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Asociația de Biosiguranță și Biosecuritate din Republica Moldova (ABBRM) este o organizație profesională cu caracter științifico-practic și instructiv-educativ, neguvernamentală, apolitică și nonprofit, creată în 2017.

Obiectivul principal al asociației este dezvoltarea bunelor practici și culturii în domeniul biosiguranței și biosecurității și promovarea cunoștințelor în cadrul grupurilor profesionale și de cercetare-inovare.

Biosiguranța – include principii de securizare, tehnologii și reguli ce trebuie urmate pentru a preveni expunerea neintenționată la agenți patogeni și toxine sau eliberarea/scurgerea lor accidentală.

„Protejarea personalului, populației de expunerea neintenționată la patogeni/material cu biohazard”.

Biosecuritatea – include un spectru larg de măsuri (politici de biosecuritate, regim de reglementări, măsuri științifice și tehnice) aplicate într-un cadru organizat, necesar minimalizării riscurilor (prevenirea acțiunilor, atentatelor teroriste de eliberarea intenționată de patogeni sau toxine precum și a pierderii, furtului sau folosirii greșite a acestora).

„Protejarea și prevenirea furtului, abuzului intenționat a patogenilor/materialului cu biohazard”.

Managementul riscului – este un proces de luare a deciziilor în urma cărui rezultate din evaluarea riscului (procesul de estimare a pericolelor la locul de muncă) sunt integrate cu principii economice, tehnice, sociale și politice pentru generarea unor strategii de reducere a riscului.

The issue is published in context of the National Scientific Conference
with international participation
"ONE HEALTH" approach in a changing world

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ȘTIINȚA ESTE CA TIMPUL - MEREU MERGE ÎNAINTE ȘI NICIODATĂ ÎNAPOI



Larisa SPINEL,
doctor habilitat în științemedicale, profesor universitar,
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publica Moldova

*„Progresul științei este determinat de lucrările
oamenilor de știință și de valoarea descoperirilor lor”
(Louis Pasteur)*

Revistele științifice, (pe suport de hârtie și cele electronice) sunt unul din principalele surse de diseminare a informației științifice noi, cu scopul de a asigura transparența, comparabilitatea și reproductibilitatea proceselor. Ele permit cercetătorilor să fie informați vizavi de rezultatele recente, în domeniul de interes și nu numai. Impactul articolelor științifice și a revistelor este evaluat prin cuantificarea numărului citărilor („impactul citării” sau „factorul de impact”).

Articolele științifice au un impact semnificativ în formarea continuă a specialiștilor și a studenților. Manualele reprezintă o sursă clasică pentru învățare, însă ele sunt scrise/publicate într-un timp îndelungat și, drept rezultat, informația devine neactuală și desuetă. În așa mod, cea mai recentă și la zi informație, ce ține de metodele de diagnostic și de tratament, este accesibilă numai prin intermediul articolelor științifice.

Un aport deosebit al Asociației de Biosiguranță și Biosecuritate din Republica Moldova (ABBRM) a fost contribuția la lansarea revistei științifice „One Health & Risk Management”, sursă ce reprezintă un punct forte în promovarea rezultatelor științifice, care țin de sănătate și protecția mediului înconjurător, atât în Republica Moldova, cât și la nivel internațional.

Rolul revistei astăzi se axează, în mod prioritar, pe promovarea vaccinării populației împotriva COVID-19, prezentarea dovezilor științifice despre eficacitatea diferitor vaccinuri, propagarea credibilității în cadrele medicale și în oamenii de știință, cu atât mai mult cu cât există și multă dezinformare în spațiului online și, în special, pe rețelele de socializare. Totodată, trebuie să fie promovate și măsurile nespecifice de prevenire: purtarea măștii de protecție, păstrarea distanței fizice, igiena mâinilor și dezinfectarea suprafețelor și a spațiilor în care ne aflăm.

Suntem siguri că articole științifice publicate în revista „One Health & Risk Management” vin cu abordări multisectoriale, multidisciplinare și vor asigura comunicări și colaborări eficiente între toate structurile guvernamentale, agențiile, părțile interesate, sectoarele și disciplinele relevante, pentru o colaborare optimă în menținerea sănătății populației.

**SYNTHESIS ARTICLE – ARTICOLE DE SINTEZĂ –
ARTICLES DE SYNTHÈSE – ОБЗОРНЫЕ СТАТЬИ**



POSSIBLE ALGORITHMS FOR DETERMINING ADVERSE REACTIONS CAUSED BY FOOD SUPPLEMENTS IN ROMANIA

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Keywords: *nutrivi-
gigilence, algorithms,
food supplements,
side effects.*

Introduction. *The advertising of food supplements on various media channels or in special-
ty stores with natural products and other places, as well as the lack of informative and edu-
cational programs for the population upon side effects and the interaction of food supple-
ments with food and drugs, have led to the development of uncontrolled marketing of these
products.*

Material and methods. *PubMed, ResearchGate and EUR-Lex databases were analyzed
during 2015-2021, based on search criteria based on: adverse reactions, ingredient new
food, food supplements, algorithms.*

Results. *Certain dietary supplements can cause multiple side effects, such as: impaired
platelet function by decreased platelet aggregation, gastrointestinal side effects (diarrhea
vomiting), decreased wound healing/epithelialization, bacterial or fungal sepsis, mos
common in patients older. Herbal resources such as Aloe vera, Matricaria recutita, Taraxa-
cum officinale and others, can cause dermatological side effects and inhibit the elimination
of dermatological drugs metabolised by cytochrome P-450 (e.g. terbinafine). Matricaria
recutita, Allium sativum, Mentha piperita L. and others, inhibit the enzyme CYP2C9. Another
enzyme with a role in the metabolism of dermatological drugs and which is inhibited by
plant resources is CYP3A4.*

Conclusions. *It is imperative to legislate the reporting of adverse reactions caused by food
supplements, including their interaction with food or drugs.*

Cuvinte cheie:
nutrivi-
gigilenta,
algoritmi, supli-
mente alimentare,
efecte secundare.

**ALGORITMI POSIBILI PENTRU DETERMINAREA REACȚIILOR ADVERSE CAUZATE DE
SUPLEMENTELE ALIMENTARE ÎN ROMÂNIA**

Introducere. *Promovarea suplimentelor alimentare în diverse surse media sau de către
unele magazine, în special de cele specializate în comercializarea produselor naturale, pre-
cum și lipsa programelor informative și educaționale pentru populație cu privire la efectele
secundare și interacțiunea suplimentelor alimentare cu alimentele și medicamentele, au du-
la dezvoltarea comercializării necontrolate a acestor produse.*

Material si metode. *Bazele de date PubMed, Research Gate și EUR-Lex au fost analizate în
perioada 2015-2021, pe baza criteriilor de căutare: reacții adverse, ingrediente alimentare
noi, suplimente alimentare, algoritmi.*

Rezultate. *Anumite suplimente alimentare pot provoca efecte secundare multiple, cum ar fi
afectarea funcției trombocitelor prin scăderea agregării plachetare, efecte secundare gas
trointestinale (diaree, vărsături), scăderea vindecării/epitelizării rănilor, sepsis bacterian
sau fungic, atestate cel mai frecvent la pacienții cu vârstă înaintată. Resursele vegetale pre
cum Aloe vera, Matricaria recutita, Taraxacum officinale și altele, pot provoca reacții ad-
verse dermatologice și inhiba eliminarea medicamentelor dermatologice metabolizate de
citocromul P-450 (de exemplu terbinafină). Matricaria recutita, Allium sativum, Mentha
piperita L. și altele, inhibă enzima CYP2C9. O altă enzimă cu rol în metabolismul medica-
mentelor dermatologice și care este inhibată de resursele vegetale este CYP3A4.*

Concluzii. *Este imperativ să se reglementeze raportarea reacțiilor adverse cauzate de su-
plimentele alimentare, inclusiv interacțiunea acestora cu alimentele sau medicamentele.*

INTRODUCTION

Advertising of food supplements on various media channels or in specialty stores with natural products, as well as the lack of information and educational programs of the population, on adverse reactions and interaction of food supplements with food and drugs, have led to uncontrolled development of marketing these products.

Although in the US, the FDA (Food and Drug Administration) only authorizes food and drugs, the 1994 Dietary Supplement Health and Education Act (DSHEA) monitors the side effects (SE) of post-market food supplements (1). Under this law, food supplements are orally ingested foods that include botanical products (such as herbal remedies) and non-botanical substances, such as minerals, amino acids, vitamins and microbial products, and traditional cultural remedies, including Asian plants (2). Although the prohibition on the statement that "food supplement (FS) may be used for the treatment or prevention of a disease" is valid in Romania, in the USA, the mention regarding general well-being and health is allowed provided that on the packaging/label is "This statement has not been evaluated by the FDA. This product is not intended to diagnose, treat, cure or prevent any disease" (1).

SE has been found and reported in vitamin food supplements:

- doses higher than 500 mg/day pyridoxine (vitamin B₆) – photosensitivity, neurotoxicity,
- chronic sensory polyneuropathy associated with pyridoxine,
- bleeding associated with antiplatelet action at doses 800-1200 mg/day,
- diarrhea, weakness, blurred vision and gonadal dysfunction at doses higher than 1200 mg/day α -tocopherol (vitamin E) and
- increased recurrence of cancer in the first 3.5 years (1).

The "Retinol Efficacy Trial" and "ATBC" studies demonstrated the toxicity of β -carotene (vitamin A) supplements by significantly increasing the risk of lung cancer in male smokers (1). Following the study "Teratogenicity of high vitamin A intake" (1), researchers Rothman KJ, Moore LL, Singer MR et al. suggested the association of dietary supplements containing vitamin A with adverse effects on bone health and decreased bone density, thus increasing the risk of fracture.

Side effects have also been found with mineral supplements, omega 3/fish oil, soy protein, soy protein, plant nutrients, antioxidants, anti-inflammatory, supplements for weight loss or bodybuilding, various botanical supplements (3). Multi-skeletal distortion, fatigue, pain and gastrointestinal symptoms and hepatic adverse events have been reported with the nutraceutical ingredient RYR (red yeast rice) at the doses recommended by EFSA (European Food Safety Authority) (4).

With the exception of "classic" foods (hazelnuts, nuts, eggs, etc.) known to cause certain side effects such as allergies, the development of the food industry has led to the emergence of foods eaten especially by teenagers, such as energy drinks. Frequent consumption of this type of drink (≥ 7 times a week) was significantly associated with asthma, allergic rhinitis and atopic dermatitis (3), high stress, lack of sleep, poor school performance and suicide attempts in Korean adolescents (5).

This present research is aimed at displaying the algorithms that can be applied to determine adverse reactions caused by the consumption of food supplements and foods in Romania, the need to initiate a legislative project and its implementation regarding the reporting of these adverse reactions and implementation of information/education programs on the population when consuming these products. The implementation of the nutrition surveillance system may be one of the methods of re-evaluation of food additives approved by EFSA and European Commission (EC).

The purpose of this paper was to implement nutrivigilance in Romania.

MATERIAL AND METHODS

The PubMed, ResearchGate and EUR-Lex databases (online portal offering access to EU legislation) were analyzed during 2015-2021, starting from the search criteria like: side effects, new food ingredients, supplements food, algorithms. Herbal resources that may influence the clearance of dermatological drugs metabolized by cytochrome P-450 have been identified (enzymes CYP2C9, and CYP3A4).

RESULTS

Of the total of 5696 European Union Regulations and/or Decisions published during this period, 39 refer to the authorization of novel food ingredients in the European Union, which are presented in Tables 1, 2 and 3.

Table 1. Adverse reactions caused by new food ingredients authorized by EFSA in the European Union, in the period 2015-2017.

Ingredient/substance approved as a novel food ingredient in the EU	EU Decision/Regulation	Category of products for which it has been authorized or action - Maximum dose/day (mg or g/day), according to EU Decision/Regulation	Adverse reactions/Warnings	Consumption mode (e.g. mono-ingredient)
(6S) -5-methyltetrahydrofolic acid, the glucosamine salt, as a source of folate (6)	Reg. (EU)* no. 414/2015 (6)	FS (6)	SE* reported for patients taking 15 mg folic acid for 1 month: - gastrointestinal: nausea, abdominal distension and flatulence; - nervous system: bitter taste, sleep changes, difficulty concentrating, hyperactivity, impaired thinking; - metabolic: anorexia; - other: decrease in serum diphenylhydantoin in patients taking 5 or 15 mg of folic acid daily (7).	Multi-ingredient (7)
Oil extracted from microalgae <i>Schizochytrium</i> sp. (ATCC PTA-9695) (8)	EU Decision no. 545/2015 (8)	FS: • 250 mg DHA* per day, as recommended by the manufacturer for the normal population; • 450 mg DHA per day, as recommended by the manufacturer for pregnant and lactating women. Foods intended for use in low-calorie diets for weight loss within the meaning of Directive 96/8/EC: • 250 mg per meal replacement. Other foodstuffs for particular nutritional uses as defined in Directive 2009/39/EC, with the exception of infant formulas and follow-on formulas: • 200 mg /100 g. Dietary foods for special medical purposes: • according to the specific nutritional needs of the persons for whom the products are intended (8).	Possible side effects: - buckling, slight increase in cholesterol; - pregnant women: dose > 3g/day slowing blood clotting and increasing the chances of bleeding; - respiratory sensitivity, in the case of people sensitive to aspirin; - diabetes: Increased blood sugar before meals in people with type 2 diabetes; - tension: decreased blood pressure (9); - respiratory infection and gastroesophageal reflux (10).	Mono-ingredient (9)



