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Nutrition And Neurodegenerative Diseases: Patient Practices And Physician Perceptions In An Algerian Cohort Study

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ABSTRACT

Background: Growing evidence suggests nutrition influences neurodegenerative disease risk and progression, yet clinical integration remains limited in developing countries. **Objective:** To evaluate dietary habits of patients with neurodegenerative diseases and healthcare professionals' perceptions in Oran, Algeria. **Methods:** Descriptive cross-sectional study with prospective data collection (January-March 2025) at Etablissement Hospitalo-Universitaire (EHU) Oran, involving 102 consecutive patients (Parkinson's 56%, Alzheimer's 24%, Multiple Sclerosis 16%, ALS 4%) and 15 healthcare professionals. Structured questionnaires assessed dietary habits, nutritional knowledge, and clinical practices. Statistical analysis: descriptive statistics with 95% confidence intervals; chi-square/Fisher exact tests for comparisons; multivariable logistic regression for predictors of counseling receipt and symptom improvement. **Results:** Pre-diagnosis, only 16% (95% CI: 10-24%) followed balanced diets. Post-diagnosis, 70% modified eating habits, with 40% reporting self-perceived symptomatic improvement. However, 62% received no professional nutritional counseling. All healthcare professionals recognized nutrition's importance (53% as major), but 73% reported insufficient training. Systematic nutritionist collaboration occurred in only 40% of cases. Main barriers: food costs (patients 53%, professionals 87%) and inadequate training (73%). Nutritional counseling independently predicted perceived symptom improvement (aOR 3.42, p=0.024). **Conclusion:** Substantial gaps exist between scientific knowledge and clinical practice. Addressing barriers requires strengthening professional education, institutionalizing nutritionist collaboration, and facilitating economic access to healthy foods.

Keywords: Neurodegenerative diseases, Nutrition, Healthcare practices, Algeria, Barriers, Parkinson's, Alzheimers, Multiple Sclerosis.

INTRODUCTION

Neurodegenerative diseases (NDs)—including Alzheimer's disease (AD), Parkinson's disease (PD), Multiple Sclerosis (MS), and Amyotrophic Lateral Sclerosis (ALS)—represent a major public health challenge with rising global prevalence (1). These pathologies share common pathophysiological mechanisms: oxidative stress, neuroinflammation, mitochondrial dysfunction, and protein aggregation (2). Accumulating evidence suggests nutrition may influence disease risk and progression through modulation of these mechanisms (3). Mediterranean, DASH, and MIND diets demonstrate neuroprotective associations in epidemiological studies (4, 5). Key nutrients—omega-3 fatty acids, B vitamins, and antioxidants—support brain function and may combat oxidative damage (6). Conversely, diets high in saturated fats, refined sugars, and processed foods are associated with accelerated cognitive decline (7).

Despite this evidence, nutritional knowledge integration into clinical practice remains limited, particularly in developing countries (8). Recent European guidelines emphasize systematic nutritional assessment (9), yet implementation faces barriers including insufficient training, limited interdisciplinary collaboration, and socioeconomic constraints (10).

In Algeria and North Africa, data on nutritional practices in neurodegenerative diseases are virtually nonexistent. Understanding current practices, barriers, and the concordance between patients' needs and clinicians' capacity is essential for developing culturally adapted interventions.

This study aimed to: 1) Characterize dietary behaviors and nutritional knowledge of patients with NDs in Oran, 2) Assess healthcare professionals' perceptions, practices, and training needs, and 3) Identify barriers to nutritional care from both perspectives.

MATERIALS AND METHODS

Study design and setting

This was a descriptive cross-sectional study with prospective data collection conducted over three months (January-March 2025) at the Etablissement Hospitalo-Universitaire (EHU) d'Oran, tertiary specialized neurology referral center in Oran, Algeria. The EHU is one of the leading public teaching hospitals in western Algeria, recognized for its high-performing neurology department and providing multidisciplinary care for patients with neurodegenerative diseases from urban Oran and surrounding regions.

