

# Megaloblastic anemia and non-vegetarian diet – Is there a changing trend?

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## ABSTRACT

**Background:** According to various studies, non-vegetarians are not at an inherent risk of developing megaloblastic anemia, a common deficiency of Vitamin B12. However, recent trends of the consumption of non-vegetarian food in the processed form as well as changes in cooking methods may gradually change the trend of the occurrence of megaloblastic anemia in non-vegetarians. Very few studies have been conducted on the same in a non-vegetarian population. **Objectives:** The objective of this study was to study the prevalence of megaloblastic anemia in a non-vegetarian population. **Materials and Methods:** The study was conducted on 100 non-vegetarian adults after due approval of the institutional ethics committee. The patients were evaluated on the basis of their hematological profile including peripheral smear examination and indices. **Results:** About 29% of total patients presented with features suggestive of megaloblastic anemia, of which 72% of patients agreed to predominantly be consuming non-vegetarian food from processed sources such as fast-food outlets at an average frequency of 3 weeks. **Conclusion:** There is a changing trend of megaloblastic anemia in the non-vegetarian population. Processing of food and change in conventional cooking practices along with the recent decline in home cooking of meat seem to be the major factors putting the non-vegetarians at a risk of developing megaloblastic anemia.

**KEY WORDS:** Megaloblastic Anemia; Vitamin B12 Deficiency; Peripheral Smear; Non-vegetarian


## INTRODUCTION

According to recent studies, 56% of the Indian population is anemic. Among various types of anemias, the number of reported cases of megaloblastic anemia, in particular, has increased drastically.<sup>[1]</sup>

Megaloblastic anemia is a common type of anemia in developing countries like India. It is characterized by a decreased hemoglobin level with elevated mean corpuscular volume (MCV). Common signs are pallor, fatigue, glossitis, and neurological disturbances.<sup>[2]</sup> The

principal cause of megaloblastic anemia is deficiency of Vitamin B12, a primary constituent of non-vegetarian dietary food. Deficiency of folic acid, pernicious anemia, diseases affecting the metabolism of vitamins, or the defect in DNA synthesis are also noted causes of megaloblastic anemia.<sup>[3]</sup> It is commonly seen in those who observe a strict vegetarian diet. A study conducted in India states that 80% of individuals having megaloblastic anemia were lactovegetarians.<sup>[4]</sup> In contrast to folate, the main source of Vitamin B12 in the human body is strictly food of animal origin such as liver, kidney, and meat. Cooking is believed not to have any major effect on vitamin activity;<sup>[5]</sup> however, recent studies indicate that microwaves and other newer ways of processing animal products tend to decrease their bioavailability.<sup>[6]</sup> Hence, Vitamin B12 deficiency is thought to be rare in meat consumers as the recommended daily allowance (RDA) is met easily.

In spite of this, in recent times, the newer practices of food processing, packaging, rise in fast-food consumption and

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patented, and undisclosed methods of food preparation by multinational companies could be putting the non-vegetarian group at a risk for megaloblastic anemia. Various studies have already established the prevalence and causes of it in vegetarians.<sup>[1-5]</sup> However, very few studies have been conducted on the same in a non-vegetarian population.

This study aims to find out whether there is a changing trend of megaloblastic anemia cases occurring in a non-vegetarian population.

### Objectives

The objectives of this study were as follows:

1. To study the prevalence of megaloblastic anemia in a primarily non-vegetarian population
2. To study whether non-vegetarians with hematological changes suggestive of megaloblastic anemia were consuming predominantly processed or unprocessed non-vegetarian food.

### MATERIALS AND METHODS

A cross-sectional study was conducted after due to approval from the institutional ethics committee, in a sample population of 100 consenting non-vegetarian adults in a crowded, urban setup. Those patients with any underlying pathologies that are known causes of macrocytosis such as alcoholic liver disease, hemolysis and bleeding, liver disorder, and hypothyroidism were excluded from the study after evaluation through meticulous history taking, clinical and pathological investigations.<sup>[7]</sup> Similarly, those undergoing pharmacotherapy<sup>[8,9]</sup> or taking Vitamin B12 supplementation were also excluded from the study. These apparently healthy males and non-pregnant females were selected to undergo a hematological profiling.

On the basis of their MCV, the patients were divided into three groups:

- a. The first group consisted of subjects with MCV <90 fL
- b. The second group consisted of subjects with an MCV between 90 and 100 fL
- c. The third group consisted of subjects with an MCV >100 fL.

The patients were further evaluated through peripheral smears and were screened for the presence of features suggestive of megaloblastic anemia such as hypersegmented neutrophils, Cabot's rings, macroovalocytes, basophilic stippling, Howell–Jolly bodies.<sup>[10,11]</sup> The patients presenting with features suggestive of megaloblastic anemia were subjected to a detailed questionnaire regarding their food habits and frequency of consumption of non-vegetarian food.

### RESULTS

Of a total of 100 patients screened, 31 were male and 69 were female, of which 33% of population were anemic and had a hemoglobin below 10.99 g/dl.

