pharmacy

MDPI

Article

Community Pharmacists' Familiarity and Professional Exposure to Ketogenic Supplements for Epilepsy: An Exploratory Cross-Sectional Study in Portugal

Rafaela Oliveira [1], Ana Rita Soares Mateus [1,2,3,4,5], Maria João Campos [1,2,*] and Angelina Pena [1,2,*]

[1] Health Sciences Campus, Faculty of Pharmacy, University of Coimbra, Azinhaga de Santa Comba, 3000-548 Coimbra, Portugal; rafaelamiguel2001@gmail.com (R.O.); anarita.mateus@iniav.pt (A.R.S.M.)
[2] Associated Laboratory for Green Chemistry (LAQV), Network of Chemistry and Technology (REQUIMTE), Laboratory of Bromatology, Pharmacognosy and Analytical Sciences, Faculty of Pharmacy, University of Coimbra, 3000-548 Coimbra, Portugal
[3] National Institute for Agricultural and Veterinary Research (INIAV), I.P., Rua dos Lagidos, Lugar da Madalena, Vairão, 4485-655 Vila do Conde, Portugal
[4] Center for Study in Animal Science (CECA), Institute of Sciences, Technologies and Agroenvironment (ICETA), University of Porto, P.O. Box 55142, 4051-401 Porto, Portugal
[5] Associate Laboratory for Animal and Veterinary Sciences (Al4AnimalS), 1300-477 Lisbon, Portugal
* Correspondence: mcampos@ff.uc.pt (M.J.C.); angelina.pena@ci.uc.pt (A.P.)

Abstract

The ketogenic diet (KD) is an established nutritional treatment for drug-resistant epilepsy, yet little is known about community pharmacists' professional familiarity, exposure, and practices regarding the KD and ketogenic supplements (KS) in Portugal. This exploratory cross-sectional study assessed these aspects, as well as reported availability, accessibility, and demand for KS in Portuguese community pharmacies. An online cross-sectional survey was conducted among Portuguese pharmacists, with a final sample of 204 community pharmacists. Only 3.4% of pharmacists reported good familiarity with the KD and KS, whereas 62.3% had never heard of them in the context of epilepsy management. Furthermore, 98.0% reported that their pharmacy teams had not received specific training, while 81.9% indicated that their pharmacies would be interested in participating in future training programmes. Complete KS were reported to be in stock by only 8.3% of respondents, while 53.9% indicated that these products could be ordered. Customer demand was limited, with 77.9% reporting that KS were never requested. The most frequently perceived barriers to availability were insufficient knowledge among healthcare professionals (83.3%) and low customer demand (46.6%). These findings suggest limited self-reported familiarity, training, and availability of complete KS, highlighting the potential importance of professional education and further research to improve access to ketogenic nutritional therapies in community pharmacy practice.

Keywords: ketogenic diet; education; community pharmacists; pharmacy practice; ketogenic supplements

Check for updates

Academic Editor: Jon C. Schommer

Received: 13 October 2026
Revised: 20 November 2026
Accepted: 21 November 2026
Published: 25 November 2026

Copyright: © 2026 by the authors. Licensee MDPI, Basel, Switzerland. This article is an open access article distributed under the terms and conditions of the Creative Commons Attribution (CC BY) license.

1. Introduction

Community pharmacy practice has evolved considerably over recent decades, extending beyond the traditional role of medicine dispensing towards a more patient-centred approach [1,2]. This evolution is particularly relevant in the context of population ageing, the increasing prevalence of chronic diseases, and growing pressures on European healthcare systems [1]. As highly accessible frontline healthcare professionals, community

pharmacists are therefore strategically positioned to contribute to primary healthcare and public health [1,2].

The expansion of pharmacists' professional responsibilities requires their knowledge and competencies to evolve accordingly. In this context, the Global Competency Framework of the International Pharmaceutical Federation (FIP) emphasises that pharmacy practice requires competencies that extend beyond scientific knowledge, making education and continuing professional development essential to addressing the evolving needs of patients and populations [2,3].

In the field of nutrition, community pharmacists are well positioned to provide evidence-based advice, particularly on food supplements, which are widely used by the general population [4,5]. However, limitations in pharmacists' nutritional knowledge and education have been identified, potentially affecting their confidence and professional practice [4,6]. Accordingly, greater investment in nutrition education has been advocated [4,6]. This need becomes particularly evident when specific nutritional interventions form part of, or complement, the therapeutic management of certain conditions, as is the case with the ketogenic diet (KD) in epilepsy [7].

The KD is a high-fat, low-carbohydrate diet with adequate protein intake that induces a state of metabolic ketosis [8–11]. It is an established therapeutic option for refractory epilepsy, particularly in children, with reported seizure reductions exceeding 50% after 3 months of treatment [12,13]. Epilepsy is one of the most prevalent chronic neurological disorders worldwide, affecting approximately 50 million people [14–16], including an estimated 40,000–70,000 individuals in Portugal [17]. Although antiseizure medications (ASMs) are considered the first-line treatment, approximately 30% of patients develop refractory epilepsy, defined as the inability to achieve sustained seizure control after two appropriately chosen and tolerated regimens [14,18–22].

Given the diet's restrictiveness, ketogenic oral nutritional supplements (ONS) may be used to facilitate dietary adherence and help meet nutritional requirements [23]. These products are classified as Foods for Special Medical Purposes (FSMPs), in accordance with Regulation (EU) N.º 609/2013 [24]. In ketogenic therapy, certain ONS classified as FSMPs function as complete ketogenic supplements, providing the high-fat, low-carbohydrate profile required to maintain therapeutic ketosis. Other supportive ketogenic products, such as medium-chain triglyceride (MCT) oil or modular lipid supplements, may complement energy intake but do not replace the full diet [23,25]. In this study, the term ketogenic supplements (KS) is used as an umbrella category that includes both complete FSMP-based ONS and supportive ketogenic supplements.

