A comparative study on the prevalence of microcytic anemia and associated age of anemic patients from Benghazi city

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Abstract Anemia is a public health problem marked by deficiency of RBCs and classified on the basis of size into microcytic, normocytic and macrocytic anemia. This study aimed to determine the prevalence of microcytic anemia with the other types of anemia and related age groups in Benghazi city. there have been very few studies describing the prevalence of anemia types. A cross sectional study was performed in duration of 6 months, a total of 299 cases were studied, blood samples were collected and hematologicaly tested for CBC in hematology cell counter .As a result(72.9%) of the total anemic patients were females and (27.09%) were males, prevalence of microcytic anemia was the highest (59.19%) among anemia types, the most infected age group in females was (21-40 years) and in males was (1-10 years). Regarding normocytic anemia, the prevalence was (39.46%) and age groups (21-40 years) and (>40 years) were the most infected in both females and males respectively. Prevalence of macrocytic anemia was the lowest (1.33%), (75%) of infected cases were in age group (>40 years) and (25%) were in (21-40 years) age group. According to this study females are more anemic than males , microcytic anemia is the most predominant type of anemia followed by normocytic anemia and finally macrocytic anemia is the lowest prevalent type of anemia. More studies are needed to determine the main causes of prevalence each type of anemia.
Key words: Anemia – Microcytic – Normocytic – Macrocytic.
Abbreviations: RBCs (red blood cells) **– CBC** (complete blood count).

دراسة مقارنة انتشار انيميا الكريات الصغيرة والعمر المصاحب من مرضى انيميا في مدينة بنغازي

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الملخص الانيميا مرض عام يتميز بنقص كريات الدم الحمراء ويتم تقسيمه على حسب حجمها الى انيميا الكريات الصغيرة والمعتدلة والضخمة. هذه الدراسة هدفت الى تحديد مدى انتشار انيميا الكريات الصغيرة مع الانواع الاخرى من الانيميا والأعمار المرتبطة بها في مدينة بنغازي. حيث ان عدد قليل جداً من الدراسات وصفت مدى انتشار انواع الانيميا الثلاثة. اجريت هذه الدراسة على مدى 6 أشهر واشتملت على 299 حالة. تم تجميع عينات الدم واجراء تحليل قياس صورة الدم، حيث وجدت هذه الدراسة ان نسبة الاصابة بالانيميا في الاناث كانت 72.9% من اجمالي الحالات وفي الذكور كانت 27.09% من الحالات. وان انتشار انيميا الكريات الصغيرة كان الاعلى بين الانواع الثلاثة بمعدل (59.19%) وان الفئة العمرية الاكثر اصابة بين الاناث كانت ما بين (21–40 سنة) بينما في الذكور كانت ما بين (1–10 سنوات). بالنسبة لانيميا الكريات المعتدلة كان معدل الانتشار (39.46%) ما بين الانواع الثلاثة، والفئات العمرية الاكثر اصابة كانت ما بين (21–40 سنة) وأكبر من (40 سنة) في كلا من الاناث والذكور على التوالي. بينما كان انتشار انيميا الكريات الضخمة الاقل بين الانواع الثلاثة بمعدل (1.33%) وكانت 75% من الحالات المصابة في الفئة العمرية أكبر من (40 سنة) و25% في الفئة العمرية ما بين (21–40 سنة). طبقاً لهذه الدراسة فان الاناث أكثر اصابة بالانيميا من الذكور، وان انيميا الكريات الصغيرة هي الاكثر انتشاراً تليها انيميا الكريات المعتدلة واخيرا انيميا الكريات الضخمة. نحتاج الى المزيد من الدراسات لتحديد السبب الاساسي لانتشار كل نوع من انواع الانيميا الثلاثة.

الكلمات المفتاحية: انيميا – انيميا الكريات الصغيرة – انيميا الكريات المتوسطة – انيميا الكريات الضخمة.

1. Introduction:

Anemia is the most common disorder of blood . It is defined as a reduction below normal limits of the total circulating red cell mass or a reduction in the hemoglobin concentration of the blood in comparison with the normal values for the age and sex [1] . It is a general medical issue influencing both creating and created nations everywhere throughout the world . All around it influences 1.62 billion individuals, this compares to 24.8% of the populace, with the most noteworthy predominance among babies (6-24 months) and preschool age kids [2] . Women were already anemic at the time of conception, with an estimated prevalence of anemia of 43% in non pregnant women in developing countries and of 12% in women in wealthier regions [3] . International center for research has recorded high rates of anemia in Asia and Africa with 42% prevalence in Nepal, 55% in India and 32% in Cameroon[4] .

