

ПРОГРЕСС В ПРОФИЛАКТИКЕ И УСТРАНЕНИИ ЙОДОДЕФИЦИТНЫХ ЗАБОЛЕВАНИЙ (ЙДЗ) В РЕГИОНЕ ЕВРОПЫ И ЦЕНТРАЛЬНОЙ АЗИИ (ЕЦАР) В 2010–2020 ГОДАХ



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Йодирование соли в странах региона Европы и Центральной Азии (ЕЦАР) имеет долгую историю. Стратегии всеобщего йодирования соли (ВЙС) были повторно введены в странах ЕЦАР в середине 1990-х гг. и получили мощный импульс в течение десятилетия 2000–2009 гг.: к концу 2009 г. доступ населения в ЕЦАР к адекватно йодированной соли увеличился до 55%. Это было качественным скачком по сравнению с предыдущим десятилетием, но все еще ниже целевого показателя в 90%. Целью этого обзора было задокументировать достижения и проблемы ВЙС в 18 странах ЕЦАР за десятилетие 2010–2020 гг. и разработать рекомендации по устойчивому поддержанию ВЙС. Обзор проводился на основе анализа информации, полученной из различных источников, включая офисы ЮНИСЕФ и национальных координаторов глобальной сети по йоду (ГСЙ), а также общедоступных онлайн-ресурсов и публикаций. Исходя из имеющейся информации, страны ЕЦАР делятся на 3 группы. *Группа 1. Йодный дефицит устойчиво устранен*: 11 стран (Армения, Азербайджан, Босния и Герцеговина, Косово, Северная Македония, Черногория, Сербия, Туркменистан, Казахстан, Кыргызстан и Грузия) успешно сохранили достигнутый ранее адекватный йодный статус. Эта группа стран должна сосредоточиться на поддержании ВЙС, обеспечить включение цели ВЙС по использованию йодированной соли в домашних хозяйствах и пищевой и хлебопекарной промышленности в соответствующие национальные программы. *Группа 2. Йодный дефицит устранен, но есть риск отката назад*: 3 страны (Албания, Молдова и Кыргызстан) сохранили адекватный йодный статус населения, но потребление адекватно йодированной соли в домохозяйствах остается низким, а использование йодированной соли в промышленно обработанных пищевых продуктах (ПОПП) — неоднородным, тогда как слабая система мониторинга надзора ставит под угрозу устойчивость ВЙС. Этим странам даны рекомендации по обеспечению строгого мониторинга и соблюдения национальных стандартов йодированной соли для обеспечения постоянного и высокого (>90%) использования йодированной соли на уровне домашних хозяйств, а также при производстве основных солесодержащих ПОПП (в основном хлеба). *Группа 3. Устранение йодного дефицита требует дополнительных усилий*: в 4 странах (Россия, Таджикистан, Украина и Узбекистан) население в целом и наиболее уязвимые группы в частности сохраняют неадекватный йодный статус. Этой группе стран необходимо усилить внедрение ВЙС путем более тесного взаимодействия с производителями соли и частным сектором и выявления ресурсов для улучшения мониторинга. Принятие законодательства по ВЙС имеет первостепенное значение для достижения высокого охвата йодированной солью и оптимального йодного статуса населения в России и Украине. Материалы настоящего обзора подтверждают, что стратегия ВЙС успешно поддерживается в большинстве стран ЕЦАР. Опыт, накопленный в этом регионе, дополняет растущее количество свидетельств того, что ВЙС является эффективной стратегией снижения йодной недостаточности у населения, и поддерживает точку зрения о том, что глобального успеха можно добиться, сделав йодирование пищевой соли нормой.

КЛЮЧЕВЫЕ СЛОВА: йодный статус; йодированная соль; дети школьного возраста; беременные женщины; Европа; Центральная Азия; Глобальная сеть по йоду; ЮНИСЕФ.

PROGRESS IN IODINE DEFICIENCY DISORDERS (IDD) CONTROL AND ELIMINATION IN EUROPE AND CENTRAL ASIA REGION (ECAR) IN 2010–2020

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Salt iodization in Europe and Central Asia Region (ECAR) countries has a long history. Universal salt iodization (USI) strategies were reintroduced in ECAR countries in the mid-1990s and gained strong momentum during the 2000–2009 decade: by the end of 2009, access to adequately iodized salt by the population in ECAR had risen to 55% — a quantum leap improvement compared to a previous decade but still short of the operational target of 90%. The objective of this review was to document the USI achievements and challenges in the 18 ECAR countries during the decade of 2010–2020 and developed recommendations for actions to maintain the USI. The review was conducted by analysis of information obtained from a variety of sources, including communication with UNICEF country offices, IGN National Coordinators as well as online resources and publications available publicly. Based on available information, countries of the ECAR fall into 3 groups. *Group 1. USI at scale*: 11 countries (Armenia, Azerbaijan, Bosnia and Herzegovina, Kosovo, North Macedonia, Montenegro, Serbia, Turkmenistan, Kazakhstan, Kyrgyzstan and Georgia) successfully sustained the adequate iodine status achieved earlier. This group should

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focus on USI maintenance ensuring that the USI target of uninterrupted universal use of iodized salt in households and food/bakery industry is included into relevant national programs, along with the salt reduction targets. *Group 2. USI at scale but risk of slippage*: 3 countries (Albania, Moldova and Kyrgyzstan) sustained the adequate iodine status of population but their household use of adequately iodized salt remains low and the use of iodized salt in processed foods — patchy, with weak regulatory monitoring and enforcement systems in place putting sustainability at risk. Recommendations for these countries are to secure strong regulatory monitoring and enforcement of the national iodized salt standards to ensure consistent and high (>90%) use of iodized salt at household level as well as in production in key salt-containing industrially processed staple foods (especially, bread). *Group 3. USI — more efforts needed*: in 4 countries (Russia, Tajikistan, Ukraine and Uzbekistan), the population and, specifically, most vulnerable groups continued to suffer from inadequate iodine status. This group of countries will need to enhance and expand their existing USI effort by better engaging with salt producers and private sector and identifying resources for improved regulatory monitoring. Adoption of USI legislation is paramount to reaching high iodized salt coverage and optimum iodine nutrition in Russia and Ukraine.

