

ENSURING THE RIGHT TO ADEQUATE SCHOOL MENU FOR CHILDREN WITH METABOLIC OR KETOGENIC DIETS: A NATIONAL SURVEY OF CLINICAL AND FOOD SERVICE DIETITIANS

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ON BEHALF OF TECHNICAL SCIENTIFIC ASSOCIATION OF FOOD,
NUTRITION AND DIETETICS (ASAND) AND THE ITALIAN SOCIETY FOR THE STUDY
OF INBORN ERRORS OF METABOLISM AND NEWBORN SCREENING (SIMMESN)

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ABSTRACT – Objective: To examine approaches for managing school menus for special diets in Italy, highlighting regional variations and proposing strategies for improvement.

Materials and Methods: An online survey was developed by dietitians with expertise in ketogenic dietary therapies (KDTs) ($n=2$), inherited metabolic disorders (IMDs) ($n=5$), both KDTs and IMDs ($n=1$) and food services ($n=2$). The survey was distributed via e-mail to dietitians affiliated with the Technical Scientific Association of Food, Nutrition and Dietetics (ASAND) and with the Nutrition and Dietetics working group of the Italian Society for the Study of Inborn Errors of Metabolism and Newborn Screening (SIMMESN). The questionnaire included sections tailored to food service and clinical dietitians.

Results: A total of 165 dietitians participated, with 41% working in school food services and 21% specializing in IMDs or KDTs. Both clinical and food service dietitians reported challenges in managing IMD diets; ketogenic diets were perceived as significantly more complex, particularly by clinical dietitians. Major barriers included inadequate staff training in school food service, a lack of standardized protocols, and limited availability of specialized foods. Participants emphasized the importance of interdisciplinary collaboration, training programs, and standardized guidelines in improving school meal management.

Conclusions: Ensuring appropriate school nutrition for children with metabolic disorders is essential. Addressing existing gaps through policy development, professional training, and interdisciplinary collaboration is critical to optimizing dietary management and fostering inclusive school environments.

KEYWORDS: Inherited metabolic diseases, Ketogenic dietary therapies, Special diets, Dietitians, Food service, School lunch menu.

LIST OF ABBREVIATIONS: ASAND: Technical Scientific Association of Food, Nutrition and Dietetics; IMDs: Inherited metabolic disorders; DRE: Drug-resistant epilepsy; GLUT1: Glucose-transporter type 1; KDTs: Ketogenic dietary therapies; SIMMESN: Italian Society for the Study of Inborn Errors of Metabolism and Newborn Screening.

INTRODUCTION

Inherited metabolic disorders (IMDs) comprise a diverse group of conditions affecting metabolic pathways responsible for the breakdown or storage of carbohydrates, fatty acids, and proteins^{1,2}. These disorders can lead to multisystem complications. With the implementation of the Expanded Newborn Screening Program, many IMDs can now be detected within the first few days of life, enabling early intervention and reducing the risk of irreversible damage, often through the prompt initiation of dietary therapy³. Dietary management is fundamental to IMD treatment, as it involves restricting specific nutrients, ensuring scheduled meals to prevent fasting, and providing supplementation to avoid nutritional deficiencies. Depending on the affected metabolic pathway, dietary regimens may require the restriction of one or more macronutrient groups (e.g., proteins, fats, carbohydrates), precise gram-based portioning, the preparation of complex recipes, and the use of specialized medical foods⁴.

Neurological and genetic conditions may also require strict dietary interventions to manage symptoms. Among these, drug-resistant epilepsy (DRE) and glucose-transporter type 1 (GLUT1) deficiency syndrome are notable for their treatment with ketogenic dietary therapies (KDTs)⁵.

These specialized diets can be challenging for patients and caregivers, as they must be maintained long-term and require strict nutritional monitoring and regular follow-up to ensure proper dietary management. Therefore, dietitians play a crucial role in developing tailored nutritional interventions and promoting overall health based on the specific needs of each individual⁶. Children with metabolic disorders have distinct dietary requirements compared to adults, particularly due to their school and pre-school attendance. The school food environment constitutes a major part of their daily nutrition⁷. Integrating special diets into standard school food service systems is demanding for dietitians and school staff, who must exercise heightened vigilance and assume significant responsibility. The strict and precise requirements of dietary management of IMDs pose serious risks if not meticulously followed. Even minor deviations – such as accidental tray-switching among students or inadequacies in kitchen facilities – can have severe consequences⁸.

According to guidelines from the Italian Ministry of Health⁹, pre-school and primary school food services provide between one and five meals per week. School meals are designed to supply 35–40% of the average daily energy requirement. Consequently, school food services can serve as a communication channel with families, guiding appropriate choices for the evening meal – ensuring balanced daily and weekly dietary intake – and promoting an adequate, nutrient-rich breakfast. Modern school food services extend beyond ensuring food and nutritional safety, which are now considered fundamental prerequisites rather than primary objectives. They encompass broader functions, including disease prevention, health promotion, taste education, and fostering sociability, conviviality, and inclusion. These aspects contribute to a value that surpasses the mere provision of meals.

Despite these expanded roles, Italian school food service remains unregulated, and research on managing school lunches for pediatric patients with rare metabolic and neurological disorders is still limited. Addressing this gap could provide essential support to clinical professionals and food service staff in accommodating specialized dietary needs for which clear guidelines are currently lacking.

