

# SERUM FERRITIN LEVELS IN APPARENTLY HEALTHY SUBJECTS

Pages with reference to book, From 63 To 66

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## Abstract

Serum ferritin levels were estimated in 78 normal subjects (46 males and 37 females) using radio-immunoassay techniques. The mean serum ferritin level in normal men was 83 ng/ml (range 7.4 - 190.0 ng/ml), compared with 43 ng/ml (range 5.1 — 104 ng/ml) in normal women. The difference in the mean ferritin level between the two sexes was significant. A concentration below 10 ng/ml was associated with a low transferrin saturation (< 15%) in both males and females (JPMA 37: 63, 1987).

## INTRODUCTION

The determination of ferritin in serum by radioimmunoassay is a promising new means to assess body iron stores. In healthy adults the concentration of ferritin in serum is directly related to the available storage iron in the body,<sup>1-3</sup> It also reflects iron stores in iron deficiency and iron overload states and can be useful in diagnosis and monitoring of patients with these disorders<sup>3-6</sup>. This study was undertaken to evaluate the concentration of serum ferritin in apparently healthy subjects and to establish the normal ranges both in males and females.

## MATERIAL AND METHODS

A total of 78 apparently healthy subjects were studied. These included the attendants of the patients and medical and laboratory staff of the Research Centre and Hospital. Blood samples were drawn from these subjects for the estimation of hemoglobin, serum iron, total iron binding capacity (TIBC) and serum ferritin.

Hemoglobin was estimated by the Cyanmethemoglobin method and packed cell volume (PCV) by microhematocrit technique. Serum iron and total iron binding capacity were estimated by the method of Both well and Finch (1962). Serum ferritin concentration was measured by radioimmunoassay (RIA) technique using ferritin RIA kit (Amersham International Limited, U.K.). The kit provides a sensitive and convenient assay for the measurement of ferritin in serum over the approximate range of 0 to 1000 ng/ml. A set of quality control sera (Amersham U.K.) were also analysed with each assay. Each assay was performed in duplicate serum samples and the radioactivity was counted in Multi detector computerised Gamma counter (Model 1612 - NE) using 4 parameter non linear curve fitting model.

## RESULTS

Seventy eight subjects in this study included 46 males and 32 females. Their ages ranged from 16 to 48 years and 17 to 50 years, respectively. The mean age in males was 27.28, (SE 1.49) and in females 27.37 (SE 1.64) years. Majority of males (58.69%) and females (59.37%) were in the age group of 21 to 30 years.

**TABLE – I**  
**Serum Ferritin Concentration in Normal Males**  
**and Females at various Age Groups.**

Age (years)	Males Mean $\pm$ S.E. (No)	Females Mean $\pm$ S.E. (No)
1 – 10	Nil	Nil
11 – 20	84.8 $\pm$ 22.69 (10)	50.24 $\pm$ 14.36 (5)
21 – 30	81.23 $\pm$ 9.26 (26)	39.87 $\pm$ 5.78 (19)
31 – 40	98.75 $\pm$ 24.49 (4)	41.3 $\pm$ 19.04 (5)
41 – 50	93.6 $\pm$ 23.28 (5)	59.8 $\pm$ 26.02 (3)

Table I shows serum ferritin concentration (Mean  $\pm$  SE) in males and females at various age groups. Highest mean for serum ferritin in males was found in age group 31 to 40 years and in females 41 to 50 years. The lowest mean for serum ferritin in both groups was found in the age group 21 to 30 years. One male aged 70 years had a ferritin level 33 ng/ml.