The data and information in the present review confirm that USI strategy is successfully sustained in the majority of countries in the ECAR. The experiences in this region add to the growing evidence that USI is effective in alleviating iodine deficiency in the population and support the view that global success can be achieved by ensuring that food-grade salt iodization becomes the norm in the salt industry and society.

KEYWORDS: iodine status; iodized salt; school children; pregnant women; Europe; Central Asia; Iodine Global Network; UNICEF

INTRODUCTION

The 43rd World Health Assembly (1990) proclaimed the elimination of Iodine Deficiency Disorders (IDD) as a major public health goal for all countries, and both the World Health Organization (WHO) and United Nations Children's Fund (UNICEF) have recommended Universal Salt Iodization (USI) as a safe, cost-effective and sustainable strategy to ensure sufficient intake of iodine by all individuals [1]. The global Agenda 2030 and Sustainable Development Goals (SDG) adopted by the UN General Assembly [2] in 2015 introduced the SDG target 2: "By 2030, end all forms of malnutrition and leave no one behind" [3]. At least 10 out of 17 SDG are related to optimal nutrition status of individuals and nations, and, by implication, to the achievement of the adequate iodine status.

USI involves the iodization of all human and livestock salt, including salt used in the food industry. Adequate iodization of all salt delivers iodine in the required quantities to the population on a continuous and self-sustained basis [4].

Salt iodization in Europe and Central Asia Region (ECAR)^a countries has a long history. The first regulation on salt iodization in the former Yugoslavia was introduced in 1937, initially for only household salt directed to endemic goiter areas. In 1954, iodization was expanded to all salt for human and animal consumption and made mandatory for the entire country. The main source of iodized salt in that country was "Solana Tuzla", which was originally established in 1885. Based in Bosnia and Herzegovina (B&H), the company continued producing iodized salt even during the siege of Tuzla during the Balkan war in the 1990s [5].

In the former USSR, pilot salt iodization programs started in 1938 and resumed after the Second World War. In 1954, the USSR Ministry of Health (MoH) issued an Executive Order that required iodized salt supply to all "endemic goiter areas" of the country. The list of these areas was defined by the MoH and, in fact, covered most of the administrative regions of Russia and other Soviet Republics. As salt iodization was not mandatory otherwise, the amount of iodized

salt production was defined by the annual supply requests from the Ministries of Trade and of Food Industry of each of the Soviet Republics. After large-scale goiter surveys during the late 1960s demonstrated that new cases of cretinism had ceased and the prevalence of goiter had fallen to a sporadic level in the endemic regions, the USSR MoH proclaimed endemic goiter as "virtually eliminated disease". It also discontinued the monitoring of iodized salt supplies and iodine status of the population (i.e., goiter incidence and prevalence). As would be expected in hindsight, high prevalence of iodine deficiency recurred once the salt iodization system entirely collapsed after the dissolution of the USSR in 1991 [6].

USI strategies were reintroduced in ECAR countries in the mid-1990s and gained strong momentum during the 2000–2009 decade. By the end of the first decade, several countries in the Region had already reached the goal of optimum iodine nutrition; other countries were quickly approaching this goal, and in only a few countries the progress toward USI had remained slow or high-level political commitment had not yet materialized in enacting a mandate [5].

More recently, the emphasis across ECAR countries has started shifting toward approaches that can self-sustain the USI successes. The importance for iodine nutrition of industrially processed foods (IPF) is becoming paramount, provided these foods are formulated with iodized salt in the recipe [7]. To tackle population-wide high blood pressure levels, national strategies to reduce salt intakes are also gaining momentum, and to avoid counter-productive policy practices, the need to ensure synergy between the two strategies has come to the fore [8].

The COVID-19 pandemic which started in late 2019 had adversely affected the region through the collapse in global commodity prices, disruptions to regional supply chains and the decline in domestic demand. These trends project medium to long-term risks to the health and wellbeing of children and their families, which may impede the SDG progress towards the 2030 deadline, through the risks of decreased budgets for public services [9], including, for health and agriculture and the disruption to the implementation of national programs, including those related to micronutrient nutrition.

^a Formerly — Central and Eastern Europe and Commonwealth of Independent States (CEE/CIS) Region of UNICEF

UNICEF and IGN started supporting the national counterparts in ECAR in reaching for USI from the mid-1990s using the lessons learned from experience in other parts of the world. The global USI record showed that by the year 2000 only about 20% of the population in the majority of countries in the region was using iodized salt.

In 2009 UNICEF commissioned a report aimed at documenting the experiences, achievements and lessons learned from USI strategies in 20 countries of the region during the previous decade (2000–2009) that was published in 2010. It showed that by the end of 2009, access to adequately iodized salt by the population in ECAR countries had risen to 55% — a quantum leap improvement compared to a decade ago but still short of the operational target of 90%. The report demonstrated that during 2000–2009 the USI strategy was accomplished, along with a demonstration of adequate population iodine nutrition, in 9 countries of the region. USI was close and population iodine nutrition indicators showed mostly minor imperfections in 6 countries. “True” USI (i.e. mandatory iodization of salt all salt for human consumption, including salt for food industry) had been enacted in 13 of these 15 countries. The report concludes that exemplary progress has been made during the 2000–2009 decade in the region but numerous problems remained to be solved [10].

In this context, a decade later, in late 2020, UNICEF ECAR Office commissioned IGN to document the progress in USI, including the achievements and challenges in countries during the period of 2010–2020, in order to develop recommendations to support country teams to safeguard their USI achievements from potential pandemic-imposed risks. This article is based on the proceedings of this progress review.

METHODOLOGY

The objective of the present review, conducted by an IGN team in 2021 with support from UNICEF ECAR Office, was to document USI achievements and challenges in the ECAR countries during the decade of 2010–2020 and formulate recommendations for actions to sustain the national salt iodization programs. The review is based on analysis of information obtained from a variety of sources, including UNICEF country offices, national nutrition focal points and IGN National Coordinators as well as publicly available online resources, such as population-based studies and WHO Global GINA database [11]. The analysis of data was conducted based on the framework of the (2007) WHO/UNICEF/IGN Guideline “Assessment of iodine deficiency disorders and monitoring their elimination” [12] and builds on the monitoring formats applied earlier by the UNICEF in similar assessments [10]. These allowed monitoring the progress and indicating achievement of sustainable elimination of IDD through USI as well as identifying implementation gaps. Addressing these gaps will help to ensure maintenance of USI through continuous sustainability. The status of the indicators in countries and their integrated analysis is presented in the next sections of the article.