This study aims to examine approaches for managing school menus tailored to special diets, particularly those required for metabolic and neurological conditions, by focusing on clinical and food service dietitians at a national level. It seeks to identify regional variations in practice and provide insights for improving strategies.

MATERIALS AND METHODS

An online survey comprising 46 multiple-choice and short-answer questions ([Supplementary Material](#)) was developed by an expert panel consisting exclusively of dietitians with diverse expertise: two specialized in KDTs, five in IMDs, one in both KDTs and IMDs and two in food services. The survey was distributed via e-mail to dietitians affiliated with the Technical Scientific Association of Food, Nutrition and Dietetics (ASAND) – the national association representing dietitians across all areas of practice – and to the members of the Nutrition and Dietetics working group of the Italian Society for the study of Hereditary Metabolic Diseases and Newborn Screening (SIMMESN).

The questionnaire was developed in Italian and included an initial section with general questions (e.g., study title and years of experience in the field), followed by two specialized sections focusing on school food service management (A) and the dietary management of metabolic and neurological disorders (B).

A) School food service: the survey investigated how school food services manage special meal requests for pediatric patients with rare metabolic or neurological disorders. It examined key aspects such as menu planning, food preparation, monitoring dietary compliance, and challenges related to logistics, nutrition, and communication. Additionally, the survey explored potential improvements, including staff training programs and the implementation of standardized protocols for special diets.

B) Clinical dietitians working with IMDs or rare neurological diseases requiring KDTs: the survey assessed the role of clinical dietitians in adapting school menus for pediatric patients on special diets and their collaboration with school food services to ensure adherence to strict dietary protocols and nutrient requirements. It also examined whether menu standardization could enhance the efficiency of dietary management in schools.

Participants were asked to complete the survey based on data collected from mid-November to mid-December 2024. Ethical approval was not required as no patients data were included.

Statistical analysis

Descriptive statistics were used to analyze the data, while responses from open-ended questions were categorized and presented by topic.

RESULTS

Characteristics of the Sample – General section

The survey received a total of 165 responses. Of these, 63 (38%) were excluded from the analysis because respondents reported having no experience in food service, IMDs or KDTs. Among the remaining responses, 68 (41%) were from food service dietitians; only 40 (24% of the total sample) had experience with metabolic or ketogenic diets. Thirty-four (21%) responses were obtained from clinical dietitians involved in dietary treatments for inherited metabolic disorders or ketogenic therapies. **Figure 1** illustrates the survey methodology, detailing the number of dietitians involved and the selection process for each group. The majority of survey participants (35%, 58/165) were aged 26–35 years, followed by 24% (39/165) aged 36–45 years. Participants aged 46–55 years and over 56 years accounted for 18% (29/165) and 17% (28/165), respectively, while those under 25 years comprised 6% (11/16) of the sample. Regarding professional experience as dietitians and in school food service, 33% (54/165) of respondents reported over 20 years of experience, followed by 26% (43/165) with 11–20 years of experience. Additionally, 22% (36/165) had 6–10 years of experience, while 19% (32/165) had worked in the field for less than 5 years. Regarding education, the majority of respondents (90%, 149/165) held a Bachelor's degree in dietetics, often with additional qualifications, such as a Master's degree or PhD. A smaller proportion had degrees in biology (9%, 15/165) or in food technology (1/165). **Table 1** presents demographic characteristics and professional experience in relation to educational