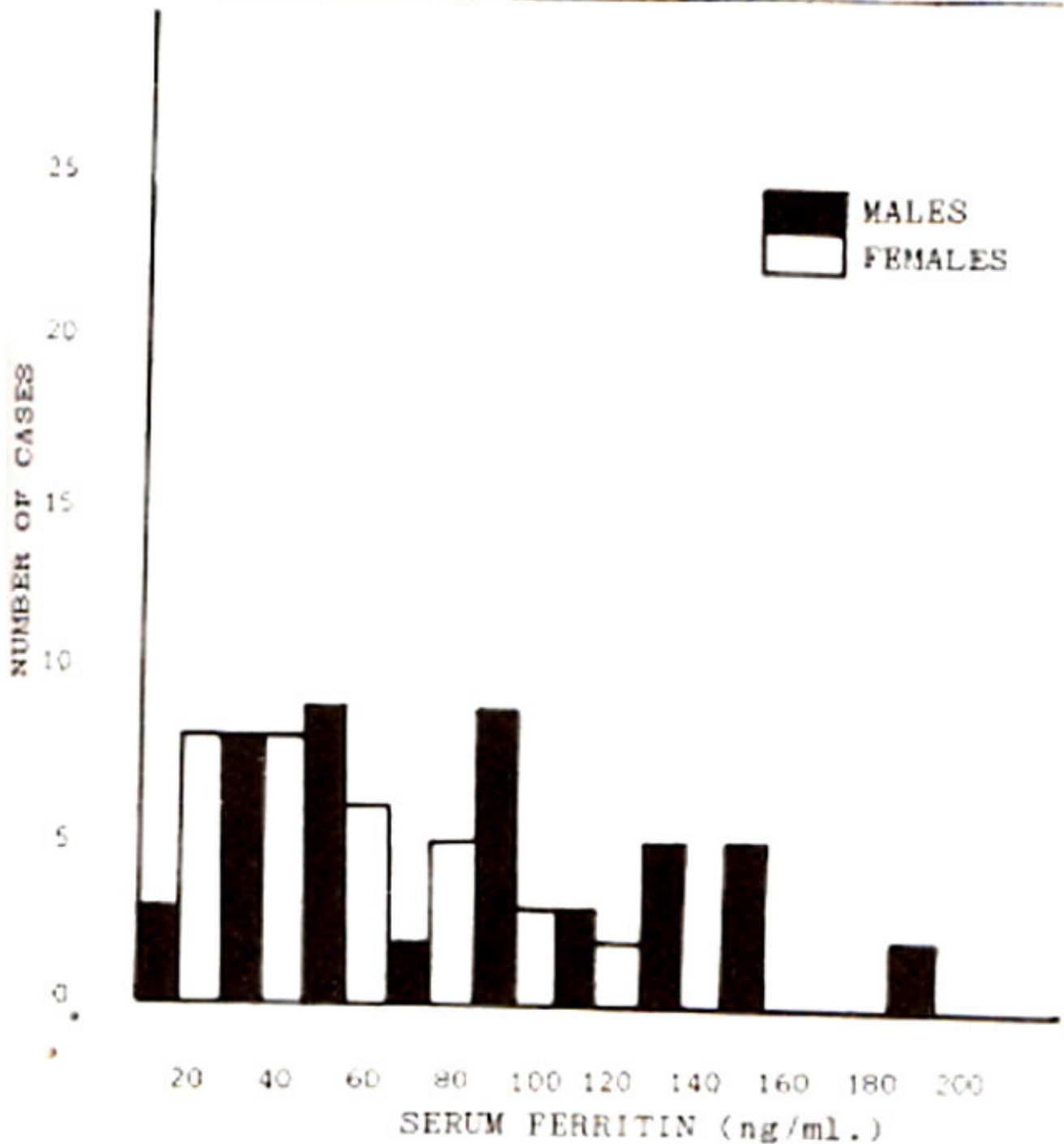
Hematological data in normal males and females is shown in Table II.

**TABLE – II**  
**Hematological Data in Normal Males and Females.**

	Males Mean $\pm$ S.E. (No)	(Range)	Females Mean $\pm$ S.E. (No)	(Range)
Ferritin (ng/ml)	83.82 $\pm$ 7.40 (46)	(7.4 – 190)	43.58 $\pm$ 5.37 (32)	(5.1 – 104)
Hb. (G/dl)	14.15 $\pm$ 0.20 (46)	(12.0 – 16.0)	12.49 $\pm$ 0.17 (32)	(9.4 – 14.5)
PCV. (%)	42.61 $\pm$ 0.65 (46)	(30.0 – 52.0)	37.03 $\pm$ 0.53 (32)	(27.0 – 43.0)
MCHC (%)	33.30 $\pm$ 0.23 (46)	(25.0 – 38.4)	33.72 $\pm$ 0.11 (32)	(33.09 – 35.0)
Iron (ug/dl)	92.97 $\pm$ 4.44 (46)	(37.5 – 167.6)	81.46 $\pm$ 5.02 (32)	(46.6 – 140.0)
TIBC (%)	348.41 $\pm$ 7.46 (46)	(262.0 – 506.0)	351.90 $\pm$ 13.66 (32)	(180.0 – 540.0)
Transferrin saturation(%)	27.16 $\pm$ 1.15 (46)	(7.40 – 42.2)	23.77 $\pm$ 1.38 (32)	(7.58 – 34.30)

There was a significant difference ( $P < 0.01$ ) in mean ferritin levels between the two sexes. Although the mean serum iron and percent saturation of transferrin was low in females but the difference was statistically insignificant. Mean hemoglobin levels were also significantly low ( $P < 0.001$ ) in females.