Anemia can caused by deficiency of essential elements required for hemoglobin synthesis (Iron, vitamin B12 and folic acid), repeated pregnancy, blood loss, worm infestation, chronic conditions such as chronic renal failure , rheumatoid arthritis and tuberculosis [5] . The morphologic approach which groups anemia by red blood cell size into microcytic if the cells are smaller than normal . Normocytic if they are of normal size (92 ± 9 Fl) and macrocytic if they are larger than normal (80 - 100 μ m3) [6 and 7] . Microcytic anemia is a type of anemia with smaller than normal red blood cells, it is widely categorized as Iron deficiency anemia (deficiency in Iron delivery to heme group) it is 18% among adult women and 10% in adult men [8 , 9 and 10] , thalassemia (deficiency of globin production), anemia of chronic diseases (reduced Iron delivery to the heme group) and anemia because of other minor causes [11] .

Iron deficiency anemia, the most well-known reason for microcytosis, is an overall dietary issue. Egypt Demographic wellbeing review (2005) announced a 48.5% predominance of Iron insufficiency anemia among Egyptian kids and 26.6% among Egyptian grown-ups [12 and 13] . Babies matured (6 - 24 months) comprise one of the most noteworthy hazard gatherings of Iron inadequacy anemia [14], inadequate Iron intake in diet is the most common cause of it [15] . Previous studies suggest the use of RBCs indices obtained from automated cell counter, including mean corpuscular volume (MCV) and mean corpuscular Hb (MCH), to predict Iron deficiency anemia, as they have become very sensitive indicators of it [16] . Around the world, the commonness of anemia is 50% in pregnant ladies and in Libya is 28% which put it among nations with Iron deficient predominance of moderate general wellbeing noteworthiness as indicated by WHO [17].   In Western Libya, of the 711 screened school   children 11.08% males and 12.90% females were anemic ,9.67% females and 8.92% males were having Iron deficiency anemia [18].

2. Materials and Methods :

A cross – sectional observational study was conducted from the first of January 2019 to the first of June 2019 for a period of 6 months, this study was included 299 anemic patients and carried out in ALSALEEM medical lab Benghazi .The blood samples were collected in EDTA tubes and were immediately hematologicaly tested for CBC.
The equipment used is (Mindray BC – 3000) automated hematological cell counter, this instrument was calibrated with reference methods and has a regular quality control program .
For assessment of microcytic anemia, hemoglobin levels less than 13.5 g /dL for men and less than 12.0   g /dL for women were considered anemic, mean corpuscular volume (MCV) less than (80 Fl) were considered microcytic [19 and 20] , from (80-100 Fl)
were considered normocytic, and more than (100 Fl) were considered macrocytic. All data collected were entered and analyzed in (Minitab – version 16 software) and Microsoft Excel . Participated subjects were divided into four age groups as following:
Group **I** (1-10 years) – Group **II** (11-20 years) – Group **III** (21-40 years) – Group **IV** (> 40 years).
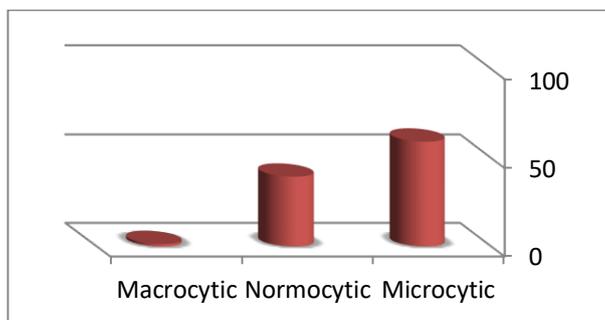
3. Results :

A total of 299 subjects participated in present study, we found numbers of males infected with anemia were 81 (27.09%) of the total anemic patients and females were 218 (72.9 %) of the total anemic patients. Cases of microcytic anemia were the highest (177 subjects) (59.19%) and the next common anemia was normocytic anemia (118 subjects) (39.46%) and eventually the lowest cases were macrocytic anemia (4 subjects) (1.33%) as presented in (Figure 1) & (Table1).