Community pharmacists, often the first point of contact for patients and caregivers, play a pivotal role in counselling and providing access to KS [26]. Pharmacist interventions have been shown to enhance adherence, improve quality of life, and support patient follow-up [5,27–29]. High-fat dietary patterns, such as the KD, may also alter the absorption and metabolism of ASMs, while the carbohydrate content of some medicines and supplements can compromise ketosis and increase seizure risk [30–33]. These aspects further reinforce the importance of pharmacists in identifying potential interactions, advising on low-carbohydrate alternatives, and ensuring appropriate formulations to support safe and effective treatment [31]. Nevertheless, evidence regarding community pharmacists' knowledge of the KD and KS remains scarce in Portugal [5,27–29].

This exploratory cross-sectional study aimed to provide preliminary insights into Portuguese community pharmacists' self-reported familiarity with, professional exposure to, and practices related to the KD and KS used in epilepsy management. Additionally, the study sought to describe the reported availability of these products in community pharmacies, their accessibility through ordering and reimbursement, customer demand,

perceived barriers to availability, and professional training needs, with the aim of informing future research and identifying potential implications for community pharmacy practice.

2. Materials and Methods

2.1. Study Type

This was an observational, quantitative, cross-sectional, exploratory study. Data were collected through an online questionnaire administered to community pharmacists to assess their self-reported familiarity with and professional exposure to the KD and related supplements used in epilepsy management, as well as the reported availability of these supplements in pharmacies in Portugal.

2.2. Population and Eligibility Criteria

The target population for this analysis consisted primarily of pharmacists working in community pharmacies within Portuguese territory, estimated to include approximately 12,260 professionals [34]. The inclusion criteria were: (1) being a licensed pharmacist and (2) currently working in a community pharmacy. Pharmacists working exclusively in other professional areas (e.g., clinical, industrial, regulatory affairs) were excluded from the final analytical sample.

This study was designed as an exploratory cross-sectional survey to describe community pharmacists' self-reported familiarity, exposure, and practices related to the ketogenic diet and supplements, with the aim of providing preliminary evidence to inform future larger-scale research. No formal sample size calculation was performed, given the exploratory objectives of the study and the use of non-probability sampling.

2.3. Instrument and Data Collection

Data were collected via an individual online questionnaire developed in Google Forms® (Google LLC, Mountain View, CA, USA). Based on the research objectives, the instrument was designed specifically for this study. Before its application, the questionnaire was informally pretested with a convenience group of 10 pharmacists to assess the clarity and comprehensibility of the questions. No modifications were made following this preliminary assessment. The pretest responses were not included in the final analytical dataset.

The questionnaire included closed-ended questions, multiple choice items, checkboxes, and one open-ended question, organised into several thematic sections: sociodemographic and professional characterisation, training and experience, availability of complete and supplementary ketogenic products, frequency of demand, and identified barriers. The original Portuguese questionnaire and its English translation are available in the Supplementary Materials.

Responses were accepted between 27 March and 29 July 2025. The questionnaire was disseminated through three main channels: (i) Direct email sent to community pharmacies, using publicly available contact lists; (ii) Posts on the authors' social media accounts (LinkedIn®, LinkedIn, Carpinteria, CA, USA and Facebook®, Meta, Cambridge, MA, USA); (iii) Sharing in professional and personal groups via WhatsApp® and Messenger® (Meta, Cambridge, MA, USA) applications. The number of direct email invitations was not systematically recorded. Furthermore, as the total number of individuals reached through subsequent sharing could not be determined, a conventional response rate could not be calculated.

The questionnaire was administered anonymously. Specific technical measures to prevent duplicate submissions could not be retrospectively confirmed. Therefore, the possibility of multiple submissions by the same individual could not be completely excluded.

2.4. Variables Under Study

This study analysed variables collected through an online questionnaire, classified into seven main categories: (1) Sociodemographic and professional variables: sex, age group, and length of practice in the pharmaceutical field; (2) Familiarity and exposure variables: degree of familiarity with the ketogenic diet and ketogenic supplements, and source of information or prior exposure; (3) Pharmacy context variables: working in a community pharmacy, region of Portugal, and urban or rural location; (4) Product availability variables: presence of ketogenic supplements in stock, distinguished into complete ketogenic supplements (FSMPs such as K-Flo®, KetoCal®, KetoVie®) and supportive/supplementary products (e.g., MCT oil, Liquigen®, K-Quik®), as well as the possibility of ordering these products when not available in stock; (5) Demand and consumption variables: frequency of client requests and age group of the main consumers; (6) Training and policy-related variables: reimbursement via medical prescription, information requests, previous team training, and interest in future training activities; (7) Subjective/opinion variables: identified obstacles to product availability, opinion on the need for greater dissemination, and space for additional comments.

The categorical (nominal and ordinal) variables were self-reported and analysed according to the study objectives, aiming to characterise community pharmacists' reported familiarity, professional experiences, and perceptions regarding ketogenic supplements in Portugal.

2.5. Data Analysis

Data were analysed using Microsoft Excel (Microsoft Corporation, Redmond, WA, USA) and Google Forms. A descriptive analysis was performed, presenting absolute and relative frequencies (n and %) for categorical variables. Responses were filtered according to the eligibility criteria to include only community pharmacists ($n = 204$) in the final analysis. Percentages were calculated based on the number of valid responses for each question, accounting for conditional questions where applicable. For multiple-response questions, each selected option was counted separately; therefore, percentages could sum to more than 100%.