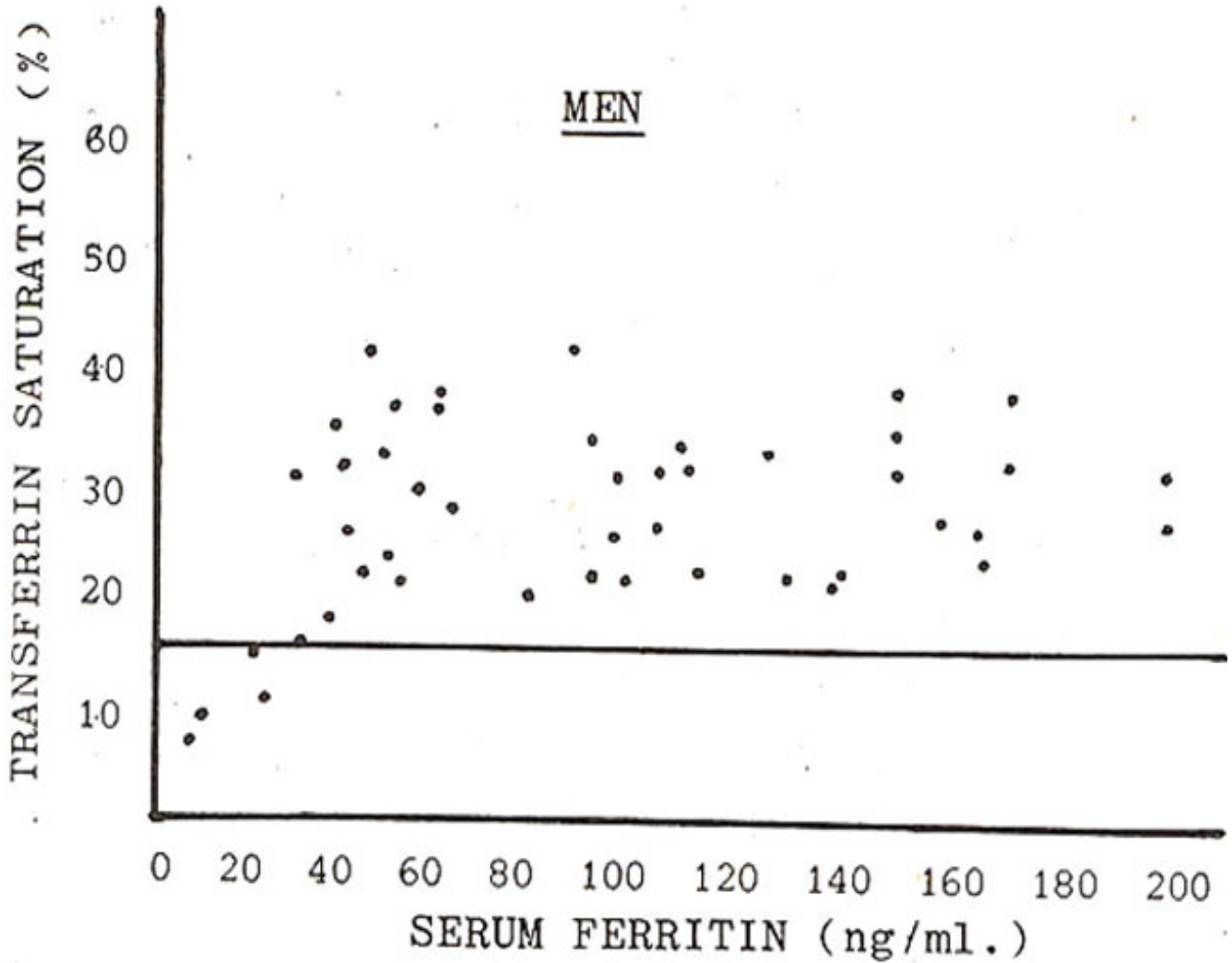
## SERUM FERRITIN CONCENTRATIONS IN NORMALS.



