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SALT CONTENT IN SPICE MIXTURES OF SELECTED PRODUCERS ON THE POLISH MARKET

ZAWARTOŚĆ SOLI W MIESZANKACH PRZYPRAWOWYCH WYBRANYCH PRODUCENTÓW NA POLSKIM RYNKU

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Abstract: Spice mixtures are very popular additives used in food technology and households. They consist of salt (understood as the content of sodium chloride (NaCl)) and vegetables, as well as substances influencing sensory properties, such as those enhancing the taste and aroma and affecting the general appearance and texture of spices. The main aim of the study was to assess the salt content of traditional, conventional spice mixtures in comparison with a new line of spice herb mixtures produced by two leading companies on the Polish market. The traditional mixtures contained salt in a very wide-ranging amounts, from trace amounts to over 50 g salt/100 g of product. Spice herbs produced by both companies did not contain salt. An additional aim of the study was to present ways of dietary salt intake reduction through educational programmes and the implementation of innovative spice mixtures with a reduced salt content or salt-free spice products.

Keywords: spices, salt content, product innovations.

Streszczenie: Mieszanki przyprawowe należą do bardzo popularnych dodatków stosowanych w technologii żywności i gospodarstwach domowych. W ich skład wchodzi sól (rozumiana jako zawartość chlorku sodowego, NaCl) i warzywa oraz substancje wpływające na cechy sensoryczne, jak substancje wzmacniające smak i zapach oraz wpływające na ogólny wygląd i konsystencję przypraw. Celem głównym pracy była ocena zawartości soli w tradycyjnych mieszankach przyprawowych w porównaniu z nową linią mieszanek ziół przyprawowych produkowanych przez dwie wiodące na polskim rynku firmy. Mieszanki tradycyjne zawierały sól w bardzo szerokim zakresie – od ilości śladowych do ponad 50 g soli/100 g produktu. Zioła przyprawowe produkowane przez obie firmy nie zawierały soli. Celem dodatkowym niniejszej pracy było przedstawienie sposobów redukcji soli w diecie poprzez programy edukacyjne oraz stosowanie innowacyjnych mieszanek przypraw o obniżonej zawartości soli lub też produktów przyprawowych niezawierających soli.

Słowa kluczowe: przyprawy, zawartość soli, innowacje produktowe.

1. Introduction

Epidemiological studies conducted in recent years have shown that a high content of table salt in diet causes an increase in blood pressure and may play a role in the increased incidence of cardiovascular diseases (Gardener, Rundek, Wright, Elkind, and Sacco, 2012; Mente et al., 2021; Strazzullo, D'Elia, Kandala, and Cappuccio, 2009). In addition, high salt intake increases fluid intake and urine volume, and increases urinary osmolyte excretion. Salt-induced metabolic changes may link high salt intake with diabetes mellitus, osteoporosis, obesity, and an increased risk of cardiovascular diseases (Rakova, Luft, and Titze, 2017).

Therefore, the WHO, as well as the UN resolution of the 66th World Health Assembly in 2013, pointed out that one of the solutions is to reduce the consumption of table salt, i.e. sodium chloride, to below 5 g per day (Sixty-sixth World Health Assembly… 2013; WHO, 2012). Yet, one cannot ignore the results of studies which show that lowering the sodium chloride content in the diet to below 5 g per day, and especially below 2 g per day, is as dangerous as its high consumption (Cappuccio, Beer, and Strazzullo, 2019; Cook, He, MacGregor, and Graudal, 2020; Mente et al., 2016; Mente et al., 2018; O'Donnell et al., 2014). It should also be remembered that iodized table salt is often the primary dietary source of iodine, so a drastic decrease in table salt consumption would result in a reduced iodine supply (Zygmunt et al., 2019).

