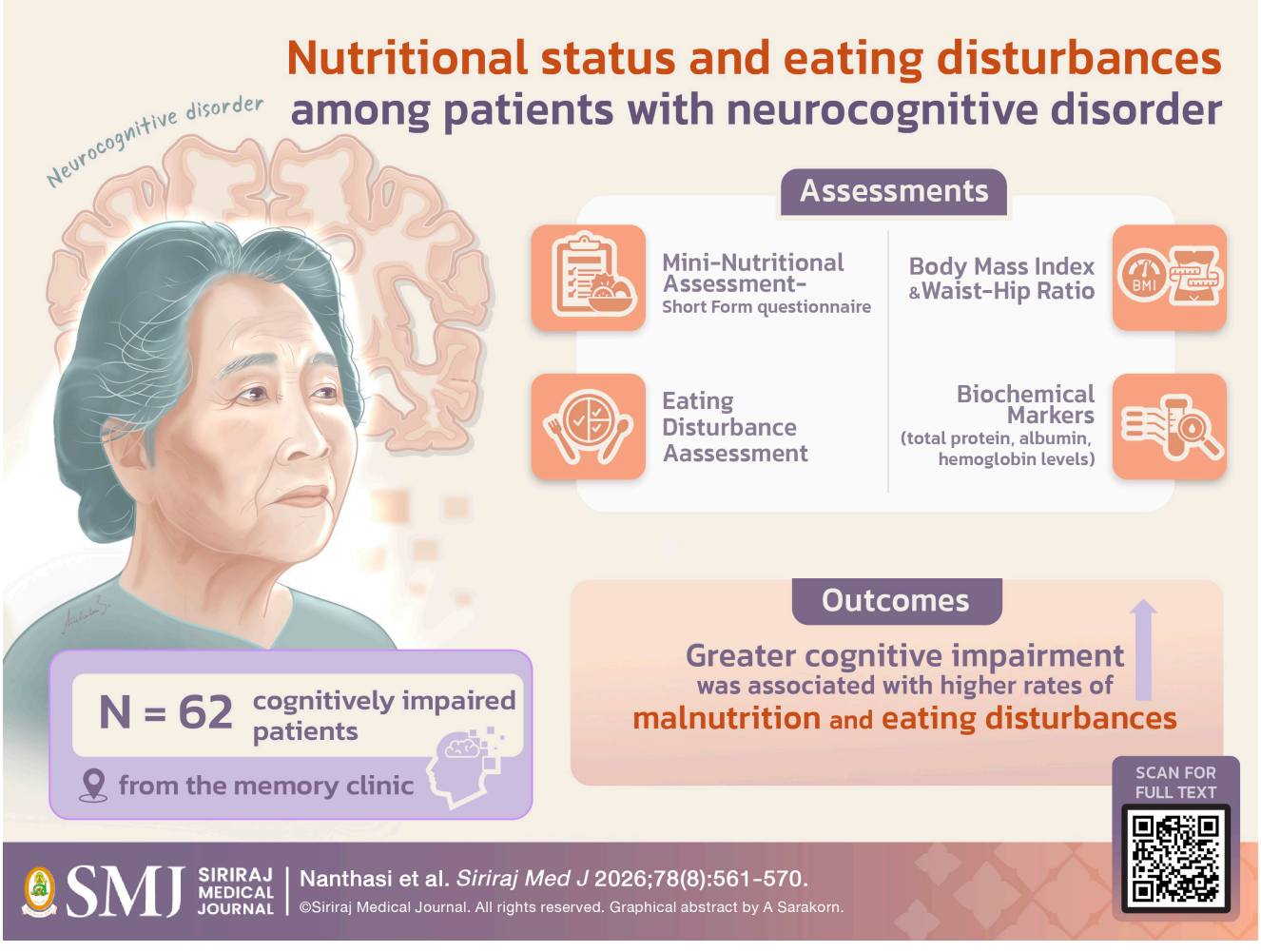
Nutritional Status and Eating Disturbances among Patients with Neurocognitive Disorder

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ABSTRACT

Objective: Evaluate the prevalence of malnutrition and explore the issue of eating disturbances in cognitively impaired patients at the memory clinic.

