

EFFECT OF AGEING ON HAEMOGLOBIN CONCENTRATION AND RBC COUNT

Dinesh J Parmar^{*}, Divyesh Prajapati^{**}, Upasana Jadeja^{**}, Piyush Makwana^{***}, Sadiya Campvala^{***}, Rajesh Mohan^{****}

^{*} Associate Professor, Physiology, GMERS medical college, Himmatnagar-383001

^{**} Assistant Professor, Physiology, GMERS medical college, Himmatnagar-383001

^{***} Tutor, Physiology, GMERS medical college, Himmatnagar-383001

^{****} Professor, Physiology, GMERS medical college, Himmatnagar-383001.

Background and Objective: Ageing is described as the process that reduces the number of healthy cells in the body; therefore, the body loses its ability to respond to a challenge to maintain homeostasis. Physiological changes occur with ageing in all organ systems. Ageing is among the greatest known risk factors for most human diseases. Ageing is heterogeneous and varies widely in different individuals. Our aim was to know the effect of ageing on various haematological parameters and to understand the cellular and molecular basis of age related changes. **Methods:** The study was conducted after the permission of Institutional Human Ethics Committee. It included 50 subjects of different ages from 20 years and above. Subjects were divided in five groups depending on their age. (1) 20-29 yrs (2) 30-39 yrs (3) 40-49 yrs (4) 50-59 yrs (5) \geq 60 yrs. 10 subjects were included in each group. The subjects who suffered any diseases were excluded. Hb concentration and RBC count were compared between all groups. **Results:** We observed statistically significant difference in Hb concentration and RBC count in all groups. Haemoglobin concentration and red blood cell count significantly lower in \geq 60 year age group compared to other group. **Conclusion:** Poor nutrition resulting in vitamin B12 and folic acid deficiency in old age might be the cause of early haematological changes and early ageing. Awareness about balanced diet probably slows the ageing processes.

Key Words: Ageing, Hb concentration, RBC count

Corresponding Address: Dr.Dinesh Jethabhai Parmar, Associate Professor, Physiology Department, GMERS Medical college, Himmatnagar. **Email Id:** parmardinesh1982@gmail.com

Introduction:

Ageing is described as the process that reduces the number of healthy cells in the body; therefore, the body loses its ability to respond to a challenge to maintain homeostasis. Physiological changes occur with ageing in all organ systems. Ageing is among the greatest known risk factors for most human diseases.¹ Of the roughly 150,000 people who die each day across the globe, about two thirds die from age-related causes. Ageing is not pathology; it is a fact of life.

Since ageing is a process that results from the accumulation of somatic damage, which increases the risk of mortality, there is a profound desire to assess the risk of mortality on the basis of laboratory parameters.² For many years, particularly in view of the increasingly ageing population in the Western world, haematologists have had a profound interest in researching the the pathophysiology and clinical relevance of anaemia in association with ageing. Despite the fact that numerous studies show a link between

lower haemoglobin levels and morbidity and/or mortality.³

Just as the immune system develops and matures with age, various haematological parameters have also been shown to change and develop with age although other factors such as genetics, sex, altitude, and life style may affect this process. Most of these factors vary depending on the population and geographical area studied. Reference values that have been validated for one country or age group cannot be assumed for application in populations from other countries.⁴ The full blood count is one of the most common investigations patients undergo, and has been available since the 1960s. In adults, reference ranges are the same for all ages despite evidence that erythrocyte count and haemoglobin concentration start to decline in men around 40 years of age; age-associated changes in women are less marked.⁵

It is possible that haematological profiles and their underlying factor structure may differ in younger versus older populations: age-related changes in both haemoglobin concentration and platelet

count are recognized.^{6,7} Ageing is heterogeneous and varies widely in different individuals. Our aim was to know the effect of ageing on Hb concentration and RBC count and to understand the cellular and molecular basis of age related changes.

Material and Methods:

The study was conducted after the permission of Institutional Human Ethics Committee. It included 50 healthy subjects of different ages from 20 years and above. Subjects were divided in five groups depending on their age. (1) 20-29 yrs (2) 30-39 yrs (3) 40-49 yrs (4) 50-59 yrs (5) ≥ 60 yrs. 10 subjects were included in each group. They were all healthy, asymptomatic, non obese, non smoker males with moderate built and non sedentary, moderately active life style. Method: Informed written consent was taken from each subject. Five millilitres of venous blood was withdrawn with minimum stasis into a clean disposable syringe 5 ml. The blood samples were stored in EDTA bulb. Hb concentration and RBC count were done using CBC Automatic Analyzer in pathology laboratory.

