measurements namely height, weight, waist and hip measurements were carried out and the corresponding Body Mass Index and Waist Hip Ratio were calculated for all the athletes' using standard procedures.

##### 2. Analysis of Body Composition:

Determining body fat is useful for weight management, body building, sports training and health risk assessment (Wilborne et al., 2005). Complete body composition profile including weight, fat mass, visceral fat, Body Mass Index (BMI), estimated muscle mass, bone mass and total body water were measured using Tanita Body Composition Analyzer which measures body composition using a constant current source with a high frequent current 90 (A).

##### 3. Dietary Pattern and Health Status

The dietary pattern of the selected athletes was elicited using 24-hour recall survey form for three consecutive days. Details on type of diet followed, intake of beverages and fast foods and problems experienced after sports and the athletes' sleep pattern were elicited using a questionnaire.

#### D. DEVELOPMENT, ACCEPTABILITY AND NUTRIENT ANALYSIS OF FUNCTIONAL FOOD SUPPLEMENT

Sweet potato, rice flakes, roasted Bengal gram, soya flour, jaggery and ghee were used to make a toffee. A three-point scale was used to score acceptability by a panel team of fifteen athletes. Every day 20 gram of the toffee was supplemented for six weeks to the athletes of the experimental group. Nutrients namely energy, carbohydrate, protein, fat, iron and antioxidants were analyzed using standard procedures.

#### E. IMPACT OF SUPPLEMENTATION ON SPORTS PERFORMANCE, BODY WEIGHT AND HAEMOGLOBIN STATUS OF THE ATHLETES

The impact of supplementation on the sports performance was studied using a six-hundred yard run test and fifty-yard run test to measure endurance and speed respectively for all

the athletes before and after supplementation. The impact of supplementation on body weight and haemoglobin for pre and post supplementation was assessed.

**RESULTS AND DISCUSSION**

The results of the study are discussed under the following headings:

**A. ASSESSMENT OF NUTRITIONAL STATUS AND BODY COMPOSITION OF THE SELECTED ATHLETES**

**i. Age distribution of the athletes**

Table I about here presents the age distribution of athletes

**TABLE I  
AGE DISTRIBUTION OF THE ATHLETES**

Years	Athletes (N=50)
17-20	20
20-23	21
23-26	9

Twenty athletes were in the age group of 17- 20 years pursuing their studies in physical education in the university after completing high school. The age group between

20-26 years was seen to be high among the 50 athletes with the number being 30, as many had been admitted late or they did not get admission in the regular courses and had opted for physical education.

**ii. Sports activities of the athletes**

Table II about here presents the details on sports activities of athletes practiced in the university.

**TABLE II  
SPORTS ACTIVITIES OF THE ATHLETES**

Sports Activity*	Athletes (N=50)
Running	13
Foot Ball	11
Basket Ball	5
Hockey	7
Hand Ball	13
Volley Ball	13
Kabaddi #	20
Kho-Kho!	8

\* Multiple response

# - a game played between two teams of seven players in which individuals take turns to chase and try to touch members of the opposite team without being captured by them.

!-Indian sport played by teams of twelve g who try to avoid being touched by members of the opposite team.

University provides extensive play facilities that include 400 meters track for excelling in activities like running, standard fields of hockey, football, volleyball and kabaddi for the athletes to excel in their sports activities. It was a good sign to note that the athletes were interested in all sports activities other than cricket.

**iii. Body Mass Index of the athletes**

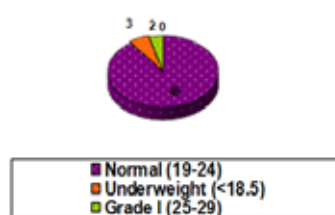


Figure I about here presents the Body Mass Index of Athletes.

The Body Mass Index of the athletes showed that 45 athletes had normal BMI, as they were involved in physical activity. Three were underweight and two were grade I obese but the values obtained were marginal. These athletes can reverse the condition (i.e., under weight and grade I obesity), if they follow suitable dietary practices.

**iv. Mean segment distribution of fat, muscle and bone mass**

Table III about here presents the mean segment distribution of fat, muscle and bone mass.

**TABLE III  
MEAN DISTRIBUTION OF FAT, MUSCLE AND BONE MASS**

Segment distribution	Fat mass	Muscle mass	Bone mass
Trunk	12.9	83.8	4.2
Right arm	0.9	7.8	0.5
Left arm	1.1	7.2	0.6
Right leg	6	18.3	1.5
Left leg	5.8	18.4	1.5
Total	26.7	135.5	8.3

The distribution varied between right and left of the body. As the subjects were athletes the muscle mass distribution was more compared to fat and bone mass, because they are in need to build muscle to carry out their sports performance. Many athletes' need to build more muscle at some point in their athletic career (Cope et al., 2008). Bone mass decrease in physical activity may lead to an increased loss of bone mineral and an increase in the incidence of osteoporotic fractures (Peterson et al., 1999). The bone mass was distributed in the trunk and legs more than in the hand region.

**C. DIETARY PATTERN AND HEALTH STATUS OF THE ATHLETES**

1. Thirty-two athletes were non-vegetarians and two were ova vegetarians. Athletes' those stayed outside consumed egg once in three days and non-vegetarian foods once in a week.
2. Tea, coffee and milk were preferred almost by all the athletes'. The athletes' took no sports drink.
3. Eleven athletes' consumed fast foods daily and twenty two weekly and a total of seventeen athletes preferred fast foods monthly and occasionally.
4. The main energy intake of the athletes' was from carbohydrates and was double the recommended dietary allowances. Intake of protein met the daily recommended allowance. The fat intake in the diet was below ten gram.
5. Mean food intake of the athletes showed that cereals, pulses and milk were mostly included in the diet of athletes.
6. Breathlessness was seen to be common among athletes after performance. Fourteen athletes were found to be healthy.
7. All the athletes had sufficient sleep hours to refresh their mind and health for better performance.

