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FITNESS ASSESSMENT AND EFFECT OF NUTRITION INTERVENTION IN 12-14 YEARS OLD (MALE) FOOTBALL PLAYERS DURING TRAINING DAYS

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ABSTRACT

Poor nutrition intake, dehydration, and fatigue are some of the most common causes of a decrease in the performance during the football training sessions. This study analyzed the food intake pattern and measured the effect of an 8-week nutrition intervention to improve the performance of 12-14 years old male players playing at club level during training days. A 3-Day dietary recall estimated that the 13 players had poor energy intake, excessive protein intake, and optimal fat and carbohydrate intake. Fitness assessments comprising of 20 m shuttle test (endurance), test for muscle endurance (plank), functional test (Glute Bridge), and test for speed (10 m sprint) were conducted (152.6 ± 8.1 cm, 39.2 ± 6.23 kgs, and 16.6 ± 1.65 kg/m2) before and after the intervention. The nutrition intervention comprised of pre, during and post-training meals in the form of sports drinks (6% CHO), dates and bananas for carbohydrates and cottage cheese and egg whites for proteins as the 2-hour training sessions included warm-up, functional training, skill training, and small durations of a practice match. At the end of 8 weeks the aerobic capacity improved from 40.4 ± 6.01 to 45.0 ± 2.7 ml O2/kg/min and the muscle endurance improved from 96.8 ± 52.9 to 165 ± 76.5 seconds.

Keywords – Fitness, Performance, Endurance, Nutrition, Carbohydrate, and Protein

1. INTRODUCTION

The evolution of football took place in Britain as early as the 19th century (FIFA, 2018) and is said to be the most popular sport worldwide with approximately 240-265 million amateur players and 200,000 professional players (Briggs et.al., 2015).

Football is a game of intermittent work and players generally perform low-intensity activities for more than 70% of the game, but heart rate and body temperature measurements suggest that the total energy demand is high due to the repeated high-intensity efforts that players are called upon to perform and thus, leading to an energy expenditure of about 2522 ± 252 Kcals (Morehead, 2018). which is considerably different from training days.

During the game there are incidences of high-intensity bouts involving sprints and running, hence the training for the matches involves warm-ups, drills such as high knees, German drill, Nine point challenge, attack vs. defense, and a lot more contributing to an energy expenditure of about 3566 585 Kcals (Anderson, et.al., 2017) in four and a half hours. The sweat rate quantified for 100 minutes of training is 1167 ± 662 ml (Laitano , Runco, & Baker, 2014). Additionally, as the training takes place in groups and there are numerous activities, the opportunities for numerous small breaks are possible.

A top-class player performs about 150-250 brief intense actions during a game and these efforts place high demands on the anaerobic energy systems which ultimately lead to the exhaustion of muscle and liver glycogen and thus, lead to fatigue that occurs at all stages of the game (Maughan et.al., 2018).

Hard work in training is essential, but a well-chosen diet can offer many benefits such as optimum gains from the training program, enhanced recovery within and between workouts and events, achievement and maintenance of an ideal body weight and physique, a reduced risk of injury and illness, confidence in being well-prepared for match play and consistency in achieving high-level performances in matches. Despite these advantages, many players do not meet their nutrition goals due to common problems and challenges that include poor knowledge of foods and drinks, poor choices when shopping or dining out, poor or outdated knowledge of sports nutrition, inadequate finances, busy lifestyle leading to inadequate time to obtain or consume appropriate foods, and frequent travel(Maughan et.al., 2018). Additionally, energy balance and adequate nutrition is all the more important for the young adolescents to sustain optimal growth and development with an increased energy cost of high-level training and competition (Briggs et.al., 2015).

Thus, the aim of the study was to design a nutrition intervention that could help the young aspiring football players to change their eating habits which would have a positive impact on their performance.

2. MATERIAL AND METHOD

2.1 Subjects

Thirteen professional soccer players (Hero Sub-Junior I-League) were chosen with the help of purposive sampling who gave informed consent to participate in the study.

