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ORIGINAL ARTICLE

Functional loss and worsening geriatric assessment parameters are more common in dementia with Lewy bodies than Alzheimer's disease

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Abstract

Background: The main aim of this study was to compare older patients with Alzheimer's disease (AD) to those with dementia with Lewy bodies (DLB) according to their dependency in daily living activities and comprehensive geriatric assessment parameters.

Method: A total of 227 AD and 123 DLB patients underwent a geriatric assessment that included comorbidities, number of drugs used, falls, urinary incontinence, hand grip strength, Mini-Nutritional Assessment (MNA), Tinetti Performance Oriented Mobility Assessment Scale, Insomnia Severity Index (ISI), and Epworth Sleepiness Scale. Basic and instrumental activities of daily living were assessed by the Barthel Index and the Lawton scale, respectively.

Results: The mean age of the participants was 83.4 years, and 73% were female. There were no statistically significant differences between AD and DLB patients in age, gender, cognitive function, or comorbidities except for coronary artery disease ($P < 0.05$). The number of falls, drugs used, and ISI and Epworth scores were higher in patients with DLB than patients with AD ($P < 0.05$). DLB patients had lower MNA, Tinetti scale, and hand grip strength scores than AD patients. The ratio of patients highly dependent in basic daily activities as a whole was significantly greater in DLB than in AD ($P < 0.05$), but there was no significant difference in the overall levels of dependency in instrumental activities.

Conclusion: DLB patients are more dependent on their caregivers than AD patients. Nutritional deterioration, sleep disorders, falls, balance and gait problems, decreased muscle strength, and multiple drug use are more common in those with DLB compared to those with AD. The management of older patients with DLB may be more difficult than older patients with AD.

Key words: *activities of daily living, Alzheimer's disease, dementia, Lewy bodies, nutrition, sleep.*

INTRODUCTION

Dementia is a common disorder that causes impairment, morbidity, and mortality, as well as increased caregiver burden. Alzheimer's disease (AD) is the most common cause of dementia, accounting for about 60%–80% of cases,[1] and dementia with Lewy bodies (DLB) is the second most common type of neurodegenerative dementia in older adults, accounting for about 4%–10% of all dementia cases.[2] There has been research showing that DLB has a worse prognosis than AD, as well as a greater burden on family caregivers, higher care costs, and higher admission rates to general hospitals and residential care facilities.[3] Among the reasons for this, autonomic dysfunction, extrapyramidal motor findings, and neuropsychiatric symptoms, such as visual hallucinations, depression, daytime somnolence, and delusions, are more common in DLB than in AD.[4,5] In addition, a few studies have shown that the reasons mentioned may be more affected by dependence in

activities of daily living in DLB than in AD.[6,7] However, how independence in basic and instrumental activities of daily living, which is already reduced in older adults, is affected in both types of dementia has not been compared in detail.

Moreover, geriatric syndromes such as nutritional problems, sarcopenia, polypharmacy, fear of falling, balance and gait disturbances, falls, and sleep problems, which increase in frequency with aging, occur due to multifactorial causes.[8] These factors are indeed observed at a high rate in both older DLB and older AD patients from an early stage in disease progression, which is detrimental to both quality of life and life expectancy.[9] Moreover, such factors increase caregiver burden and the need for complicated clinician treatment and follow-up. In studies conducted so far, DLB and AD have indeed been compared in terms of neuropsychiatric symptoms, cognitive and functional decline, parkinsonism, and caregiver burden,[6,7] and discussions of difficulties in the management of these patients have often focused attention on these issues. However, the two types of dementia have seldom been compared from a broader perspective of geriatric care.

Patients with dementia are affected in activities of daily living at varying rates depending on the stage of the disease.[1] On the other hand, it can be predicted that a decrease in quality of life may be at the forefront in older dementia patients due to deterioration in their activities of daily living and other geriatric syndromes.[1,3] Although the importance of these factors for dementia practice is well known, there are no previous studies comparing the most common dementia subtypes in older adults in such terms.

Given this background, the aim of this study is to make a detailed comparison of DLB and AD, the two most common dementias in older adults, with regard to dependencies in basic and instrumental activities of daily living, along with other geriatric assessment parameters.