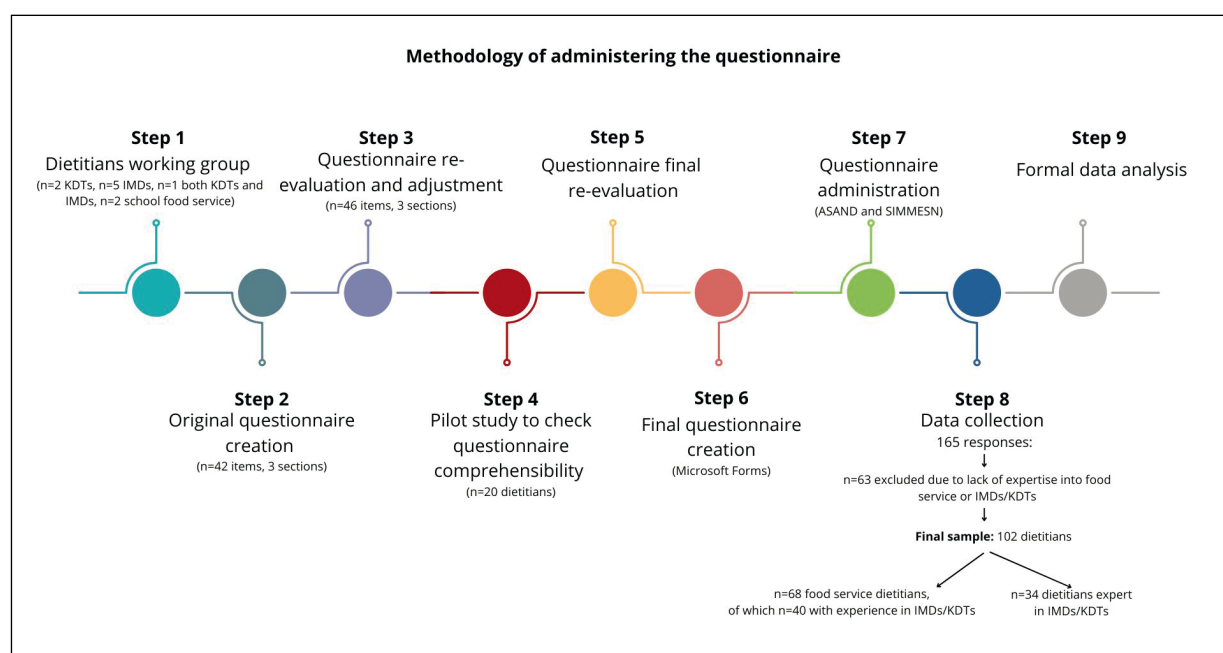


Figure 1. Illustration of the methodology for questionnaire administration, detailing the number of dietitians involved, the data collection process, and the criteria for response selection across participants.

background across different professional areas. Geographically, most participants were from Lombardia (18%, 29/165), Veneto (15%, 25/165), Toscana (10%, 17/165), and Emilia-Romagna (10%, 17/165). Other regions (Abruzzo, Calabria, Campania, Friuli Venezia Giulia, Lazio, Liguria, Marche, Molise, Piemonte, Puglia, Trentino Alto adige, Umbria) were less represented, whereas no responses were received from Valle d’Aosta, Sicilia, Sardegna and Basilicata.

Results among dietitians from School Food Service – Section A

Specific questions regarding school food service were included in Section A of the questionnaire. During their professional experience, 59% (40/68) of respondents reported having received requests for special meals for children with inherited metabolic or rare neurological disorders, while 41% (28/68) stated they had never received such requests. Among respondents who had managed special diet requests for children with rare neurological disorders undergoing ketogenic therapy or inherited metabolic disorders, 30/40 asked parents to plan the school menu, 20/40 trained food service staff, 22/40 forwarded the medical certificate to the special diet section of the central kitchen, and 15/40 consulted the child’s clinical reference center. The most frequently reported challenge in managing special diets was inadequate training on diseases and therapies, followed by the high cost of the required foods, the need for training food service personnel and difficulties in gaining parents’ trust. Regarding the time required to implement a special metabolic or ketogenic diet in schools: 42.5% (17/40) of the participants reported needing less than 3 days, 40% (16/40) required 3 days to 1 week, and 10% (4/40) took 1–2 weeks. Longer implementation times (over 2 weeks) were uncommon, reported by 7.5% (3/40) (**Figure 2A**). Regarding resources for managing special diets: 26/40 highlighted joint meetings involving dietitians, parents, and teachers, 18/40 proposed adaptable recipe books, 15/40 suggested menu standardization, and 15/40 considered infographics on rare disease diets helpful. When asked about adapting recipes to standard menus, 47.5% (19/40) reported rarely doing so, only for specific cases, 42.5% (17/40) stated they often adapted recipes, and 10% (4/40) reported never being able to adapt menus, citing time and organizational constraints. Finally, only 20% (8/40) indicated that explicit requests for specific products, such as food for special medical purposes, were included in food service contracts.

Table 1. General information of respondents.

General information	Results				
	Food service respondents with experience in metabolic or ketogenic diets (n=40), % (n)	Food service all respondents (n=68), % (n)	Dietitian involved in IMDs/ KDTs, (n=34), % (n)	Total respondents with experience in metabolic or ketogenic diets (n=74), % (n)	All respondents (n=165), % (n)
Age range					
<25 years	5.0 (2)	10.3 (7)	2.9 (1)	4 (3)	6.7 (11)
26–35 years	42.5 (17)	42.7 (29)	47.1 (16)	44.6 (33)	35.2 (58)
36–45 years	17.5 (7)	16.2 (11)	29.4 (10)	23.0 (17)	23.6 (39)
46–55 years	17.5 (7)	17.6 (12)	5.9 (2)	12.2 (9)	17.6 (29)
>55 years	17.5 (7)	13.2 (9)	14.7 (5)	16.2 (12)	16.9 (28)
Experience as a dietitian or another figure					
<5 years	20.0 (8)	29.4 (20)	11.8 (4)	16.2 (12)	19.4 (32)
6–10 years	27.5 (11)	22 (15)	35.3 (12)	31.1 (23)	21.8 (36)
11–20 years	22.5 (9)	20.6 (14)	29.4 (10)	25.7 (19)	26.1 (43)
>20 years	30.0 (12)	28 (19)	23.5 (8)	25.7 (20)	32.7 (54)
Degree					
Dietetic diploma	5.0 (2)	4.5 (3)	0.0 (0)	2.7 (2)	6 (10)
Dietetics Bachelor's degree	50.0 (20)	38.2 (26)	35.3 (12)	43.2 (32)	35.2 (58)
Dietetics Bachelor's degree + Master's/PhD	27.5 (11)	38.2 (26)	58.8 (20)	41.9 (31)	49.1 (81)
Biology degree	15.0 (6)	17.6 (12)	5.9 (2)	10.8 (8)	9.1 (15)
Food technology degree	2.5 (1)	1.5 (1)	0.0 (0)	1.4 (1)	0.6 (1)
Experience in the reference field					
<5 years	30 (12)	–	32.4 (11)	31.1 (23)	–
6–10 years	22.5 (9)	–	26.4 (9)	24.3 (18)	–
11–20 years	25 (10)	–	20.6 (7)	23 (17)	–
>20 years	22.5 (9)	–	20.6 (7)	21.6 (16)	–

Sixty-three answers (38%) were not analyzed because respondents were without experience in food service, IMDs or KDTs. *Abbreviations* - IMDs=inherited metabolic diseases. KDTs=ketogenic diet therapies.

