DOI Number: 10.5958/2320-608X.2018.00117.8

Effect of Vegetarian and Non-Vegetarian Diet on Hematological Parameters among Young Adults of Uttarakhand

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ABSTRACT

There is a conspicuous shift in the dietary habits of the population worldwide owing to economic status, technological advances and advertisement bombardment shifting this paradigm towards non vegetarian lifestyle affecting health in general. The present study was thus conducted to explore the effect of vegetarian and non-vegetarian diet on hematological parameters. 150 healthy adults were recruited and anthropometric measurements viz; height, weight, BMI was taken along with dietary intake pattern assessment through 24 hours recall method. Blood samples were taken for estimation of hemoglobin, red blood cell count, haematocrit, white blood cell count, platelet count. The results showed high prevalence of Hb, RBC count, WBC count and Haematocrit in non-vegetarianism as compared to vegetarian. Anthropometric profile of non-vegetarian was higher as compared to vegetarian but statistically not significant. Also non-vegetarians exhibited high Hb, RBC count, WBC count and haematocrit as compared to vegetarians which revealed deficiency of important nutrients like iron, Vit-B_{12} among vegetarian population. Hence vegetarians must consume food fortified with the nutrients lacking in vegetarian diet to avoid the deficiency of the aforementioned nutrients in their body.

Keywords: *Vegetarian diet, non-vegetarian diet, hematological parameters, Vit-B_{12} deficiency, Folic Acid deficiency*

INTRODUCTION

There is an evident change in the dietary habits of the population worldwide. With the change in economic status the pattern of food consumption also changes noticeably. The vegetarian populations in most parts of the world do not consume meat owing to fiscal reasons. However, technological advances and advertisement bombardments shift this paradigm towards non vegetarian lifestyle[1]. Enormous social science literature is available which examines the factors that influence meat consumption behavior of individuals. Economic analysts devised sophisticated models used to project future demand for eclectic food types, including meat. They found population growth, economically mediated lifestyle changes and urbanization form key factors influencing global food consumption trends. Popkin BM suggested that rapid shift in habitual dietary intake along with market globalization has significant and inevitable impact on an individual's lifespan. Most people tend to ignore healthy eating habits subtly until the catastrophic health hazards become ominous[2].

Various studies have reported both the short terms as well as the long term advantages of adopting vegan lifestyle but most of them have chosen cohorts who are vegan for either religious reasons or differed in lifestyle habits from non-vegetarians. Moreover, most of the times vegans do not represent a homogenous group with cultural and religious nominations, moral beliefs related to animal rights, and health implications and environmental issues[3]. In India, dietary habits exhibit wide heterogeneity due to diverse socioeconomic and

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religious beliefs[4]. Also, vegetarianism has been attributed as a major cause of vitamin-B_{12} deficiency. A well-planned varied vegan diet is perfectly consistent with good health potentially minimizing risk of many chronic ailments[5]. However, care must be taken during times of extra nutritional demand for instance adolescence to ensure sufficient intake of energy, calcium, iron, and vitamins B_{12} and D[6]. The present study thus investigates the effects of vegetarianism and non-vegetarianism on different hematological parameters.

MATERIALS AND METHOD

Methodology

Study design: This cross sectional analytical study was designed to explore the effects of vegetarianism and non-vegetarianism on different hematological parameters. Volunteers; aged 16-25 years of both genders were selected from Himalayan Institute of Medical Sciences (HIMS), Dehradun. The research was carried out in the Department of Physiology, HIMS over a period of 12 months after obtaining written consent from all participants and approval by the institutional ethics committee.

Study population: Subjects were divided into two groups according to their dietary patterns; Non-vegetarians and vegetarians. Subjects were classified as non-vegetarians if foods of plant and animal origin, including meat, fowl, eggs, milk, other dairy products, and fish were included in their diet and vegetarians if foods of plant and milk and dairy products were included in their diet. Exclusion criteria includes unhealthy adults with any history of acute or chronic illness, bleeding and bleeding disorders, drug addiction and if they had donated blood within the previous 6 months were not included in the study. Pregnant women and those who had delivered within 3 months were also excluded.

