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ASSESSMENT OF TOTAL BINDING CAPACITY AND HAEMATOCRIT VALUE AMONG MALE AND FEMALE PATIENTS OF FEDERAL MEDICAL CENTRE MAKURDI, BENUE STATE

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ABSTRACT

Background and Objectives: Total Iron Binding Capacity (TIBC) is a vital blood test used for analysis, measuring how much iron the blood protein, transferritin can transport indicating how the body can carry iron and also aid in the diagnosis of iron deficiency anemia and other disorders of iron metabolism. Haematocrit is a vital component of a complete blood count (CBC). It measures the percentage of red blood cells (RBCs) in the total volume of blood. Total Iron Binding Capacity and Haematocrit Value remain global public health concerns, particularly among male and female patients. The aim of the study was to assess total iron binding capacity and haematocrit levels among male and female patients of Federal Medical Centre Makurdi, Benue State. **Materials and Methods:** A total number of 50 male and female patients were recruited for the study, comprising of 25 male and 25 female patients. The study was conducted using a cross-sectional design. 5 mL of whole blood was collected from each patient venepuncture and was dispense into a plain container and Ethylendiamine tetracetic acid. The coagulated blood in the plain container was spun to retrieve the serum and the serum was stored at -20°C in another plain tube. Serum iron and unsaturated iron binding capacity were analyzed by Spectrophotometric method while Haematocrit value was obtained using the Microhematocrit Method. **Results:** From the results of the study, P-value was shown to be lesser than 0.05 ($P<0.05$) in haematocrit, and greater than 0.05 ($P>0.05$) in Total Iron Binding Capacity. It can therefore be said that there were statistically significant values among the means of the different age and gender groups for haematocrit; and there were no

statistically significant values among the means of the different age and gender groups for Total Iron Binding Capacity. It further shows that the Mean±SD of Haematocrit for females (18-19 years), females (20-29 years), males (18-19 years) and males (20-29 years) were 33.50±4.212, 34.53±4.547, 45.25±4.583, and 42.59±4.251 respectively. While for TIBC, it was 314.30±50.526, 329.27±44.682, 335.13±40.304, and 318.18±61.580 respectively. One-way ANOVA was used to compare the means and see if the results revealed at least one that differed from the other. **Conclusion:** The Null hypothesis which states that there is no significant difference in total iron binding capacity and haematocrit levels between male and female patients is therefore accepted, and the Alternative hypothesis of the study rejected. Hence, the study concludes that Haematocrit and Total Iron Binding Capacity levels were elevated in males and decreased in females.

KEYWORDS: Total Binding Capacity, Haematocrit Value, Male and Female Patients

INTRODUCTION

Total Iron Binding Capacity (TIBC) or sometimes transferritin binding iron capacity is a vital test used for diagnosis or analysis of iron deficiency anemia and other disorders of iron metabolism. TIBC measures the maximum amount of iron that can be bound by proteins in the blood primarily transferritin. Transferritin can bind two atoms or ferric iron with high affinity. Total Iron Binding Capacity ranges from 240 - 450 mcg/dL, though varies by gender and laboratories. It measures how well transferritin carries iron (body's protein). Iron Binding Capacity reflects the capacity of the blood to transport iron and is an indirect marker of transferritin level. Elevated TIBC can indicate iron deficiency, while depreciated TIBC may suggest iron overload or chronic inflammation conditions.

Gender-related differences in iron metabolism are widely recognized and are shaped by physiological factors such as menstrual blood loss in females, as well as variations in muscle mass and blood volume between males and females. Recognizing these distinctions is crucial for the proper assessment of iron status and associated health conditions. Although numerous physiological and biochemical parameters differ between genders, the extent and nature of changes in serum iron-binding capacity have not yet been clearly defined.

A Total Binding Capacity (TIBC) test measures the blood capacity to bind itself to iron and transport it around the body. A transferritin test is similar to this. Measurements of total iron-binding capacity (TIBC) and haematocrit are valuable in diagnosing iron-deficiency anaemia

and chronic inflammatory diseases, and they are also useful as screening tools for other clinical conditions such as iron overload, liver disease and pregnancy.

MATERIALS AND METHODS

Study area: The study was carried out from June to November, 2025 at Federal Medical Centre Makurdi, Benue State. It is located in the NorthCentral geopolitical zone of Nigeria. The native language is tiv, idoma, nyifon, itilo, igede which lies between Latitudes 7.7322'N and Longitude 8.5391'E.

Study population: A total number of 50 patients from Federal Medical Centre Makurdi, Benue State were used for the study, comprising of 25 male patients and 25 female patients.

Selection criteria:

- Inclusion criteria
- Patients who gave their consent
- Patients not on folic acid or iron supplement
- Patients who did not eat within 8 hours before sample collection

Exclusion criteria:

- Patients who did not give their consent
- Patients on folic acid or iron supplement
- Patients who ate within 8 hours before the sample collection

Ethical approval/consideration: Before the beginning of the study, ethical approval was obtained from the Ethical and Research Committee of Federal Medical Centre Makurdi, Benue State.

Informed consent: Individual consent was sought for and obtained from the subjects prior to sample collection.

Sample collection: The 5 mL of whole blood was collected from each patient venepuncture and was dispense into a plain container and Ethylendiamine tetracetic acid. The coagulated blood in the plain container was spun to retrieve the serum and the serum was stored at -20°C in another plain tube.

Method of analysis: Serum iron and unsaturated iron binding capacity were analyzed by Spectrophotometric method. Haematocrit value was then obtained using the Microhematocrit Method.

RESULTS

Table 1: Mean±SD of Haematocrit and Total Iron Binding Capacity (TIBC) of the various age groups.

