**Title Page**

**Title:** Relationship between personality traits and fatigue in multiple sclerosis patients and healthy individuals

**Başlık:** Multipl skleroz hastalarında ve sağlıklı bireylerde kişilik özellikleri ve yorgunluk arasındaki ilişkisi

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**MULTİPL SKLEROZ HASTALARINDA VE SAĞLIKLI BİREYLERDE KİŞİLİK ÖZELLİKLERİ VE YORGUNLUK ARASINDAKİ İLİŞKİ**

***Amaç:*** *Multipl skleroz (MS) hastalarında önemli bir engelleyici semptom olan yorgunluğun hastaların % 50-90’ını etkilediği bildirilmektedir.* *Yorgunluk çok boyutlu bir semptomdur ve kişilik özelliklerinden etkilenebilir. Fakat, MS hastalarında kişilik özellikleri ve yorgunluk arasındaki ilişki hakkında henüz yeterli bilgiye ulaşılmamıştır. Bu çalışmanın amacı, MS hastalarında ve sağlıklı bireylerde kişilik özellikleri ve yorgunluk arasındaki ilişkiyi belirlemektir.*

***Yöntem:*** *Bu kesitsel çalışmaya 66 MS hastası ve 38 sağlıklı birey dahil edildi. Kişilik özellikleri ve yorgunluk sırasıyla Eysenck kişilik anketi ve Yorgunluk Etki Ölçeği kullanılarak değerlendirildi.* *Sağlıklı bireyler ve MS hastalarını karşılaştırmak için bir Mann-Whitney U testi kullanıldı. Kişilik özellikleri ile yorgunluk arasındaki ilişkiyi belirlemek için Spearman korelasyon analizi uygulandı.*

***Bulgular:*** *Kişilik özelliklerinin gruplar arası karşılaştırılması; MS hastalarının sağlıklı bireylerden daha yüksek nevrotiklik ve daha düşük dışadönük kişilik özelliklerine sahip olduğunu gösterdi (p<0,05). Beklendiği gibi, yorgunluğun bilişsel, fiziksel ve psikososyal boyutları MS hastalarında sağlıklı bireylerden daha yüksekti (p<0,05). Korelasyon analizi ise; MS hastalarında nevrotik kişilik özelliğinin tüm yorgunluk boyutlarıyla orta düzeyde ve pozitif yönlü ilişkisi olduğunu (p<0,001), sağlıklı bireylerde ise herhangi bir kişilik özelliği ile yorgunluk arasında ilişki olmadığını (p>0,05) ortaya koydu.*

***Sonuç:*** *Bu çalışma MS hastalarında yorgunluk ve nevrotiklik arasında bir kısır döngü olduğunu ortaya koymuştur. Yüksek nevrotiklik yorgunluğu etkileyebilir ve yorgunluk, duygusal olarak dengesiz, düşmanca, kızgın veya endişeli olma eğilimine yol açan nevrotikliğe neden olabilir. Bu nedenle klinisyenler, tedavi öncesinde hastaların kişilik özelliklerini gözlemlemeyi ihmal etmemeli ve hastaları psikolojik yardıma başvurmaya yönlendirmelidir. MS hastalarının kişilik özelliklerini anlamak, klinisyenin MS'teki yorgunluğu daha iyi anlamasına katkıda bulunabilir ve yorgunlukla başa çıkmak için daha etkili yöntemler geliştirilmesini sağlayabilir.*

***Anahtar Kelimeler:*** *Multipl Skleroz, Kişilik, Yorgunluk*

**RELATIONSHIP BETWEEN PERSONALITY TRAITS AND FATIGUE IN MULTIPLE SCLEROSIS PATIENTS AND HEALTHY INDIVIDUALS**

***Purpose:*** *It is reported that fatigue, which is an important preventing symptom in patients with multiple sclerosis (MS), affects 50-90% of the patients. Fatigue is a multidimensional symptom and can be affected by personality traits. However, there is not enough information about the relationship between personality traits and fatigue in MS patients. The aim of this study was to determine the relationship between personality traits and fatigue in multiple sclerosis (MS) patients and healthy individuals (HI).*

