frontiers | Frontiers in Sustainable Food Systems

TYPE Original Research
PUBLISHED 04 March 2024
DOI 10.3389/fsufs.2024.1265745

OPEN ACCESS

EDITED BY
Emmanuel Cohen,
UMR7206 Eco Anthropologie et Ethnobiologie (EAE), France

REVIEWED BY
Katarzyna Lewtak,
Medical University of Warsaw, Poland
Cinzia Barbieri,
University of Turin, Italy

*CORRESPONDENCE
Katarzyna Magdalena Brukało
✉ kbrukalo@sum.edu.pl

RECEIVED 23 July 2023
ACCEPTED 16 January 2024
PUBLISHED 04 March 2024

CITATION
Brukało KM, Nowak J, Pietrzykowska A, Fras N, Ožbolt P, Kowalski O and Blenkuš MG (2024) Public food procurement as a tool of sustainable food and nutrition policy—fat products.
Front. Sustain. Food Syst. 8:1265745.
doi: 10.3389/fsufs.2024.1265745

Public food procurement as a tool of sustainable food and nutrition policy—fat products

Katarzyna Magdalena Brukało[1]*, Justyna Nowak[2], Aleksandra Pietrzykowska[3], Neza Fras[4], Petra Ožbolt[4], Oskar Kowalski[5] and Mojca Gabrijelčič Blenkuš[4]

[1]Faculty of Public Health in Bytom, Health Policy Department, Medical University of Silesia, Katowice, Poland, [2]Department of Metabolic Disease Prevention, Faculty of Public Health in Bytom, Medical University of Silesia, Katowice, Poland, [3]Student Scientific Circle, Department of Metabolic Disease Prevention, Faculty of Public Health in Bytom, Medical University of Silesia, Katowice, Poland, [4]Healthy Lifestyle Promotion Department, National Institute for Public Health, Ljubljana, Slovenia, [5]Department of Human Nutrition, Faculty of Public Health in Bytom, Medical University of Silesia, Katowice, Poland

Introduction: Ensuring a sustainable and responsible diet, particularly in the procurement of fatty products, holds paramount importance for early childhood development. Dietary fats significantly influence children's growth and well-being, both in the short and long term. Schools and kindergartens play a pivotal role in shaping children's dietary habits. This study aims to quantitatively and qualitatively analyze public procurement orders conducted by educational institutions.

Materials and methods: Out of 1,126 public procurement orders, 197 met inclusion criteria, leading to the identification of 1,248 products categorized as sources of fats in children's diets. The study conducted both quantitative and qualitative analyses on the identified products.

Results: Criteria commonly employed by purchasers were derived from product descriptions. While product composition, especially fat content and the absence of certain additives, received due attention, organoleptic characteristics criteria were frequently overlooked. Sustainable procurement criteria were given the least consideration. The study highlights a notable reliance on vegetable oils, predominantly rapeseed oil. However, it reveals a worrisome prevalence of animal-derived fats, including butter, mayonnaise, pork belly, and lard. Although plant-based fats constitute around 52.77% of total orders, the substantial presence of animal fats poses challenges to maintaining a balanced and healthy diet for children.

Conclusion: The study underscores the necessity of establishing specific criteria for evaluating the quality of delivered products, especially fatty items, in educational settings. Standardized guidelines are crucial to promote healthier food choices, encourage sustainable diets, and ultimately enhance the overall health and well-being of children.

KEYWORDS

public food procurement, food policy, fat products, schools and kindergartens, nutrition policy, sustainability

Introduction

Rational nutrition is defined as systematically providing the body with an optimal amount of energy and all necessary nutrients, including proteins, carbohydrates, fats, vitamins, and minerals. A healthy nutritious provides beneficial nutrients (e.g., vitamins, minerals, essential amino acids, essential fatty acids, dietary fibre) and minimizes potentially harmful elements (e.g., sugars, saturated fats, anti-nutrients, quantities of sodium). Consuming these macronutrients and micronutrients in appropriate proportions, according to the body's needs, enables normal functioning and significantly influences one's health. Proper nutrition ensures proper growth and development in children. On the other hand, unhealthy nutrition leads to numerous lifestyle diseases. Both excess and deficiency of nutrients can cause serious health disorders, such as obesity or malnutrition (Neufeld et al., 2021).

It is crucial to create an environment in schools that promotes the development of healthy habits, including dietary habits, in a proper and supportive manner during children's education. Incorporating appropriate child nutrition into a healthy lifestyle is essential for ensuring proper development, preventing childhood diseases, and reducing the risk of diet-related illnesses in later stages of life. The reported obesity prevalence data pertains specifically to children aged 1–3 years old. Currently, approximately 10% of this age group is identified as overweight or obese, while 18.4% are deemed at risk of excessive body weight. The issue of overweight and obesity also affects nearly one in three 8-year-olds. Among adolescents aged 10–16 years old, one in five children is affected by excessive body weight. The significant increase in the prevalence of obesity among children and adolescents in Poland is very important as a problem of public health. Research shows that over a span of 30 years in Warsaw, the prevalence of obesity among boys aged 11–15 years old has tripled, while among girls of the same age group, it has increased tenfold (National Institute of Food and Nutrition, 2023a,b).