2.2 Experimental Design

The study was experimental and involved the use of an intervention trial. It fell under the category of pre-experimental design studies. It was one group pre-test and post-test design where the dependent variables such as the fitness assessment and the nutrition assessment were assessed before the intervention and re-assessed post-intervention for one group of subjects only.

The study was divided into phases. The first phase comprised of a session with the players and their parents to introduce them to the field of nutrition, to provide them insights on the study,

and the written consent form was signed. The second phase comprised of the fitness assessment across various parameters - anthropometry, muscle strength and endurance, functional testing, cardiorespiratory fitness test (endurance), and speed test. The third phase involved the nutrition assessment which was conducted with the help of a 3-Day Dietary Recall spread over a 1 weekend and 2 weekdays (one training day and one non-training day).

After the submission of the 3-Day Dietary Recall Sheets, customized plans were made for each player across training days and non-training days considering their age, food preferences, school and practice timings, and ethnic background. However, the diet prescription was predominantly focused on pre-during-post training meals. The guidelines for the same were adopted from various sports nutrition studies.

During the fourth phase, the subjects were then asked strictly to follow the diet plan for 8 weeks and maintain a food and training monitoring sheet that will emphasize on the pre-during-post meals.

In the last phase, the fitness parameters were re-assessed to observe the outcome of post-8-weeks of intervention.

2.3 Quality and Quantity of the Pre, During and Post Training Meals:

2.3 Quality and Quantity of the Pre, During, and Post Training Meals: To improve the performance, a high glycemic index meal in the form of dried dates was prescribed along with the intake of water as a part of the hydration strategy 20 – 30 minutes prior to the training. During training, a sports drink made from 50 g of Glucon-D and 21.8 g (1 sachet) of electoral was suggested to meet the carbohydrate and electrolyte requirement for a 2-hour moderate to high-intensity work-out. Separate meals for vegetarians and non-vegetarians were prescribed in the form of 100 g Banana and 100 g Paneer or 100 g Banana and 100 g Egg Whites respectively. At the end of the training total energy consumed by vegetarian and non-vegetarian participants was about 793 Kcals and 512 Kcals representing around 29.5 % and 19.1 % of the total recommended energy by the Indian Council of Medical Research for the age group of 12–13-year-old boys with vigorous activity respectively. The meal composition is described in Table 1.

TABLE 1

NUTRITIVE VALUE OF PRE, DURING AND POST TRAINING MEALS

	Exchange	Amount(g)	Energy	CHO (g)	Protein (g)	Fat (g)	Sodium (mg)	Potassium (mg)
Pre	Dates*	20	62	14.5	0.4	0	0.6	156
	Water	400 ml	-	-	-	-	-	-
During	Glucon-D**	50	184	46	0	0	-	-
	Electral**	21.8	54	13.5	0	0	75 mOsmol/L	20 mOsmol/L
		Total	238	59.5	0	0	1725	780
	Dates*	20	62	14.5	0.4	0	0.6	156
		Total	**300**	**74**	**0.4**	**0**	**1725.6**	**936**
Post (veg)	Banana*	100	106	23.41	1.49	0.35	1	335
	Paneer*	100	325	23.5	15	19	18	63.5
		Total	431	46.91	16.49	19.35	19	398.5
Total			**793**	**135.41**	**17.29**	**19.35**	**1745.2**	**1490.5**
Post (Non-veg)	Banana*	100	106	23.41	1.49	0.35	1	335
	Egg Whites*	100	44	0	10.84	0	147	144
		Total	150	23.41	12.33	0.35	148	479
Total			**512**	**111.91**	**13.13**	**0.35**	**1874.2**	**1571**

*Source- Indian Food Composition Table by National Institute of Nutrition , ** From Nutrition Label on the packet of Glucon-D and Electral. 75 mOsmol/L = 1.725 g and 20 mOsmol/L = 0.78 g

2.4 Statistical Analysis:

Microsoft Excel was used to tabulate mean and standard deviation of parameters. The Statistical Package for Social Sciences (SPSS) was used to obtain the value of significance for paired t-test between the participants pre and post intervention.