Materials and Methods: Sixty-two cognitively impaired patients from the memory clinic were assessed. The cognitive stage was categorized using the Clinical Dementia Rating scale-Sum of Boxes. Participants underwent a comprehensive assessment including: Mini-Nutritional Assessment-Short Form (MNA-SF) questionnaire, Body Mass Index (BMI) and Waist-Hip Ratio (WHR) measurements, biochemical markers such as total protein, albumin, and hemoglobin levels, and a comprehensive questionnaire to evaluate eating disturbances. Logistic regression and chi-square analyzed the relationship between cognitive impairment severity, nutritional status, and eating disturbances.

Results: Participants were classified into three groups: mild cognitive impairment (MCI) (n=30), mild dementia (n=22), and moderate dementia (n=10). No significant differences were observed between the groups in terms of BMI, WHR, total protein, albumin, and hemoglobin levels. Based on the MNA-SF score, the odds of malnutrition increased with the severity of cognitive impairment. Moderate dementia patients exhibited a significantly higher risk of malnutrition compared to MCI patients (adjusted OR = 8.87; 95%CI = 1.59-49.46; p = 0.013). The prevalence of eating disturbances increased with the severity of cognitive impairment. Patients with moderate dementia had higher odds of experiencing changes in eating habits compared to those with MCI (aOR=9.37; 95%CI = 0.98–89.64; p=0.052).

Conclusions: Cognitive impairment was associated with increased malnutrition risk and progressive eating disturbances, including changes in appetite and eating habit.

Keywords: Nutritional status; eating disorder; neurocognitive disorder (Siriraj Med J 2026;78(8):561-570)

INTRODUCTION

Nutritional status is a major concern for people with cognitive decline. Malnutrition is highly prevalent among patients with dementia. Estimates from previous large-scale reviews suggest a pooled malnutrition rate of 15.20%–26.98% within the dementia population residing in care facilities. The risk of malnutrition was even higher, with a pooled prevalence between 49.20% to 57.43%.[1,2] The risk of malnutrition also increased with the severity of dementia. One study found that the percentage of malnourished individuals jumped from 35.5% in those with mild dementia to 60.3% in those with severe dementia.[3]

Nutritional status is correlated with cognitive performance. Low levels of nutritional biomarkers, such as red blood cell counts, high-density lipoprotein, and serum albumin, were associated with a subsequent cognitive decline in older adults.[4] Furthermore, deficiencies in certain nutrients, such as vitamin B12 and folate, were known to contribute to cognitive impairment.[5,6] The risk of malnutrition may also have predicted cognitive decline and the onset of neurocognitive disorders. A longitudinal study conducted in Singapore found that patients with a high nutritional risk score were more likely to experience cognitive decline (odds ratio [OR] = 1.42; 95% Confidence Interval [CI] = 1.01-1.99) and developed an incident neurocognitive disorder (OR = 1.64; 95%CI = 1.03-2.59).[7] These findings indicated that nutrition influences cognitive function. To mitigate the risk of cognitive deterioration, the World Health Organization (WHO) advocates for a Mediterranean-style dietary pattern for both cognitively healthy adults and those experiencing mild impairment.[8]

Conversely, cognitive impairment can also lead to malnutrition. This was due to a combination of physiological, pathological, and psychological factors. Patients with cognitive decline may have experienced difficulty swallowing, changes in food preferences, or an altered ability to recognize feelings of hunger and thirst.[9] Eating disturbances and changes in mealtime behaviors were common in patients with cognitive impairment. One study found that 39% of patients with moderate-to-severe dementia were dependent on others for eating. This study also indicated that poorer cognitive function was linked to both poorer eating performance and reduced functional ability.[10] The types of eating disturbances varied depending on the stage of dementia. Patients with mild Alzheimer's disease may have shown changes in appetite. Those with moderate dementia often exhibited altered eating habits and food preferences, while individuals with severe dementia were more likely to have swallowing problems.[11] Additionally, dementia patients often had

impaired self-feeding skills, such as difficulty manipulating food on their plate or using utensils. They also tended to refuse to eat. These eating disturbances were associated with their nutritional status.[12]

