BMC Women's Health

RESEARCH Open Access

The sleep quality in women with surgical menopause compared to natural menopause based on Ardakan Cohort Study on Aging (ACSA)

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Abstract

Objective Menopause is a significant period in a woman's life that can be natural or surgical. We aimed to assess the association between the type of menopause and sleep quality, especially in elderly women.

Method This was a cross-sectional study using data from the first phase of the Ardakan Cohort Study on Ageing (ACSA) of 50 and above years of menopausal women, distributed into two groups of natural and surgical menopause. Three questionnaires were used to assess sleep quality, including Pittsburgh Sleep Quality Index (PSQI), Berlin questionnaire, and Epworth Sleepiness Scale. Multiple regression models were used to assess the association between the type of menopause and sleep quality. *P*-value less than 0.05 was considered significant.

Results In total, 2,532 menopausal and postmenopausal women were included in the study, of which 669 (26.4%) had surgical menopause. The mean of the PSQI score for participants with surgical menopause was 9.29±4.30 compared to 8.78±4.10 for participants with natural menopause (*P*-value = 0.001). 37.1% of participants with natural menopause had sleep-disordered breathing according to the Berlin questionnaire despite 43.9% among participants with surgical menopause (*P*-value = 0.007). The multivariable regression models showed that surgical menopause was not significantly associated with the PSQI score differences, Epworth score, or Berlin score compared to natural menopause (OR:0.89, 1.13, and 0.85; CI 95%: 0.13–1.19, 0.68–1.86, and 0.68–1.07 respectively).

Conclusion The findings suggest that the type of menopause is not associated with sleep quality. However, further studies employing objective sleep assessments are necessary to validate these results and guide clinicians and individuals in refraining from prioritizing the type of menopause as a significant risk factor for poor sleep quality.

Keywords Sleep, Elderly, Menopause, PSQI, Epworth, Berlin questionnaire

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Introduction

The population of elderly women in the world is increasing, and 1 in 6 people will be aged 60 and older by 2030 [1]. The population aging is increasing in Iran due to the decreasing infertility rate and increasing life expectancy. The population of people aged above 60 years in Iran was approximately 10% in 2022 [2]. Moreover, studies showed that more than 20% of older people experienced mental problems regarding biological and social changes [3]. Many factors could be related to the quality of life in older people; one of the main factors is sleep [4]. Furthermore, menopause could reduce sleep quality, ultimately affecting the quality of life [5]. Sleep restriction can have deleterious effect in cognition, hormones, mood, immune, and cardiovascular system [6, 7].

Menopause marks the end of the menstrual cycle, primarily due to the ovarian which is not able anymore to provide healthy follicles [8]. It is an important period of a lifetime for women because most women spend approximately more than 30% of their lives in menopause and post-menopause periods, especially in elderly ages [9]. Moreover, many conditions could be associated with the quality of life for menopausal women; for example, sleep disturbances such as obstructive sleep apnea (OSA) increase due to menopausal transition [10, 11]. Also, mood disorders, including anxiety and depression, are commonly experienced during menopause and can significantly impact women's quality of life [12].

Menopause is considered natural when no medical intervention occurs for 12 months after the end of the menstrual cycle. Also, surgical menopause occurs due to the removal of both ovaries [13]. Surgical menopause is performed due to medical problems, including malignancies and ovarian disorders, or as a preventive treatment after evaluation by specialists [14]. Surgical menopause differs from natural menopause in the aspect of many health outcomes; for example, sexual function can be associated with the sudden reduction of sexual hormones after bilateral oophorectomy, while it is gradual in natural menopause [15]. Additionally, early menopause due to surgical operations can increase the risk of cardiovascular disease [16]. Furthermore, some evidence suggests that surgical menopause could result in worse sleep quality compared to natural menopause [17], while others have declared that there are no significant differences between surgical and natural menopause regarding sleep quality [18]. Due to the reliance on subjective assessments and population studies, the evidence remains inconclusive, with insufficient knowledge to clarify the role of surgical hysterectomy in women's sleep quality, further compounded by the scarcity of significant studies utilizing multiple concurrent sleep quality assessment methods for a more comprehensive and precise evaluation.

The aim of this study was to investigate the association between menopause type and sleep quality in menopausal and postmenopausal women. Multiple scoring techniques were employed to evaluate this relationship comprehensively.