<p>Oil rich in DHA and EPA, extracted from microalgae <i>Schizochytrium</i> sp. (11)</p>	<p>EU Decision no. 546/2015 (11)</p>	<p>FS: • 3000 mg as recommended by the manufacturer, for the adult population, except for pregnant and lactating women (11).</p>	<p>Possible SE: - belching, slight increase in cholesterol (9); - pregnant women: dose > 3g/day slowing blood clotting and increasing the chances of bleeding (9); - respiratory sensitivity, in the case of people sensitive to aspirin (9); - diabetes: Increased blood sugar before meals in people with type 2 diabetes (9); - blood pressure: decreased blood pressure (9); - respiratory infection and gastroesophageal reflux (10).</p>	<p>Mono-ingredient (9)</p>
<p>Flavonoids from <i>Glycyrrhiza glabra</i> L. (12)</p>	<p>EU decision no. 1213/2015 (12)</p>	<p>Foods intended for use in low-calorie diets for weight loss (only for products presented as a substitute for the whole daily diet): • daily consumption of 120 mg. Dietary foods for special medical purposes: • daily intake of 120 mg (12).</p>	<p>- dose-dependent increase in plasma renin, Na, concomitant decrease in plasma cortisol, ACTH *, aldosterone and K (13); - hipertensiune, hipokaliemie, edem (13); - contraindicated with co-administration with laxatives or diuretics (13).</p>	<p>Mono-ingredient (13)</p>
<p>Refined <i>Buglossoides arvensis</i> seed oil (14)</p>	<p>EU Decision no. 1290/2015 (14)</p>	<p>FS as defined in Directive 2002/46/EC, with the exception of food supplements for infants and young children: • a daily dose of 500 mg, as recommended by the manufacturer. Foods intended for special medical purposes as defined in Directive 1999/21/EC, with the exception of dietary foods for infants and young children: • in accordance with the specific nutritional needs of the persons for whom the products are intended. Foods intended for use in low-calorie diets for weight loss within the meaning of Directive 96/8/EC: • 250 mg/food substitute (14).</p>	<p>No side effects have been reported (15).</p>	<p>Mono-ingredient (15)</p>



Lacto-N-neotetraosis (16)	EU Decision no. 375/2016 (16)	Dietary foods intended for special medical purposes as defined in Directive 1999/21/EC: <ul style="list-style-type: none"> in accordance with the specific nutritional needs of the persons for whom the products are intended. FS, as defined in Directive 2002/46/EC, with the exception of infant food supplements: <ul style="list-style-type: none"> 1.5 g/day for the general population 0.6 g/day for young children, etc. (16). 	No adverse reactions have been reported (17, 18).	Mono-ingredient (17, 18)
2'-O-fucosyl-lactose (19)	EU decision no. 376/2016 (19)	Dietary foods intended for special medical purposes, as defined in Directive 1999/21/EC: <ul style="list-style-type: none"> in accordance with the specific nutritional needs of the persons for whom the products are intended. Foods used in low-calorie diets for weight loss as defined in Directive 96/8/EC (only for products presented as a substitute for the whole daily diet): <ul style="list-style-type: none"> 4.8 g/l in beverages and 40 g/kg in bars. FS, as defined in Directive 2002/46/EC, with the exception of infant food supplements: <ul style="list-style-type: none"> 3.0 g/day for the general population and 1.2 g/day for young children, etc. (19). 	Mild side effects: <ul style="list-style-type: none"> flatulence; stomach ache; diarrhea. Severe side effects not reported (20).	Mono-ingredient (20).
Trans-resveratrol (21)	EU Decision no. 1190/2016 (21)	FS in the form of tablets or capsules intended adults, in maximum dose: <ul style="list-style-type: none"> 150 mg per day (21). 	No side effects have been reported (22).	Mono-ingredient (22).
Enzymatic preparation of prolyl-3-oligopeptidase produced with a genetically modified strain of <i>Aspergillus niger</i> (23)	EU decision no. 1387/2017 (23)	FS as defined in Directive 2002/46/EC: <ul style="list-style-type: none"> 120 PPU*/day (2.7 g of enzyme preparation/day); (2×106 PPI*/day) for the general adult population (23). 	No side effects have been reported (24).	Multi-ingredient (7)
Beta glucans in yeast *	EU Decision no. 2078/2017, for the extension of	FS, as defined in Directive 2002/46/EC, with the exception of food supplements for infants and young children:	Possible side effects: <ul style="list-style-type: none"> dermal hypersensitivity (26) 	Multi-ingredient (26)

	the field of use according to Decision no. Commission Regulation (EC), no. 762/2011 (25)	<ul style="list-style-type: none"> • 1,275 g/day for children older than 12 years and the adult population in general; • 0.675 g/day for children under 12 years of age; <p>Substitutes for a total diet for weight control as defined in Regulation (EU), No 182/2011. 609/2013:</p> <ul style="list-style-type: none"> • 1,275 g/day; <p>Foods intended for special medical purposes, as defined in Regulation (EU), No 182/2011. 609/2013, except for foods intended for special medical purposes for infants and young children:</p> <ul style="list-style-type: none"> • 1,275 g/day (25). 		
Taxifolin Rich Extract * (27, 28)	EU Decision no. 2079/2017 (27, 28)	FS, as defined in Directive 2002/46/EC, with the exception of food supplements for infants and young children, children and adolescents under 14 years of age: <ul style="list-style-type: none"> • 100 mg/day (27, 28). 	No adverse reactions have been reported (29).	Multi-ingredient (29)
2'-fucosyl-lactose * (30)	EU Decision no. 2201/2017 (30)	Starting formulas and follow-on formulas: <ul style="list-style-type: none"> • 1,2 grams of 2'-fucosyl-lactose per liter of final product, ready to use, marketed as such or reconstituted according to the manufacturer's instructions (30). 	Not mentioned	Not mentioned
<i>Calanus finmarchicus</i> oil * (31)	EU Decision no. 2353/2017 (31)	FS as defined in Directive 2002/46/EC: <ul style="list-style-type: none"> • 2.3 g/day (31) 	Mild side effects: <ul style="list-style-type: none"> - increased incidence of eczema (32). <p>Possible side effects:</p> <ul style="list-style-type: none"> - gastrointestinal disorders, in case of an amount greater than 2.3 g/day; - intolerance (33). 	Mono-ingredient (32)
Chia seeds (<i>Salvia hispanica</i>) (34)	EU Decision no. 2354/2017 (34)	Yogurt: <ul style="list-style-type: none"> • 1.3 g of whole chia seeds per 100 g yogurt; • 4.3 g of whole chia seeds per 330 g of yogurt (portion). <p>Bakery:</p> <ul style="list-style-type: none"> • 5 g of whole seeds per 100 grams of bak- 	No side effects have been reported.	Mono/multi-ingredient (34)

		ery products. Breakfast cereals; mixes of fruits, nuts and seeds, as well as prepacked chia seeds as such: • 5 g of whole seeds per 100 grams of breakfast cereals (34). Marketed fresh (35)							
Ultraviolet-treated mushrooms * (<i>Agaricus bisporus</i>) (35)	EU Decision no. 2355/2017 (35)							Not mentioned	Not mentioned

*SE - Side effects; RYR – Red yeast rice fermented with *Monascus purpureus*; **monocholine** - monocholine of K, Reg. (UE) - Regulation (EU); FS – Food supplements; DHA - docosahexaenoic acid; PPU - Prolyl peptidase units or proline protease units; PPI – Protease Picomole International; **beta glucans in yeast** – human studies are very limited (27); **taxifolin-rich extract** - obtained from *Dahurian larch wood* [*Larix gmelinii* (Rupr.) Rupr]; 2'-**fucosyl-lactose** - produced with *Escherichia coli* BL21 strain (31); **Calanus finmarchicus oil** - oil obtained from the shellfish (*marine zooplankton*) *Calanus finmarchicus* harvested in the Norwegian Economic Zone, and in the Jan Mayen area (32).

Table 2. Adverse reactions caused by new food ingredients authorized by EFSA in the European Union during 2018.

Ingredient/substance approved as a novel food ingredient in EU	EU Decision/Regulation	Category of products for which it has been authorized or action - Maximum dose/day (mg or g/day), according to EU Decision/Regulation	Adverse reactions/Warnings	Consumption mode (eg: mono-ingredient)
RYR * - monocholine K * (36)	EFSA Journal 2018; 16 (8): 5368 (36)	Maintaining the normal concentration of LDL-cholesterol in the blood: • 10 mg monocholine K from RYR/day (36).	- multicellular-skeletal distortion; - fatigue; - pain and gastrointestinal symptoms; - hepatic side effects (37).	Mono and multi-ingredients (37)
Florotannins from <i>Ecklonia cava</i> * (38)	EU Regulation no. 460/2018 (38)	Food supplements, as defined in Directive 2002/46/EC, intended for the general population, except for children under 12 years of age: • 163 mg/day for adolescents between 12 and 14 years old; • 230 mg/day for adolescents over 14 years of age; • 263 mg/day for adults (38).	EFSA Warning*: the intake of iodine from food supplements containing fluorotannins from <i>Ecklonia cava</i> may be of concern to people at risk of thyroid disease and for those who are not at risk for thyroid disease but consuming food supplements containing fluorotannins from <i>Ecklonia cava</i> in addition to other dietary supplements containing iodine, since their total iodine intake may exceed the upper limit established for iodine (38).	Mono and multi-ingredients (38)



L-ergotionein (39)	Reg. (EU) no. 462/2018 (39)	Food supplements, as defined in Directive 2002/46/EC: • 30 mg/day for the general population (except pregnant and lactating women); • 20 mg / day for children older than 3 years (39).	No possible side effects have been reported (39).	Mono and multi-ingredients (39)
Extract from the roots of three plants (<i>Cynanchum wilfordii</i> Hemsley, <i>Phlomis umbrosa</i> Turcz. and <i>Angelica gigas</i> Nakai) (40)	Reg. (EU) no. 469/2018 (40)	Food supplements, as defined in Directive 2002/46/EC, intended for the adult population: • 175 mg / day (40)	Possible allergic side effects (40).	Mono and multi-ingredients (39)
Yeast for ultraviolet-treated bakery (<i>Saccharomyces cerevisiae</i>) (41)	Reg. (EU) no. 1018/2018 (41)	Food supplements, as defined in Directive 2002/46/EC: • CN (41).	No possible side effects have been reported (41).	Multi-ingredients (41)
Quinoa pyrroloquinoline disodium salt * (42)	Reg. (EU) no. 1122/2018 (42)	Food supplements, as defined in Directive 2002/46/EC, intended for the adult population, with the exception of pregnant women and lactating women: • 20 mg/day (42).	- no side effects have been reported (42); - no comprehensive assessment of renal function has been performed (43); - pro-oxidant activity (43); - no information on allergenicity has been provided (43).	Multi-ingredients (43)
Dry aerial parts of <i>Hoodia parviflora</i> (43)	Reg. (EU) no. 1113/2018 (43)	Food supplements, as defined in Directive 2002/46/EC, intended for the adult population: • 9.4 mg/day (43).	Insufficient characterization of novel food, limited allergenicity assessment, insufficient data to exclude risk to children over 12 years of age, insufficient information on specifications, stability, consumption assessment and toxicological data (43).	Multi-ingredients (43)
Cranberry extract in powder form (44)	Reg. (EU) no. 1631/2018 (44)	Food supplements, as defined in Directive 2002/46/EC, intended for the adult population: • 350 mg/day (44).	Possible nutritional risks associated with excessive consumption of polyphenols in children aged one to three years, resulting from the intake of polyphenols in novel foods and other sources of polyphenols in children's diets (44). Insufficient data to exclude the risk for young children aged one to three	Mono-/multingredient (44)



<p>Whey Protein Isolate from Cow's Milk (46)</p>	<p>Reg. (EU) no. 1632/2018 (46)</p>	<p>Starting formulas, as defined in Regulation (EU) No. 609/2013:</p> <ul style="list-style-type: none"> • 30 mg/100 g (powder); • 3.9 mg/100 ml (reconstituted). <p>Follow-up formulas as defined in Regulation (EU) no. 609/2013:</p> <ul style="list-style-type: none"> • 30 mg/100 g (powder); • 4.2 mg/100 ml (reconstituted). <p>Substitutes for a total diet for weight control as defined in Regulation (EU) no 182/2011.</p> <ul style="list-style-type: none"> • 300 mg/day. <p>Foods intended for special medical purposes, as defined in Regulation (EU) no 182/2011.</p> <p>609/2013:</p> <ul style="list-style-type: none"> • 58 mg/day for young children; • 380 mg/day for children and adolescents aged 3 to 18 years; • 610 mg/day for adults (46). 	<p>years, the incomplete nature of the novel food specification and the lack of information on the protein content needed to exclude the risk of allergy (44). Possible side effects: Gastroesophageal reflux, nausea, digestive disorders (45).</p>	<p>Mono-ingredient (47)</p>
<p>Refined shrimp peptide concentrate* (48)</p>	<p>Reg. (EU) no. 1633/2018 (48)</p>	<p>Food supplements, as defined in Directive 2002/46/EC, for the adult population:</p> <ul style="list-style-type: none"> • 1,200 mg/day (48). 	<p>No possible RAs have been reported regarding the blood pressure and interaction of the concentrate with the drugs used in treatment of blood pressure disorders (48, 49). Allergen (49).</p>	<p>Mono-ingredient (48, 49)</p>
<p>Egg Membrane Hydrolysate (50)</p>	<p>Reg. (EU) no. 1647/2018 (50)</p>	<p>Food supplements, as defined in Directive 2002/46/EC, for the general adult population:</p> <ul style="list-style-type: none"> • 450 mg/day (50). 	<p>Adverse reactions reported in subjects included in the clinical trial: - hypertension; - allergies (51).</p>	<p>Mono-ingredient (51)</p>

Xylo-oligosaccharide (52)	Reg. (EU) no. 1648/2018 (52)	Breakfast cereals: • 14 g/kg. Chocolate confectionery: • 30 g/kg (52).	Reported side effects: - transient gastrointestinal disorders: diarrhea (53). RA possible: - allergy (low probability) (53).	Mono-/Multi-ingredient (53)
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Ultraviolet-treated mushrooms (*Agaricus bisporus*) - with high levels of vitamin D2 (35); **Ecklonia cava** - edible seaweed (38); **EFSA** – Authority European Food Safety Authority; **quinine pyrroloquinoline disodium salt** - produced from the bacterium *Hyphomicrobium denitrificans*; **BLF** - bovine lactoferrin; **BLP** - lactoperoxidase, the refined peptic concentrate of shrimp - by enzymatic hydrolysis of the shells and heads of northern shrimp (*Pandalus borealis*).

Table 3. Adverse reactions caused by new food ingredients authorized by EFSA in the European Union, in the period 2019-2021.