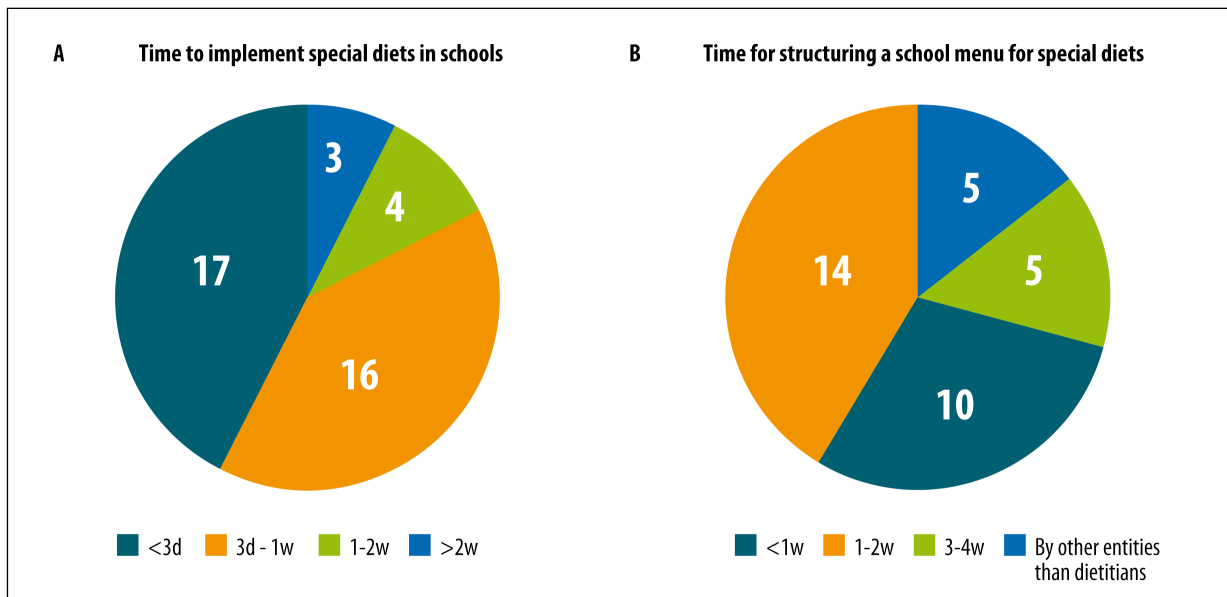


Figure 2. A, Time to implement special diets in school. B, Time for structuring a school menu for special diets.

Results from Dietitians Dedicated to Patients with Inherited Metabolic or Neurological Diseases – Section B

Section B of the questionnaire focused on clinical dietitians providing nutritional assistance to patients with inherited metabolic or neurological diseases. During their professional experience, 59% (20/34) of respondents primarily managed dietary therapy for inherited metabolic disorders, while 18% (6/34) specialized in ketogenic therapies for drug-resistant epilepsy or GLUT1 deficiency. The remaining 23% (8/34) worked in both areas. When structuring a school menu for a metabolic and/or ketogenic diet, 29% (10/34) required less than a week, 41% (14/34) needed 1–2 weeks, 15% (5/34) took 3–4 weeks, and 15% (5/34) indicated that menus were prepared by another professional (**Figure 2B**). Most clinical dietitians (88%, 30/34) reported being contacted by school food services for requests or clarifications. About 76% (26/34) of participants reported instances where families independently prepared school menus for their children. Among these, 19% (5/26) stated this occurred frequently, 58% (15/26) reported it happened occasionally, and 23% (6/26) indicated it occurred rarely. The remaining 23% (8/34) stated they had never encountered such cases (**Figure 3A**). Among respondents who reported that families were allowed to bring meals from home (79%, 27/34), 22.2% (6/27) indicated this happened frequently, 33.3% (9/27) occasionally, and 44.5% (12/27) rarely, while 21% (7/34) had never encountered such cases (**Figure 3B**). Regarding support for dietary management in schools, 30/34 recommended organizing informative meetings with food service dietitians, families, and school staff, 21/34 suggested specific training for dietitians in school food service, 19/34 emphasized the need for increased availability of medical-purpose foods. Additionally, 25/34 supported collaboration pathways between clinical centers, food services, and schools, 15/34 proposed specialized recipe books, and 15/34 recommended informative materials for parents and teachers. Most respondents (88%, 30/34) reported never actively training food service staff. A minority provided training either for groups (3/34) or individuals (1/34) on a regular basis. When asked who primarily develops special menus for metabolic or rare neurological diseases, dietitians at clinical centers were responsible for 65% (22/34) of cases, and dietitians from food service companies, after consulting clinical centers, in 26% (9/34) of cases. Other entities, such as public health institutions were involved in 9% (3/34) of cases.