According to European Society of Clinical Nutrition and Metabolism (ESPEN) guidelines, malnutrition can be identified using alternative sets of criteria. One method focuses on a BMI lower than 18.5 kg/m^2, while the other emphasizes unplanned weight loss in conjunction with a diminished BMI, as defined by their established standards.[13] Some people, however, believed that these criteria were not sufficient or precise. They defined malnutrition as a disordered nutritional state caused by a combination of inflammation and negative nutrient balance, leading to alterations in body composition, functional status, and clinical outcomes.[14]

Nutritional status could be evaluated using a range of methods, including validated assessment tools such as the Mini Nutritional Assessment (MNA), the Mini Nutritional Assessment–Short Form (MNA-SF), the Subjective Global Assessment (SGA), and the Malnutrition Universal Screening Tool (MUST).[1,15] Other methods included biological indices such as Body Mass Index (BMI), Fat-Free Mass Index (FFMI), and Waist-Hip Ratio (WHR), as well as biochemical blood markers including serum albumin, transferrin, and hemoglobin.[1,15-17]

This investigation sought to determine the extent of malnutrition within a clinical population of memory clinic patients experiencing cognitive decline. To do this, we used a cross-sectional approach, employing various methods to identify the problem, including validated nutritional assessment tools, biological indices, and biochemical blood markers. In addition, we sought to explore the issue of eating disturbances within this cohort. This study presented data on outpatient dementia, as opposed to a long-term care setting, in a low-to-middle-income country.

MATERIALS AND METHODS

Patient selections

At the Siriraj Hospital Memory Clinic, we performed a random enrollment of 62 patients with cognitive symptoms. Evaluation of these subjects followed a standardized framework, incorporating clinical histories, physical assessments, and neuropsychological characterization using the Thai Mental State Examination (TMSE)[18], and the Clinical Dementia Rating–Sum of Boxes (CDR-SB). All participants also received brain imaging, either magnetic resonance imaging or computed tomography. Patients diagnosed with mild cognitive impairment or any subtype of dementia were eligible for inclusion. Disease severity was classified according to CDR-SB scores[19]: mild cognitive impairment (0.5–2.5), mild dementia (3.0–9.0), moderate dementia (9.5–15.5), and severe dementia (16.0–18.0).

We excluded patients who, either independently or with the help of a caregiver, were unable to complete the questionnaire. In addition, patients were excluded if they had severe neuropsychiatric symptoms, an unstable physical illness, any type of malignancy, liver or kidney failure, or significant brain injury, such as a brain tumor or traumatic brain injury.

This research adhered to established ethical standards and received formal authorization from the Siriraj Institutional Review Board (approval no. SI 035/2019). Before any study procedures commenced, written informed consent was obtained from all participating individuals.

Nutritional status assessment

This study utilized the Mini Nutritional Assessment-Short Form (MNA-SF) due to its specialized design for geriatric populations and its proven effectiveness in identifying malnutrition risk. This tool was particularly effective, as it could identify a patient's nutritional status before the onset of severe weight loss. Its concise and practical nature also made it well-suited for use in a clinical setting.[1,15,20] The total score for the MNA-SF was 14 points. A score ranging from 0 to 7 indicated that a patient was malnourished, while a score of 8 to 11 suggested that they were at risk of malnutrition. A score of 12 to 14 was considered normal nutritional status.[20,21]

We evaluated biological indices by measuring patients' body weight and height to calculate their Body Mass Index (BMI). We classified a patient as malnourished if their BMI was below 18.5 kg/m^2, as per the ESPEN consensus statement.[13] We did not use alternative diagnostic criteria because we lacked data on weight changes over the last three months and did not measure fat-free mass index. Waist-to-hip ratio (WHR) was calculated to evaluate abdominal obesity. Abdominal obesity was defined as a WHR $\geq$ 0.85 in women and $\geq$ 0.90 in men.[22] Enrolled patients were also evaluated for biochemical blood markers, including total protein, albumin and hemoglobin levels.