Ingredient/ substance approved as a novel food ingredient in EU	EU Decision/ Regulation	Category of products for which it has been authorized or action - Maximum dose/day (mg or g/day), according to EU Decision/Regulation	Adverse reactions/ Warnings	Consumption mode (eg mono-ingredient)
<i>Schizochytrium</i> sp. Oil (54)	Reg. (EU) no. 109/2019 (54)	Food supplements, as defined in Directive 2002/46/EC: • 250 mg DHA/day for the general population; • 450 mg DHA/day for pregnant and lactating women. Replacements of a total diet for weight control, as defined in Regulation (EU) no. 609/2013 and substitutes for a weight control table: • 250 mg/portion. Milk-based beverages and similar products for young children: • 200 mg/100 g (54).	No side effects/possible side effects reported (55).	Mono-ingredient (55)
<i>Allanblackia</i> seed oil (56)	Reg. (EU) no. 110/2019 (56)	Yellow spreadable fats and cream products: • 30 g/100 g. Mixtures of vegetable oils (*) and milk (falling into the food category: Dairy products, including beverage bleaching preparations): • 30 g/100 g (56).	No side effects/possible side effects reported (57).	Mono-ingredient (57)
<i>Yarrowia lipolytica</i> yeast biomass (58)	Reg. (EU) no. 760/2019	Food supplements, as defined in Directive 2002/46/EC, with the exception of food supple-	No clinical studies have been presented on the safety of <i>Yarrowia lipolytica</i>	Multi-ingredient (58, 59)

The mixture of 2'-fucosyl-lactose/difucosyl-lactose * (60)	Reg. (EU) no. 1979/2019 (60)	<p>ments for infants and young children:</p> <ul style="list-style-type: none"> • 6 g/day for children over 10 years of age, adolescents and the general adult population; • 3 g/day for children aged 3 to 9 years (58). <p>Replacements of a total diet for weight control, as defined in Regulation (EU) no. 609/2013:</p> <ul style="list-style-type: none"> • 4.0 g/l (drinks); • 40 g/kg (products other than beverages). <p>Foods intended for special medical purposes, as defined in Regulation (EU) No 182/2011, 609/2013:</p> <ul style="list-style-type: none"> • in accordance with the specific nutritional needs of the persons for whom the products are intended. <p>Food supplements, as defined in Directive 2002/46/EC, intended for the general population, except infants:</p> <ul style="list-style-type: none"> • 4.0 g/day (60). 	<p>yeast biomass in humans.</p> <p>Possible side effects:</p> <ul style="list-style-type: none"> - allergies (59). <p>No clinical trials have been reported to verify the safety of the mixture 2'-fucosyl-lactose/difucosyl-lactose.</p> <p>Studies performed with 2'-fucosyl-lactose alone, in amount of 20 g/day, over 2 weeks were provided. Gastrointestinal RAs have been reported:</p> <ul style="list-style-type: none"> - nausea; - ballooning; - diarrhea (61). 	Mono-ingredient (61)
Partially defatted chia seed powder (<i>Salvia hispanica</i>) (62)	Reg. (EU) no. 500/2020 (62)	<p>Food supplements within the meaning of Directive 2002/46/EC, with the exception of food supplements for infants and young children:</p> <ul style="list-style-type: none"> • 7.5 g/day (62). 	<p>There are no clinical studies to verify the safety of Chia seeds in humans. The studies followed the benefits and few parameters for safety (eg blood pressure, histological parameters).</p> <p>Allergies may occur.</p> <p>No side effects have been reported (63).</p>	Mono-ingredient (63)
Mushroom powder with vitamin D2 (64)	Reg. (EU) no. 1163/2020 (64)	<p>Maximum vitamin D2 levels.</p> <p>Meal substitutes in the form of bars and drinks:</p> <ul style="list-style-type: none"> • 2.25 µg of vitamin D2/100 g/l; • 125 µg of vitamin D2/100 ml (drinks). <p>Foods intended for special medical purposes, as defined in Regulation (EU) no. 609/2013, except for those for infants:</p> <ul style="list-style-type: none"> • 15 µg/day. 	<p>No specific studies have been provided on the safety of vitamin D2 fungus in humans. The studies made available to the Authority * by the applicant were performed with similar products. These studies show a little evidence in assessing the potential health effects of vitamin D2 mushroom powder.</p> <p>Regarding allergenicity, the applicant</p>	-

Sugars derived from cocoa pulp (<i>Theobroma cacao</i> L.) (66)	Reg. (EU) no. 1634/2020 (66)	Food supplements, as defined in Directive 2002/46/EC, intended for the general population, except infants: • 15 µg/day (64). Used as an ingredient for the population as a whole (66).	referred to EFSA's conclusion on ultraviolet-treated mushrooms* (<i>Agaricus bisporus</i> (35)) (65).	-
Alga <i>Euglena gracilis</i> * (67)	Reg. (EU) no. 1820/2020 (67)	Food supplements, as defined in Directive 2002/46/EC, with the exception of infant food supplements: • 100 mg/day for young children; • 150 mg/day for children aged 3 to 9 years; • 225 mg/day for children aged 10 years and adolescents (up to 17 years); • 375 mg/day for adults (67).	The Commission considers that, in the case of the current application, it is not necessary for EFSA to do so (66). Based on the results, EFSA considers that the highest dose that has been tested and at which an adverse effect may occur is 3300 mg of seaweed <i>Euglena gracilis</i> desiccata/kg body weight/day (68).	-
Extract of <i>Panax notoginseng</i> and <i>Astragalus membranaceus</i> (AstraGin™) (69)	Reg. (EU) no. 1821/2020 (69)	Food supplements, as defined in Directive 2002/46/EC, for the general adult population, excluding food supplements for pregnant women: • 35 mg/day (69).	The applicant did not provide clinical trials and there were no extensive human studies published in the literature on the safety of <i>Panax notoginseng</i> and <i>Astragalus membranaceus</i> in humans.	-
Yeast Biomass (<i>Yarrowia lipolytica</i>) with chromium content (71)	Reg. (EU) no. 1822/2020 (71)	Food supplements as defined in Directive 2002/46/EC, with the exception of food supplements for infants and young children: • 2 g/day for children aged 3 to 9 years, which means 46 µg of chromium per day; • 4 g/day for children over 10 years of age, adolescents and adults, which means 92 µg of chromium per day (71).	Possible side effects: allergies (70). Possible side effects: - allergies (low risk) (72).	Mono-ingredient (72)
Selenium-containing yeast biomass (<i>Yarrowia lipolytica</i>) (73)	Reg. (EU) no. 1993/2020 (73)	Food supplements, as defined in Directive 2002/46/EC, with the exception of food supplements for infants and children under 4 years of age: • 50 mg/day for children aged 4 to 6 years, which means 10 µg of selenium per day; • 100 mg/day for children aged 7 to 10 years, which means 20 µg of selenium per day; • 500 mg/day for adolescents aged 11 to 17 years, which means 100 µg of selenium per day;	Possible side effects: - Allergies (low risk) (72, 74).	Mono-ingredient (72, 74)



Partially defatted rapeseed powder of <i>Brassica napus L.</i> * (75)	Reg. (EU) no. 120/2021 (75)	<ul style="list-style-type: none"> • 800 mg/day for adults, which means 160 µg of selenium per day (73). Grain mix sticks: <ul style="list-style-type: none"> • 20 g/100 g. Bread and buns with special ingredients added (such as seeds, raisins, herbs): <ul style="list-style-type: none"> • 7 g/100 g (75). 	Possible side effects: - Allergies, in the case of people allergic to mustard (76).	-
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Schizochytrium sp oil - oil extracted from *Schizochytrium sp microalgae*; **2'-fucosyl-lactose/difucosyl-lactose mixture** - obtained by fermentation microbial with a genetically modified strain of *Escherichia coli* K12 DH1; **Authority** - EFSA, Commission - European Commission, alga *Euglena gracilis* - whole cells dried by *Euglena gracilis*

In addition to the product categories mentioned in Table 1, the oil extracted from the microalga *Schizochytrium sp.* (ATCC PTA-9695) may be added to dairy products, other than milk-based beverages, for cheeses, dairy products, excluding beverages or, for cheese-like products, spreadable fat and salad dressings, bakery products (bread and buns), sweet biscuits, cereal bars, cooking fats, non-alcoholic beverages (including similar dairy products and milk-based drinks), preparations for infants and preparations for young children – used in accordance with Directive 2006/141/EC, cereal-based preparations and baby foods for infants and young children, including those used in accordance with Directive 2006/125 (8).

Regarding food supplements, special medical foods and foods for use in low-calorie diets listed in Table 1, refined *Buglossoides arvensis* seed oil is approved as a novel food ingredient in dairy products and the like, beverages, cheese and cheeses, butter and other fat and oil emulsions, including spreads (not for cooking or frying), breakfast cereals (14).

The European Commission has approved lacto-N-neotetraose (tab. 1) (16) as a novel food ingredient in pasteurized and sterilized milk products (including UHT), non-flavored, non-flavored fermented milk products, beverages and other products than beverages, flavored fermented milk products, including heat-treated products in beverages and non-beverages, cereal bars, tabletop sweeteners, infant formulas, as defined in Directive 2006/141/EC.

In vitro and in vivo studies suggest that trans-resveratrol sulphate may inhibit CYP enzymes in humans and may interact with drugs that are primarily metabolised by CYP2C9 (22).

Other authorized uses for yeast beta glycans (*Saccharomyces cerevisiae*) are the following: beverages based on fruit juice and/or vegetable juice including concentrated and dehydrated juice, fruit flavored beverages, powdered form for cocoa-based beverages, breakfast cereals, breakfast cereals, whole grain breakfast cereals (instant hot cooking), cookies, crackers, milk drinks, dairy products fermented milk, similar dairy products, dehydrated milk/milk powder, soups and mixes for soups, chocolate and sweets, protein bars and protein powder, jam, marmalade and other fruit spreads (25).

The extended conditions under which taxifolin-rich extract may be used are the plain yogurt/fruit yoghurt (when used in dairy products, taxifolin-rich extract may not replace, in whole or in part, any constituent of milk), kefir, sour milk, powdered milk, cream, fermented cream, cheese, butter, chocolate confectionery, soft drinks (28).

Commercially grown *Agaricus bisporus* mushrooms are subjected to ultraviolet treatment after harvest, which results in a vitamin D₂ content of $\leq 10 \mu\text{g}/100 \text{ g}$ fresh weight. UVB radiation: a process of radiation in ultraviolet light with a wavelength in the range 290-320 nm. Vitamin D₂ in the finished product: 5-10 $\mu\text{g}/100 \text{ g}$ fresh weight at the end of the shelf life (35).

The Scientific Opinion issued by EFSA on monacolin K in RYR (36), it has the same structure as lovastatin, the active ingredient in several medicines authorized to treat hypercholesterolemia in the EU. With the help of the Mintel Global New Products (MintelGNPD) database, which lists the contents of all product labels containing monacolin K from RYR, 40 products containing monacolin K from RYR were identified and included in the category "Vitamins and dietary supplements". Approximately 25% of the total products identified provided the daily intake of 10 mg monacolin K recommended by EFSA, and only 8 products were identified as mono-ingredients, containing only RYR preparation (36). Although studies underlying this scientific opinion have shown that monacolin K and lovastatin rapidly convert from the lactone form to an identical form of hydroxy acid (HA), the latter being responsible for the inhibition of 3-hydroxy-3-Methylglutaryl-coenzyme A (HMG-CoA) enzyme reductase involved in cholesterol biosynthesis, and the acid form occurs naturally in RYR. The bioavailability of lovastatin increases by 30-50% when taken as a standard dose. Due to the involvement of the CYP3A4 isoform in its metabolism, there have been found interactions with drugs or food ingredients with inhibitors of this enzyme, leading to increased plasma statin levels and a possible increased risk of toxic effects (36).

The WHO, FDA, EMA, and ANSES have published common side effects for RYR and lovastatin: damage to musculoskeletal and connective tissue, liver, nervous system, gastrointestinal tract, skin, and subcutaneous tissue (4, 36).

The case reports used to carry out the aforementioned scientific opinion, specified the daily intake of monacolin K in which SE (rhabdomyolysis, hepatitis and skin disorders) occurred was 3 mg/day for a period between 2 weeks and 1 year (36).

L-ergothioneine is also accepted as a novel food ingredient in the following food categories: non-alcoholic beverages, milk-based beverages, fresh dairy products – maximum 0.040 g/kg (when used in dairy products, L-ergothioneine cannot replace, in whole or in part, any milk constituent), cereal bars. The name of the novel food mentioned on the label of foods containing it is "L-ergothioneine" (39).

In addition to food supplements, the European Commission and EFSA have approved yeast for ultraviolet-baked bread (*Saccharomyces cerevisiae*) and for the addition of yeast-leavened bread and buns, yeast-leavened bakery products, fresh or dried pre-packaged yeast for home baking (41).

In accordance with Article (5) of Regulation (EU) no. 1133/2018 (43), in its opinion, the Authority did not confirm the safety of dry aerial parts of *Hoodia parviflora* in food for the uses and use levels proposed by the applicant, as consumption would exceed the level considered safe (0.134 mg/kg body weight). However, the Authority concluded that the dry aerial parts of *Hoodia parviflora* are safe for adults when added to food supplements in a maximum daily dose of 9.4 mg, which corresponds to the safe level of consumption of an adult with a body weight of 70 kg.

In the case of refined shrimp peptic concentrate - by enzymatic hydrolysis of shells and heads of northern shrimp (*Pandalus borealis*) (48), according to point (13) of Regulation (EU) no. 1633 of 2018, data from the 90-days oral toxicity study served as a basis for assessing the toxicity profile of refined shrimp peptide concentrate and for establishing the level at which no adverse effects are observed. Data from the study evaluating the antihypertensive effects and safety of the refined peptide concentrate in shrimp in healthy subjects with mild to moderate hypertension, as well as data from the parallel double-blind, placebo-controlled study on the evaluation of the antihypertensive effect and safety dietary supplement with refined shrimp peptide concentrate in the case of healthy individuals with mild

or moderate hypertension, served as a basis for establishing the safety of the novel food for this category of consumers.

Therefore, it is considered that, in the absence of data from the unpublished reports of those studies, it would not have been possible to reach these conclusions on the safety of the refined shrimp peptide concentrate. In carrying out this study, the applicant replied that some Member States had objected to the safety of refined shrimp peptide concentrate in the case of hypo-, normo- and hypertensive consumers given its alleged antihypertensive effects, its potential side effects related to its presumed ability to inhibition of angiotensin converting enzyme (ACE) and its potential cardiac effects, and on potential drug interactions used in the treatment of blood pressure disorders (48).

Powder with a high content of partially defatted chia seed protein (*Salvia hispanica*) (62), in addition to food supplements (tab. 1) may also be added in unflavored fermented dairy products, including unflavored natural sour milk (excluding sterilized sour milk), untreated after fermentation, non-flavored fermented milk products, heat-treated after fermentation, flavored fermented milk products, including heat-treated products, confectionery, fruit juices within the meaning of Directive 2001/112/EC and vegetable juices, fruit nectars within the meaning of Directive 2001/112/EC and vegetable nectars and similar products, flavored beverages. Powder with a high content of partially defatted chia seed fibers (*Salvia hispanica*) is accepted by EFSA for addition to confectionery, fruit juices within the meaning of Directive 2001/112/EC and vegetable juices, fruit nectars within the meaning of Directive 2001/112/EC and vegetable nectars and similar products, flavored beverages (62).