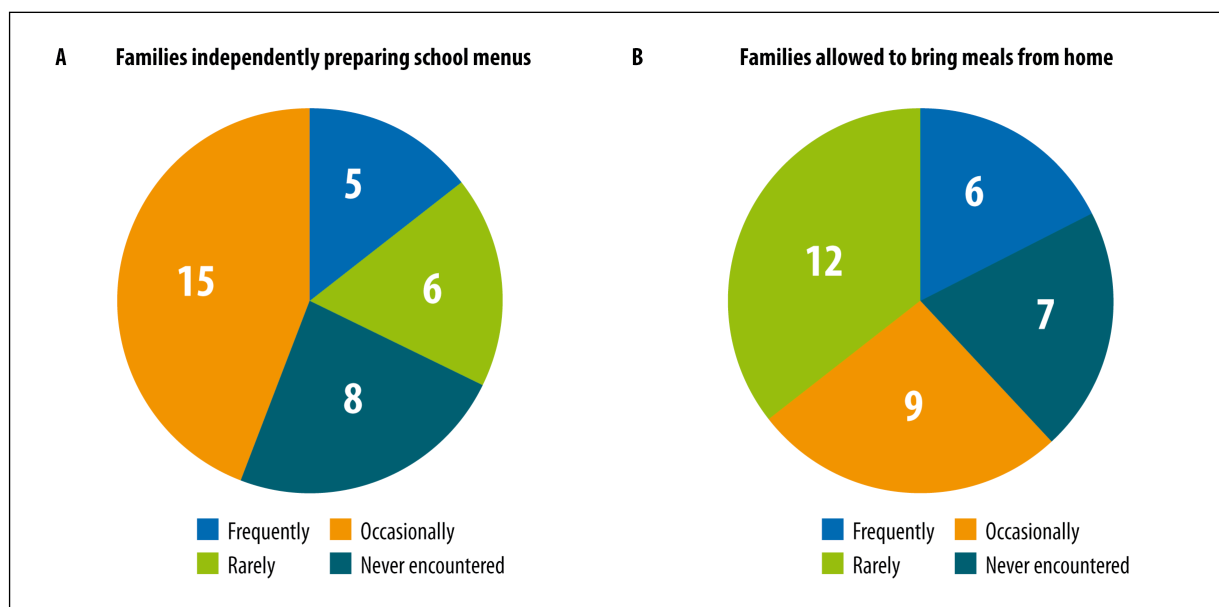


Figure 3. A, Families independently preparing school menus. B, Families allowed to bring meals from home. Abbreviations - d: days; w: weeks.

Questions targeting all professional figures – Section C

Respondents were asked to evaluate the level of difficulty in managing various special diets by the food service using a five-point scale: score 1: easy – 5: very difficult (see **Table 2** for detailed information). The diets receiving the highest difficulty scores (≥ 4) were ketogenic dietary therapies (62%), low-protein (35%) and sucrose, fructose, sorbitol-free diets -free diets (34%), low-fat diets (26%) and galactose-free diets (19%). All other dietary regimens received difficulty scores of 4 or 5 in fewer than 10% of cases. When comparing responses from food service dietitians and IMD/KDTs specialists, ketogenic dietary therapies, low-protein, low-fat, sucrose, fructose, sorbitol-free and galactose-free diets were consistently perceived as the most difficult to manage. Among participants involved in both school food service and special diet management, the diets that could potentially be standardized – at least partially – in the future included low-protein diets (29/74), low-fat diets (32/74), controlled carbohydrates diets (34/74), galactose-free diets (44/74), sucrose, fructose, sorbitol-free diets (32/74), and ketogenic diets (19/34). In contrast, other special diets - including gluten-free, egg-free, nut-free, tomato-free, fish-free, and diets for favism - were considered easier to manage compared to metabolic or ketogenic diets.

DISCUSSION

This study aimed to explore approaches for managing school menus for special diets, particularly those required for metabolic and neurological conditions. The findings highlight the complexity of accommodating school meals for children with IMDs or requiring KDTs and underscore unmet needs. Our results indicate that more than half of school food service dietitians have managed such diets, suggesting that they are not as rare as often assumed. Both clinical and food service dietitians reported similar challenges in managing IMD diets; however, KDTs were perceived as more difficult by clinical dietitians. This discrepancy likely arises from the complex calculations and individualized tailoring required for KDTs despite their relative ease of adaptation due to the availability of recipes requiring minimal modifications. In contrast, IMD diets are more adaptable to standard school menus, making them less challenging for both groups. Furthermore, metabolic or ketogenic special diets were considered more difficult to manage compared to dietary accommodations for common allergies and intolerances. Enhancing training and collaboration between healthcare professionals and school staff could improve the management of these specialized diets. Interdisciplinary collaborative meetings

Table 2. Evaluation of difficulties in managing various special diets by the food service.

