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Original Article

Haematological Reference Values in Adults from Rural South Libya: A Cross-Sectional Study in Wadi Shatti

Ramadan M. Elkalmi[1,2],

[1]Faculty of Medicine, University of Sebha, Sebha, Libya

[2] Adjunct lecturer, School of Medical Sciences, Department of Pharmacy, Libyan Academy for Postgraduate Studies, Tripoli, Libya.

Correspondent Author :Email: ram.elkalmi@sebhau.edu.ly

Abstract

Background: This study aimed to evaluate the hematological profile of adults residing in rural South Libya, with a focus on identifying potential health concerns and establishing localized reference values for key blood parameters.**Methods:** A descriptive cross-sectional study was conducted from August to December 2023 across three western villages in Wadi Shatti, Libya: Edri, Timssan, and Al Mansoura. A total of 165 individuals were randomly selected. Complete Blood Count (CBC) tests were performed, and data were analyzed using IBM SPSS Statistics for Windows, version 23. The analysis focused on five hematological parameters: hemoglobin (Hb), red blood cell count (RBCs), hematocrit (Hct), mean corpuscular volume (MCV), and platelet count.**Results:** Out of 161 valid CBC reports, the mean hemoglobin concentration was 13.9 g/dL, with 28.7% of participants exhibiting Hb levels below 12 g/dL. Statistically significant gender-based differences were observed, with males showing higher Hb levels than females ($p < 0.001$). Smokers demonstrated elevated Hb and RBC levels compared to non-smokers ($p < 0.001$). The mean MCV was 83.28 fL, with females showing higher values than males ($p = 0.041$). Hematocrit levels were significantly higher among males and smokers ($p < 0.001$).**Conclusion:** The findings reveal notable variations in hematological parameters based on gender and smoking status. These results emphasize the importance of developing region-specific reference values and conducting further studies to enhance understanding of hematological health in the Libyan population.

Keywords: Hematological profile; Libya; adult population; rural health; Wadi Shatti

Introduction

A hematological profile typically consists of a complete blood count (CBC), which measures the number and size of different types of blood cells, and a blood smear, which examines the shape and appearance of blood cells under a microscope. Depending on the purpose and the results of these tests, a hematologist may also order additional tests, such as a bone marrow biopsy, a blood enzyme test, a coagulation test, or a hemoglobin test [1-3]. The importance of the haematological profile is that it can help diagnose and monitor various blood disorders, such as anaemia, infection, haemophilia, leukaemia, and blood-clotting disorders [4]. Moreover, help assess the overall health and well-being of a person, as blood plays a vital role in transporting oxygen and nutrients, regulating the body's balance of water and acidity, and fighting off disease[1]. haematological profile It can help evaluate the effects of certain treatments, such as chemotherapy, radiation, blood transfusions, and medications, on the blood and its functions [1, 3]. It can help identify potential risk factors for cardiovascular diseases, such as heart attack and stroke, by measuring the levels of certain enzymes and proteins in the blood [2]. Unfortunately, Currently, Libya, as an African developing nation, uses reference values for hematologic and immunologic indices that are derived from data gathered for populations residing in industrialized nations [5]. The reports proved to be different from those used and extracted from the data of citizens of industrialized countries.

On the few, previous studies indicate differences in the normal values of the blood file indicators of African countries compared to those of developed countries, which may be attributed to many factors such as ethnicity, gender and several other barometric indicators. Therefore, this study was carried out to examine the profile of haematological constituents of blood among in adult urban population

Materials and Methods

Study Design and Location

Between August and December 2024, a descriptive cross-sectional study was conducted to assess key hematological parameters among adult residents of the western villages of Wadi Shatti, Libya—specifically Edri, Timssan, and Al Mansoura.

Sampling Technique and Participant Selection

Throughout the study duration, a total of 165 individuals residing in the villages of Edri, Timssan, and Al Mansoura within Wadi Shatti, Libya, were randomly selected from among patients attending Edri General Hospital (EGH). Participant inclusion was independent of age, gender, or clinical status, and all individuals had been referred by their attending physicians for Complete Blood Count (CBC) testing.