The analysis includes 18 countries of the region, namely the four Eastern European countries: Belarus, Moldova, Russia^b and Ukraine; the three states of the South Caucasus:

Armenia, Azerbaijan and Georgia; and the five Central Asian republics: Kazakhstan, Kyrgyz Republic, Tajikistan, Turkmenistan and Uzbekistan. It also includes the six West-Central European states of Bosnia and Herzegovina, Kosovo^c, North Macedonia, Montenegro, Serbia and Albania.

FINDINGS

Legislation and normative base:

Recent international evidence confirms that salt with iodine content at an “adequate” level (around 25 mg/kg), when it makes up a high proportion of the total amount of salt consumed, provides sufficient amount of dietary iodine to ensure adequate iodine nutrition in all population groups, including pregnant and lactating women and breastfed infants [13]. It is also well established that the commitment to IDD elimination by a national government is essential to the achievement of the USI. Evidence of political commitment to USI and IDD elimination comes in the form of legislation that mandates that all salt for human consumption must be iodized [11].

By 2010 mandatory USI legislation and/or normative base had already been enacted in all ECAR countries, except in Ukraine and Russia. Post 2010, changes in policy or legislation were reported in several ECAR countries. In Bosnia and Herzegovina, the use of only KIO₃ was made compulsory and salt iodization level increased to 20–30 mg/kg. In Moldova, the salt iodine standard was lowered in 2011 to 20–35 mg/kg and the provision of iodized salt was made obligatory in restaurants and public catering. In 2015, the Parliament in Uzbekistan adopted an amendment to the USI law, which abolished the previous requirement to provide non-iodized salt to people with “contraindications” to iodized salt; now all the salt intended for human consumption must be iodized. In Tajikistan a more comprehensive Food Fortification Law had been adopted in 2019 that replaced previous IDD Prevention Law of 2002. Montenegro in 2020 updated its Rulebook on salt iodization and increased iodine level in salt to 20–30 mg/kg from previous 12–18 mg/kg. In Albania the revised USI Law (2020) requires the use of iodized salt for human and animal consumption and in the food industry. Some countries, such as Moldova, Russia and Turkmenistan, mandate the use of iodized salt in public (state-funded) catering, such as school lunches.

In terms of the salt iodization standard, all the former USSR countries, except Moldova, share a common standard of 25–55 mg iodine/kg salt. The Balkan countries apply lower iodization levels (20–30 mg/kg), with the lowest (12–18 mg/kg) still remained in Serbia. It should be noted that the majority of the countries require the use of iodized salt through the application of food standards, therefore, ensuring a higher level of sustainability.

USI standalone programs versus integration in other nutrition and non-communicable disease (NCD) related programs:

Before 2010, dedicated stand-alone USI national programs operated in the majority of the ECAR countries. Situation changed post-2010 as no evidence of stand-alone USI Programs were found in countries during the 2021

^b While Russia is not formally part of UNICEF ECAR since 2012, it was included in the previous [11] and current reviews.

^c United Nations Security Council Resolution 1244

progress review. In ECAR countries, nutrition activities are operated under various types of programs: “Nutrition” or “Food and Nutrition” (in 4 countries), “Non-communicable disease (NCD) prevention” (in 9 countries) and “Health” (in 2 countries). Evidence of USI objectives or targets, however, could be found in only 4 of these programs — in Moldova, Albania, Turkmenistan and Uzbekistan [16]. In a number of countries, such as Armenia and Belarus [14], where salt iodization practices are included in routine regulatory monitoring mechanisms these targets were not included into programming documents. The experience from other regions, however demonstrates that downgrading of the USI objectives and targets based on apparent achievement of program targets and/or misunderstanding that IDD had been “eliminated” leads to a fall in program coverage and iodine intake levels and must be prevented by all means [16].

It should be noted, however, that despite the absence of standalone USI programs, the USI goal has been sustained in majority of the ECAR countries because salt iodization requirements became part of wide array of normative and regulatory documents, as well as routine practice.

In the context of the ECAR, re-establishing national IDD prevention or stand-alone vertical programs could potentially be counterproductive. As countries embrace the NCD programming approach focused on prevention and mitigation of the health risks to the population, it is important that USI is part of the approach, as one of the most cost-effective micronutrient deficiency prevention strategies. Furthermore, it is critical that a salt reduction strategy, one of the NCD “best buys” recommended by the WHO [17], is linked to the USI effort of countries in the ECAR, especially, those in Central Asia and the Caucasus, which have the highest per capita salt consumption levels in the world [18]. It has been long recognized that policies on salt reduction and salt iodization are compatible [19]. Monitoring of both salt intake and salt iodization at country and sub-national levels is needed to adjust salt iodization levels over time, as necessary.

Iodized salt production and supply:

In the USSR salt production and processing was highly centralized: Raw salt was extracted predominantly from large mines in Ukraine, Belarus and Russia. The former Soviet Republics which lacked their own salt production relied on salt supplies from other parts of the USSR. For example, most of iodized salt supplied to the Central Asia republics (Kyrgyzstan, Tajikistan, Uzbekistan), Moldova, Georgia and Azerbaijan were produced in Ukraine and Russia. After the dissolution of the USSR, local salt production by large number of small enterprises started in Azerbaijan, Tajikistan and Uzbekistan. In the absence of domestic salt deposits, Moldova and Georgia continued importation of iodized salt (mainly from Ukraine) while Kyrgyzstan imported both iodized salt and raw salt (for local iodization) from Kazakhstan [6].

In the Balkan area “Tuzla Solana” in Bosnia and Herzegovina is the main supplier of iodized salt to domestic market and also for export to many former Yugoslav republics (Serbia, North Macedonia, Montenegro, Kosovo and others) that lack their own salt production. These countries are also importing iodized salt from Greece, Belarus,

Egypt and other countries and partially iodize imported raw salt inside the country [8].

In the ECAR, currently 10 countries produce iodized salt domestically, with the remaining 7 relying on import. While large producers account for most of edible salt production, significant proportion of the salt is still produced by a large number of small producers in three Central Asian countries (Tajikistan, Uzbekistan, Kyrgyzstan) creating challenges in ensuring good quality of salt iodization.