Diet type	Difficulty	Results		
		Food service (n=40), % (n)	IMD and KDTs (n=34), % (n)	Total (n=74), % (n)
rs Low-protein	1 (easy)	14.7 (5)	17.6 (6)	16.2(12)
	2	23.5 (8)	14.7 (5)	17.6 (13)
	3	35.3 (12)	23.5 (8)	27.0 (20)
	4	23.5 (8)	26.5 (9)	23.0 (17)
	5 (very difficult)	11.8 (4)	14.7 (5)	12.2 (9)
	I don't know	5.9 (2)	2.9 (1)	4.1 (3)
	Low-fat	1 (easy)	14.7 (5)	23.5 (8)
2		20.6 (7)	23.5 (8)	20.3 (15)
3		29.4 (10)	32.4 (11)	28.4 (21)
4		23.5 (8)	11.8 (4)	16.2 (12)
5 (very difficult)		14.7 (5)	5.9 (2)	9.5 (7)
I don't know		11.8 (4)	2.9 (1)	6.8 (5)
Galactose-free		1 (easy)	26.5 (9)	17.6 (6)
	2	35.3 (12)	41.2 (14)	35.1 (26)
	3	17.6 (6)	20.6 (7)	17.6 (13)
	4	8.8 (3)	11.8 (4)	9.5 (7)
	5 (very difficult)	14.7 (5)	5.9 (2)	9.5 (7)
	I don't know	11.8 (4)	2.9 (1)	6.8 (5)
	Fructose-free Sucrose, fructose, sorbitol-free diets	1 (easy)	17.6 (6)	11.8 (4)
2		17.6 (6)	32.4 (11)	24.3 (18)
3		17.6 (6)	23.5 (8)	18.9 (14)
4		23.5 (8)	14.7 (5)	17.6 (13)
5 (very difficult)		20.6 (7)	14.7 (5)	16.2 (12)
I don't know		17.6 (6)	2.9 (1)	9.5 (7)

Continued

Table 2 continued. Evaluation of difficulties in managing various special diets by the food service.

Diet type	Difficulty	Results		
		Food service (n=40), % (n)	IMD and KDTs (n=34), % (n)	Total (n=74), % (n)
Ketogenic Dietary Therapy	1 (easy)	0.0 (0)	5.9 (2)	4.1 (3)
	2	14.7 (5)	2.9 (1)	8.1 (6)
	3	32.4 (11)	0.0 (0)	14.9 (11)
	4	8.8 (3)	17.6 (6)	12.2 (9)
	5 (very difficult)	35.3 (12)	73.5 (25)	50.0 (37)
	I don't know	23.5 (8)	0.0 (0)	10.8 (8)
	Gluten-free	1 (easy)	73.5 (25)	55.9 (19)
2		23.5 (8)	29.4 (10)	24.3 (18)
3		5.9 (2)	11.8 (4)	8.1 (6)
4		2.9 (1)	2.9 (1)	2.7 (2)
5 (very difficult)		5.9 (2)	0.0 (0)	2.7 (2)
I don't know		2.9 (1)	0.0 (0)	1.4 (1)
Eggs-free		1 (easy)	76.5 (26)	55.9 (19)
	2	26.5 (9)	29.4 (10)	25.7 (19)
	3	2.9 (1)	11.8 (4)	6.8 (5)
	4	2.9 (1)	2.9 (1)	2.7 (2)
	5 (very difficult)	2.9 (1)	0.0 (0)	1.4 (1)
	I don't know	2.9 (1)	0.0 (0)	1.4 (1)
	Nuts-free	1 (easy)	67.6 (23)	44.1 (15)
2		23.5 (8)	41.2 (14)	29.7 (22)
3		8.8 (3)	11.8 (4)	9.5 (7)
4		5.9 (2)	2.9 (1)	4.1 (3)
5 (very difficult)		5.9 (2)	0.0 (0)	2.7 (2)
I don't know		2.9 (1)	0.0 (0)	1.4 (1)
Favism		1 (easy)	70.6 (24)	67.6 (23)
	2	23.5 (8)	20.6 (7)	20.3 (15)
	3	5.9 (2)	5.9 (2)	5.4 (4)
	4	5.9 (2)	2.9 (1)	4.1 (3)
	5 (very difficult)	5.9 (2)	0.0 (0)	2.7 (2)
	I don't know	2.9 (1)	2.9 (1)	2.7 (2)

Continued

Table 2 continued. Evaluation of difficulties in managing various special diets by the food service.

