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ORIGINAL ARTICLE/ARAŞTIRMA MAKALESİ

Anaemia, Iron, and Vitamin D Deficiency in the Elderly: A Retrospective Review

Yaşlılarda Anemi, Demir ve D Vitamini Eksikliği: Retrospektif Bir İnceleme

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ABSTRACT

Aim: Anaemia, iron, and vitamin D deficiency are prevalent health problems in society. Nevertheless, the number of studies on the prevalence of vitamin D in the elderly is minimal. This study aimed to determine the prevalence of vitamin D, anaemia, and iron deficiency in the elderly in Amasya Province.

Materials and Methods: This study was conducted retrospectively on the patient records of individuals aged 65 and over who applied to Amasya University Training and Research Hospital Internal Medicine Polyclinics between 01.01.2015 and 31.12.2020. Information including age, gender, hemogram, vitamin D, and serum iron levels of the individuals, the status of any chronic disease, the date of application of the individual to the health institution, and the reason for the application was recorded in the data collection form to be used in the study.

Results: 66.6% of the elderly individuals are female, and 33.4% are male. Anaemia was detected in 38.4% of the elderly, iron deficiency in 48.1%, and vitamin D severe deficiency in 40.7%. In elderly individuals, haemoglobin values were moderately positively correlated with gender and low iron values. In contrast, haemoglobin values were found to be negatively correlated with age and vitamin D values at a low level. The regression analysis results show that being underage, having low iron levels, and being of the female gender are associated with lower haemoglobin values in elderly individuals.

Conclusion: This study reveals that anaemia, iron deficiency, and vitamin D deficiency/insufficiency are common in the elderly.

Keywords: Elderly, Anaemia, Iron Deficiency, Vitamin D Deficiency

ÖZ

Amaç: Anemi, demir ve D vitamini eksikliği toplumda oldukça yaygın görülen sağlık sorunlarıdır. Bununla birlikte yaşlılarda D vitamini prevalansına ilişkin yapılmış çalışma sayısı oldukça kısıtlıdır. Bu çalışma ile Amasya ilinde yaşlılarda D vitamini, anemi ve demir eksikliği prevalansının belirlenmesi amaçlanmıştır.

Gereç ve Yöntemler: Bu çalışma Amasya Üniversitesi Eğitim ve Araştırma Hastanesi Dahiliye Polikliniklerine 01.01.2015-31.12.2020 tarihleri arasında başvuran 65 yaş ve üstü bireylerin hasta kayıtları üzerinden retrospektif olarak yapılmıştır. Araştırmada kullanılmak üzere hasta kayıtlarından bireylerin yaş, cinsiyet, hemogram, D vitamini ve serum demir düzeyleri, herhangi bir kronik hastalığının olma durumu, bireyin sağlık kuruluşuna başvurduğu tarih ve başvuru nedeni gibi bilgiler veri toplama formuna kaydedilmiştir.

Bulgular: Yaşlı bireylerin %66,6'sı kadın, %33,4'ü erkektir. Yaşlıların %38,4'ünde anemi, %48,1'inde demir eksikliği, %70,8'inde D vitamini eksikliği saptanmıştır. Yaşlı bireylerde hemoglobin değerleri, cinsiyet ile düşük demir değerleriyle orta düzeyde pozitif yönde ilişkili; hemoglobin değerleri yaş ve D vitamini değerleriyle düşük düzeyde negatif yönde ilişkili bulunmuştur. Regresyon analizi sonuçları, yaşı küçük, demir değerleri düşük ve kadın cinsiyetine sahip olmanın yaşlı bireylerde düşük hemoglobin değerleriyle ilişkili olduğunu göstermektedir.

Sonuç: Bu çalışma yaşlı popülasyonda anemi, demir eksikliği ve D vitamini eksikliği/yetersizliğinin yaygın olarak görüldüğünü ortaya koymaktadır.

