



# Cytopenias in Treatment-naive HIV Patients: A Comparison of Turkey and Somalia

## Tedavi Almamış HIV Hastalarında Sitopeniler: Türkiye ve Somali Karşılaştırması

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### Abstract

**Objective:** Cytopenias are common complications in HIV-positive individuals, generally correlated with the stage of the disease. Prevalence of cytopenias depends on the stage of HIV infection, gender, race, geographic location, and nutritional status. The objective of this study was to determine the frequency of cytopenias in treatment-naive HIV infected patients in two ethnically, geographically and socio-economically different countries, Turkey and Somalia.

**Method:** The study participants were all newly diagnosed adult HIV-positive patients, not on any antiretroviral treatment. The exclusion criteria included being at the age of <18 years, the presence of hematologic and oncologic disorders, having HIV-positivity with malignancy, chronic renal failure, hepatic disease, pregnancy, acute illness (i.e., pneumonia, or gastroenteritis), opportunistic infections and congenital hematological disorders.

**Results:** In our study, the most common type of cytopenia was normocytic normochromic anemia. Anemia was significantly more common among Somalia patients than their Turkish counterparts. The second common hematological abnormality was leucopenia among Somalian patients and thrombocytopenia among Turkish patients. Leucopenia was rare in Turkish patients.

**Conclusion:** The hematological findings of our study have implications for the selection of antiretroviral drugs and other agents in HIV-positive individuals and also in monitoring the development of side effects. These results vary between countries with socio-economic and geographical differences.

**Keywords:** Acquired immune deficiency syndrome, anemia, cytopenia, Somalia, Turkey

### Öz

**Amaç:** Sitopeni, HIV pozitif bireylerde yaygın olarak görülen ve genellikle hastalığın evresi ile ilişkili komplikasyonlardır. Sitopenilerin prevalansı HIV enfeksiyonunun evresine, cinsiyete, ırka, coğrafi konuma ve beslenme durumuna bağlıdır. Bu çalışmanın amacı etnik, coğrafi ve sosyo-ekonomik olarak farklı iki ülkede, Türkiye ve Somali'de tedavi görmemiş HIV ile enfekte hastalarda sitopeni sıklığını değerlendirmektir.

**Yöntem:** Çalışmaya katılanların tümü, herhangi bir antiretroviral tedavi almamış, yeni teşhis edilmiş yetişkin HIV pozitif hastalardı. Dışlama kriterleri, 18 yaşından küçük olmak, hematolojik ve onkolojik bozuklukların varlığı, malignitesi olan HIV pozitif hastalar, kronik böbrek yetmezliği, karaciğer hastalığı, hamilelik, akut hastalık (yani, pnömoni veya gastroenterit), fırsatçı enfeksiyonlar ve konjenital hematolojik bozukluklar idi.

**Bulgular:** Bu çalışmada en sık görülen sitopeni normositik normokromik anemi idi. Anemi, Somalili hastalarda Türk hastalara göre önemli ölçüde daha yaygındı. Somalili hastalarda ikinci sık görülen hematolojik anormallik lökopeni, Türk hastalarda ise trombositopeni idi. Türk hastalarda lökopeni nadirdi.

**Sonuç:** Çalışmamızın hematolojik bulguları, HIV pozitif bireylerde antiretroviral ilaçların ve diğer ajanların seçiminde ve ayrıca yan etkilerin gelişiminin izlenmesinde çıkarımlara sahiptir. Bu sonuçlar sosyo-ekonomik ve coğrafi farklılıklara sahip ülkeler arasında farklılık göstermektedir.