Method and materials

Study design and population

This was a cross-sectional study performed using the data from the first phase of the Ardakan Cohort Study on Ageing (ACSA), part of The Iranian Longitudinal Study on Ageing (IRLSA) [19]. This cohort was performed in Ardakan, a region located in central Iran. It included adults aged ≥ 50 years recruited through a multistage stratified random sampling method. The inclusion criteria for this study were females, 50 years or older, and residing in Ardakan City. Exclusion criteria included a diagnosis of dementia, blindness, deafness, mental or psychological disorders such as intellectual disability or psychosis, not being able to understand and respond to study questions, paralysis, or unwillingness to participate.

Data collection and measurements

The total population of ACSA was 5,197 individuals, of which 2,695 were females and 2,426 were with a history of menopause. We categorized individuals into two different groups: females with natural menopause and females with surgical menopause. The data was collected by trained personnel (including nurses and midwives) of the ACSA center located in Ardakan.

Three questionnaires, including the Pittsburgh Sleep Quality Index (PSQI), the Berlin questionnaire, and the Epworth Sleepiness Scale score were used to evaluate sleep quality:

Pittsburgh Sleep Quality Index (PSQI): The translated and validated version was used as a self-reported questionnaire to evaluate sleep quality and disturbances through one-month intervals [20]. This scale is separated into seven areas: subjective sleep quality, latency, duration, habitual sleep efficiency, sleep disturbances, use of sleeping medication, and daytime dysfunction. Scores range from 0 to 3 for each area, with a total score range of 0 to 21. A score of more than five was considered poor sleep quality due to the questionnaire description.

Epworth Sleepiness Scale score: The translated and validated version was used to measure participants' daytime sleepiness [21]. The questionnaire asks participants to rate their sleepiness in eight daily situations from 0 to 3, giving a total score of 0 to 24. A score of more than ten is considered the presence of daytime sleepiness due to the questionnaire description.

Berlin questionnaire: The translated and validated version was used to assess obstructive sleep apnea (OSA) among participants. The questionnaire includes three categories related to the risk of having sleep apnea. The participants are considered at high risk for OSA if the score has more than two positive categories due to the questionnaire description.

Depressive syndromes were evaluated using the Persian version of the Center for Epidemiological Studies-Depression Scale-10 (CES-D-10) [22], and anxiety was assessed using the Persian version of The Hospital Anxiety and Depression Scale (HADS) [23]. Physical activity levels were evaluated using the Physical Activity Scale for the Elderly (PASE) among participants. The PASE score ranges from 0 to 400 or higher and includes 10 items that assess activities in three categories: leisure time, household time, and work time. Based on their PASE score, individuals were categorized into four groups according to their activity levels, ranging from the lowest to the highest physical activity [24].

The baseline characteristics, including age, age at menopause, educational status, body mass index (BMI), smoking, alcohol, underlying disease, and history of any hormone consumption (female hormone therapy to replace estrogen or progesterone), were recorded using designed checklists. Body Mass Index (BMI) was calculated based on each participant's weight and height and categorized into two groups: obese (> 30 kg/m^2), and non-obese (< 30 kg/m^2). An adult who has smoked at least 100 cigarettes in their lifetime but who had quit smoking at the time of the interview was considered a former smoker.

Statistical analysis

All variables were checked in terms of normality using the Kolmogorov-Smirnov test. Mean (SD) and count (%) were used to describe quantitative and qualitative variables. Missing data was less than 1%. The T-test was used to compare the mean of quantitative variables in the main group of study (natural/surgical menopause). The Chi-square test was also used to compare qualitative variables. The logistic regression model was used to evaluate the relation of independent variables on the PSQI, Epworth, and Berlin questionnaires. Multivariable (adjusted) models were fitted to adjust the relation of possible confounding factors. This relationship was adjusted with age, body mass index, history of any hormone therapy, history of underlying diseases, history of oral contraceptive use, parity, physical activity, anxiety, Depressive symptoms, education, age at menopause due to previous evidence and clinical judgments that might be associated the sleep quality [17, 25]. All data analysis was performed using STATA v.14. A *P*-value less than 0.05 was considered statistically significant.

