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# Frailty and Malnutrition Among Dialysis Patients Stratified by Age: Before and After Emergence of COVID-19 Pandemic

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## ABSTRACT

**Objective:** Dialysis patients are at risk of malnutrition and frailty. In our study, we aimed to reveal how the COVID-19 pandemic affects the frailty and malnutrition status in dialysis patients.

**Methods:** Patients without COVID-19 who received regular dialysis treatment in our center were included in our study. On March 1, 2020, and June 1, 2020, frailty test, subjective global evaluation, and mini nutrition evaluation were performed.

**Results:** A total of 137 patients were included in the study. Patients were evaluated on the March and June 2020 Fragile scale. In the frailty assessment, a significant increase in pre-frailty and frailty was found ($P = .007$). Significant changes were found between concomitantly measured levels of vitamin D, low-density lipoprotein, albumin, and total protein ($P = .000$, $P = .016$, $P = .013$, and $P = .008$), respectively. The patients were divided into 2 groups as under 65 years old and over 65 years old. There was a significant increase in frailty and frailty risk in frailty assessment of patients over 65 years of age ($P = .031$). There were no significant changes in short mini-feeding assessments and laboratory parameters. There were no significant changes in frailty assessments of patients under 65 years of age. In the subjective global assessment, there was a significant increase in mild to moderate malnutrition and severe malnutrition ($P = .008$). Significant changes were found between concurrently measured levels of vitamin D, low-density lipoprotein, albumin, and total protein ($P = .000$, $P = .039$, $P = .029$, and $P = .004$), respectively.

**Conclusion:** It was concluded that the COVID-19 pandemic may increase the risk of frailty, especially in dialysis patients over 65 years of age, and may deteriorate the nutritional status in patients under 65.

**Keywords:** COVID-19, frailty, malnutrition, dialysis

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## INTRODUCTION

Frailty is an important syndrome characterized by increased sensitivity to stressors as a result of the effects of multiple organ systems, and the frequency increases with aging.[1-5] Chronic kidney disease also increases the risk of frailty. In addition, many metabolic and nutritional disorders are seen in patients with chronic kidney disease (CKD), which contributes to malnutrition.[6,7] Many studies have shown a high risk of frailty and malnutrition in dialysis patients. Frailty and malnutrition cause increased morbidity and mortality in patients with CKD.[8-12] It is known that infectious diseases increase the risk of frailty and malnutrition.

The impact of the COVID-19 pandemic on the elderly and patients with comorbidities is particularly significant. COVID-19 causes severe cases of pneumonia, difficulty in treatment, and a fatal course. Social distance rules and the implementation of curfews can also affect patients not infected with COVID-19, increasing the risk of frailty and malnutrition.

In addition, the clinical significance of frailty and nutrition has been highlighted in clinical guidelines that recommend the assessment of frailty and nutritional status for adults during the COVID-19 pandemic.[13-15] Frail scale is used in the assessment of frailty. Short-form mini-nutritional assessment (MNA-SF) and subjective global assessment (SGA) are used in the evaluation of nutrition. These tests are easy to apply and understand, so they are often preferred.

Aggressive diagnosis and treatment methods should be used in patients who are thought to have pre-frail, frail, malnutrition, or malnutrition risk. Because the presence of any of these is associated with more complications, hospitalization, morbidity, and mortality.[13,16] There are proven therapeutic approaches to frailty and malnutrition; These are exercise, calorie and protein supplementation, vitamin D supplementation, and reduction of polypharmacy.[17,18]



In our study, we aimed to learn the effect of the COVID-19 pandemic on the frailty and nutritional status of dialysis patients and the change between age groups.

## METHODS

In our hospital, 137 patients who received regular dialysis treatment for 3 months were included in the study. Our hospital is a large training and research hospital. The patients included in the study were evaluated in the first week of March 2020 and the first week of June 2020.

Demographic characteristics (gender, age), chronic diseases [hypertension (HT), diabetes mellitus (DM), CKD, asthma, chronic obstructive pulmonary disease, congestive heart failure], coronary artery diseases (such as myocardial infarction, angina pectoris, and documented coronary heart disease), the number of drugs used (the use of 4 or more than 4 drugs was defined as polypharmacy), laboratory data (albumin, total protein, prealbumin, calcium, phosphorus, calcium, C-reactive protein, low-density lipoprotein (LDL), parathyroid hormone (PTH), transferrin saturation, vitamin D, hemoglobin, and Kt/v) were recorded.