**Anahtar kelimeler:** Anemi, edinsel immün yetmezlik sendromu, sitopeni, Somali, Türkiye



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## Introduction

One of the most common complications in people with human immunodeficiency virus (HIV) is hematological changes. Cytopenias are characterized by reduction in blood cell lines and lead to anemia, thrombocytopenia, and leucopenia (1,2). They are generally correlated with the stage of the disease in the incidence and the severity, increasing as the progression of the disease from the asymptomatic HIV-positive state to the advanced state (3-5). Low CD4+ T-cell numbers, high viremia, later stages of the disease, increased age and side effects of drugs given for HIV are the risk factors for cytopenias in HIV-infected patients (6-8). The pathophysiology of cytopenias in HIV infection is complex and multifactorial. Direct bone marrow suppression of HIV or indirect abnormal production due to cytokine impaired hematopoiesis especially causes anemia or leucopenia. On the other hand, thrombocytopenia usually results from immune-mediated destruction of platelets (9-12). Other causes of cytopenia in HIV infected patients include nutritional deficiencies (e.g., iron deficiency, folic acid deficiency), opportunistic infections, malignancies, decreased erythropoietin, infiltrative diseases of the bone marrow, opportunistic infection or co-existing medical problems and treatment-related adverse events (13,14). Cytopenias play an important role in HIV-related morbidity and mortality (10,15,16). In addition, cytopenias have a major impact on patients' quality of life (15). Prevalence of cytopenias has been shown to vary geographically (17,18). In recent years, studies conducted all around the world have shown highly different results regarding the cytopenias in HIV patients (8,17-19). Anemia is the most common cytopenia observed in patients with HIV-infection and is often associated with leucopenia or thrombocytopenia. The level of anemia correlates with the stages of HIV infection (20). In previous studies, the prevalence rates of anemia have been reported between 6.3% and 84% depending on the stage of HIV infection, gender, race, geographic location, nutritional status, and definition of anemia (21,22). In some studies, the prevalence of anemia has been estimated to be 30% in asymptomatic patients and 63-95% in HIV-infected patients in late-stage (18,21,22-26). Geographical differences in the prevalence of anemia in HIV infected individuals have been reported all over the world. In Europe and in the United States, anemia occurs in about 35-65% of treatment-naive patients (27,28).

The second most frequent hematological complication seen in HIV infected patients is the thrombocytopenia found in 3-40% of patients. Thrombocytopenia can be seen at any

stage of the disease. The frequency of thrombocytopenia varies among countries, while race and ethnicity may affect the prevalence of thrombocytopenia (18,19,24,29,30). The geographical distribution of thrombocytopenia differs from that of leucopenia and anemia in HIV infected patients (17).

The prevalence of leukopenia also varies widely among patients with HIV, ranging from 10% to 50%. The most common form of leucopenia is neutropenia, which has been reported in 0% to 28.3% of treatment-naive patients. Its incidence rises from 13% to 44% with disease progression from HIV to AIDS (19,24,25,31).

The objective of this study was to determine the frequency of cytopenias in treatment-naive HIV infected patients in two ethnically, geographically and socio-economically different countries.

## Materials and Methods

### Study Design and Patient Selection

This cross-sectional study was conducted among treatment-naive HIV infected individuals at two hospitals in two geographically different countries. One of them was Recep Tayyip Erdoğan Training and Research Hospital in Mogadishu, Somalia and the other was Koç University Hospital in İstanbul, Turkey. The patient groups in these hospitals had very different socio-economic conditions and belonged to different ethnic groups and races. Ethics committee permission was obtained from Recep Tayyip Erdoğan Training and Research Hospital, Mogadishu, Somalia for this study (date: 25.11.2019, no: 153). It was carried out in accordance with the 1975 Declaration of Helsinki, as revised in 2000. After informing participants about the objectives of the study, written informed consent was taken from all the participants.

The study focused on HIV-positive patients from Somalia and from Turkey. All descriptive data, consisting of demographics, diagnosis, and laboratory findings, were obtained from the hospital's medical records at Recep Tayyip Erdoğan Training and Research Hospital, Mogadishu, Somalia between January 2017 and November 2019 and at Koç University Hospital, İstanbul, Turkey between January 2016 and December 2019.

The study participants were all newly diagnosed adult HIV-positive patients, not on any antiretroviral treatment. The exclusion criteria included being at the age of <18 years, the presence of hematologic and oncologic disorders, having HIV-positivity with malignancy, chronic renal failure, hepatic disease, pregnancy, acute illness (i.e., pneumonia,

or gastroenteritis), opportunistic infections and congenital hematological disorders.

