AN ANALYTICAL STUDY TO EXPLORE IRON STORES IN A POPULATION OF NOWSHERA BASED ON AGE AND GENDER PERSPECTIVE

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ABSTRACT:

OBJECTIVES:

To analyze the impact of age and gender on iron stores in a population of the Nowshera region.

METHODOLOGY:

This cross sectional study was conducted in the Department of Pathology Qazi Hussain Ahmed Medical Complex Nowshera from 1st January 2019 to 31st March 2020. All patients were selected by convenience sampling in the Pathology department irrespective of age and gender. Both descriptive and inferential statistics were applied to analyze data by the latest SPSS version 25.

RESULTS:

Out of the total study population males were 70 (27.1%) and females 188 (77.9%) with median age 30 years. The median ferritin level was 12.8 ng/ml. Out of total, 142 (55%) of cases were with serum ferritin less than 15ng/ml. A significant (p=0.03) gender based median ferritin level difference was observed with 1.5 times more probability of low iron stores in females as compared to males (OR=1.5). No statistically significant difference in body iron stores exists in different age groups.

CONCLUSION:

A significant difference was noted in the iron stores in gender groups and the probability of depleted/low iron stores was higher in female gender as compared to male gender in all age groups in our population.

KEYWORDS: *Gender, Iron Stores, Serum Ferritin Levels, Anemia Children*

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INTRODUCTION:

Iron deficiency anemia (IDA) is a global issue more common in the third world countries including Pakistan. Although the prevalence of IDA is declining, still Iron deficiency continues to be the top ranking cause of anemia in children, women and adults worldwide, both in the developed and developing countries[1]. In Pakistan a study from Thatta Sindh, reported 63% prevalence of the Iron deficiency in women in their child gearing age[2]. Iron deficiency (ID) and iron deficiency anemia (IDA) can affect an individual‟s emotion, cognition, and development as iron is responsible for many enzymatic activities in the body and is related to development of normal milestone[1]. Serum ferritin is indirect measure of total body iron store. Exhaustion of these stores leads to Iron deficiency anemia. It is a

predictor though not a gold standard for diagnosis of IDA[3]. The determination of serum ferritin by in-vitro is done to assess body iron stores. However, it is also an acute phase reactant and is the only drawback of this indicator that would otherwise exhibit as gold standard for IDA. In adulthood ferritin concentration is directly related to the iron storage in the body. Serum ferritin concentration has the highest sensitivity and specificity to detect iron deficiency anemia. A study from Armed Force Institute of Pathology reported ferritin as gold standard for diagnosis of IDA with sensitivity of 63.5% and specificity of 38% with diagnostic accuracy of 49.4% in their target population[4]. In female gender, gestational age is most often associated with exhaustion of iron store and if not given iron therapy can result in morbid outcome in the form of iron deficient babies. In Pakistan the female gender in their reproductive age and children less than 5 years have been reported to be the most iron-depleted segment of our population[5]. Females of reproductive age and children under 5 years have been shown to be the most IDA affected population segment. Habib et al, reported IDA 47% in children aged 2-6 years, female age 17-21 years in a prevalence study covering 7491 individuals[6]. Serum ferritin in the third trimester is clinically associated with the maternal outcome bad or good. There is a significant correlation between maternal serum ferritin levels when compared with parameters like birth weight, occipetofrontal circumference (OFC) and height. When maternal serum ferritin is <15 ng/ml, the babies delivered are usually mentally deficit and physically poor with low birth weight, baby height and head circumference (OFC)[7]. Present study was therefore designed to analyze the impact of age and gender on iron stores in a population of Nowshera.

METHODOLOGY:

This cross-sectional study was conducted in the Department of Pathology Qazi Hussain Ahmed Medical Complex Nowshera from 10th January to 31st December 2019. Sample size was calculated using Open-epi software. The sample size of 258 was calculated to represent the true population with absolute precision of (5%) and confidence level of 95%, taking the anticipated proportion of serum ferritin, of 45.5% from a study by Khan N et al published in Pakistan Armed Force Medical Journal[8]. Ethical approval for the survey was obtained from the Ethical Review Committee and from the Department of Research and Development, Nowshera Medical College. The inclusion criteria were all individuals irrespective of age and gender received for serum ferritin levels, in the department of Pathology. While the exclusion criteria were all candidates taking oral or IV iron therapy for their already diagnosed IDA. Two milliliters of blood was drawn from everyone, by veni-puncture under aseptic conditions. Blood in the gel bottle was stored for ferritin analysis. Blood was centrifuged. Serum Ferritin was measured by electro-chemiluminescence immunoassay using Roche Cobas E411 Chemistry Analyzer, using commercial kits of Roche diagnostics as per the instructions of the manufacturer. For calibration, we used 3 ferritin standards (corresponding to ferritin levels of 10, 250, and 1000 ng/ml) as per the instructions of the manufacturer. Patients were categorized in three categories based on serum ferritin levels. Analysis of serum ferritin levels based on the recommendations of the WHO[9].