Given the clinical trials conducted by various teams of specialists, EFSA considers that in the case of yeast biomass (*Yarrowia lipolytica*) (72) containing selenium, it should be re-evaluated (74).

Probiotics that can cause human sepsis, generally in elderly patients and those suffering from chronic diseases, are Lactobacilli (strains of *L. rhamnosis*, due to its high translocation potential) (77), *Lactobacillus sp.* bacteremia which is sometimes fatal (77), infectious endocarditis

(77) caused by *L. rhamnosus*, *L. casei*, *L. acidophilus*, *L. jensenii*, *L. plantarum* and *L. paracasei* (77). They can cause anaphylactic response in patients who have undergone cardiovascular surgery (77) or localized infection in diabetes associated with old age and liver transplantation (77).

Thus, for terbinafine (78) which is metabolised by the enzyme CYP3A4 and the clearance (or intracellular concentration) of this drug may be influenced by dietary supplements/other products containing *Agaricus blazei* Murrill, *Aloe vera*, *Artemisia annua*, *Andrographis paniculata*, *Matricaria recutita*, *Chrysanthemum morifolium*, *Vitex agnus castus*, *Taraxacum officinale*, *Echinacea purpurea*, *Tanacetum parthenium*, *Zingiber officinale*, *Allium sativum*, *Hydrastis Canadensis*, *Centella asiatica*, *Commiphora mukul*, *Crataegus monogyna*, *Cymbopogon citratus*, *Artemisia annua*, *Urtica dioica*, *Mentha piperita* L, 3,3', 4', 5,7-pentapentahydroxyflavone (quercetin), *Monascus purpureus* (Red Yeast Rice), *Trifolium pratense*, 3,5, 4'-trihydroxystilbene (resveratrol), *Rhodiola rosea*, *Serenoa repens*, *Glycine max* (Soy), *Turmeric longa* (79).

The CYP2C9 enzyme metabolizes dermatological drugs such as voriconazole (80) and can be inhibited by dietary supplements/other products containing *Andrographis paniculata*, Sulphydryl

proteolytic enzyme, cysteine proteinase, *Matricaria recutita*, *Harpagophytum procumbens*, *Tanacetum parthenium*, *Allium sativum*, *Centella asiatica*, *Cymbopogon citratus* (Lemongrass), *Magnolia officinalis*, *Urtica dioica*, *Mentha piperita* L. (Peppermint), *Trifolium pratense*, 3,5,4'-trihydroxystilbene (resveratrol), *Serenoa repens*, *Eleutherococcus senticosus* (79).

As regarding "Nutrivigilance that is a new activity referring to dietary supplements" (2), the authors Morgan C, Ghibu S, Juncan AN et al presented the current use of SE and the interaction with drugs of certain substances or herbs, such as *Aloe Vera*, *Aristolochic acids/Aristolochia sp*, *Chelidonium majus*, *Citrus sp*, *Cytisus sp*, *Echinacea purpurea*, *Ginkgo biloba*, *Green tea extract*, *Camellia sinensis*, *Hypericin St. John's wort/Hypericum perforatum*, *Lamiaceae sp*. With high contents in *Rosmarinic acid*, *Valeriana officinalis*, etc.

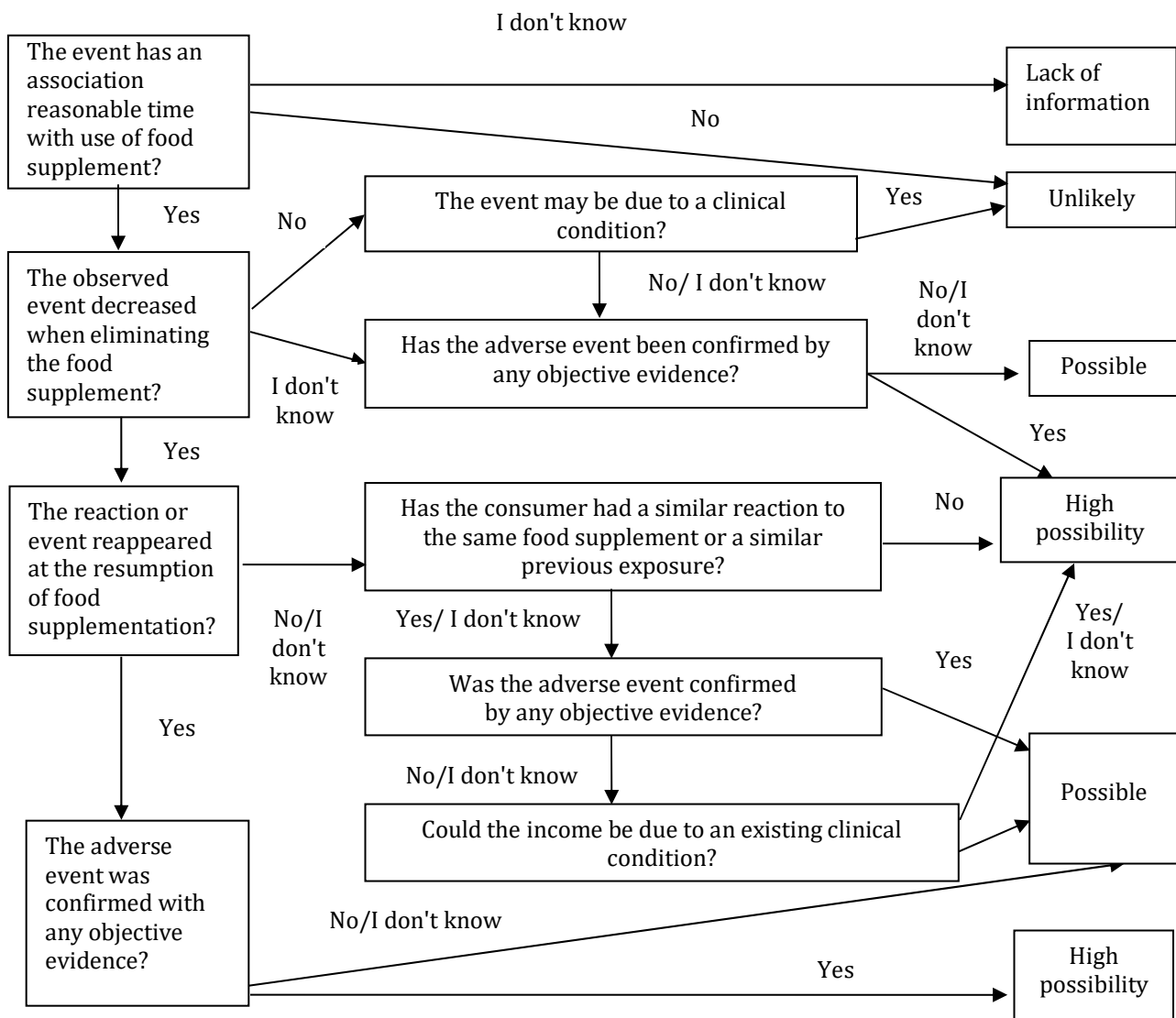
To establish the severity-causality relationship in the case of SA, authors such as Kazuki I, Hiroshi Y, Mamoru K et al. (79) propose the use of algorithms used in pharmacovigilance, for drug-induced RA: Naranjo scale, FDA, Kramer scale, Liverpool scale, WHO scale.

Table 4 and Figure 1 show the Naranjo and FDA algorithms.

Table 4. Naranjo algorithm (81).

Nr. No	The question	Yes*	Not*	I do not know *
1	Is there a notification about the reaction, on the label or in the package leaflet food supplement?			
2	Did the side effect occur after taking the food supplement?			
3	Did the adverse reaction improve when the suspected food supplement was discontinued?			
4	Did the adverse event recur when the food supplement was given?			
5	Are there any causes other than the dietary supplement that could have caused side effects?			
6	Was the reaction more severe when the dose was increased or less severe when the dose was decreased?			
7	Did the consumer have a similar adverse reaction to the similar food supplement in the previous exposure?			
8	Has the adverse event been confirmed by any objective evidence?			

* Scores applied: ≥ 9 most likely, 5 - 8 likely, 3 - 4 very likely, 1 - 2 possible, ≤ 0 unlikely.



DISCUSSIONS

Given that new food ingredients can be added to food supplements and a wide range of foods, in which new food ingredients, the lifestyle of many people can be added, there is a risk of reaching and/or exceeding the maximum allowable dose and challenging AR identified or unidentified up to date. A major risk is the large amount of commercial information on the benefits of various plant resources, without a possible and scientifically proven/clinically proven AR and their interaction with food or medicine.

Nutrivigilance is also important from the perspective of CYP's transformation of certain plant components into toxic or mutagenic

substances and reactive, carcinogenic metabolites by 1'-hydroxylation to allylic side chains and the bioactivation of alkylbenzenes, such as

CYP1A1, CYP1A2, and CYP1A2, and by their high catalytic capacity they contributed to the metabolic activation of elemicin, by the formation of 1'-hydroxyelemicin (82). Thus, excessive intake of foods and spices containing elemicin can lead to cellular toxicity. This is an argument why nutravigilance is important in both the food and food supplements, dietetics and nutrition and pharmaceutical industries.

We propose the application of the algorithm model for drug-induced RA to food supplements. One method of collecting information on possible ARs caused by FS is by telephone survey, including the following criteria: the substance involved, the age of the patient (adult/paediatric), the type of ingestion (accidental or intentional), the food consumed and their approximate amount, where he bought FS (hypermarket, health food store, community pharmacy, online pharmacy or vari-

ous websites), the symptoms recorded, evaluated according to severity and causality.

Another method of collecting information about AR caused by FS are online questionnaires distributed through social networks, or through companies organizing medical events or otherwise.

We joined the signal sent by colleagues Morgan C, Ghibu S, Juncan AN et al (2) and supported the urgent need to legislate the reporting of adverse reactions caused by dietary supplements, including their interaction with food or medicine. The veracity of the practical applicability of the legislation and the existence of an educational program of the population, proved that this intervention is not to be null and void.

We consider that the formation of multidisciplinary teams of regional specialists, as well as

their cooperation on a regular basis, might have a constructive brainstorming for data collection (adverse reactions, age, etc.), the database formation and the identification of severity-causality, which could be a good start for implementing nutriviigilance in Romania.

Given the mandatory pharmacovigilance process in pharmaceutical companies, a similar system of nutriviigilance is needed in food and food supplement factories in Romania. The implementation of the nutrition surveillance system may be one of the methods of re-evaluation of food additives and ingredients approved by the European Food Safety Authority (EFSA) and European Commission.

Due to the complexity of nutriviigilance, this article has the following weaknesses: the methodology of approaching the problem and the existing scientific basis.

CONCLUSIONS

1. The formation of territorial teams of specialists and their involvement in risk assessment, monitoring and management of unauthorized exposure to food supplements, especially among vulnerable population groups, can have a constructive impact on the collection of medical and pharmaceutical data (adverse reactions, age, etc.).
2. The formation of a pharmacovigilance database and the identification of the causality of the reported side effects could be a good start in implementing nutriviigilance in Romania.
3. We recommend conducting a pilot study in Romania and possibly in collaboration with colleagues from the Republic of Moldova, to test the two algorithms and adapt to the conditions in this area.

CONFLICT OF INTERESTS

The authors have no conflicts of interest to declare.

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MAJOR BEHAVIORAL RISK FACTORS FOR ROAD TRAFFIC INJURIES

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Keywords: motor vehicle injuries, risk factors, car accident, prevention.

Introduction. Road traffic injuries are a major public health problem, ranking 8th in the leading causes of death and are forecasted to rank 5th by 2030 worldwide. Children, pedestrians, cyclists and the elderly remain among those most at risk of road traffic injuries.

Material and methods. A specialized literature search was conducted within the main international databases, including: PubMed/MEDLINE, Google Scholar, and Research Gate, using a set of inclusion criteria. Data from references were extracted systematically into results tables, including: author/citation, study design, assessments/data, limitations, and key facts. Reported outcomes were compiled in narrative form.

Results. Many researchers and scientists both in the country and abroad have studied road injuries. Authors of the studies used different methods and obtained obvious data about road traumas and major risk factors. Among the main causes of unintentional motor vehicle injuries were excessive speed, alcohol consumption while driving, mental disorder, drugs, and unsupervised children. There is an increasing incidence of road injuries among children, and most of the road traffic crashes involving children occur in May-September, between 11.00 and 18.00. The obtained results motivate the need to study this topic in depth, on separate age groups, and to propose specific prevention measures for each actor involved.

Conclusions. There are many factors, which contributes to road crashes and related injuries, but those requires multisectoral involvement.

Cuvinte cheie: traume rutiere, factori de risc, accidente rutiere, prevenire.

FACTORII COMPORTAMENTALI ÎN PRODUCEREA TRAUMATISMELOR RUTIERE

Introducere. Traumele rutiere constituie o problemă majoră de sănătate publică, ocupând locul 8 după principalele cauze de deces și se estimează că vor deține locul 5 după cauzele de deces până în 2030. Copiii, pietonii, bicicliștii și vârstnicii rămân printre cei mai expuși riscului de accidente rutiere.

Material și metode. A fost efectuată o cercetare specializată a principalelor baze de date internaționale, precum: PubMed/MEDLINE, Google Scholar și Research Gate, urmând criteriile de includere stabilite. Datele și referințele au fost extrase și sistematizate după următoarele criterii: autor, citare, designul studiului, date obținute, limitările. Rezultatele raportate au fost compilate sub formă narativă.

Rezultate. Mulți cercetători și oameni de știință, atât din țară, cât și din străinătate, au studiat traumatismele rutiere. Autorii studiilor au folosit diferite metode și au obținut date evidente despre traumele rutiere și factorii de risc major. Printre principalele cauze ale traumelor rutiere au fost subliniate viteza excesivă, consumul de alcool și de droguri în timpul conducerii, supraaboseala, nerespectarea regulilor de circulație. Există o tendință în creștere a traumelor rutiere în rândul copiilor, iar majoritatea accidentelor rutiere cu implicarea lor au loc în lunile mai-septembrie, între orele 11.00 și 18.00. Datele obținute ne motivează să continuăm studiul acestui subiect mai în profunzime, pe grupe de vârstă separat și să întreprindem măsuri de prevenire specifice pentru fiecare actor implicat.