Anahtar Kelimeler: Yaşlı, Anemi, Demir Eksikliği, D Vitamini Eksikliği

INTRODUCTION

Old age is a period in which mortality, the number of chronic diseases, and the need for health care increase, in which multimorbidity/comorbidity is involved, the dependency ratio increases, economic difficulties manifest themselves more, and the problem of loneliness arises. With these emerging changes, the concepts of disease prevention and quality aging have become the significant issues of health services. In this context, many experimental studies on elderly health have shown that vitamin D and iron play an essential role in the emergence and treatment of various diseases (1).

Understanding the role of vitamin D in maintaining health has increased significantly in recent years. There is growing evidence that vitamin D not only has a beneficial effect on preventing osteoporosis and the risk of falls in the elderly but may also reduce the incidence of cancer, infections, autoimmune, cardiovascular, neurological diseases, and psychiatric disorders (2). In addition, it has been determined that anaemia and vitamin D deficiency increase with age and are essential factors that independently increase morbidity and mortality (3). According to the Third National Health and Nutrition Examination Survey (NHANES III) study, the incidence of anaemia in men and women over 65 years of age was 11% and 10%, respectively. However, the prevalence of anaemia increases rapidly after age 50 and reaches 20% in people aged 85 and over (4).

Iron and vitamin D deficiency are common in many parts of the world and are recognized as a global public health problem (5). In a study conducted in the UK, vitamin D deficiency was found in more than 50% of the adult population during the winter and spring periods, and severe vitamin D deficiency in 16% (6). The elderly population has increased in Turkey by 21.9% in the last five years in parallel with the world, reaching 7,550,727 people in 2019. Thus, the proportion of the elderly population in the total population increased to 9.1% as of 2019 (7). Çelebi et al., in a study they conducted in Ankara, 36.6% of women had severe, 29% moderate, and 16.8% mild vitamin D deficiency was found (8).

Iron deficiency is a common cause of anaemia in older individuals but shows a weak correlation with malnutrition. With advancing age, gastritis, colon cancer, abnormalities and gastrointestinal system bleeding are the most common causes of iron deficiency (9). In studies conducted in different regions of Turkey, Yıldırım et al. found the frequency of iron deficiency to be 7.1%, and Cankurtaran et al. found 40.5% (10, 11).

Over the past decade, anaemia has emerged as a risk factor associated with various adverse outcomes in older adults, including hospitalization, disability, and death. Anaemia is a homeostatic imbalance in the blood concentration of haemoglobin (12). Anemia is an important risk factor in old age. Given that anaemia is a multifactorial condition, the heightened comorbidity among older adults poses challenges in discerning whether anaemia serves as an indicator of disease burden or functions as a causal mediator resulting in adverse events.

In the reviews of the literature, it is seen that iron and vitamin D deficiency is a fairly common health problem in adult individuals, but there are not enough studies on vitamin D prevalence, especially in the elderly population. This study aims to determine the prevalence of anemia, vitamin D deficiency, and iron deficiency in older adults, and to identify potential research needs in epidemiology for the future.

MATERIAL AND METHOD

This study was conducted retrospectively on the patient records of individuals aged 65 and over who applied to Amasya University Training and Research Hospital Internal Medicine Polyclinics between 01.01.2015 and 31.12.2020. The blood results of 5706 individuals aged 65 and over who applied to the hospital within the specified date range were evaluated. If there are multiple applications, the date of the person's first admission to the hospital is considered as the basis. The results of 781 individuals were analyzed in total.

The data were collected from the patient records through the form prepared by the researchers. Information such as age, gender, haemoglobin, vitamin D and serum iron levels of the individuals, the status of any chronic disease, the date of application of the individual to the health institution, and the reason for application were recorded in the data collection form to be used in the study.