Eating disturbance assessment

Eating disturbances were assessed using a validated and comprehensive questionnaire specifically designed for patients with dementia.[11,23] This tool evaluated five domains of eating disturbances: (1) swallowing disturbance, (2) appetite changes, (3) food preferences, (4) eating habits (such as wanting to eat at the same time, a decline in table manners), and (5) other eating behaviors (such

as eating non-edible items, episodes of vomiting). The questionnaire consisting of 37 items reflected symptoms over the past month. To simplify the process for patients and caregivers, we adapted the questionnaire into a simple "yes/no" format to indicate the presence or absence of a symptom (Supplementary Table 1). This approach was chosen because it was easier to understand than a system that requires rating the frequency and severity of each symptom.

Statistical analyzes

To determine the distribution of continuous variables, the Kolmogorov–Smirnov test was employed. Normally distributed data are reported as means ± standard deviation (SD) and compared using independent sample t-tests or one-way ANOVA. Conversely, non-normal data are expressed as medians with interquartile ranges (IQR), utilizing Mann–Whitney U or Kruskal–Wallis tests for group comparisons. We utilized ordinal logistic regression to examine the association between cognitive stages and MNA-SF nutritional risk. Frequency differences in eating disturbances across cognitive groups were evaluated via chi-square tests, with post-hoc analyses conducted to pinpoint specific symptomatic variations. Furthermore, binary logistic regression determined the odds of distinct eating behaviors based on cognitive status. Statistical significance was set at $p < 0.05$, and all computations were performed using IBM SPSS Statistics (v. 29).

RESULTS

Patient characteristics

The demographic and clinical profiles of the 62 patients with cognitive impairment included in the study were summarized in Table 1. Participants were categorized into three groups: mild cognitive impairment (MCI; n = 30), mild dementia (n = 22), and moderate dementia (n = 10). The median age varied between the groups, ranging from 75 to 83 years, with a higher age associated with a more severe stage of cognitive impairment (p = 0.017). There were no significant differences in terms of sex or years of education. As expected, scores on the CDR-SB and the TMSE differed between the groups, consistent with their cognitive stages.

Nutritional status in cognitively impaired patients

In our evaluation of nutritional status using biological indices, there were no significant differences in BMI or WHR between the patient groups. The median BMI ranged from 23.0–24.7 kg/m^2, and the WHR was in the range of 0.91–0.92. Similarly, there were no significant

TABLE 1. Demographic data and nutritional status parameters in each group.

	MCI (n=30)	Mild dementia (n=22)	Moderate dementia (n=10)	p-value
Age (years)	75.4±8.6	79.6±7.1	83.1±4.9	0.017*
Sex, female	16 (53.3%)	15 (68.2%)	6 (60.0%)	0.561
Years of education	8.2±4.7	7.3±4.1	12.5±6.2	0.182
CDR-SB	1.5 (0.5-2.5)	4.7 (4.1-5.0)	9.7 (9.5-10.0)	<0.001*
TMSE	26.3±2.6	21.4±4.3	15.7±3.1	<0.001*
BMI (kg/m^2)	23.5±3.5	23.0±4.9	24.7±5.9	0.703
WHR	0.91±0.06	0.94±0.08	0.92±0.11	0.454
Total protein (g/dL)	7.5±0.8	7.3±0.6	7.0±1.7	0.526
Albumin (g/dL)	4.4±0.7	4.1±0.5	4.4±1.1	0.412
Hemoglobin (g/dL)	12.9±1.5	12.9±1.7	12.1±1.1	0.326

Data are presented as n (%), median (IQR), or mean ± SD

* Statistically significant

Abbreviations: BMI, body mass index; CDR-SB, Clinical Dementia Rating-Sum of Boxes; MCI, mild cognitive impairment; TMSE, Thai Mental State Examination; WHR, waist-to-hip ratio

differences in the levels of biochemical blood markers, including total protein, albumin, and hemoglobin, between the three groups (Table 1).

When nutritional status was evaluated using the MNA-SF, the overall prevalence of malnutrition was 3.2% (2 out of 62 patients). Additionally, 38.7% (24 out of 62) were at risk of malnutrition, while 58.1% (36 out of 62) had a normal nutritional status.