3. RESULT AND DISCUSSION

Out of the 13 players, ten (77%) participants were non-vegetarians, whereas three players (23%) were vegetarians. Additionally, the average time spent in playing football by the participants was around one hour for three participants (23%), two hours for eight participants (62%), and three hours for two participants (15%).

The 3-Day Dietary Recall concluded that the average energy intake on a non-training day was about 1789 Kcals, 1714 Kcals on a training day, and 1756 Kcals on a weekend, leading to an average of 1753 Kcals for all the three days for all the 13 subjects. This average energy intake was 34.6 % lesser when compared to the actual requirement of 2680 Kcals suggested as Recommended Dietary Allowances (RDA) given by the Indian Council of Medical Research (ICMR) for a boy in the age group of 12-13 years engaging in vigorous activity (8). A Canadian study conducted on 33 female soccer athletes in the age group of 15.7 ± 0.7 years also reported an energy deficit in the consumption compared to the daily requirement (Gibson, et.al. 2011).

The mean and Standard Deviation of the Energy and Macronutrient Consumption on Different Days across Vegetarian (n=3) and Non-Vegetarian Participants (n=10) is shown in Table 2. The mean carbohydrate intake in all the participants was about 239.4 g (54.5 % of total energy) on a non-training day, 238.9 g (56.7 % of total calories) on a training day, and 222.8 g (52.4 % of total energy) on a weekend, and leading to an average of 233.6 g (54.6 % of total energy). Additionally, 23 % of the participants consumed less than 5 g per kg body weight of carbohydrate per day, about 46.2 % consumed in the range of 5 – 7 g per kg body weight per day and the remaining 30.8 % of them consumed more than 7 g per kg body weight on an average. According to the International Society of Sports Nutrition, for Moderate- to high-intensity training (2-3 hours/day, 5-6 times a week), the carbohydrate requirement must be about 5-8 g per kg body weight per day, which has been met by the most of the participants on the study (Potgieter, 2013).

On the other hand, the mean protein intake in all the participants was about 57.2 g (13.2 % of total energy) on a non-training day, 56.2 g (13.8 % of total energy) on a training day, and 64 g (14.5 % of total energy) on a weekend, contributing to an average of 59.1 g (13.7 % of total energy) for all the three days. Moreover, at least 15.4 % of the participants consumed less and 1.2 g per kg body weight of protein per day, about 30.7 % consumed between 1.2 – 1.5 g per kg body weight of protein per day, and the remaining 53.9 % consumed more than 1.5 g per kg body weight of total protein per day on an average. According to the RDA given by the ICMR, the protein requirement for a boy in the age group of 12-13 years is 1.15 g per kg body weight per day which contributes to 38 g per day ((National Institute of Nutrition, 2009). When compared to the current dietary intake, nearly 84.6 % of the participants have consumed about 64.4 % excess protein on a daily basis. Out of vegetarian subjects, 66.6 % of them consumed less than 1.2 g/kg body weight of protein, and 33.4% consumed about 1.5 g/kg of protein on an average

TABLE 2
MEAN AND STANDARD DEVIATION OF THE ENERGY AND MACRONUTRIENT CONSUMPTION ON DIFFERENT DAYS ACROSS VEGETARIAN AND NON-VEGETARIAN PARTICIPANTS

	Vegetarian Participants (n=3)				Non – Vegetarian Participants (n=10)			
Day	Energy (Kcals)	Protein (g)	Fat (g)	CHO (g)	Energy (Kcals)	Protein (g)	Fat (g)	CHO (g)
Non-Training Day	1694 ± 238	45.9 ± 12.2	55.2 ± 10.9	241.5 ± 26	1817 ± 445	60.6 ± 14.1	64.3 ± 3.7	238.7 ± 89.8
Training Day	1649 ± 249	47.9 ± 10	55.2 ± 15	231.3 ± 35.3	1734 ± 371	58.6 ± 13.6	54.5 ± 12.9	241.1 ± 61.6
Weekend	1618 ± 81	52.7 ± 6.5	53 ± 6.8	233.2 ± 11.4	1798 ± 366	67.4 ± 14.1	68.1 ± 20.5	219.7 ± 58.9
Player (Individual) Average	1653 ± 126	48.8 ± 5.8	54.4 ± 10.2	235.3 ± 8.2	1783 ± 350	62.2 ± 11.7	62.3 ± 13.7	233.2 ± 61.1