METHOD

Participants

A total of 1531 older adult outpatients who were admitted to a geriatric clinic in Turkey for any reason and who had none of the exclusion criteria listed below were included in this cross-sectional study. The investigation conformed to the Declaration of Helsinki and was approved by the Bezmialem Vakif University ethics committee (14/298). Informed consent was provided by each participant or a legal guardian before participating in the study.

Probable AD was diagnosed with the National Institute on Aging–Alzheimer's Association workgroup's criteria, and probable DLB was diagnosed with the fourth consensus report of the DLB Consortium.[10,11]

All patients underwent neuroimaging protocols such as cranial magnetic resonance imaging or computed tomography to rule out other causes of cognitive impairment (such as intracranial haemorrhage, brain cancer). Patients who had severe illness that may impair their general health status, such as acute cerebrovascular event, sepsis, acute renal failure, acute coronary syndrome, and acute respiratory failure, and those who did not agree to undergo the comprehensive geriatric assessment (described in the following section), or who had severe vision and hearing impairment that prevented communication and understanding commands during the examination, were excluded. Except for those with probable DLB or AD, the patients with mild cognitive impairment were also excluded from the study. Moreover, other types of dementia were excluded, such as vascular dementia, frontotemporal dementia, and Parkinson's disease' dementia.

Finally, 350 patients with dementia (227 AD, and 123 DLB) were included.

Comprehensive geriatric assessment[8]

A geriatrician, a psychologist, and a gerontologist interviewed family members or caregivers of each included patient, thereby obtaining information about the participants. Demographic characteristics (age, gender, and years of education) were recorded. Comorbid diseases including hypertension, diabetes mellitus, coronary artery disease, congestive heart failure, chronic obstructive pulmonary disease, cerebrovascular events, osteoarthritis, and peripheral artery disease were reported. All drugs and drug counts were recorded. The patients were also questioned in terms of recurrent falls (≥1 falls/year) within the past year. Urinary incontinence was considered as involuntary leakage in the last 3 months except when urinary tract infection was present. Nutritional status was assessed using the Mini-Nutritional Assessment (MNA) score. Cognitive status

Table 1 Demographic and clinical characteristics of the participants ($n = 350$)

Characteristics	AD ($n = 227$)	DLB ($n = 123$)	*P*-value
Age (mean, SD)	82.3 ± 5.5	82.9 ± 7.2	0.163
Gender (female) %	72.7	73.2	0.923
Marital status %			
Married	39.7	29.4	0.097
Widowed	50.4	52.9	
Other	9.9	17.7	
Living status %			**0.010**
Alone	8.7	4.9	
With spouse	39.4	25.2	
With children	42.9	54.5	
Other	9.1	15.4	
Number of drugs used (mean, SD)	6.3 ± 3.1	7.03 ± 3.02	**0.026**
Comorbidities %			
HT	61.3	62.6	0.816
DM	32.9	31.7	0.822
CAD	16.5	27.9	0.012
COPD	5.8	7.4	0.553
CVE	7.6	5.7	0.517
CHF	9.9	13.0	0.371
OA	11.1	13.1	0.581
Geriatric syndromes			
Falls %	38.5	59.5	**0.000**
Number of falls in last year (mean, SD)	0.90 ± 1.7	1.90 ± 3	**0.000**
Urinary incontinence %	58.6	58	0.918
Constipation %	41.3	45.9	0.434
MMSE/MOCA (mean, SD)	15.3 ± 4.8	14.6 ± 4.7	0.352
BADL score (mean, SD)	67.09 ± 30.7	56.5 ± 30.2	**0.000**
IADL score (mean, SD)	6.09 ± 3.9	4.34 ± 3.15	**0.005**
MNA (mean, SD)	19.13 ± 5.8	18 ± 5.28	**0.021**
Tinetti balance (mean, SD)	10.52 ± 5.8	7.56 ± 5.9	**0.000**
Tinetti gait (mean, SD)	8 ± 4.3	6.4 ± 4.62	**0.001**
Tinetti total (mean, SD)	18.50 ± 9.9	13.89 ± 10.19	**0.000**
ISI (mean, SD)	9.81 ± 9.57	14.61 ± 9.9	**0.000**
Epworth (mean, SD)	7.29 ± 6.47	9.23 ± 6.9	**0.011**
Blood analysis (mean, SD)			
GFR (mL/min/1.73 m^2)	57.0 ± 20.12	54.3 ± 20.9	0.321
Albumin (g/dL)	5.7 ± 8.06	5.01 ± 7.5	**0.015**
Triglyceride (mg/dL)	129 ± 58.4	124.7 ± 63.4	0.402
HDL (mg/dL)	56.7 ± 20.4	54.07 ± 17.8	0.307
LDL (mg/dL)	126.5 ± 43.6	126.2 ± 44.5	0.814
Vitamin B12 (pmol/L)	535.2 ± 413.7	511.6 ± 427.9	0.481
Vitamin D (ng/mL)	22.4 ± 14.6	28.5 ± 14.24	0.225
Folic acid (ng/mL)	18.8 ± 9.2	17.98 ± 7.4	0.795
Haemoglobin (g/dL)	12.7 ± 3.7	12.7 ± 3.2	0.578