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Instrument and Data collection

To fulfill the study's objectives, the research team developed a tailored data collection instrument designed to record all routinely assessed hematological parameters, as prescribed by physicians and analyzed in standard medical laboratories. Prior to data acquisition, the team formally briefed the staff at Edri General Hospital (EGH) regarding the study's aims and ethical considerations. Complete Blood Count (CBC) results were retrieved directly from hospital records, with all data anonymized to ensure participant confidentiality and compliance with ethical research standards.

Statistical analysis:

Data analysis was performed using the Statistical Package for Social Sciences (IBM SPSS Statistics for Windows, version 23, Armonk, NY: IBM Corp). Descriptive statistics, including percentages, frequencies, and mean scores, were used to present demographic variables. For the hematological profile, mean, median, standard deviation, and reference intervals were calculated, with the normal reference range defined as the mean ± 2 standard deviations (SD). Given that the hemoglobin profile data followed a normal distribution, comparisons of hemoglobin means across different age groups and demographic variables were conducted using Student's t-tests and one-way analysis of variance (ANOVA), as appropriate.

Results

During the two-month study duration, a total of 161 complete blood count (CBC) reports were gathered. To eliminate age-related variations in blood references, eleven reports (n=11) from individuals below 18 years old were excluded. The demographic details of the participants are outlined in Table 1. The majority of responses (n=102, 68.0%) originated from Edri village, followed by Timassan (n=33, 22.0%) and Alminsurah with n=15 (10.0%). Females outnumbered male subjects (61.3% vs. 38.7%). The mean age of participants was 35+8.6 years (median, 33 years). The study revealed that slightly over one-third (57, 38.0%) of participants fell within the age group of 31-40 years old. Among females, approximately half of them reported being pregnant (n=41, 44.5%). Overall, while the majority of study respondents (n=109, 72.7%) did not disclose their smoking status, a significant number admitted to being smokers (n=26, 28.2%).

In this study only five haematological parameters were studied; haemoglobin (Hb), red blood cell count (RBCs), haematocrit (Htc), mean corpuscular volume (MCV), and platelets. As the primary objective of this study was to answer general public concerns and fears about blood haemoglobin levels.

Examining the outcomes of the Hb study, it was observed that the average haemoglobin level among the participants aligns with the World Health Organization's (WHO) recommendations. The mean haemoglobin concentration for the 150 participants was 13.9 g/dl, with a standard deviation of 1.8 g/dl, falling within the WHO reference range of 10.8–17.0 g/dl. Nonetheless, approximately one-third (28.7%) of the respondents exhibited haemoglobin concentrations below 12 g/dl, as per the WHO-recommended cut-off for detecting anaemia in adult males (13 mg/dl) and non-pregnant females (12 mg/dl). [6]

The Haemoglobin Reference Values (Hb-rvs) obtained from this study were lower than those reported for their counterparts in some other African countries. A significant gender-based difference in haemoglobin reference values was noted ($p < 0.001$), with males displaying higher haemoglobin levels compared to females, as supported by previous studies [7, 8]. Conversely, no statistically significant differences were observed in Hb-rvs concerning age, residency, pregnancy status, and marital status ($P= 0.985$; $P = 0.377$; $P= 0.230$ & $P = 0.157$) respectively.

While a large proportion of the study participants did not report smoking status, there was a statistically significant relationship between Hb levels and smoking status ($p<0.001$).In this study, it was found that smokers had higher levels of haemoglobin, which is consistent with previous research that has demonstrated a strong relationship between elevated Hb levels and smoking behaviour [9]. However, a recent study in southern Libya reported that there was no statistically significant difference in hemoglobin levels between smokers and non-smokers, despite the fact that smokers had higher levels of the substance [10].

The study results showed that the total mean corpuscular volume (MCV) was 83.28+7.9 which is considered normal [6, 11] and lower than what was previously reported in the city of Brack in the south of Libya [10]. Females had significantly higher MCV values (84.33 fL+ 4.6) than males (81.61 fL11.2; p=0.041). Study groups with age groups of <20 and the age group of 31-40 showed a gradual increase in comparison with the subsequent or older age groups.

