

## CONSUMPTION AND HOME PREPARATION OF FERMENTED VEGETABLE PRODUCTS IN POLAND

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**Purpose:** To present the results of consumer research in terms of the self-reported levels of recognition, sourcing, self-preparation and consumption of certain types of fermented food products in Polish households and to investigate the traditions of making these products at home in two macro-regions.

**Design/methodology/approach:** Recognition of products, household consumption habits, sourcing of products (RHS) in Northern and Eastern Poland were explored. On-line questionnaire survey was conducted in households located in these macro-regions (n = 600). Data were analysed with Statistica 13.1 PL software, which included descriptive statistics and Chi-squared  $\chi^2$  test.

**Findings:** Pickled cucumbers and sauerkraut were the most recognized fermented vegetable products. These products are rooted in the culinary tradition of the households surveyed. Regional differences in terms of consumption, commitment to culinary heritage, engagement with traditional production at home and openness to new market propositions were observed. The region and place of residence influence the consumption of pickles, as well as related behaviours, customs and culinary traditions.

**Research limitations/implications:** The use of a convenience sampling method limits the conclusions and the generalisability of the results. The findings have theoretical implications as they bring new knowledge about consumer behaviour that is mediated by home heritage and tradition, and region of origin.

**Practical implications:** The results can be a starting point for food promotion agencies and for importers of ethnic food. The regional differences should be taken into account by food business operators.

**Originality/value:** There has been little empirical study on the subject. The designed RHS model can be replicated in further research.

**Keywords:** fermented vegetables, household consumption, macro-regions, tradition.

**Category of the paper:** Research paper.

## 1. Introduction

Many food habits and traditional products and dishes are associated with regional/country culinary heritage, which is affected by such factors as the availability of natural resources, the possibility of farming and animal husbandry, historical events, the pace of economic development of the region, local traditions, customs and religious ceremonies or various types of rituals related to the preparation and consumption of meals (Berndt-Kostrzewska, 2001). Fermented vegetables occupy a very important place among such products in Poland (Varzakas et al., 2017; Irakoze, Wafula, and Owaga, 2021; Słupski, Bernaś, and Głębczyński, 2021). Dishes prepared from fermented vegetables are the basis of the Christmas Eve dinner in Poland and some other countries, and recipes for Christmas dishes are passed down from generation to generation (Tambor, 2020; Słupski, Bernaś, and Głębczyński, 2021; Łukasiewicz et al., 2022). In September, the Sauerkraut Festival takes place in Charsznica in Lesser Poland that confirms the role of this product in Polish tradition. During this holiday, the king and the queen of cabbage are chosen. Such action is a strong marketing accent and applies not only to the product, but also to the region itself. This region is famous for the production of high-quality sauerkraut, which is often exported, and appreciated for its value all over the world. A very interesting promotional event is also the “Festival of Pickled Cucumber” organized in Kalisz Pomorskie. It refers to the tradition of pickling cucumbers in barrels immersed in the lake, now called the Cucumber Lake. Researchers agree that such events are an essential element in building a tourist brand (Wiśniewska, 2012; Marek, and Wiśniewska, 2021; Czekalski, 2021).

Old Polish cookbooks provide plenty of recipes for pickling cucumbers and cabbage due to the great popularity of these foods over the centuries. Many of these have strict requirements in terms of the time of preparation, the list of ingredients and additives that both stabilize the fermentation process and add aroma to the end-product, the quality of kegs/jars for pickling, and winter storage for maturation (Słupski, Bernaś, and Głębczyński, 2021; Łukasiewicz et al., 2022). The preparation of bigos, a traditional Polish dish based on sauerkraut, often eaten after hunting, sleigh rides and during the carnival, is described in the Polish literature, i.e. in a national epic “Master Thaddeus” by Adam Mickiewicz.

Another example of the presence of fermented vegetable products in national culinary tradition is the Korean kimchi (fermented Chinese cabbage), and the method of its production, called Kimjang, both included in the register of Representative List of the Intangible Cultural Heritage of Humanity. They form an essential part of Korean meals, transcending class and regional differences. The collective practice of Kimjang reaffirms Korean identity and is

an excellent opportunity for strengthening family integration. Kimjang is also an important reminder for many Koreans that human communities need to live in harmony with nature. There are regional differences, and the specific methods and ingredients used in Kimjang are considered an important family heritage, typically transmitted from a mother-in-law to her newly married daughter-in-law (<https://ich.unesco.org...>). An important factor conducive to marketing activities, including promotion, and protection of this product in Korea, is the Kimchi Industry Promotion Act amended in 2020 (Min, Cho, and Seo, 2021). The popularity of these products among consumers around the world is due to their century-long presence in the everyday human diet (Słupski, Bernaś, and Głębczyński, 2021; Łukasiewicz et al., 2022), as well as their long shelf-life, functionality, safety, sensory, and nutritional properties (Rezac et al., 2018). In Poland, the most traditional fermented food categories are fermented cucumbers and fermented cabbage (sauerkraut) (Korzeniowska-Ginter, 2017). Many dishes based on sauerkraut and pickled cucumbers are included in the list of traditional products supervised in Poland by the Ministry of Agriculture. Most of them (9 products) were registered in Eastern Poland ([www.gov.pl...](http://www.gov.pl...)). The role of this type of products in promoting the country, the region, and even lifestyle, is now undeniable. They are recognized as a powerful marketing tool, also when it comes to culinary tourism (Grębowiec, 2017; Domagała, Najgebauer-Lejko, and Walczycka, 2022). Sauerkraut and pickled cucumbers-based products and dishes are also very popular in neighboring countries, e.g. in the Czech Republic, Slovakia, Lithuania or Ukraine, which is related to mutual historical heritage interwoven with national tradition (Paulauskienė et al., 2018; Garmasheva et al., 2019; Kameník, 2022; Shamtsyan et al., 2022). However fermented products from abroad are also gradually entering the Polish food market, e.g. from China, Japan or Korea (Tambor, 2020). Moreover, regional variations in food consumption, including fermented vegetables, food preparation and food behaviors, depending on different demographic features, have been observed by different researchers. This type of pattern has been noted in countries of all sizes, with a more traditional approach in this regard characterizing the inhabitants of rural areas and smaller towns (Barslund, 2007; Camel et al., 2015; Chatelan et al., 2017; Sang et al., 2020; Bousquet et al., 2021). Food fermentation as a form of preservation is no longer as essential as it was centuries ago when any other form of food preservation was limited. However, this traditional food processing technique has experienced a cautious cultural renaissance (Provident Barometer, 2018; 2019; 2020; Davison, 2018; Lewin, 2022).