Lastly, the fat intake among all the participants on a non-training day was about 62.2 g (32.3 % of total energy), 54.6 g (29.5 % of total energy) on a training day, and 64.6 g (33.1 % of total energy) on a weekend, thus leading to a mean intake of 60.5 g (31.7 % of total energy) for all the three days. According to the American College of Sports Medicine, the daily requirement of fat for athletes should be 20-35% of total energy intake and that fat intake should not decrease below 20% of total energy intake (10). The guideline by the ICMR states that at least 25% of total energy must come from fat, and the minimum level of visible fat in children and adolescents should range between 25-30 and 35-50g / day respectively (National Institute of Nutrition, 2009).

Thus, with respect to the fat intake, the participants are in compliance to the recommendation. The physical characteristics of the pre and post the intervention of subjects that participated in the study are listed in Table 3. The anthropometric measurements improved at the end of 8 weeks and the values observed stated no significant improvement in height, a significant change in mean weight to 40.66 ± 6.69 kg (p= 0.008), and thereby a significant change in BMI to 17.2 ± 1.98 kg/m2 (p= 0.011) (Figure 1). The height, weight, and BMI when compared to the Indian Academy of Pediatrics (IAP) growth charts, the height of the participants was at 50th percentile, whereas the weight of the participants was between 25th and 50th percentile and BMI was between 50th and 75th percentile (Hospital, Hospital, Mahavidyalaya, 2015). Additionally, the mean waist circumference measured 64.8 ± 5.06 cm which according to the Alpha Fitness Test Battery for children and adolescents, comes in the category of low for its age (Santosh & Mota, 2009).

Significant improvements were found in the right and left calf circumference as the values improved to 29.84 ± 2.31 cm and 29.65 ± 2.20 cm respectively (p= 0.0061 and p=0.018).