2.6. Ethical Considerations

The study received approval from the Ethics Committee for Research of the University of Coimbra (CEIUC) in March 2025, under the code CEIUC_14-04/2025. Respondents' participation was voluntary and anonymous, and all procedures were conducted in accordance with the ethical principles of the Declaration of Helsinki and the guidelines for scientific research ethics. Data were treated confidentially and used exclusively for academic purposes, in full compliance with the General Data Protection Regulation (GDPR).

3. Results

3.1. Sample Characteristics

A total of 221 individuals responded to the questionnaire. Of these, seven who reported not being pharmacists were excluded. The remaining 214 respondents constituted the initial sample of pharmacists. Among them, 204 indicated that they worked in community pharmacies and were automatically directed to complete the full survey, forming the final study sample. The remaining 10 pharmacists, employed in other professional settings (e.g., industry or hospital), completed only the initial sociodemographic section and were not included in the main analyses (Figure 1).

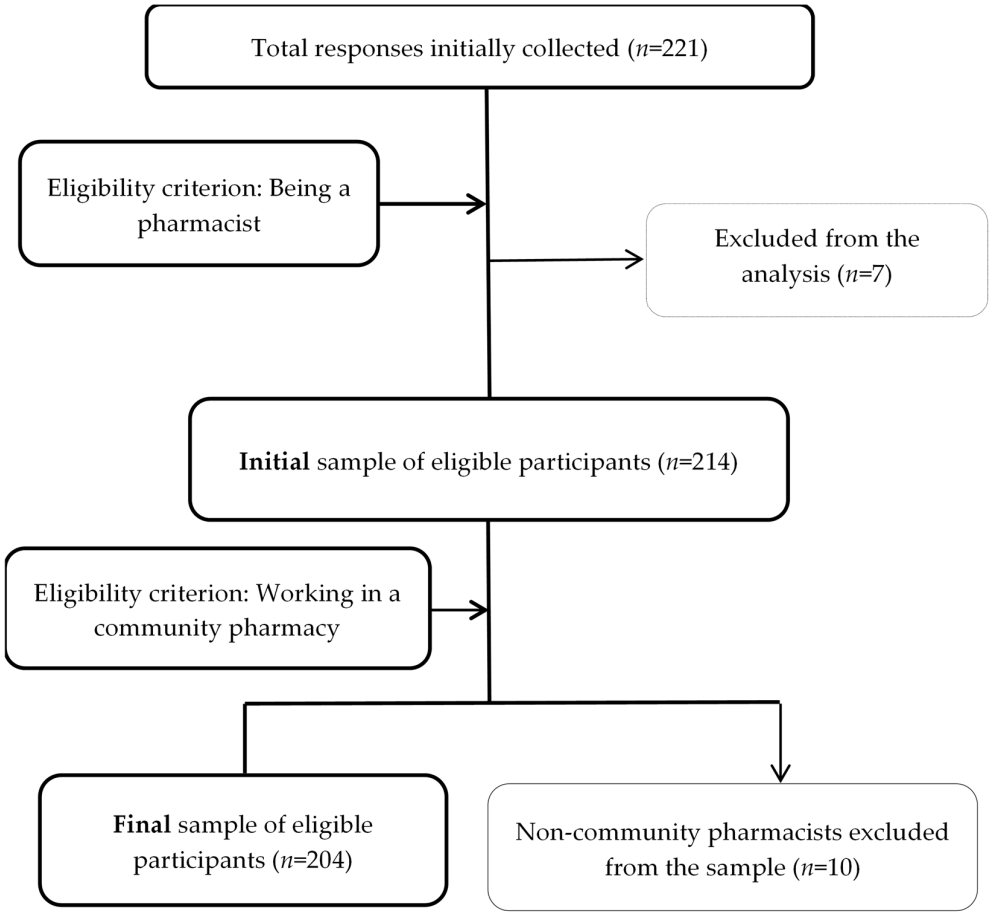


Figure 1. A flowchart showing the subjects of this study.

Table 1 presents the absolute and relative distribution of sociodemographic characteristics among the 204 community pharmacists included in the final analytical sample. Most respondents were female (83.3%), and the most prevalent age group was 42–60 (42.2%). Regarding professional experience in pharmacy practice, more than half of the sample reported having more than 10 years of experience.

Table 1. Sociodemographic characteristics (n = 204).

Characteristics		Absolute Number (n)	Relative Frequency (%)
Sex	Female	170	83.3
	Male	33	16.2
	Do not know/Prefer not to answer	1	0.5
Age	21–25	28	13.7
	26–30	25	12.3
	31–41	59	28.9
	42–60	86	42.2
	>60	6	2.9

Table 1. *Cont.*

Characteristics		Absolute Number (*n*)	Relative Frequency (%)
Years of experience in the pharmaceutical sector	<1	11	5.4
	1–3	27	13.2
	4–6	17	8.3
	7–10	17	8.3
	>10	132	64.7

Percentages may not sum to 100% due to rounding.

3.2. Self-Reported Familiarity and Professional Training

As shown in Table 2, most community pharmacists (62.3%) reported having never heard of the ketogenic diet (KD) or ketogenic supplements (KS) as a treatment for epilepsy, while 34.3% indicated limited familiarity and only 3.4% reported being well familiar with the topic. Among the 77 respondents who reported some degree of familiarity with KD/KS, 29.9% identified the Integrated Master's Degree in Pharmaceutical Sciences as their source of familiarity, while 24.7% reported training provided by pharmaceutical companies. The remaining 45.5% indicated other sources, including self-directed learning, scientific literature, online searches, social media, and pharmacy-related experiences.