### MAIN POINTS

- COVID-19 pandemic puts the elderly and patients with comorbidities at risk of death. In addition, infectious diseases are known to increase the risk of fragility and malnutrition.
- Social distancing and isolation measures applied in the COVID-19 pandemic also increase the risk of frailty and malnutrition in elderly or patients with chronic kidney disease (CKD).
- Frailty and malnutrition cause increased morbidity and mortality in elderly patients or patients with CKD.
- In our study, the negative effects on frailty in hemodialysis patients during the COVID-19 pandemic were more pronounced in patients over 65 years of age, and the negative effects on nutrition were more pronounced in patients younger than 65 years of age.
- As a result, during the COVID-19 pandemic, it is necessary to increase the exercise programs for dialysis patients and to be careful about good nutrition.

We evaluated frailty with FRAIL questionnaire. The Frail scale consists of 5 items: Fatigue, resistance, mobility, weight loss, and existing diseases. In the FRAIL frailty questionnaire evaluation, patients who scored 0 points were considered normal, patients scoring 1-2 points were pre-frail, and patients who scored 3-5 points were considered frail.

Nutritional status was evaluated by SGA in younger patients and MNA-SF in older patients.

Body mass index of MNA-SF patients, in the last 3 months; It is a test that investigates whether there is weight loss, psychosocial stress, or an acute illness, whether there is a decrease in food intake due to anorexia, and whether it is accompanied by psychological problems such as mobility, dementia, and depression. The total score was obtained by scoring each item between 0 and 3. Scores of 11 and above were accepted as normal nutrition, 7-11 malnutrition risk, and less than 7 points as malnutrition.

In SGA, changes in body weight, change in food intake, gastrointestinal symptoms, functional capacity, loss of subcutaneous breast fat tissue, muscle mass loss, and edema were evaluated in the last 6 months. After scoring the anamnesis and physical examination data, SGA classified as A = well nourished, B = mild to moderate malnutrition, and C = severe malnutrition.

According to the normal ranges given in the hospital laboratory, normal range for hemoglobin 11.1-14.7 g/dL; normal albumin range 3.5-5.2 g/dL, normal prealbumin range 0.17-0.34 g/L, normal range for phosphorus 2.55-4.5 mg/dL, Ca normal range for 8.6-10 mg/dL, normal range for LDL 50-150 mg/dL, normal range for PTH 15-65 ng/L, normal range for total protein 6.6-8.7 g/dL, normal range for vitamin D 30-80 µg/L, and the Kt/v range was set as 1.2-1.4 target range.

On March 11, it was announced that the first COVID-19 case was seen in our country. We made the first evaluation of our patients before the first case was seen in our country. Patients with a history of COVID-19 disease, patients with acute infectious diseases, malignancies, and those who did not receive regular dialysis treatment were excluded from the study. There were no patients who underwent home hemodialysis or stayed in a nursing home.

This study was approved by the Kartal Dr. Lütfi Kırdar City Hospital Clinical Research Ethics Committee on October 14, 2020.

### Statistical Analysis

The distribution was examined. Numerical variables were given as mean ± standard deviation for normally distributed

variables and as medians for skewed continuous variables. Categorical variables are shown as frequency. A chi-square test was used to evaluate categorical data. In the analysis of continuous variables, paired sample *t*-test and Wilcoxon Signed Ranks test were used appropriately considering the distribution of the data. Data were analyzed using the SPSS 21.0 statistical program (IBM Corp., Armonk, NY, USA). A *P*-value of less than .05 was accepted as the statistical significance limit.

## RESULTS

There were 137 patients who underwent chronic dialysis treatment in our center. 105 (77%) hemodialysis patients, and 32 (23%) peritoneal dialysis patients were included in the study. Of the patients included in the study, 75 (55%) were male and 62 (45%) were female. Their average age was 55.1 + 14.3 years. Dialysis vintage was 47.8 ± 57.4 months. The most common accompanying diseases were HT 68% (118/137) and DM 31% (43/137). Polypharmacy was present in 71% (97/137) of the patients.