Fermented vegetables, as probiotic products, have a very beneficial effect on human health which is critical to the dissemination of such foods. Probiotics are defined as live microorganisms which when administered in adequate amounts confer a health benefit on the host (FAO/WHO, 2002). In general, fermented foods are foods and beverages made using controlled microbial growth and enzymatic conversion of food components (Marco et al., 2017). A key role in the fermentation process is played by microbial food cultures, live bacteria, yeasts and moulds (Herody et al., 2010). Their value is associated with their physiological

features such as substrate utilization and metabolic capabilities. Their common occurrence in foods, coupled with their long historical use, contributes to their acceptance as Generally Recognized as Safe (or GRAS) for human consumption (Singh and Gaur, 2021). Although the current probiotic market is dominated by dairy food products, non-dairy foods such as probiotic fermented cereals, vegetables, fruit, and vegetable juices are becoming more and more popular, due to increasing health concerns about lactose intolerance, milk protein allergy, high cholesterol content and high amounts of saturated fatty acids of dairy based foods (Lillo-Pérez et al., 2021). Researchers point out that the market of probiotic products, especially of plant origin, is developing more and more due to contemporary consumer trends (Pimentel et al., 2021). This is due to the noticeable tendency to avoid animal products, the production of which is contributing to the deepening of the climate crisis (Mahoney et al., 2021; Kowalska, and Manning, 2022). This situation is conducive to the development of various new marketing strategies, the aim of which should be to promote this type of product. In the promotion of this type of products, special emphasis should be placed on their pro-health features and their relationship with the tradition and identity of a given country or region (Pimentel et al., 2021; Kariyawasam, Lee, and Paik, 2021).

The purpose of our article is to present the results of consumer research in terms of the self-reported levels of recognition, sourcing, self-preparation and consumption of certain types of fermented food products in Polish households and to investigate the traditions of making these products at home in two macro-regions: Northern Poland (NP) and Eastern Poland (EP). NP is classified as part of Poland A, while the EP is classified as part of Poland B. This is due to differences in the level of income, wealth, unemployment rate, as well as access to education and culture (Cieślak-Wróblewska, 2021). Poland B is a less developed region of Poland than Poland A as a result of some historical events. The two analysed macro-regions (NP, EP) are economically and culturally different and the original cause of the differences was the territorial partitioning of Poland by Russia, Prussia and Austria. Poland was partitioned and disappeared from maps of Europe and the world for over 120 years. The presence of Prussian culture in NP and of Russian influence in EP has a tangible impact on local livelihoods, culture and economic opportunities.

In our marketing research two categories of fermented vegetable products are considered: traditional products derived from cultural heritage which are well established in the Polish culture, and emergent products, namely those fermented vegetable products that are gradually appearing on the Polish market from abroad, e.g. from Asia. To our knowledge, our research fills the research gap, because although there are studies on the consumption of fermented vegetables products in Poland, there are no comparative studies regarding new emerging products of this type from other countries.

We have divided the article into several parts. After the introduction, the subsequent parts cover the methodological approach, including the design of the RHS model, the results and the discussion. The article ends with conclusions, the research implications and limitations, and further research directions.

## 2. Material and methods

Data were collected through a self-administered on-line survey run in two economically and culturally different regions of Poland to explore similarities and differences between consumer behaviors. We have prepared a measurement tool called the RHS (recognition, habits and sourcing) questionnaire. Data collection was carried out at two universities: University X, the largest university of NP, and University Y, the largest university in EP. The questionnaire was approved by the Research Ethics Committees at both universities. The survey population were households located in either EP or NP represented by students of these universities. The measurement tool was a self-completed survey questionnaire, prepared by the authors in Polish and English, which consisted of an introduction, instructions for the respondents, nine relevant questions and five questions on the demographic characteristics of the students participating in the survey and the characteristics of their households. The English version of the RHS questionnaire was used for efficient communication between the authors of this paper (see Table 1). The following traditional product categories were analysed: fermented cucumbers and sauerkraut. The following emerging product categories were analysed: fermented beetroots, fermented pumpkins, kimchi, fermented carrots, fermented peppers, fermented tomatoes, fermented radishes, fermented mixed vegetables, and other fermented vegetables.

**Table 1.**  
*The RHS questionnaire*

-----	<b>I – Question regarding recognition of the products</b>				
a. fermented beetroots	Do you recognise this food product?				YES (1)
b. fermented pumpkins					NO (0)
c. sauerkraut (fermented cabbage)	<b>II – Questions reflecting household consumption habits</b>				
d. kimchi (fermented Chinese cabbage)	Are fermented sour pickled vegetables consumed in your household?				YES (1)
e. fermented carrots					NO (0)
f. fermented cucumbers	How often is the product (alone or with other foods) consumed in your household?				
g. fermented peppers	Never (0)	No more than once every six months (1)	Monthly (2)	Weekly (3)	Several times a week (4)
h. fermented tomatoes					
i. fermented radishes					
j. other ...fermented mixed vegetables					

Cont. table 1.