Table 2. Self-reported familiarity with the ketogenic diet and supplements and pharmacy team training among community pharmacists (*n*= 204).

	n (%)
Self-reported familiarity with KD/KS	
Yes, I know it well	7 (3.4)
Yes, but I know little about it	70 (34.3)
No, I have never heard of it	127 (62.3)
Previous specific training of the pharmacy team	
Yes	4 (2.0)
No	200 (98.0)
Interest in future training programmes	
Yes	167 (81.9)
No	37 (18.1)

Percentages may not sum to 100% due to rounding.

Regarding professional training, 98.0% of respondents reported that their pharmacy team had not received specific training on KD/KS. Nevertheless, 81.9% indicated that their pharmacy would be interested in participating in future training programmes on the ketogenic diet.

Overall, these findings indicate low levels of self-reported familiarity with KD/KS, limited previous training among pharmacy teams, and substantial interest in further professional education.

3.3. Availability, Accessibility and Demand for Ketogenic Supplements

As shown in Table 3, only 8.3% (n = 17) of respondents reported that complete ketogenic supplements were available in their pharmacies, while 91.7% (n = 187) indicated that these products were not in stock. All 204 community pharmacists were asked whether the products could be ordered if they were out of stock, and all answered the question. Regarding the possibility of ordering these products, 53.9% (n = 110) indicated that ordering was

possible, 6.4% ($n = 13$) reported that it was not, and 39.7% ($n = 81$) were unsure. In contrast, supplementary ketogenic products were reported to be available by 93.1% ($n = 190$) of respondents, while 6.9% ($n = 14$) indicated that they were not. Concerning the possibility of ordering supplementary products, 50.0% ($n = 102$) reported that ordering was possible, 7.4% ($n = 15$) indicated that it was not, and 42.6% ($n = 87$) were unsure.

Table 3. Self-reported availability, accessibility, and demand for ketogenic supplements among community pharmacists (n= 204).

	n **(%)**
Availability of complete ketogenic supplements	
Yes	17 (8.3)
No	187 (91.7)
Possibility of ordering complete ketogenic supplements	
Yes	110 (53.9)
No	13 (6.4)
I don't know	81 (39.7)
Frequency of customer requests for ketogenic supplements	
Very frequently (>10 times/month)	0 (0.0)
Frequently (4–10 times/month)	1 (0.5)
Rarely (<3 times/month)	44 (21.6)
Never	159 (77.9)
Reimbursement status of ketogenic supplements available at the pharmacy	
Yes, all are 100% reimbursed	27 (13.2)
Yes, reimbursed at less than 100%	0 (0.0)
Yes, but only some are reimbursed	6 (2.9)
No, none are reimbursed	4 (2)
I don't know/Not applicable	167 (81.9)

Percentages may not sum to 100% due to rounding.

Regarding customer demand, 77.9% ($n = 159$) of respondents reported that ketogenic supplements were never requested, while 21.6% ($n = 44$) indicated that requests occurred rarely. Only 0.5% ($n = 1$) reported frequent requests, and none reported very frequent requests. Concerning reimbursement, 81.9% ($n = 167$) of respondents indicated that they did not know the reimbursement status of ketogenic supplements or that the question was not applicable. Meanwhile, 13.2% ($n = 27$) reported that all products were fully reimbursed, 2.9% ($n = 6$) indicated that only some products were reimbursed, and 2.0% ($n = 4$) reported that none were reimbursed. No respondents selected the option indicating reimbursement at a rate below 100% for all products.

Regarding the perceived barriers to the availability of ketogenic supplements, the most frequently reported obstacle was the lack of knowledge about the ketogenic diet among healthcare professionals (83.3%, $n = 170$), followed by low customer demand (46.6%, $n = 95$). High costs for consumers (14.2%, $n = 29$) and difficulties ordering products from suppliers (10.8%, $n = 22$) were less frequently identified. As respondents could select multiple options, the percentages do not sum to 100%.

4. Discussion

This exploratory cross-sectional study aimed to assess Portuguese community pharmacists' self-reported familiarity, professional exposure and practices regarding the KD and KS, as well as reported availability, accessibility, and demand for these products. Overall, familiarity was limited, with 62.3% of participants reporting that they had never heard of the KD or KS in the context of epilepsy management and only 3.4% reporting good familiarity. Furthermore, most respondents indicated that their pharmacy teams had not received specific training on this topic, despite substantial reported interest in future training activities.

The availability of complete KS was also limited, while customer demand was generally low. These findings provide preliminary insights into potential gaps in professional familiarity, training, and access to specialised nutritional products in Portuguese community pharmacy practice [35].

Female participants accounted for 83.3% of the sample. Considering that 79.6% of active pharmacists practicing in Portugal are women, this female predominance is consistent with the gender distribution in the profession [36]. Nevertheless, this similarity should not be interpreted as evidence of sample representativeness, particularly given the snowball sampling method used for dissemination, which may have introduced selection bias.

In addition, the largest age group comprised participants aged between 42 and 60 years (42.2%). Although a considerable proportion of respondents reported more than 10 years of professional experience, overall familiarity with ketogenic therapy remained limited. This observation highlights the importance of addressing specialised educational needs throughout professional practice.

Previous research in community pharmacy has reported limitations in nutrition-related knowledge, including knowledge of ONS [4,37]. In Portugal, community pharmacists have also reported insufficient training and limited information resources to support counselling on ONS [37]. Given their accessibility and frequent contact with patients [6,12], the observed limitations in pharmacists' familiarity with ketogenic therapy and in product availability may be relevant to the provision of information and counselling in community pharmacy. Previous research has also highlighted the importance of professional support in the implementation of nutritional interventions and treatment adherence [28,38].