In the frailty assessment conducted in March 2020, 88 (64%) patients were robust, 49 (36%) patients were frail or pre-frail. In the second evaluation made in June 2020, 77 (56%) patients were robust, 60 (44%) patients were frail or pre-frail (*P* = .007).

At the beginning of our study, the difference between mean vitamin D, mean LDL, mean albumin, mean total protein, mean PTH values in the first and second measurements in 137 patients was significant (respectively *P* = .000, *P* = .016, *P* = .013, *P* = .008, *P* = .034). There was no significant difference between hemoglobin, calcium, phosphorus, CRP, prealbumin, transferrin saturation, and Kt/v values. The demographic characteristics and laboratory characteristics of the study population are detailed in Tables 1 and 2.

46 (34%) of the study patients were over 65 years of age. While there were 38 (83%) patients over 65 years of age receiving hemodialysis treatment, there were 8 (17%) patients receiving peritoneal dialysis treatment. Of the patients over 65 years of age, 28 (61%) were male and 18 (39%) were female. The mean age of patients over 65 years old was 69.9 ± 5.6. The mean age of dialysis in patients over 65 years was 54.7 ± 65.7 years. The most common comorbidities were HT 82% (38/46) and DM 41% (19/46). Polypharmacy was present in 61% (28/46) of the patients.

When the data of 46 patients over 65 years of age were examined in the first MNA-SF evaluation, 34 (74%) patients had normal nutrition and 12 (26%) patients were at risk of malnutrition or malnutrition. In the second evaluation made 3 months later, 30 (65%) patients were under normal nutrition and 16 (35%) patients were at risk of malnutrition or malnourished (*P* = .219). There was no significant difference between the biochemical parameters measured at the beginning of our study and the biochemical parameters measured 3 months later.

**Table 1.** Demographic Characteristics and Comorbidities of the Patients

| Parameters | Patients Under 65 Years of Age, n = 91 | Patients Over the Age of 65, n = 46 | Total, n = 137 |
|---|---|---|---|
| Demographic features | | | |
| Age | 47.7 ± 11.2 | 69.9 ± 5.6 | 55.1 ± 14.3 |
| Sex | | | |
| Female, n (%) | 45 (50) | 18 (39) | 63 (46) |
| Male, n (%) | 46 (51) | 28 (61) | 74 (54) |
| Dialysis | | | |
| PD, n (%) | 24 (26) | 8 (17) | 32 (33) |
| HD, n (%) | 67 (74) | 38 (83) | 105 (77) |
| Dialysis age, month | 54.7 ± 66 | 34.3 ± 26 | 47.8 ± 57 |
| Hypertension, n (%) | 80 (88) | 38 (83) | 118 (68) |
| Diabetes mellitus, n (%) | 24 (26) | 19 (41) | 43 (31) |
| CHF, n (%) | 9 (10) | 15 (32) | 24 (18) |
| CVD, n (%) | 11 (12) | 11 (24) | 22 (16) |
| COLD, n (%) | 4 (4) | 4 (9) | 8 (6) |
| Polypharmacy, n (%) | 69 (75) | 28 (61) | 97 (71) |
| Average number of drugs | 6.3 ± 3.6 (5) | 6.3 ± 4.2 (5.5) | 6.4 ± 3.8 (5.5) |

CHF, congestive heart failure; COLD, chronic obstructive lung disease; CVD, coronary vascular diseases; HD, hemodialysis; PD, peritoneal dialysis.

In the first assessment of frailty in patients over 65 years of age, 26 (57%) patients were robust, and 20 (43%) patients were frail or pre-frail. At the second evaluation performed 3 months later, 20 (43%) patients were robust, 26 (57%) patients were frail or pre-frail (*P* = .031).

The laboratory values of the patients over 65 years of age are detailed in Table 3.

Of the 137 patients included in the study, 91 (66%) were under the age of 65. While there were 67 (74%) patients under the age of 65 who received hemodialysis treatment, there were 24 (26%) patients who received peritoneal dialysis treatment. Of the patients under 65 years of age, 46 (51%) were male and 45 (49%) were female. The mean age of the patients under 65 years was 47.7 ± 11.2 years. The vintage of dialysis in hemodialysis patients under 65 years was 34.3 ± 26 months. The most common comorbidities were HT 88% (80/91) and DM 26% (24/91). Polypharmacy was present in 75% (69/91) of the patients.