Sample size: A sample size of 77 for each group was calculated through Cohen flexible algorithm using Fischer's 'F' distribution by comparing means between two group(s) with 'α'=0.05, 'β'= 80%, 'F'= 0.9 / 2 * 1 = 0.45 and effect size (es) which is difference b/w the two groups / 2 * within the group SD = 0.7

Measurement of anthropometric and hematological parameters

Standing height was recorded with bare feet on a wall mounted measuring tape to nearest of centimeters. Weight was recorded with bare feet with light cloths on a weighing machine. BMI is measured as the weight in kilogram divided by square of height in meters (Kg/m^2) based on Metric Imperial BMI formula. After taking antiseptic precautions samples were drawn from the ante-cubital vein were collected in 3ml EDTA vacutainers (Akuret, eastern medkit limited). The EDTA blood sample was processed using MS-9 automated hematology cell counter for obtaining various hematological parameters. Samples were processed on the same day within 3-5 hours of collection. Data collected was subjected to standard statistical analysis by SPSS software

Statistical Analysis

Dataset was analyzed using SPSS (Statistical Package for the Social Sciences; version 20.0 for Windows). Student's t-testwas used for comparing continuous variables which include weight, height, BMI, RBC, WBC, hemoglobin, hematocrit, and platelets between vegetarian and non-vegetarian groups.

RESULTS

Table 1: compares the difference between anthropometric (weight, height and BMI) and hematological parameters (WBC count, RBC count, hematocrit, hemoglobin, platelets) amongst vegetarian and non-vegetarian subjects. Anthropometric measures showed mean weight, height and BMI of non-vegetarian subjects on a higher side as compared to vegetarians but only weight showed differences statistically significant difference (p= 0.02). For hematological parameters, the means values of total WBC count (p=0.004), total RBC count (p=0.003), hematocrit (p=0.001), hemoglobin (p=0.001) were significantly higher in non-vegetarian subjects as compared to vegetarian subjects. There was no statistically significant difference between the mean values of platelet count of non-vegetarian and vegetarian subjects (p=0.9).

Table-I: Comparison of anthropometric and hematological parameters amongst vegetarian and non-vegetarian subjects

S.No	PARAMAETER	VEGETARIAN DIET (n=73) M ± SD	NON-VEGETARIAN DIET (n=77) M ± SD	'p' value
1.	Weight (Kg)	61.38 ± 9	65.01 ± 10.99	0.020
2.	Height (m)	1.59 ± 0.05	1.61 ± 0.05	0.090
3.	BMI (kg/m^2)	24.05±3.02	24.88±3.21	0.100
4.	**White blood cell count (10,000 cells/mm^3)**	6.73±1.58	7.43±1.37	0.004
5.	Red blood cell count (10,00,000 cells/mm^3)	4.35±0.56	4.66±0.71	0.003
6.	Hematocrit (%)	38.18±3.70	42.24±3.42	0.001
7.	**Hemoglobin (gm/dl)**	12.85±1.14	14.26±0.96	0.001
8.	**Platelet count (1,00,000 cells/mm^3)**	144.45±54.64	143.94±49.14	0.900

Data was presented as mean ± standard daviation (**M ± SD)**.Analysis was done using Student's't' test. $P<0.05$ is taken as statistically significant.

DISCUSSION

The practice of vegetarianism involves exclusion of all meat and animal products from the diet which may confer few health benefits due to fiber rich content and minimal quantity of saturated fat. But for actively growing children a strict vegetarian diet however enhances the risk of micronutrient deficiencies as these diets are poor micronutrients source thus escalating demand of essential micronutrients in childhood. It's noteworthy once the diet becomes more restrictive in case of strict vegetarians it is empirical to select, diversify and plan meals. In vegetarian diets iron and vitamin-B_{12} are present in traces as compared to non-vegetarian diets reasonably rich in meat, eggs and dairy products. It must be emphasized that although the iron content of vegetarian diet is typically similar to non-vegetarian diets, yet the bioavailability of iron is relatively on a lower side both due to unavailability of haem iron as well as high phytic acid content in plant food reduces it's availability. Globally iron availability is a prevalent nutrient deficiency and affects approximately two-third children in developing countries who typically receive homemade complementary foods which are poor sources of bioavailable iron. Even a high dietary iron intake perhaps does not assure optimum bioavailability, it is paramount to promote dietary practices which encourage iron absorption from plant food[7].