Note: Bold values show statistically significant results. Abbreviations: AD, Alzheimer's disease; BADL, Barthel Index for Activities of Daily Living; CAD, coronary artery disease; CHF, congestive heart failure; COPD, chronic obstructive pulmonary disease; CVE, cerebrovascular events; DLB, dementia with Lewy bodies; DM, diabetes mellitus; GFR, glomerular filtration rate; HDL, high-density lipoprotein; HT, hypertension; IADL, Instrumental Activities of Daily Living; ISI, Insomnia Severity Index; LDL, low-density lipoprotein; MMSE, Mini-Mental State Examination; MNA, Mini-Nutritional Assessment; MOCA, Montreal Cognitive Assessment; OA, osteoarthritis; SD, standard deviation.

was evaluated by the Mini-Mental State Examination (MMSE)[12] or the Montreal Cognitive Assessment scale (MOCA)[13] according to the patients' education levels. The MOCA were used for individuals who had 11 or more years of education.[13]

Gait and balance function was assessed by the Tinetti Performance Oriented Mobility Assessment Scale. A hand dynamometer was used to determine muscle strength, and the highest of the three measurements of the dominant hand was accepted as the hand grip strength value. The Insomnia Severity Index (ISI) and Epworth Sleepiness Scale were used to detect insomnia and daytime sleepiness, respectively.[14]