Concluzii. Există mulți factori care contribuie la producerea accidentelor rutiere și a traumelor rezultate de pe urma acestora, dar acestea pot fi prevenite cu eforturi multisectoriale comune.

INTRODUCTION

Road injuries are a widespread public health problem, particularly in low- and middle-income countries, and are responsible for more years of life lost than most of human disease (1-3). This public health problem is widespread and has social and economic sequelae (4) that can influence the development and stability of countries. The negative social and economic impacts are very high for the people affected, their families, and the country as a whole. According to World Health Organization (WHO), Global Status Report on Road Safety, the number of deaths on the world's roads remains unacceptably high, with an estimated 1.35 million people dying each year (2, 5). Road traffic injuries are now the leading cause of death for children and young adults aged 5-29 years and more than half of all road traffic deaths are among vulnerable road users: pedestrians, cyclists, and motorcyclists (2). The Global Burden of Disease Collaborative Network, 2019, estimates that road injury ranks 8th after the main causes of death and according to forecasts will rank 5th by 2030.

The aim of this literature review was to identify the main behavioral risk factors responsible for the road traffic injuries among adult population and develop prevention measures for road safety among the target group. The PICO tool (population, intervention, comparison, outcome) was used to formulate *the research question of the study*: Would identifying and assessing the risk factors for road traffic injuries among populations above 18 years old contribute to the development of specific actions in changing the risky behavior and reduce road injury indicators?

MATERIAL AND METHODS

A specialized literature search was conducted within the main international databases, including: PubMed/MEDLINE, Google Scholar, and Research Gate. The search was done by applying Boolean operators: road trauma AND accident, road trauma AND risk factors, "road trauma" AND "risk factors", (trauma OR risk factor), car accident. Considering the significant amount of information published on the topic, the search was assigned for the period of 2010-2021. The inclusion criteria were the following: studies related to motor vehicle crashes and risk factors, original research, observational studies and systematic reviews, full-text articles, written in

English and published in open access, all of those criteria referring to population above 18 years old. From the 4535 results obtained from the applied operators, only 45 studies were included in the review, which answered the specific set up-criteria. Most of the articles were excluded because they were not published in open access and another majority were excluded because the study population was under 18 years old. Also excluded the book chapters, papers/abstracts presented at conferences and articles not related to behavioral risk factors in road traffic injuries. Data and references were extracted systematically into results tables, which included: author/citation, study design, assessments/data, limitations, and key facts. Reported outcomes were compiled in narrative form.

RESULTS

According to the results of the current study, behavioral risk factors have a great importance in road traffic injuries (2, 3, 6, 7), associated with road infrastructure, environmental factors, and factors conditioned by the vehicle (8, 9). In the literature, varied behavioral factors are described that contribute to the prevalence of road traffic crashes and injuries. According to the World Health Organization's Global Road Safety Report (2) the most common causes of road trauma are traffic rule violations, drunkenness, poor road conditions, and environmental factors (e.g., ice, fog, technical vehicle defections, time of year, street lighting). Other important contributing factors include: age, sex, road safety knowledge and skills, and proper use of the safety device. A paper regarding human-centered crash contributing factors on crash outcomes (7) identified six specific driving behaviors considerably contributing to the prevalence of serious crashes: driver error, speeding, driving under the influence, fatigued driving, distracted driving, and not using a seatbelt.

A recent study (10) conducted in Nigeria on 321 individuals involved in road traffic crashes highlighted four major contributing behaviors of road users, such as not using seat belts, driving under the influence of alcohol, using a mobile phone while driving, and not using child restraint systems. Approximately 64% did not use seat belts, which was associated with young people and being alone in the vehicle. They also noted that the level of education and driving

experience affected the rate of seat belt compliance, the higher the level of education and more years of experience behind the wheel both increased the use of seat belts. About 1/3 of road users admitted to driving under the influence of alcohol and more than half admitted to not using child restraint systems.

Two of the most identified important factors for road safety are lack of attention and distraction of drivers, by writing text messages on the phone, or by looking at roadside billboards (11). Driver distraction has a high impact on safety, and has been estimated that 25% of crashes involve at least some degree of distraction of traffic participants (12-15) and about 68% of crashes were caused by distraction (16). Distracted driving is also classified by the WHO (14, 17) as an important risk factor for road traffic crashes (18), with behaviors including mobile phone use, eating, talking with passengers, personal care, reading, watching videos, adjusting the radio or music player, and using a Global Positioning System (GPS) for navigating locations.

Examining the causal effects of distracted driving on the severity of traffic crashes, the results of another study indicate that drivers are more likely to be young and female and distracted on roads with higher speed limits, during rush hour, at intersections, during sunlight, during cloudy weather, and driving heavy vehicles. Results have also shown significant effects of driver distraction on the severity of traffic crashes, highlighting the need for countermeasures to reduce distracted driving (19).

Driver distraction according to a recent scientific report, can be both internal and external. The presence of external sources (e.g., billboards, advertising, other ongoing events, urbanization) (20, 21) are not in the driver's control, whereas internal sources are frequently self-imposed and avoidable.

Within the main distracting behaviors is also, mobile texting and calls, talking to passengers, handling children, smoking, and looking at roadside advertisements (whether it is directly on the roadside or elevated). Gazder et al. 2020, split the road distraction into three main types: manual distraction, visual distraction, and cognitive distraction (22).

Driver emotions (e.g., anger) are also associated

with road injuries, resulting in both positive and negative driving behavior, such as high speed, distraction, and noncompliance with the traffic rules. A study on this issue in Japan revealed that drivers' negative emotions (angry and sad) are likely to increase driving speed (23).

According to the European transport safety council (24), driving under the influence of alcohol is one of the four main killers on the road, alongside speeding, non-use of seatbelts, and driver distraction. Driving under the influence of alcohol, drugs, and fatigue, were analyzed in the European Survey of Road users' safety Attitudes (ESRA) study to underline their impact (25). According to the WHO, 27% of road traffic deaths worldwide are attributable to alcohol (2, 26). Alcohol is the most commonly used psychoactive substance among drivers in Europe (27).

A recent study performed in Brazil (28) and one of the largest and longest studies ever developed for monitoring road traffic risk factors, highlighted that alcohol-related fatalities were consistently a high percentage, with 39% of road traffic deaths involving alcohol in 2016. However, the authors indicate it is a great challenge for the public authorities to control drink driving and speeding behavior. Nevertheless, the driving rate under the influence of alcohol has decreased, likely due to an increase of drivers who refuse breath alcohol tests, while the speeding rates remain high especially for motorcyclists.

Despite countries having implemented legal blood alcohol concentration (BAC) limits (2), many alcohol-related crashes and injuries continue to be registered. Around 31% of all road crashes in the US, around 34 % in China (29), and over a third of car driver fatalities in Australia attributable to illegal alcohol consumption (30). About one-quarter of those road user fatalities were impaired by either alcohol or drugs according to a recent study that presents detailed statistics on alcohol and drug findings among active road users (27).

A recent study in Australia on drink-driving behaviors comparing data during and after the period of COVID-19 restrictions, found that young males were more likely to drink-drive during restrictions (31).

Another important behavioral risk factor associated with motor vehicle crashes is aggressive

and anger-related driving. One study highlights the importance of understanding and preventing aggressive driving and its negative results to reducing the number of crashes (32).

One of the main causes of road traffic crashes and a growing phenomenon is the use of mobile phones while driving a car. Despite legislative restrictions in most countries of the world, many drivers continue to use their mobile phones while driving, putting their lives, passengers, and pedestrians at risk (15). Use of mobile phones while driving is common in such countries as Sweden, Australia, the United States, the United Kingdom, and Spain (14, 17). Almost two-thirds of drivers in high-income countries admit to using their cellphones at some time while driving (33). One study simultaneously analyzed the knowledge, attitudes, and behavior towards the use of mobile phones while driving in Naples, one of the largest and most populous metropolitan areas in Italy. They highlighted that 69% of respondents have used their mobile phone while driving at least once in their lifetime, 63.6% have made phone calls while 75.2% only answer them while driving; 49.1% read messages and only 33.3% write them while driving, 34.1% do not stop to answer a call and only 10% do not value the use of headsets while driving as fundamental (34). According to the findings of a recent study in the US (35), mobile phone use while driving increases crash risk by four times compared to those who do not use mobile phones.

Drivers' propensity to use a mobile phone while driving was examined by the type of road given, the condition of the road, and the nature of the traffic through an observational study (36). Results of that study showed a high percentage of drivers did not use their phone on highways, bumpy roads, and in low-density traffic, while most drivers used their mobile phones on street-level roads, and smooth surface roads. They also found determining factors in answering calls during driving were based on the urgency of the call, the exigency of the calls, and the speed limit of the roadway.

Crash risk factors related to age and sex have long been recognized in the literature. Young people have an increased risk of traffic crashes and this risk tends to decrease as they age and gain more driving experience. Young men are more frequently involved in road traffic crashes,

compared to young women and older drivers. However, women have a higher risk of injury and hospitalization when involved in a crash. (2, 37, 38). Overall, young adults have been found to have higher rates of texting and driving than older drivers (18). In the U.S., teen drivers are at considerable excess risk of motor-vehicle crashes compared with adult drivers and there are several factors which lead to crashes (39): conversations with passengers in the car; night and weekend driving have higher crash risk for all ages but more associated with younger drivers; drinking and driving; and not using the seatbelt. Compared to other age groups, teens have the highest rates of not using a seatbelt. According to another study, young drivers are also more likely to use mobile phones while driving compared to older people. The proportion of crashes involving young people is exceedingly high (29). Knowledge, skills, and experience of the driver also are of interest, young drivers, especially novice ones, are more likely to be involved in crashes compared to experienced drivers (18). Factors such as previous driving violations, distraction, passenger presence, time of crash, and lack of driver protection system have been highlighted as predominant risk factors in multiple young drivers of different ages (40). Other studies underline that more middle-aged drivers use mobile phones while driving, compared to elderly drivers (41). A study in Jordan also found that drivers with more driving experience were more exposed to crash risk and were often involved in crashes (4). The authors of an analytic study in Portugal (42), identified that 612 car drivers (37.3%) reported being involved in a road traffic crash with damage or injury in the period 2013-2016. The majority were male, older than 65 years old, with no children, not employed, and living in an urban area.

In most studies, the authors came up with solutions to contribute to the prevention of road injuries. One of the solutions is to set up intelligent transportation systems, such as speed limit systems (43) with new methods and strategies for managing speed limits that can effectively accommodate high traffic densities to increase road safety. Car-sharing software (e.g., the DiDi travel app) can help to decrease driving distractions and improve the driver's ability (44). Applying different theories of behavior change (18) or examining virtual reality driving simulations

(ex. determining the effect of cell phone position) (33) could contribute to more effective measures in road safety control. Other smart technologies, such as the Cab Safety Device driver monitoring

systems, could identify driver sleepiness or fatigue (45). It is also valuable to evaluate existing road safety policies and practices (46) and update them to follow best practice.

CONCLUSIONS

1. There are many factors that contribute to road crashes and related injuries, which require a multisectoral involvement. Considering the burden and impact of traffic crashes and injuries, more road safety campaigns should be launched, initiated, and supported and strategic road safety management mechanisms should be developed and implemented to control and reduce the growing number of crash rates.
2. Results from this review further motivate the need to study this topic in depth, concentrating specifically on each of the risk factors identified. In particular, further research on separate age groups and development of specific prevention measures are required.

CONFLICT OF INTERESTS

All authors declare no competing interests.

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RISCUŁ PENTRU SĂNĂTATE AL EXPUNERII LA RADON

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Keywords: residential radon, lung cancer, radon-tobacco synergism.

HEALTH RISK OF RADON EXPOSURE

Introduction. Radon is a chemical element of increased interest to the scientific community due to its implications in the etiology of bronchopulmonary cancer. Pollution of indoor air with radon causes serious effects on health, due to alpha radiation emitted following the process of disintegration into isotopes that together with dust particles, dust enters the alveolar level.

Material and methods. This study was based on the analysis of bibliographic sources within the PubMed and Google Scholar platforms. The relevant articles for the study were chosen analogously to the research objectives, interest in publications attesting to the problem of residential radon, its implications in the etiology of lung cancer and the synergism between radon and tobacco.

Results. Radon is attributed a significant role in indoor air pollution, has a share of about 50% of total exposure to ionizing radiation and is the second leading cause of death from lung cancer internationally. The synergism between radon and tobacco causes an increased effect in triggering the processes of damage at the cellular level, by disturbing translation and transcription. In the Republic of Moldova, the problem is current; the level of residential radioactivity caused by radon exceeds European and national standards in about half of cases.

Conclusions. It is imperative to continuously monitor radon concentrations in the country's homes, set benchmarks, update national rules and implement an effective strategy to reduce the negative effects of radon exposure.

Cuvinte cheie: radonul rezidențial, cancer bronhopulmonar, synergism radon-tutun.

Introducere. Radonul reprezintă un element chimic radioactiv, de interes sporit pentru comunitatea științifică, din cauza implicațiilor acestuia în etiologia cancerului bronhopulmonar. Poluarea aerului din interior cu radon provoacă efecte grave asupra stării de sănătate, produse de radiațiile alfa, emise în urma procesului de dezintegrare în izotopi, care, împreună cu particule de praf, pătrund în organism la nivel alveolar.

Material și metode. Studiul dat este bazat pe analiza surselor bibliografice din cadrul platformelor PubMed și Google Scholar. Articolele relevante pentru tema studiului au fost selectate în funcție de obiectivelor cercetării, interes prezentând publicațiile ce atestă problema radonului rezidențial, implicațiile acestuia în etiologia cancerului pulmonar și a relației de synergism dintre radon și tutun.

Rezultate. Radonului i se atribuie un rol semnificativ în poluarea aerului de interior, deține o pondere de circa 50% din expunerea totală la radiații ionizante și la nivel internațional prezintă a doua cauză de deces prin cancer pulmonar. Sinergismul dintre radon și tutun determină un efect sporit în declanșarea proceselor de afectare la nivel celular, prin dereglarea translației și a transcripției. În Republica Moldova problema este actuală, nivelul radioactivității rezidențiale, cauzat de radon, depășește atât normele europene, cât și pe cele naționale în circa jumătate dintre cazuri.

Concluzii. Este imperios a asigura monitorizarea continuă a concentrațiilor de radon în locuințe, stabilirea valorilor de referință, actualizarea normelor naționale și implementarea unei strategii eficiente de reducere a efectelor negative, datorate expunerii la radon.