The World Health Organization (WHO) definition of anaemia (haemoglobin concentration) was referenced as <12 g/dL in women and <13 g/dL in men for the classification of anaemia. Although there is no consensus on the optimal level of 25(OH) vitamin D, most guidelines suggest that a vitamin D above 20 ng/ml (50 nmol/L) is sufficient, between 10 and 20 ng/ml (25-50 nmol/L) as deficiency and a level below 10 ng/ml (25 nmol/L) is considered as severe deficiency (13). Reference ranges for serum iron in the adult age group are accepted as 60-180 mg/dL in women and 70 180 mg/dL in men (14).

Ethical Approval

Before the study, administrative permission (dated 28.12.2020 and numbered 68724985-044) and ethical approval (dated 19.01.2021 and numbered E-15386878-044-1696) were obtained from the non-interventional clinical research ethics committee of a university. In the study, an Informed Consent Form was obtained from the participants.

Statistical Analysis

All statistical analyses were completed in Statistical Package for the Social Sciences (SPSS) 25 data analysis program. Descriptive statistics, including frequency, percentage, mean, and standard deviation values, were used to provide information about the sociodemographic characteristics of elderly individuals and classifications of iron, vitamin D, and haemoglobin values. Pearson Multiplication Moment Correlation Coefficient analysis was used to examine the relationship between haemoglobin values with gender, age, iron, and vitamin D values in elderly individuals. Multiple regression analysis was used to determine which of the values of sex, age, iron, and vitamin D were the predictors of hemogram values in the elderly. The appropriate analyses examined assumptions of normality, linearity, homoscedasticity, multiple linearities, and normality of regression errors. Since vitamin D values showed a highly platokurtic (8.57) and skewed distribution (137.79), this variable was transformed using the 1/ Square Root (Vitamin D) formula. In line with this transformation, high scores refer to low vitamin D values, while low scores refer to high vitamin D values and are interpreted accordingly. After this transformation, it was observed that the data met all the assumptions of the analysis. Impact magnitude classification was used to interpret the Pearson Product Moment Correlation Coefficient values and the variance rates explained in multiple regression analysis. The $p < .05$ significance level was used in all inferential statistics.

RESULTS

Table I shows the sociodemographic characteristics of elderly individuals and classifications of iron, vitamin D, and haemoglobin values.

Table I. Descriptive statistics

Features	n	%
Gender		
Female	520	66.6
Male	261	33.4
Age Group		
Young Elderly (65-74 years)	491	62.9
Middle Elderly (75-84 years)	240	30.7
Elderly (85 and over)	50	6.4
Haemoglobin		
Low (<12 g/dL in women and <13 g/dL in men)	300	38.4
Normal	481	61.6
Serum Iron Level		
Iron Deficiency	376	48.1
Sufficient Iron Level	405	51.9
Vitamin D Value		
Severe Vitamin D Deficiency	318	40.7
Vitamin D Deficiency	236	30.2
Adequate Level of Vitamin D	227	29.1

Note. n = 781.

As shown in Table I, most of the elderly individuals included in the study consisted of women (66.6%), young elderly (62.9%), individuals with sufficient iron levels (51.9%), Severe vitamin D deficiency (40.7%) and normal haemoglobin (61.6%).

Table II shows the results of the Pearson Multiplication Moment Correlation Coefficient analysis performed to examine the relationship between haemoglobin values and gender, age, iron, and vitamin D values in elderly individuals.

Table II. Pearson multiplication moment correlation coefficient analysis results

	1. Haemoglobin	2. Gender	3. Age	4. Vitamin D	5. Iron
1. Haemoglobin					
2. Gender	.24***				
3. Age	-.25***	.05			
4. Vitamin D	-.07*	-.12***	.03		
5. Iron	.31***	.09*	-.08*	-.08	
Mean	12.64	1.33	73.28	.30	67.32
Standard Deviation	1.87	.47	6.31	.11	33.83
Skewness	-.44	.70	.67	1.03	.65
Kurtosis	.22	-1.51	-.48	2.93	-.14

Note. Gender variable coding: 1 = Female, 2 = Male. $p < .05$*, $p < .001$***.