Diet type	Difficulty	Results		
		Food service (n=40), % (n)	IMD and KDTs (n=34), % (n)	Total (n=74), % (n)
Tomato-free	1 (easy)	79.4 (27)	67.6 (23)	68.9 (51)
	2	17.6 (6)	23.5 (8)	18.9 (14)
	3	5.9 (2)	8.8 (3)	6.8 (5)
	4	5.9 (2)	0.0 (0)	2.7 (2)
	5 (very difficult)	2.9 (1)	0.0 (0)	1.4 (1)
	I don't know	2.9 (1)	0.0 (0)	1.4 (1)
Fish-free	1 (easy)	88.2 (30)	67.6 (23)	73.0 (54)
	2	8.8 (3)	23.5 (8)	14.9 (11)
	3	8.8 (3)	2.9 (1)	5.4 (4)
	4	0.0 (0)	5.9 (2)	2.7 (2)
	5 (very difficult)	5.9 (2)	0.0 (0)	2.7 (2)
	I don't know	2.9 (1)	0.0 (0)	1.4 (1)
Low-sodium	1 (easy)	44.1 (15)	88.2 (30)	62.2 (46)
	2	35.3 (12)	11.8 (4)	21.6 (16)
	3	14.7 (5)	0.0 (0)	6.8 (5)
	4	11.8 (4)	0.0 (0)	5.4 (4)
	5 (very difficult)	2.9 (1)	0.0 (0)	1.4 (1)
	I don't know	5.9 (2)	0.0 (0)	2.7 (2)
Diet for diabetes	1 (easy)	35.3 (12)	50.0 (17)	40.5 (30)
	2	35.3 (12)	35.3 (12)	32.4 (24)
	3	23.5 (8)	11.8 (4)	16.2 (12)
	4	11.8 (4)	2.9 (1)	6.8 (5)
	5 (very difficult)	2.9 (1)	0.0 (0)	1.4 (1)
	I don't know	5.9 (2)	0.0 (0)	2.7 (2)
Diet for dysphagia	1 (easy)	26.5 (9)	17.6 (6)	21.6 (16)
	2	32.4 (11)	52.9 (18)	39.2 (29)
	3	41.2 (14)	14.7 (5)	25.7 (19)
	4	2.9 (1)	11.8 (4)	6.8 (5)
	5 (very difficult)	8.8 (3)	2.9 (1)	5.4 (4)
	I don't know	2.9 (1)	0.0 (0)	1.4 (1)

Abbreviations - IMD=inherited metabolic diseases; KDTs=ketogenic dietary therapies.

represent a promising strategy to to strengthen communication, equip professionals with the necessary skills, and ensure more effective dietary management. This approach could ultimately enhance health outcomes and daily quality of life for children and their families. **Figure 4** illustrates the complex collaboration between clinical dietitians specialized in IMDs or/and KDTs and school food services, detailing the school meal request process, challenges encountered, and potential solutions. School meals play a crucial role in children's daily nutrition, providing up to 35-40% of their total daily intake, according to the Italian Healthy Eating Guidelines 2018¹⁰.

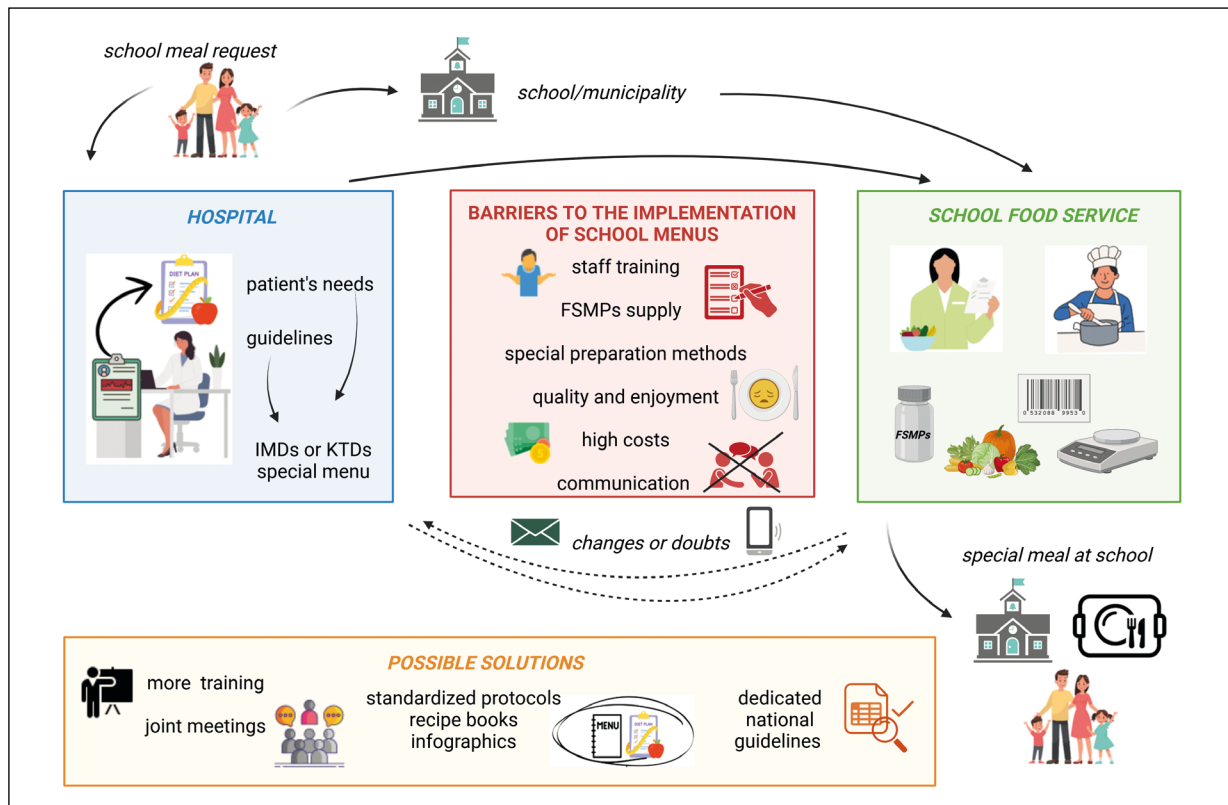


Figure 4. Collaboration between clinical dietitians specialized in IMDs and/or KTDs and school food services. It also includes the main challenges identified and possible solutions proposed.