Fig 1 illustrated the proportion of each nutritional status within each cognitive stage. The odds of malnutrition were found to increase with the severity of cognitive impairment (Table 2). Patients with mild dementia trended towards a higher risk of malnutrition compared to those with MCI (adjusted OR [aOR] = 2.27; 95%CI = 0.67-7.73; p = 0.191). More significantly, patients with moderate dementia had a much higher risk of malnutrition compared to those with MCI (aOR = 8.87; 95% CI = 1.59-49.46; p = 0.013). The adjusted odds ratios were adjusted for age, as there were age differences among the various cognitive stages.

Eating disturbances in cognitively impaired patients

Overall, the prevalence of eating disturbances in at least one domain was 82.3% (51 out of 62 patients). Fig 2 and Supplementary Table 2 illustrated the proportion of patients with different types of eating disturbances at each cognitive stage. Of all the eating disturbance domains, only changes in eating habits showed a statistically significant overall difference across the cognitive stages. The prevalence of these disturbances increased with the severity of dementia: 36.7% in patients with MCI, 50.0% in those with mild dementia, and a notable 90.0% in those with moderate dementia (p = 0.01). Furthermore, patients with moderate dementia tended to have higher

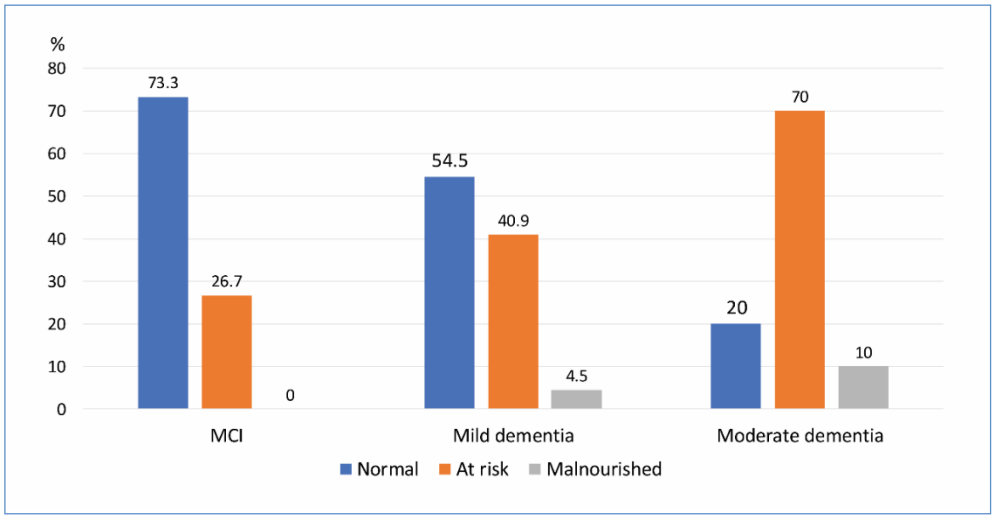


Fig 1. Proportion of each nutritional status based on the MNA-SF questionnaire in each group

This figure illustrates the proportion of patients in each nutritional status category as evaluated by the Mini Nutritional Assessment-Short Form (MNA-SF). The MNA-SF classified patients as having normal nutritional status, being at a risk of malnutrition, or being malnourished. The patients were grouped by their cognitive stage as determined by the Clinical Dementia Rating–Sum of Boxes (CDR-SB). This particular patient cohort included individuals with Mild Cognitive Impairment (MCI), mild dementia, and moderate dementia.

TABLE 2. Risk of malnutrition according to the stage of cognitive impairment.

Stage	uOR (95%CI)	p-value	aOR (95% CI)	p-value
MCI	1	-	1	-
Mild dementia	2.40 (0.75-7.70)	0.137	2.27 (0.67-7.73)	0.191
Moderate dementia	10.70 (2.11–54.15)	0.004*	8.87 (1.59-49.46)	0.013*

* Statistically significant

Abbreviations: MCI, mild cognitive impairment; uOR, unadjusted odds ratio; aOR, adjusted odds ratio