According to Polish recommendations for the nutrition of children and adolescents, a daily diet should provide proteins, fats, carbohydrates, as well as vitamins and minerals in appropriate proportions (National Center for Health Education, n.d.). The diet should include a small amount of plant-based fats (vegetable oils and products such as nuts, seeds, or kernels). It is important for health to limit the consumption of products such as cookies, candy bars, salty snacks, and fast food, as they contain harmful trans fats in addition to high amounts of salt or sugar. Excessive intake of animal fats, which contain saturated fatty acids, is a cause of many diseases, especially cardiovascular diseases and certain types of cancer. On the other hand, vegetable oils are the richest source of mono- and polyunsaturated fatty acids, which protect against these diseases. Therefore, it is recommended to replace animal fats with vegetable oils, with the exception of coconut and palm oil. The best choice is rapeseed oil, which has the most favorable fatty acid composition. It is important to note that cold-pressed oils should only be consumed raw, as an excellent addition to salads and raw vegetable dishes. For frying, it is best to use refined rapeseed oil or olive oil (however, it is advisable to limit the consumption of fried foods) (Food Pyramid for Children, 2022).

One of the effective tools for promoting proper dietary choices and proper patterns in schools and kindergartens are public food procurement, on which the entire mass catering system in educational units is based. Either ready meals or products and semi-finished products are ordered, from which dishes are made on site. It is important that the products used for school nutrition meet certain requirements and are of the highest quality, and on the other hand, they fit into a sustainable diet.

In Poland, public procurement of food is not subject to any special regulations, and the regulation on nutrition in schools focuses more on products available for sale, vending machines and menu composition rules (Regulation of the Minister of Health, 2016). This type of gap, on the one hand, leaves a lot of freedom to the stewards, but on the other hand, it can lead to the selection of inferior products if the only criterion is price.

All Polish public procurements are collected in the Public Procurement Bulletin (in the form of an application), from which documents are removed 3 months after the end of the procedure (only general information remains).

Aim of the study

The aim of the study was to evaluate the use of public procurement as an investment in health promotion and a tool for sustainable and responsible food/nutrition policy. For this purpose, a quantitative and qualitative analysis of food products classified as sources of fats in children's nutrition was carried out and qualitative criteria for product composition, organoleptic characteristics and sustainable public procurement were defined and verified.

Materials and methods

In Poland, the E-procurement Platform has been in operation since 2022. Each entity performing public procurement must log in and enter all relevant documents.

An integral part of the E-Procurement Platform is the Public Procurement Bulletin, which allows you to search for and obtain information about a specific public procurement. In accordance with the rules of operation of the E-Procurement Platform, all documents related to a specific public procurement are deleted within 3 months of its completion.

According to Polish legislation, educational units (kindergartens, primary schools and preschool teams) are obliged to provide at least one hot meal during the day. They can fulfill this obligation in two ways – by providing a catering service or preparing meals. In order to collect information on public tenders carried out by educational units for food products ordered for 2023, data collection was carried out between 15 November 2022 and 15 March 2023.

In order to obtain information on tenders concerning the purchase of food products, the resources of the database were searched on the basis of CPV codes (15000000–8–Food, beverages, tobacco and related products and all fats related to it, a detailed list is included in Annex 1).

On this basis, a database was created covering 1,126 items – public procurement, which in a given period were processed by the above-mentioned educational units in the scope of the indicated CPV codes.

The final criterion for inclusion in the analysis was the first procurement (those in which part of the procedure was repeated due to the invalidity of one of the parts was excluded) and the availability

of full documentation to guarantee the reliability of the analysis carried out.

In the end, 197 public contracts were extracted, which together met the following criteria:

- have been processed by an educational unit (kindergarten, primary school or school-preschool complex),
- were processed for the first time (covered the full commodity demand of individual units),
- had complete documentation of public procurement process.

A comprehensive database of 1,248 ordered products from the group of animal or vegetable fats was created based on the collected documentation. This group encompasses various fats such as: oil, olive oil, frying grease, butter, margarine, lard, pork fat, pork belly, bacon, and dewlap. This group also includes mayonnaise, avocados, and nuts, which are primary sources of fat in the diet. Subsequently, a quantitative analysis was carried out for each product.

Quantitative data were supplemented with a qualitative analysis – taking into account the criteria that are given by the Purchaser for individual food products classified in this group.

Based on the preliminary review of the collected descriptions of individual products, the following quality criteria were identified:

- in terms of product composition:

  o fat content, monounsaturated fatty acids [JNKT] and polyunsaturated fatty acids [WNKT],
  o without artificial colours, flavour enhancers and flavourings,
  o without preservatives,
  o without thickeners and stabilizers,
  o without added salt/sugar,
  o without the addition of palm oil,
  o free of antioxidants;

- in terms of organoleptic characteristics:

  o taste,
  o smell,
  o colour,
  o appearance/consistency;

- in the field of sustainable public procurement:

  o locality of products,
  o organic products,
  o GMO-free products.

To the best of the authors' knowledge, this is the first detailed and comprehensive analysis of public procurement of a specific group of food products.