**Table 2.** Laboratory Characteristics of All Patients

| Parameters | March | June | *P* |
|---|---|---|---|
| Frailty | | | .030 |
| Robust, n (%) | 88 (64) | 77 (56) | |
| Pre-frail/frail, n (%) | 49 (36) | 60 (44) | |
| Laboratory findings | | | |
| Hemoglobin, g/dL | 10.6 ± 1.8 (10.7) | 10.5 ± 2.1 (10.6) | .678 |
| Hematocrit, % | 31.1 ± 5.2 (31.1) | 32.1 ± 5.4 (32.1) | .240 |
| Vitamin D, mcg/L | 9.3 ± 4.3 (7.0) | 12.6 ± 6.6 (11.0) | .000 |
| LDL, mg/dL | 209 ± 57 (223.0) | 197 ± 45.5 (214.0) | .016 |
| Albumin, g/dL | 3.6 ± 0.6 (3.7) | 3.5 ± 0.5 (3.6) | .013 |
| Prealbumin, g/dL | 0.29 ± 0.11 (0.3) | 0.3 ± 0.10 (0.30) | .606 |
| Total protein, g/dL | 6.6 ± 0.6 (6.6) | 6.4 ± 0.6 (6.4) | .008 |
| Calcium, mg/dL | 8.6 ± 1 (8.7) | 8.7 ± 0.8 (8.7) | .144 |
| Phosphorus, mg/dL | 5 ± 1.6 (4.7) | 4.8 ± 1.2 (4.7) | .274 |
| Tsat, % | 27.1 ± 12.7 (28.0) | 27 ± 10.3 (25.0) | .156 |
| CRP, mg/dL | 26.9 ± 46.7 (9.2) | 19.7 ± 38 (8.2) | .153 |
| Kt/v | 1.6 ± 0.4 (1.6) | 1.55 ± 0.2 (1.6) | .142 |

CRP; C-reactive protein, LDL; low-density lipoprotein, Tsat: transferrin saturation.
Data are given as mean ± standard deviation (median).



**Table 3.** Laboratory Characteristics of Patients Over 65 Years of Age

| Parameters | March | June | *P* |
|---|---|---|---|
| MNA | | | .219 |
| Normal nutrition, n (%) | 34 (74) | 30 (65) | |
| Malnutrition risk/malnutrition, n (%) | 12 (26) | 16 (35) | |
| Frailty | | | .030 |
| Robust, n (%) | 26 (57) | 20 (43) | |
| Pre-frail/frail, n (%) | 20 (43) | 26 (57) | |
| Laboratory findings | | | |
| Hemoglobin, g/dL | 10.7 ± 1.6 (10.7) | 10.8 ± 1. 2 (10.7) | .670 |
| Hematocrit, % | 31.5 ± 5.7 (30.4) | 33.3 ± 5.8 (32.6) | .140 |
| Vitamin D, mcg/L | 9.6 ± 4.6 (70.) | 12.4 ± 5.9 (11.0) | .130 |
| LDL, mg/dL | 209 ± 58 (222) | 197 ± 41 (214) | .243 |
| Albumin, g/dL | 3.5 ± 0.5 (3.6) | 3.4 ± 0.5 (3.4) | .154 |
| Prealbumin, g/dL | 0.28 ± 0.11 (0.3) | 0.29 ± 0.19 (0.3) | .677 |
| Total protein, g/dL | 6.5 ± 0.5 (6.5) | 6.4 ± 0.6 (6.4) | .494 |
| Calcium, mg/dL | 8.4 ± 1.2 (8.6) | 8.7 ± 0.7 (8.7) | .611 |
| Phosphorus, mg/dL | 4.9 ± 1.5 (4.6) | 4.8 ± 1.3 (4.6) | .913 |
| Tsat, % | 29.8 ± 12.3 (28.5) | 26.4 ± 9.5 (25.0) | .152 |
| CRP, mg/dL | 31.2 ± 55 (7.8) | 19.5 ± 36 (8.5) | .218 |
| Kt/v | 1.5 ± 0.2 (1.4) | 1.5 ± 0.21 (0.3) | .814 |

CRP; C-reactive protein, LDL; low-density lipoprotein, MNA; mini nutritional assessment, Tsat; transferrin saturation.
Data are given as mean ± standard deviation (median).