### Measurement of Laboratory Parameters

Blood samples were collected into EDTA (ethylenediaminetetraacetic acid) containing tubes. Hematological parameters of Somalian patients and Turkish patients were determined using automated hematology analyzer Sysmex XN-1000 (Sysmex Corporation, Kobe, Japan) and Sysmex XN-3100 (Sysmex Corporation, Kobe, Japan), respectively. In this study, we only evaluated baseline information. The hematological profiles of the patients were collected at the initial baseline visit.

Anemia in adults was defined using the World Health Organization criteria, as hemoglobin (Hb) <13 g/dL in males and <12 g/dL in non-pregnant females. Anemia severity was classified as: Mild for 11-11.9 g/dL in females and for 11-12.9 g/dL in males, moderate for 8-10.9 g/dL in both sexes, and severe for <8 g/dL in both sexes. Anemia was defined as normocytic, if the mean corpuscular volume (MCV) was between 80 and 100 fL. MCV <80 fL was considered as microcytic and MCV >100 fL as macrocytic (32,33).

The platelet count less than  $150 \times 10^9/L$  was considered as thrombocytopenia. It was further classified into mild ( $100-150 \times 10^9/L$  cells), moderate ( $50-99 \times 10^9/L$ ) and severe thrombocytopenia ( $<50 \times 10^9/L$ ). Leucopenia was defined as total white blood cell (WBC) count less than  $4 \times 10^9/L$ . Neutropenia was defined as an absolute neutrophil count  $<1.5 \times 10^9/L$  and subcategorized as mild ( $1.0-1.5 \times 10^9/L$ ), moderate ( $0.5-1 \times 10^9/L$ ), and severe ( $<0.5 \times 10^9/L$ ). Lymphopenia was considered when absolute lymphocyte count was less than  $1.0 \times 10^9/L$  (34,35).

We categorized patients based on their cytopenias. Patients with isolated anemia, thrombocytopenia or neutropenia were defined as patients with unicytopenia. Bicytopenia was defined as having any two of the three lineage cell counts (neutrophils, Hb, or platelets) that were below the levels designated above. Pancytopenia was defined as having three lineage cell counts below the levels designated above.

An initial enzyme-linked immunosorbent assay (ELISA), followed by a confirmatory Western blot if the initial ELISA was positive, was made for the diagnosis of HIV to all patients. Polymerase chain reaction (PCR, RealStar®, Altona Diagnostics, Germany) test was performed to detect the HIV RNA titre.

### Statistical Analysis

All statistical analyses were performed using SPSS 26.0 software (SPSS Inc., Chicago, IL, USA). Continuous variables are presented as mean and standard deviation (SD).

The differences between the groups were analyzed by using independent student t-test. Categorical variables were presented as frequencies and percentage of each category. Comparison of categorical variables was performed using the chi-square test. The statistical tests were two-tailed, and  $p < 0.05$  was considered to be statistically significant.

### Results

A total of 327 HIV-positive treatment-naive patients, of which 208 (63.6%) from Somalia and 119 (36.4%) from Turkey were included in this study. The age range of the patient were between 18 and 90 years old. The mean age was found to be  $40.2 \pm 13.3$  years. The majority of the study participants were males (67.3%) and the ratio of males to females was 2.05:1. Statistically there was no significant difference between mean ages of Somalian and Turkish patients ( $39.5 \pm 13.6$  vs.  $41.6 \pm 12.7$  respectively,  $p = 0.17$ ). The majority of cases ( $n = 138$ , 42.2%) were in the age group of 31-45 years and followed by 90 (27.5%) cases in 18 to 30 years age group. Demographic characteristics of treatment-naive HIV positive patients is seen in Table 1. The male/female ratio was significantly higher among Turkish patients compared to Somalian patients (Table 1).