**Figure 1. Serum Ferritin concentrations in normals.**

Figure I shows the frequency distribution of serum ferritin in males and females. There is a skew distribution in both sexes. The serum ferritin concentration ranged from 7.4 to 190 ng/ml in males (mean 83.82, SE 7.4) and from 5.1 to 104 ng/ml in females (mean 43.58, SE 537). Ferritin levels below 12 ng/ml were found in 7 (8.97%) subjects (2 males ÷ 5 females).

Four of them (2 males and 2 females) were found to have ferritin levels below 10 ng/ml. All these subjects had transferrin saturation below 15% and serum iron (except in one) below 50 ug/dl. Ferritin levels above 100 ng/ml were found in 15 (32.6%) males and 2(6.25%) females. The levels were 104 ng/ml in these two females. There was no correlation between serum ferritin and transferrin saturation but in both sexes a serum ferritin concentration below 10 ng/ml is associated with a transferrin saturation less than 15% (Figure 2).



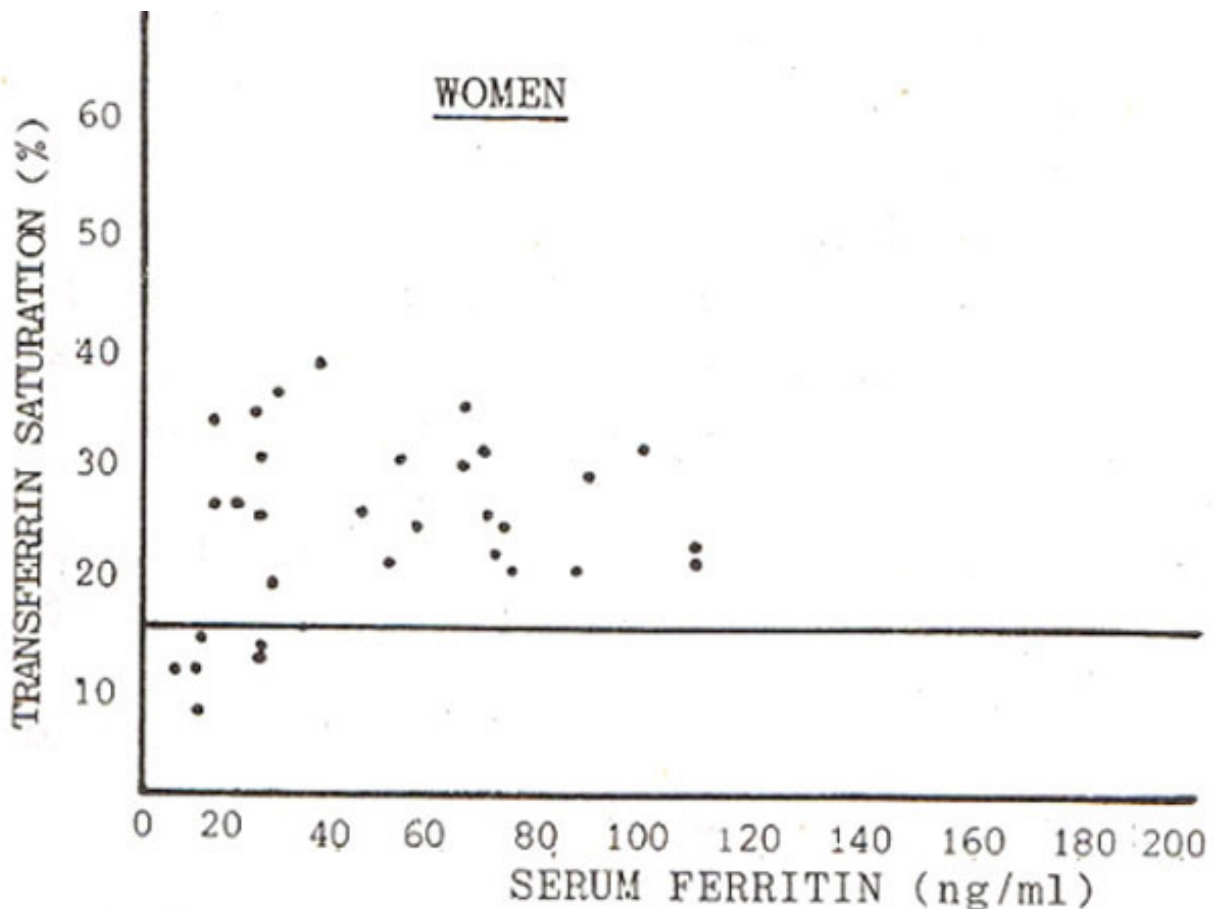


Figure 2. Serum Ferritin concentrations and Transferrin Saturation in normals (men and women).

