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Study Of Iron Intake and Haemoglobin Concentration In Vegetarian And Non-Vegetarian Female Athletes

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Abstract

Hemoglobin in blood is responsible for supply oxygen to the organs and tissues of human body. It is directly associated with aerobic performance. Iron is one of the importantnutrients which human body needs to make hemoglobin. Iron is an essential micronutrient which human body needs in small amount. For female participating in endurance sports the requirements of iron will increase due to high depletion of iron storesduring physical activity. One of the major causes of iron deficiency is an inability of body toabsorb enough iron from food. Dietary iron is classified into two types named ashaeme iron and non heme iron. Animal based products such as liver, seafood and poultry are rich sources of heme iron which absorbed easily by the body. Vegetarian diet contains non heme iron which is less efficiently absorbed by human body as compare to heme iron. The present study was conducted to determine iron intake and haemoglobin level among female athletes in endurance sports with respect to their dietary patterns.A total number of fifty national level female athletes participating in different endurance sports (Hockey, Football, handball, cycling and basketball) age ranged between 18 to 25 years participated in study. Anthropometry measurements height, weight and BMI were taken for eachsubject. For assessment of dietary iron intake 24 hours dietary recall method was used for consecutive 3 days. Bloodsamples were taken for assessment of haemoglobin. The prevalence of vegetarianism was higher in female athletes participating in endurancesports. The result of study revealed that iron intake of female athletes was lower than recommended dietary allowance. The haemoglobin concentration of non-vegetarian female athletes was significantly higher than vegetarian female athletes when there was nosignificant difference was observed between the dietary iron intake of these two groups. It was observed from results of study that there was a positive relationship between dietary iron intake and haemoglobin concentration in female athletes.

1. INTRODUCTION

The food consumption and dietary patterns in India are very diverse due to various religious, cultural and family values. A non-vegetarian diet is a kind of diet that involves consumption of meat or animal-based products, whereas a vegetarian is an individual who does not consume meat and meat products. A vegetarian diet can be further classified into different groups such as vegan, lacto-ovovegetarian, lacto-vegetarian. Vegetarian and non-vegetarian diets are an important consideration for nutrition.In India about 30-40% of population consumes vegetarian diet(Choudhary&kumar, 2017).The prevalence of non-vegetarianism was high in Indian sports women than lacto, ovo lacto vegetarianism. Haemoglobin level and endurance performance was better in non-vegetarians than lacto, ovo lacto vegetarians

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(Khanna et al, 2006). Due to Some nutrients intake, haemoglobin level was better in non-vegetarians than vegetarians (sharma et al 2013). Iron is an essential nutrient for the formation of haemoglobin and myoglobin. It is a micronutrient which is vital for health and peak performance in endurance sports.Our body contain total 3 to 5 gm of iron from which 75% present in haemoglobin. So iron is an important constituent of haemoglobin. The main role of iron in our body is to transport oxygen to the tissues. Apart from this iron involved in some cellular respiration and detoxification process.From the food we eat, body normally absorbs about 10% to 30% of the iron. Without enough iron, a condition develops which is called anemia. In anemia body does not have enough iron which needs to make haemoglobin and myoglobin. Haemoglobin and myoglobin in muscles are accountable for carrying and storing oxygen in our body. When the body doesn't get sufficient oxygen, it can cause a variety of symptoms like pale skin, fatigue dizziness etc.Haemoglobin concentration is directly associated with exercise performance (Lipinski et al 2009). The world health organization ranks iron deficiency anaemia as number one nutritional disorder. Nearly 80%of the population in worldmay not get sufficient iron.The one of the major reason of iron deficiency is poor nutritional status and an inability of body to absorb enough iron from the diet. Meat is one of the rich sources of iron and the form of iron in meat is absorbed easily by the body. It is called heme iron and it also found in liver, seafood, and poultry. Vegetarian diet or diet from plant sources containsnon heme iron which is less efficiently absorbed by body as compare to heme iron. The sources of non heme iron include green leafy vegetable, beans and iron fortified foods. Vitamin c increases the bioavailability of iron. So addition of vitamin C in vegetarian diet is helpful to increase absorption of iron in body. participation in endurance sports are often responsible for iron-deficiency anaemia in females.Therefore, it has been recommended that endurance athletes consume more iron than RDA for the general population (Nagamine 1979).The required intake of iron appears to vary depending upon various factors such as the training method, duration of training session, intensity of training and the competition level (Fujii et al, 2015).