Studies conducted in many countries show that the consumption of salt, understood only as sodium chloride consumption, exceeds the recommended dose of 5-6 g NaCl / day (Kloss, Meyer, Graeve, and Vetter, 2015). However, properly assessing salt intake is a challenging task. The tools used for testing, such as questionnaires or food diaries, are insufficient to characterize an individual salt intake. Therefore, 24-hour sodium excretion in the urine is considered the reference method for assessing salt intake, because approximately 93% of sodium ingested, mainly in the form of salt (understood as sodium chloride – 2.5 g of NaCl contains 1 g of sodium), is eliminated via the kidneys over the next 24 hours (Lucko et al., 2018). There are also limitations to this method, especially in very hot climates where large amounts of salt may be excreted with sweat. People in different climates can vary greatly in their salt intake and fluid intake, as well as blood pressure.

Salt consumption in selected European countries is presented in Table 1.

Table 1. Daily salt intake in selected European countries
Tabela 1. Dzienne spożycie soli w wybranych krajach europejskich

Country/ Kraj	Daily salt intake/ Dzienne spożycie soli
1	2
Finland/ Finlandia	9.4 g men, 7.3 g women
France/ Francja	10.0 g men, 8.0 g women

Table 1, cont.

1	2
Germany/ Niemcy	>10 g (30% women, 50% men)
Ireland/ Irlandia	10.4 g men, 7.6 g women
Italy/ Włochy	10.8 g men, 8.3 g women (2008-2012) 9.5 g men, 7.2 g women (2018-2019)
Netherlands/ Holandia	10.9 g men, 7.8 g women
Poland/ Polska	11.5 g
Portugal/ Portugalia	12.3 ± 3.8 g 10.7 g
Spain/ Hiszpania	11.5 g men, 8.4 g women
Sweden/ Szwecja	11.4 g men, 8.7 g women
UK/ Wlk. Brytania	9.5 ± 0.2 g 8.3 g men, 6.8 g women

Source: own study based on (Hendriksen, van Raaij, Geleijnse, Breda, and Boshuizen, 2015); Kloss et al., 2015).
Źródło: opracowanie własne na podstawie (Hendriksen, van Raaij, Geleijnse, Breda, and Boshuizen, 2015; Kloss et al., 2015).

2. Salt intake reduction programmes

The data in Table 1 show that in order to achieve the salt intake recommended by the WHO in European countries, appropriate educational programs should be implemented. Such programmes have already been implemented in Portugal and the United Kingdom. In these countries, salt consumption has fallen in recent years, but in both of these countries salt consumption continues to exceed the target values (Gonçalves 2020; Hendriksen et al., 2015).

Diagnosing factors that can reduce salt intake has highlighted several possibilities. One of them is the food industry's commitment to reducing salt in processed foods. It is postulated to lower the salt content, e.g. in meat, bakery and vegetable processing industries. The next step is to inform consumers about the salt content of products through correct labelling. Such forms of informing about high salt content, e.g. in breakfast cereals, have already been introduced in the UK and in Canada. Unfortunately, they were shunned by food producers, as they discouraged consumers from purchasing these products. This marking is based on the traffic lights system

(Figure 1). The colour coding of traffic lights on food products was an intervention in terms of public health in order to improve the dietary habits of consumers. The idea was to avoid foods with red light on the label for ingredients such as energy, total fat, saturated fat, sodium, and sugar intake by adults. In studies carried out in Canada, following the introduction of the traffic light labels system, the consumption of calories was reduced by 5%, total fat by 13%, saturated fat by 14%, and sodium by 6% (Emrich, Qi, Lou, and L'Abbe, 2017).

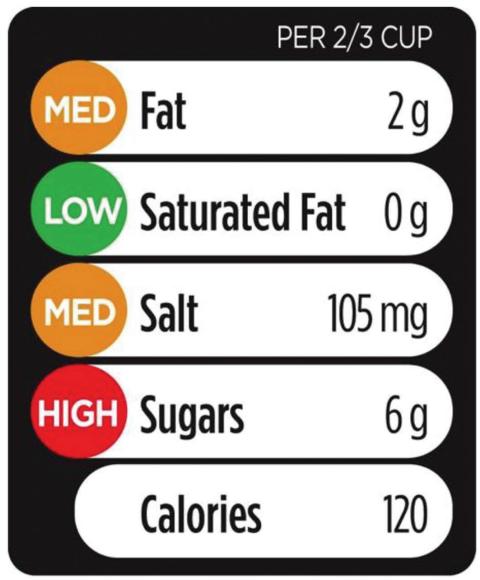

Fig. 1. Example of a traffic light label on the front of the packaging
Rys. 1. Przykład etykiety sygnalizacji świetlnej z przodu opakowania

Source/Źródło: (Emrich et al., 2017).