***Methods:*** *Sixty-six MS patients and 38 HI were included in this cross-sectional study. Personality traits and fatigue were assessed using by Eysenck personality questionnaire and Fatigue Impact Scale, respectively. A Mann-Whitney U test was used to compare HI and MS patients. A Spearman correlation coefficient was performed to determine the relationship between personality traits and fatigue.*

***Results:*** *The comparison of the personality traits between the groups showed that MS patients had higher neuroticism and lower extraversion personality traits than HI (p<0.05). Expectedly, cognitive, physical, and psychosocial dimensions of fatigue were higher in MS patients than HI (p<0.05). The correlation analysis revealed that neuroticism had moderate positive correlations with all dimensions of fatigue in MS patients (p<0.001) whereas there was no relationship between any personality traits and fatigue in HI (p>0.001).*

***Conclusion:*** *This study revealed that there was a vicious circle between fatigue and neuroticism in MS patients. High neuroticism may affect fatigue and fatigue may cause neuroticism, leading to a tendency to be emotionally unstable, hostile, angry, or anxious. Therefore, clinicians should not neglect to observe the personality characteristics of the patients before treatment and guide patients to consulting emotional help. Understanding the personality traits of MS patients can contribute to the clinician's better understanding of fatigue in MS and develop more effective methods to cope with fatigue.*

***Keywords:*** *Multiple Sclerosis, Personality, Fatigue*

1. **INTRODUCTION**

The frequency of fatigue, one of the most disabling symptoms in multiple sclerosis (MS) patients varies between 50-90% (Bakshi et al., 2000, Fisk et al., 1994a). The Multiple Sclerosis Council for Clinical Practice Guidelines defines fatigue as "a subjective lack of physical and/or mental energy that is perceived by the individual or caregiver to interfere with usual and desired activities" (Haselkorn et al., 2005). Although fatigue is so common in MS patients, the pathophysiology of fatigue is not fully understood yet (Bol et al., 2009). Most studies are ongoing on the role of proinflammatory cytokines, central nervous system lesions, cerebral quantitative imaging methods, cerebral activation patterns, endocrine system activity, and axonal injuries (Isuru et al., 2012).

Personality traits are important psychological characteristics that distinguish the character, action, and attitude of a person. Personality traits describe people in terms of relatively stable patterns of behavior, thoughts, and emotions (Oshio et al., 2018). It has been shown that personality traits may play a vital role in health in general (Ranchor and Sanderman, 1991). According to Eysenck (1975), there are three basic personality traits: extroversion (tendency to be sociable, impulsive, assertive, energetic, seek excitement, and experience positive affect), neuroticism (tendency to be emotionally unstable, hostile, angry, anxious, self-conscious), and psychoticism (tendency to be tough-minded, non-conformist, aggressive, and impulsive) (Eysenck and Eysenck, 1975).

Merkelbach et al. (2003) showed that MS patients had higher neuroticism scores and decreased extraversion personality traits compared to healthy controls (Merkelbach et al., 2003). They reported that MS patients with fatigue generally had high neuroticism scores and that there was a relationship between personality traits and fatigue in MS patients. In another study, Penner et al. (2007) reported increased neuroticism and decreased extraversion score, and showed that there was no relationship between fatigue and personality traits in MS patients (Penner et al., 2007). Thus, it can be seen that there is conflicting and limited information regarding the relationship between fatigue and personality traits in MS patients in the literature.

The aim of this study is to contribute to the literature by determining the relationship between personality traits and fatigue in patients with multiple sclerosis (MS) compared to healthy individuals (HI).

1. **METHODS**
	1. **Participants**

MS patients and HI were included in this retrospective cross-sectional study which was conducted at Gazi University, Department of Physiotherapy and Rehabilitation between January 2018-January 2020. The study protocol was approved by the Gazi University Ethics Commission (No: 2020-519 date: 08.09.2020). The patients were recruited by their treating neurologists who gave the diagnosis and determined the Expanded Disability Status Scale (EDSS) score. For MS patients, the inclusion criteria were (1) the diagnosis of definite MS according to McDonald criteria (Thompson et al., 2018), (2) age between 18-65 years (3) ambulatory without aids (EDSS score<6) (Kurtzke, 1983), (4) relapse-free for the last 3 month. Exclusion criteria for all participants were (1) history of neurological disease (other than MS for the patient group), (2) presence of orthopedic, vision, or hearing problems.