In the past decade many salt producers in the ECAR have instituted food production management systems focused on food quality and safety, such as ISO 9000 and ISO 22000 series, Hazard Analysis and Critical Control Points (HACCP) or Good Manufacturing Practices (GMP). Given the widespread use of iodized salt in the processed foods in the ECAR it is assumed that the quality assurance and quality control (QA/QC) procedures do reasonably include the use of iodized salt [20]. Large salt producers in Ukraine, Belarus, Kazakhstan, Azerbaijan, Armenia and Russia have established rigorous QA/QC procedures and achieved ISO and HACCP certification. These large factories have no major problems in the ability to supply quality iodized salt according to national standards. In Azerbaijan, a new salt factory (under the “Azersun” Holding) has been put into operation during the 2010–2020 decade for the production of quality iodized salt which currently covers the entire national demand and replaced the low-quality salt that was previously manufactured by many small producers [21].

Problems with QA/QC of iodized salt supplies remain in Tajikistan, Uzbekistan and Kyrgyzstan (mainly with small producers that are iodizing locally imported raw salt). The 2015 assessments showed that more than 90% of the iodized salt in the Khatlon region of Tajikistan is of inadequately quality, which is connected with intermittent sourcing of potassium iodate [22]. Significant problems with the procurement of potassium iodate remain also in Uzbekistan. In Kyrgyzstan, the Association of Salt Producers established a revolving fund to facilitate stable supply of good quality and reasonably priced potassium iodate through the Global Alliance for Improved Nutrition (GAIN) Premix Facility. Quality assurance procedures at production and inspections of iodized salt import at borders guarantee that adequately iodized salt is consistently produced or imported into the country [23].

Taxes and subsidies:

To ensure that iodized salt is available to populations at affordable prices, the governments in selected countries have passed bills that exempt iodized salt from Value Added Tax (VAT), including, more recently, in response to the negative economic effects of COVID-19 pandemic [24]. In the ECAR, Kyrgyzstan and Georgia have earlier waived VAT and import tax on iodized salt, Kazakhstan reduced the VAT on iodized salt to 8 percent and Belarus — to 10 percent. While these measures are aimed at ensuring affordability of the iodized salt, globally 60% of food producers interviewed by GAIN in a recent review of barriers to food fortification did not consider these to be effective [25]. In general, it is not clear how the exemption influences the effectiveness of the USI effort as we were unable to identify relevant reviews on the subject. More research is required in this area.

Role of industrially processed foods (IPF):

IPF account for an increasing proportion of total salt intake in many populations. Understanding the contribution of key salt containing processed foods to the total salt intake and to potential iodine intake if this salt is iodized, is important to sustain optimal iodine nutrition in countries. IGN developed a Programme Guidance "The Use of Iodised Salt in Industrially Processed Foods"^d, recently piloted in the three countries of the ECAR (Armenia, North Macedonia and Moldova) to assess contribution of IPF to iodine nutrition [26].

All 3 countries had optimal iodine status of population, high use of iodized household salt in Armenia and North Macedonia, and mandatory legislation for iodization of all salt for human consumption. The percent of households using adequately iodized salt was estimated to be over 90% in Armenia and North Macedonia and 60% in Moldova.

The results from Armenia indicate that, for non-pregnant adults, 100% of the Recommended Nutrient Intake (RNI) for iodine could be met through current levels of consumption and iodization for household salt and bakery salt, at least at the national level. In North Macedonia iodine from iodized household salt on its own could be meeting RNI for iodine for non-pregnant adults. If a 30% reduction in household salt intake is achieved, then iodine from this source may drop below 100% of the RNI for iodine both in both countries. In Moldova less than 80% of the RNI for iodine for non-pregnant adults is likely being met through current levels of iodization and consumption of household salt and the eight processed foods included in the assessment. Total estimated iodine intake from household salt and the selected processed foods remains well below the upper limit (UL) for iodine of 600 µg in all countries for both non-pregnant adults and pregnant women.

This assessment provided estimates of significant contribution from processed foods to the overall iodine and salt intake that could be applied to other ECAR countries. The modelling has also clearly demonstrated that, if universally iodized, salt used at households and bread production could ensure adequate iodine intake in the entire population, including pregnant women.

Monitoring of iodized salt availability and quality:

Availability of sufficient quantity of adequately iodized salt throughout the food chain - in the wholesale, retail and food processing — is critical to the sustainability of the USI effort [23] and constitutes the purpose of the regulatory monitoring. Historically in the ECAR, food safety and quality monitoring were carried out by the public health departments (former State Sanitary and Epidemiological Service), under the Health Ministries [27, 28] and at least four countries of Central Asia, Russia and Belarus still maintain this model for monitoring of iodized salt quality at the production (factory) and retail levels as well as in mass catering establishments, hospitals, bread bakeries and food industry.

In other countries this role is being transferred to the newly established food security agencies (FSA) as a result of the reforms of the food control systems related to the accession or association agreements with the European Union (EU). For example, Moldova initiated in 2010 a comprehensive reform of food safety system aimed at alignment with EU

food safety law and driven by the EU integration agenda and the agreement signed in June 2016. As a result, the ANSA (National Food Safety Agency) became operational in 2013 and, by February 2020, took over the entirety of the food control functions, as the single competent authority [29].

However, the FSA capacity for monitoring of the salt iodization chain might be low and in need of strengthening, as some authors argue that regulatory monitoring systems for fortified foods are not yet effective [25]. It is recognized that earlier food control systems were focused on safety and did not prioritize fortification, especially where resources were limited. Furthermore, preventing food contamination that presents high safety risks typically has a clear budget line while lower safety risks, including under-fortification or checking quality parameters of foods is often under-budgeted. Analysis of the FSA capacities and opportunities for enforcement of quality fortified foods and iodized salt in countries is, therefore, recommended and could guide the improvement of the regulatory monitoring.

With regard to regulatory monitoring at import and salt production, the inquiry by the Global Fortification Data Exchange (GFDx) project revealed no publicly available external monitoring protocols in countries of the European region [30]. Similarly, we have not been able to identify dedicated or integrated regulatory monitoring protocols at commercial sites (retail). The existing Codex Standard for food grade salt — *CX STAN 150-1985* revised in 2012 — provides guidance on the methods of iodine content analysis (Section 9) [31]. Equivalent national salt standards, however, may not necessarily include the sampling and analysis provisions, the assumption being that other, related regulatory documents cover the subject.