<b>III – Questions/statements reflecting sourcing of fermented vegetable products (self-preparation, motives for self-preparation, sourcing of ingredients, sourcing of recipes)</b>					
For each product listed click on the statement that best describes your consumption behaviour at home.					
I/We do not eat this product at home (1)	I/We only buy this product from a store to eat at home (2)	I/We do not make this product but eat product at home only if we get it made by friends or relatives (3)	I/We make this product ourselves to eat at home (from vegetables bought from a store or market) (4)	I/We make this product ourselves to eat at home (from vegetables we grow) (5)	I/We make this product ourselves to eat at home (from vegetables grown by relatives or friends) (6)
If vegetables are pickled in your household, please answer the question: where do you (and/or other members of your household) obtain vegetables intended for pickling? Click all those that apply.					
<ul style="list-style-type: none"> <li>a. Hypermarket/Supermarket</li> <li>b. Discount store, e.g. Lidl</li> <li>c. Small format grocery store</li> <li>d. Market</li> <li>e. Organic shop</li> <li>f. Organic farm</li> <li>g. Farm</li> <li>h. On-line shop</li> <li>i. Other household</li> <li>j. Relatives</li> <li>k. Own vegetable garden</li> </ul>					
If vegetables are pickled in your household, please answer the question: which sources of pickles' recipes are important for you (and/or other members of your household)?					
Not important (0) Important (1)					
<ul style="list-style-type: none"> <li>a. Mother, other relatives and/or friends representing an older generation</li> <li>b. Family and friends of a similar age</li> <li>c. Celebrity Chef's website, TV programme, cookbook etc.</li> <li>d. Cookbooks</li> <li>e. TV programme</li> <li>f. Periodicals and newspapers (paper version)</li> <li>g. Grocery store handouts (e.g. weekly flyers)</li> <li>h. Nutrition interest websites</li> <li>i. Grocery store/Company-branded websites (e.g. Lidl)</li> <li>j. Food blogs</li> <li>k. Food-related mobile applications</li> <li>l. Facebook</li> <li>m. Pinterest</li> <li>n. Own experience</li> </ul>					

Cont. table 1.

If vegetables are pickled in your household, please answer the question: what has motivated you (and/or other members of your household) to prepare fermented sour pickled vegetables on your own? Click to show your level of agreement or disagreement with each statement.					
	Strongly disagree (1)	Disagree (2)	Neutral (3)	Agree (4)	Strongly agree (5)
a. I think that homemade fermented sour pickled vegetables are healthier than those bought from a store. b. I think that making pickles at home is a way of saving money. c. I think that homemade fermented sour pickled vegetables are of a better quality than those bought from a store. d. Self-prepared fermented sour pickled vegetables were always present at my home. e. I like making pickled vegetables at home.					
<b>IV – Profile questions</b>					
Please select the word or phrase that best matches your response.					
What is the place of your residence?			In what macro-region of Poland is located your household?		
a. City of 500,000 inhabitants and more b. City of 100,000-499,999 inhabitants c. City of 20,000-99,999 inhabitants d. City up to 19,999 inhabitants e. Rural areas			a. Central (Łódź, Świętokrzyskie Province) b. Eastern (Podlaskie, Lublin, Subcarpathian Province) c. Northern (Pomeranian, Warmian-Masurian, Kuyavian-Pomeranian Province) d. Southern (Lesser Poland, Silesian Province) e. Northwestern (West Pomeranian, Greater Poland, Lubusz Province) f. Southwestern (Lower Silesian, Opole Province) g. Masovian Voivodship (Masovian Province)		
How many persons are in your household?			What is your self-reported economic status?		
a. 1 b. 2 c. 3 d. 4 e. 5 and more			a. Very good b. Rather good c. Average d. Rather poor e. Very poor		
What is the name of your university?					
UX			UY		

The questionnaire was piloted to ensure all questions were appropriately designed and no changes were made to the final questionnaire. The questionnaire in Polish was distributed via the Internet throughout the universities' channel (emails and MS Teams), social media (Facebook), and personal connection (emails, Messenger). An opportunity sampling method was used; the sample was drawn from that part of the population which was close to hand. It was a group sampling (the whole groups of students were invited to participate in the survey). The completion of the questionnaire was associated with the informed consent to participate in the study. Participation was voluntary. The students who accepted to participate in the study were invited to complete the questionnaire.

The study was positioned with the research questions (RQ) posed, taking into account three research perspectives of the research model: recognition, habits and sourcing: (A) Recognition of products: RQ1: Do consumers recognise particular fermented foods? (B) Household consumption habits: RQ2: What are the household habits regarding the consumption of (individual) fermented vegetable products? (C) Sourcing of products: RQ3: Where do consumers source fermented vegetable products? RQ4: Where are vegetables intended for self-preparation of fermented products sourced? RQ5: What are the motives for self-preparation of fermented vegetable products? RQ6: Where are the recipes for self-preparation of fermented products sourced?

Data were collected through the survey period December 2020 – February 2021 and analysed with Statistica 13.1 PL software, which included descriptive statistics and Chi-squared  $\chi^2$  test. Chi-square test for independence helps us determine whether two classification criteria are independent of each other. This technique makes use of contingency tables (*cross-tabs*) – tables with cells corresponding to cross-classifications of attributes or events (Aczel and Sounderpandian, 2008). It has been assumed that the results are statistically significant when  $p < 0.05$ . Due to the use of a convenience sampling method, we took care to maintain the homogeneity of the sample (Jager, Putnick, and Bornstein, 2017). This homogeneity was promoted by focusing on two groups of students but, respectively, coming from the same universities and regions. The on-line survey responses were collated and then the data was cleaned to avoid duplication or poor quality data. Responses with repeat values and identical IP addresses were discarded. Using this approach, 691 full responses were obtained. Due to the use of the group sampling method the respondents' households were located in seven regions of Poland: Central (n = 24), Eastern (n = 209), Northern (n = 391), Southern (n = 4), Northwestern (n = 18), Southwestern (n = 2), and Masovian province (n = 43). Since the survey was directed to students representing households located in two explored macro-regions: EP and NP, the responses collected from students whose households were located in other five regions were excluded from further analysis.