Regarding professional training, 98.0% of respondents reported that their pharmacy teams had not received specific training on KD or KS, while 81.9% indicated that their pharmacies would be interested in future training activities. These finding are consistent with previous research indicating the importance of education and training in nutrition-related community pharmacy practice [4,37] and with studies identifying educational needs among healthcare professionals involved in ketogenic dietary therapy (KDT) [39–41]. Previous research among Portuguese community pharmacists has similarly indicated that experience with ONS and patient feedback may contribute to professional learning and greater confidence in subsequent counselling [37,42]. Continuing professional development may provide an appropriate mechanism for supporting pharmacists in specialized areas of practice that may not be routinely encountered. Flexible educational approaches, including modular and online formats, have also been proposed in the context of KDT education [6].

Regarding product availability, only 8.3% of respondents reported that complete ketogenic supplements were stocked in their pharmacies, compared with 93.1% reporting the availability of supplementary products. This distinction is important, as supplementary products do not independently provide a nutritionally complete ketogenic intervention. Although 53.9% indicated that complete supplements could be ordered, 39.7% were unsure about this possibility, suggesting potential gaps in awareness of product access routes.

Customer demand was also limited, with 77.9% of respondents reporting that ketogenic supplements were never requested. The most frequently perceived barriers to availability were insufficient knowledge among healthcare professionals (83.3%) and low customer demand (46.6%). These findings highlight potential challenges related to professional awareness and access to ketogenic nutritional products. However, the descriptive nature of the study does not allow conclusions regarding the relationship between demand, professional familiarity, and product availability. Previous research has also highlighted the relevance of health information-seeking behaviour and social factors in professional familiarity and access to specific health-related products.

Overall, these preliminary findings highlight the potential value of targeted professional education and improved awareness of ketogenic supplements and their availability in community pharmacies. Further research involving larger and more representative samples is needed to explore these issues in greater depth.

4.1. Limitations

This study acknowledges certain methodological limitations. Data collection was conducted exclusively online and through a non-probabilistic snowball sampling strategy, which may have introduced selection bias and limited the representativeness and generalizability of the finding. The inability to calculate a response rate and to completely exclude duplicate submissions represents additional methodological limitations.

The use of self-reported data, including questions requiring recall of previous experiences, may also have introduced self-report and recall bias, potentially affecting the accuracy of responses. Additionally, as individual pharmacies were not identified, multiple respondents may have worked in the same pharmacy. Therefore, the findings reflect pharmacists' reports rather than estimates based on a sample of distinct pharmacies. The cross-sectional design and descriptive analytical approach also limit conclusions regarding relationships between the variables examined.

Despite these limitations, this study has several strengths, including its specific focus on community pharmacists and the broad range of variables assessed through a questionnaire adapted to the Portuguese context. Given the limited research on this topic in Portugal, the findings provide preliminary insights that may inform future investigations and professional education initiatives.

4.2. Proposals for Improvement and Future Perspectives

The results of this study highlight several key future perspectives, with a particular emphasis on the continuous professional development of healthcare professionals, especially community pharmacists. Furthermore, assessing the impact of interventions led by community pharmacists on patient outcomes would be important for enhancing community pharmaceutical services in epilepsy management.

The present study found that 62.3% of respondents were unfamiliar with the ketogenic diet as a therapeutic approach, while 81.9% indicated that their pharmacies would be interested in participating in future training programmes. These results highlight a clear opportunity to integrate related content into pharmacy school curricula. Such an approach could help future pharmacists become more aware of emerging therapies in epilepsy and better prepared to meet the needs of the population, while supporting the safe use of these therapeutic approaches. At the European level, the Pharmaceutical Group of the European Union (PGEU) also underscores the importance of expanding the community pharmacist's role in monitoring patients with chronic diseases, reinforcing the need for continuous training and integrating competencies into pharmacy practice [27].

Future actions could prioritise pharmacist training and multidisciplinary collaboration to enhance care for patients using the ketogenic diet and supplements. Professional associations, universities, and organizations such as the PGEU and the National Leagues Against Epilepsy could promote accredited continuing education programmes, ideally in hybrid formats, to strengthen pharmacists' counselling and monitoring skills. Improving health literacy through educational materials, leaflets, digital campaigns and reinforcing community initiatives such as regional epilepsy meetings or epilepsy projects could further support patient adherence and awareness [43].

Greater multidisciplinary collaboration involving physicians, dietitians, and pharmacists should be encouraged in the context of ketogenic therapy [4,44]. Collaboration with

health authorities such as INFARMED (Portuguese National Authority of Medicines and Health Products) and the National Leagues Against Epilepsy could support the development of guidance and reliable information resources for community pharmacy practice.

At the regulatory level, Ordinance no. 82/2025, of 4 March, which expanded state reimbursement to include enteral and modular formulas, may provide an opportunity to consider whether ketogenic supplements could be included in future developments of the exceptional reimbursement scheme, particularly given the potential relevance of cost to patient access [45,46]. From a scientific perspective, there is a need to strengthen national research on KS in the context of epilepsy, particularly within community pharmacy practice. Future studies should further investigate pharmacists' familiarity, professional exposure, counselling practices, and access to KS, using larger and more representative samples.

Overall, these proposals underscore that the current findings represent only a first step. They provide a rationale for conducting a larger, nationally representative studies, potentially complemented by international research, to generate more robust evidence and inform future policy and training.