INTRODUCERE

Atribuirea problemelor sănătății un rol de prioritate în cadrul obiectivelor internaționale permite cristalizarea unor tendințe ambițioase de susținere a inițiativelor ce vizează păstrarea bunăstării populației și promovarea conceptului de sănătate sub toate aspectele. Un element decisiv în prioritizarea intervențiilor de sănătate îl constituie cunoașterea riscurilor și comunicarea intersectorială a acestora, în scopul atingerii unui nivel maxim de eficiență a activității sistemelor medicale. Evaluarea comunitară a riscurilor privind determinantele stresogene chimice și non-chimice, reprezintă elemente de bază în cadrul elaborării politicilor de sănătate. Gradul de influență a unei determinante față de alta sau efectele cumulative potențate reciproc necesită a fi luate în calcul la elaborarea modelelor factorilor de risc din cadrul unei comunități. O provocare importantă în cadrul elaborării modelelor de expunere comunitară a factorilor de risc o reprezintă evaluarea cumulativă a acestora, fapt care implică necesitatea modelării simultane a expunerii la acești factori de stres chimici și non-chimici, în condițiile existenței altor elemente predictorii și a extinderii demografice și epidemiologice diferit la nivel global (1).

Aprecierea stării generale de sănătate a populației permite abordarea integrală a tuturor caracteristicilor ce o determina, evaluării fiind supuse atât calitatea serviciilor medicale, organizarea sistemului medical, gradul de dezvoltare a țării cât și nivelul cunoștințelor indivizilor privind propria stare de bine fizic, social, mintal și riscurile din mediul înconjurător ce o pot afecta. Nivelul de conștientizare a populației referitor la determinanții stării de sănătate reprezintă o latura extrem de importantă, cu un potențial semnificativ de influență asupra indicatorilor morbidității și mortalității. Pentru sensibilizarea populației referitor la anumite aspecte ale profilaxiei, educației pentru sănătate este necesară o argumentare integrată și prezentarea clară a riscurilor și beneficiilor pe care le poartă fiecare determinantă. Astfel este indispensabilă necesitatea realizării unor studii și cercetări în scopul definirii exacte a tuturor momentelor importante și a aspectelor legate de factorii de risc și efectele directe sau indirecte asupra

organismului uman. Un element esențial, cu repercusiuni majore asupra stării de sănătate îl constituie nivelul fondului radiologic natural, estimarea riscului de expunere a populației la sursele de radiații naturale, care capătă actualitate în contextul unei dezvoltări a tehnologiilor nucleare și a extinderii fondului artificial de radiații. Pentru o abordare amplă a riscului asociat expunerii la surse de radiații este indispensabilă monitorizarea dozelor survenite din expunerea la radiația cosmică, la substanțele prezente în apa consumată, în materialele de construcție utilizate și expunerea la radonul din interiorul locuințelor, contribuția acestora capătă valoare în special pentru anumite categorii de muncitori, prezentând riscuri nu doar pentru populația generală, dar și în cadrul mediului ocupațional (2). Deși omul este supus periodic unor expuneri la doze semnificative de radiații artificiale, precum radiațiile folosite în medicină cu scop de diagnostic (radioscopii, radiografii) sau tratament, radiațiile naturale au un rol aparte, deoarece acțiunea lor asupra organismului este permanentă. Specia umană a fost supusă expunerii radiațiilor naturale de la începuturi, nivelul lor, cel mai probabil, nu devia semnificativ față de cel actual, iar radionuclizii naturali erau prezenți în scoarța Pământului de la formarea sa. Unele elemente ce se caracterizează printr-o durată de viață scurtă au dispărut, iar altele au format sedimente contribuind în continuare la emiterea de radiații și generarea fondului radioactiv (3). Se estimează că circa 82% din totalul radiațiilor absorbite de om sunt de origine naturală - cosmică, terestră și radiații de emisie (4). Noțiunea de radioactivitate naturală presupune proprietatea de dezintegrare nucleică a atomilor unor elemente, cu emiterea spontană de radiații ionizante, precum alfa, beta, gamma, generând astfel elemente noi, ce formează familii radioactive. Radioactivitatea semnifică, în același timp, și depistarea acestor elemente în toate componentele mediului ambiant: apă, sol și aer, dar și în diverse substanțe și materiale (5). Conform literaturii de specialitate, în natură se cunosc circa 340 de radionuclizi, însă nu toți posedă proprietăți radioactive, doar circa 70 dintre aceștia care apar în mod natural, fiind izotopi ai elementelor grele (3). Acești radionuclizi pot fi clasificați, în funcție de origine, în *radionuclizi primordiali*, a căror timp de înjumătățire este estimativ mai mare decât timpul

scurs de la formarea Pământului *radionuclizii cosmogeni*, ce se formează în urma interacțiunii radiației cosmice cu anumiți atomi țintă în atmosferă sau la nivelul scoarței terestre și *radionuclizi derivați* din activitatea umană prin intermediul unor procese de exploatare generându-se materiale TENORM (*technologically enhanced naturally occurring radioactive materials*) (4, 6, 7). În condițiile unei influențe continue asupra organismului apare necesitatea instituirii unui sistem permanent de monitorizare și de supraveghere a nivelului de fond al radioactivității. Fenomenul de radioactivitate contribuie la poluarea mediului extern și intern, corespun-zător dozelor de expunere, timpului și asocierii altor factori negativi, apar efectele imediate sau tardive. *Scopul acestui studiu* constă în estimarea riscului pentru sănătate, asociat expunerii populației la concentrații sporite ale radonului și identificarea influenței asupra stării de sănătate a factorului radiostresogen.

MATERIAL ȘI METODE

Prezenta cercetare are drept obiectiv studiul cercetărilor expuse în sursele bibliografice privind influența radonului rezidențial asupra stării de sănătate a populației și stabilirea interacțiunii dintre consumul de tutun și expunerea organismului uman la concentrații crescute ale gazului radon. Pentru realizarea obiectivelor au fost selectate publicațiile din cadrul platformelor PubMed și Google Scholar în limba engleză și română. Au fost analizate studiile efectuate în perioada anilor 2010-2020, și au fost selectate publicațiile relevante care prezentau consecințele pe termen lung ale expunerii la radiațiile ionizante cauzate de radon. Cuvintele-cheie după care au fost realizate căutările publicațiilor sunt: *radon and lung cancer, radon and smoking, the effects of radon expositions*.

REZULTATE

Poluarea aerului din interiorul locuințelor cu elemente radioactive reprezintă în continuare una dintre preocupările majore ale Agenției Internaționale pentru Energie Atomică (AIEA). Deși radioactivitatea naturală și fenomenul de radioactivitate a fost descoperit datorită unui minereu radioactiv, Uraniu, în 1896 de către Henri Becquerel, această descoperire nu a fost abordată sub aspectul unui subiect cu impact socio-medical până în momentul când a apărut

problema poluării cu substanțe radioactive artificiale, survenite în urma proceselor nucleare și a producerii de energie. Progresul tehnologic, evoluția și schimbările survenite în societate în ultimele secole conferă un sens particular fondului radioactiv natural în contextul analizei expoziției totale a populației și definirii riscului asociat acestei expunerii (2). Efectele expunerii populației la surse de radiații pot fi caracterizate sub mai multe aspecte. Inițial, expunerea organismului la radiații provoacă ionizarea țesuturilor prin transferul de energie, efect datorat particulelor încărcate, ulterior se declanșează o serie de procese fizico-chimice, soldate mai târziu cu apariția efectelor biologice. Consecințele se pot manifesta în timp, fie imediat sau tardiv, determinând afectarea la nivel molecular prin deteriorarea acizilor nucleici ARN și ADN, dereglând procesele de transcripție și de translație, degradarea proteinelor, afectarea nucleelor și a aparatului mitotic celular, a cromozomilor și a altor componente celulare, prin declanșarea lizei la nivel de citoplasmă și formarea radicalilor liberi, provocând apariția unor mutații la nivel de gene sau fiind factor de risc în apariția maladiilor oncologice (8, 9, 10). Tot mai multe studii la ora actuală tind să demonstreze riscurile și consecințele legate de expunerea organismului la radiații ionizante naturale, care, în mod cert, este continuă, iar asocierea altor factori stresogeni induce activitatea radiațiilor, sporind șansele apariției și dezvoltării unor maladii oncologice.

Deoarece radioactivitatea naturală reprezintă un proces comun pentru toate statele lumii, problema protecției populației de iradiere capătă dimensiuni continentale. Nivelul radioactivității este diferit atât pe plan național, cât și internațional, variațiile fiind în strânsă corelație cu o serie de factori. Diferențele dintre distribuția fondului natural sunt determinate de tipul de roci din care este compus solul fiecărei regiuni. Solurile ce sunt compuse din roci de granit, precum este în sud-vestul Marii Britanii determină un fond de radiații mai intens, în comparație cu celelalte zone ale țării al căror sol conține în mare parte roci de calcar (11). Fiind distribuite neomogen în toate straturile scoarței și fiind prezente în diverse tipuri de soluri, elementele radioactive, precum și izotopii acestora, prezintă un pericol subestimat pentru

starea de sănătate, fiind direct sau indirect implicate în diminuarea stării de sănătate a populației și generarea patologiilor oncologice. Aportul considerabil în crearea fondului natural terestru de radiații îi aparține radonului, ^{222}Rn , se estimează că circa 50% din iradierea totală de origine naturală este cauzată de radon, iar 82% din totalul radiațiilor absorbite de om sunt de origine cosmică, terestră sau sunt radiații de emisie (6). Fiind un gaz nobil, nu reacționează chimic cu alte substanțe, incolor, lipsit de miros acesta difuzează din sol datorită dimensiunilor relativ mici ale atomului în interiorul locuințelor, producând diferite concentrații, astfel populația fiind expusă iradierii de tip alfa. Radonul este cel mai greu gaz din natură, având densitatea de 9,73 kg/m³, perioada de înjumătățire de 3,82 zile, se dizolvă ușor în solvenții organici și în apă, face parte din seria Uraniului, fiind produs în toate cele trei serii de dezintegrare (12). În prezent populația este expusă riscului îmbolnăvirii, din cauza creșterii nivelului de poluare a aerului atmosferic cu pulberi în suspensie, dioxid de sulf, aldehida formică, etc., iar a celui de interior - cu gazul radon.

Studiile epidemiologice confirmă că expunerea la radon cauzează afecțiuni ale sistemului respirator și declanșarea cancerului bronhopulmonar. Cota-parte a cancerelor bronhopulmonare (din numărul total), cauzate de radon constituie 3-14%, fiind în strânsă legătură cu nivelul de concentrație medie a radonului pe țară. Conform UNSCEAR, radonului i se atribuie circa 70% din doza efectivă totală de expunere a populației la surse de radiație ionizante naturale și 50% din expunerea totală la radiații ionizante (13).

Gradul de nocivitate a gazului, precum și influența acestuia asupra țesuturilor, este diferită, iar în funcție de doza de expunere radonul poate manifesta calități de la negative până la curative. Utilizarea radonului în scop de tratament este datorată acțiunii sale multiple asupra aparatului reproductiv, fiind eficient în tratamentul impotenței și al infertilității, la nivelul sistemului endocrin acesta determină hipofuncția glandei tiroide, posedă un important efect diuretic contribuind la eliminarea acidului uric, este eficient în tratamentul unor patologii ale pielii, ameliorând circulația periferică, determină atenuarea simptomelor reumatice și are un efect pozitiv asupra sistemului nervos vegetativ,

reglând tensiunea arterială. În pofida efectelor terapeutice multiple relevate de către comunitatea științifică medicală, contactul dintre organismul uman și acest gaz prezintă o serie de riscuri, care clasifică radonul drept primă cauză de cancer bronhopulmonar la nefumători și a doua cauză pentru fumători, prima fiind consumul de tutun (1, 12, 14, 15). Radonul reprezintă un element important în evaluare metodelor de studiu cu privire la analiza factorilor de risc chimici și non-chimici, aprecierea riscului cumulativ și elaborarea modelelor de influență a factorilor stresogeni. Nivelurile individuale de risc, asociate radonului, sunt diferite, datorită multitudinii de factori determinanți. Asocierea expunerii la concentrații mari de radon cu consumul de tutun atât la actualii fumători, cât și la ex-fumători sau nefumători crește riscul de apariție a cancerului bronhopulmonar pe unitate de expunere la radon, astfel pentru caracterizarea distribuției tumorilor bronhopulmonare, asociate acestui gaz, este necesară luarea în considerare a unor modele extinse de urgență a altor elemente (1, 15). Numeroase studii internaționale relatează despre riscurile comune asociate radonului și tutunului, raportând despre necesitatea monitorizării și realizării unor eforturi comune de diminuare a influenței negative, produse de acești doi factori. De-a lungul anilor au fost comunicate o serie de rezultate privind repercusiunile asupra stării de sănătate, produse de radon și o gamă vastă de estimări potențiale ale riscului atribuit acestuia, cu certitudine acest gaz ubicuitar rămâne a fi declarat unul dintre cele mai răspândite pericole de mediu (1). Studiile efectuate pe animalele de laborator demonstrează și susțin ipoteza potrivit căreia emiterea radiațiilor alfa de către radionuclizi determină o frecvență sporită a cancerului pulmonar în rândul animalelor expuse. Același model experimental nu poate reda cu precizie debutul și evoluția proceselor tumorale la organismul uman, deoarece o serie de factori influențează asupra etiologiei tumorale, dintre cele mai importante fiind stilul de viață și consumul de tutun. Expunerea la radiații, în absența tutunului, provoacă efecte ce pot fi remediate de către factorii protectivi ai organismului, dacă vorbim de doze mici, însă se atestă o interacțiune multiplicativă dintre consumul de țigarete și concentrațiile sporite de radon (14). La momentul de față nu există dovezi



care ar confirma implicarea radonului în etiologia altor tipuri de tumori, însă sunt studii care demonstrează implicațiile expunerii la concentrații sporite ale radonului rezidențial, în declanșarea cancerului bronhopulmonar. Deși relevă o legătură slab pozitivă datorită impedimentelor montării unor astfel de studii, asocierea dintre expunerile la radonul din interior și incidența cancerului bronhopulmonar nu poate fi neglijată (16). Analizele combinate ale unor studii din America de Nord și din Europa completează ipotezele expuse anterior privind riscul asociat radonului rezidențial, susținând modelul liniar fără prag, expus de către Comitetul BEIR VI și de către alte organizații (17). Asocierea dintre radiațiile ionizante și tumori poate fi atestată în diverse studii unde se menționează o incidență crescută a cancerului printre populația din zonele de risc. Radonul este un gaz omniprezent, fapt pentru care poluarea aerului de interior cu acest caz nu poate fi evitată, dar poate fi prevenită prin aplicarea tehnologiilor speciale ce împiedică pătrunderea acestuia în interior sau asigură un nivel optim al ventilării mecanice, determinând un microclimat adecvat. Pătrunderea radonului în interiorul încăperilor este influențată de temperatură, umiditate, gradientii de presiune, vânt, încălzirea și ventilația încăperilor, de aceea termenul de expunere la radon trebuie tratat individual de către fiecare persoană și trebuie conștientizat la nivel de risc și consecințe. Calitatea precară a aerului de interior prin gradul înalt de poluare cu radon poate determina efecte negative majore asupra stării de sănătate, acestea fiind potențate de asocierea altor factori nocivi. Conform celor expuse, radonului i se atribuie termenul de *carcinogen bronhopulmonar uman*, în baza studiilor de mutageneză experimentală pe culturi celulare și animale de laborator, rezultatele exprimând dovezi clare privind rolul acestuia în apariția proceselor tumorale (1, 14, 15, 18, 19, 20).