A significant negative correlation between ferritin and TIBC was found in both males ( $r = -0.469, P < 0.001$ ) and females ( $r = -0.324, P < 0.05$ ).

## DISCUSSION

Ferritin has generally been regarded as an intracellular compound but latter it has been reported that it is normally present in the circulation<sup>6-7</sup> It has been suggested that circulating ferritin in peripheral blood is derived from the iron FEMALES stores present in reticuloendothelial cells. The well defined range of serum ferritin concentrations implies a fairly steady influx, and this may result either from an active process of excretion by reticuloendothelial cells or by passive release as moribund cells reach the end of their normal lifespan. Ferritin iron forms a reserve which can be drawn on when necessary for the synthesis of hemoglobin or other iron containing compounds. This is of particular importance in states of negative iron balance and under these conditions storage iron is mobilized and eventually entirely depleted.

The concentration of ferritin in the serum of normal individuals is directly related to body iron stores<sup>1-3</sup>. The difference in serum concentration in males and females found in this study reflects the known difference in storage iron levels<sup>1,3,6,8,9</sup>

In men there is an increase in serum ferritin levels with age<sup>9</sup>. A merely three fold rise in serum ferritin level occurred between 15 and 25 years of age. Beyond that age values continued to increase in males

at a rate of 13 ng/ml yearly. In contrast serum ferritin values in females remained low until age 45, at which time a similar increase was observed which continued at a rate of 1.8 ng/ml yearly, paralleling the rise in men<sup>10</sup> In this study, similar effects of age on serum ferritin levels were seen though the sample size was very small in some age groups; the mean levels in women remained lower than men at all ages and there was also a progressive increase in serum ferritin levels in both adult males and post-menopausal females.

The serum ferritin levels found in normal subjects of this study closely resemble those reported by other workers (Table III).

**TABLE III**  
**Serum Ferritin Levels in Healthy Subjects of Other reported Studies.**

Studies	Males		Females	
	Mean (No. of subjects)	(Range)	Mean (No. of Subjects)	(Range)
Jacobs <sup>6</sup> et al (1972)	69.2 ng/ml (75)	(6-180)	34.8 ng/ml (44)	(3 - 162)
Jacobs <sup>1</sup> et al (1975)	123.0 ug/L (280)	-	56.0 ug/L (153)	-
Cook <sup>3</sup> et al (1974)	94.0 ng/ml (174)	(27 - 329)	34.0 ng/ml (152)	(9 - 125)
Cook <sup>10</sup> et al (1976)	94.0 ug/L (240)	(34 - 196)	25.0 ug/L (370)	(7 - 140)
Finch <sup>9</sup> et al (1977)	127.0 ug/L (803)	(66-244)	46.0 ug/L (812)	(19 - 107)
Prieto <sup>8</sup> et al (1975)	176.0 ug/L (13)	(110-300)	49.0 ug/L (15)	(13 - 125)
Siimes <sup>5</sup> et al (1974)	Median 140.0 ng/ml	-	39.0 ng/ml	-
Present series	83.0 ng/ml (46)	(7.4-190)	43.0 ng/ml (32)	(5.1-104)

Although reported means and ranges for serum ferritin in normal subjects vary considerably there is general agreement that the reference interval for male is significantly higher than for females and that a serum ferritin (ug/ml) serum ferritin value less than 10 ng/ml is associated with iron deficiency<sup>3,5,6,8,9</sup> Similar<sup>11</sup> findings were noted in present series. Differences in mean levels might be the result of differences in the iron status of different populations. In this study ferritin levels less than 10 ng/ml are associated with transferrin saturation less than 15%, presumably because of impaired iron delivery to the plasma pool. This level therefore marks the lower limit of storage iron adequate to meet the demand of erythropoiesis<sup>6</sup>. The upper limit of normal serum ferritin concentration is a little more difficult to define. In both men and women there is a skew distribution and some subjects may have usually high levels of serum ferritin.<sup>6,12</sup> In present series no normal subject was found to have serum ferritin concentration higher than 200 ng/ml and very few women had levels above 100 ng/ml.

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