The hematological parameters of treatment-naive HIV-positive patients is given in Table 2. The mean  $\pm$  SD Hb concentration for the study population was  $12.6 \pm 2.46$  g/dL (range 4.6-17.5), it was  $14.1 \pm 1.69$  g/dL and  $11.8 \pm 2.47$  g/dL for Turkish and Somalian patients, respectively. Demographic characteristics of treatment-naive HIV positive patients is seen in Table 1. The difference in Hb concentration between the Turkish and Somalian patients groups was statistically significant ( $p < 0.001$ ) (Table 2).

The prevalence of anemia in treatment-naive HIV-positive patients was 44.3% (145/327). The overall anemia prevalence was higher in Somalian patients compared to Turkish patients [58% (120/208) vs 21% (25/119)] and this difference was statistically significant ( $p < 0.001$ ) (Table 2).

Anemia was significantly more common in female patients compared to male patients [60.7% (65/107) vs 36.4% (80/220)  $p < 0.001$ ]. In the Turkish patient group, the proportion of female patients was very small (6.8%

**Table 1. Demographic characteristics of treatment-naive HIV positive patient groups**

Variable	Total patients (n=327)	Somalian patients (n=208)	Turkish patients (n=119)	p-value between Somalia and Turkish patients
<b>Age (in years)</b>				
Mean age	40.2±13.3	39.5±13.6	41.6±12.7	0.17
18-30	90 (27.5%)	66 (31.7%)	24 (20.1%)	<b>0.024</b>
31-45	138 (42.2%)	81 (39%)	57 (47.9%)	0.115
46-60	72 (22%)	44 (21.2%)	28 (23.6%)	0.618
>60	27 (8.3%)	17 (8.1%)	10 (8.4%)	0.942
<b>Sex</b>				
Male	220 (67.3)	109 (52.4%)	111 (93.2%)	<b>&lt;0.001</b>
Female	107 (32.7%)	99 (47.6%)	8 (6.8%)	<b>&lt;0.001</b>

**Table 2. Hematological parameters of treatment-naive HIV-positive patient groups**

	All HIV+ patients (n=327) mean ± SD	Somalian HIV+ patients (n=208) mean ± SD	Turkish HIV+ patients (n=119) mean ± SD	p-value
WBC	6.643±3.29	6.850±3.83	6.280±2.03	0.08
TLC	1.856±1.02	1.802±1.058	1.949±0.946	0.213
ANC	4.339±3.783	4.747±4.080	3.625±1.872	<b>&lt;0.001</b>
HGB	12.59±2.46	11.79±2.47	14±1.69	<b>&lt;0.001</b>
MCV	85.3±7.8	84.95± 8.47	85.9±6.5	0.26
RDW	14.45±2.67	14.87±3.04	13.72±1.62	<b>&lt;0.001</b>
PLT	255.2±113.6	266.7±126.9	235.1±82.1	<b>0.007</b>
MPV	9.49±1.37	9.25±1.51	9.92±0.95	<b>&lt;0.001</b>

SD: Standard deviation, WBC: White blood cell, MCV: Mean corpuscular volume, RDW: Red cell distribution width, TLC: Layer chromatography, ANC: Absolute neutrophil count, PLT: Platelet count, HGB: Hemoglobin

in Turkish patients vs 47.6% in Somalian patients). In the comparison of only male patients, the frequency of anemia was 53% in Somalian male patients and 20% in Turkish male patients.

Anemia was present at mild level in 67 (46%) of cases and at moderate level in 62 (43%) of cases. Yet, 11% (n=16) of the anemic patients had severe anemia (Hb <8 g/dL). Among Somalian HIV-positive patients, 40% had mild level, 47.5% had moderate level, and 12.5% had severe level anemia. These rates were 76%, 20%, and 4%, respectively, in Turkish HIV positive patients. The prevalence of mild anemia was significantly higher among Turkish patients than Somalian ones.

The most common pattern of anemia was normocytic anemia (in 61% of all patients). Microcytic anemia was present in 28.9% of patients. Macrocytic anemia was uncommon (seven cases only).