Impact of the COVID-19 pandemic on salt iodization in the ECAR:

Overall, there were no reports of substantial or long-term shortages of iodized salt in Armenia, Georgia, Kyrgyzstan, Moldova and Uzbekistan. No problems with availability of salt packaging were reported in Armenia, Kyrgyzstan, and Moldova. Based on that, perhaps the same was the case in the other countries of ECAR, even though specific information was not provided by the informants. According to representatives of the largest salt producers in Belarus and Ukraine, there were no substantial problems in procurement of KIO₃ and production of iodized salt in those countries. An increase in market price of iodized salt was reported only for Georgia^e, due to apparent monetary inflation in that country since the start of the pandemic, and in Moldova due to multiple reasons.

A reported partial subsidy from GAIN toward the transportation cost of KIO₃ to Kyrgyzstan likely helped to keep the market price of iodized salt relatively stable in that country. There was a near doubling of shipping cost of KIO₃ to Uzbekistan in 2021 compared to 2017. That substantial shipping cost may have also led to an increase in the market price of iodized salt in that country. Despite the lack of reported information for Turkmenistan, since the country has adequate domestic supplies of raw salt and also produces KIO₃, the market availability of iodized salt in that country was likely not affected significantly. Though not confirmed, it is also highly likely that salt iodization was sustained during the pandemic

^d <https://www.ign.org/program-guidance-on-the-use-of-iodized-salt-in-industrially-processed-foods.htm>

^e Import of iodized salt in Georgia in 2020 amounted to 39,300 tones compared to 37,500 tones in 2016 (R.Tziklauri, personal communication)

Table 1. Epidemiologic criteria for assessment of iodine nutrition in a population based on median or range of median urinary iodine concentrations [5]

| Median urinary iodine concentration (µg/L) | Iodine intake | Iodine nutrition |
|--|--------------------|---|
| School aged children | | |
| <20 | Insufficient | Severe iodine deficiency |
| 20–49 | Insufficient | Moderate iodine deficiency |
| 50–99 | Insufficient | Mild iodine deficiency |
| 100–299 | Adequate | Optimum |
| >300 | Adequate* | Risks of adverse health consequences*** |
| Pregnant women | | |
| <150 | Insufficient | |
| 150–250 | Adequate | |
| 250–500 | More than adequate | |
| ≥500 | Excessive* | |
| Lactating women** | | |
| <100 | Insufficient | |
| ≥100 | Adequate | |
| Children less than 2 years of age | | |
| <100 | Insufficient | |
| ≥100 | Adequate | |

Comments: * — The term “excessive” means in excess of amount to prevent and control iodine deficiency; ** — In lactating women, the numbers of median urinary concentrations are lower than the iodine requirements, because of the iodine excreted in breast milk; *** — Consequences include iodine induced hyperthyroidism, autoimmune thyroid disease [5].

in the salt producing countries of the former Yugoslavia because of the long history of such practice by the salt production companies, even during the Balkan wars in the 1990s.

Although the pandemic did not have a direct impact on the USI achievements, UNICEF's systematic capacity development initiatives to promote and sustain the USI programs in Tajikistan, Ukraine, Albania, Bosnia and Herzegovina, and Turkmenistan have been delayed by almost a year. This has been mainly due to shift in the priorities of the engaged stakeholders in all countries due to the pandemic situation. In some countries such as Ukraine the undertaking of the national iodine survey has been delayed for almost a year. This has slowed the momentum gained in the development and adoption the USI legislation which demanded fresh evidence on the iodine nutrition status in the country.

Monitoring and surveillance of USI impact.

The effect of salt iodization on iodine intake in the population is monitored using biological markers of iodine status. Since more than 90% of ingested iodine is excreted in the urine over the next 24–48 hours, urinary iodine concentration (UIC) is a reliable indicator of iodine intake. In population-based surveys, it is recommended that the UIC be measured in spot urine sample collected from a representative group of the target population [12]. Table 1 presents the epidemiological criteria for assessing the iodine status of the population based on the range of the median UIC [32].

In 2010–16, national or subnational iodine surveys have been conducted in Albania [33], Kazakhstan [34], Tajikistan [35] and Kyrgyzstan [36]. Only in Kazakhstan the survey was funded entirely by the national government,

while in other countries these surveys depended on external funding (mostly from USAID through UNICEF).

In 2016–2017 national surveys were conducted in Georgia [37] and Armenia [38] and showed sustained success in USI and IDD elimination. Iodine assessments were also conducted in regions of Abkhazia [39] and Nagorno-Karabakh [40]. In 2017–2020 iodine surveys were conducted in Montenegro [41], Uzbekistan [42], Belarus [43], Kosovo [44], Albania [45], North Macedonia [46] and Moldova [47]. Periodic iodine surveys were not conducted in the decade of 2010–2020 in Azerbaijan, Serbia^f, Bosnia and Herzegovina and Turkmenistan.

In 2020, the National Research Center for Endocrinology resumed iodine research and conducted subnational assessments of iodine status in 3 regions of Russia. In the Republic of Tuva, previously known for severe iodine deficiency, an effective IDD prevention program has led to the coverage of 95% of the population with iodized salt and an increase in the median UIC in school aged children to the optimal level of 153 µg/L [48]. However, in two other regions (Crimea and Bryansk), a mild iodine deficiency has persisted [49, 50].

Thus, based on the available information, 11 countries of the ECAR sustained USI during the 2010–2020 decade with optimum iodine status of population and high household coverage with iodized salt. Three countries (Albania, Moldova and Kyrgyzstan) have USI at scale but relatively low coverage with iodized salt pose a substantial risk of slippage. Four countries (Russia, Tajikistan, Ukraine and Uzbekistan) need more efforts to achieve and sustain USI and equitably optimum iodine status of the population (Table 2).

^f In Serbia limited assessment (74 urine samples) was conducted in 2018 within the framework of EUthyroid project and revealed optimum mUIC (187 mcg/l) in schoolchildren [52].