A according to present study, total numbers of males had microcytic anemia were 48 (27.12%) of the total cases of microcytic anemia, and females were 129 (72.88%) . Hence, females are affected more than males as shown in (Figure 2) . The prevalence rate of microcytic anemia was higher in males aged (1-10 years) and (>40 years) (68.75% and 18.75%, respectively) and was in males aged (21-40 years) (8.33%), whereas the lowest rate was in age group (11-20 years) (4.17%) as shown in (Figure3). In females, the highest rates of prevalence of microcytic anemia were in age groups (21-40 years) and (>40 years) (43.41% and 34.11%, respectively), and the rate in age group (1-10 years) was (13.95%). Whereas, the lowest rate was in age group (11-20 years) (8.53%) (Figure 4).

Regarding normocytic anemia, total numbers of both males and females had normocytic anemia were 32 (27.12%) and 86 (72.88%) , respectively. (Figure 5) . In males, the highest rate of prevalence was in male aged (>40 years)(43.75%) of cases, and the rate was (25%) in age group (1-10 years) , whereas, the lowest rate was in both age groups (11-20 years) and (21-40 years) with equal percentage for both (15.63%) (Figure 6). According to this study , in females the highest rate of normocytic anemia prevalence was in age group (21-40 years) and (>40 years) (54.65% and 31.40%, respectively) and in age group (11-20 years) the rate was (9.30%), while, the lowest rate of prevalence was in age group (1-10 years) (4.65%) as shown in (Figure 7) .

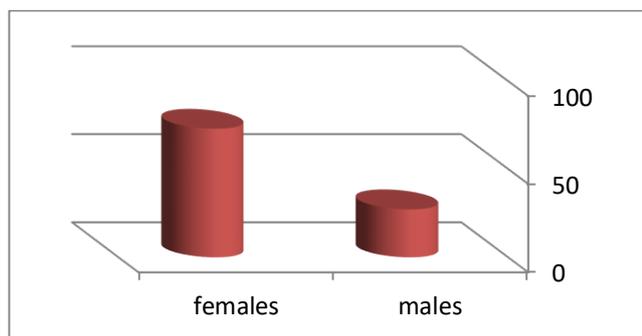According to present study, only 4 out 299 subjects were had macrocytic anemia (1.33%), of the total cases of anemia which represents the lowest rate of prevalence among anemia types , males were (25%) and females were (75%) of cases. Females in age group (>40 years) were (75%) and in age group (21-40 years) were (25%) , and there were no cases in both age groups (1-10 years) and (11-20 years).(Figure 8 & 9).
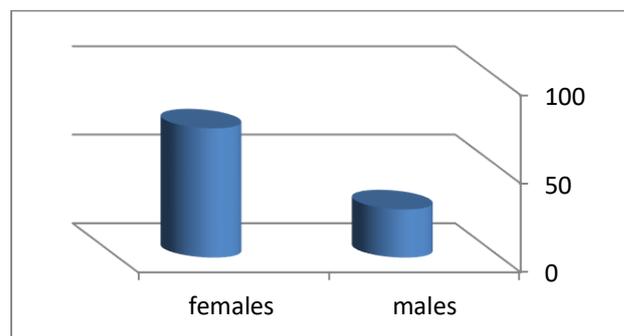
(Figure 1): percentage of microcytic, normocytic, and   macrocytic anemia prevalence.

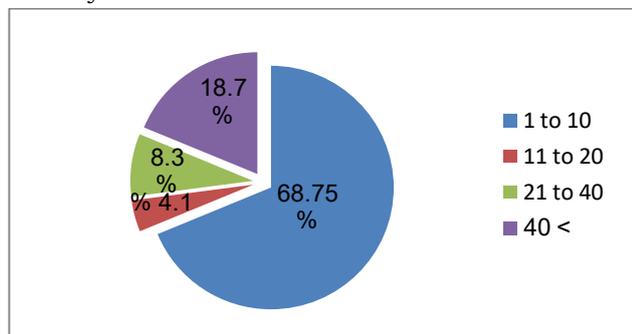**Table 1: Numbers and percentages of patients with microcytic, normocytic and macrocytic anemia.**