The mean ± SD platelet count of the study population was 255.2±113.6×10<sup>9</sup> (range 16-836) /L, it was 235.1±82.1×10<sup>9</sup>/L and 266.7±126.9×10<sup>9</sup>/L for the Turkish and Somalian patient groups, respectively. The difference in thrombocyte counts

of two groups was statistically significant (p=0.007). On the other hand, there was also statistically significant difference in thrombocyte counts between male and female patients (241.6±103.6 and 283.3±127.9×10<sup>9</sup>/L, respectively p=0.004).

Thrombocytopenia (platelet count <150×10<sup>9</sup>/L) was detected in 12.8% (n=42) of study participants. Frequency of thrombocytopenia was similar in men (13.2%) and women (12.4%) patients (p=0.79). Twenty-seven patients (64%) had mild thrombocytopenia and 16 patients (36%) had moderate or severe thrombocytopenia. The overall prevalence of thrombocytopenia was 11.8% (14/119) and 13.5% (28/208) for Turkish and Somalian patients, respectively. There was no significant difference in the prevalence of thrombocytopenia between Turkish and Somalian patients (p=0.66).

The mean ± SD leukocyte count for the study population was 6.643±3.298×10<sup>9</sup> (range 0.690-21.580)/L, it was 6.280±2.029 and 6.850±3.829×10<sup>9</sup>/L for the Turkish patient group and for the Somalian patient group, respectively. There was no statistically important difference in WBC counts between patient groups (p=0.08).

**Table 3. Cytopenias in treatment-naive HIV positive Somalian and Turkish patients**

	All HIV + patients (n=327)	Somalian HIV + patients (n=208)	Turkish HIV + patients (n=119)	p-value between Somalia and Turkish patients
Any cytopenia	178 (54.4%)	136 (65.4%)	42 (35.3%)	<0.001
Pancytopenia	9 (2.8%)	9 (4.3%)	0 (0%)	0.029
Bicytopenia	43 (13.1%)	36 (17.3%)	7 (5.9%)	0.003
Anemia and leucopenia	25 (7.6%)	24 (11.5%)	1 (0.8%)	<0.001
Anemia and thrombocytopenia	12 (3.7%)	10 (4.8%)	2 (1.7%)	0.223
Thrombocytopenia and leucopenia	6 (1.8%)	2 (0.9%)	4 (3.7%)	0.195
Isolated anemia	99 (30.3%)	77 (37.1%)	22 (18.4%)	<0.001
Isolated leucopenia	12 (3.7%)	7 (3.7%)	5 (4.2%)	0.763
Isolated thrombocytopenia	15 (4.5%)	7 (3.7%)	8 (6.7%)	0.163

Leucopenia (WBC  $<4 \times 10^9/L$ ) was found in 15.9% (n=52) of the study participants. The overall prevalence of leucopenia was 20.1% and 8.4% among Somalian and Turkish patients, respectively. Leucopenia was statistically significantly more common in the Somalian patient group (p=0.005).

The mean  $\pm$  SD absolute lymphocyte count for all study population was  $1.856 \pm 1.020 \times 10^9$  (range 0.200-6.740)/L. Lymphopenia (lymphocyte count  $<1 \times 10^9/L$ ) was found in 18.4% (n=60) of the participants, the prevalence was 22.6% (47/208) and 10.9% (13/119) for Somalian and Turkish patients, respectively (p=0.009). Neutropenia was present in 18/327 patients (5.6%) and no patient had severe neutropenia.

The cytopenias in treatment-naive HIV positive patients in both Somalian and Turkish groups is given in Table 3. Cytopenia was detected in 178/327 (54.4%) of patients in our cohort, of which 126 (38.5%) patients had unicytopenia, 43 (13.1%) had bicytopenia, and 9 (2.8%) had pancytopenia. Isolated anemia was the most common unicytopenia in this study. Among the unicytopenia cases, 99 (30.3%) patients had isolated anemia, 12 (3.7%) had isolated leukopenia, and 15 (4.5%) had isolated thrombocytopenia. The anemia and leucopenia combination was the most frequent bicytopenia (7.6%, n=25). This was followed by anemia and thrombocytopenia combination at the rate of 3.7% (n=12). Leukopenia and thrombocytopenia combination was seen rarely 1.8% (n=6). The prevalence of cytopenia/s was higher in Somalian patients compared to Turkish patients (65.4% vs 35.3%) and the difference was statistically significant (p<0.001). The distribution of cytopenia is shown in Table 3.