Further study was done by dividing the patients into three groups:

- a. Group A (MCV <90 femtoliter) comprised 63 patients consisting of 18 males and 47 females. On peripheral smear examination, it was revealed that in Group A, none of the patients presented with any features suggestive of megaloblastic anemia
- b. Group B (MCV 90–100 femtoliter) comprised 27 patients consisting of 9 males and 18 females. In this group, 19 patients showed features suggestive of megaloblastic anemia in the form of abnormalities on peripheral smear examination such as hypersegmented neutrophils, megaloblasts, Cabot rings, and basophilic stippling, of which 6 were male and 13 were female. These 19 patients were subjected to questionnaire since peripheral smear changes are the first signs of megaloblastic anemia and appear before the MCV increases
- c. Group C (MCV >100 femtoliter) comprised 10 patients consisting of four males and six females. In Group C, all 10 patients showed features suggestive of megaloblastic anemia on peripheral smear examination, of which three were male and five were female. All the patients in this group were subjected to questionnaire.

Thus, a total of 29 of the non-vegetarian patients presented with features suggestive of megaloblastic anemia. This is statistically significant with  $P < 0.001$ . These patients were subjected to a detailed questionnaire about their pattern of dietary habits [Table 1].

Of these 29 patients, 21 (72%) agreed to be predominantly consuming non-vegetarian food from processed sources such as outlets and fast-food chains in malls, at an average frequency of 3 times/week [Figure 1].

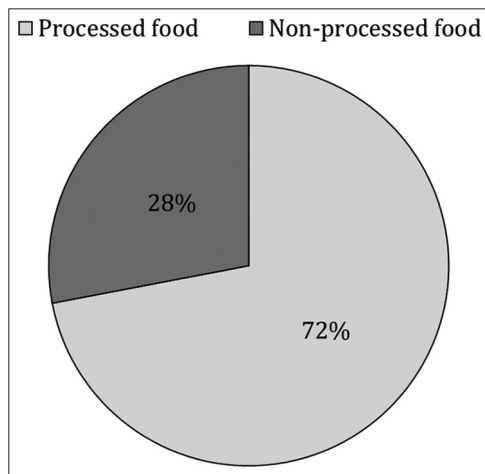
### DISCUSSION

In this study, it was found that 33% of the patients had a hemoglobin level below 10.99 g/dl. More so, 29% of the non-vegetarian patients, in spite of consuming non-vegetarian food at an average of 3 times/week, were affected by changes suggestive of megaloblastic anemia in the form of increased MCV (10% of cases) and morphological changes on peripheral smear (19% of cases). Of these 29% of patients, 72% of patients consumed processed non-vegetarian food. This is a significant finding considering that the non-vegetarians population has been inherently believed to not be at a risk of developing megaloblastic anemia.<sup>[4]</sup>

**Table 1:** Number of patients with features suggestive of megaloblastic anemia on peripheral smear

MCV (femtoliter)	Features suggestive of megaloblastic anemia		Total	Chi-square test	P-value	Significant at 5% level
	Not observed	Observed				
<90	63	0	63	72.658*	<0.001	Yes
90–100	8	19	27			
>100	0	10	10			
Total	71	29	100			

\*Statistically significant at 5% level, i.e.,  $P < 0.05$ . MCV: Mean corpuscular volume



**Figure 1:** Patients showing features suggestive of megaloblastic anemia consuming processed non-vegetarian food or unprocessed non-vegetarian food

Very few studies have been conducted to study the prevalence of megaloblastic anemia in the general population.<sup>[4]</sup> We could not find any similar study to compare our results of megaloblastic anemia and non-vegetarian diet leave alone the consumption of processed non-vegetarian food which is a recent trend. Vitamin B12 is an essential component of the human body. It is required for the DNA synthesis and cellular energy production.<sup>[12]</sup> It is essential for the proper maturation of red blood cells. The RDA of Vitamin B12 is 2.4 ug/day<sup>[13]</sup> and in those consuming good quality meat, this requirement should easily be met. Therefore, non-vegetarians have been conventionally considered to be a low-risk population to be affected by megaloblastic anemia due to abundant presence of this vitamin in food of animal origin such as kidney, muscle meat, liver, and heart.<sup>[1,2,4,14]</sup>

This study is an innovative one, having been designed after observations made during routine laboratory work. However, similar studies have not been carried out and there is a limitation of inability to compare it with other population groups across the world.

The earlier pattern of non-vegetarian food consisted of freshly bought meat that was cooked at home with good quality condiments and was consumed within a day. However, there has been a change in the habit of consumption of non-vegetarian food due to factors such as rise in price of meat,

modern cooking methods such as microwaves replacing tedious traditional methods, and lack of time. This has led to an incline in consumption of cheaply available meat, preserved for longer duration by freezing, and processed meat at malls and outlets in the form of burgers, pizzas, and others.<sup>[6]</sup> Popular brands with false advertising policies and undisclosed, patented methods of processing and the population’s preference to consume food outside may be the predisposing factors for the non-vegetarian population to be at a risk of developing megaloblastic anemia. All of the above factors could potentially be causing early changes of megaloblastic anemia in non-vegetarians.

**CONCLUSION**

There is a change in the trend of megaloblastic anemia in the non-vegetarian crowded, urban population as statistically evaluated by our study. The cause of this is attributed to the consumption of processed, packaged, preserved, and undisclosed patented methods of non-vegetarian food preparations by local vendors and multinational companies. We suggest further studies in different population groups for conclusively substantiating our findings. Dieticians and clinicians must stay vigilant about these rising number of cases of megaloblastic anemia in the non-vegetarian population.

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