### 3. Results and discussion

Finally, a sample of 600 households was obtained (EP: n = 209, NP: n = 391) (see Table 2). Nearly two thirds of the households analysed were located in NP. About half of the households analysed were located in big cities of over 100 thousand inhabitants and twenty-six percent of them were in rural areas. Only 16.8% of the households consisted of 1 or 2 members. When asked the perceived financial status just 4% of the respondents stated that was 'rather poor' or 'very poor'. The results are now presented and discussed and introduced by research question. Where the number of respondents varies this is confirmed in each question.



**Table 2.***Profile of the sample (n = 600)*

Variable	Category	Frequency	Percentage (%)
Distribution area of households (region)	Eastern Poland	209	34.83
	Northern Poland	391	65.17
Distribution area of households (place of residence)	City of 500,000 inhabitants and more	127	21.17
	City of 100,000-499,999 inhabitants	181	30.17
	City of 20,000-99,999 inhabitants	98	16.33
	City up to 19,999 inhabitants	35	5.83
	Rural areas	159	26.50
Number of household members	1	18	3.00
	2	83	13.83
	3	142	23.67
	4	218	36.33
	5 and more	139	23.17
Self-reported economic status of respondents	Very good	113	18.83
	Rather good	326	54.33
	Average	137	22.83
	Rather poor	21	3.50
	Very poor	3	0.50

### 3.1. Recognition of products and household habits (RQ1 and RQ2)

The level of recognition was assessed (n = 598) and two traditional fermented vegetable products were well known among the respondents: fermented cucumbers (99.2% recognition) and sauerkraut (96.2%) respectively (see Table 3) confirming results of earlier studies, showed these products are the most popular fermented vegetables in Poland, being highly valued among consumers and having a role in identity formation and associated with home and cultural heritage (Korzeniowska-Ginter, 2017).

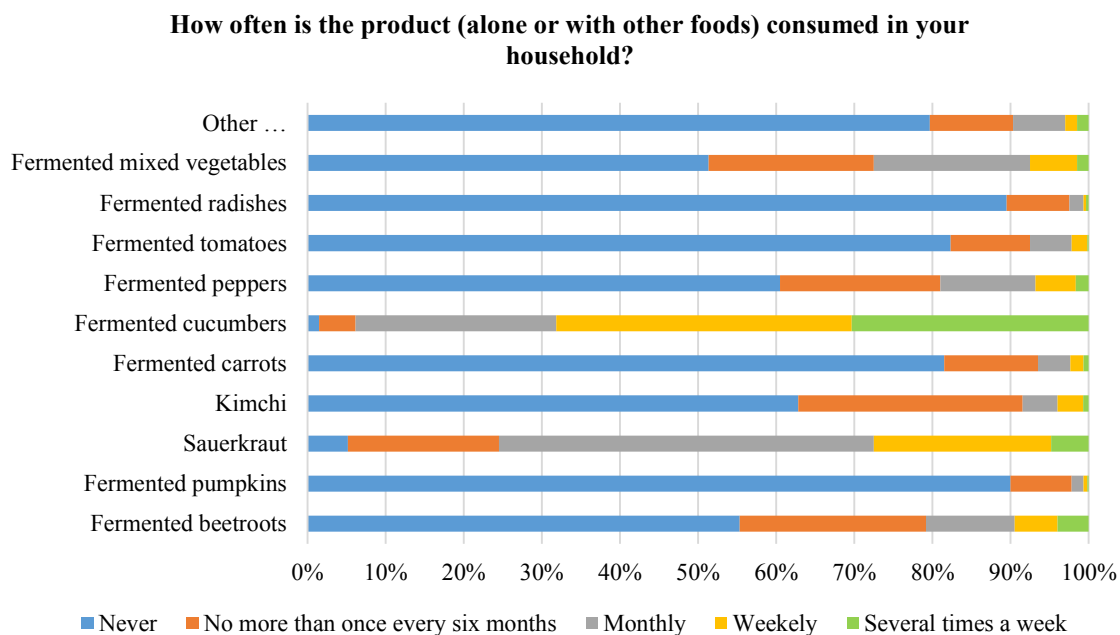
There was a medium level of recognition of fermented beetroots, fermented mixed vegetables, kimchi and fermented peppers among the respondents where around half of the respondents recognised the products. Other fermented vegetable products were the least recognized by the participants (see Table 3) concurring with Czyżowska et al. (2020) and Szutowska et al. (2021). The products are already emerging in Poland since they appear in the (online) store/processing plant offer which are often family-owned, as well as on culinary blogs and in culinary workshops which promote consuming and preparation of fermented vegetable products. Statistically significant differences in recognition of fermented products between the macro-regions were found only for kimchi ( $p < 0.05$ ). The level of recognition of kimchi was associated with location and was higher among respondents from NP (63.5%) than among respondents from EP (40.2%). The level of kimchi recognition was statistically significantly higher (at  $p < 0.05$ ) among respondents living in cities of 500,000 inhabitants and more (there is only one such a city in NP, Gdansk). A statistically significantly lower percentage of respondents from big cities declared that kimchi was “never” consumed in their households whereas a significantly higher percentage of respondents from big cities claimed that kimchi was consumed in their households at least once a month. Polish citizen's preferences regarding

food consumption have changed substantially in recent years. Polish citizens are increasingly experimenting in the kitchen, influenced by culinary programmes and increasing availability of oriental products in supermarkets and discounters. These marketing channels introduce Asian products not only as part of their temporary offers, but also their regular offering. Moreover, a greater interest in Asian cuisine and dishes can be seen in restaurants, mainly in larger cities, where more and more access is being created (Tambor, 2020). The opening of Poland to global gastronomy, fosters interest in various ethnic products. It is influenced by noticeable demographic changes, increase in the level of education, development of tourism, as well as globalization of the living space. However this is more of an urban than a rural trend, especially because it is in cities where specialized grocery stores are available (Pielak, and Czarniecka-Skubina, 2016). Products traditionally consumed in Asia are a novel alternative in Poland and as an important part of a healthy diet (Tamang et al., 2020).