Ethical considerations

The Ethical Committee of the University of Social Welfare and Rehabilitation Sciences approved the study (IR.USWR.REC.1394.490) and informed written consent was obtained from all participants. The study was conducted according to Helsinki's declaration [26].

Results

In total, 2,532 menopausal and postmenopausal women were included in the study, and 669 (26.4%) had surgical menopause. The mean age of the women with natural menopause was 63.09±7.59 years, while 62.00±6.97 years for participants with surgical menopause (p-value = 0.520). Only six (0.2%) participants had a history of smoking, three of whom were women with natural menopause. Also, no women declared any history of alcohol consumption. Furthermore, most of the population's educational level was in elementary school (60.3%). The baseline characteristics of each group are demonstrated in Table 1.

The score of PSQI for women with natural menopause was 8.78±4.10, while it was 9.29±4.30 for women having surgical menopause (p-value = 0.001). 550 (84.5%) women who had surgical menopause had poor sleep quality (PSQI > 5), while 1,497 (82.1%) women with natural menopause had poor sleep quality (p-value = 0.170). After adjusting with variables, surgical menopause was not significantly related to the PSQI scores differences among participants (OR: 0.89, CI 95%: 0.13–1.19). Both mild and severe anxiety could significantly be associated with higher PSQI scores (OR: 3.95, 3.84; CI 95%: 2.54–6.13, 2.11–7.06, respectively). Additionally, depressive symptoms were significantly associated with higher PSQI scores (OR: 7.23; 95% CI: 3.68–14.22). More detailed information is shown in Table 2.

The Epworth mean score for women with natural menopause was 4.21±3.03, while it was 4.21±3.06 for the other group (p-value = 0.717). 126 (5%) women with natural menopause had daytime sleepiness (Epworth score > 10), while 33 (4.9%) women with surgical had daytime sleepiness (p-value = 0.952). After adjusting with variables, surgical menopause was not significantly associated with the Epworth score differences among participants (OR: 1.13, CI 95%: 0.68–1.86). More detailed information is shown in Table 2.

According to the Berlin Questionnaire, 661 (37.1%) women with natural menopause had Sleep-disordered breathing (Berlin questionnaire score ≥ 2), while 284 (43.9%) women with surgical menopause had sleep-disordered breathing, (P-value = 0.002). After adjusting with variables, surgical menopause was not significantly

Table 1 The baseline characteristic of the population based on the type of Menopause