When the data of 91 patients under 65 years of age were examined in the first SGA, 71 (78%) patients were well-nourished and 20 (22%) were evaluated as mild to moderate malnutrition or severe malnutrition. In the second SGA performed 3 months later, 63 (69%) patients were well nourished, and 28 (31%) patients were evaluated to have mild to moderate or severe malnutrition ($P$ = .008).

In the first and second laboratory evaluation of 91 patients under 65 years of age, there was a significant difference between the mean vitamin D, mean LDL, mean albumin, and total protein measurements ($P$ = .000, $P$ = .039, $P$ = .029, and $P$ = .004, respectively). There was no significant difference between hemoglobin, calcium, phosphorus, PTH, CRP, prealbumin, transferrin saturation, and Kt/v values.

In the initial evaluation of frailty, 62 (68%) patients were robust, and 29 (32%) patients were frail or pre-frail. At the second evaluation performed 3 months later, 57 (62%) patients were robust, 34 (37%) patients were frail or pre-frail ($P$ = .180).

The laboratory characteristics of the patients under 65 years of age are detailed in Table 4.

When the results are examined, the risk of malnutrition increases in patients under 65 years of age during the COVID-19 outbreak. Frailty risk increases in all patients provided that it is more pronounced in patients over 65 years of age.

The demographic characteristics and laboratory characteristics of the study population are detailed in Tables 1 and 2.

## DISCUSSION

The COVID-19 pandemic especially puts the elderly and patients with comorbidities at risk of death. For this reason, social distance and isolation measures are implemented in our country to limit viral transmission. However, these restrictions may cause increased frailty and nutritional deficiencies in elderly patients or patients with comorbidities. Identifying conditions that promote malnutrition and frailty in older adults or in malnourished and frail individuals with multiple comorbidities is critical to prevent adverse health outcomes. In our study, we revealed how hemodialysis patients were affected in terms of nutrition and frailty during the COVID-19 pandemic. Our study is important because it is one of the first publications to contribute to the limited data on this subject.



**Table 4.** Laboratory Characteristics of Patients Under 65 Years of Age

| Parameters | March | June | *P* |
|---|---|---|---|
| MNA | | | .008 |
| Normal nutrition | 71 (78) | 63 (69) | |
| Malnutrition risk / malnutrition | 20 (22) | 28 (31) | |
| Frailty | | | .180 |
| Robust | 62 (68) | 57 (62) | |
| Pre-frail/frail | 29 (32) | 34 (37) | |
| Laboratory findings | | | |
| Hemoglobin, g/dL | 10.5 ± 1.8 (10.8) | 10.3 ± 2 (10.6) | .446 |
| Hematocrit, % | 30.8 ± 5 (31.0) | 31 ± 5.1 (30.9) | .214 |
| Vitamin D, µg/L | 9.2 ± 4.2 (7.0) | 12.6 ± 6.8 (11.8) | .000 |
| LDL, mg/dL | 209 ± 56 (223) | 197 ± 47 (197) | .039 |
| Albumin, g/dL | 3.6 ± 0.58 (3.8) | 3.5 ± 0.5 (3.6) | .029 |
| Prealbumin, g/dL | 0.29 ± 0.11 (0.11) | 0.30 ± 0.10 (0.1) | .678 |
| Total protein, g/dL | 6.6 ± 0.6 (6.7) | 6.4 ± 0.6 (6.4) | .004 |
| Calcium, mg/dL | 8.6 ± 0.9 (8.8) | 8.7 ± 0.8 (8.7) | .063 |
| Fosfor, mg/dL | 5 ± 1.6 (4.8) | 4.8 ± 1.2 (4.8) | .234 |
| Tsat, % | 28.8 ± 12 (26.0) | 27.2 ± 10.7 (25.0) | .467 |
| CRP, mg/dL | 24.2 ± 41 (41.0) | 19.5 ± 39 (7.1) | .428 |
| Kt/v | 1.6 ± 0.5 (1.6) | 1.5 ± 0.2 (1.5) | .135 |

CRP; C-reactive protein, LDL; low density lipoprotein, MNA; mini nutritional assessment, Tsat; transferrin saturation.
Data are given as mean ± standard deviation (median).

