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Reference Ranges and Gender Differences in Blood Parameter Establishment at Dental Institutions: A Prospective Study

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ABSTRACT

Gender differences in haematological variables were shown to be considerable in the majority of this research as such, determining this difference and estimating the population's reference range are crucial. The goal of the current study was to establish a range of comparison for the general population as well as to evaluate the haematological variations in several blood parameters between males and females. The research was organised on a total of 250 patients with 125 males (50%) and 125 females (50%) in the haematology laboratory of the institution. 20 µl of capillary blood obtained by puncturing the skin over a finger was introduced into 100 µl of diluent. The contents of diluent are sodium sulfate, sodium chloride, a buffering agent, EDTA, formaldehyde, 1pyridone-2-sulphur a with pH of the 6.2-7.6. The study shows that the mean values of red blood cells, Haemoglobin, Haematocrit, mean corpuscular volume and Mean corpuscular Haemoglobin were statistically substantially reduced in men compared to females ($p < 0.001$), and that the mean values of MCHC were considerably lower in females than in males (). PLT and PCT, two haematological markers, were marginally higher in females than in men, with statistically significant findings at $p < 0.05$. Compared to only reporting cell counts, the CBC provides a wealth of detailed information about every blood cell. Even if there are new molecular analysis-based diagnostic and prognostic techniques available today, it's still crucial to recognize the significance of the tests that doctors have been prescribing for decades. Our research would contribute to the updating of current data on blood variables, their reference range, and gender variance at the regional level.

Keywords: Gender, Heamogra, Hematocrit, WBC, RBC, Platelet

INTRODUCTION

General practitioners have long utilized the complete blood count (CBC) to evaluate the health of both ill and well patients. Because CBC is simple, inexpensive, and readily available, it is

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frequently used to evaluate, identify, and assess the anticipation of conditions like anaemia, coagulation disorders, blood donor screening, and infections and/or hematologic malignancies. (1)

An appropriate diagnosis, treatment planning, or other physiological evaluation is made by comparing observed results from a patient's or person's laboratory tests with a reference interval. (2) A reference interval is usually predetermined for almost every experiment conducted in a clinical laboratory. The gap between values observed and the reference range serves as a guidance for a clinician's decision-making process. (3)

Numerous studies have looked at hematologic characteristics in various populations, including subgroups based on ethnic background, gender, race and even season. Gender differences in haematological variables were shown to be considerable in the majority of this research as such, determining this difference and estimating the population's reference range are crucial. (4,5) The goal of the current study was to establish a range of comparison for the general population as well as to evaluate the haematological variations in several blood parameters between males and females.

MATERIAL AND METHODOLOGY

The research was organised on a total of 250 patients with 125 males (50%) and 125 females (50%) in the haematology laboratory of the institution. Patients with age of 20 to 60 years appearing for dental procedures and who were free of systemic diseases were included in the study based on convenience sampling method. The research was done for a course of seven months from March to November, 2023. 20 µl of capillary blood obtained by puncturing the skin over a finger was introduced into 100 µl of diluent. The contents of diluent are sodium sulfate, sodium chloride, a buffering agent, EDTA, formaldehyde, 1pyridone-2-sulphur a with pH of the 6.2-7.6.

Utilizing a tiny amount of sample suction, the fully automated blood cell counter PCE 210 was used to perform CBC, which included a WBC-differential and a reticulocyte count. It took only 1 minute to get the parameter measurements and histograms. Electrical impedance, otherwise referred as the Coulter principle, is the primary concept used in cell counting. One cell at a time can travel through the tiny opening that separates the two electrodes while whole blood is transferred between them. (4) The cells are passed through an orifice individually employing hydrodynamic focusing. They are exposed to a laser throughout this procedure, and the light that is dispersed is calculated from different directions. Absorbance was also measured. The amount of absorbance, the rate of the light that is dispersed, and the colorimetric method of measuring haemoglobin may all be used to identify the cell. (5)

The differential WBC count and hemogram are the two parts of the complete blood count (CBC). The hemogram analyses platelets, RBCs, and WBCs. Also, it enables the assessment of RBC indices, haematocrit, and haemoglobin. The various WBC types are included in the differential WBC count. Hemograms and differential WBC counts work together to help diagnose, treat, and predict the outcome of many bleeding illnesses. (6,7)

The current research included statistical analysis that is both descriptive and inferential. Mean

± SD was used to provide the findings of continuous data, whereas number (%) was used to give the results of categorical measurements. A value of 0.05 or less was deemed statistically significant, with the fixed degree of importance set at p=0.05.

IBM SPSS statistics 20.0 was the statistical program utilised to examine all of the study's variables.

RESULTS

Table 1 lists the average values of the obtained haematological parameters. The average readings of haematological parameters between males and females were analysed, and it indicated statistically important findings with specific parameters utilising unpaired t test (Table 2).