As seen in Table II, in elderly individuals, haemoglobin values are low and positively correlated with gender (r = .24) and moderately positively correlated with iron values (r = .31). On the other hand, haemoglobin values are negatively correlated with age (r = -.25) and vitamin D values (r = -.07). Elderly individuals with male gender, younger age, low vitamin D values, and high iron values tend to have high haemoglobin values.

Table III shows the results of a multiple regression analysis to determine which gender, age, iron, and vitamin D values are predictors of haemoglobin values in elderly individuals.

Table III. Multiple regression analysis results

	B	*SH*	β	*t*	*p*	*sr*	VIF
Constant	14.99	.73		20.47	.001***		
Gender	.93	.12	.24	7.46	.001***	.24	1.02
Age	-.06	.01	-.22	-6.90	.001***	-.22	1.01
Vitamin D	-.28	.53	-.02	-.52	.604	-.02	1.02
Iron	.02	.00	.32	10.15	.001***	.32	1.02

Note. Gender variable coding: 1 = Female, 2 = Male. $p < .05$*, $p < .001$***.

As a result of the multiple regression analysis, the model created to predict the haemoglobin values were found to be significant ($F(4, 773) = 58.99$, $p < .001$, $\Delta R2 = .23$). This model has a moderate impact magnitude and describes approximately 23% of the change in haemoglobin values of older individuals. As seen in Table 3, while male gender (β = .24) and iron levels (β = .32) are positive predictors of high haemoglobin values in elderly individuals, age (β =.-22) is a negative predictor of haemoglobin values. Iron values are the most important predictor of haemoglobin values in elderly individuals. The regression analysis results show that being older, having low iron levels, and being female is associated with lower haemoglobin values in elderly individuals.

DISCUSSION

Today, anaemia is now recognized as a risk factor for a range of adverse outcomes in older

adults, including hospitalization, morbidity, and mortality. About one-third of older adults with anaemia also have a deficiency of iron, folate, or vitamin B12 (12). In our study, the frequency of anaemia in the elderly population was found to be 38.4%. However, the prevalence of anaemia was found to be 37.5% in men and 38.7% in women. In addition, the study concluded that having low iron values and being female were associated with low haemoglobin values in elderly individuals. According to the literature, the prevalence of anaemia in the elderly population varies between 9.2 and 23.9% in men, while this rate varies between 8.1 and 24.7% in women (15). In the NHANES-III study conducted with more than 5000 individuals, it was reported that the prevalence of anaemia increases with age after age 50 and exceeds 20% for those aged 85 and over (4). Another study conducted with 232 patients aged 65 to 98 (mean 81) found that 24% of individuals were anaemic (16). The prevalence of anaemia increases dramatically after the fifth decade of life, with this increase being more pronounced in the male gender. In studies conducted using the WHO anaemia classification criteria, the prevalence of anaemia ranges from 14.9% to 15.0% in men and between 7.1-12.7% in women (12). It is thought that the difference in the prevalence of anaemia in the elderly population is due to the differences in the sampling design and the racial characteristics of the individuals living in the regions where the studies were conducted.

Iron deficiency is among the top five causes of Years lived with disability (YLD) in recent years and remains the leading cause in women (17). It can be expressed as a public health problem mainly affecting children, pregnant women, and the elderly. Anaemia affects one-third of the world's population, and anaemia due to iron deficiency is the most crucial cause. Iron deficiency, especially in old age, is more difficult to treat compared to other groups (18). In our study, it was determined that 48.1% of the elderly had iron deficiency. In addition, according to the findings obtained from the study, haemoglobin values were found to be low with gender (r = .24) and moderately positively correlated with iron values (r = .31) in elderly individuals. Although menstruation, pregnancy, and the lactation process are common causes of anemia in women during their adult years, inadequate treatment of the deficiency can result in a higher prevalence of anemia among elderly women. In a study conducted by Çoban et al. involving 1388 elderly individuals, anemia was found in 25% of the participants, with iron deficiency anemia (IDA) accounting for one-third of the cases of anemia. (19). While the prevalence of IDA was reported to be 7.1% in the elderly living in Ankara, a study conducted on the elderly living in the Western Black Sea region showed that the prevalence was 40.5% (10, 11). The variations in the prevalence of anemia can be attributed to differences in the definition of anemia, sampling methods employed, ethnicity of the study population, as well as specific characteristics of the cohorts under investigation. World Health Organization estimates that 50% of anaemia cases globally are caused by iron deficiency. Anemia, in particular, is attributed to iron deficiency regardless of the cause, but there are many other underlying causes, including nutrition and various diseases.