Statistical Analysis: Anova test was used to comparison of all groups. P value less than 0.05 was considered as significant

Result: 50 healthy male were participated in this study. Subjects were divided in five groups depending on their age. (1) 20-29 yrs (2) 30-39 yrs (3) 40-49 yrs (4) 50-59 yrs (5) ≥ 60 yrs. Hb concentration and RBC count were compared in all groups. There were insignificant difference in height and weight in all groups (Table-1). We observed statistically significantly difference of Hb concentration and RBC count in all groups. Haemoglobin concentration and red blood cell count significantly lower in ≥ 60 year age group compared to other group. (Table-2)

Table 1: Mean values for age, height, weight in different age groups

Age groups (in year)	Age(in year)	Height (cm)	Weight(Kg)
20-29	23.4 \pm 1.58	169.9 \pm 7.14	57.1 \pm 9.37
30-39	34.7 \pm 2.11	165.4 \pm 6.77	58.9 \pm 7.14
40-49	43.8 \pm 3.11	169.8 \pm 7.92	62.1 \pm 7.62
50-59	53.8 \pm 3.11	168.8 \pm 6.70	64.7 \pm 8.98

≥ 60	66.1 \pm 1.02	165.3 \pm 2.003	62 \pm 7.60
Mean and SD of all groups	44.3 \pm 15.23	167.86 \pm 6.54	60.96 \pm 8.30
p-value	p value <0.05	0.2814	0.275

Table 2: Hb concentration and RBC count in Different age groups

Age groups (in year)	Hb concentration	RBC count
20-29	14.8 \pm 1.17	5.03 \pm 0.46
30-39	13.51 \pm 0.97	4.98 \pm 0.83
40-49	13.8 \pm 1.31	4.84 \pm 0.71
50-59	13.46 \pm 0.89	4.78 \pm 0.41
≥ 60	12.65 \pm 0.70	4.24 \pm 0.46
Mean and SD of all groups	13.5 \pm 1.09	4.78 \pm 0.64
p-value	0.041	0.0316

(* Non significant p value >0.05)

Discussion: We observed statistically significantly Hb concentration and RBC count in all groups. Haemoglobin concentration and red blood cell count significantly lower in ≥ 60 year age group compared to other group. According to different studies^{8,9,10,11} the haemoglobin concentration, red blood cell count and haematocrit value began to decrease in men in their sixth decade and in women in their seventh decade and the change was more prominent with advancing age, especially in men.

Vellar OD et al¹² observed decrease in haemoglobin, haematocrit, MCHC values and reticulocyte count in old men and women. Van Oosterhout EC et al¹³ reported the significant decrease in haemoglobin values (7.4-10.5 mmol/l) and erythrocyte counts (3.8-5.5 x 10¹²/l). Ohhara Y et al¹⁴ assessed haematological parameters in the elderly and reported that red blood cell count (RBC), haemoglobin level (Hb), haematocrit value (Hct) showed a significant decrease in the older group. Suwannuruks R et al¹⁵ reported advancing age is associated with the decline of haemoglobin, red blood cell count, haematocrit and other parameters. Blain H et al¹⁶ reported red blood cell

count, haemoglobin concentration and haematocrit for the healthy aged showed the tendency of decreasing with ageing. Takubo T et al¹⁷ observed red blood cell count, Hb concentration and haematocrit for the healthy aged showed the tendency of moderate decreasing with ageing. These phenomena become more obvious by dividing the healthy aged into three groups 65-74 years, 75-84 years and over 85 years. Dr Preeti Jain et al¹⁸ studied in 30 cases of young adult subjects as a control group and 30 cases of elderly subjects as a experimental group. The mean age (in years) of young adult subjects was 35.83 ± 8.90 and for elderly subjects was 72.13 ± 7.25 . The mean Hb concentration in young adult subjects was 13.73 ± 1.45 gm % while in elderly subjects it was 12.27 ± 1.68 gm %. The Hb concentration decrease with age remarkably after 5th decade. This significantly decreases in 9 th decades. Mean TRBC count in young adults and elderly was 4.80 ± 0.40 million / mm³ of blood and 4.44 ± 0.82 million / mm³ of blood respectively. In our study, there is reduction in TRBC count with age. It is remarkable in 9th decade. The reduction from its values in young adult group. Padaliya et al¹⁹ observed that Haemoglobin, RBC count and Packed cell volume (PCV) among males in all age groups was found to be statistically significant ($p < 0.05$). The difference among males was highly significant in fifth decades.

"Genetic damage (particularly gene loss) is almost certainly a (or probably the) central cause of ageing. Hb values are affected by age, sex, pregnancy, disease & altitude. It has been suggested that Hb undergoes specific changes with age the alterations occur in content, structure and function of Hb within the ageing erythrocyte.^{20,21,22,23} Anaemia is common in the elderly and its prevalence increases with age. The increased incidence of anaemia with ageing has led to speculation that lower Hb levels may be a normal consequence of ageing. The most common causes of anaemia in the elderly are chronic disease and iron deficiency. The changes characteristic of the ageing erythrocyte involve a diminished cell size and increased cell density. Total red cell mass shows a significant diminution in elderly.