Patient population

Participants were recruited using consecutive sampling over a three-month period. Of the 118 eligible patients approached, 102 consented and completed the questionnaires, yielding a response rate of 86.4%. Sixteen patients declined participation: eight cited time constraints, five had severe cognitive or communication impairments, and three provided no reason. Non-participation analysis demonstrated no statistically significant differences in age ($p = 0.34$) or sex ($p = 0.58$) between participants and non-participants (Figure 1).

Inclusion criteria were: (1) age ≥18 years; (2) a confirmed diagnosis by a neurologist of Parkinson's disease according to the Movement Disorder Society (MDS) criteria (11), Alzheimer's disease according to the NIA-AA criteria (12), multiple sclerosis according to the 2017 McDonald criteria (13), or amyotrophic lateral sclerosis according to the Revised El Escorial criteria (14); (3) ability to provide informed consent independently or through a primary caregiver; and (4) attendance at EHU Oran neurology services during the study period.

Exclusion criteria were: (1) acute neurological conditions (e.g., stroke, encephalitis, or head trauma within the previous six months); (2) non-degenerative neurological pathologies as the primary diagnosis; (3) inability to provide informed consent without an available proxy; (4) severe communication impairment precluding participation in an interview; (5) co-existing malignancy or terminal illness with life expectancy <6 months; and (6) current participation in dietary intervention trials. Among patients with Alzheimer's disease (n = 25), 18 (72%) required a primary caregiver to serve as proxy respondents.

Healthcare professional sample

All 15 healthcare professionals invited to participate consented, resulting in a 100% response rate. Thirteen were affiliated with the neurology department at EHU Oran, including neurologists (n = 7, 47%), psychologists (n = 2, 13%), psychiatrists (n = 1, 7%), and other specialists (n = 3, 20%). The remaining two participants, a psychologist and a psychiatrist, were not members of the neurology department but were actively involved in the care of patients with neurodegenerative diseases.

Data collection instruments

Two structured questionnaires were developed based on a review of the literature (4–6, 15, 16), expert consultation, and adaptation of validated instruments. Both questionnaires were pilot-tested, and face validity was assessed by subject-matter experts. The patient questionnaire demonstrated acceptable internal consistency (Cronbach's $\alpha = 0.71$).

The patient questionnaire (Supplementary File S1) collected data on sociodemographic characteristics, disease-related variables, and dietary habits before and after diagnosis using a five-item Mediterranean/MIND-based scoring system. The scoring system assessed: fruit and vegetable intake (≥5 servings/day), fatty fish consumption (≥2 meals/week), olive oil as the primary fat source, nut and seed intake (≥3 times/week), and processed food consumption (<2 times/week). Additional domains included specific food consumption patterns, receipt of nutritional counseling, nutritional knowledge, lifestyle factors, and perceived barriers to maintaining a balanced diet.

The healthcare professional questionnaire (Supplementary File S2) assessed professional characteristics, perceptions of the role of nutrition in neurodegenerative disease management, clinical practices related to nutrition, collaboration with nutritionists, perceived causes of increasing neurodegenerative disease burden, and barriers to integrating nutritional care into routine practice.

Questionnaires were administered face-to-face by a single trained interviewer in either French or Arabic during routine consultations. Completion time ranged from 20 to 30 minutes for patients and 15 to 20 minutes for healthcare professionals.

Variables

The primary outcomes were the proportion of participants reporting a balanced diet before and after diagnosis, the proportion receiving nutritional counseling, and the proportion of healthcare professionals recognizing the role of nutrition in disease management. Secondary outcomes included self-reported symptom changes, dietary consumption patterns, barriers to accessing nutritional care, and nutrition-related professional practices. Covariates included age, sex, education level, disease type and duration, comorbidities, treatment status, and family history.