1. IDA: less than 15 ng/ml
2. Normal: 15.1-150 ng/ml
3. Iron loaded: >150 ng/ml

Data was entered on SPSS version 25. The normality of data was assessed using the Shapero-wilk test. The quantitative variables were presented as mean with SD or median and range depending on the distribution of data. Categorical variables were represented with percentages. Mann Whitney U test was applied to show the difference of ferritin in age and gender groups. Chi square test was used to show the association of iron stores in gender and age groups.

RESULTS:

The total number of patients was 258. Out of the total sampling, 70 (27.1%) were males and 188 (77.9%) females. The age and levels of ferritin distribution was in a skewed pattern (p-0.0001, Shapiro-wilk test). The median ferritin level was 12.8ng/ml, ranging from minimum of 1.86 to maximum of 2000ng/ml (Table 1). Out of total, 142 (55%) of cases had serum ferritin <15ng/ml (Table 1). The median level of the serum ferritin in male gender was significantly higher than female patients with p-value of 0.03 (Table 2). We observed an increase in iron stores in male gender and depleted ferritin levels were noted in the female gender (p-0.017) (Table 3). Furthermore, a risk of two times was noted to have low iron stores in female gender as compared to male gender (OR-2, 95%CI: 1.12-3.55) (Table 4). Likewise, the distribution of iron stores in different age groups is mentioned (Table 5) with a non-significant p-value (p-0.994).