Results

Based on the analysis of the volume of ordered fats, they were divided into 13 subgroups (Table 1):

TABLE 1 Type and quantity of ordered fats for schools and kindergartens in 2023 (according to forecasts).

Type of fats	Number of products		Order volume	
	Number of products (*n*)	% of all products	Order volume [kg]	% of order volume
Oil	239	19.15%	21,442,851,32 [l]	99.73%
Olive oil	94	7.53%	1516.50 [l]	0.01%
Frying grease	4	0.32%	130.50 [l]	0.00%
Avocados	37	2.96%	401.29	0.00%
Nuts	194	15.54%	2086.34	0.01%
Mayonnaise	156	12.50%	4511.50	0.02%
Butter	228	18.27%	36577.70	0.17%
Margarine	91	7.29%	2,826.65	0.01%
Lard	20	1.60%	219.95	0.00%
Pork fat	27	2.16%	511.00	0.00%
Pork belly	149	11.94%	9254.40	0.04%
Bacon	2	0.16%	20.00	0.00%
Dewlap	7	0.56%	167.00	0.00%
Total	1,248	100.00%	21,501,074,14	100.00%

The main source of fat in products ordered by educational institutions was oil (21442851.32 L, 99.73%). It should be noted that subsequent places were occupied by animal fats: butter (36577.70 kg, 0.17%) and pork belly (9254.40 kg, 0.04%).

In terms of the number of products, butter (228 products, 18.27%), oil (239 products, 19.15%) and nuts (194 products, 15.54%) were ordered the most.

Detailed analysis of each of the groups is presented below.

Vegetable fats—vegetable oil

239 products were classified into the oil category, of which the most numerous group was rapeseed oil. A detailed summary is presented in the Table 2.

The ordering pattern indicated a predominant preference for rapeseed oil, with 194 products (81.17% of vegetable oils) and a substantial volume of 21,433,247.66 liters (99.96% of vegetable oils). The second large group consisted of products categorized under the general name "oil," because the Purchaser did not specify in any way what type of product it expects. The least frequently ordered oils were coconut oil (1 product, 0.42%) and sesame oil (1 product, 0.42%).

The Purchaser mainly chose refined oil (113 products, 47.28%), virgin oil (132 products, 55.23%) and cold filtered oil (91 products, 38.08%). In the description of 100 products (41.84%), the contracting authority also specified the expected content of monounsaturated fatty acids (minimum 50%), and in the description of 96 products (40.17%) also polyunsaturated fatty acids (less than 40%). For 12 products (5.02%), specific proportions of fat content in 10 g were determined:

saturated fatty acids—0.7 g, monounsaturated fatty acids 6.5 g, polyunsaturated acids 2.8 g, cholesterol 0 mg.

In the case of 62 products (25.94%), it was indicated that the ordered oil was suitable for both frying and salads. In addition, according to the description, 61 products (25.52%) classified in the group of oils should not contain preservatives, artificial dyes and flavour enhancers in their composition, and 2 products (0.84%) should be zero-erucic.

No criteria on the composition or characteristics of the oil were taken into account for 64 products (26.78%). Organoleptic features have not been described with any product.

Other vegetable fats

Olive oil

The educational units ordered only olive oil (94 products, 7.53%). This oil should be virgin (40 products, 42.55%), free of preservatives, flavour enhancers and artificial colours (3 products, 3.19%), and cold-pressed (2 products, 2.13%).

No quality criteria were defined for 50 products (53.19%). Organoleptic features have not been described with any product.

Frying grease

The frying grease was ordered only by 4 educational units (4 products, 0.00%) in the amount of 130.5 L (0.00%). The temperature of smoking was expected to be at least 232°C.

Avocados

Avocados were ordered 37 times (2.96%), of which in 3 cases (8.10%) it was indicated that a variety of hass was desirable. The only criteria indicated in this product group concerned organoleptic characteristics. The ordered avocado should be ripe and without damage (14 products, 37.83%), without signs of rotting and mold (13 products, 35.14%), without stains (12 products, 32.43%) and fresh (10 products, 27.03%), firm (6 products, 16.22%), healthy (5 products, 13.51%) and green (4 products, 10.81%).

Nuts

Nuts, although in terms of quantity they constitute a small part of the ordered fats (2086.34 kg, 0.01%), it is necessary to pay attention to their wide volume in public procurement of educational units (Table 3).

The most frequently ordered are almonds (56 products, 28.87%) and walnuts (52 products, 26.80%), while the least frequently ordered are peanuts (3 products, 1.55%), pistachios (1.03%) and Brazil nuts (1 product, 0.52%) and nut cream (1 product, 0.52%).

In the largest quantities, walnuts, hazelnuts and cashews are ordered. In total, they account for 71.44% of all ordered nuts (1490.4 kg). The Purchaser expects these nuts to be husked (40 products, 20.62%), without the addition of salt (34 products, 17.53%) and/or without the addition of sugar (33 products, 17.01%).

Nuts should also not contain preservatives, artificial colors and flavor enhancers, as well as palm oil (27 products, 13.92%).

In addition, the description of 2 products indicates that these products should be marked with the bio symbol, and in the case of the next two, that they should come from the European Union.