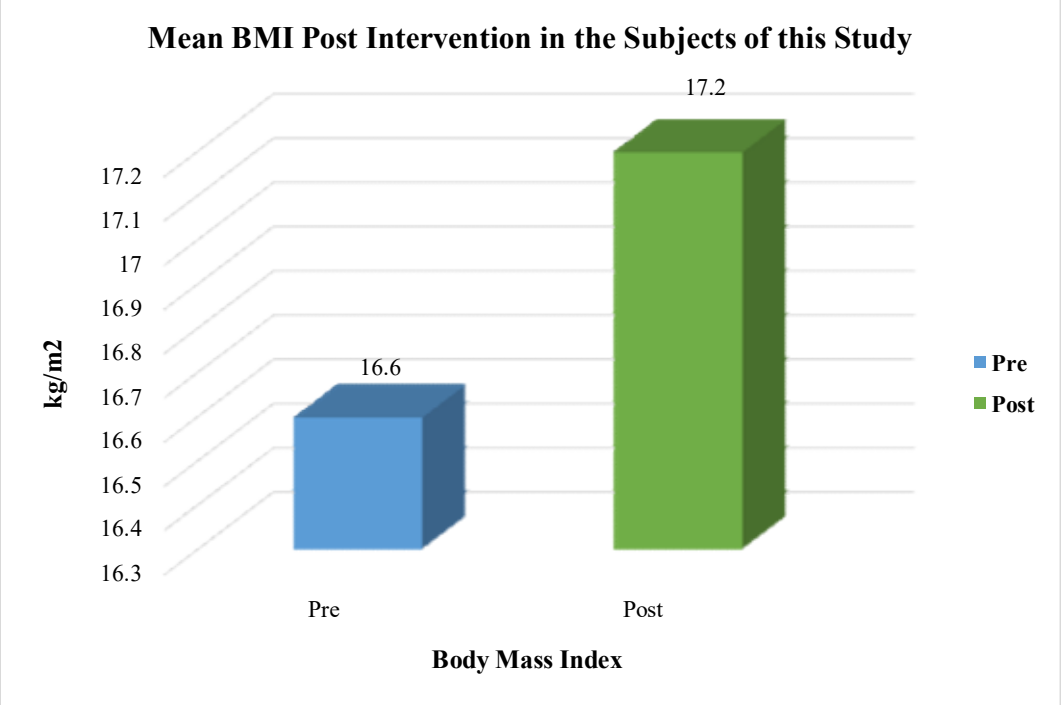

Figure 1 Mean BMI Post Intervention in the Subjects of this Study

Duration of plank improved from 96.84 ± 52.9 to 165.69 ± 76.59 seconds (p= 0.000), side plank right and left improved from 73.69 ± 33.5 to 86.0 ± 35.01 seconds (p=0.014) and from 63.76 ± 26.74 to 90.15 ± 37.49 seconds (p=0.007) respectively and lastly, glute bridge right and left side improved to 114.38 ± 38.74 seconds (p=0.002) and 102 ± 39.92 seconds (p=0.000) respectively. (Figure 2). The mean VO2 Max observed at the end of the intervention was significantly higher with a value of 45.06 ± 2.7 ml O2/kg/min (p=0.003) which according to the Alpha Fitness Test Battery for children and Adolescent comes in the category of very high (≥8 .0) for their age ((Santosh & Mota, 2009). (Figure 3). This when compared to a study conducted in Turkey on 12 years (n=15) and 13 years (n=12) old boys which concluded an average VO2 max 29.94 ± 4.64 ml O2/kg/min and 32.02 ±7.16 ml O2/kg/min respectively, reflected that the participants had a much better endurance (Aktug, Çelenk, & Yilmaz, 2014). The mean value for the speed test significantly increased to 2.72 ± 0.12 seconds from 2.41 ± 0.17 (p=0.000) which was undesirable as the longer t the time taken to cover the distance, the poorer is the speed of an individual.

TABLE 3

COMPARISON OF FITNESS ASSESSMENT PRE-INTERVENTION (WEEK 1) AND POST-INTERVENTION (WEEK 8)

Parameter	Week 1	Week 8	'p' value
Height (cm)	152.61 ± 8.10	152. ± 8.02	0.054
Weight (kg)	39.26 ± 6.23	40.66 ± 6.69	**0.008***
BMI (kg/m2)	16.66 ± 1.85	17.2 ± 1.98	**0.011***
Waist Circumference (cm)	64.8 ± 5.06	65.8 ± 4.7	0.67
Right Thigh Circumference (cm)	41.03 ± 3.80	41.57 ± 3.50	0.45
Left Thigh Circumference (cm)	40.57 ± 3.55	41.57 ± 3.40	0.06

Parameter	Week 1	Week 8	'p' value
Right Calf Circumference (cm)	29.46 ± 2.20	29.84 ± 2.31	**0.0061***
Left Calf Circumference (cm)	29.30 ± 2.11	29.65 ± 2.20	**0.018***
Plank (sec)	96.84 ± 52.9	165.69 ± 76.59	**0.000***
Side Plank - Right (sec)	73.69 ± 33.5	86.0 ± 35.01	**0.014***
Side Plank - Left (sec)	63.76 ± 26.74	90.15 ± 37.49	**0.007***
Glute Bridge - Right (sec)	78.61 ± 41.94	114.38 ± 38.74	**0.002***
Glute Bridge - Left (sec)	64.15 ± 25.8	102 ± 39.92	**0.000***
10 m Sprint Test (Speed) (sec)	2.41 ± 0.17	2.72 ± 0.12	**0.000***
20 m shuttle test (ml O_2/kg/min)	40.43 ± 6.01	45.06 ± 2.7	**0.003***