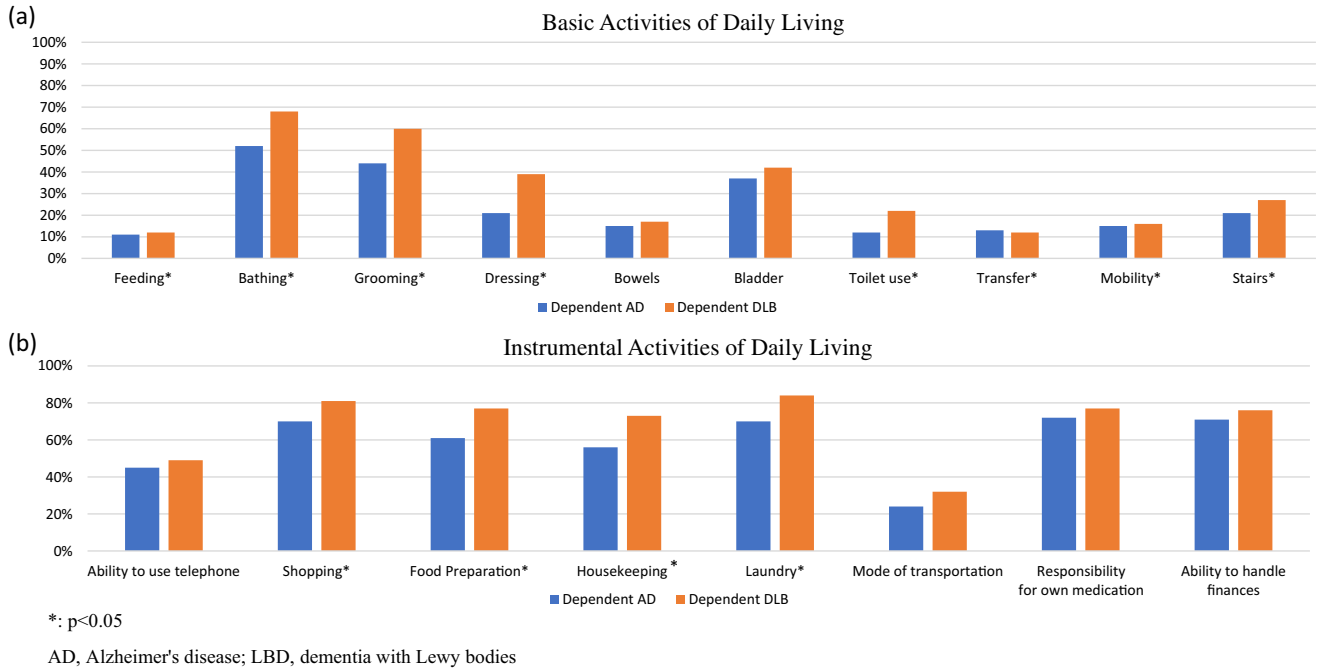


Figure 1 (a) Comparison of rates of dependent status in various basic activities of daily living between patients with Alzheimer's disease (AD) and dementia with Lewy bodies (DLB). (b) Comparison of rates of dependent status in various instrumental activities of daily living between patients with AD and DLB. *$P < 0.05$.

Barthel Index for Activities of Daily Living (BADL) and Lawton Instrumental Activities of Daily Living (IADL) Scale

The Barthel Index for Activities of Daily Living (BADL) measures the level of independence and functional status in basic daily activities like feeding, bathing, dressing, bowels/bladder control, using the toilet, and transfers (from bed to chair), mobility (on flat surfaces), and stair climbing. A score of 100 indicates complete independence, whereas a score of 0 indicates complete dependency on another person. Further, the BADL has been divided into five separate score ranges (100–91: fully independent; 99–91: mildly dependent; 62–90: moderately dependent; 61–21: highly dependent; 20–0: fully dependent).[15]

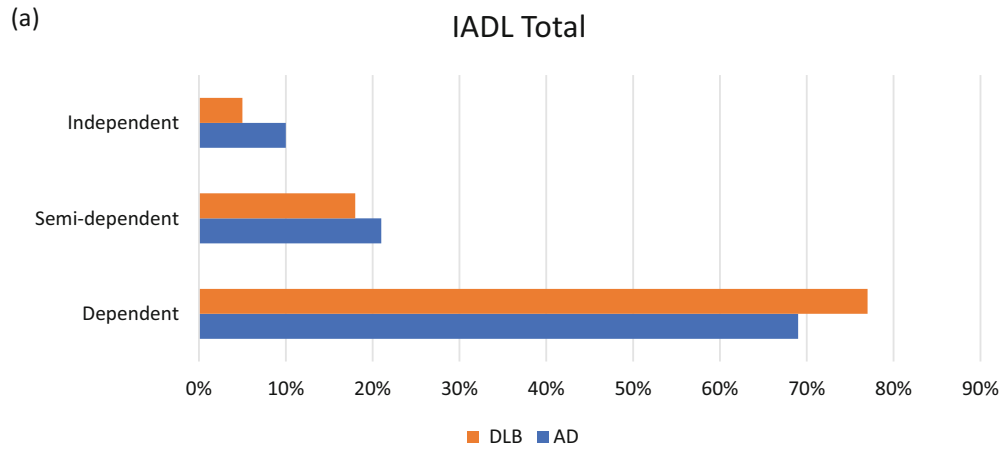
Disability levels and other factors in community-dwelling older adults individuals were first measured and evaluated by researchers Lawton and Brody in 1969 using the Lawton Instrumental Activities of Daily Living Scale (IADL). In older people, the IADL, the most commonly used assessment tool for instrumental activities of daily living, measures eight abilities, including the use of a telephone, shopping, food preparation, housekeeping, laundry, mode of transportation, responsibility for own medication, and ability to handle finances. Each activity is given a score ranging from 0 to between 2 and 4 in the Turkish version. Low scores indicate a high degree of dependency, and the scale runs from 0 to 23. The total score is interpreted as follows: 0–8: dependent; 9–16: semi-dependent; 17–23: independent.[16,17]