În Republica Moldova, problema radonului rămâne a fi în continuare actuală și importantă în contextul dinamicii incidenței maladiilor oncologice, în special a cancerului bronhopulmonar, fiind astfel afectate sectoarele economiei naționale și ale sistemului medical al țării. O importanță majoră o prezintă cunoașterea dozelor de expunere a populației în scopul comunicării riscului asociat radonului, prioritizării strategiilor de sănătate publică și implementarea cât mai urgentă a programelor de monitorizare și de

diminuare a efectelor negative. Numeroase studii, efectuate pe teritoriul țării, comunică despre concentrația mare a radonului depistată în locuințe. În baza Studiului estimării Riscului de Expunere a populației Republicii Moldova la sursele naturale de radiații ionizante, a fost realizată o evaluare complexă a riscului asociat iradierii de la toate sursele naturale de radiații ionizante în urma estimării nivelului de iradiere a populației. La finalizarea acestuia a fost argumentată necesitatea elaborării atât a unui nou act normativ național de protecție radiologică a expunerii populației la sursele naturale, cât și a recomandărilor practice ce se impun. Au fost obținute date noi privind concentrația radonului în factorii de mediu: apă, aer și sol (21). Monitorizarea concentrațiilor de radon în aerul din locuințele de pe teritoriul Republicii Moldova în perioada 2018-2020, realizat de către ANSP cu suportul AIEA, prin măsurări pasive de lungă durată (3 luni), a demonstrat că în 51% dintre locuințele investigate valorile au depășit nivelul de 150 Bq/m³, din care 25% sunt între 150 și 300 Bq/m³, iar 26% depășesc nivelul de 300 Bq/m³. Astfel, conform rezultatelor studiului, efectuat pe întreg teritoriul țării, publicat în anul 2019, în interiorul locuințelor s-au înregistrat concentrații ale radonului ce depășeau normele naționale (150 Bq/m³), în circa 25% de cazuri, în alte 26% - depășeau normele europene (300 Bq/m³). Concentrația medie a radonului în locuințe pe țară a depășit 200 Bq/m³, iar în unele locuințe peste 1000 Bq/m³ (22). Din cele expuse rezultă că până la momentul actual cercetările asupra radonului în aerul din locuințele Republicii Moldova au fost efectuate doar la nivel de screening, utilizând echipament și detectori activi (de scurtă durată, 3-4 ore) de măsurare a concentrației de radon (radonometrul RTM 1800, producător compania SARAD) (21). Studiile internaționale subliniază faptul că pentru expunerea la radon cu o concentrație de 200 Bq/m³, riscul estimat este de 2,98-6,55% pentru bărbații care fumează continuu și 0,19-0,42% pentru bărbații care nu fumează niciodată, în condițiile unei relații multiplicative pentru efectul comun al radonului și fumului (15). Conducându-ne de cele puse anterior, privind concentrația medie a radonului pe țară și analizând ponderea semnificativă a fumătorilor, relevăm necesitatea monitorizării continue a variațiilor radonului și a calculării riscului estimativ. Riscul asupra sănătății, cauzat de

expunerea la radonul din aerul din locuințe este studiat insuficient. Astfel, nu se cunosc dozele de expunere a populației țării doar la radon, deoarece calcularea riscului a fost efectuată pentru celelalte surse naturale și medicale. Este imperios necesar efectuarea unor studii epidemiologice de identificare a relației radon × tutun × declanșarea cancerului pulmonar în Republica Moldova. Până la acest moment nu este elaborată strategia de comunicare a riscului expunerii la radon conform directivei europene.

De o importanță deosebită în examinarea problemei poluării interioare cu radon sunt o serie de factori asociați, începând de la tipul solului, amplasarea zonei locative, numărul de nivele ale locuinței și până la materialele de construcție utilizate. Sursele principale de radon din locuințe sunt în ordinea importanței: exalarea radonului din sol, emanarea din materialele de construcție, componente ale locuinței, apa folosită pentru spălat/gătit, precum și gazul utilizat în bucătărie sau în sobe pentru încălzit. În multe țări dezvoltate în prezent există valori recomandate, unele chiar și de intervenție, pentru a căror depășire sunt necesare acțiuni suplimentare de reducere a nivelului de radon în locuințe. Se estimează că nivelul de concentrație a radonului descrește de la parter până la etajele superioare, iar de cele mai dese ori acest decalaj al concentrației este de ordinul centimetrilor, dacă vorbim de radonul emanat prin temeliiile construcțiilor. Deși concentrația radonului se află în strânsă legătură cu nivelul ridicat de concentrație a uraniului în sol, prezența acestuia sub forma unor urme în toate tipurile de sol determină o extindere globală a problemei expunerii populației la radonul rezidențial. La problema difuziei radonului din sol prin temeliiile caselor de locuit se asociază cea a exalării radonului din materialele de construcție, astfel cauzându-se o poluare intensă a aerului de interior. Procesul de eliminare este dependent de doi factori, prezența radiului în structura materialelor, coeficientul de emanație al acestuia, iar al doilea este tipul și microstructura elementelor de construcție de care depinde eliberarea radonului, fenomen condiționat de umiditate (23). Cel mai crescut conținut de radium, respectiv radon, este atestat la cărămidă, urmată de beton, gresie, faianță, iar cele mai mici cantități sunt determinate la lemn. Utilizarea neadecvată a materialelor de construcție, funcționarea ineficientă a sistemelor de ventilație, microclimatul

nefavorabil, închiderea etanș a geamurilor contribuie la crearea condițiilor nesatisfăcătoare privind acțiunea radonului și la expunerea la doze mari de radiații. Astfel, elaborarea unor norme în constru vizând reducerea impactului acestui gaz la etapa proiectării, construcției și dării în exploatare este indispensabilă. Nivelurile concentrației radonului în aerul locuințelor variază în funcție de anotimp și de mediul de trai, fiind atestată o concentrație ridicată în mediul rural, cauzată de particularitățile de construcție și un nivel de concentrație, practic neglijabil în blocurile de locuit din mediul urban. Descendenții seriei de dezintegrare a radonului (^{214}Po , ^{218}Po , ^{214}Pb , ^{214}Bi) se fac responsabili de efectele principale în declanșarea cancerului pulmonar prin modificările produse la nivel de ADN, din cauza particulelor alfa ce pătrund în arborele pulmonar împreună cu aerosolii sau cu praful. Problema expunerii la radon nu se referă doar la casele de locuit, dar și la locurile de muncă. Studiile arată că circa 90% din timp oamenii îl petrec în interior (locuință, birou, școală sau alte încăperi), calitatea aerului are o influență majoră asupra stării de bine a organismului, iar prezența radonului determină nemijlocit gradul de poluare a aerului din spațiul unde ne aflăm. Datorită capacităților de difuzie sau prin transportarea cauzată de diferențele de presiune, radonul pătrunde și se acumulează în aerul din interiorul locuințelor, iar concentrația sa poate atinge valori critice pentru sănătatea populației. Acest gaz omniprezent se face responsabil de efectele asupra aparatului mitotic, componentele celulare și nucleare fiind astfel implicate în etiologia maladiilor oncologice (24).

În majoritatea țărilor este constituit un sistem stabil, bazat pe directive și strategii implementate în scopul prevenirii, diminuării și conștientizării riscului asociat expunerii la radon. Republica Moldova se află la o primă etapă de comunicare și abordare a problemei, ca scop principal fiind aprobarea unei strategii naționale, cu implicare multisectorială. Țara noastră doar începe să facă primii pași pentru dezvoltarea și implementarea unui program național de reducere a pericolului de radon. Actualmente este elaborat Planul Național de acțiuni în controlul expunerii la radon, care urmează a fi aprobat de autorități.

Contribuția acestui gaz la expunerea internă și externă, datorată producerii unei familii întregi de izotopi radioactivi și asocierea proprietăților

fizico-chimice ale radonului prin faptul că poate migra în componentele țesuturilor având tropism marcat față de pulmoni, determină efecte grave asupra organismului uman (25). Peste 1,3 milioane de oameni anual sunt victimele cancerului pulmonar, dintre aceștia circa 16% decedază ca urmare a expunerii la radon (22). Comunitatea științifică internațională, de comun acord cu Organizația Mondială a Sănătății, atribuie radonului un rol major în etiologia maladiilor oncologice, fiind considerat a doua cauză în declanșarea cancerului bronhopulmonar, după consumul de tutun. În Republica Moldova problema radonului devine și mai stringentă în condițiile unei ponderi semnificative a populației fumătoare. Conform statisticilor expuse de către Organizația Mondială a Sănătății, anual tutunul se face responsabil direct sau indirect de moartea a circa 6 milioane de persoane la nivel mondial, iar până în 2030 această cifră poate atinge 8 milioane în lipsa unor strategii concrete de diminuare a efectelor asociate. În Republica Moldova rata mortalității cauzate de consumul de tutun ajunge la 613 decese la 100 mii populație, potrivit OMS, această cifră fiind de aproape două ori mai mare decât cea din Regiunea Europeană (26). Potrivit datelor publicate de către Biroul Național de Statistică al Republicii Moldova, în anul 2017, în urma analizei ponderii persoanelor fumătoare pe grupe de vârstă, sex, mediul de trai, se constată că circa 20 la sută dintre fumători sunt tineri cu vârsta cuprinsă între 25 și 34 ani, peste jumătate dintre fumători au început această practică în adolescență și cea mai gravă constatare este că circa 17,8% dintre persoanele care suferă de o boală cronică respiratorie sunt fumători zilnici, iar 3,6% fumează ocazional. Nu întâmplător se aduc aceste date, deoarece radonul modificând procesele de translație și de transcripție la nivel celular, se soldează cu urmări potențate de acțiunea tutunului la nivelul aparatului respirator, în special la persoanele al căror statut de sănătate este compromis de prezența unei patologii cronice. Nicotina împiedică procesele de apoptoză celulară, prin creșterea activității acetilcolinei, astfel, celulele expuse unor doze semnificative ale radiațiilor de tip alfa, și care au acumulat anumite mutații nu se autodistrug, dar pot evolua în procese tumorale. Unele studii, efectuate în scopul evidențierii riscurilor legate de inhalarea

unor componente din mediul înconjurător în declanșarea de boli cronice inflamatorii la nivel alveolar, au relevat că acestea pot spori și riscul apariției cancerului bronhopulmonar. Utilizându-se modelul inhalării gazelor de eșapament la concentrații crescute s-a observat ca rezultă o supraîncărcare a plămânilor cu particule, ceea ce determină un risc crescut de dezvoltare a proceselor tumorale respiratorii. Studiul a demonstrat că inhalarea altor produse decât cele chimice cancerigene pot produce același răspuns inflamator, respectiv orice leziune la nivel pulmonar are capacitatea de provocare a unei boli cronice inflamatorii. Așadar se creează un mediu favorabil dezvoltării cancerului bronhopulmonar, acesta fiind responsabil și de acțiunea sinergică dintre fumul de țigară și radon (1, 6, 19, 27). Sinergismul dintre acești doi factori cu tendință cumulativă, determină o afectare masivă a țesutului alveolar, proces ce decurge în timp și are impact asupra structurii morbidității și a mortalității. Asocierea iradierii tip alfa, cauzată de radon, determină un sinergism al acestor doi factori ce condiționează tendințele actuale ale morbidității și ale mortalității la nivel mondial. Problema tutunului se caracterizează în același mod, precum cea a radonului; particularitățile demografice, indicatorii socio-economici, factorii contextuali precum legislația locală și internațională determină gradul de consum al tutunului la nivel mondial. Repartizarea incidenței cancerului bronhopulmonar atât la nivel regional, cât și la cel continental fiind astfel influențată de variabilitatea fumatului și dispersia concentrațiilor radonului în locuințe. O importanță deosebită în abordarea problemei tutunului o reprezintă expunerea nefumătorilor la fumul de țigară și efectele asupra stării generale de sănătate. Foștii fumători prezintă interes ca obiect de studiu, deoarece, conform analizelor efectuate la nivel internațional, riscul legat de apariția cancerului pulmonar asociat radonului este de circa 5-7 ori mai mare decât la nefumători. Interacțiunea dintre fumul de țigară și radon trebuie tratată din perspectiva altor factori stresogeni non-chimici ai stilului de viață, care ar permite consolidarea rezultatelor privind sinergismul dintre aceștia. Studiile demonstrează ca nu există diferență de sex în ceea ce privește riscul de cancer pulmonar cauzat de radon pentru anumite categorii de fumători (15, 28, 29).