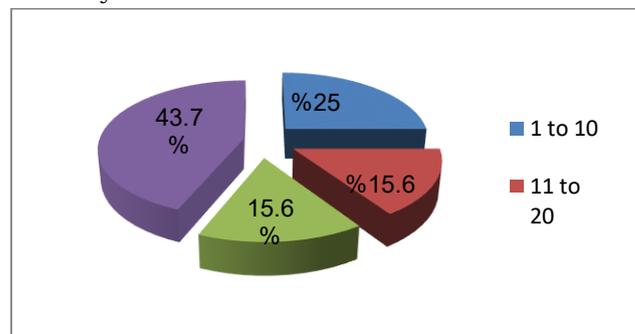| Gender	No of anemic patients	Microcytic anemia	Normocytic anemia	Macrocytic anemia
Male	81	48 (27.12%)	32 (27.12%)	1 (25%)
Female	218	129 (72.88%)	86 (72.88%)	3 (75%)
Total	299	177 (59.19%)	118 (39.46%)	4 (1.33%)

(Figure 2): percentage of males and females with microcytic anemia
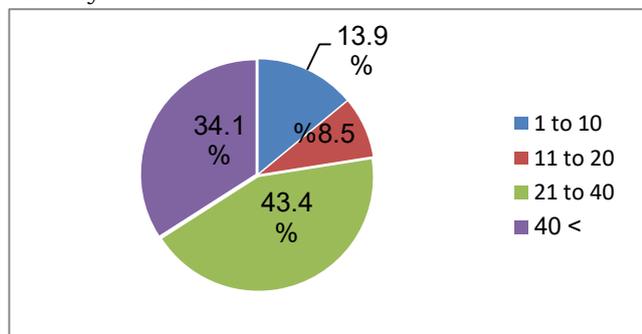

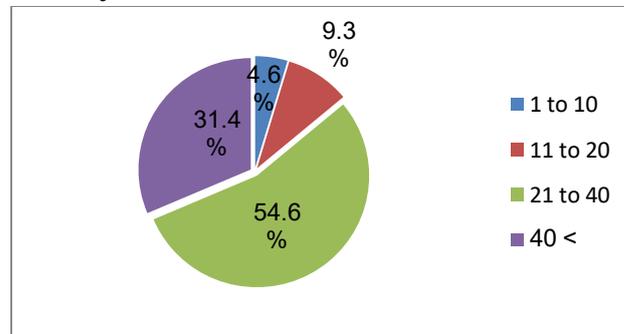**(Figure 5):** percentage of males and females with normocytic anemia

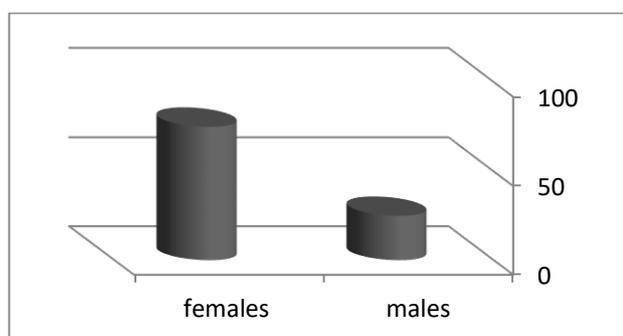**(Figure 3):** Frequency of age (years) of males with microcytic anemia

(Figure 6): Frequency of age (years) of males with normocytic anemia
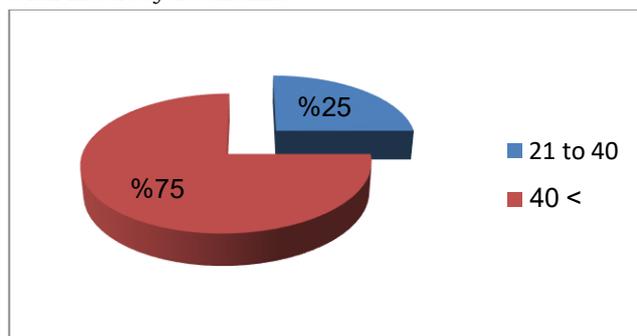

(Figure 4): Frequency of age (years) of females with microcytic anemia

(Figure 7): Frequency of age (years) of females with normocytic anemia

(Figure 8) : percentage of males and females with macrocytic anemia

(Figure 9) : Frequency of age (years) of femles with macrocytic anemia

4.Discussion:

Anemia the most prevalent condition of multifactorial etiology, it has been greatly contributing to mortality by increasing the percentage of infectious conditions due to poor immune status that results from various nutritional deficiencies [21] . The results of present study showed that microcytic anemia was the most common type (59.19%) among cases of anemia this consistent with Alvarez-Uria, etal [22] and Patel, etal [23] .