For children with special dietary needs, particularly those with IMDs or DRE and GLUT1 deficiency syndrome, properly tailored meals are even more critical, as their diet functions as a therapeutic intervention. It is, therefore, essential that school food services are designed to meet the specific dietary requirements. However, while legal provisions exist for children with celiac disease (Law 123/2005), no specific legislation currently addresses school meal accommodations for children with IMDs or DRE or GLUT1 deficiency syndrome. The National Guidelines for Hospital/Care and School Foodservice (2021)⁹ recognize food service as a key component of public health, emphasizing its role in the prevention and treatment of nutrition-related diseases in both healthcare and school settings. The guidelines recommend that school food services provide tailored meals for children with clinical conditions (allergies/intolerances), as well as for cultural, ethical, or religious dietary needs. Despite these recommendations, a regulatory gap remains in ensuring comprehensive protections for children with IMDs or DRE and GLUT1 deficiency syndrome, underscoring the need for stronger policies to guarantee appropriate nutritional support in schools. Current national guidelines for managing special diets in school food service require a medical certificate from the child's primary care pediatrician or specialist. While special diets for celiac disease or food allergies are well-documented through established guidelines and operational procedures, making them easier to standardize, IMDs and KDTs present additional challenges that require individualized planning and greater policy attention. Furthermore, there is often no clear designation of responsibility for managing the implementation of special diets in schools. International frameworks, such as the Vienna Declaration on the Right to Nutritional Care¹¹, emphasize that nutritional care is a fundamental human right closely linked to the

right to food and health. For children following metabolic or ketogenic diets, ensuring that their dietary needs are met at school is crucial for disease management and healthy growth. However, the level of support for children with special dietary needs in schools varies significantly between countries. In the USA, the legislation mandates that school food services provide special meals at no additional cost to children whose disability restrict their diet, in accordance with USDA's¹² non-discrimination regulations. This policy ensures that children with medical conditions are not excluded from proper nutrition during school hours. In the UK, the Children and Families Act (2014) requires schools to support children with medical conditions, including those with inherited metabolic disorders such as phenylketonuria (PKU)¹³. Schools must collaborate with healthcare professionals, parents, and children to meet their dietary needs, while also implementing staff training programs and policy development to ensure proper accommodation of dietary requirements. Since all children are entitled to a school meal, food services are expected to work with parents and medical professionals to provide safe, inclusive meal options for children with PKU, as outlined in a national PKU patients' association guide¹⁴. By contrast, in Italy, while standardized procedures exist for common dietary accommodations (e.g., celiac disease, food allergies), guidelines for personalized diets (e.g., metabolic disorders, ketogenic diet therapy) remain insufficient. There is no national policy defining who is responsible for approving and overseeing these specialized menus, and prescriptions from specialized centers vary by region, often lacking clarity and consistency. Beyond the need for legislation and food service guidelines, it is also important to recognize that implementing these specialized dietary approaches imposes a significant workload on food service providers, healthcare professionals, and families. This burden associated with managing specialized diets, as reported by the dietitians in this survey, should be carefully considered from an organizational perspective to ensure adequate allocation of resources for dietitians working in both food service and clinical nutrition services.

Limitations

One limitation of this study is the potential for selection bias, as the survey was distributed voluntarily by invitation. This may have led to an overrepresentation of dietitians from northern Italy, limiting the sample's representativeness of the entire population of Italian dietitians. Moreover, the survey did not assess the perceptions and barriers experienced by patients and families regarding access to school meals, which is an important aspect of the right to food.

On the other hand, this study is the first of its kind to evaluate and compare the activities of dietitians working in food service and clinical nutrition for IMDs and KDTs on a national scale. Efforts were made to maximize participation through the dual-channel distribution via ASAND and the Nutrition and Dietetic working group of SIMMESN. By identifying shared challenges and unique difficulties within each field, this study underscores the need for greater collaboration and networking among professionals to enhance the management of special diets in schools.

CONCLUSIONS

Providing appropriate meals for children with metabolic disorders is not only a nutritional requirement but also a fundamental human right. This study highlights the challenges of integrating special diets into school food services, particularly the complexity of ketogenic diets. To create a more inclusive school environment and optimize school meal provisions for children with rare metabolic and neurological disorders, an interdisciplinary collaboration between healthcare professionals and school staff, professional education for dietitians and food service personnel, standardized protocols for managing special diets, and policy alignment with international standards to ensure equal access to adequate nutrition are essential. By implementing these measures, schools can better support children with IMDs and rare neurological conditions, ensuring that their right to proper nutrition is upheld.

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Study conception and design: MT, MGU, GM, MGe, RDA, AD, ET, JZ and GB; collection and interpretation of data: MT, MGU and GG; statistical analysis: MT and MGU; manuscript drafting: MT, MGU, GM, MGe and GG; manuscript editing AD, JZ, ET and GB; approval to submit: MT and GB.

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