For 147 products (75.77%) no quality criteria were defined.

TABLE 2 Type and quantity of oil ordered for schools and kindergartens in 2023 (according to forecasts).

Type of oil	Number of products		Order volume	
	Number of products (*n*)	% of all products	Order volume [l]	% of order volume
Oil	18	7.53%	9030.65	0.04%
Coconut oil	1	0.42%	8	0.00%
Flaxseed oil	9	3.77%	150	0.00%
Rice oil	2	0.84%	104	0.00%
Rapeseed oil	194	81.17%	21433247.66	99.96%
Sesame oil	1	0.42%	2.5	0.00%
Sunflower oil	3	1.26%	178	0.00%
Pumpkin seed oil	2	0.84%	4	0.00%
Grape seed oil	9	3.77%	115.5	0.00%
Total	239	100.00%	21,442,840,31	100.00%

TABLE 3 Type and quantity of nuts ordered for schools and kindergartens in 2023 (according to forecasts).

Type of nuts	Number of products		Order volume	
	Number of products (*n*)	% of all products	Order volume [kg]	% of order volume
Coconut	25	12.89%	96.8	4.64%
Nut cream	1	0.52%	2	0.10%
Peanut butter	11	5.67%	61.92	2.97%
Almonds	56	28.87%	390.22	18.70%
Brazil nuts	1	0.52%	30	1.44%
Hazelnuts	26	13.40%	495.04	23.73%
Cashew nuts	17	8.76%	470.2	22.54%
Walnuts	52	26.80%	525.16	25.17%
Peanuts	3	1.55%	11.5	0.55%
Pistachios	2	1.03%	3.5	0.17%
Total	194	100.00%	2086.34	100.00%

In terms of organoleptic characteristics, the main focus was on the shape and texture (softness/hardness) of nuts (9 products, 4.64%).

Mayonnaise

Mayonnaise was ordered 156 times (12.50%) by educational institutions in the amount of 4,511.50 kg (0.02%). The description of

10.3389/fsufs.2024.1265745

15 products (9.62%) indicated that it was decorative mayonnaise, and the description of 9 products (5.77%) indicated that it was salad mayonnaise.

For every fifth product (31 products, 19.87%), the desired fat content was defined (at a minimum of 70%), and for 20 products (12.82%), the expected egg content was determined (at a minimum of 4%) or specifically egg yolk (38 products, 24.36%, at a minimum of 6%).

Mayonnaise was most commonly expected to be free of preservatives (85 products, 54.49%), stabilizers (62 products, 39.74%), artificial colors (62 products, 39.74%), antioxidants (50 products, 32.05%), and flavor enhancers (59 products, 37.82%). In addition, its composition should not include the addition of citric acid (26 products, 16.67%), as well as sugar (6 products, 3.85%), sweeteners (5 products, 3.21%) and salt (1 product, 0.64%).

For every third mayonnaise ordered (48 products, 30.77%), a specific permissible composition is given in the description. There were also individual specific records, such as without E385 (EDTA), starch, phosphoric acid (E338), powdered eggs, xanthan gum or glucose-fructose syrup.

In terms of organoleptic characteristics, the consistency was specified, which should be dense (3 products, 1.92%) or creamy (1 product, 0.64%), color and taste (1 product, 0.64%).

In the case of 6 products (3.85%), it was indicated that mayonnaise should be produced using free-range eggs.

For 58 products (37.18%) no criteria were defined (neither in terms of composition nor in terms of organoleptic characteristics).

Hydrogenated vegetable fats—margarine

A specific type of fat and a semi-synthetic product of plant origin is margarine. It was ordered 91 times to schools and kindergartens (7.29%) (Table 4).

Among margarines, vegetable butter (27 products, 29.67%) is the most frequently ordered, while soft margarine (12 products, 13.19%) and milk margarine (7 products, 7.69%) are the least frequently ordered. For 27 products (29.67%), the expected fat content was determined (at the level of a minimum of 60%).

Margarines should be free of preservatives (22 products, 24.18%), flavor enhancers (21 products, 23.08%), artificial colors (18 products, 19.78%) antioxidants (10 products, 10.99%) and stabilizers (2 products, 2.2%).

In addition, they should also be free of genetically modified organisms (6 products, 6.59%) and the addition of palm fat (1 product, 1.1%).

None of the descriptions referred to the organoleptic characteristics of margarine.

No criteria were identified for 59 products (64.84%).

Animal fats—butter

Butter is the product of the fat group that was ordered most often (228 products, 18.27%) (Table 5).

Traditional butter was most often ordered, the so-called "extra butter" (168 products, 73.68%), and one in ten butter ordered by educational units was clarified butter (25 products, 1.96%). In 13 cases (5.70%) schools and kindergartens also ordered lactose-free butter.

For 179 products (78.5%), the expected fat content was specified (for cream butter it was at least 60%, and for traditional butter it was 82% /although for 2 products it was 73%/). In addition, butter should be without vegetable additives (56 products, 24.56%) and without salt (34 products). Butter should also not include preservatives (42 products, 18.42%), artificial colors (38 products, 16.67%) and antioxidants (11 products, 4.82%) and stabilizers (11 products, 4.82%). In relation to 12 products (5.26%), the Ordering Party specified the specific required composition.