Addressing potential biases

Selection bias was minimized through consecutive sampling of clinic attendees. However, patients unable to access tertiary care, those managed exclusively in primary care, or those not seeking care during the study period were not captured. The single-center, urban tertiary-care setting limits generalizability.

Information bias may have arisen due to face-to-face interviews, potentially introducing social desirability bias. This was mitigated through a neutral interviewing approach, assurance of confidentiality, and use of a trained interviewer.

Recall bias was possible because pre-diagnosis dietary habits required retrospective reporting over variable timeframes, increasing the risk of memory distortion, particularly among cognitively impaired participants.

Measurement error may have occurred because 72% (18/25) of patients with Alzheimer's disease required proxy responses from caregivers. Sensitivity analyses comparing self-reported and proxy-reported responses showed no statistically significant differences (dietary modification: 86% vs. 83%, $p = 0.85$; counseling receipt: 43% vs. 44%, $p = 0.96$), supporting pooled analysis (Supplementary File S4).

Sample size

For patients, an a priori sample size calculation was performed to achieve a ±10% margin of error at a 95% confidence level, assuming a 40% prevalence of a balanced pre-diagnosis diet. The required sample size was calculated as:

$$n = (1.96^2 \times 0.4 \times 0.6) / 0.1^2 \approx 92.$$

A total of 102 patients were recruited, providing approximately 80% power to detect moderate effect sizes (Cohen's $w \geq 0.35$) at $\alpha = 0.05$.

For healthcare professionals, a census approach was used, including all 15 professionals involved in neurodegenerative disease care, with 100% participation. Given the small sample size, findings from this group should be interpreted as exploratory.

Statistical analysis

Descriptive statistics were used to summarize the data. Categorical variables were presented as frequencies, percentages, and 95% confidence intervals calculated using the Wilson score method. Continuous variables were summarized as medians and interquartile ranges due to non-normal distributions.

Comparative analyses were conducted using chi-square or Fisher's exact tests for categorical variables, and Mann–Whitney U or Kruskal–Wallis tests for continuous or ordinal variables.Subgroup analyses were performed according to disease type, sex, education level, and presence of cardiometabolic comorbidities. Multivariable logistic regression was used to identify predictors of receipt of nutritional counseling and perceived symptom improvement. Backward elimination was applied, retaining variables with $p < 0.10$.

Missing data were <5% for most variables, and complete-case analysis was performed. Sensitivity analyses using multiple imputation (m

= 5 datasets, predictive mean matching) yielded qualitatively similar results (data not shown). All tests were two-tailed, with statistical significance defined as $p < 0.05$. Analyses were conducted using IBM SPSS Statistics version 26.0.

Ethical considerations

This study was conducted in accordance with ethical principles. This study was approved by Research Ethics and Deontology Committee, University of Oran 1, Ahmed Ben Bella; approval number 991. Participation was voluntary, and verbal informed consent was obtained from all participants prior to questionnaire administration. For patients with Alzheimer's disease requiring assistance, patient assent was obtained in addition to formal caregiver consent. Questionnaires were coded numerically, and all data were stored securely in accordance with the Declaration of Helsinki. Anonymity and confidentiality were maintained throughout the study.

Data availability

The anonymized dataset and complete questionnaires (French and Arabic versions) are available from the corresponding author upon reasonable request. Study materials, including the questionnaires and codebook, are provided as Supplementary Files S1 and S2.

Reporting standards

This study is reported in accordance with the STROBE guidelines. The completed STROBE checklist is available as Supplementary File S3.