Laboratory findings

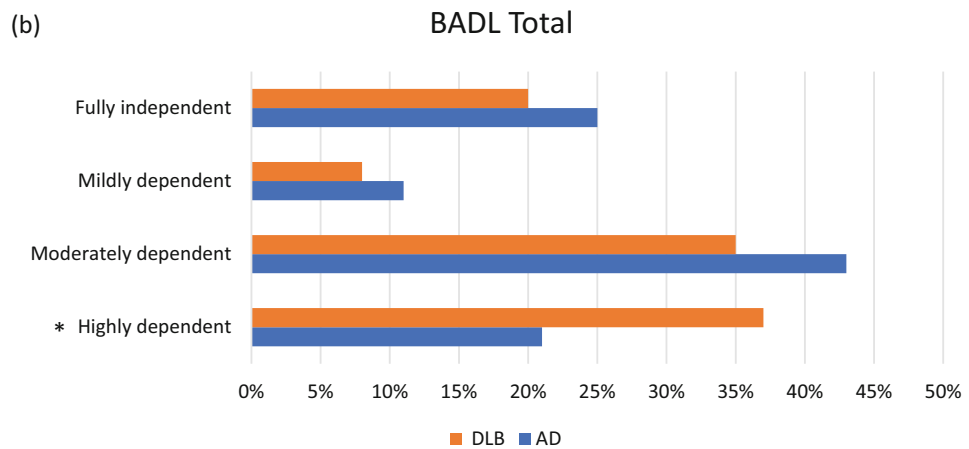
Laboratory tests, including complete blood count, kidney functions, and cholesterol levels, were performed to evaluate the biochemical and metabolic status of the patients. Serum vitamin B12, folate, and 25(OH)D levels were measured. All biochemical tests were conducted using the Diagnostic Modular Systems auto analyser (Roche E170 and P-800).

Statistical analyses

Data were analysed using SPSS version 22. The participants were divided into two groups, AD and DLB, and all statistical analyses were performed to compare the two groups. Continuous variables were evaluated as means and standard deviations, and for normal distribution by the Kolmogorov–Smirnov test. Normally distributed continuous variables were analysed by the paired sample *t*-test. In case of non-normal distribution,



AD, Alzheimer's disease; DLB, dementia with Lewy bodies; IADL, Instrumental Activities of Daily Living. p>0.05 for all.



AD, Alzheimer's disease; DLB, dementia with Lewy bodies BADL, Basic Activities of Daily Living.

*: p<0.05

Figure 2 (a) Comparison of ratios of levels of dependency in instrumental activities of daily living between patients with Alzheimer's Disease (AD) and dementia with Lewy bodies (DLB). (b) Comparison of ratios of levels of dependency in basic activities of daily living between patients with AD and DLB. BADL, Barthel Index for Activities of Daily Living; IADL, Instrumental Activities of Daily Living. *$P < 0.05$.

continuous variables were assessed by the Mann–Whitney *U*-test. Differences between categorical variables were evaluated by the chi-squared and Fisher's exact chi-squared tests. A probability level of $P < 0.05$ was considered significant. All the statistical analyses were carried out using SPSS 22.0 (SPSS Inc.).

RESULTS

The participants in this study included 350 individuals with a mean age of 83.4 years. They comprised 227 (65.3%) AD and 123 (34.7%) DLB patients. There were no statistically significant differences in the patients' ages, genders, or MMSE/MOCA scores. Additionally, there were no statistically significant differences in comorbidities except for coronary artery disease ($P < 0.05$; for details see Table 1).