5. Conclusions

This exploratory cross-sectional study provides preliminary insights into community pharmacists' professional familiarity and exposure to the KD and KS, as well as the reported availability of these products in community pharmacies in Portugal. The findings indicate limited self-reported familiarity and professional exposure, together with limited reported availability of complete KS. Most respondents indicated that their pharmacy teams had not received specific training, although a substantial proportion reported that their pharmacies would be interested in future training activities, highlighting an opportunity for targeted educational initiatives within continuing professional development and pharmacy education. The low reported customer demand and limited availability of complete KS highlight the importance of further investigating access to these specialised nutritional products through community pharmacies. Further research with larger and nationally representative samples is needed to explore these findings in greater depth and better define the role of community pharmacists in counselling and facilitating access to ketogenic therapy.

Supplementary Materials: The following supporting information can be downloaded at https://www.mdpi.com/article/10.3390/pharmacy14090177/s1, The questionnaire used in this study is available as supplementary material (File S1).

Author Contributions: Conceptualization, R.O. and M.J.C.; methodology, R.O. and M.J.C.; software, R.O.; validation, R.O., A.R.S.M., M.J.C. and A.P.; formal analysis, R.O.; investigation, R.O.; resources, A.P.; data curation, R.O.; writing—original draft preparation, R.O.; writing—review and editing, R.O., A.R.S.M., M.J.C. and A.P.; visualization, R.O., A.R.S.M., M.J.C. and A.P.; supervision, M.J.C. and A.P.; project administration, A.P.; funding acquisition, A.P. All authors have read and agreed to the published version of the manuscript.

Funding: This work was financed by National Funds through FCT/MCTES—Portuguese Foundation for Science and Technology within the scope of the project UIDB/50006/2025.

Institutional Review Board Statement: The study was conducted in accordance with the Declaration of Helsinki and was approved by the Ethics Committee for Research of the University of Coimbra (CEIUC) in 12 March 2025, under the code CEIUC_14-04/2025.

Informed Consent Statement: Informed consent was obtained from all subjects involved in the study.

Data Availability Statement: The datasets presented in this article are not readily available because privacy restrictions. Requests to access the datasets should be directed to the corresponding author.

Acknowledgments: The authors want to acknowledge the efforts of all the pharmacists who voluntarily answered the questionnaire to make this investigation possible.

Conflicts of Interest: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as potential conflicts of interest.

Abbreviations

ASMs	Antiseizure Medications
FIP	International Pharmaceutical Federation
FSMPs	Foods for Special Medical Purposes
INFARMED	Portuguese National Authority of Medicines and Health Products
KD	Ketogenic Diet
KDT	ketogenic dietary therapy
KS	Ketogenic Supplements
MCT	Medium-Chain Triglyceride
ONS	Oral Nutritional Supplements
PGEU	Pharmaceutical Group of the European Union

References

1. Batista, J.P.B.; Weidmann, A.E.; Mallarini, E.; Henman, M.C.; Passarani, I. Evolution of Community Pharmacy Services in the European Union and beyond: A Cross-Country Survey of 33 National Pharmacy Organisations. *Int. J. Clin. Pharm.* **2026**, *48*, 1559–1572. [CrossRef]
2. International Pharmaceutical Federation (FIP). *International Pharmaceutical Federation (FIP) Strategic Plan*; FIP: The Hague, The Netherlands, 2025.
3. International Pharmaceutical Federation (FIP). *FIP Global Competency Framework (GbCFv2) Handbook Supporting Early Career Training Strategy 2023 FIP Global Competency Framework 2021 | Pi*; FIP: The Hague, The Netherlands, 2023.
4. Slavcheva, K.; Staynova, R.; Neycheva, N.; Kafalova, D. Community Pharmacists' Knowledge, Attitudes, and Readiness to Provide Counseling on Food Supplements—A Scoping Review. *Nutrients* **2025**, *17*, 3754. [CrossRef]
5. Campos, M.J.; Garbacz, A.; Czlapka-Klapinska, N.; Czlapka-Matyasik, M.; Pena, A. Key Factors Driving Portuguese Individuals to Use Food Supplements—Findings from a Cross-Sectional Study. *Foods* **2025**, *14*, 884. [CrossRef]
6. Douglas, P.L.; McCarthy, H.; McCotter, L.E.; Gallen, S.; McClean, S.; Gallagher, A.M.; Ray, S. Nutrition Education and Community Pharmacy: A First Exploration of Current Attitudes and Practices in Northern Ireland. *Pharmacy* **2019**, *7*, 27. [CrossRef]
7. Figueroa, A.G.; Joshi, C.N.; Patel, M.N. From Clinical Practice to Mechanistic Insights in Ketogenic Diets for Epilepsy. *Lancet Neurol.* **2026**, *25*, 519–532. [CrossRef]
8. Nassar, M.F.; Shata, M.O.; Awadallah, S.M.; Youssef, M.A.; Ibrahim, H.E. Impact of L-Carnitine Supplementation on Gastric Emptying and Bowel Function in Pediatric Ketogenic Diet Therapy: A Clinical Trial. *Sci. Rep.* **2024**, *14*, 28099. [CrossRef]
9. Tayutivutikul, N.; Wanleenuwat, P.; Panapongvasin, T.; Klajing, R.; Iwanowski, P. Dietary Effects on Antiseizure Drug Metabolism and Management of Epilepsy. *Seizure Eur. J. Epilepsy* **2022**, *102*, 14–21. [CrossRef]
10. D'Ascanio, F.; e Rui Jorge, I.F. Dieta Cetogénica e Epilepsia: Uma Revisão Narrativa Da Literatura. *Acta Port. De Nutr.* **2021**, *27*, 64–67. [CrossRef]
11. Cicek, E.; Sanlier, N. The Place of a Ketogenic Diet in the Treatment of Resistant Epilepsy: A Comprehensive Review. *Nutr. Neurosci.* **2023**, *26*, 828–841. [CrossRef]
12. Falsaperla, R.; Sortino, V.; Striano, P.; Kluger, G.; Ramantani, G.; Ruggieri, M. Is Ketogenic Diet a 'Precision Medicine'? Recent Developments and Future Challenges. *Eur. J. Paediatr. Neurol.* **2024**, *48*, 13–16. [CrossRef]
13. Rezaei, S.; Abdurahman, A.A.; Saghazadeh, A.; Badv, R.S.; Mahmoudi, M. Short-Term and Long-Term Efficacy of Classical Ketogenic Diet and Modified Atkins Diet in Children and Adolescents with Epilepsy: A Systematic Review and Meta-Analysis. *Nutr. Neurosci.* **2019**, *22*, 317–334. [CrossRef]
14. Dong, H.; Shi, J.; Wei, P.; Shan, Y.; Zhao, G. Comparative Efficacy of Surgical Strategies for Drug-Resistant Epilepsy: A Systematic Review and Meta-Analysis. *World Neurosurg.* **2025**, *195*, 123729. [CrossRef]
15. Ziganshina, L.E.; Abakumova, T.; Hoyle, C.H.V. Gabapentin Monotherapy for Epilepsy: A Review. *Int. J. Risk Saf. Med.* **2023**, *34*, 243–286. [CrossRef]
16. Geremew, G.W.; Wassie, Y.A.; Tadesse, G.; Fentahun, S.; Yazie, A.S.; Anberbr, S.S.; Genet, G.; Bekalu, A.F.; Chanie, G.S.; Alemayehu, T.T. Treatment Outcome and Its Predictors among Children with Epilepsy on Chronic Follow-up in Ethiopia: A Systematic Review and Meta-Analysis. *BMC Public Health* **2024**, *24*, 3001. [CrossRef]