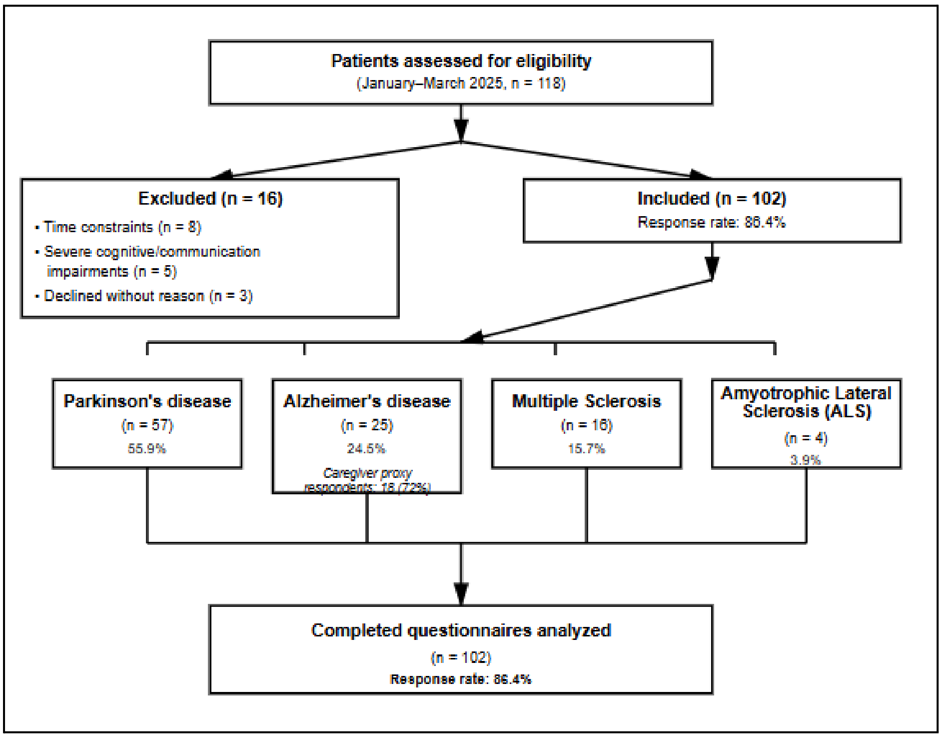

Figure 1: Study Flow Diagram

RESULTS

Patient characteristics

A total of 102 patients were included in the analysis. The median age was 68 years (IQR 59–75), 54% were male, and 40% had no formal or only primary education. Diagnoses were distributed as follows: Parkinson's disease (PD) 56%, Alzheimer's disease (AD) 24%, multiple sclerosis (MS) 16%, and amyotrophic lateral sclerosis (ALS) 4%. Comorbidities were common, including hypertension (34%), diabetes (24%), and cardiovascular disease (8%). A family history of neurodegenerative disease was reported by 30%, and 83% were receiving disease-specific treatment.

Before diagnosis, only 16% (95% CI 10–24%)

reported a balanced diet, while 67% reported an average diet and 18% an unbalanced diet. After diagnosis, 70% (95% CI 60–78%) reported modifying their dietary habits. Among the 71 patients who modified their diet, 40% (95% CI 28–51%) perceived symptom improvement or stabilization, 45% reported no change, and 16% considered the question not applicable. Despite these modifications, 62% (95% CI 52–71%) of all patients reported not receiving professional nutritional counseling. Water intake was frequently suboptimal: 43% consumed less than 1 liter per day, and only 28% consumed at least 2 liters daily.

Food consumption and lifestyle

Beneficial foods were widely reported (multiple responses permitted): fruits and vegetables (87%), olive oil (57%), nuts and seeds (56%), and fatty fish (48%). Processed food consumption was reported as never (51%), rarely (34%), and often (15%). More than half of patients (56%) did not use dietary supplements, while 31% used them occasionally and 13% regularly.

Lifestyle factors revealed substantial risk exposure: 45% were physically inactive, and 58% reported poor sleep quality. The most commonly reported barriers to maintaining a balanced diet were food cost (53%), difficulty changing established habits (33%), and dysphagia (8%).

Nutritional knowledge

Only 46% of patients recognized the preventive role of diet in neurodegenerative disease, while 43% reported not knowing whether diet had such a role. Among the 70% who believed certain foods could worsen disease, the most frequently cited were excess sugar (58%), saturated fats (48%), and food additives (34%).