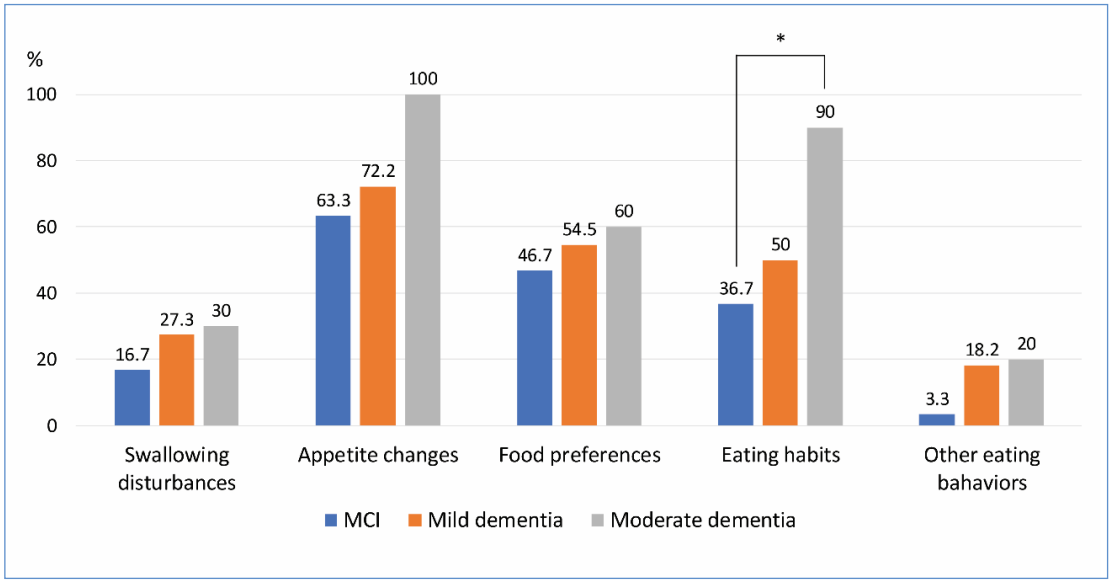


Fig 2. Proportion of each type of eating disturbance by group

This figure shows the proportion of patients with different types of eating disturbances, which were categorized into five domains: (1) swallowing disturbances, (2) appetite changes, (3) food preferences, (4) eating habits, and (5) other eating behaviors. Among these, only a change in eating habits showed a significant difference in the various cognitive stages.

* Statistically significant

odds of experiencing these disturbances compared to those with MCI (aOR = 9.37; 95% CI = 0.98-89.64; p = 0.052), as detailed in Table 3. A closer look at the specific symptoms within this domain revealed that patients with moderate dementia had a higher proportion of behaviors including "wanting to eat at the same time every day", "decline in table manners", "eating with hands", and "taking a long time to eat". (Supplementary Table 3).

DISCUSSION

Our study explored how nutritional status and eating disturbances correlate with cognitive impairment in the clinical sample. We used a multi-modal approach to assess nutritional status, including biological indices, biochemical blood markers, and a validated questionnaire. Our findings indicated that the risk of malnutrition increased with the severity of cognitive impairment. Additionally, eating disturbances were a significant issue among these patients. While all domains of eating disturbances showed an increasing trend with increased cognitive impairment, only changes in eating habits showed a statistically significant difference between each cognitive stage.

The prevalence of malnutrition based on the MNA-SF was 3.2%, and the prevalence of patients at risk of malnutrition was 38.7%. These rates were lower than the worldwide pooled prevalence reported in systematic reviews and meta-analyses, which found malnutrition prevalence ranging from 15.20% to 26.98% and the prevalence of patients at risk of malnutrition ranging from 49.20% to 57.43%.[1,2] This difference may be attributed

TABLE 3. Risk of changes in eating habits according to the stage of cognitive impairment.