It is more prevalent in females (72.88%) than males (27.12%), mainly in premenopausal females because they lose blood with each menstrual cycle [24]. Microcytic anemia is a distinct morphological sub-group characterized by decreasing in RBCs size. It may result from inherited defects of globin chain synthesis or, more commonly, from acquired Iron deficiency usually because of low dietary intake, increased requests for growth or pregnancy, malabsorption or chronic blood loss. Genetic models of Iron deficiency anemia have been identified in animals, autosomal recessive defects of Iron use were first characterized in rodents [25 and 26] .

Iron deficiency anemia, the most common cause of microcytic anemia, it is also the most common nutritional deficiency in the world. Mach-pascual ,etal found Iron deficiency anemia to be the leading cause of microcytosis (45.2%) [27] . Sinha, etal found a high incidence of Iron deficiency anemia (40.57%) among 262 people presenting with microcytic hypochromic anemia on peripheral blood smear [28] . microcytic anemia in males was more prevalent in group age (1-10) years which includes infants and preschool aged children, these findings consistent with Benoist, etal [2] .

Preschool aged children suffer the most from anemia because of lack of Iron in their primary diet [24]. There was solid relationship between bovine's milk utilization during the principal year of life and advancement of Iron inadequacy anemia, which was identified with mysterious blood misfortune through stool attributable to hypersensitivity toward dairy animals' milk protein, low bio-accessibility of cow's milk Iron, and it is impedance with Iron ingestion from nourishment [29].

In contrast, microcytic anemia in females was more common in (21-40 years) age group (43.41%), it can be attributed to pregnancy and chronic blood loss due to menstrual cycle which causes Iron deficiency in the body, a study of Swedish women showed that despite a dietary intake of about 10mg of Iron per day. (67%) of women with menstrual blood loss exceeding 80ml / period were anemic [30] .

In the current study, normocytic anemia (anemia of chronic disease) was the second most prevalent type of anemia (39.46%), it is usually described as   anemia of inflammatory response and often mild [31], the risk factors linked to the majority of chronic diseases such as diabetes and hypertension, have been shown to increase inflammation [32] , studies showed that the prevalence of hypertension increases with age in adults [33] .

In males, normocytic anemia is more prevalent in age group (>40 years) (43.75%) than other groups, this consistent with a Brazilian study that studied a free-living elderly individuals in Southern Brazil and has concluded a normocytic anemia was the most common type of anemia among elderly (between 54.5% and 70%) [34] .In females, we noticed the same results as those observed in microcytic anemia where the highest rate of prevalence still in age group (21-40 years) (45.65%) which represents the age of pregnancy and chronic blood loss , and followed by age group (>40 years) (31.40%) .

In our study, macrocytic anemia was the least prevalent type of anemia (1.33%), this result a approaches to the general ratio (2-4%)[24 and 35] . (75%) of cases in age group (>40 years), causes of macrocytic anemia range from alcohol use, deficiencies in folate and vitamin B12, and medications . Immune system causes are progressively normal in moderately aged ladies. Hyperthyroidism and essential bone marrow malady represent more instances of macrocytic anemia in more seasoned patients, the pervasiveness of nutrient B12 lack increments in patients more established than 60 years [24 and 35].

5. Conclusion :

As a result of present study, It can be concluded that females are more anemic than males, microcytic anemia is the most prevalent type of anemia , females in age group (21-40 years) and males in age group .

(1-10 years) were more susceptible to microcytic anemia, the second predominant type of anemia is normocytic anemia which more common in females from (21-40 years) and males (>40 years), finally macrocytic anemia is the lowest prevalent type. More studies are needed to determine the main causes of the different types of anemia such as peripheral blood smears, Iron, TIBC , serum Ferritin, and Hb electrophoresis, and other studies on the morphological changes in RBCs caused by anemia.

6.Acknowledgments:

7. References :

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