Disease-specific patterns

Significant differences were observed across disease groups (Table 3). Patients with Alzheimer's disease had the highest rate of dietary modification (84%), largely driven by caregiver involvement, whereas patients with Parkinson's disease had the lowest rate (61%). Patients with multiple sclerosis were significantly more likely to receive nutritional counseling compared with those with Parkinson's disease (56% vs. 32%, p = 0.041).

Predictors of counseling receipt

In multivariable logistic regression analysis (Table 4), higher education level independently predicted receipt of nutritional counseling (adjusted OR [aOR] 2.41, 95% CI 1.03–5.64, p = 0.043). A greater number of comorbidities was also independently associated with counseling receipt (aOR 1.68 per additional comorbidity, 95% CI 1.02–2.77, p = 0.041). Patients with multiple sclerosis showed a trend toward increased counseling compared with Parkinson's disease (aOR 2.94, p = 0.062).

Association between dietary modification and symptom improvement

Among the 71 patients who modified their diet, 28 (39%) reported perceived symptom improvement or stabilization. These patients were more likely to have higher baseline education (secondary or university level: 71% vs. 47%, p = 0.048) and to have received nutritional counseling (57% vs. 28%, p = 0.016) compared with those reporting no symptom change (n = 32, 45%).

In multivariable analysis (Table 5), receipt of nutritional counseling remained independently associated with perceived symptom improvement (aOR 3.42, 95% CI 1.18–9.91, p = 0.024). Higher education showed borderline statistical significance (aOR 2.68, 95% CI 0.95–7.58, p = 0.063).

Healthcare professional perspectives

All 15 healthcare professionals recognized the importance of nutrition in neurodegenerative disease management, rating its importance as major (53%) or moderate (47%). The most frequently identified key nutrients (multiple responses) were vitamins B, D, and E (73%, 11/15), antioxidants (53%, 8/15), and omega-3 fatty acids (40%, 6/15).

Despite universal recognition, only 40% (6/15) reported systematic collaboration with nutritionists. Most professionals (73%, 11/15; 95% CI 45–92%) reported insufficient training in nutritional management. Regarding dietary recommendations, 33% recommended a Mediterranean diet, 27% recommended the DASH diet, and 40% did not systematically recommend a specific dietary pattern.

Perceived contributors to the increasing burden of neurodegenerative disease in Algeria included oxidative stress (87%), genetic predisposition (67%), aging (60%), and physical inactivity (53%). Reported barriers to integrating nutrition into care included patient food costs (87%), lack of medical training (73%), patient adherence difficulties (40%), and perceived insufficient scientific evidence (20%).

Theory-practice gap analysis

A clear theory–practice gap emerged when comparing patient experiences with professional practices. Although 100% of healthcare professionals recognized the importance of nutrition, only 38% of patients (39/102, 95% CI 28.8–48.4%) reported receiving nutritional counseling. Similarly, while 70% of patients modified their diets after diagnosis, only 40% of professionals reported systematic collaboration with nutritionists. Notably, food cost emerged as a convergent barrier, cited by 53% of patients and 87% of professionals.

This quantified mismatch highlights structural and systemic barriers that constrain the translation of professional awareness into routine clinical nutritional care.

Table 1. Patient Characteristics (n=102)

Variable	n (%)	95% CI
Age ≥60 years	66 (64.7)	54.6-73.8
Male sex	55 (53.9)	43.8-63.9
No formal/primary education	41 (40.2)	30.6-50.4
Disease type		
Parkinson's disease	57 (55.9)	45.7-65.7
Alzheimer's disease	25 (24.5)	16.5-34.0
Multiple sclerosis	16 (15.7)	9.3-24.3
ALS	4 (3.9)	1.1-9.7
Comorbidities		
Hypertension	35 (34.3)	25.3-44.3
Type 2 diabetes	25 (24.5)	16.5-34.0
Cardiovascular disease	8 (7.8)	3.5-14.8
≥1 comorbidity	83 (81.4)	72.5-88.4
Family history ND	31 (30.4)	21.7-40.3
Specific treatment	85 (83.3)	74.7-89.9

CI=confidence interval; ALS=amyotrophic lateral sclerosis; ND=neurodegenerative disease.