Variables	Total ($n=2,532$, 100%)	Type of menopause		
		Natural ($n=1,863$, 73.6%)	Surgical ($n=669$, 26.4%)	*P*-value
Age (years) *	62.80 ± 7.44	63.09 ± 7.59	62.00 ± 6.97	0.520
Educational status **				
No formal education	490 (19.4%)	385 (20.7%)	105 (15.7%)	0.076
Elementary school	1,526 (60.3%)	1,107 (59.5%)	419 (62.6%)	
Middle school	257 (10.1%)	181 (9.7%)	76 (11.4%)	
High school	160 (6.3%)	117 (6.3%)	43 (6.4%)	
College	98 (3.9%)	72 (3.8%)	26 (3.9%)	
BMI **,[1]				
Obese (30 kg/m^2 ≤)	1,301 (51.4%)	934 (50.1%)	367 (54.9%)	**0.020**
Non-obese (< 30 Kg/m^2)	1,231 (48.6%)	929 (49.9%)	302 (44.1%)	
Physical activity **,[2]				
Quantile 1	654 (25.8%)	492 (26.4%)	162 (24.2%)	0.182
Quantile 2	626 (24.7%)	448 (24.0%)	178 (26.6%)	
Quantile 3	619 (24.6%)	469 (25.2%)	150 (22.4%)	
Quantile 4	633 (25.0%)	454 (24.4%)	179 (26.8%)	
Depression **, [3]				
With depressive symptoms	610 (24.2%)	428 (23.1%)	182 (27.4%)	**0.027**
Normal	1,905 (75.8%)	1,423 (76.9%)	482 (72.6%)	
Anxiety **, [4]				
Abnormal	452 (18.0%)	316 (17.1%)	136 (20.5%)	0.107
Borderline	459 (18.2%)	335 (18.1%)	124 (18.7%)	
Normal	1,604 (63.8%)	1,200 (64.8%)	404 (60.8%)	
Underlying disease				
Hypertension	1,460 (58.4%)	1,049 (57.0%)	411 (62.45)	**0.016**
Diabetes	1,124 (44.4%)	811 (43.5%)	313 (46.8%)	0.146
Cardiovascular diseases	309 (12.5%)	223 (12.2%)	86 (13.1%)	0.568
Malignancy	56 (2.3%)	30 (1.6%)	26 (4.0%)	**0.001**
PSQI global score *,[5]	8.91 ± 4.16	8.78 ± 4.10	9.29 ± 4.30	**0.001**
Sleep quality **				
Poor (PSQI > 5)	2,047 (82.7%)	1,497 (82.1%)	550 (84.5%)	0.170
Good (PSQI ≤ 5)	427 (17.3%)	326 (17.9%)	101 (15.5%)	
Epworth Sleepiness Scale (ESS) score *	4.21 ± 3.04	4.21 ± 3.03	4.23 ± 3.06	0.717
Daytime sleepiness **				
Yes (ESS > 10)	126 (5.0%)	93 (5.0%)	33 (4.9%)	0.952
No (ESS ≤ 10)	2,406 (95.0%)	1,770 (95.0%)	636 (95.1%)	
Sleep-disordered breathing				
Yes (Berlin questionnaire score ≥ 2)	945 (38.9%)	661 (37.1%)	284 (43.9%)	**0.002**
No (Berlin questionnaire score < 2)	1,487 (61.1%)	1,123 (62.9%)	363 (56.1%)	
Gravid*	5.26 ± 2.63	5.33 ± 2.70	5.08 ± 2.44	0.086
Alive parity *	4.62 ± 2.28	4.67 ± 2.35	4.47 ± 2.06	**0.027**
Age at menopause (years) *	49.26 ± 20.89	50.14 ± 9.22	46.80 ± 37.54	**< 0.001**
Oral Contraceptive drug**				
Yes	948 (37.5%)	678 (36.4%)	270 (40.4%)	0.066
No	1,582 (62.5%)	1,184 (63.6%)	398 (59.6%)	
Hormone Therapy **				
Yes	21 (0.9%)	8 (0.5%)	13 (2.2%)	**< 0.001**
No	2,319 (99.1%)	1,736 (99.5%)	583 (97.8%)	

*: mean±standard deviation, Independent T-test is used; **: number(percent), Chi-square is used, 1: body mass index, 2:, 3: CES-D 10 is used, 4: HADS-A is used. 5: Pittsburgh Sleep Quality Index