## Discussion

Anemia was the most common hematological abnormality which was followed by leucopenia and then

thrombocytopenia in the study. Anemia was more frequent among Somalian patients compared to Turkish patients. All of the patients with severe anemia were Somalian patients.

To our knowledge, our study is the first study from Turkey, comparing hematological findings in HIV-positive treatment-naive individuals with those in other countries.

Hematological abnormalities, such as cytopenias, are a major problem in HIV-positive individuals, especially in those who are not on antiretroviral therapy or in uncontrolled ones. HIV-induced impaired hematopoiesis, drug side effects, and several other factors may lead to cytopenias (3).

Anemia has been shown to influence the progression of HIV disease by accelerating and increasing mortality. There are many reports suggesting that anemic HIV patients have faster disease progression, higher morbidity and mortality rate than non-anemic ones (27,36-38). In our study, the anemia prevalence among treatment-naive Somalian HIV patients was similar to results of studies from different countries in Africa, such as Ghana (64%) (39), Ethiopia (52%) (40), South Africa (60%) (19), Uganda (48%) (8), and Tanzania (77%) (41). In Nigeria, Erhabor et al. (42) and Kagu et al. (43) reported a very high anemia prevalence of 80% and 90%, respectively. Daka et al. (44) reported an anemia prevalence of 86% among treatment-naive HIV positive patients in Ethiopia. In the present study, the prevalence of anemia among Turkish patients was lower than these values. The differences in anemia rates of Somalian and Turkish patients can be explained by the differences in socio-economic conditions, levels of poverty and malnutrition. A similar result was shown in another study, showing the high prevalence of anemia in poorer countries compared to resource-rich countries (45). In another study conducted in Africa and Haiti, the authors emphasized that

the cause of anemia might be related to the levels of poverty, low income and nutritional deficiency in these areas of the world (17). On the other hand, Mata-Marin et al. (13), Akinbami et al. (46) and Enawgaw et al. (25) reported the prevalence of anemia as 20% in Mexico, 24.2% in Nigeria and 29.7% in Ethiopia, respectively, among treatment-naive HIV-positive patients, which was similar to Turkish patients in our study. The difference between our finding and others can be explained by the differences in study populations, race/ethnicity, socio-demographic profile, geographical location, variability in the study design, and definition of anemia used in each study.

In the study, anemia frequency was higher in HIV infected females compared to males. This was also documented in different studies (17,47). The reason for the difference in anemia between the Somalian and Turkish patients may be due to the difference in gender distribution between the two groups since the proportion of female patients was very small in Turkish patients than in Somalian patients. However, this is not valid for the present study. In the comparison of only male patients, the frequency of anemia was detected to be 53% in Somalian male patients and 20% in Turkish male patients.

The anemia associated with HIV is characteristically a normochromic, normocytic anemia, yet the HIV-positive patients can also present with a hypochromic microcytic anemia. Macrocytosis is also infrequent (18,21,23). Similarly, in the present study, we found the normocytic normochromic as the most common morphologic type of anemia in patients without antiretroviral treatment, and it was followed by microcytic hypochromic and macrocytic anemia. This finding is supported by the other studies in which normocytic normochromic anemia is the major type of anemia in HIV infected treatment-naive patients (7,18,23,25,42,48).

Thrombocytopenia may be the first clinical manifestation in asymptomatic HIV infected patients. The degree of thrombocytopenia is generally mild to moderate in treatment-naive HIV infected patients. Thrombocytopenia is correlated with low levels of CD4+ cell and older age (8,23,25,30,49). The possible mechanisms that may be responsible for the development of thrombocytopenia include increased autoimmune-mediated destruction of thrombocytes due to the presence of anti-platelet antibodies, and ineffective platelet production by direct infection of megakaryocytes with HIV (25,50).