The BADL and IADL total scores were both lower in the DLB than in the AD group ($P < 0.05$). According to the breakdown of BADL scores by dependency level, the rate of patients highly dependent in basic activities was greater for DLB than for AD ($P < 0.05$; Fig. 2b). In terms of separate activities, feeding, bathing, grooming, dressing, toilet use, transfer, mobility,

and stairs were significantly different between the DLB and AD groups ($P < 0.05$; Fig. 1a). For instrumental activities, although separate IADL scores were lower in DLB patients and dependency thus greater in shopping, food preparation, housekeeping, and laundry (Fig. 1b), there was no significant difference for the breakdown of total IADL scores by the level of dependency (Fig. 2a).

Patients with DLB had a higher rate of falls, number of drugs used, and ISI and Epworth scores than patients with AD ($P < 0.05$), whereas the MNA, Tinetti, and hand grip strength scores were lower in the DLB than the AD group ($P < 0.05$). It was determined that only the serum albumin level was lower in patients with DLB compared to AD ($P < 0.05$), while for all other laboratory findings there were no differences between the two syndromes (Table 1).

DISCUSSION

When older DLB and AD patients who are similar in age, gender, and cognitive status were compared, overall dependency in both basic and instrumental activities of daily living was higher in DLB patients. Falling, impaired gait and balance functions, higher numbers of drugs used, insomnia and excessive daytime sleepiness, nutritional deterioration, and decrease in muscle strength were more common in older DLB patients compared to AD patients.

Although the diagnosis of dementia is important for an older patient and his/her caregiver to aid in management, the dementia subtype is of equal importance for care management, because neuropsychiatric symptoms, the affected neurocognitive domains, prognosis of the disease, caregiver burnout, and survival times may differ in each dementia subtype. Therefore, comparative studies of dementia subtypes have increased in recent years.[18–20] For example, the two most common dementia types in older adults are AD and DLB, with the latter having higher mortality (average survival time in DLB from diagnosis being 4.11 years versus 5.66 years in AD), equating to a 1.55-year shorter survival in DLB.[3] In addition, caregiver burden for DLB patients is higher than for AD patients for two important reasons.[21] One is the greater number of neuropsychiatric symptoms in DLB, and the other is the higher level of dependency in various daily living activities in DLB from the early stage of dementia.[7,21,22]

To date, comparative studies investigating how DLB and AD affect dependency in daily activities are few and their results are inconsistent. In our study, which included patients with a mean age of 83, both the BADL and IADL total scores were lower in DLB than AD, although the groups were similar in terms of age, gender, and cognitive status. Additionally, in our study, the DLB group had significantly greater dependency in basic activities of personal care (i.e., feeding, bathing, grooming, dressing, toilet use, mobility, and stairs), as well in several instrumental activities (shopping, food preparation, housekeeping, and laundry). McKeith *et al*. compared both subtypes of dementia, showing that dependency in similar items of basic and instrumental activities was higher in DLB than in AD, as in the present study.[6] In the same study, correlations were determined between neuropsychiatric and extrapyramidal symptoms, and dependency in BADLs.[6] Although IADL scores were lower in DLB in our study, there were no significant differences between AD and DLB in terms of the levels of dependency for the total scores of IADL categories. The possible reason for this may be that the mean age of our patients was ≥80 years. Gill *et al*. demonstrated that the decrease in functionality was more pronounced in young dementia patients, but slower in older dementia patients, especially in instrumental activities.[7] Moreover, differences in patients with DLB and AD appear most pronounced early in the prognosis of the disease.[23] Since all the patients except those severe with dementia were included in our study, a difference might not have been detected in dependencies in comparing instrumental activities.

Geriatric syndromes, which occur due to multifactorial reasons and cause many negative clinical outcomes in older adults, reduce the quality of life and complicate the care of patients.[8] Therefore, multiple syndromes in the same patient means that his/her care becomes more complicated to manage for both the clinician and the caregiver. Multiple drug use, nutritional problems, recurrent falls, gait and balance problems, and sleep disorders are the leading items among these syndromes.[8] There are several plausible pathways that help to explain such findings. Common symptoms experienced by people with DLB, such as parkinsonism and signs of postural instability, are known to increase the risk of falling.[24] For example, in one study in which AD and DLB patients were included, risk factors for falling were

investigated, and it was determined that parkinsonism was the most important factor for falling.[25] Additionally, oculo-visual changes such as visual hallucinations, colour vision impairment, and decreased occipital lobe activity are common in DLB and can also increase problems of gait and balance function.[26] Moreover, the excess of drugs used in DLB, worsening nutrition, and higher sleep disorders detected in our study may also lead to higher falls and to gait and balance problems in DLB.[27]