In terms of organoleptic characteristics for the Purchasers, the most important was the consistency, which should be: uniform, compact and lubricating and slightly hard or slightly greasy (30 products, 13.16%), carefully formed (27 products, 11.84%) with a smooth surface (17 products, 74.56%). The smell should

TABLE 4 Type and quantity of ordered margarine for schools and kindergartens in 2023 (according to forecasts).

Type of margarine	Number of products		Order volume	
	Number of products (*n*)	% of all products	Order volume [kg]	% of order volume
Margarine	26	28.57%	616.5	21.81%
Soft margarine	12	13.19%	244.15	8.64%
Milk margarine	7	7.69%	410	14.50%
Hard margarine	19	20.88%	411.25	14.55%
Vegetable butter	27	29.67%	1,144.75	40.50%
Grand total	91	100.00%	2,826.65	100.00%

TABLE 5 Type and quantity of butter ordered for schools and kindergartens in 2023 (according to forecasts).

Type of butter	Number of products		Order volume	
	Number of products (*n*)	% of all products	Order volume [kg]	% of order volume
Butter	168	73.68%	33475.90	91.52%
Lactose-free butter	13	5.70%	164.50	0.45%
Clarified butter	25	10.96%	798.00	2.18%
Butter mix	1	0.44%	90.00	0.25%
Pat of butter	6	2.63%	614.90	1.68%
Cream butter	15	6.58%	1434.40	3.92%
Grand Total	228	100.00%	36577.70	100.00%

be characteristic of butter (16 products, 7.02%), slightly sour taste with a specific taste of pasteurization (19 products, 8.33%), and the color should be uniform and golden (16 products, 7.02%).

47 products (20.61%) had no defined quality or organoleptic criteria.

Other animal fats

Lard

Lard for schools and kindergartens was ordered 20 times (1.60%) in the amount of 219.95 kg. Only for 1 product (5.00%) it was indicated that it should consist of 100% bacon, without the addition of preservatives and without foreign smells.

Pork fat

Of the analysed products, 27 (2.16%) were pork fat. In the case of 4 products (14.81%), the Purchaser indicated that it should be raw, and in the case of 3 products (11.11%), that it should be smoked. This pork fat is supposed to be fresh (6 products, 22.22%) and unfrozen (2 products, 7.41%), but can be minced (2 products, 7.41%). In addition, it should be without skin (4 products, 14.81%) and without bone shards (1 product, 3.7%) and without any additives (2 products, 7.41%). It should have a thickness of 2–4 cm (2 products, 7.41%), a white to light cream color (2 products, 7.41%) and a specific smell (1 product, 3.7%).

Pork belly

Pork belly was included in public procurement of educational units 149 times (11.94%). The most frequently ordered pork belly smoked (115 products, 77.18%) or steamed (43 products, 37.39%), less raw (27 products, 18.12%), fresh (23 products, 15.44%), unfrozen (4 products, 2.68%) or cooked (2 products, 1.34%).

The description of 12 products (8.05%) specifies the expected meat content in the product (above 70%), and for 2 products (1.34%) the expected fat content (below 30%).

These products should be free of ribs (48 products, 32.21%), skin (37 products, 24.83%) and bones (14 products, 9.4%). They should not contain preservatives (9 products, 6.04%), flavor enhancers (9 products, 6.04%), emulsifiers (5 products, 3.36%), antioxidants (3 products, 2.01%), stabilizers (3 products, 2.01%), acidity regulators (3 products, 2.01%), protein additives (3 products, 2.01%) and artificial flavors (3 products, 2.01%).

The taste (24 products, 16.11%) and smell (28 products, 18.79%) should be characteristic for a given product type, and the color (17 products, 11.41%) should be pale pink to red. The consistency (19 products, 12.75%) should be moist and soft, but at the same time firm and elastic.

With regard to 2 products (1.34%), it was indicated that they were of Polish origin.

68 products (45.64%) did not have any criteria.

Bacon

These were only 2 products (0.16%), smoked, with no specific criteria for composition or organoleptic characteristics.

Dewlap

Dewlap schools and kindergartens ordered 7 times (0.56%). It was supposed to be a fresh, unfrozen, smoked and skinless product.

Collective sheet

The matrix summarizing the occurrence of the identified criteria in the descriptions of individual groups of products from the fat group is presented below.

The most frequently taken into account criteria are those for the composition of the product (taking into account the specific fat content and the absence of the addition of preservatives, artificial colours and flavour enhancers). The criteria for organoleptic characteristics are quite often overlooked and the criteria for sustainable public procurement are the least taken into account.

The group of products that is described in the most detail (the largest number of products has specific criteria) is butter, mayonnaise and oil.

A detailed summary is presented in the Table 6.