Figure 1 shows that the mean values of red blood cells, Haemoglobin, mean corpuscular volume, and Mean corpuscular Haemoglobin were statistically substantially lower in men than in females (**p < 0.001**), and that the mean values of Mean corpuscular Haemoglobin concentration were considerably lower in females than in males (**p < 0.05**). Platelet and Plateletcrit, two haematological markers, were marginally higher in females than in men, with statistically significant findings at **p < 0.05** (Figure 2)

Table 1: Mean values of haematological parameters

Variables	Mean	SD
White blood cells	5.5864	1.5643
Lymphocytes	4.6752	1.6329
Granulocyte	2.78524	0.9542
Red blood cells	6.0438	2.7517
Haemoglobin	13.365	3.9424
Haematocrit	34.328	8.539
Mean corpuscular volume	78.867	12.648
Mean corpuscular Haemoglobin	28.715	5.283
Mean corpuscular Haemoglobin concentration	32.934	1.947
Red cell distribution width	13.459	1.136
Platelet	249.62	91.681

Plateletcrit	2.5487	1.1738
Mean platelet volume	11.762	1.526

Table 2: Analysis of different parameters amongst males and females

Variables	Mean		SD		P value
	Male (50%)	Female (50%)	Male (50%)	Female (50%)	
WBC	5.5693	5.7404	1.41623	1.76464	0.431
LYM	4.6871	4.7354	1.97513	1.98998	0.272
GRA	1.9571	2.1207	0.71702	0.77178	0.188
RBC	6.7306	6.0103	3.68114	1.94242	0.00
HB	14.3933	12.4334	3.62328	3.86172	0.03
HCT	38.2049	32.0465	8.45234	7.75814	0.04
MCV	81.2301	76.7005	12.98352	12.46623	0.00
MCH	30.2442	27.9293	5.04556	5.29646	0.02
MCHC	32.9920	32.0939	2.31046	1.63112	0.01
RDW	13.8362	13.9935	1.33869	0.94334	0.369
PLT	234.87	261.49	93.308	90.424	0.00
PCT	2.22834	2.26273	1.105365	1.117285	0.04
MPV	11.4663	11.4260	1.73612	1.73776	0.617

DISCUSSION

It is crucial for accurate interpretation of the CBC findings to have a complete understanding of the reference values of the Red blood Cells and White Blood cells in both males and females. It is a well-established fact that there are gender disparities in haematological profiles; males have a greater RBC profile than females, as another research have also revealed. Similar to a study that examined sex and cultural variations in WBC and PLT counts, females showed greater platelet counts than males. The underlying processes behind the well-known sex disparities in adult Hb levels are most likely due to the direct effects of sex hormones, including both androgens and oestrogen, on erythropoiesis. There is no proof that females have less cellular processes for heme production, while there is no distinction in the way males and females absorb iron.

There are no significant gender variations in pre-pubertal human RBC counts, Hb levels, or serum ferritin concentrations. After menstruation begins, there is a disparity between men and women in haematological variables that lasts for ten years beyond the menopause. Menstruation and dietary consumption are the two primary causes of females decreased Haemoglobin, iron, and red blood Cell counts in accordance to males. Since Haematocrit, mean corpuscular volume, mean corpuscular Haemoglobin, and Mean corpuscular Haemoglobin concentration are reliant on the levels of red blood Cells and Haemoglobin, decreased levels of these parameters in females are the cause of the following decline in these parameters.

Our study's results were in line with research by Pekelharing et al and Wakeman et al. that demonstrated a statistically significant decrease in the reference intervals for Haemoglobin, Red blood cells, Haematocrit, mean corpuscular volume, and Mean corpuscular Haemoglobin concentration in females compared to men, but an increase in Platelet and Plateletcrit. There was no discernible variation in the WBC characteristics between the sexes. The average values of Haemoglobin, Red blood cells, Haematocrit, mean corpuscular volume, and Mean corpuscular Haemoglobin concentration are greater in men, whereas platelet are higher in females, according to a study by Rui Qiao21 on 1259 Han people from North China. Male and female PLT counts were comparable up to the age of 14, but as age increased, female PLT counts consistently outpaced male PLT counts, as per Ginevra Biino et al.

A deeper comprehension of normal and abnormal blood parameter levels is necessary since distinct metrics can be employed as separate biomarkers to assess the prognosis of patients with different pathologic diseases. A greater chance of coronary artery disease is linked to higher concentrations of RBC and HCT. In addition to being a reliable indicator of peripheral vascular disease, MPV may also be used to identify inflammation in peripheral arterial disease patients. When diagnosing individuals with gastric cancer compared to those with intestinal metaplasia, RDW and PLT count are useful tools. Biomarkers MCV and RDW have the potential to serve as predictive indicators for patients diagnosed with endometrial cancer.

Few research have been conducted in the literature about the relationship among blood parameters and mouth lesions. A study by Ramesh et al. found that compared to controls, 40 samples of Oral sub mucous fibrosis patients had considerably lower levels of Haemoglobin, Red blood cells, and Platelet and 20 higher levels of WBC and ESR. Therefore, it is suggested that the patients undergo haematological studies as this might help with early illness identification and prognosis.

To the greatest of our understanding, there isn't much information available on how blood parameters change in oral lesions. Therefore, it's important to do these studies so that clinicians are informed about how blood parameters vary by age, gender, ethnicity, and geography in various oral lesions. In this study, the whole Hemograms of males and females were analysed, and a reference interval was established for the same. In order to use the results, the test need to be run on a larger sample size. This would provide a more accurate estimation of the test, making it simpler to determine whether the sample is representative and to extrapolate the findings.

CONCLUSION

Compared to only reporting cell counts, the CBC provides a wealth of detailed information about every blood cell. Even if there are new molecular analysis-based diagnostic and prognostic techniques available today, it's still crucial to recognize the significance of the tests that doctors have been prescribing for decades.(9) Although these blood parameters are unlikely to offer definitive diagnostic or therapeutic information, when interpreted and applied appropriately, they can offer easily accessible, affordable, and practical data that can support and direct clinical decision making. Updates to reference intervals on a regular basis are necessary to improve connection with both wellness and disease situations. Our research would contribute to the updating of current data on blood variables, their reference range, and gender variance at the regional level. (10)

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