The World Action on Salt, Sugar and Health (WASSH) was established to implement nutritional education and WHO recommendations. It is a global group whose mission is to improve the health of the global population by gradually reducing salt and sugar consumption. WASSH has expert members in 100 countries, mainly in the field of hypertension, cardiovascular diseases, obesity and kidney diseases, but also working in the fields of public health and nutrition. WASSH shares information and research on salt and sugar reduction, advises on the development and implementation of salt and sugar reduction programmes, and conducts international product research through its members. The implementation of these tasks takes place, for example, as part of the World Salt Awareness Weeks. The World Action on Salt and Health (WASH) was held on March 12-18, 2018 under the catchphrase **"5 ways to 5 grams**" (Figure 2). The slogan of the campaign in 2021 was "**Less salt,**

more flavor". The next World Salt Awareness Week event will take place on March 14-20, 2022 under the slogan "**Shake the salt habit!**" (Figure 3).

Fig. 2. Poster of World Action on Salt and Health in 2018
Rys. 2. Plakat World Action on Salt and Health w 2018 r.
Source/Źródło: www.worldactiononsalt.com

Fig. 3. Poster of World Action on Salt and Health in 2022
Rys. 3. Plakat World Action on Salt and Health w 2022 r.

The programme of reducing excess dietary salt is planned in 5 steps:

- educating about the dangers of consuming excessive amounts of salt,
- checking the amount of salt in food products,
- encouraging school and staff canteens to offer dishes with less salt,
- informing consumers about the salt content through the appropriate labelling of food products,
- encouraging food producers to reduce the amount of salt in food products.

Changes are being introduced in the technology of food products, e.g. in the processing of meat and cheese, using spice mixes with reduced addition of salt or containing potassium, magnesium or calcium salts instead of sodium chloride. However, one should be aware that lowering the sodium chloride content too much in processed meat, cheese and bakery products may affect the composition of the microbiota and the palatability of the preserves. The research results also indicate that the problem concerns not only the reduction of salt content in food products, but that the consumption of certain products, such as red meat and its products, should likewise be reduced (Feng et al., 2021; Halagarda and Wójciak, 2022; Rysová and Šmídová, 2021).

Recently an intensive development of product and process innovations in spices, especially in seasoning mixtures, has been observed. Spice mixtures are of great importance in industrial food processing and in catering technology. Spice mixtures

can be treated as convenient additives in the preparation of meals. They standardize the sensory values of dishes and facilitate the work of preparing meals at home, in canteens and restaurants (Śmiechowska, Newerli-Guz, and Skotnicka, 2021). Earlier studies showed that spice mixtures may contain a very large amount of salt in their composition and thus pose a health hazard in case of their excessive use (Śmiechowska and Kaczmarczyk, 2014).

3. Purpose of the work, research material and methodology

The aim of this study was to determine the salt content of selected spice mixtures produced by two leading companies on the Polish market. The study was carried out both in traditional mixtures and in innovative mixtures containing no added salt. The research material consisted of seven spice mixes from two companies identified here as company A and company B, and five mixes without salt addition. The products were purchased in the so-called Tricity (Gdańsk, Gdynia and Sopot) in Poland, and the research was carried out in 2018. The determination of salt content was carried out using the Mohr method in four repetitions for each spice sample (Krełowska-Kułas, 1993). The method is based on the precipitation of chloride anions (Cl^-) in aqueous solution with a standard solution of silver nitrate ($AgNO_3$) as a titrant in the presence of potassium chromate (K_2CrO_4) as an indicator. Prior to the determination, the studied spice samples were dissolved in warm water and decanted. The statistical analysis of the results was performed in a spreadsheet. For each sample, the standard error of mean was calculated and the difference between the mean value and the expectation value (producer's declaration) was assessed using t test at $p = 0.05$.