**Table 3.**  
*Fermented vegetable products recognition*

All participants answering this question											
(n = 598)	fermented cucumbers	sauerkraut	fermented beetroots	fermented mixed vegetables	kimchi	fermented peppers	fermented carrots	fermented tomatoes	other	fermented radishes	fermented pumpkins
Percentage that do recognize (%)	99.16	96.15	55.85	55.52	55.35	50.17	28.43	27.42	24.25	18.39	14.04
Participants representing households located in Eastern Poland											
Percentage that do recognize (%)	99.52	99.04	58.37	54.07	<b>40.19</b>	47.37	26.32	32.06	19.62	17.22	11.48
Participants representing households located in Northern Poland											
Percentage that do recognize (%)	98.97	94.60	54.50	56.30	<b>63.50</b>	51.67	29.56	24.94	26.74	19.02	15.42

Only 2.17% of the respondents claimed that fermented vegetable products were not consumed in their households, and they were from NP and this is a statistically significant result ( $p < 0.05$ ). Figure 1 shows the frequency of consumption of particular fermented vegetable products in the sample population. Nearly seven out of ten of the surveyed households (68.16%) ate fermented cucumbers either weekly or several times a week; and just over a quarter of households consumed sauerkraut either weekly or several times a week (27.5%). This result is in line with other studies (Pielak, and Czarniecka-Skubina, 2016; Korzeniowska-Ginter, 2017).



**Figure 1.** Frequency of consumption of fermented vegetable products in the research sample (n = 600).

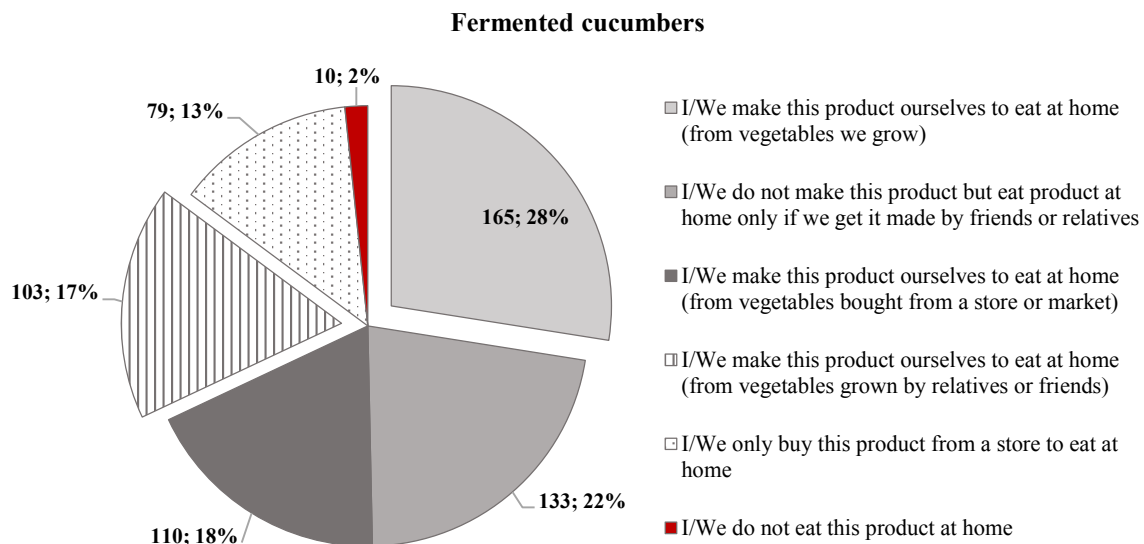
A significant association was also identified between macro-region and the consumption of sauerkraut ( $p < 0.05$ ). Sauerkraut was more often consumed in households located in EP. Respondents from NP, when asked about the frequency of consumption of sauerkraut, more than twice more often answered “never” or “no more than once every six months” (30.42%) than respondents from EP (13.47%). This may be due to culinary heritage, as dishes based on sauerkraut were traditional EP dishes, as cited in historical (Dumanowski, 2019), and cultural references (Kłosiński, 2000). For seven products over half of the respondents said they never consumed the products. In comparison fermented cucumbers and sauerkraut were widely consumed. In summary, the level of recognition for some fermented foods varies by location (RQ1) and the household habits associated with consumption of fermented vegetables (RQ2) has been shown to vary by region and product.

The analysis of responses for the next session is focusing on the two most recognized and more often consumed fermented vegetable products, i.e. fermented cucumbers and sauerkraut.