The frequency of thrombocytopenia was similar in both Somalian and Turkish patients in the present study. Different studies conducted in Ethiopia, Uganda, Tanzania, Nigeria, Rwanda, and Iran reported that the prevalence of thrombocytopenia was 18.7%, 17.8%, 14.4%, 16.1%, 13.5%, and 20%, respectively, among antiretroviral treatment-naive patients (23,29,51-53). In some African countries such as Ethiopia and Uganda, the frequency of thrombocytopenia has been found to be lower (9% and 8.3%, respectively) in treatment-naive HIV-positive patients (8,25). In another study from Turkey, the frequency of thrombocytopenia was 23.1%, which is higher compared to our results (54).

The prevalence of leucopenia in our study group was 15.9%. This rate was 20.1% in Somalian patients, which is similar with studies from Nigeria (26.8%), Uganda (24.3%), Tanzania (23.7%) and Ethiopia (16.6%) (8,23,25,53). A study conducted among adult HIV infected Zimbabweans showed that the prevalence of leukopenia was 1.7% (55). The prevalence of leucopenia was much lower in the Turkish patient group (8.4%).

In this study, we found that unicytopenia was the most common type of cytopenia and it was followed by bicytopenia and pancytopenia. At least one form of cytopenia was present in half of the participants, but cytopenia was found twice as much in Somalian patients compared to Turkish patients. The anemia was the most common type of cytopenia among unicytopenias, and it was followed by leucopenia and thrombocytopenia. While anemia and leucopenia were the most common bicytopenias in Somalian patients, thrombocytopenia and leukopenia were the most common bicytopenias in Turkish patients.

Prior studies reported different rates of HIV associated cytopenias among treatment-naive individuals. Studies conducted in Uganda, Ethiopia, South Africa and Nigeria reported that 65%, 63.4%, 63.2%, and 59.8% of the participants had at least one form of blood cytopenias, respectively (8,19,51,56). The prevalence of cytopenia in Somalian patients was in agreement with these studies. On the other hand, the prevalence of cytopenia in Turkish patients was found to be lower compared to studies conducted in African countries, which was higher than the rates reported in studies conducted in China (19.1%) and South Korea (11.2%) (57,58).

### Study Limitations

To our knowledge, this is the first study from Turkey, which compares hematological parameters among groups of HIV-positive treatment-naive patients between two different

countries with different geographic location, ethnic and socio-economic conditions. Yet, there are some limitations in our study. First, our study was a cross-sectional study and there was no follow-up period. Second, there were very few female patients in the Turkish patient group.

## Conclusion

The most common cytopenia in this study was anemia and the most frequent form was normocytic normochromic anemia. Anemia was significantly more common in Somalia patients than in Turkish patients. Leukopenia was the second most common hematological abnormality in Somalian patients, while thrombocytopenia was the second most common hematological abnormality in Turkish patients. Leukopenia was rare in Turkish patients. These findings have implications for the selection of antiretroviral drugs and other agents in HIV-positive individuals and also in monitoring the development of side effects. It should also be kept in mind that these results vary between countries with socio-economic and geographical differences.

## Ethics

**Ethics Committee Approval:** Ethics committee permission was obtained from Recep Tayyip Erdoğan Training and Research Hospital for this study (date: 25.11.2019, no: 153).

**Informed Consent:** Written informed consent was taken from all the participants.

**Peer-review:** Internally and externally peer-reviewed.

## Authorship Contributions

Surgical and Medical Practices: Ö.S., S.T., Ü.Ü., M.K., Concept: Ö.S., Design: Ö.S., Data Collection or Processing: Ö.S., S.T., M.K., Analysis or Interpretation: Ö.S., Ü.Ü., S.T., Literature Search: Ö.S., M.K., S.T., Writing: Ö.S., S.T., Ü.Ü., M.K.

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