Table 2. Dietary habits and counselling (n=102)

Variable	n (%)	95% CI
Pre-diagnosis diet quality		
Balanced†	16 (15.7)	9.3-24.3
Average	68 (66.7)	56.6-75.6
Unbalanced	18 (17.6)	10.8-26.4
Post-diagnosis modification	71 (69.6)	59.7-78.3
Symptom evolution (n=71)		
Improvement/stabilization*	28 (39.4)	28.1-51.7
No evolution	32 (45.1)	33.4-57.2
Not applicable	11 (15.5)	7.9-26.2
Counseling received	39 (38.2)	28.8-48.4
Water consumption		
<1L/day	44 (43.1)	33.4-53.3
1L/day	29 (28.4)	20.0-38.2
≥2L/day	29 (28.4)	20.0-38.2

**Self-reported subjective perception among those who modified diet. "Not applicable"=diagnosis <1 year or maintained poor diet. †Balanced=meeting ≥4/5 Mediterranean/MIND criteria: (1) Fruits/vegetables ≥5 servings/day, (2) Fatty fish ≥2 meals/week, (3) Primary fat: olive oil, (4) Nuts/seeds ≥3 times/week, (5) Processed foods <2 times/week; Average=2-3 criteria; Unbalanced=≤1 criterion. CI=confidence interval.*

Table 3. Disease-Specific Comparisons

Variable	PD (n=57) %	AD (n=25) %	MS (n=16) %	p-value *
Modified diet post-diagnosis	61.4	84.0	75.0	0.008
Received counseling	31.6	44.0	56.3	0.041
Pre-diagnosis balanced diet	10.5	16.0	37.5	0.065

*PD=Parkinson's disease; AD=Alzheimer's disease; MS=multiple sclerosis. *Chi-square test. ALS (n=4) excluded due to small sample size.*

Table 4. Independent predictors of receiving nutritional counseling

Predictor	aOR	95% CI	p-value
Secondary/university education^{+}	2.41	1.03-5.64	0.043
Number of comorbidities (ordinal)	1.68	1.02-2.77	0.041
Disease type^{++}			
MS vs. Parkinson's	2.94	0.95-9.13	0.062
Alzheimer's vs. Parkinson's	1.82	0.68-4.87	0.233

aOR=adjusted odds ratio from multivariable logistic regression; MS=multiple sclerosis; CI=confidence interval. $^{+}$Reference: no formal/primary education. $^{++}$Parkinson's disease as reference category.

Table 5. Predictors of perceived symptom improvement after dietary modification (n=71)

Predictor	aOR	95% CI	p-value
Received nutritional counseling	3.42	1.18-9.91	0.024
Secondary/university education	2.68	0.95-7.58	0.063

aOR=adjusted odds ratio; CI=confidence interval. Model adjusted for education, counseling receipt, disease type

DISCUSSION

This study reveals a substantial gap between scientific evidence on nutrition in neurodegenerative diseases and its implementation in clinical practice in Algeria. Only 16% of patients reported a balanced diet prior to diagnosis. Although 70% modified their diet post-diagnosis, just 38% received professional nutritional counseling. Forty percent of those modifying their diet perceived symptom improvement or stabilization. Despite universal professional recognition of nutrition's importance, most reported insufficient training (73%) and limited systematic collaboration with nutritionists (40%). Food cost emerged as a shared barrier across patients and professionals.