Review of literature

Brocherie, et al (2015)conducted a study to investigate relationship between hematological variables and specific fitness performance in elite field hockey players. Hemoglobin mass was measured in twenty-five elite field hockey players using the optimized(2min) CO- rebreathing method. Hemoglobin concentration was analyzed by venous blood. The results of study revealed that hemoglobinmass was highly correlated with specific fitness performance($r=0.62$) in elite field hockey players.

Alaunyte et al (2015) stated that because Iron is an essential component for oxygen transport and energy production in human body, therefore it is a vital micronutrient for sport and exercise performance. Female athletes participating in endurance sports are at higher risk oflow iron status and iron deficiency due to heightened iron losses of iron from body through menstruation and exercise-induced mechanisms associated with endurance activity.

Haider et al. (2017) Stated that iron status of vegetarian group is compromised by the absence of haem-iron in vegetarian diet which has higher bioavailability. A total 30 studies were selected for meta-analysis. From which twenty-seven were cross-sectional studies and three interventional studies. The results of study showed that vegetarians have significantly lower serum ferritin levels than non-vegetarians ($p < 0.01$). The study concluded that both groups vegetarians and non-vegetarians should have to regularly control their iron status by improve their diet regarding the content of iron in diet and bioavailability of iron.

Pawlak, et al (2018)conducted a review of published data on iron status among non- vegetarian and vegetarian groups. Total 13 original articles met inclusion criteria were selected andanalyzed. A higher percentage of vegetarian females had low serum ferritin level

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as compare to non vegetarian females.A prevalence of iron deficiency anemia was higer in vegetarians as compared to non-vegetarians.

Mahajani and Bhatnagar(2015) investigate the prevalence of iron deficiency anaemia between vegetarians and non vegetarians. In results of study significant difference was observed in the BMI of vegetarian and non-vegetarian group. The mean haemoglobin level ofvegetarian group was lower than thenon vegetarian group. 40% vegetarians were moderate anaemic whereas 60% were having mild anaemia.

2. METHODOLOGY

The present study was carried out on 50 female athletes participating in five different endurance sports named hockey, football, handball, cycling and basketball (10 players from each team) age ranged between 18-25 years. The subjects taken from Punjabi university Patiala during their inter university camp. A pre- calibrated portable weighing machine was used to measure the body weight of subjects. Anthropometric rod was used to measure the height of subjects. With the help of height and weight BMI was calculated for each subject. Haemoglobin content from the blood was determined with blood sample taken by finger prick method in pathology lab of university health centre. Iron intake was determined with help of 24 hours dietary recall method for consecutive 3 days. For dietary analysis the software named as dietcal was used. The statistical computations were made by using the Statistical Package (SPSS 22). Data of study was presented as Mean and Standard Deviation. The one way analysis of variance and independent t-test was used to find out significant difference of means in each parameter between the groups with p value <0.05. The Karl Pearson's correlation was used to determined relationship between iron intake and haemoglobin.

3. RESULTS

The main aim of study was to analyse the iron intake and haemoglobin level of vegetarianand non vegetarian female athletes. For this purpose data was collected from 50 female athletes participating in different endurance sports. The descriptive statistics of parametersare presented as below.