P-value < 0.05 is significant

Table 2 Logistic regression of type of menopause on Sleep Quality

Variables	Pittsburgh Sleep Quality Index (PSQI)			Epworth score			Berlin score		
	OR	CI 95%	*p*-value	OR	CI 95%	*P*-value	OR	CI 95%	*P*-value
Surgical menopause (yes) (Reference: no)	0.89	0.13 to 1.19	0.466	1.13	0.68 to 1.86	0.622	0.85	0.68 to 1.07	0.180
Age (year)	**1.02**	**1.00 to 1.04**	**0.039**	1.03	0.99 to 1.07	0.083	**0.97**	**0.96 to 0.99**	**0.022**
Educational status (reference: no formal education)									
Elementary school	1.02	0.71 to 1.46	0.896	2.24	1.04 to 4.84	0.038	0.86	0.65 to 1.14	0.304
Middle school	1.13	0.68 to 1.86	0.629	3.12	1.23 to 7.91	0.016	1.35	0.90 to 2.02	0.137
High school	0.65	0.38 to 1.12	0.129	3.76	1.40 to 10.10	0.009	0.89	0.55 to 1.44	0.665
College	**0.77**	**0.41 to 1.43**	**0.416**	1.18	0.23 to 5.94	0.840	**0.41**	**0.21 to 0.81**	**0.011**
BMI > 30 kg/m2 (reference BMI < 30 kg/m2)	1.02	0.80 to 1.29	0.849	1.06	0.69 to 1.62	0.083	**3.03**	**2.49 to 3.68**	**< 0.001**
Physical activity (Reference: quantile 1)									
quantile 2	0.80	0.56 to 1.14	0.219	**2.10**	**1.01 to 4.36**	**0.046**	0.98	0.75 to 1.29	0.924
quantile 3	0.81	0.56 to 1.15	0.249	**2.93**	**1.43 to 5.99**	**0.003**	1.04	0.87 to 1.38	0.757
quantile 4	**0.61**	**0.43 to 0.88**	**0.008**	**3.03**	**1.46 to 6.28**	**0.003**	0.83	0.62 to 1.12	0.234
Anxiety (reference: normal)									
Mild	**3.95**	**2.54 to 6.13**	**< 0.001**	1.16	0.66 to 2.04	0.591	**1.44**	**1.11 to 1.87**	**0.005**
Moderate to severe	**3.84**	**2.11 to 7.06**	**< 0.001**	1.02	0.52 to 1.99	0.949	**2.50**	**1.84 to 3.39**	**< 0.001**
Depressive symptom (reference: No)	**7.23**	**3.68 to 14.22**	**< 0.001**	1.50	0.85 to 2.67	0.159	1.28	0.97 to 1.67	0.070
Yes									
Hypertension (reference: No)	1.10	0.86 to 1.42	0.410	0.79	0.50 to 1.26	0.334	**3.60**	**2.87 to 4.52**	**< 0.001**
Yes									
Diabetes (reference: No)	1.10	0.86 to 1.41	0.429	**1.42**	**0.91 to 2.21**	**0.112**	1.08	0.89 to 1.32	0.406
Yes									
Cardiovascular diseases (reference: No)	**1.56**	**1.07 to 2.56**	**0.023**	1.02	0.53 to 1.95	0.950	**1.35**	**1.01 to 1.80**	**0.038**
Yes									
Malignancy (reference: No)	**0.56**	**0.25 to 1.28**	**0.177**	0.57	0.07 to 4.32	0.592	0.77	0.39 to 1.50	0.450
Yes									
Hormone Therapy (reference: Yes)	0.69	0.20 to 2.30	0.548	1.01	0.12 to 8.01	0.985	1.90	0.68 to 5.29	0.217
No									
Oral contraceptive use (reference: No)	1.01	0.79 to 1.29	0.882	0.93	0.60 to 1.44	0.765	0.89	0.73 to 1.09	0.271
Yes									

Table 2 (continued)

Variables	Pittsburgh Sleep Quality Index (PSQI)			Epworth score			Berlin score		
	OR	CI 95%	*p*-value	OR	CI 95%	*P*-value	OR	CI 95%	*P*-value
Alive parity (number)	0.97	0.90 to 1.03	0.380	0.95	0.84 to 1.07	0.456	0.98	0.93 to 1.04	0.676
Age at menopause (years)	0.98	0.97 to 1.00	0.061	0.97	0.94 to 1.00	0.065	0.85	0.68 to 1.46	0.180

adjusted by age, body mass index, history of hormone therapy, history of underlying diseases, history of oral contraceptive use, parity, physical activity, and anxiety, depressive symptoms, education, age at menopause; multivariant logistic regression is used in models, *P*-value < 0.05 is significant; CI95%: confidence interval 95%;

related to the Berlin score differences among participants (OR: 0.85, CI 95%: 0.68–1.07). Both mild and severe anxiety could significantly be associated with higher PSQI scores (OR: 1.44, 2.50; CI 95%: 1.11–1.87, 1.84-3,39, respectively). Furthermore, a BMI of over 30 Kg/m^2 is significantly associated with the Berlin score (OR:3.03, CI 95%: 2.49–3.68). More detailed information is shown in Table 2.

Discussion

This study aimed to explore the relationship between sleep quality and type of menopause in women aged 50 years and older. Three distinct questionnaires were administered among the study participants to achieve this objective. The investigation outcomes revealed that the type of menopause is not significantly associated with sleep quality in individuals, as indicated by the three different scoring systems. However, the number of people who had sleep-disordered breathing based on the Berlin questionnaire and poor sleep quality based on PSQI were significantly higher in participants who had surgical menopause compared to participants with natural menopause; the regression models showed that type of menopause was not associated with sleep-disordered breathing or poor sleep quality significantly.