Dietary patterns and disease-specific variations

The low prevalence of balanced diets before diagnosis mirrors global findings of suboptimal dietary quality in aging populations (17). The high burden of cardiometabolic comorbidities reinforces established vascular contributions to neurodegeneration (18), mediated through oxidative stress, inflammation, and cerebral hypoperfusion (19).

After diagnosis, most patients increased Mediterranean-aligned foods. Alzheimer's disease patients showed the highest modification rate (84%), likely reflecting caregiver involvement, whereas Parkinson's disease patients showed lower rates (61%). Patients with multiple sclerosis were more likely to receive counseling, and higher education independently predicted counseling receipt (aOR 2.41, $p = 0.043$), suggesting inequitable access.

Receipt of nutritional counseling was independently associated with perceived symptom improvement (aOR 3.42, $p = 0.024$). Although causality cannot be inferred, this association supports the potential clinical relevance of structured nutritional guidance, particularly given that 62% received no counseling despite recommendations for systematic assessment (9). The 40% reporting symptomatic improvement should be interpreted cautiously, as outcomes were self-reported and not measured using validated scales.

Knowledge-practice gaps

Less than half of participants recognized the preventive role of diet in neurodegenerative disease, limiting sustained behavioral change. The coexistence of high post-diagnosis dietary modification and low counseling rates suggests patient motivation that is not being systematically supported.

Regression findings indicate counseling was delivered selectively, favoring individuals with higher education or greater comorbidity burden. This selective approach contrasts with international guidelines advocating systematic nutritional integration (9) and may exacerbate health inequities

Professional perspectives and structural barriers

Although all professionals acknowledged nutrition's importance, only 40% reported systematic collaboration with nutritionists, and 73% cited inadequate training. This reflects broader curricular deficiencies in medical nutrition education (20). When recommendations were made, they aligned with evidence-based dietary patterns such as the Mediterranean and DASH diets (4,5), but implementation remained inconsistent.

Food cost was the principal barrier identified by both patients and professionals. Mediterranean-style diets are often more expensive than processed-food–based alternatives (21), limiting feasibility in this context. Policy responses may include subsidies, promotion of affordable local alternatives, and fiscal measures targeting ultra-processed foods (22). The second barrier—insufficient professional training—is modifiable through curriculum reform, continuing education, and embedding nutritionists within neurology services.

Clinical and Policy Implications

Closing the identified gap requires coordinated reforms. Integrating structured nutrition training and counseling competencies into neurology education and continuing professional development is essential. Institutionalizing neurologist–nutritionist collaboration through standardized referral pathways would shift practice from selective to systematic assessment. Allocating protected consultation time for nutritional evaluation could facilitate routine integration. Culturally adapted materials in French and Arabic emphasizing affordable local dietary options may enhance adherence. At the policy level, economic measures such as targeted subsidies or fiscal policies addressing ultra-processed foods (22) may improve access to healthier diets. Prospective cohort studies, interventional trials, and implementation research in North African populations are needed to strengthen context-specific evidence.

Study limitations: The cross-sectional design precludes causal inference. Retrospective dietary assessment introduces recall bias, particularly among cognitively impaired patients. Proxy reporting for patients with Alzheimer's disease may introduce measurement error, although sensitivity analyses showed similar patterns. Symptom outcomes were self-reported and not assessed using validated instruments. The small professional sample limits precision, and single-center urban recruitment restricts generalizability. Residual confounding remains possible despite multivariable adjustment.

CONCLUSION

There is a clear disconnect between evidence and clinical implementation of nutritional care in neurodegenerative disease management in Algeria. While professionals recognize nutrition's importance and patients demonstrate willingness to modify diets, structural and socioeconomic barriers limit systematic integration. Nutritional counseling was independently associated with perceived symptom improvement, underscoring its potential relevance. Although nutrition is not curative, evidence supports its role in risk modification and supportive management (4,5,9). Bridging this gap requires educational reform, institutional restructuring, socioeconomic policy measures, and context-specific longitudinal research.

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