### 3.2. Sourcing of products (RQ3, RQ4, RQ5 and RQ6)

Only 1.67% of our respondents claimed that fermented cucumbers were not present in their diet and the diet of their households’ members (see Figure 2). Exactly 63% of respondents declared that fermented cucumbers were made at home by them or their households’ members. Over 44.66% of the respondents claimed fermented cucumbers were made either from vegetables grown in their home garden or from vegetables grown by relatives or friends. This may be due to the fact that the number of people cultivating crops in their own allotment gardens in Poland is estimated at 4 million, which constitutes approximately 11% of the adult population. A similar tendency regarding home-made fermented cucumbers was also observed

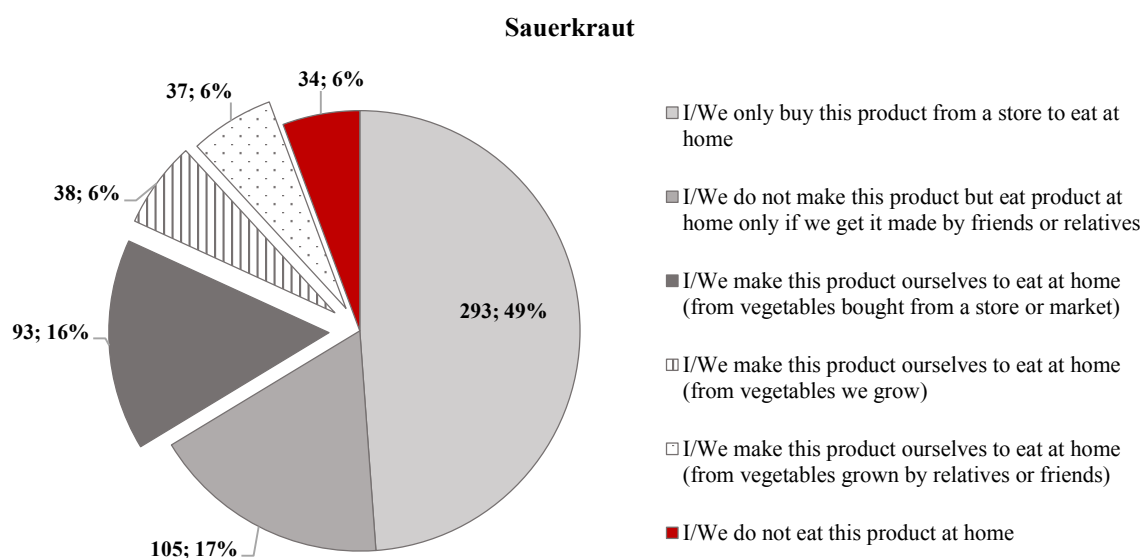
by other studies (Korzeniowska-Ginter, 2017). Allotment gardening in Poland is a century-long tradition that has been cultivated by each new generation. The idea of allotment gardening originated in the 16th century, when plots of land were let, under perpetual usufruct, as gardens to city inhabitants (Mokras-Grabowska, 2020). For several years, there has been a growing interest in having allotment gardens in Poland, which has grown during the pandemic (Szkup, 2020). Therefore, it is not surprising that just 13.17% of our respondents stated that their households purchased fermented cucumbers from a store.



**Figure 2.** Self-reported consumption behaviour concerning home preparation of fermented vegetable cucumbers (n = 600).

A statistically significant association was discovered between place of residence and the way fermented cucumbers were sourced ( $p < 0.05$ ). Fermented cucumbers were more often bought from a store or sourced from relatives/friends in households located in bigger cities of over 100 thousand inhabitants than in smaller cities and rural areas. These products were more likely to be homemade from vegetables grown in own home garden in households located in small towns of under 20 thousand inhabitants and rural areas. The traditional approach to the preparation of this type of products was statistically confirmed by Korzeniowska-Ginter (2017), who recognized that the inhabitants of smaller towns and villages were significantly more likely to prepare homemade preserves, because this was the tradition of their families. The issue of having less access to own raw materials in larger cities, a higher pace of life, and less time to prepare food due to work and commuting also seem to be important. According to Provident Barometer (2018), the preserves were most often prepared by villagers who had access to their own agricultural products. They didn't have to get engaged in shopping, they enjoyed what their land produced and they perceived making fermented vegetables at home as a great way to save money. A statistically significant association was also identified between macro-region and the way fermented cucumbers were sourced ( $p < 0.05$ ). In NP, the percentage of households sourcing fermented cucumbers only from a store was double that of households in EP.

Fermented cucumbers were more often homemade from vegetables grown in own home garden in households located in EP. A statistically significant association was also discovered between number of household members and their sourcing of fermented cucumbers ( $p < 0.05$ ). Fermented cucumbers were more likely to be made from vegetables grown in the home garden in households composed of 5 and more members. Fermented cucumbers were bought from a store twice as frequently in households composed of two members as in households composed of 1, 3 or 4 members. The Provident Barometer (2018) also confirmed that an important factor in making fermented products at home was the number of people in a household. Over 70% of households with four or more people declared that they prepared pickles from vegetables grown in their own home garden. No significant association was identified between self-reported economic status and sourcing fermented cucumbers. Almost half of the respondents (48.83%) claimed that sauerkraut was purchased from a store to consume at home, and 28% of the participants declared that sauerkraut was made at their home, whereas cabbages were more often bought from a store or market (see Figure 3).



**Figure 3.** Self-reported consumption behaviour concerning home preparation of sauerkraut ( $n = 600$ ).

A statistically significant association was identified between place of residence and the way sauerkraut was sourced ( $p < 0.05$ ). Sauerkraut was more often bought from a store in households located in cities of 500 thousand inhabitants and more. Cabbages were more often fermented to make sauerkraut using vegetables grown in home garden in households located in rural areas. The same tendency was reported in Provident Barometers (2018; 2019). A statistically significant association between macro-region and the way fermented cabbages were sourced was discovered ( $p < 0.05$ ). Sauerkraut was more frequently bought from a store in households located in NP and more often made at home from cabbages grown in home garden in households located in EP, as in the case of fermented cucumbers. It is probable that the economic status of respondents from less economically developed regions (e.g., being a part of Poland B)

influences the cultural belief that preserves made at home are cheaper. Homemade preparation of fermented products can be treated as a manifestation of rational food consumption in households and rational sourcing of raw materials (Korzeniowska-Ginter, 2017).