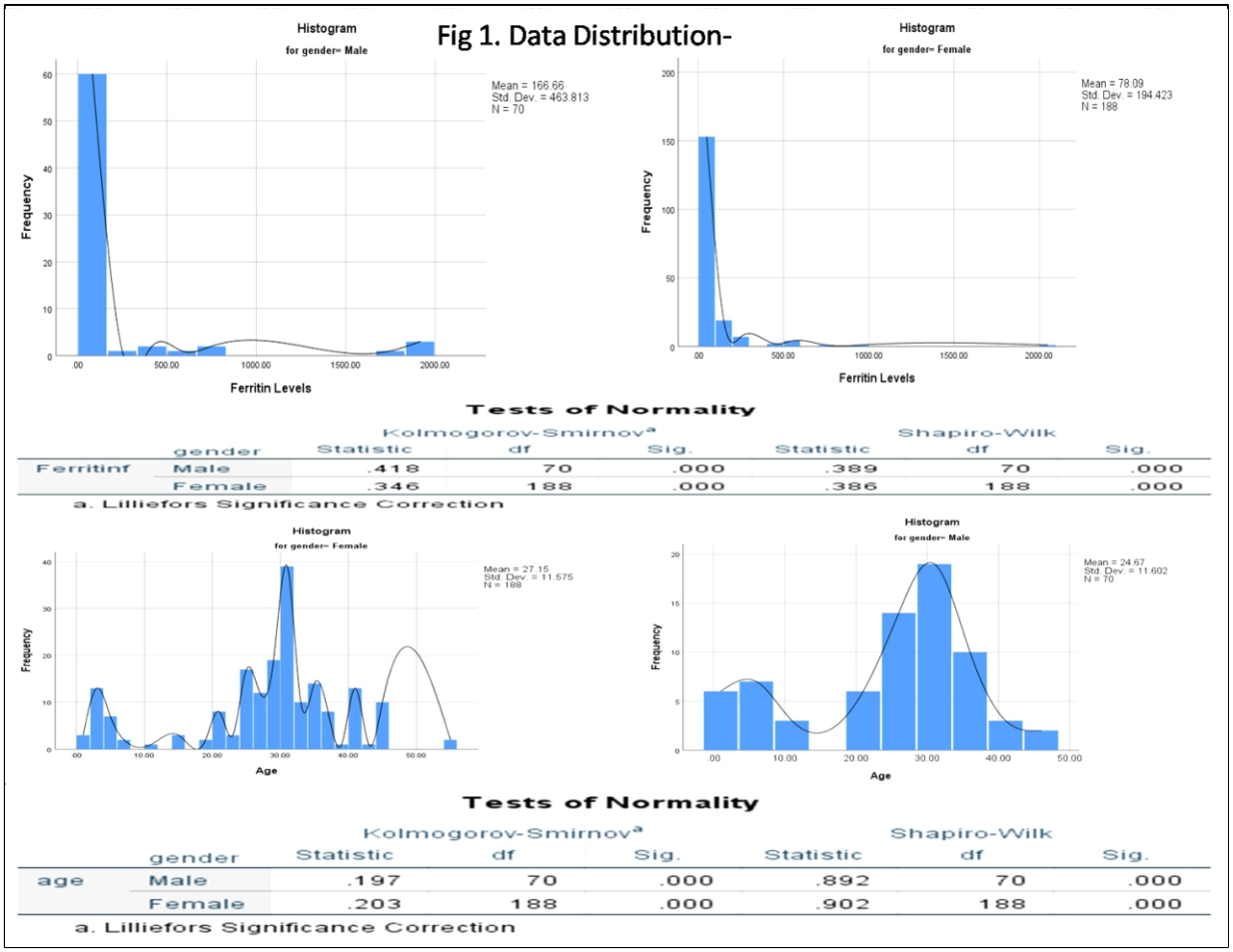

Figure 1: Data Distribution

Table 1: Categories of Iron Stores in Patients Based on Serum Ferritin

	Frequency	Percent	Cumulative Percent
Less than 15ng/ml (IDA)	142	55.0	55.0
15.1-150ng/ml (Normal)	81	31.4	86.4
>150ng/ml (Loaded)	35	13.6	100.0
Total	258	100.0	

Table 2: Non-Parametric Test (Mann Whitney U Test) Showing Distribution of Iron Stores in Gender Groups

Gender		Number of Patients	Median	Mann Whitney U Test
Ferritin	Male	70	12.80	0.032
	Female	188	10.60	
	Female	188	25.00	

Table 3: Chi Square Test to Show the Association of Iron Stores in Gender Groups

		Ferritin Categories		Total	Chi-Square Test (P-Value)
		Ferritin <15ng/ml	Ferritin >15ng/ml		
Gender	Male	47	23	70	0.017
	Female	95	93	188	
Total		142	116	258	

Table 4: Risk Estimate

	Value	95% Confidence Interval	
		Lower	Upper
Odds Ratio for Gender (Male/Female)	2.00	1.12	3.55
For Cohort Ferritin Category=Ferritin <15ng/ml	1.32	1.07	1.65
For Cohort Ferritin Category=Ferritin >15ng/ml	0.66	0.46	0.95
N of Valid Cases	258		

Table 5: Chi Square Test to Show the Association of Iron Stores in Different Age Groups

		Ferritin Categories		Total	Chi-Square Test (P-Value)
		Ferritin Less Than 15ng/ml	Ferritin More Than 15ng/ml		
Age Categories	<5 Year	17	14	31	0.994
	6-18 Year	8	7	15	
	19-35 Year	94	75	169	
	26-55 Year	23	20	43	
Total		142	116	258	

DISCUSSION:

Serum Ferritin level estimation is a cost effective and indirect measurement of iron stores in the body. We observed a skewed distribution of ferritin levels in our population ranging from 1.86ng/ml (minimum) to 2000ng/ml (maximum). Likewise 142 (55%) of total cases had serum ferritin less than 15ng/ml. The median ferritin level was 12.8ng/ml. A study reported showed that more than 505 of their target population were having iron stores less than 20 ng/ml,[10] that were in concordance with our findings. The median values of serum ferritin of the male gender (12.8ng/ml) were significantly higher than female gender (10.6 ng/ml±11) (p-0.004). Abuaisha M et al[11], reported the prevalence of iron deficiency in 57.5% females and 7.6% in males with 192 (87.67%) cases with serum ferritin less than 15ng/ml. Another study published in Reprod Health reported ferritin less than 13ng/ml in 41% in antenatal woment[12-14]. They also suggested that it would be worthwhile to assess the ferritin levels in antenatal visits amongst the anemic patients. The difference in Means±SD of serum ferritin in our target population for male gender (205.66ng/ml±587.5) was statistically significant with the Mean±SD ferritin of female gender (75.38ng/ml±217.32) with p-value of 0.004. Apparently, the low levels of the ferritin values in women have been reported representing iron deficiency in female gender. Reference ranges need to be evaluated based on gender of the specific geographical location and history of iron intake and menstrual and gestational history[15,16].We also observed the probability of iron deficiency was 1.5 times more in female gender as compared to male gender (OR=1.5). Another regression analysis from Jordan reported that Ferritin deficiency was observed in 55.8% of the female study population,[15,17] that matches our findings (58.9%). Similarly, their regression analysis showed female gender 2.5 times more at risk ($p<0.05$, OR=2.5) of low iron stores as compared to their counterparts. In present study we did not find a significant difference in iron stores in different four age groups as mentioned in our study. Our study correlated with other researchers however a study from Rawalpindi suggests serum ferritin as the best indicator and predictor of IDA in children/pediatric groups irrespective of gender[18].

CONCLUSION:

It is concluded that serum ferritin is a good predictor for diagnosis of iron deficiency anemia. Female gender has more probability of acquiring iron deficiency anemia and low iron stores. A high proportion of sampling 142 (55%) had serum ferritin levels less than 15ng/ml. It is recommended that as IDA is more common in female gender therefore all the females attending the antenatal care services in tertiary and secondary care hospital with Hb% less than 11g/dl must be screened for serum ferritin levels and remedial action may be taken well in time to combat iron deficiency in pregnancy especially in third trimester to avoid the fetal thirst for iron and to avoid neonatal morbidities and mortalities associated with IDA.

CONFLICT OF INTEREST: None

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