**P value is significant*

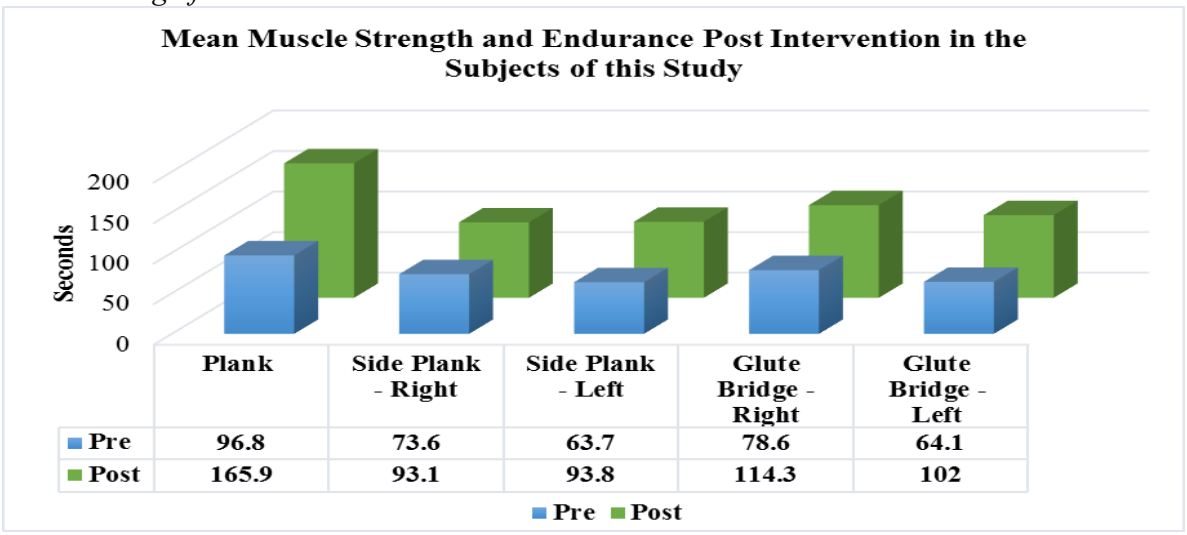

Figure 2 Mean Muscle Strength and Endurance Post Intervention in the Subjects of this Study

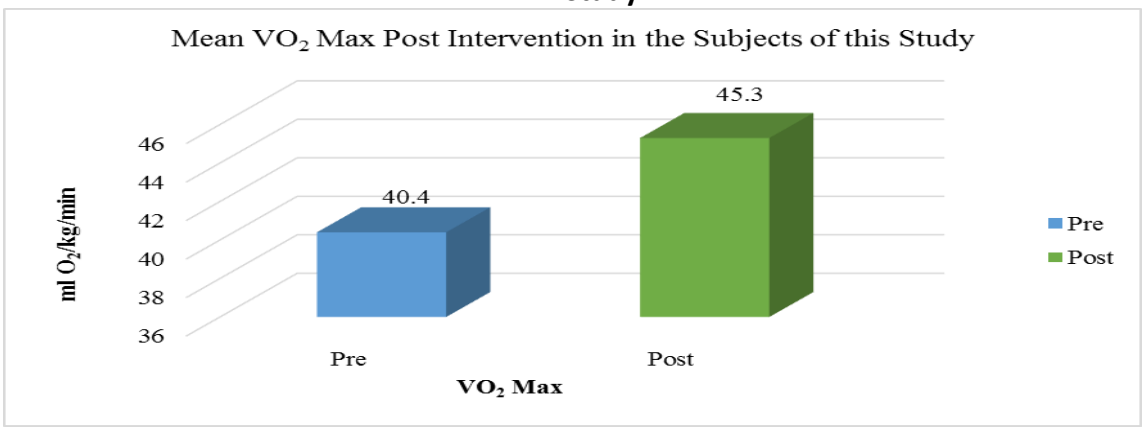

Figure 3 Mean VO_2 Max Post Intervention in the Subjects of this Study

4. CONCLUSION

The analysis of the 3-Day Dietary Recall concluded that the subjects were deficient in energy consumption, adequate in carbohydrate and fat consumption, and excess in protein consumption. The 8-week nutrition intervention concluded that it has a positive effect for both vegetarian and the non-vegetarian participants of this study with significant improvement in the

calf circumference, muscle strength, and functional tests, and lastly, endurance which are important for football players.

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