The average age of dialysis patients included in our study was similar to frailty, nutritional studies, and COVID-19 studies previously conducted on the dialysis population (between 57 and 66).[19-22] Gender distribution varied from study to study.[19,23,24] The most common comorbidities accompanying patients in the study group were HT and DM in accordance with the literature.[25,26]

The first frailty and nutrition evaluations made before the COVID-19 cases were seen in our country and the frailty and nutrition evaluations done in the third month of the pandemic were compared.

The risk of pre-frailty or frailty increased significantly in the third month of the pandemic in all patients and the patient group over 65 years of age. This increase in frailty assessment may be the result of patients' restricted mobility due to curfew restrictions and social distance rules. Because even short-term decreased activity has been shown to cause rapid muscle mass and physical function loss.[27,28] This decrease in physical functions in the dialysis patient population, especially patients over 65 years of age may have caused increased frailty.



Nutritional evaluation was performed by MNA-SF in patients over 65 years of age and by SGA in patients under 65 years of age. There was no significant change in MNA-SF evaluations and biochemical parameters performed 3 months apart in patients over 65 years of age. The lack of change in nutritional status assessment may be due to the small number of patients.

In the patient group under 65 years of age, the frailty or frailty risk of the patients did not change significantly in the third month of the pandemic. This may be because patients in this group are less affected by the curfews (because curfews were more heavily imposed over the age of 65).

However, there was a significant increase in the risk of malnutrition or malnutrition in MNA-SF assessments. Changes in biochemical parameters supported this finding. The reason for this increase in malnutrition or malnutrition risk may be psychological stress caused by the COVID-19 pandemic and economic concerns (unemployment or unpaid leave, etc.) (it should be kept in mind that one of the evaluation parameters used in MNA-SF evaluation may be the presence of stress or acute illness in the last 3 months). In addition, the social distance and isolation rules applied during the COVID-19 pandemic may have increased the risk of malnutrition or malnutrition by causing a feeling of loneliness, especially in the elderly and patients with additional diseases, due to reasons such as less going out, not participating in social activities, and not being visited.[29-31] Some studies have found that both social isolation and loneliness are independently associated with a higher risk of malnutrition.[32]

In the third month of the pandemic, the average vitamin D levels of the patients in both groups were high. The increase in vitamin D levels was more pronounced in patients under 65 years old. It is known that the prognosis of COVID-19 disease is significantly worse in people with low vitamin D.[33-36] Emphasizing the importance of vitamin D support in the trainings given in dialysis units during the COVID-19 pandemic process may have led to increased drug compliance and regular use of vitamin D treatments. The more pronounced difference in vitamin D levels in patients under 65 years of age may be due to their increased exposure to sunlight due to less exposure to curfews.

Our study has some limitations. A limitation is that we did not have physical performance tests and did not make inquiries about economic change (job loss, unpaid leave, etc.). In addition, the limited number of patients studied should be specified as a limitation. However, despite the small number of patients, clinicians interested in managing this group of patients should be informed.

## CONCLUSION

This study is the first to evaluate the change in frailty and nutrition in dialysis patients without COVID-19. As a result, patients who received dialysis treatment and did not have COVID-19 were affected by the COVID-19 pandemic in as little as 3 months and became more vulnerable. Adverse effects on frailty are more pronounced in patients over 65 years of age, while adverse effects on nutrition are more pronounced in patients under 65 years of age. During the COVID-19 pandemic, it is necessary to be careful about increasing exercise programs for dialysis patients, D vitamin support, and good nutrition.

**Ethics Committee Approval:** This study was approved by the Kartal Dr. Lütfi Kırdar City Hospital Clinical Research Ethics Committee (Date: October 14, 2020, Decision no: 2020/514/187/12).

**Informed Consent:** Informed consent was obtained from the patients who participated in this study.

**Peer-review:** Externally peer-reviewed.

**Author Contributions:** Concept – K.A.B.; Design – K.A.B.; Supervision – S.Y.; Materials – S.Y.; Data Collection and/or Processing – K.A.B.; Analysis and/or Interpretation – K.A.B.; Literature Review – S.Y.; Writing – K.A.B.; Critical Review – S.Y.

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