Table 2. ECA Region Population Iodine Status Dashboard (2021)

| Country or territory | Population Group | | | | Group 1. USI at scale | | | | | | | | | | Use of IS in processed foods |
|-----------------------|-------------------------|----------------|------------------|-----------------------|-----------------------|------------------|------------------------------|--|-----------------|--|----------------|----------------------------|--|--|------------------------------|
| | mIIC (µg/L) before 2010 | Year of survey | Population Group | mIIC (µg/L) 2010-2020 | Year of survey | Population Group | Current Iodine intake status | HH use of IS (Total/ Adequate) before 2010 | Year of sur-vey | HH use of IS % (Total/ Adequate) 2010-2020 | Year of survey | | | | |
| 1 Armenia | 313 | 2005 | SAC | 242 225 | 2017 2017 | SAC PW | Adequate | -/97 | 2005 | 93/93 | 2017 | Mandatory (except cheese) | | | |
| 2 Belarus | 179 | 2006 | SAC | 191 121 | 2018 2018 | SAC PW | Adequate | 94/- | 2006 | 81/81 | 2018 | Mandatory (except seafood) | | | |
| 3 North Macedonia | 180 | 2003 | SAC | 236 167 | 2016 2016 | SAC PW | Adequate | -/94 | 2005 | 98/98 | 2016 | Mandatory | | | |
| 4 Kosovo | 176 | 2009 | SAC | 148 | 2018 | SAC | Adequate | 79/- | 2007 | 95/95 | 2018 | Mandatory | | | |
| 5 Georgia | 321 | 2005 | SAC | 298 211 | 2017 2017 | SAC PW | Adequate | 90/- | 2005 | 98/98 | 2017 | Mandatory | | | |
| 6 Kazakhstan | - 249 | 2006 | SAC WRA | - 311 | 2015 | SAC Adults | No data Adequate | 92/- | 2005 | 97/- | 2015 | Mandatory | | | |
| 7 Azerbaijan | 204 195 | 2007 2007 | SAC PW | - | - | - | No data | -/45 | 2007 | 94/- | 2013 | Mandatory | | | |
| 8 Serbia | 195 158 | 2007 2007 | SAC PW | 187 | 2018 | SAC | Adequate | 100/68 | 2007 | - | - | Mandatory | | | |
| 9 Bosnia& Herzegovina | 157 158 | 2005 2005 | SAC PW | - | - | - | No data | 65/- | 2008 | - | - | Mandatory | | | |
| 10 Monte-negro | 174 | 2007 | SAC | 173 134 | 2020 2017 | SAC PW | Adequate Border-line | -/53 | 2007 | 81/81 | 2020 | Mandatory | | | |
| 11 Turkmenistan | 188 | 2006 | SAC | - | - | - | No data | -/87 | 2006 | 100/- | 2018 | Mandatory | | | |

Table 2 continuation

| Table 2. Continued | | | | | | | | | | | | | |
|--|-------------------------|----------------|------------------|-----------------------|-------------------|----------------------|------------------------------|--|----------------|--|----------------|------------------------------|-------------------|
| Country or territory | mUIC (µg/L) before 2010 | Year of survey | Population Group | mUIC (µg/L) 2010–2020 | Year of survey | Population Group | Current iodine intake status | HH use of IS (Total/ Adequate) before 2010 | Year of survey | HH use of IS % (Total/ Adequate) 2010–2020 | Year of survey | Use of IS in processed foods | |
| Group 2. USI at scale but risk of slippage | | | | | | | | | | | | | |
| 1 | Moldova | 165 | 2005 | SAC | 204 173 134 | 2012 2012 2016 | SAC PW Adults | Adequate Adequate Adequate | -/60 | 2005 | 77/57 | 2016 | Mandatory (bread) |
| 2 | Kyrgyzstan | 114 | 2007 | SAC | 103 | 2016 | PW (Chui obl) | No data | -/39 | 2007 | 98/92 | 2018 MICS | Mandatory |
| 3 | Albania | 86 95 | 2006 2006 | SAC PW | 136 | 2020 | SAC | Adequate | -/60 | 2006 | 68/- | 2020 | Mandatory |
| Group 3. USI - more efforts needed | | | | | | | | | | | | | |
| 1 | Russia | <100 | - | SAC | 78 to 153 | 2020 | SAC | Regional data only | <30 | - | 15 to 95 | 2020 | Voluntary |
| 2 | Uzbekistan | - | - | - | - 135 117 | 2017 2017 2017 | SAC WRA PW | No data Adequate Inadequate | -/53 | 2006 | 65/20 | 2017 | Mandatory |
| 3 | Tajikistan | 108 | 2009 | WRA | - 75 | 2016 | SAC WRA | No data Inadequate | 58/- | 2009 | 74/0 | 2016 | Mandatory |
| 4 | Ukraine | 90 | 2002 | WRA | - | - | - | Inadequate | -/18 | 2005 | 21/- | 2012 | Voluntary |

Two countries in the region, Georgia and Turkmenistan, attempted to move away from the survey-based monitoring to the facility-based sentinel nutrition surveillance system, inclusive of data collection on iodine status of the population [51]. Given the almost universal access to primary health care in the former USSR countries, such systems are justified as they can adequately reflect the population's iodine status and require relatively smaller budgets compared to the large cost associated with population surveys.

The recent "EUthyroid" project was aimed to establish the first standardized map of iodine status in Europe by using standardized median UIC data from 23 countries (among them — Montenegro and North Macedonia included in the present study). Of the 40 studies, 16 were conducted in schoolchildren, 13 in adults, and 11 in pregnant women. Median UIC was $<100 \mu\text{g/L}$ in 1 out of 16 (6%) studies in schoolchildren, while in adults 7 out of 13 (54%) studies had a median standardized UIC $<100 \mu\text{g/L}$. Seven out of 11 (64%) studies in pregnant women revealed a median UIC $<150 \mu\text{g/L}$. Results of EUthyroid project show that iodine deficiency is still present in European countries while adults and pregnant women, particularly, are at high risk for iodine deficiency, which calls for action [52].

Equity considerations:

Iodine deficiencies are known to be more prevalent in lower-income groups, especially in countries with limited access to iodized salt as well as in groups with higher iodine requirements, such as pregnant and breastfeeding mothers where iodine deficiency can linger. Almost all countries in the ECAR have data on the iodine status of school-age children (SAC) and some — of pregnant women (PW) and women of reproductive age (WRA). However, the situation by socio-economic status (SES) groups in the ECAR is largely unknown. Generally, there are only few studies presented below which include data disaggregated by SES, residence/geographical location or education level of participants.