The prevalence of severe vitamin D deficiency and deficiency in the elderly is relatively high, and it is a significant public health problem. Vitamin D is an important regulator of bone metabolism. The risk of hip fracture, the most critical complication of osteoporosis, threatens the health of the elderly with advanced age and is associated with low vitamin D levels (20, 21). In our study, vitamin D severe deficiency was found in 40.7% of the elderly, and vitamin D deficiency was found in 30.2%. In a study conducted by Porto et al., the rate of elderly people with vitamin D deficiency was found to be 65% (22). In another study conducted with individuals over 60 years of age in Japan, the prevalence of vitamin D deficiency and severe deficiency was 93.9% and 71.7%, respectively, and in a study conducted with 166 women in Saudi Arabia, vitamin D deficiency was calculated as 60.2% (20, 23). A retrospective study by Ateş Bulut et al. involving 560 older adults found that 35.7% of the participants had vitamin D deficiency, with 26.2% presenting with severe insufficiency. (24).

In other studies, it was observed that vitamin D severe deficiency and deficiency were lower, but it was noted that these studies were carried out in the summer months (25, 26). The study findings may vary due to the well-known fact that increased exposure to sunlight can enhance the synthesis of vitamin D obtained from food.

In the study, it was determined that elderly individuals of the male gender, younger age, and high iron values tended to have higher haemoglobin values. Furthermore, the regression analysis conducted in our study revealed that being younger, having low iron levels, and being female are significantly associated with lower haemoglobin values in elderly individuals. Recent evidence suggests that other dietary factors, such as adequate vitamin D consumption, may affect iron regulation (27, 28). The NHANES III study conducted with 5.456 individuals between 2001 and 2006 revealed that low vitamin D status was associated with an increased risk of anaemia in the general population (4). Another study of 11,206 adults in Korea found that advanced age, female gender, smoking, and low vitamin D levels were associated with low haemoglobin (29). "The relationship between vitamin D levels and anemia is potentially of significant public health, as severe deficiency and deficiency of vitamin D are prevalent in the general population." The results obtained are supported by the literature findings, and it is considered very important in terms of demonstrating that vitamin D level is a modifiable risk factor for anaemia.

Limitation of the Study

Since the study was conducted on patient files, the data were limited to those recorded in the file.

CONCLUSION

Anemia, iron deficiency, as well as severe deficiency or deficiency of vitamin D, are known to significantly contribute to morbidity and mortality among elderly individuals. Provision of adequate support, particularly to elderly individuals with severe vitamin and mineral deficiencies, can significantly enhance their quality of life.Therefore, it is crucial to periodically perform blood tests and assess vitamin and mineral levels in elderly individuals, and develop appropriate strategies based on the prevailing findings.

Conflict of Interest

There is no conflict of interest between the authors.

Financial Support

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Ethical Declaration

Approval was obtained from the Non-Interventional Clinical Research Board of Amasya University with the date 19.01.2021 and the number E-15386878-044-1696. In the study, an Informed Consent Form was obtained from the participants.

Author Contributions

Concept: ZİS, AK, Design: ZİS, AK, Supervising: ZİS, Financing and equipment: ZİS, AK, Data collection and entry: ZİS, Analysis and interpretation: AK, Literature search: ZİS, AK, Writing: ZİS, AK, Critical review: ZİS, AK.

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