This outcomes differed from a 2018 study that investigated the sleep quality among 526 Korean menopausal women, which showed lower sleep quality scores on the PSQI among women who underwent surgical menopause [17]. Furthermore, another study in the USA showed that surgical menopause could increase the risk of obstructive sleep apnea (OSA) among women compared to natural menopause [25]. However, a longitudinal study among 176 American women who underwent surgical menopause showed that this procedure does not worsen sleep quality [18]. The different results between studies could be due to population size, ethnicity, or the time interval since menopause. In total, the sleep quality of women during menopausal time is decreased [11, 27, 28]. Therefore, clinicians should pay attention to it regardless of the type of menopause.

Our study had other finding through analysis besides the main goal of the study. It showed that age could significantly be associated with sleep quality, especially based on the PSQI, and Berlin score. According to PSQI, aging is associated with lower quality of sleep as sleep problems are very prevalent in the elderly population [29], and other factors, such as anxiety and depressive syndromes, can make it worse [30]. The results indicated that anxiety and depression, as assessed by the HADS and CES-D, are significantly associated with sleep quality across various sleep evaluations. Additionally, significant differences in depressive symptoms between women with surgical and natural menopause were observed;

hence, they were considered confounding factors in comparing types of menopause and sleep quality. Furthermore, obese individuals are significantly associated with higher Berlin scores. As McMillan et al. mentioned high BMI could increase the risk of sleep-breathing disorders among elderly people significantly [31]. Additionally, our results showed that hormone therapy is significantly higher among women with surgical menopause; however, it was not considered a significant factor in predicting the quality of sleep quality.

Limitations

This study was performed among a large population. Additionally, this study was novel in its simultaneous investigation of three different questionnaires for sleep situations while also evaluating other confounding factors, such as anxiety and depression, using validated questionnaires. However, the religious context of the city led to either no reports of alcohol consumption or a lower rate of cigarette smoking despite the national population of women. One notable limitation of the study was the lack of assessment of vasomotor symptoms and their impact on sleep quality, particularly among women entering menopause. While most participants were likely in their late postmenopausal years (with a mean age above 60), and therefore less likely to experience acute sleep issues due to vasomotor symptoms, the study did explore the relationship between sleep quality and hormone therapy. However, the duration of hormone therapy was not considered, despite hormone therapy not showing a significant association with sleep quality. Also, we confirmed the menopausal and post- menopause statues through self-reported evaluation in this steps. More precise methods, such as hormonal assays, could have been utilized to confirm menopausal status. Additionally, the study revealed a significantly higher prevalence of sleep issues among participants who underwent surgical menopause. Moreover, this was a retrospective cross-sectional report of the sleep status. Longitudinal analysis should be performed to evaluate the differences in sleep through different questionnaires before and after menopause in different time intervals.

Conclusion

The specific type of menopause did not significantly impact sleep quality, as assessed through PSQI, Berlin, and Epworth measures, even after adjusting for confounding factors. However, it is important to note that sleep disturbances are common among individuals over 50 years old, and menopause may exacerbate these issues for women. Clinicians and individuals should not necessarily prioritize the type of menopause as a risk factor for poor sleep quality. Instead, they should consider modifying other factors such as anxiety, depression, and BMI. Further longitudinal studies may provide more insight into the specific role of menopause type in sleep quality.

Abbreviations

PSQI Pittsburgh Sleep Quality Index

Acknowledgements

The authors would like to thank all the esteemed authorities of the University of Social Welfare and Rehabilitation Sciences and all who participated in the study.

Author contributions

M.H. and A.D. designed the study, A.D. and F.T. contributed to data collection and had critical feedback on the manuscript. M.H, I.A., T.E., S.H., F.H. and S.A. assisted in preparing data for analysis and data analysis, writing and critically reviewing multiple manuscript drafts. All authors contributed to the manuscript revision, read and approved the submitted version.

Funding

The University of Social Welfare and Rehabilitation Sciences supported and funded this work.

Data availability

The datasets generated and analyzed during the current study are not publicly available due to the reason why data are not public but are available from the corresponding author upon reasonable request.

Declarations

Ethics approval and consent to participate

The Ethical Committee of the University of Social Welfare and Rehabilitation Sciences approved the study (IR.USWR.REC.1394.490), and informed written consent was obtained from all participants. The study was conducted according to Helsinki's declaration [23].

Consent for publication

Not applicable.

Competing interests

The authors declare no competing interests.

Received: 22 September 2024 / Accepted: 28 January 2025
Published online: 05 March 2025

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