17. Liga Portuguesa Contra a Epilepsia. A Epilepsia e Generalidades. Available online: https://epilepsia.pt/epilepsia-e-generalidades/ (accessed on 10 July 2025).
18. Fawcett, J.; Davis, S.; Manford, M. Further Advances in Epilepsy. *J. Neurol.* **2023**, *270*, 5655–5670. [CrossRef]
19. Wei, S.; Shiwen, W.; Cao-wenjing, C.; Huajun, Y.; Qun, W. A Randomized, Double-blind, Placebo-controlled, Dose-escalating Phase IIa Trial to Evaluate the Safety, Tolerability, Efficacy, and Pharmacokinetics of Multiple Oral Doses of Pynegabine Tablets as Add-on Therapy in Patients with Focal Epilepsy. *CNS Neurosci. Ther.* **2024**, *30*, 1550–1564. [CrossRef]
20. Chan, H.Y.; Janssen, L.M.M.; Wijnen, B.F.M.; Hiligsmann, M.; Majoie, M.H.J.M.; Evers, S.M.A.A. Economic Evaluations of Nonpharmacological Treatments for Drug-resistant Epilepsy: A Systematic Review. *Epilepsia* **2023**, *64*, 2861–2877. [CrossRef]
21. Pinto, A.L.; Montenegro, M.A.; Valente, K.; Sampaio, L.B. Ketogenic Diet Therapy for Epilepsy: Clinical Pearls. *Epilepsy Behav.* **2024**, *161*, 110091. [CrossRef]
22. El-Shafie, A.M.; Bahbah, W.A.; Abd El Naby, S.A.; Omar, Z.A.; Basma, E.M.; Hegazy, A.A.A.; El Zefzaf, H.M.S. Impact of Two Ketogenic Diet Types in Refractory Childhood Epilepsy. *Pediatr. Res.* **2023**, *94*, 1978–1989. [CrossRef]
23. Kossoff, E.H.; Zupec-Kania, B.A.; Auvin, S.; Ballaban-Gil, K.R.; Christina Bergqvist, A.G.; Blackford, R.; Buchhalter, J.R.; Caraballo, R.H.; Cross, J.H.; Dahlin, M.G.; et al. Optimal Clinical Management of Children Receiving Dietary Therapies for Epilepsy: Updated Recommendations of the International Ketogenic Diet Study Group. *Epilepsia Open* **2018**, *3*, 175–192. [CrossRef]
24. European Parliament and Council of the European Union. Regulation (EU) No 609/2013 of the European Parliament and of the Council of 12 June 2013. *Off. J. Eur. Union* **2013**, *L 181*, 35–56. Available online: https://eur-lex.europa.eu/eli/reg/2013/609/oj (accessed on 26 July 2025).
25. Cervenka, M.C.; Wood, S.; Bagary, M.; Balabanov, A.; Bercovici, E.; Brown, M.-G.; Devinsky, O.; Di Lorenzo, C.; Doherty, C.P.; Felton, E.; et al. International Recommendations for the Management of Adults Treated with Ketogenic Diet Therapies. *Neurol. Clin. Pract.* **2021**, *11*, 385–397. [CrossRef]
26. STADA Health Report Farmacêuticos Entre Os Profissionais de Saúde Em Que Os Europeus Mais Confiam. Available online: https://www.ordemfarmaceuticos.pt/pt/noticias/farmaceuticos-entre-os-profissionais-de-saude-em-que-os-europeus-mais-confiam/ (accessed on 27 July 2025).
27. Pharmaceutical Group of the European Union (PGEU). *Pharmacy 2030: A Vision for Community Pharmacy in Europe*; PGEU: Belgium, Brussels, 2019.
28. Petrides, M.; Peletidi, A.; Nena, E.; Constantinidis, T.; Kontogiorgis, C. The Role of Pharmacists in Enhancing Epilepsy Care: A Systematic Review of Community and Outpatient Interventions. *J. Pharm. Policy Pract.* **2025**, *18*, 2487046. [CrossRef]
29. Rice, K.; LaPreze, J. Community Pharmacists' Role in the Treatment of Epilepsy. *US Pharm.* **2023**, *48*, 17–28.
30. Marinescu, S.C.; Apetroaei, M.-M.; Nedea, M.I.; Arsene, A.L.; Velescu, B.Ș.; Hîncu, S.; Stancu, E.; Pop, A.L.; Drăgănescu, D.; Udeanu, D.I. Dietary Influence on Drug Efficacy: A Comprehensive Review of Ketogenic Diet-Pharmacotherapy Interactions. *Nutrients* **2024**, *16*, 1213. [CrossRef]
31. Al-Beltagi, M.; Saeed, N.K.; Bediwy, A.S.; Elbeltagi, R. Unraveling the Nutritional Challenges in Epilepsy: Risks, Deficiencies, and Management Strategies: A Systematic Review. *World J. Exp. Med.* **2025**, *15*, 104328. [CrossRef]
32. Armeno, M.L.; Kossoff, E.H. Let Food Be Thy Medicine. The Interaction between Ketogenic Diet Therapy and Anti-seizure Medications: A Systematic Review. *Epileptic Disord.* **2023**, *25*, 18–27. [CrossRef]
33. McArtney, R.; Bailey, A.; Champion, H. What Is a Ketogenic Diet and How Does It Affect the Use of Medicines? *Arch. Dis. Child. Educ. Pract. Ed.* **2017**, *102*, 194–199. [CrossRef]
34. Observatório da Ordem dos Farmacêuticos. Distribuição de Farmacêuticos Ativos Em Exercício Por Área Profissional. Available online: https://www.ordemfarmaceuticos.pt/pt/numeros/ (accessed on 25 March 2025).
35. Tavakol, M.; Dennick, R. Making Sense of Cronbach's Alpha. *Int. J. Med. Educ.* **2011**, *2*, 53–55. [CrossRef]
36. Ordem dos Farmacêuticos. Distribuição de Farmacêuticos Ativos Em Exercício Por Género. Available online: https://www.ordemfarmaceuticos.pt/pt/numeros/ (accessed on 30 July 2025).
37. Lopes Neri, L.d.C.; Guglielmetti, M.; Fiorini, S.; Pasca, L.; Zanaboni, M.P.; de Giorgis, V.; Tagliabue, A.; Ferraris, C. Adherence to Ketogenic Dietary Therapies in Epilepsy: A Systematic Review of Literature. *Nutr. Res.* **2024**, *126*, 67–87. [CrossRef]
38. Gregório, J.; Tavares, P.; Alves, E. Pharmacists' Perceptions on Nutritional Counseling of Oral Nutritional Supplements in the Community Pharmacy: An Exploratory Qualitative Study. *Pharmacy* **2023**, *11*, 78. [CrossRef]
39. Tsang, E.; Webster, R.; Mohammad, S.; Menezes, M.; Kothur, K.; Tantsis, E.; Troedson, C.; Gupta, S.; Gill, D.; Patel, S.; et al. The Nutritional Adequacy of the Ketogenic Diet in Paediatric Epilepsy: Detailed Nutrient Analysis and Dietary Recommendations. *Clin. Nutr. ESPEN* **2025**, *69*, 274–285. [CrossRef]
40. Metzger, S.; Lee, J.; McDavid, L. Literature Review: Support for Caregivers of Children on the Ketogenic Diet for Epilepsy and Other Neurologic Disorders. *Epilepsy Behav.* **2024**, *156*, 109830. [CrossRef]
41. Chen, S.; Su, X.; Feng, Y.; Li, R.; Liao, M.; Fan, L.; Liu, J.; Chen, S.; Zhang, S.; Cai, J.; et al. Ketogenic Diet and Multiple Health Outcomes: An Umbrella Review of Meta-Analysis. *Nutrients* **2023**, *15*, 4161. [CrossRef]