Stage	uOR (95%CI)	p-value	aOR (95% CI)	p-value
MCI	1	-	1	-
Mild dementia	1.73 (0.57-5.28)	0.338	1.24 (0.38-4.05)	0.720
Moderate dementia	15.55 (1.73-139.65)	0.014*	9.37 (0.98-89.64)	0.052

Abbreviations: MCI, mild cognitive impairment; uOR, unadjusted odds ratio; aOR, adjusted odds ratio

to the patient setting, as our study was conducted in an outpatient clinic rather than a long-term care facility. The prevalence of malnutrition was lowest in the community setting, followed by home care, with nursing homes and geriatric day hospitals having the highest prevalence.[24] Furthermore, studies showed a significant variation in the prevalence of malnutrition among patients with dementia across different countries. For example, the prevalence of malnutrition in dementia patients had been reported as high as 75.6% in Japan, compared to a much lower figure of 6.8% in France.[1,25,26] Research synthesizing data on the Thai geriatric population, though not restricted to dementia cases, identified comparable aggregate malnutrition rates of 6.1% and 5.7% when applying the MNA and MNA-SF, respectively.[27] This raised a question about why cognitive impairment did not lead to a higher overall prevalence of malnutrition as might have been expected. However, our findings did show that the risk of malnutrition increased with the severity of cognitive impairment. Patients with moderate dementia were at a higher risk than those with mild dementia and MCI, respectively. These results were consistent with another study on Alzheimer's disease patients, which found that the prevalence of malnutrition increased with the stage of dementia: 14.5% in mild dementia, 31.6% in moderate dementia, and 48.4% in severe dementia.[28] We did not, however, include patients with severe dementia in our study.

The nutritional assessment tools used in our study yielded different results. Although biological indices (BMI and WHR) and biochemical blood markers (total protein, albumin, and hemoglobin) did not show significant differences between cognitive stages, the validated questionnaire provided more detailed information. The overall BMI was not below 18.5 kg/m^2; in fact, the median BMI was in the range of 23.0–24.7 kg/m^2, which was considered overweight for an Asian population.[29] While the WHR was in the range of 0.91–0.92, indicating that most patients had abdominal obesity.[22] Both BMI and WHR had limitations as single, cross-sectional measurements. They did not capture important changes over time, such as recent significant weight loss, which was a key indicator of poor health or malnutrition. For a more comprehensive diagnosis of malnutrition, the ESPEN consensus statement offered an alternative to these single measurements. This approach considered a significant weight loss, more than 10% over an indefinite period, or more than 5% in the last three months, in combination with either BMI or Fat-Free Mass Index (FFMI) criteria.[13]

We did not find significant differences in albumin and hemoglobin levels in the various cognitive stages and all levels were within the normal range. This finding was in contrast to previous research which suggested that low levels of red blood cells, HDL, and albumin could be markers of subsequent cognitive decline.[4] It's important to recognize that these biomarkers can be influenced by confounding factors. For example, serum albumin and transferrin levels are not only indicators of nutritional status; they are also affected by other factors such as inflammation and co-morbidities.[30] A normal serum albumin level may indicate good nutritional status at a specific time point, but does not necessarily reflect changes in nutritional status over time.

In our study, only the questionnaire method could differentiate patients based on their nutritional status. The MNA-SF was particularly effective because it inquired about nutritional problems over the past three months, providing a more detailed and long-term view rather than just a snapshot in time. Although MNA-SF had a high sensitivity of 85.2-89.3% and a specificity of 81.8-94.3% for classifying patients into the three nutritional categories, those identified as being at risk of malnutrition should still complete the full MNA for a more accurate assessment.[21] A previous study compared the validity of several nutritional assessment methods-including the MNA-SF plus serum albumin, the MNA-SF plus serum albumin, and clinical signs and symptoms-against the ESPEN consensus. It found that these classical diagnostic tools had only fair validity and poor agreement with the ESPEN consensus, with a sensitivity of 52.63-57.89% and a specificity of 64.47-89.47%. It was important to note that this study was conducted on patients admitted to post-acute geriatric rehabilitation care for medical diseases.[31] This suggested that the patient setting significantly impacted the choice and effectiveness of assessment tools.