Discussion

Dietary fats are all lipids present in plant and animal tissues that are consumed as food. They primarily serve as a source of energy necessary for proper growth and maintenance of the body's vital functions. Additionally, they provide essential unsaturated fatty acids and serve as a source of fat-soluble vitamins. Fats play various important roles in the human body. To maintain good health, it is crucial to ensure the intake of fats of appropriate quality. Excessive fat intake in the diet increases the risk of developing overweight, obesity, and other metabolic disorders and nutrition-related diseases. It is important for maintaining good health to consume an appropriate level of total fat while reducing the intake of Saturated Fatty Acids (SFA) and Trans Fatty Acid isomer (TFA). Saturated fatty acids contribute to an increase in total cholesterol and LDL cholesterol levels in the blood serum and are risk factors for the development of cardiovascular diseases. They also increase the risk of developing diseases such as colorectal cancer and breast cancer. Saturated fatty acids have prothrombotic effects, increasing the risk of strokes. The consumption of trans fatty acid isomers should be limited as they are primarily formed during the industrial partial hydrogenation of vegetable oils. They lead to an elevation of LDL cholesterol levels in the blood serum, decrease HDL cholesterol levels, and are recognized risk factors for cardiovascular diseases, stroke, and type 2 diabetes. Replacing saturated fatty acids with polyunsaturated fatty acids (PUFAs) reduces the risk of ischemic heart disease. Monounsaturated fatty acids (MUFAs) can play a protective role in the prevention of atherosclerosis and heart disease when they replace saturated fats as a component of the diet [g]. Based on Polish recommendation percentage of fat in total daily energy for children and adolescents aged 4–18 years is 20–35%. Intake of Saturated Fatty Acid and Trans Fatty Acid in daily diet should be as lower as is possible for healthy and balanced diet (but not more than 10% among 1–9 years group and 5–6% among adolescents aged 10–18 years) (Jarosz et al., 2020).

According to Polish observation (2007–2011) among children and adolescents there has been a shift in the structure of its sources in favor of plant-based fats. However, the consumption of animal fats remains too high. Among animal fats, butter dominates and is used both as a spread on bread and as an addition to dishes. Cream is also frequently added. Other animal fats such as lard and bacon are also found in the diets of children and adolescents, although they should practically be eliminated from the diet. High consumption of total fats

TABLE 6 Summary of the number of fat products for which a given feature is specified.

		Oil	Olive oil	Frying grease	Avocado	Nuts	Mayonnaise	Margarine	Butter	Lard	Pork fat	Pork belly
Product composition	Fat content	100 (41,84%)					31 (19,87%)	27 (29,67%)	179 (78,51%)	1 (0,05%)		2 (1,34%)
	Without artificial colours	61 (25,52%)	3 (3,19%)			27 (13,92%)	62 (39,74%)	18 (19,78%)	38 (7,89%)			
	No preservatives	61 (25,52%)	3 (3,19%)	1 (25%)		27 (13,92%)	85 (54,59%)	22 (24,18%)	42 (18,42%)	1 (0,05%)		9 (6,04%)
	Without flavor and aroma enhancers	61 (25,52%)	3 (3,19%)			27 (13,92%)	59 (37,82%)	21 (23,08%)				3 (2,01%)
	Without stabilizers						62 (39,74%)	2 (2,2%)	11 (4,82%)			3 (2,01%)
	Without added sugar					33 (17,01%)	6 (3,85%)					
	Without added salt					34 (17,53%)	1 (0,64%)		34 (14,91%)			
	Without antioxidants						50 (32,05%)	10 (10,99%)	11 (4,82%)			3 (2,01%)
	Without palm fat					27 (13,92%)		1 (1,1%)				
Sustainability characteristics	Non-GMO							6 (6,59%)				
	Bio/eco					2 (1,03%)						
	Origin					2 (1,03%)						2 (1,34%)
	Use of sustainable ingredients						6 (3,85%)					
Organoleptic characteristics	Taste								16 (7,02%)			24 (16,11%)
	Smell								19 (8,33%)	2 (0,1%)	1 (3,7%)	28 (18,79%)
	Colour				4 (1,08%)				16 (7,02%)		2 (7,4%)	17 (11,41%)
	Consistency				6 (16,22%)		3 (1,92%)		30			19 (12,75%)

10.3389/fsufs.2024.1265745

in the diet of young individuals and the continued high intake of animal fats make saturated fatty acids a significant source of energy, while the contribution of polyunsaturated fatty acids is lower. The dietary patterns of this population also show a low intake of n-3 fatty acids, which is not only due to an improper fat consumption structure but also inadequate fish intake (Rychlik and Jarosz, 2008). Mean intake of total fat among Polish children aged 1–9 was 30.9 ± 7.8% and among 13–18 aged group 34.2 ± 7.2%. Respectively mean intake of SFA was 11.6 ± 3.7% and 11.4 ± 3.8% and mean intake of MUFA was 12.9 ± 3.9% and 14.6 ± 3.9%. Mean intake of PUFA among Polish children aged 1–9 was 4.1 ± 2.3% and among 13–18 aged group 5.1 ± 2.7% (Harika et al., 2011).