The importance of equity data is revealed in the example of Moldova where a study conducted in 2012 clearly indicated disparities in the iodine status of population sub-groups. While median UIC was $237 \mu\text{g/L}$ in SAC whose parents completed high school/university education, it was $169 \mu\text{g/L}$ in children whose parents had primary (eight grades school) education only. Similarly, median UIC in PW residing in rural areas was $151 \mu\text{g/L}$ (or, just above the threshold of iodine sufficiency) where the iodized salt use was also the lowest, comparing to $199 \mu\text{g/L}$ in PW from urban areas [53]. In Uzbekistan, the median UIC in WRA ($135,3 \mu\text{g/L}$) was above the cut-off level of $100 \mu\text{g/L}$ which defines an iodine-sufficient status in the population; however, the median UIC was higher in women from urban ($148,2 \mu\text{g/L}$) than rural ($129,3 \mu\text{g/L}$) areas. In some districts, such as Namangan and Samarkand, median UIC in WRA was well below the cut-off defining population iodine sufficiency and WRA from the poorest households had borderline low median UIC [42].

In contrast, in North Macedonia, where high levels of household coverage with adequately iodized salt were sustained for decades, no statistically significant differences in the median UIC were found between children from low and high SES households. The USI strategy consistently applied in the country for more than sixty years contributed

to reducing the inequalities related to iodine status among population of different social strata [46].

These countries' examples point out to the need for disaggregated equity-based data to allow in-depth monitoring of iodine status in countries with household use of iodized salt less than recommended 90%, and adjustment of action.

Progress in the ECAR towards the USI goal.

The goal of sustainable and equitable elimination of iodine deficiency through the USI as part of the Agenda 2030 is achievable for the majority of countries in the ECAR based on three indicators (Table 2):

1. Iodine status of population (impact indicator):

- **Group 1:** 11 countries (Armenia, Azerbaijan, Bosnia and Herzegovina, Kosovo, North Macedonia, Montenegro, Serbia, Turkmenistan, Kazakhstan, Kyrgyzstan and Georgia) successfully maintained the adequate iodine status achieved earlier ("USI at scale").
- **Group 2:** 3 countries (Albania, Moldova, Kyrgyzstan) achieved significant progress but have weak regulation and/or enforcement systems putting sustainability at risk ("USI at scale but risk of slippage").
- **Group 3:** 4 countries — Russia, Ukraine, Tajikistan and Uzbekistan and the region of Abkhazia continued to suffer from inadequate iodine status ("USI — more efforts needed").
- Limited data is available on the status of iodine nutrition at sub-national level and in vulnerable population sub-groups of rural, remote and poor young children, adolescent girls and pregnant or breastfeeding mothers as well as certain geographical areas, such as Transnistria region in Moldova. Therefore, the equity status in relation to iodine nutrition cannot be firmly determined in the majority of countries.

2. Household use of iodized salt (outcome indicator):

- 11 countries — Armenia, Azerbaijan, Bosnia and Herzegovina, Kosovo, North Macedonia, Montenegro, Serbia, Turkmenistan, Kazakhstan, Kyrgyzstan and Georgia achieved or maintained over 90% household use of adequately iodized salt;
- While household use of iodized salt in the region was 55% by 2009, the number for 2020 could not be firmly established as only 8 countries out of 17 have recent (after 2015) survey data.

3. Earlier decade's progress was also maintained in the use of iodized salt by food industry (output indicator):

- 16 out of 18 countries (except Ukraine and Russia) maintained the mandatory provision in the law on the use of iodized salt in IPF;
- Data on actual use of iodized salt (coverage) by food industry are not, however, readily available;
- Contribution of iodized salt from IPF was assessed in 3 countries of the region and is estimated to provide a significant proportion of daily iodine intake — from 35% of RNI in Moldova to 66% in Armenia, with bread being the main source. Ensuring and maintaining the use of iodized salt in key salt-containing foods, such as bread, as opposed to just household use is, therefore, critical.

The progress towards the USI goal at the regional and country level is an opportunity for governments and partners to celebrate their achievements but also a prime

opportunity to assess their capacity and take appropriate action and address the remaining implementation gaps. The decreased revenues, re-allocation of public resources and various fiscal measures in response to COVID-19 pandemic as well as the prices and supply chain disruptions that followed, may pose serious risks to the sustainability of national food and nutrition security efforts, including, for the maintenance of the USI [54].

USI Roadmap recommendation for the ECAR.

Although tremendous progress has been made in making salt iodization universal in the ECAR, the fact still remains that sub-populations in at least 7 countries of the region are at risk of iodine deficiency. The proposed Roadmap recommendations outlines smart investments that countries can adopt to further sustain as well as achieve the USI goal of sufficient iodine nutrition status at national and sub-national levels. It offers a platform for governments, private sectors, development partners and civil society organizations to work together for USI in the ECAR post-2021.

As seen from the evidence presented in the previous section of this paper, the maintenance and sustainability of the USI in the ECAR is primarily dependent on the consistent implementation of regulatory monitoring to ensure that adequately iodized salt is available to all population groups and used throughout the food chain. Applying good regulatory practice even in a crisis, such as COVID-19 pandemic, is essential and must be supported and sustained [48]. When it comes to guaranteeing the effectiveness and relevance of regulatory effort in relation to iodized salt and fortified foods, in general, the collective, collaborative and coordinated action remain as critical as ever.

Countries with sustained USI — focus on maintenance.

Over the last decade, 11 countries of the ECAR reached or maintained the USI target of >90% household use of adequately iodized salt and have continuously realized an equitable iodine nutrition status, as estimated through the median UIC in SAC or PW. These countries also mandated and successfully enforced the use of iodized salt by food producers, predominantly, for bread production. This has been done through ensuring a strong positive engagement and consistent compliance with national salt iodization standard by the private sector, mainly represented by the large food and salt producers. It should be noticed that Azerbaijan, Bosnia and Herzegovina, and Turkmenistan do not have recent (less than 10 years) population-based median UIC data. Given that high household use of iodized salt has been confirmed in these countries for several decades, it is safe to assume that they maintained the adequate iodine nutrition status; however, recent median UIC data are needed to confirm this assumption.