Before performing the experiment, the labelling of the mixtures was assessed in accordance with the currently applicable requirements contained in Regulation (EU) No 1169/2011 of the European Parliament and of the Council of 25 October 2011 on the provision of food information to consumers (Regulation (EU) No 1169/2011).

4. Results and discussion

The packaging of the spice mixtures selected for this study contained basic information in accordance with the requirements of Regulation (EU) No 1169/2011 of the European Parliament and of the Council of 25 October 2011 on the provision of food information to consumers. Ingredients with known allergenic properties were highlighted in bold, informing consumers about the possible presence of trace amounts of allergens, such as chicken eggs, celery, soybeans and others. Information of this type is willingly placed on spice packaging and serves not only marketing purposes, but also has informational potential. Sometimes, however, the labelling is illegible and consumers, especially older people, are unable to read it (Newerli-Guz, 2011). The requirement to inform consumers forces the producers to provide a lot of information, sometimes posing a challenge for packaging designers to include this in a small area.

Information security is an important element of food safety and has a significant impact on the evaluation of the quality of foodstuffs in the opinion of consumers (Śmiechowska and Kłobukowski, 2017). It should be noted that spices may pose a threat to the life and health of consumers for various reasons, both natural and those related to the toxicological aspects of plants, as well as hazards that may arise during technological processes or during storage.

Tables 2 and 3 show the results of the salt content determination in the seasoning mixtures produced by companies A and B. The seasoning mixes by company A had a very wide range of salt content, from trace amounts of salt (below 0.30) to 58.8 ± 0.53 g/100 g of product. For spice mixes produced by company B, the salt content was in the range of 24.7 ± 0.14 to 47.3 ± 0.71 g/100 g of product. In 10 out of 14 studied seasoning mixtures, the salt content was concordant with the producer's information on labeling. In one sample by company A (no. 3) the salt content was statistically significantly lower than declared, while in three samples by company B (no. 1, 6, 7) the salt content was in turn statistically significantly higher than declared ($p = 0.05$). However, the extent of the discrepancy was relatively minor and did not exceed 1.1 g/100 g (for spice 1 by company B).

Table 2. The salt content of the spices produced by company A
Tabela 2. Zawartość soli w przyprawach firmy A

Sample no./ Numer próby	Seasoning mix name/ Nazwa mieszanki przyprawowej	NaCl content/ Zawartość NaCl [g/100 g]	Salt content declared by producer/ Zawartość soli deklarowana przez producenta [g/100 g]
1	Seasoning for minced meat/ Przyprawa do mięsa mielonego	15.2 ± 0.21	15.0
2	Seasoning for fish/ Przyprawa do ryb	37.2 ± 0.64	37.3
3	Seasoning for gyros/ Przyprawa do gyrosa	32.6 ± 0.61	33.5
4	Seasoning for bigos/ Przyprawa do bigosu	45.2 ± 0.39	45.0
5	Tripe spice/ Przyprawa do flaków	0.3 ± 0.34	0.0
6	Spice for ribs with honey/ Przyprawa do żeberek z miodem	35.9 ± 0.70	35.7
7	Seasoning for grill/ Przyprawa do grilla	58.8 ± 0.62	59.4

Source: own research.
Źródło: badania własne.

In 12 out of 14 selected mixtures, salt was mentioned in first place in the product composition. Only in two spices produced by company A the situation was different. In the seasoning for minced meat, salt was listed as the third ingredient, and in

the seasoning for tripe the manufacturer did not use sodium chloride at all during production.

The amount of salt in the spice mixtures currently produced by companies A and B is lower than those determined back in 2014. In the samples of spice mixtures tested then by Śmiechowska and Kaczmarczyk, from 27.88 ± 0.05% to 64.59 ± 0.15% of salt (NaCl) was found. A dish prepared with the addition of spice mixtures can contribute 20-47% of table salt to the daily diet (Śmiechowska and Kaczmarczyk, 2014).