It is not surprising that the tendency for malnutrition is high in DLB, the reasons for which are the prolonged duration of swallowing food and liquids as extrapyramidal symptoms are likely to cause eating and swallowing problems, higher frequencies of anorexia and constipation in DLB than AD, and decreased energy intake due to the more frequent occurrence of neuropsychiatric symptoms such as hallucinations, delusions, depression, irritability, abnormal motor behaviour, and decreased social interaction in DLB leading to a reduction in adequate energy consumption.[18,20] Among the laboratory parameters, the fact that albumin is lower in DLB than in AD also supports this finding.

Sleep–wake cycle disorders are common features of neurodegenerative dementia. Although REM sleep behaviour disorder (RBD) is one of the core symptoms of DLB, sleep problems are also common in AD patients; however, there are only two studies comparing older adults with DLB and AD patients in terms of the two most common sleep disorders, insomnia and excessive daytime sleepiness (EDS).[28,29] In these studies, especially in which EDS was investigated further, it was indicated that the regions that affect the sleep cycle in DLB include locus coeruleus, raphe nucleus, tuberomammillary nucleus of the hypothalamus and the associated ascending reticular activating system.[30] Furthermore, the decrease in DLB in the level of the hypocretin hormone, which provides daytime wakefulness, may cause EDS to be seen more commonly than in AD.[31] Although it is known that insomnia is common in neurodegenerative diseases, there is no study comparing it in DLB and AD. Decreased night sleep due to EDS in DLB or high RDB and nutritional deficiencies in DLB may cause insomnia to be seen more frequently.[28,32]

Polypharmacy, one of the most important issues in geriatric practice, accelerates functional decline in both DLB and AD,[33] and drug use was found to be higher in older DLB patients in our study. The prevalence of neuropsychiatric symptoms, sleep disorders, and parkinsonism findings in DLB, and having to add drugs to the treatment regimen for each of these, along with the fact that coronary artery disease was observed more commonly in DLB in our study, may have caused the total number of drugs to be higher than for AD.

Findings from this study must be interpreted in light of its limitations. First, the study was cross-sectional in design. Second, a formal assessment of extrapyramidal symptoms, such as with the Unified Parkinson's Disease Rating Scale, could not be performed, nor were the clinical features/domains of DLB detailed. Third, no actigraphy or polysomnography was used for sleep disorders; instead, validated scales were used and evaluations were made according to the information received from the caregivers. The strengths of the study include the adequate number of samples and the evaluation of many parameters important for geriatric practice. In this study we were able to exclude factors affecting cognitive functions and geriatric assessment parameters, since laboratory parameters, such as vitamin levels and kidney functions were detailed.

In conclusion, older DLB patients are more dependent in activities of daily living than older AD patients. Moreover, multiple drug use, nutritional problems, recurrent falls, gait and balance problems, and sleep disorders are more common in DLB patients than in AD patients. Therefore, especially older DLB patients require special attention and follow-up. For this reason, it is important to follow up older adult dementia patients, especially DLB patients, with a multidisciplinary approach and from a geriatrician's perspective.

AUTHOR CONTRIBUTIONS

Study design: PS. Practical performance: PS, SKO. Data analysis: PS, SKO. Preparation of the manuscript: PS, SKO, FU. Critical review of the manuscript: LS. All authors contributed to the draft and revision of the manuscript and approved the version to be published.

DISCLOSURE

PS, SKO, FU and LS declare no conflicts of interest.

PATIENT CONSENT STATEMENT

Informed consent to participate was granted by individuals before starting the assessment.

ETHICAL STATEMENT

The study was approved by the Bezmialem Vakif University ethics committee (14/298).

DATA AVAILABILITY STATEMENT

The data that support the findings will be available in [repository name] at [DOI/URL] following an embargo from the date of publication to allow for commercialization of research findings.

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