Given the supportive environment created and enforced, these countries need to ensure that the success is maintained and are recommended to focus on a set of the following actions:

- Ensuring that the USI target of continuous/uninterrupted universal use of iodized salt at households and bread industry is included into relevant national programs, along with the salt reduction targets and objectives;

- Conduct assessments of the contribution of processed foods to salt and iodine intake of population, as relevant, as well as estimate the salt/iodine intake in the case of salt reduction target application and adjust the salt standard, as needed;
- Safeguard strong regulatory monitoring of iodized salt use throughout the food chain and integrated within the existing food control systems, including through availability, dissemination and feedback on compliance data for the use of iodized salt at salt production, commercial retail and food industry sites;
- Periodically (once in five years) monitor population iodine status to track progress and provide evidence for potential adjustments as part of the national decision-making process. The population status monitoring could be potentially conducted through nutrition sentinel surveillance (facility or school-based) and integrated with the surveillance of the outcome and impact of other fortified foods, such as fortified wheat flour.

Countries with USI within reach — focus on stronger regulatory monitoring:

Three countries — Albania, Moldova and Kyrgyzstan — achieved an adequate iodine nutrition status at national level but their household use of adequately iodized salt remains low and the use of iodized salt in processed foods — patchy, with a weak regulatory monitoring and enforcement system. These may lead to inadequate iodine status in population groups with higher iodine intake needs (pregnant and breastfeeding women) and areas with no data, such as Transnistria region in Moldova. Given the USI awareness and support created, these countries need to preserve the momentum and focus on the following set of actions:

- Secure a strong regulatory monitoring and enforcement of the national iodized salt standards to ensure consistent and high (>90%) use of iodized salt at household level as well as >90% use of iodized salt in key salt-containing industrially produced foods (mainly, bread); Conduct assessments of the contribution of processed foods to salt and iodine intake of population (Kyrgyzstan).
- Ensure that the USI target of continuous/uninterrupted universal use of iodized salt at households and bread industry is included into relevant national programs, along with the salt reduction targets and objectives. Use the opportunity of programs' renewal to include USI objectives and targets and couple these with the salt reduction strategy.
- Periodically (once in five years) monitor population's iodine status to track progress. The population status monitoring could be potentially done through nutrition sentinel surveillance (facility or school-based) and integrated with the surveillance of the impact of other fortified foods, such as fortified wheat flour.

Countries not achieved USI — focus on reaching USI targets:

The remaining four countries of the region — Russia, Ukraine, Tajikistan and Uzbekistan continued to suffer from both inadequate iodine nutrition and low use of iodized salt at household level. In Tajikistan and Uzbekistan, the quality of iodized salt remains low as quality assurance and quality control at the production level and regulatory monitoring

of the many small salt producers are challenging to ensure. The voluntary character of legislation in Ukraine and Russia have not contributed to increased use of iodized salt in households and will require a mandatory provision which, however, continues to face political challenges. This group of countries will need to enhance and expand their existing USI effort by better engaging with salt producers and private sector and identifying resources for improved regulatory monitoring. An in-country review of the USI implementation gaps is recommended and could potentially focus on the following actions:

- Facilitating the dialogue between government and salt industry representatives with the view to consolidate and strengthen the salt production industry (Uzbekistan and Tajikistan)
- Facilitate coordination and collaboration between USI stakeholders to provide transparent food control and law enforcement, including, through the timely reporting and feedback between food control and business sector or the launching of the USI law (Ukraine, Russia)
- Use the opportunity of programs' renewal to include USI objectives and targets and couple these with the salt reduction strategy;
- Assess the feasibility of monitoring population's iodine status through nutrition sentinel surveillance (facility or school-based) system, potentially integrated with the surveillance of the impact of other fortified foods, such as fortified wheat flour.

Depending on each country's context, the proposed sets of actions have to be discussed and validated by the national stakeholders and actions planned around a country-based Road Maps, inclusive of timelines, resources and roles and accountability.

CONCLUSIONS

During the decade of 2010–2020, the scaled-up USI strategies introduced earlier in the Europe and Central Asia Region have largely attained and maintained the USI goal of adequate iodine nutrition, with 11 countries operating a sustainable USI effort and 3 more countries having

the sustainable USI within reach. Importantly, the need to extend salt iodization to food industry and key salt-containing processed foods have been embraced in all countries of the region, while contribution of iodized salt to the iodine intake of population has been estimated to be significant, from 33 to 65%, thus pointing out to the importance of iodized salt use in processed foods, mainly, bread.

While tremendous progress has been made in making salt iodization universal in the ECAR, the fact still remains that in 4 countries (Uzbekistan, Tajikistan, Russia and Ukraine) population in general and/or most vulnerable groups remain at the risk of iodine deficiency. It is clear that a sustainable USI effort in these countries requires strong regulatory monitoring on the mandatory iodization of household and food industry salt and this can be achieved only when there is a strong and continuous government commitment toward the goal of adequate iodine nutrition status.

The data and information in the present paper confirm that USI strategy is successfully sustained in the majority of countries in the region. The experiences in this region add to the grown evidence that USI is effective in alleviating iodine deficiency in the population and support the view that global success can be achieved by ensuring that food-grade salt iodization becomes the norm in the salt industry and society.

ADDITIONAL INFORMATION

Source of funding. The research was conducted with the financial support of UNICEF Office for Europe and Central Asia (ECARO) and United States Agency for International Development (USAID).

Conflict of interests. Authors declare no explicit and potential conflicts of interests associated with the publication of this article.

Authors involvement. All authors contributed to writing this article and reviewing the final draft.

Acknowledgements. Authors express the gratitude to all partners in countries of the ECAR who provided with updates on situation in their respective countries, especially during extraordinary difficult time of COVID-19 pandemic. We are especially grateful to Amir Yarpavar, Nutrition specialist on UNICEF ECAR office for support to this project.

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ЦИТИРОВАТЬ:

Цуркан Л., Герасимов Г.А., Парванта И., Тиммер А. Прогресс в профилактике и устранении йододефицитных заболеваний (ЙДЗ) в регионе Европы и Центральной Азии (ЕЦАР) в 2010–2020 годах // *Клиническая и экспериментальная тиреоидология*. — 2021. — Т. 17. — №4. — С. 4-16. doi: <https://doi.org/10.14341/ket12713>
Рукопись получена: 19.12.2021 Рукопись одобрена: 20.12.2021

TO CITE THIS ARTICLE:

Turcan L, Gerasimov GA, Parvanta I, Timmer A. Progress in Iodine Deficiency Disorders (IDD) Control and Elimination in Europe and Central Asia Region (ECAR) in 2010–2020. *Clinical and experimental thyroidology*. 2021;17(4):4-16.
doi: <https://doi.org/10.14341/ket12713>
Received: 19.12.2021 Accepted: 20.12.2021