* 1. **Measurements**

Personality traits were assessed using by Eysenck Personality Questionnaire (EPQ). The EPQ consists of 24 items answered as yes and no to measure the three dimensions of personality traits including extraversion, neuroticism, and psychoticism. The score varies between 0 and 6 for each personality trait (Eysenck, 1975, KARANCI et al., 2007).

Fatigue Impact Scale (FIS) was used for assessing fatigue. This scale includes 40-item that assess the physical, cognitive, and psychosocial dimensions of fatigue over 4 weeks. It consists of 10 physical, 10 cognitive, and 20 social items, with 0 indicating “no problem” and 4 indicating “extreme problem” (Fisk et al., 1994b, Armutlu et al., 2007).

* 1. **Statistical analysis**

Statistical analysis was performed by using the IBM Statistics SPSS v21.0. (IBM Corp. Armonk. NY. The USA). The variables were determined by the measurement (histograms. Kolmogorov–Smirnov test) and expressed as the median and Interquartile Range (IQR) due to non-normal distribution. Categorical variables were expressed as a percentage. A Mann-Whitney U test was used to compare HI and MS patients. A Spearman correlation coefficient was performed to determine the relationship between personality traits and fatigue. The correlation coefficient was classified as negligible (0-0.10), weak (0.10-0.39), moderate (0.40-0.69), strong (0.70-0.89), and very strong (0.90-1.00) (Schober et al., 2018). The statistical significance level was p<0.05.

1. **RESULTS**

A total of 66 MS patients and 38 HI participated in this study. The demographic and clinical features of the participants are summarized in Table 1. The demographic features were similar between groups (p>0.05).

The comparison of the personality traits between the groups showed that MS patients had higher neuroticism and lower extraversion personality traits than HI (p<0.05). In addition, cognitive, physical, and psychosocial dimensions of fatigue were higher in MS patients than HI (p<0.05).

Table 2 shows the relationship between personality traits and fatigue in MS patients and HI. The correlation analysis revealed that neuroticism had moderate positive correlations with all dimensions of fatigue in MS patients (p<0.001) whereas there was no relationship between any personality traits and fatigue in HI (p>0.05).

1. **DISCUSSION**

The aim of this study was to determine the relationship between personality traits and fatigue in MS patients and HI. This study demonstrated that neuroticism and fatigue were interrelated in MS patients, but not in HI.

When literature is examined, it seems that many physical, behavioral, and psychological factors might contribute to fatigue in MS patients, such as motor exhaustion, general physical impairment, alterations of the autonomic nervous system, and also negative perspective (Merkelbach et al., 2003). This study supported that MS patients were more fatigued in terms of cognitive, physical, and psychosocial dimensions compared to HI.

Although many studies investigated the related factors with fatigue in MS patients, a few studies investigated the relationship of fatigue with personality traits. While Merkelbach et al. (2003) reported a significant relationship between personality traits and fatigue in MS patients, Penner et al. (2007) showed that there was no relationship (Merkelbach et al., 2003) (Penner et al., 2007). The results of this study supported the finding of the study by Merkelbach et al. (Merkelbach et al., 2003).

The study by Merkelbach et al. (2003) found that increased neuroticism and decreased extraversion, led to increased fatigue complaints in MS patients. Additionally, the fatigued MS patients were more likely to be emotionally unstable and hypersensitive, more likely to behave introverted and less sociable, and more likely to behave irritated and excited (Merkelbach et al., 2003). It is known that people with neuroticism tend to be emotionally unstable, hostile, angry, anxious, and self-conscious (Eysenck and Eysenck, 1975). Our study contributes to the literature with a similar finding. We have also shown that the neuroticism score was related to cognitive, physical, and psychological fatigue in MS patients.

In previous studies investigating personality traits in MS patients, it can be seen that generally there is a tendency towards negative perspectives and neurotic personality and that MS patients react less responsive to positive events (lriarte et al., 2000). Literature states that there are various reasons for this; first of all, the uncertainty about the recurrence of MS attacks, deterioration which can occur in the future, and also the fatigue and disability caused by MS patients may have an impact on the psychological status and personality. When these factors are taken into account, it can be seen that there may be a vicious circle between fatigue and neuroticism. The high neuroticism score seen in MS patients may have an impact on fatigue and fatigue may cause neuroticism, leading to a tendency to be emotionally unstable, hostile, angry, anxious, or self-conscious. Therefore, it may be useful to evaluate the personality characteristics of the patients before treatment and guide patients to consulting emotional help.