Conclusion:

The study was aimed to evaluate haematological parameters like Hb, RBC count in all groups to assess effect of ageing. In present study, the overall assessment shows that a significant decrease in Hb concentration and RBC count in old age. This study of blood and blood cells (haematological parameters) is the object of continuing intensive research of hematopoietic system to the functional integrity in ageing. Poor nutrition resulting in vitamin B12 and folic acid deficiency in old age might be the cause of early haematological changes and early ageing. Awareness about balanced diet probably slows the ageing processes. Further in depth studies with more sample size may provide a concrete point about it

Acknowledgment:

We sincerely acknowledge laboratory staff of pathology department of GMERS medical college, Himmatnagar.

References:

1. Dillin A, Gottschling DE, Nystrom T (2014) .The good and the bad of being connected: the integron of ageing. *Curr Opin Cell Bio.* 26:10712. doi:10.1016/j.ceb.2013.12.003. PMID 24529252
2. Kirkwood TB, Austad SN. Why do we age? *Nature.* ; 408:233–238, 2000 [Pubmed]
3. Zakai NA, Katz R, Hirsch C, et al. A prospective study of anemia status, hemoglobin concentration, and mortality in an elderly cohort: the Cardiovascular Health Study. *Arch Intern Med.* 2005 ;165:2214–2220, [Pubmed]
4. Menard D, Mandeng MJ, Tothy MB, Kelembho EK, Gresenguet G, Talarmin A. Immunohematological reference ranges for adults from the Central African Republic. *Clin Diagn Lab Immunol* 2003; 10:443–445.
5. Kelly A, Munan L. Haematologic profile of natural populations: red cell parameters. *Br J Haematol* 1977; 35:153–160. doi: 10.1111/j.13652141.tb00570.x, 1977 [Pubmed] [Cross ref]
6. Waalen J, Beutler E. The definition of anaemia: what is the lower limit of normal of the blood haemoglobin concentration? *Blood.* 2006 ; 107:147–150, [Pubmed]

7. Segal JB, Moliterno AR. Platelet counts differ by sex, ethnicity, and age in the United States. *Ann Epidemiol* 2006; 16:1231-30. doi:10.1016/j.annepidem.2005.06.052 [PubMed] [cross ref]
8. Kubota K, Shirakura OT, Toyoho M, Tamura S. Change in the blood cell counts with age. *Japanese Journal of American Geriatrics Society* 1991; 28, 4 (7): 509-514.
9. Yip R, Johnson C, Dailman PR. Age-related changes in laboratory values used in the diagnosis of anemia and iron deficiency. *The American Journal of Clinical Nutrition* 1984; 39: 427-436.
10. Dey D. Haematological Reference Ranges for Adults in Eastern India. Ashok Laboratory Centre for Transfusion Medicine and Clinical Research; [internet]. Available from: http://www.authorstream.com/Presentation/diganta_dey2006-1382161-haematological-reference-ranges-for-adults-in-eastern-india, 2006.
11. Shirakura T, Murai Y, Takeda T, Mori T. Changes of peripheral blood figures and erythropoiesis in the aged. *Japanese Journal of American Geriatrics Society* 1978; 15(2): 151-157.
12. Vellar O D. Studies on haemoglobin values in Norway. IX. Haemoglobin, hematocrit and MCHC values in old men and women. *Acta Med Scand* 1967; 182(6):681-9.
13. Van Oosterhout EC. et al. Are hematologic reference values applicable to the healthy elderly. *1 Ned Tijdschr Geneesk* 1989; 133(18):940-2.
14. Ohhara Y. et al. Longitudinal assessment of haematological parameters in the elderly. *Nippon Ronen Igakkai Zasshi* 1994; 31(7):548-53.
15. Suwannuruks R. et al. Hematologic parameters in Thai subjects over 50 years old. *J Med Assoc Thai*; 80 Suppl 1997; 1:576-80.
16. Blain H. Determination by flow cytometry of reference values of erythrocyte parameters in aged subjects 2001; 30(16): 779-84.
17. Takubo T, Tatsumi N. Reference values for hematologic laboratory tests and hematologic disorders in the aged. *Rinsho Byori*; 48(3):207-16, 2000.
18. Jain P, Jain R, Shah C, Trivedi RS, Jain AK, Jindal M, Dixit R. A Prospective Study for Comparison of Hematological Parameters in Healthy Young Adult and Elderly Age Group Subjects. *NJIRM* 2013; Vol. 4(3): 78-84.
19. Padalia MS, Trivedi RS, Panchal P, Jani H. Effect of ageing on various haematological parameters. *IJBAR* 2014; 5(10):494-495.
20. Lou Isbell. Physical changes in ageing, October, 1985
21. Edward I. et al. Ageing and geriatrics medicine: biology of ageing 1992; 2: 212-217.
22. Ajmani RS. et al. Hemorheological changes during human ageing. *gerontology* 1998; 44(2):111-120.
23. Nilsson-Ehle H, Swolin B, Westin J. Bone marrow progenitor cell growth and karyotype changes in healthy 88-year-old subjects. *Eur J Haematol* 1992; 55:14-8.

Disclosure: No conflicts of interest, financial, or otherwise are declared by authors