	Female (18-19 years)	Female (20-29 years)	Male (18-19 years)	Male (20-29 years)
Haematocrit (%)	33.50±4.212	34.53±4.547	45.25±4.583	42.59±4.251
TIBC (µg/dl)	314.30±50.526	329.27±44.682	335.13±40.304	318.18±61.580

Table 2: One-way ANOVA comparison of Mean±SD of Haematocrit and Total Iron Binding Capacity (TIBC) of the various age groups.

		Sum of Squares	df	Mean Square	F	Sig.
Haematocrit Value (%)	Between Groups	2261.458	3	753.819	39.166	<.001
	Within Groups	1847.702	96	19.247		
	Total	4109.160	99			
TIBC (µg/dl)	Between Groups	5815.882	3	1938.627	.727	.538
	Within Groups	255908.758	96	2665.716		
	Total	261724.640	99			

Table 3: Post hoc tests for multiple comparisons using Least Significant Difference (LSD) among the various age groups. LSD

Dependent Variable	(I) Age group	(J) Age group	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
Haematocrit Value (%)	Female-18-19	Female-20-29	-1.033	1.266	.417	-3.55	1.48
		Male-18-19	-11.750	1.471	<.001	-14.67	-8.83
		Male-20-29	-9.088	1.236	<.001	-11.54	-6.63
	Female-20-29	Female-18-19	1.033	1.266	.417	-1.48	3.55
		Male-18-19	-10.717	1.358	<.001	-13.41	-8.02
		Male-20-29	-8.055	1.099	<.001	-10.24	-5.87
	Male-18-19	Female-18-19	11.750	1.471	<.001	8.83	14.67
		Female-20-29	10.717	1.358	<.001	8.02	13.41
		Male-20-29	2.662	1.330	.048	.02	5.30
	Male-20-29	Female-18-19	9.088	1.236	<.001	6.63	11.54
		Female-20-29	8.055	1.099	<.001	5.87	10.24
		Male-18-19	-2.662	1.330	.048	-5.30	-.02
TIBC (µg/dl)	Female-18-19	Female-20-29	-14.967	14.904	.318	-44.55	14.62
		Male-18-19	-20.825	17.317	.232	-55.20	13.55
		Male-20-29	-3.876	14.550	.790	-32.76	25.00
	Female-20-29	Female-18-19	14.967	14.904	.318	-14.62	44.55
		Male-18-19	-5.858	15.983	.715	-25.87	37.58
		Male-20-29	11.090	12.933	.393	-14.58	36.76
	Male-18-19	Female-18-19	20.825	17.317	.232	-13.55	55.20
		Female-20-29	5.858	15.983	.715	-25.87	37.58
		Male-20-29	16.949	15.653	.282	-14.12	48.02

	Male-20-29	Female-18-19	3.876	14.550	.790	-25.00	32.76
		Female-20-29	-11.090	12.933	.393	-36.76	14.58
		Male-18-19	-16.949	15.653	.282	-48.02	14.12

DISCUSSION

The results of the study showed that Haematocrit and TIBC levels were increased in males and reduced in female patients. The lower Total Iron Binding Capacity and Haematocrit values among female patients may be attributed to several factors, including poor dietary iron intake, and increased iron requirements during puberty and adolescence. The findings revealed significant differences in Haematocrit Values between males and females, with males generally having higher values. This aligns with existing literature, which suggests that males typically have higher Haematocrit levels due to higher testosterone levels, which stimulate red blood cell production.

The mean Total Iron Binding Capacity value was higher among male patients compared to female patients, which is consistent with previous studies. The Total Iron Binding Capacity values, however, did not show significant differences across gender and age groups. This suggests that while iron-binding capacity remains relatively consistent across the patients population, other factors such as diet, menstrual health in females, and genetic factors might influence Haematocrit levels more prominently,

The higher prevalence of iron deficiency and anemia among female patients is a major public health concern, particularly in developing countries where iron-rich foods are scarce and iron supplements are not readily available. Menstrual blood loss, poor dietary iron intake, and increased iron requirements during puberty and adolescence may contribute to the higher prevalence of iron deficiency and anemia among female patients.

Additionally, the study highlights the importance of regular health screenings and targeted nutritional interventions, especially for female patients who may be at higher risk of iron deficiency anemia due to menstruation. These findings underscore the need for health education programs that promote iron-rich diets and awareness about anaemia.

CONCLUSION

From the results of the study, P-value was shown to be lesser than 0.05 ($P<0.05$) in haematocrit, and greater than 0.05 ($P>0.05$) in Total Iron Binding Capacity. It can therefore be said that there were statistically significant values among the means of the different age and gender groups for haematocrit; and there were no statistically significant values among the means of the different age and gender groups for Total Iron Binding Capacity. In the tests

of homogeneity of variances for both Haematocrit and Total Iron Binding Capacity based on mean and median showed that the variance of haematocrit and Total Iron Binding Capacity were not statistically significant different (P>0.05). Therefore, the Null hypothesis which states that there is no significant difference in total iron binding capacity and haematocrit levels between male and female patients is therefore accepted, and the Alternative hypothesis of the study rejected. Hence, the study concludes that Haematocrit and Total Iron Binding Capacity levels were elevated in males and decreased in females.

SIGNIFICANCE STATEMENT

The study investigated iron binding capacity and haematocrit levels among male and female patients of Federal Medical Centre Makurdi, Benue State. The findings revealed significant differences in Haematocrit Values between males and females, with males generally having higher values, indicating a potential risk of iron deficiency anemia and chronic inflammatory diseases. Conversely, total iron binding capacity and haematocrit levels were higher in menstruating females, suggesting the body's compensatory response to menstrual blood loss.

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