This study had several limitations. Fatigue is a symptom that is difficult to evaluate and is affected by many parameters such as sleep quality, anxiety, and depression. The fact that the sleep quality, anxiety, and depression levels of the patients were not evaluated in our study is an important limitation. Another limitation was that fatigue was evaluated using self-reported questionnaires. More objective methods should be used in future studies.

1. **CONCLUSION**

This study revealed that there was a vicious circle between fatigue and neuroticism in MS patients. High neuroticism may affect fatigue and fatigue may cause neuroticism, leading to a tendency to be emotionally unstable, hostile, angry, or anxious. Therefore, clinicians should not neglect to observe the personality characteristics of the patients before treatment. Understanding the personality traits of MS patients can contribute to the clinician's better understanding of fatigue in MS and and to develop more effective methods to cope with fatigue.

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**Table 1. Demographic and clinical features in MS patients and HI**

|  |  |  |  |
| --- | --- | --- | --- |
|  | **HI (n=38)** | **MS (n=66)** | **p** |
| **Age (years)** | 36 (24-44) | 37 (31.75-46) | 0.353 |
| **Gender (f/m) (%)** | 32/6 (84.2/15.8) | 51/15 (77.3/22.7) | 0.456 |
| **BMI (kg/m2)** | 23.17 (21.55-27.49) | 24.83 (21.54-27.95) | 0.557 |
| **Education** | 3 (2.25-3) | 3 (2-3) | 0.104 |
| **Disease duration (years)** |  | 5 (3-10) |  |
| **Number of relapses**  |  | 2 (1-4) |  |
| **Type (RR/PP) (%)** |  | 56/10 (84.8/15.2) |  |
| **EDSS (score)** |  | 1.5 (1-3) |  |
| **Eysenck Personality Questionnaire (score)** |
| **Neuroticism** | 2 (0.75-4) | 4 (2-5.25) | **0.001\*** |
| **Extraversion** | 4 (2-5.25) | 3 (1-5) | **0.036\*** |
| **Psychoticism** | 1 (0-2) | 1 (1-2) | 0.390 |
| **Fatigue Impact Scale (score)** |
| **Cognitive (0-40)** | 6 (2-15) | 16 (8-21) | **<0.001\*** |
| **Physical (0-40)** | 4.5 (1-9.5) | 16 (11-23) | **<0.001\*** |
| **Psychosocial (0-80)** | 9 (3.75-20) | 27 (15.75-37) | **<0.001\*** |
| **Total (0-160)** | 19.5 (6-48) | 56 (37-80.25) | **<0.001\*** |

Data are presented as number (%) of participants or median (IQR), \*p<0.05, Chi-square test, or Mann-Whitney U test. BMI: Body mass index, EDSS: Expanded Disability Status Scale, PP: Primary progressive, RR: Relapsing-remitting.

**Table 2. Relationship between personality traits and fatigue in HI and MS patients**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  | **HI (n=38)** |  |  | **MS (n:66)** |  |
|  |  | **Neuroticism** | **Extraversion** | **Psychoticism** | **Neuroticism** | **Extraversion** | **Psychoticism** |
| **Fatigue Impact Scale** |
| **Cognitive** | r | -0.038 | -0.073 | 0.071 | 0.432 | 0.028 | 0.237 |
| p | 0.823 | 0.664 | 0.673 | **<0.001\*** | 0.823 | 0.056 |
| **Physical** | r | 0.010 | 0.001 | 0.048 | 0.383 | -0.070 | 0.182 |
| p | 0.951 | 0.994 | 0.775 | **0.001\*** | 0.577 | 0.144 |
| **Psychosocial** | r | 0.142 | -0.079 | -0.201 | 0.516 | -0.125 | 0.200 |
| p | 0.396 | 0.639 | 0.227 | **<0.001\*** | 0.319 | 0.107 |
| **Total** | r | 0.038 | -0.066 | -0.063 | 0.496 | -0.075 | 0.226 |
| p | 0.819 | 0.694 | 0.706 | **<0.001\*** | 0.548 | 0.068 |

\*p<0.05 (Spearman correlation).