Table 3. The salt content of the spices produced by company B
Tabela 3. Zawartość soli w przyprawach firmy B

Sample no./ Numer próby	Seasoning mix name/ Nazwa mieszanki przyprawowej	NaCl content/ Zawartość NaCl [g/100 g]	Salt content declared by producer/ Zawartość soli deklarowana przez producenta [g/100 g]
1	Seasoning for minced meat/ Przyprawa do mięsa mielonego	29.1 ± 0.32	28.0
2	Seasoning for fish/ Przyprawa do ryb	42.1 ± 0.45	42.0
3	Seasoning for gyros/ Przyprawa do gyrosa	38.2 ± 0.62	38.8
4	Seasoning for bigos/ Przyprawa do bigosu	42.0 ± 0.47	41.5
5	Tripe spice/ Przyprawa do flaków	47.3 ± 0.71	46.9
6	Ribs seasoning/ Przyprawa do żeberek	24.7 ± 0.14	24.4
7	Seasoning for grilling/ Przyprawa do grilla	25.8 ± 0.42	25.0

Source: own research.
Źródło: badania własne.

Novel trends in spice mixtures explore several directions. The first is to eliminate non-plant elements to a greater extent. Spice mixtures without added monosodium glutamate and with a reduced salt and sugar content have appeared on the market. Many producers also refrain from adding ingredients containing gluten (Śmiechowska et al., 2021). Mixtures of spices replacing table salt have also appeared on the market (Taladrid, Laguna, Bartolomé, and Moremo-Arribas, 2020).

No salt was detected in any of the herbal spice mixtures produced by companies A and B listed in Table 4. However, two herbal spices produced by both companies require attention, namely Herbes de Provence and Mediterranean herbs, and although these spice mixes by both producers share the same name, they differ in composition. Research conducted by Newerli-Guz (2011) showed that Provencal herbs from different producers available on the Polish market had a different composition, however, the issue of the authenticity of spices and seasoning mixtures requires a separate study.

Table 4. Salt-free herbal spice mixtures produced by companies A and B
Tabela 4. Zioła przyprawowe firm A i B niezawierające soli

Sample no./ Numer próby	Name of herbal spice mix by company A/ Nazwa mieszanki ziołowej firmy A	Sample no./ Numer próby	Name of herbal spice mix by company B/ Nazwa mieszanki ziołowej firmy B
1	Herbs for poultry/ Zioła do drobiu	1	Dalmatian herbs/ Zioła dalmatyńskie
2	Herbes de Provence/ Zioła prowansalskie	2	Herbes de Provence/ Zioła prowansalskie
3	Italian herbs/ Zioła włoskie	3	Transilvanian herbs/ Zioła transylwańskie
4	Mediterranean herbs/ Zioła śródziemnomorskie	4	Mediterranean herbs/ Zioła śródziemnomorskie
5	Greek herbs/ Zioła greckie	5	Thai herbs/ Zioła tajskie

Source: own research.

Źródło: badania własne.

5. Summary

Medical studies show that high salt (sodium) intake causes higher blood pressure and an increased risk of cardiovascular diseases. It has been confirmed that very low salt intake can likewise adversely affect one's health (Cappuccio et al., 2019; Cook et al., 2020; Mente et al., 2018; Rakova et al., 2017).

The salt intake by consumers is at least twice as high as the reference value of 5 g/day (Kloss, Meyer, Graeve, and Vetter, 2015). In order to achieve this level one should, among others, reduce the salt content in industrially produced food and in home cooking. Such food includes spices that are widely used in food technology, catering technology, and in households.

WASSH activists postulate reducing the addition of salt in salty snacks, meat products, smoked fish, rennet cheeses, as well as vegetable preserves such as soups, sauces, and spices. Innovative food products such as seasoning mixtures are increasingly made with little or no salt at all.

In order to reduce the dietary intake of salt, first of all, education should be directed to various groups of society, promoting products with a reduced salt content. The annual World Salt Awareness Week also helps to reduce dietary salt intake. Experience to date shows that the most effective are combined activities consisting in extensive educational campaigns as well as advertising campaigns for products with a reduced salt content carried out with the participation of the mass media (Silva-Santos et al., 2022).

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