The prevalence of eating disturbances in at least one domain was 82.3%. This was consistent with a previous study that used the same validated questionnaire, which found a prevalence of 81.4% in patients with Alzheimer's disease.[11] These results highlighted the high prevalence of this issue among cognitively impaired patients and underscored its importance. A previous study demonstrated that different stages of dementia were associated with specific types of eating disturbances. For instance, patients with mild Alzheimer's disease (including those with CDR 0.5 and CDR 1.0) showed a high proportion of appetite changes, while those in the moderate stage often had changes in eating habits and food preferences. Patients with severe dementia, on the other hand, exhibited a high proportion of swallowing problems.[11] In our cohort, the domains with a prevalence exceeding 50% were: appetite

change (63.3%) in patients with MCI; both appetite change (72.2%) and change in food preference (54.5%) in patients with mild dementia; and appetite change (100%), change in eating habits (90%), and change in food preference (60%) in patients with moderate dementia. Changes in appetite were a common finding across all stages of cognitive impairment, particularly in the initial stages. In the early stages of dementia, the loss of smell, taste, and appetite were common, which were often associated with weight loss.[32]

We observed that alterations in eating habits became more pronounced as cognitive impairment progressed. These changes included poorer table manners, eating with hands, and prolonged mealtimes, which were likely attributable to declining cognitive function. A previous study mentioned how specific pathophysiological changes related to cognitive functions affect eating and nutrition in different stages of dementia. For example, impaired attention and executive function in the mild to moderate stages could contribute to difficulty preparing food. As the disease progresses, apraxia and agnosia in the moderate stage often lead to increased dependence, the loss of social relationships and behavioral problems that can affect table manners. In later stages, oropharyngeal dysphagia and refusal to eat are common.[32]

A previous systematic review and meta-analysis highlighted the limited and non-global nature of nutritional status evaluations in patients living in long-term facilities with dementia.[1] That study also raised awareness of the need for nutritional assessment in dementia patients and contributed to the existing body of knowledge by providing data from a Thai cohort. This research was crucial for policy makers as it could inform the development of healthcare services for older adults. By providing dietitians and other healthcare professionals with the necessary resources and knowledge, we could effectively address the vicious cycle of dementia and malnutrition. In this cycle, dementia leads to decreased food intake, which causes nutritional deficiencies and weight loss. These factors, in turn, contribute to accelerated cognitive decline.[32]

A notable constraint of this investigation was the exclusion of individuals with advanced dementia, primarily due to significant barriers in cognitive function and communication. This exclusion criterion is consistent with established research practices in the field. Furthermore, in cases of severe impairment, clinical priorities often shift toward enhancing quality of life and honoring dietary preferences rather than focusing strictly on standardized nutritional assessments and corrective interventions.[33,34]

Future studies should evaluate the impact of different dementia subtypes on nutritional status. Previous research has shown that patients with dementia with Lewy bodies and frontotemporal lobar degeneration had lower levels of serum albumin compared to those with Alzheimer's disease.[16] Therefore, future studies should conduct a more comprehensive assessment using a multi-modal approach to nutritional evaluation and eating disturbances. Additionally, application-based malnutrition screening tools may be considered for use in patients with cognitive impairment, with assistance from caregivers, as they may help enable early detection of patients at risk of malnutrition.[35]

In conclusion, cognitively impaired patients had a substantial prevalence of malnutrition risk. Eating disturbances are a key concern. Changes in appetite are common and changes in eating habits increase alongside cognitive decline.

Data Availability Statement

All data generated and analyzed during this research are included in the published manuscript and its accompanying supplementary materials. Further inquiries regarding the dataset may be directed to the corresponding author for consideration.

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DECLARATIONS

Grants and Funding Information

This study does not have any funding allocated.

Conflict of Interest

The authors report no conflicts of interest.

Registration Number of Clinical Trial

This was a cross-sectional study and, therefore, was not registered as a clinical trial.

Authors' Contributions

Conceptualization and methodology, W.N., A.C., C.R., and V.S. ; Investigation, W.N., A.C., C.R., N.W., A.R., S.C., and V.S. ; Formal analysis, W.N., A.C., N.W., and V.S.; Visualization and writing – original draft, W.N., and A.C. ; Writing – review and editing, W.N. and V.S. ; Supervision, V.S. All authors have read and agreed to the final version of the manuscript.

Use of Artificial Intelligence

The submitted work was produced without the use of artificial intelligence-assisted technologies.

Ethics Approval and Informed Consent to Participate

This research adhered to established ethical standards and received formal authorization from the Siriraj Institutional Review Board (approval no. Si. 035/2019). Before any study procedures commenced, written informed consent was obtained from all participating individuals.

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