We found that non-vegetarians had significantly higher total white blood cell count as compared with vegetarians. This is in corroboration with Neubauerova E et al. who too discovered reduced white blood cell counts in younger as well as older vegetarians compared to non-vegetarians[8]. A similar significantly lower leukocyte count was elucidated by Haddad EH et al in vegans compared with non-vegetarians but vegans however did not differ from non-vegetarians in functional immunocompetence[9].This lower total white blood cell count in vegetarian might either reflect deficiency or reduced bioavailability of certain minerals and micronutrients which might be responsible for their normal production. The National Institute of Health's Office of Dietary Supplements states that zinc is an essential mineral for the development and activation of white blood cells and even mild to moderate zinc deficiency can lead to a low white blood cell count[10]. The bioavailability of zinc from vegetarian diets is lower than from non-vegetarian diets. In addition, vegetarians

typically eat high levels of legumes and whole grains, which contain phytates that bind zinc and inhibit its absorption[11].

Non vegetarians have higher hemoglobin concentration than ovo lacto and lacto vegetarians[4]. Experimentally a re-introduction of beef in the diets of beef eating group increased hemoglobin concentration and hematocrit as compared to vegetarian group during 12 weeks of resistive training ($P<.05$). These changes were appreciated within clinically normal limits. During a 12-week period of resistive training Elderly men who consume beef containing higher-bioavailable iron diet have elevated hematological profile as compared to vegetarian taking lower-bioavailable iron diet[12].

In general, people eating vegetarian diet had significantly lower red blood cell count in both young as well as old individuals as compared to non-vegetarian subjects[8]. We had similar results in our study depicting significantly high red blood cell parameters (RBC count, Haematocrit and Haemoglobin) in non-vegetarians as compared to vegetarians.

Dietary iron categorically exists in two forms: haem (haem iron is almost entirely found in foods of animal origin as haemoglobin and myoglobin) and non-haem. Rich sources of non-haem iron include cereals, vegetables, nuts, eggs, fish and meat. As a matter of fact dietary haem iron's availability for absorption is 2-6 times more than non-haem iron. On the contrary calcium, phytates in cereals and legumes, and phenolic compounds found in tea, coffee and other beverages bind with iron thus restricts its availability for absorption[13]. This subsequently reduces the delivery of iron to functional sites impairing iron-dependent functions such as erythropoiesis in vegetarian, leading to a decrease in hemoglobin concentration.

In our study, non-vegetarians had less platelet count than vegetarians but this difference between the two was statistically insignificant. Vitamin B_{12} and folic acid are required for healthy red blood cell formation within the bone marrow. Deficiency of these vitamins not only results in immature, malformed red blood cells known as pernicious anemia but also reduces platelet cell production[14]. Thus, vegans have to plan their dietary intake carefully to get satisfactory amounts of vitamin B_{12}. For instance ready to-eat breakfast cereals, fortified soy and other nondairy milks, some nutritional yeasts and meat analogs often contains added vitamin B_{12} should be consumed on a daily basis. With advancing age efficiency of vitamin B_{12} absorption reduces and supplementation eventually becomes necessary. Zinc intake furthermore should be scrutinized for vegans as meat forms the most bio-available source of zinc. And despite the fact that zinc deficiency is not a major issue as such, vegans should strive to meet the RDA for zinc from cereals, wheat germ, legumes, soy products and some vegetables.

Source of Funding - Self financed

Conflict of Interest - Nil

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