Home gardens (without recreational space) are areas which are usually located around the farm, but separated from the rest of the farm. The presented research data may result from the fact that the total area of such gardens is four times larger in EP than in NP (GUS, 2019a; 2019b).

The majority of consumers surveyed sourced fermented cucumbers from their own households whereas one third of respondents claimed sauerkraut was made at home by them or their households' members (RQ3). The way fermented cucumbers and sauerkraut were sourced differed depending on whether the household was located in urban or rural areas in EP or NP.

Respondents (n = 456) replying to the question on the source of vegetables (RQ4) intended for pickling at home were asked to tick all the answers that applied. Vegetables intended for pickling were reported as being most often sourced in a market (61.18%) and home vegetable gardens (58.33%). Nearly half of households (44.95%) obtained vegetables for pickling from other households, or a discount store (30.7%), farm (28.73%), hypermarket or supermarket (24.56%), small format grocery store (18.2%), then at a lower frequency, organic farm (7.23%), organic shop (3.95%), on-line shop (1.32%), and relatives (1.32%). These results differ from those presented in Provident Barometer (2019), where 75% of the respondents claimed that they prepared preserves using the crops from their own allotment garden and 40% of the respondents declared purchasing vegetables intended for pickling in a store or market.

A statistically significant association (at  $p < 0.05$ ) was shown between place of residence and sourcing vegetables for pickling in hypermarket or supermarket; and between place of residence and sourcing vegetables for pickling in a discount store and/or small format grocery store. Respondents living in rural areas rarely obtained vegetables for pickling from hypermarkets or supermarkets, a discount store and/or a small format grocery store. The preference for these sources of vegetables grew with the increase of the number of inhabitants in a city.

Place of residence and sourcing vegetables for pickling in the home garden was statistically significantly associated ( $p < 0.05$ ). Vegetables intended for pickling were much more likely to be grown in households located in rural areas than urban areas. Macro-region was found to be significantly associated with sourcing vegetables for pickling in hypermarket or supermarket ( $p < 0.05$ ), sourcing vegetables for pickling in a discount store ( $p < 0.05$ ) and sourcing vegetables for pickling in small format grocery store ( $p < 0.05$ ). These sources of vegetables intended for pickling were definitely more popular in households located in NP. The reason for this might be that inhabitants of NP may have less access to home gardens but greater access to supermarket/hypermarket chains (GUS, 2019a; 2019b; 2019c).

A statistically significant association was also identified between macro-region and obtaining vegetables for pickling from home garden ( $p < 0.05$ ). Vegetables intended for pickling were much more often grown in households located in EP. These results show a regional variation in where vegetables are sourced for fermenting and grown in the garden and a difference between rural and urban areas.

The data (see RQ5) suggests that there were two major motives for preparing fermented sour pickled vegetables at home, strong respondents' confidence in (1) the health attributes of homemade fermented sour pickled vegetables; and (2) quality of homemade fermented sour pickled vegetables (see Table 4). Moreover, a large majority of the respondents (72%) "agreed" or "strongly agreed" with the following statements: "... making pickles at home is a way of saving money", "self-prepared fermented sour pickled vegetables were always present at my home". The last declaration shows strong ties to the family's culinary heritage. This is confirmed in the literature on fermented products, where health aspects (Korzeniowska-Ginter, 2017; Tamang et al., 2020); durability and safety (Rezac et al., 2018), cheapness (Korzeniowska-Ginter, 2017), taste and nutritional properties (Rezac et al., 2018; Tamang et al., 2020), willingness to improve physical condition (Rezac et al., 2018), limited trust to products offered by industrial manufacturers (Korzeniowska-Ginter, 2017), and cultural heritage and family tradition (Korzeniowska-Ginter, 2017) are all cited as important factors of influence.

**Table 4.**

*What has motivated you (and/or other members of your household) to prepare fermented sour pickled vegetables on your own?*

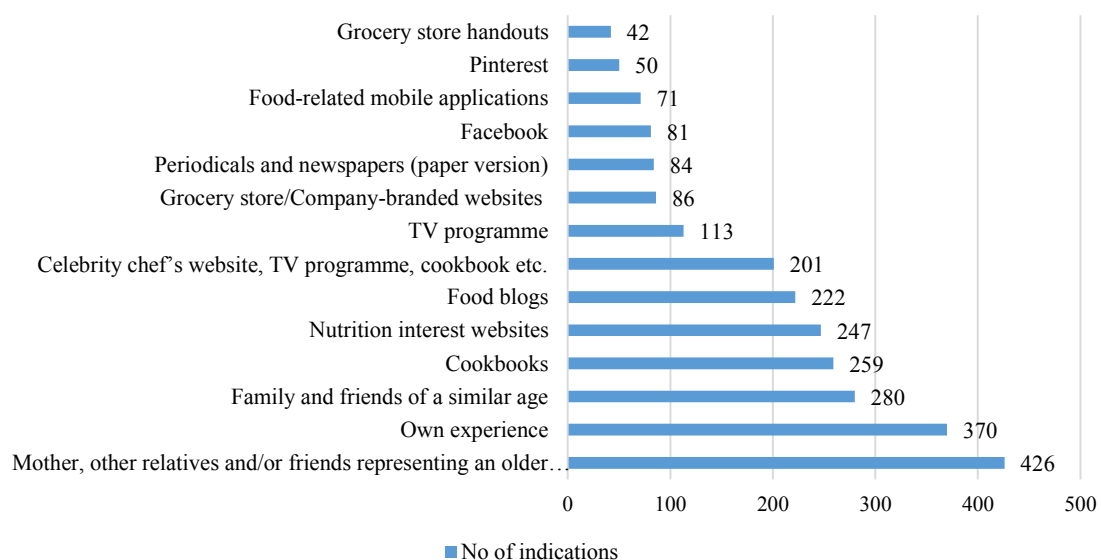
-----	To what extent do you agree or disagree with the following statements?				
	I think that homemade fermented sour pickled vegetables are healthier than those bought from a store (n=478)	I think that making pickles at home is a way of saving money (n=479)	I think that homemade fermented sour pickled vegetables are of a better quality than those bought from a store (n=477)	Self-prepared fermented sour pickled vegetables were always present at my home (n=475)	I like making pickled vegetables at home (n=478)
Strongly disagree	3.6%	2.3%	2.5%	4.2%	<b>13.0%</b>
Disagree	2.5%	5.0%	2.7%	9.5%	<b>19.5%</b>
Neutral	14.0%	21.1%	11.1%	13.5%	32.8%
Agree	<b>34.3%</b>	44.0%	<b>34.4%</b>	37.9%	24.9%
Strongly agree	<b>45.6%</b>	27.6%	<b>49.3%</b>	34.9%	9.8%