**D. DEVELOPMENT, ACCEPTABILITY AND NUTRIENT ANALYSIS OF THE FUNCTIONAL FOOD SUPPLEMENT**

**i. Development of functional food supplement**

Ingredients namely sweet potato powder, rice flakes powder, roasted Bengal gram powder, soy flour, jaggery and ghee was used for toffee preparation. Score for acceptability was done by a panel team of fifteen athletes. Nutrients present in 100-gram toffee met one-third of the nutrient need of the athletes. The analyzed values for energy was 380 Kcal, protein 6.5g, fat 1.5g, iron 17.99mg and total antioxidants 1.56mg.



FUNCTIONAL FOOD SUPPLEMENT – FLOW CHART FIGURE II

**E. IMPACT OF FUNCTIONAL FOOD SUPPLEMENT (TOFFEE) ON SPORTS PERFORMANCE, BODY WEIGHT AND HAEMOGLOBIN STATUS**

The impact of functional food supplement (toffee) on athletes is discussed in the following tables.

**i. Mean endurance of athletes before and after supplementation TABLE IV**

**MEAN ENDURANCE OF ATHLETES BEFORE AND AFTER SUPPLEMENTATION**

Experimental group (N=25)				Control group (N=25)							
Pre test		Post test		t' value		Pre test		Post test		t' value	
Min.	Sec.	Min.	Sec.	4.1152**		Min.	Sec.	Min.	Sec.	0.8764NS	
1	58	1	44			1	65	1	64		

Min.: Minutes; Sec.: Seconds

**\*\* - Significant at one percent level; NS - Not significant**

Nutritional supplement quercetin improved the aerobic endurance in a group of healthy individuals (Elizabeth, 2009). The endurance of athletes scored before supplementation of toffee was 1 minute 58 seconds and their endurance scored after intake of toffee was 1 min 44 sec. Every second counts in sports and helps to win the competition. The reduction of 14 seconds is very vital because the difference in seconds will contribute to the chances of winning the game. The antioxidant quercetin in sweet potato and arginine present in soya as supported by the studies may have brought about the desirable results. The time of one minute for the endurance test remained the same in both experimental and control group. Statistical analysis revealed one percent significant difference on pre and post performance in the experimental group athletes. There was no significant difference in the control group.

**ii. Speed performance for 50 meter before and after supplementation**

Steady increase in speed is accompanied by increase in body mass and height (Marden, 2006).

**TABLE V  
SPEED PERFORMANCE FOR 50 METER BEFORE AND AFTER SUPPLEMENTATION**

Experimental group (N=25)				Control group (N=25)							
Pre Test		Post test		t' value		Pre test		Post test		t' value	
Min.	Sec.	Min.	Sec.	4.1439**		Min.	Sec.	Min.	Sec.	0.8685NS	
7	48	7	21			7	59	7	59		

Min.: Minutes; Sec.: Seconds ;\*\* Significant at one percent level; NS-Not significant

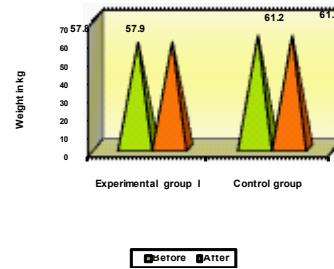
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The 50 meter speed was covered by all the athletes in the matter of seven minutes while there was a difference noted in the seconds for the experimental group. The reduction of 27 seconds was noted for the experimental group. This reduction in seconds may be contributed to the intake of the toffee which provided 1.56mg of antioxidants. The control group did not show any difference in speed during the study period. The speed of experimental group athletes before and after supplementation was significant at one percent level.

**iii. Mean body weight (kg) of the athletes before and after supplementation**

figure III about here presents the mean body weight of athletes.



There was one point increase noted in the body weight of athletes after supplementation of the toffee among the experimental group athletes which was significant at one percent level. The toffee supplemented provided 380 kcal which meets one third of the recommended dietary allowance for this age group but an increase in the body weight was not noticed which may be advantageous wherein the athletes can improve their sports performance without increasing their body weight.

**iv. Mean haemoglobin of athletes before and after supplementation**

**TABLE VI  
MEAN HAEMOGLOBIN OF ATHLETES BEFORE AND AFTER SUPPLEMENTATION**

Experimental group (N=25)			Control group (N=25) (g/dl)	Normal Range (g/dl)
Mean Haemoglobin				
Before (g/dl)	After (g/dl)	t' value		
15.9	16.1	4.0805**	15.8	14-17

**\*\* - Significant at one percent level**

The haemoglobin level of the athletes was in the normal range before and after supplementation but there was an improvement noted whereby the haemoglobin level increased from 15.9g/dl to 16.1g/dl. Though this is a slight increase in the haemoglobin level, the statistical significance at one percent level was obtained. It was encouraging to note that all the athletes in the experimental and control group had normal haemoglobin level in blood.

**SUMMARY AND CONCLUSION**

Successful athletic performance is a combination of proper training and balanced nutrition. The functional food supplement had a positive impact on the performance of athletes in terms of endurance, speed and haemoglobin status. The increase in body weight of the athletes was negligible and hence the functional food can be recommended to improve the performance ability of sports person without increasing their body weight. Hence the supplementation of antioxidant brings an encouraging impact on the performance of sports person.





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