42. Gong, Y.; Said, F.; Haq, W.; Gong, J.; Aksar, I. The Impact of Health Information Seeking and Social Influence on Functional Food Purchase Intention. *Sci. Rep.* **2025**, *15*, 4212. [CrossRef]
43. Liga Portuguesa Contra a Epilepsia. Atividades Educativas. Available online: https://epilepsia.pt/atividades-educativas/ (accessed on 30 July 2025).
44. Karandienė, J.; Endzinienė, M.; Liaušienė, K.; Jurkevičienė, G. The Assessment of the Efficacy, Safety, and Challenges of Ketogenic Diet Therapy in Children with Epilepsy: The First Experience of a Single Center. *Medicina* **2024**, *60*, 919. [CrossRef]
45. Infarmed Comparticipação de Tecnologias de Saúde Para a Nutrição Entérica | Portaria n.º 82/2025/1, de 4 de Março. Available online: https://www.infarmed.pt/web/infarmed/profissionais-de-saude/-/journal_content/56/15786/11056202 (accessed on 30 July 2025).
46. Ministério da Saúde. *Portaria n.º 82/2025/1, de 4 de Março*; Ministério da Saúde: Brasilia, Brazil, 2025.

Disclaimer/Publisher's Note: The statements, opinions and data contained in all publications are solely those of the individual author(s) and contributor(s) and not of MDPI and/or the editor(s). MDPI and/or the editor(s) disclaim responsibility for any injury to people or property resulting from any ideas, methods, instructions or products referred to in the content.