Over 73% of the respondents assessed the importance of particular sources of recipes for self-preparation of fermented vegetable products (see RQ6). "Mother, other relatives and/or friends representing an older generation" was most frequently indicated as an important source of such an information. Over 97% of the respondents assessed this source of information as an important one (see Figure 4). It confirms that knowledge of making pickles is a tradition

handed down from generation to generation by word of mouth. This is a very important issue, not only in Poland, because it is related to cultural, family and regional identity and heritage (Dumanowski, 2019). Preparing food at home is often very symbolic and has become a part of family heritage and ritual, especially during various holidays, including religious feasts (Bieńko, 2018). Home has always been associated with tradition, identity and a sense of security. It is not only a place to live, but also a space associated with emotional experiences.

A statistically significant association (at  $p < 0.05$ ) was identified between place of residence and the importance of “celebrity chef’s website, TV programme, cookbook” as a source of pickles’ recipes. Respondents living in bigger cities more often indicated celebrity chef’s activities as an important source of recipes for self-preparation of fermented vegetable products. A statistically significant relationship was also identified between macro-region and the importance of “celebrity chef’s website, TV programme, cookbook” as a source of pickles’ recipes ( $p < 0.05$ ); 33.5% of the respondents living in EP found this source important whilst 55.39% of the respondents from NP found this source important. According to Bieńko (2018), in Poland there is a growing interest in various blogs and culinary programs, especially those run by celebrities, regardless of the consumer's place of residence. The author shows that the most important sources of culinary inspiration are online recipe websites and cookbooks, and the role of the press and TV cooking programs devoted to diets and healthy food has also increased. The popularity of online recipe websites and food blogs reveals a great deal of interest in healthy eating. Social media is one of the key culinary digital communication channels in this area.

#### Which sources of pickles' recipes are important for you?



**Figure 4.** Sources of recipes for self-preparation of fermented vegetable products (n = 439).



A statistically significant relationship was also discovered between place of residence and the importance of food blogs as a source of pickles' recipes ( $p < 0.05$ ). Respondents living in bigger cities more often indicated food blogs as an important source of recipes for self-preparation of fermented vegetable products. A statistically significant association was also identified between self-reported economic status and the importance of Facebook as a source of pickles' recipes ( $p < 0.05$ ). Participants whose self-reported economic status was better, more frequently indicated Facebook as an important source of such recipes. According to the report "Digital 2020," Facebook is not the most frequently chosen medium in Poland (Hootsuite, 2020), it ranks second after Youtube, which may suggest that video presentations may be more important for users. However, Youtube was not included in our research, and this is the limitation of this study.

#### **4. Conclusions**

Pickled cucumbers and sauerkraut were the most recognized fermented vegetable products in this research. Thus, we confirmed that these products are deeply rooted in the culinary tradition of the households represented by the respondents. Their presence in the diet of Polish people has been proven historically and documented in old recipes, and in classical literature. It appeared that respondents with access to land to grow vegetables are more likely to produce them at home and the motives for self-production are linked to family and culinary heritage and tradition, but also to perceived quality and health benefits. Culinary heritage is also important in obtaining recipes for the preparation of fermented vegetable products. The major source of recipes was family members and friends. The inhabitants of smaller towns and villages were significantly more likely to prepare homemade preserves. However, there are emergent trends, mainly in larger cities, manifested by interest in food from other countries, activity on internet forums, observing culinary blogs and celebrity chefs' programs. Although Poland is not a large country, regional differences in terms of consumption, commitment to culinary heritage, engagement with traditional production at home and openness to new market propositions regarding pickles were observed. The inhabitants of EP keep alive the tradition of self-preparation of fermented vegetable products and growing vegetables in their own home gardens while people from NP, especially in larger cities, are less likely to follow traditional methods of production. Our research shows that the region and place of residence influences the consumption of fermented products, as well as related behaviours, customs and culinary traditions.

The findings have theoretical implications as they bring new knowledge about consumer behaviour that is mediated by home heritage and tradition, and region of origin. The results are also of practical value, as a starting point for agencies dealing with food promotion and for importers of ethnic food dealing with its introduction to the market. The regional variances are of note for food marketers and the food industry in general. Promotion of food sustainability and the role of home production of food is also considered in this paper and there is opportunity to consider this further especially the environmental footprint of home produced food, manufacturing produced food and how this compares to imported options available in retail stores.

There are some limitations of the research. Firstly, the use of a convenience sampling method limits the scope of the conclusions and the generalisability of the results. Secondly, there is a lack of prior domestic and international research on the topic. The only studies we have identified came from Polish literature, and considered fermented cucumbers and sauerkraut. Nevertheless, the obtained results constitute an interesting comparative study and are a starting point for further research in this field, e.g. the RHS model can be replicated in future research.

Further research can be focused on recognizing the consumer differences between other regions of Poland, but also between Poland and neighbouring countries with a common history, culinary tradition and heritage, e.g. Lithuania or Ukraine.

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