Animal products and animal fats are the main sources of saturated fatty acids in the diet. Among plant-based fats, as mentioned earlier, coconut oil (over 80%) and palm oil (over 40%) are characterized by high levels of saturated fatty acids. Monounsaturated fatty acids (MUFA) are widely present in food. The main sources of MUFA are plant oils, including rapeseed oil and olive oil, which are important sources of oleic acid, beneficial for health. Sources of polyunsaturated fatty acids (PUFA) include plant oils (such as sunflower oil, flaxseed oil, and others), nuts, seeds, and fatty fish. Trans isomers are in partially hydrogenated oils and fats, including products such as margarine (Jarosz et al., 2020).

Based on the conducted study, a positive observation is the significant presence of plant oils and olive oil in the overall pool of public procurement in the fats category for schools (26.68% of all products and 99.73% of order volume). Very positive results were also observed in orders for avocados and nuts (2.96 and 15.54% of all products, respectively). These products provide beneficial MUFA and PUFA which are advantageous for health. Unfortunately, in the diet of children and adolescents in school institutions, there is still a significant presence of animal-derived fats, such as butter (18.27%) mayonnaise (12.50%), pork belly (11.94%), pork fat (2.16%), and lard (1.60%). These products are a source of unfavorable saturated fatty acids, which are not beneficial for health. It should be emphasized that plant fats accounted for only 52.77% of the total order (unfortunately, including 7.29% of margarines that may contain trans isomers), which is a significantly low proportion. This indicates that animal fats constitute as much as 47.21% of the overall pool of fats being provided to children for consumption.

Public procurement of fat products is a frequent element of the process of supplying public institutions with food. These include different types of fats such as oil, olive, butter, margarine, lard, etc. Since fats are characterized by the highest energy density among nutrients (1 g is 9 kcal), not only their quantity, but above all their quality is very important. Public procurement procedures for fats are usually governed by the applicable public procurement law in the country or region in question. According to the review carried out as part of the Best Re-MaP Project, there are European countries that have very detailed regulations and criteria in this area (such as the Scandinavian countries), but there are also countries that are at the beginning of this road (such as Poland or Bosnia and Herzegovina) (Report Best Re-MaP, n.d.).

In Poland, there are no specific regulations regarding the purchase of this type of products for educational units. The regulation regulating nutrition in schools only stipulates that no more than two portions of fried food should be served from Monday to Friday, while refined vegetable oil with a monounsaturated acid content of over 50% and a polyunsaturated acid content of less than 40% was used for frying. The oil ordered is the most (99.73%) and according to the order specification it meets these requirements.

However, the remaining products of the fat group do not have any criteria specified either in the regulations or by the Purchasers. A large volume of cured margarines, which previously could contain a large amount of pro-inflammatory trans fats, could raise doubts (National Center for Health Education, 2022). However, in 2021, a regulation came into force that prohibits the placing on the market of products of plant origin exceeding the industrial trans fat content of 2 g per 100 grams of fat (2%). While previously in the tests the samples reached even 22% of trans fats in products available on the Polish market – currently such values would make it impossible to place the product on the market [Commission Regulation (EU), 2019]. However, it is worth noting that there are countries that go a step further in these regulations—they prohibit the use of margarines and bakery fats or all products with trans fats in schools (New Dehli Act, 2006).

The specific disorder of the criteria, which can be seen on the example of lard, can also be alarming. Purchasers often emphasized its organoleptic features, but only a fraction of them focused on key quality issues, such as the meat or fat content of the product.

None of the Purchasers referred to the criteria of sustainable public procurement. Only nuts and margarine (a total of 28 products) were required to be palm oil-free. In the case of fatty products, it is important to implement not only locality criteria, but also sustainable sourcing of raw materials that are popular and successfully used in European countries (Neto, 2020).

Public procurement criteria, when strategically designed and implemented, have the potential to become a powerful instrument in shaping broader food policies. By establishing specific guidelines for the sourcing and delivery of food products, particularly those consumed by children, policymakers can influence dietary patterns on a large scale. Incorporating criteria that prioritize nutritional value, sustainability, and health outcomes in public procurement not only supports the immediate goal of providing healthier options for children but also contributes to the larger framework of promoting public health. Through these measures, public institutions can set precedents for the food industry, encouraging the adoption of sustainable and health-conscious practices. In essence, public procurement emerges as a tangible tool through which governments can actively contribute to the development and implementation of comprehensive food policies that prioritize the well-being of their citizens.

Conclusion

The findings of the study reveal a critical insight into the composition of fats procured for schools and kindergartens in Poland. The predominant reliance on plant-based oils, avocados, and nuts indicates a positive trend towards healthier sources of fats rich in monounsaturated and polyunsaturated fatty acids. However, a substantial portion of the procurement comprises animal-derived fats, such as butter, pork belly, and mayonnaise, which contribute to the intake of less favorable saturated fatty acids.

The absence of specific regulations for the procurement of fats in educational institutions, except for refined vegetable oil used for frying, raises concerns about the overall quality of fats supplied. While

the study identifies an encouraging shift in the procurement of healthier fats, particularly in oils, there is a need for comprehensive guidelines to ensure a balanced and health-conscious approach to dietary fat intake among children.

Furthermore, the lack of emphasis on sustainable public procurement criteria is noteworthy. Only a fraction of the products, such as nuts and margarine, were required to be palm oil-free. Integrating sustainable practices into public procurement can enhance the overall impact of nutritional policies, contributing not only to the health of individuals but also to environmental and social well-being.