The study results revealed a significant ($p < 0.01$) reduction in the mean corpuscular volume (MCV) among smokers [84.98 ± 6.3 (fL)] when compared to non-smokers [71.56 ± 1.1 (fL)]. Furthermore, the study found a statistical difference in the mean MCV values concerning the residency of the participants ($p < 0.001$), with Timssan showing a higher mean (88.6 $\pm$ 6.3) compared to Edri and Almansura residents (81.94 $\pm$ 8.4; 81.88 $\pm$ 1.4, respectively). However, there was no statistically significant difference in the mean MCV based on pregnancy status (females only) ($p < 0.047$) and marital status ($p < 0.059$) among the study participants.

The average hematocrit (Hct) level for the study participants was 40.47% ±SD 5.0 (rang; 24-53), falling within the normal range when compared to established standard values for Caucasian populations. Male participants demonstrated a significantly ($p < 0.001$)

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higher Hct level (42.72%) compared to females (39.06%). Additionally, there was a notable and statistically significant difference ($p < 0.001$) in Hct levels based on smoking status. Specifically, smokers exhibited a higher Hct level (46.63%) compared to non-smokers (33.97%). However, there were no statistically significant differences in Hct levels based on age ($p = 0.956$), marital status ($p = 0.344$), pregnancy status ($p = 0.512$), or the participants' place of residence ($p = 0.540$).
In this research, the average red blood cell (RBC) counts for males (4.74 × 10^12/L) were notably higher than those for females (4.06 × 10^12/L; $p < 0.001$). Similar findings were reported, and the variability in RBC counts was linked to hormonal fluctuations in women [12]. The observed disparities in adult RBC counts based on gender align with previous studies. Moreover, the overall mean (4.94±0.3 × 10^12/L) for smokers significantly increased ($p < 0.001$) compared to non-smokers (4.06±0.01 × 10^12/L). Pregnancy status did not exhibit any significant impact on RBC counts ($p < 0.092$). in general, these findings indicate that gender, hormonal changes, and smoking status may influence red blood cell counts, and the study supports the idea that these factors should be considered when interpreting RBC values in clinical contexts.
In this study, it was observed that males exhibited higher platelet counts (247 × 10^9/L) compared to females (234.5 × 10^9/L), although the difference did not reach a high level of statistical significance ($p = 0.052$). Significant changes in platelet (PLT) levels were noted in the smoker group compared to the nonsmoker group. These findings align with those reported by Nazia Siddiqui et al. (2023) and Roethig et al. (2010), both of whom observed a noticeable increase in these parameters among smokers [13, 14]. However, our results differ from studies conducted by Pankaj et al. (2014) and Malenic et al. (2017)[9, 15]. No significant variations in PLT counts were observed based on age, marital status, or pregnancy status ($p = 0.704$, $p = 0.062$, $p = 0.106$, and $p = 0.604$, respectively).

The research results indicated that levels of Hb, MCV, Hct, and RBCs varied based on gender, with only MCV and Hct not being influenced by age.

Limitations of the Study

This study faces several limitations, including a nonrandomized design and a small sample size, which may not accurately represent the broader Libyan adult population. Technical issues with nonhemogenic blood analysis and the lack of a national standard for hematological profiles further constrain the study. As a descriptive study, its findings may not be widely applicable. Therefore, the small sample size and the absence of extensive national research on Libyan hematological profiles should be considered when interpreting the results.

Conclusion

Despite limitations in sample size, study design, and the absence of national benchmarks, the findings contribute valuable baseline data for future public health planning and clinical interpretation. Establishing region-specific hematological norms is essential for improving diagnostic accuracy and health outcomes in Libya. Further large-scale, multicenter studies are recommended to validate these observations and support the development of national reference values.

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Ethical Approval: This study did not involve human participants and did not collect patient-related data. As no institutional ethics committee was available, verbal authorization was obtained from the hospital administration. In accordance with institutional requirements, formal ethical approval was not required.

Conflict of Interest The author declares no conflict of interest.

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