Table 1: Representation of descriptive statistics of parameters studied

parameters	**Mean±SD**
Age (years)	21.60±2.61
Weight (in kg)	56±8.08
Height (in cm)	164.5±7.29
BMI (kg/m^2)	20.9±2.54
Iron intake (mg)	17.42±2.79
HB (mg)	10.59±1.37

Table.1 shows that the mean age, weight, height and BMI of subjects was 21.60±2.61 (years), 56±8.08 (kg), 164.5±7.29 (cm) and 20.9±2.54 (kg/m^2) respectively. The mean iron intake of subject was found to be 17.42±2.79 mg whereas the RDA recommended by ICMR is 12 mg. The mean hemoglobin level of female athletes was 10.59±1.37 mg.

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Table:2 Iron intake and haemoglobin level of vegetarian and non vegetarian female athletes

variable	vegetarian(n=29) Mean±SD	non-vegetarian(n=21) Mean±SD	t value
Iron	16.90±3.13	18.13±2.10	1.56^{NS}
Hemoglobin	9.72±0.77	11.80±1.09	7.83*

NS-not significant,*significant at P<0.05

It was observed from table 2 that there was high prevalence of vegetarianism in female athletes participating in different endurance sports. The difference of iron intake between vegetarian and non-vegetarian subjects was found to be non significant but a significant difference was observed in haemoglobin level between vegetarian and non vegetarian female athletes (p value<0.02).

Table: 3 iron intake and hemoglobin level among female participating in different endurance sports

variable	hockey (n=10)	handball (n=10)	football (n=10)	cycling (n=10)	basketball (n=10)	F value
iron intake	19.63±3.13	17.45±2.27	16.94±2.16	15.83±2.13	17.25±3.10	2.83*
hemoglobin	10.62±1.41	10.89±1.44	10.33±1.29	10.50±1.39	10.65±1.56	$.23^{NS}$

NS-not significant,*significant at P<0.05

Further, a look at dietary iron intake and haemoglobin level among different endurance sports (Table.3) shows that haemoglobin level was not significantly different in any group but there was a significant difference was observed in ironintake among different groups with F value 2.83*.(P<0.05)

Table: 4 Relationship between iron intake and haemoglobin level of female athletes

iron intake	**hemoglobin**	**r value**
17.42±2.79	10.59±1.37	**.69****

**significant at P<0.01

The table 4 shows that there was a positive correlation between iron intake and haemoglobin level of female participating in endurance sports.

4. DISCUSSION

The present study was done for the Determination of Haemoglobin level and iron intake among female participants in endurance sports with respect to their dietary habits. This study also examined the relationship between iron intake and haemoglobin level. The purpose of focusing this group is that, this area of study has higher risk of iron deficiency as reported in previous studies. Iron-deficiency anaemia is common among endurance athletes (Fujii et al, 2015). The finding of study showed that the mean iron intake of female athletes was lower than their RDA in both vegetarian and non-vegetarian group. There was a significant difference observed in the haemoglobin level of vegetarian and non-vegetarian female athletes when the iron intake of these two groups was almost same (p<0.05). This is may be due to less absorption of non-heme iron as compare to heme iron. The main finding of studyis that there was a positive relationship between iron intake and haemoglobin level. The more iron intake may result in higher concentration of haemoglobin. An increase of haemoglobin concentration is associated with enhanced VO^2 max and endurance performance due to increase in oxygen carrying capacity of blood (calbet et al 2006).

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Many studies have been done in this regard with significant findings (Upadhyay et al. 2011, Sharma et al. 2020, Beri et al. 2020, Kaur et al. 2019, Kaur et al. 2016a, Kaur et al. 2016b, Sharma et al. 2016).

5. CONCLUSION

Hemoglobin level is directly associated with iron intake. Haemoglobin concentration of non-vegetarians was significantly higher than vegetarians. This is due to high absorption of heme iron present in non-vegetarian products. The absorption of non-heme iron present in vegetarian foods can be improved by vitamin-C and acid base diet(Deuster et al., 1986). Female athletes participating in endurance sports are at higher risk of iron-deficiency anemia. It is recommended that endurance athletes should intake more iron than the general population (Nagamine 1979).The study concluded that not only vegetarians but also non- vegetarians female participating in endurance sports have to regularly control their iron statusby improve their dietary patterns regarding the content and bioavailability of iron while consuming foods.

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