In conclusion, addressing the identified gaps in procurement regulations, promoting the consumption of healthier fats, and incorporating sustainability criteria can collectively contribute to fostering better dietary habits and overall well-being among schoolchildren in Poland. These insights provide a foundation for future policy adjustments and interventions aimed at promoting optimal nutrition and a sustainable food system in educational settings.

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Author contributions

KB: Conceptualization, Data curation, Formal analysis, Methodology, Resources, Visualization, Writing – original draft. JN: Conceptualization, Methodology, Writing – original draft. AP: Data curation, Formal analysis, Writing – review & editing. NF: Conceptualization, Writing – review & editing. PO: Conceptualization, Writing – review & editing. OK: Conceptualization, Writing – review & editing. MB: Conceptualization, Writing – review & editing.

Funding

The author(s) declare that no financial support was received for the research, authorship, and/or publication of this article.

Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Publisher's note

All claims expressed in this article are solely those of the authors and do not necessarily represent those of their affiliated organizations, or those of the publisher, the editors and the reviewers. Any product that may be evaluated in this article, or claim that may be made by its manufacturer, is not guaranteed or endorsed by the publisher.

Supplementary material

The Supplementary material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fsufs.2024.1265745/full#supplementary-material

References

Commission Regulation (EU). (2019) *Commission Regulation (EU) 2019/649 of 24 April 2019 amending annex III to regulation (EC) no 1925/2006 of the European Parliament and of the council as regards trans-fatty acids other than trans-fatty acids naturally occurring in fat of animal origin*. Official Journal of the European Union.

Food Pyramid for Children, (2022). *National Institute of Food and Nutrition*. ed. J. Mirosław, Warsaw.

Harika, R. K., Cosgrove, M. C., Osendarp, S. J. M., Verhoef, P., and Zock, P. L. (2011). Fatty acid intakes of children and adolescents are not in line with the dietary intake recommendations for future cardiovascular health: a systematic review of dietary intake data from thirty countries. *Br. J. Nutr.* 106, 307–316. doi: 10.1017/S0007114511001528

Jarosz, M., Rychlik, E., Stoś, K., and Charzewska, J. (2020). *Normy żywienia dla populacji Polski i ich zastosowanie*. Warszawa: Narodowy Instytut Zdrowia Publicznego – Państwowy Zakład Higieny.

National Center for Health Education, (2022), Available at: https://ncez.pzh.gov.pl/abc-zywienia/mity-na-temat-izomerow-trans-kwasow-tluszczowych/

National Center for Health Education, (n. d.). Available at: https://ncez.pzh.gov.pl/abc-zywienia/talerz-zdrowego-zywienia/ (Accessed: 06-07-2023)

National Institute of Food and Nutrition, (2023a). Available at: https://ncez.pzh.gov.pl/dzieci-i-mlodziez/piramida-zdrowego-zywienia-i-stylu-zycia-dzieci-i-mlodziezy-2/ (Accessed 06-07-2023)

National Institute of Food and Nutrition, (2023b). Available at: https://ncez.pzh.gov.pl/zywienie-w-placowkach/zdrowe-dzieciaki-to-my-efektywne-narzedzie-edukacji-prozdrowotnej-w-szkole/ (Accessed 06-07-2023)

Neto, B. (2020). Analysis of sustainability criteria from European public procurement schemes for foodservices, science of the Total environment. *Sci. Total Environ.* 704:135300. doi: 10.1016/j.scitotenv.2019.135300

Neufeld, L. M., Hendriks, S., and Hugas, M.: Healthy diet: a definition for the United Nations food systems summit (2021). United Nations Food Systems Summit 2021 Scientific Group Scientific Group. Available at: https://sc-fss2021.org/

New Dehli Act, (2006), Advisory on food safety & nutrition under section 16 (5) of food safety and standards act, 2006. New Delhi: Food Safety and Standards Agency of India; 2018 Available at: https://fssai.gov.in/upload/advisories/2018/08/5b7f8212e0df3Advisory_Food_Safety_Nutrition_23_08_2018.pdf, (Accessed July 5, 2023).

Regulation of the Minister of Health (2016). *Regulation of the Minister of Health of 26 July 2016 on groups of foodstuffs intended for sale to children and adolescents in units of education and the requirements that must be met by foodstuffs used in mass catering for children and young people in these units*, Dz.U. 2016 poz, 1154.

Report Best Re-MaP, Overview applicative situation analyses of the existing EU and national legislation—Deliverable 7.1, Available at: https://bestremap.eu/results/

Rychlik, E., and Jarosz, M.: Najczęstsze wady w żywieniu dzieci i młodzieży [in:] Jarosz, M.: Zasady prawidłowego żywienia dzieci i młodzieży oraz wskazówki dotyczące aktywności fizycznej. PolHealth Narodowy Program zapobiegania nadwadze i otyłości oraz przewlekłym chorobom niezakaźnym poprzez poprawę żywienia i aktywności fizycznej 2007-2011. Instytut Żywności i Żywienia, Warszawa (2008).