DISCUȚII

Politica în domeniul protecției sănătății tinde să abordeze radonul ca o problemă medico-socială importantă, definind impactul asupra sistemelor de sănătate din întreaga lume. Monitorizarea periodică a concentrației radonului este indispensabilă în contextul dinamicii negative a indicatorilor privind patologia oncologică, dar și ca urmare a proceselor naturale desfășurate la nivelul scoarței terestre. Cunoașterea dozelor de expunere, a perioadei de expunere, a zonelor cu un nivel crescut de concentrații permite direcționarea intervențiilor de sănătate în scopul remedierii problemelor și prevenirea apariției consecințelor legate de radon. O strategie combinată, ce ar implementa condiții stricte de exploatare a materialelor radioactive și a radiațiilor, ar include ghiduri clinice, bazate pe dovezi referitor la deciziile de profilaxie, diagnostic și modalități terapeutice în legătură cu expunerea populației la radon, precum și normele în construcții cu referire la prevenirea pătrunderii gazului în încăperile locative, capabile să soluționeze o serie de probleme asociate radonului. Reglementările multisectoriale și implicațiile tuturor organelor publice și private sunt indispensabile nu doar la nivel de prevenire, dar și de implementare a politicilor privind prevenirea cancerului pulmonar, a efectelor negative asociate tutunului și expunerii la concentrații sporite de radon. Amploarea problemei nu este suficient mediatizată și evaluată, în contextul lipsei unei strategii naționale privind diminuarea efectelor negative, protecția populației și stabilirea unei direcții esențiale sub aspect al acțiunii pe termen lung. Recunoașterea consecințelor de ordin social, economic și medical pe care le reprezintă radonul și elaborarea măsurilor de diminuare a acestora va contribui la diminuarea cheltuielilor legate de expunerea la radiații ionizante și la reducerea impactului economic produs de acestea. Interacțiunea radiațiilor ionizante cu materia vie se desfășoară în timp. Din această cauză, este indispensabilă realizarea unor intervenții în

scopul reactualizării normelor naționale pentru protecția generațiilor viitoare. O importantă componentă în evaluarea riscului legat de expunerea la radon o constituie evidențierea legăturii dintre distribuția indicatorilor de sănătate pe regiunile cu concentrații sporite ale gazului atât în aerul locuințelor, cât și în alte componente ale mediului, precum ar fi apa sau solul și, implicit, influența acestuia asupra stării generale de sănătate a populației (29).

Conform recomandărilor Organizației Mondiale a Sănătății (OMS), Comisiei Internaționale pentru Protecție Radiologică (CIPR) și Agenției Internaționale pentru Energie Atomică (AIEA), crearea unui program de cercetare și a unei metodologii de stabilire a nivelurilor de referință pentru radon și reactualizarea acestora, în funcție de evoluția indicatorilor de sănătate, trebuie să constituie o premisă a sistemelor de sănătate publică din întreaga lume (27). Monitorizarea concentrațiilor de radon în încăperile locative, birouri, centre comerciale va permite atât actualizarea cartografiei radionuclidului pe teritoriul țării, cât și a distribuției morbidității prin maladii oncologice respiratorii, fapt important în dezvoltarea strategiilor de sănătate publică și în implementarea celor mai eficiente măsuri de diminuare a efectelor negative. Hărțile de radon disponibile și utilizate în întreaga lume permit efectuarea analizei ample și aprecierea riscului comunitar vizavi de concentrațiile sporite ale gazului, furnizând date valoroase organelor responsabile, deși uneori se reflectă doar distribuția concentrațiilor de radon și nu este prevăzut riscul imputabil, deoarece când se menționează radonul și efectele sale neapărat se subliniază și alți factori determinanți, cum ar fi consumul de tutun. Radonul constituie o amenințare tacită a locuințelor, de aceea nu trebuie să o trecem cu vederea și să-i tolerăm prezența, ci împreună, comunitatea științifică, societatea civilă și fiecare persoană în parte să contribuim la promovarea unui mediu de trai sănătos.

CONCLUZII

1. Radonul, ca și toate tipurile de radiații, nu poate fi perceput de oameni, însă, efectele sale asupra organismului uman intră în aria de preocupări actuale ale sănătății publice și necesită acțiuni direcționate spre remedierea acestei probleme.
2. Pentru a aborda problema radonului rezidențial este indispensabilă acumularea continuă a datelor privind concentrațiile acestuia, dozele de expunere a populației și asocierea altor factori de risc care ar determina un sinergism în declanșarea proceselor patologice respiratorii.

3. Incidența crescută a cancerului pulmonar se află în strânsă legătură cu consumul, cantitatea de tutun și vârsta de debut a fumatului, acestea fiind condiții ce influențează direct asupra evoluției proceselor tumorale bronhopulmonare.
4. Sensibilizarea societății și crearea unei strategii de comunicare a riscului sunt dezideratele care stau la baza prevenirii efectelor negative ale radonului, prin efortul comun, manifestat atât la nivel comunitar, cât și la cel individual în Republica Moldova.

CONFLICT DE INTERESE

Nimic de declarat.

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FORMATION EN SANTÉ MONDIALE CHEZ LES ÉTUDIANTS EN MÉDECINE:
EXPÉRIENCE D'UN ENSEIGNEMENT MULTIDISCIPLINAIRE A L'UFR SANTÉ
DE ROUEN, FRANCE

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Keywords: global health, school of medicine, training, multidisciplinary, public health.

GLOBAL HEALTH EDUCATION EXPERIENCE OF A MULTIDISCIPLINARY CURRICULUM AT ROUEN SCHOOL OF MEDICINE, FRANCE

Introduction. The interest in Global Health (HG) as an academic discipline has increased in the last decade. The Rouen School of Medicine is one of the first to offer a GH curriculum in France. The objective was to identify the characteristics and profile of students involved in a GH curriculum. **Material and methods.** In 2016 and 2017, a cross-sectional study was conducted, including enrolled in the GH course: 3rd and 4th year in medicine, midwives studies and pharmacy. Based on self-questionnaire, data collected were motivations for health studies, investment in humanitarian associations, opinions about the GH topics. **Results.** A total of 422 students were included; 122 students attended to GH cursus (GH+) and 300 in control group (GH-). The students of the GH+ group were more likely to get involved in a humanitarian association (22.3% versus 6.7%, $p < 0.001$) and to have already taken part in a humanitarian action (20.5% vs 9.3%, $p = 0.002$). GH+ students were more likely to engage in professional practice abroad or in humanitarian medicine (67% versus 38%, $p = 0.001$). Work in vulnerable populations, the impacts of climate change on health are frequent topics in GH+ group. **Conclusions.** Students enrolled in GH cursus presented a particular profile: predominantly female, open to The World, involved in caritative associations and aware of the importance of interculturality in the care relationship. Integrated training of future health workers is a promising avenue for a better management of effect of sanitary crisis (i.e. pandemic, climate change and health effects, etc.).

Cuvinte cheie: sănătate globală, instruire, multidisciplinaritate, sănătate publică.

INSTRUIREA MEDICINIȘTILOR ÎN SĂNĂTATEA GLOBALĂ: EXPERIENȚA ÎNVĂȚĂMÂNTULUI MULTIDISCIPLINAR LA UNITATEA DE FORMARE ȘI DE CERCETARE ÎN SĂNĂTATE DIN ROUEN, FRANȚA

Introducere. Interesul pentru Sănătatea Globală (SG) ca disciplină academică a crescut în ultimul deceniu. Unitatea de Formare și de Cercetare din Rouen este una dintre primele care oferă în Franța un curriculum în SG. Obiectivul a fost de a identifica caracteristicile și profilul studenților implicați într-un curriculum în SG. **Material și metode.** În 2016 și 2017, a fost realizat un studiu transversal, pe studenții anului 3 și 4 de la Facultățile Medicină, Moașe și Farmacie, înscriși la cursul de SG. Rezultatele chestionării au servit drept bază pentru lansarea studiilor în sănătate, investiții în asociații umanitare, opinii despre subiectele SG. **Rezultate.** În studiu au fost incluși 422 de studenți; 122 au participat la cursul SG (SG+), iar 300 de studenți au intrat în grupul de control, neparticipând la cursul SG (SG-). Studenții grupului SG+ au fost mai predispuși să se implice într-o asociație umanitară (22,3% față de 6,7%, $p < 0,001$) sau au luat deja parte la o acțiune umanitară (20,5% față de 9,3%, $p = 0,002$). Studenții SG+ au fost mai predispuși să se angajeze în domeniul activității practice profesionale în străinătate sau în medicina umanitară (67% față de 38%, $p = 0,001$). Munca în populații vulnerabile, impactul schimbărilor climatice asupra sănătății sunt subiecte frecvente în grupul SG+. **Concluzii.** Studenții înscriși la cursul SG au prezentat un profil special: predominant feminin, deschis către lume, implicați în asociații de caritate și conștienți de importanța interculturalității în relația de îngrijire. Pregătirea integrată a viitorilor lucrători din domeniul sănătății este o cale promițătoare pentru o mai bună gestionare a efectului crizei sanitare (de exemplu: pandemie, schimbări climatice și efecte asupra sănătății etc.).

INTRODUCTION

La Santé mondiale (*Global Health* dans la littérature internationale) apparaît pour la première fois en 1997 dans un rapport publié par l'Institute of Medicine, instance scientifique américaine. Elle désigne l'ensemble des enjeux de santé humaine qui transcendent les frontières nationales. Différentes définitions de la santé mondiale sont apparues ces dernières années. La définition princeps fut celle proposée par Koplan, insistant sur la nécessité d'appréhender les problèmes de santé par une approche transnationale, celle-ci est au cœur de la pandémie COVID-19, de prendre en compte l'ensemble des déterminants environnementaux et sociaux de la santé (au-delà du seul système de soins) et d'apporter une réponse globale et multilatérale (1).

Spécialité transversale et interdisciplinaire par nature, la santé mondiale a vu la médecine, la santé publique, les sciences de l'environnement, et les autres disciplines de santé se rejoindre pour développer des enseignements dans les facultés de médecine, à visée des étudiants de santé et des professionnels déjà diplômés, pour répondre à leur aspiration de formation et d'être mieux formés. La santé mondiale fait l'objet d'un intérêt croissant ces dernières années, et attire de nombreux étudiants, motivant ainsi les universités à instaurer dans leurs établissements des programmes d'enseignement sur la santé mondiale, sous des formes multiples (initiation, recherche, pratique sur le terrain) (2, 3).

La santé mondiale s'est progressivement structurée en tant que discipline reconnue, avec ses concepts novateurs, ses champs disciplinaires (santé, mondialisation, transition démographique, risques d'épidémie et de pandémie, gouvernance, fardeau des maladies chroniques, politiques de santé, etc.), ses spécialistes de santé mondiale, sa pluridisciplinarité (santé publique, sciences humaines et sociales, économiques, politiques et environnementales), sa pluri-sectorialité et une large diversité d'acteurs, car les enjeux de santé sont aussi liés à l'éducation, à la culture, au climat, à l'environnement, etc. Elle engage à la fois les acteurs publics nationaux et internationaux, les professionnels de santé, les chercheurs de multiples disciplines, les organisations non gouvernementales et associatives, le secteur privé et les citoyens (4-6).

En 2015, la faculté de médecine de Rouen, a ouvert une unité d'enseignement (UE) de santé mondiale multi-professionnelle pour les étudiants en médecine, pharmacie et maïeutique. L'objectif de cette UE est d'apporter une ouverture sur le concept de Santé dans le monde, par le biais d'une approche macroscopique, à l'échelle de l'Organisation Mondiale de la Santé (OMS), au travers de thématiques piliers de la santé mondiale. Le contenu de l'enseignement, à l'image de concept de santé globale, se partage de manière pluri et interdisciplinaire, avec des enseignants-médecins de santé publique, infectiologues, psychiatres et pharmaciens.

A l'UFR Santé de Rouen, un tel contenu d'enseignement était jusqu'alors inexistant, et, depuis sa création, aucune évaluation n'a été menée, le profil et les attentes des étudiants intéressés et participant à cet enseignement restant méconnus. Se posaient ainsi plusieurs questions : Existe-t-il des différences entre les étudiants qui ont choisi cette option, et ceux qui ont choisi une autre option ? Quelles visions de la santé mondiale ont ces différents groupes ? Quelles peuvent être les attentes de ces étudiants ?

L'objectif de notre travail était, sur deux années universitaires consécutives, 2016-2017, et 2017-2018, d'évaluer, l'existence de différences de profil entre le groupe d'étudiants ayant choisi l'UE optionnelle Santé Mondiale, et le groupe d'étudiants s'étant orientés vers d'autres UE optionnelles.

MÉTHODES

Schéma d'étude et population d'étude

Il s'agit d'une étude transversale réalisée à la faculté de médecine de Rouen pendant deux années, en janvier 2016, puis en janvier 2017. La population d'étude correspond aux étudiants en filière santé, inscrits à l'UFR Santé de Rouen, en troisième et quatrième année des études médicales, les étudiants en pharmacie et en maïeutique.

Recueil des données

Un auto-questionnaire anonyme papier a été spécifiquement construit pour l'étude. Deux questionnaires ont été distribués aux étudiants inscrits à l'UE, appelés « groupe Santé Mondiale+ », soit SM+, pendant leur présence au cours de l'UE, et respectivement, aux étudiants inscrits à d'autres UE, appelés « groupe Santé Mondiale- »,

soit SM-, (groupe de comparaison) pendant leur présence aux cours magistraux.

Le questionnaire pour les étudiants SM+ comportait 13 questions, structurées autour de trois grandes parties. La première partie recueillait des données socio-démographiques (genre, âge, année d'étude), ainsi que le recueil de données qualitatives concernant le motif du choix des études en médecine, une période antérieure de vie à l'étranger, l'implication de l'étudiant dans une association humanitaire. Une seconde partie recueillait sur une échelle de Likert cotée de 1 à 5, l'opinion des étudiants sur la pertinence de certaines thématiques pour un enseignement de santé mondiale, et d'ouvrir le débat sur le fait de rendre l'UE obligatoire dans le cursus des études médicales. La troisième partie concernait la projection professionnelle des étudiants, futures spécialités et diverses modalités d'exercice (exercice à l'étranger, engagement dans la médecine humanitaire).

Le questionnaire pour les étudiants SM-, avait un contenu presque identique à ce du questionnaire SM+, à l'exception de la question visant les motivations de l'étudiant à suivre l'enseignement de santé mondiale.

Analyse statistique

Une analyse descriptive des données a été faite à l'aide du logiciel Statview. Le test statistique du Chi² et le test exact de Fisher ont été utilisés pour comparer les variables qualitatives, le test *t* de Student - pour les variables quantitatives.

RÉSULTATS

Au total, 422 étudiants ont été inclus (206 en 2016-17, 216 en 2017-18), dont 122 étudiants SM+ et 300 étudiants SM-. Les deux groupes SM- et SM+ comportaient une majorité de femmes, avec un sexe ratio HF=0,7 dans le groupe SM- et de 0,4 dans le groupe SM+. Les femmes étaient cependant plus nombreuses dans le groupe suivant l'UE Santé Mondiale, 70% au total contre 58%, ($p=0,02$). L'âge moyen dans le groupe SM+ était de 21,1 ans, tandis qu'il était de 20,7 ans dans le groupe SM-. Cette différence était significative ($p=0,001$).

Quel que soit le groupe, les motivations à suivre des études de santé étaient les mêmes chez les étudiants, toutes filières mixtes. L'altruisme et le désir de soigner autrui représentait leur première motivation, suivi par l'attrait scientifique

des études. Quelques-uns considéraient cela comme une vocation et d'autres se disaient inspirés par un exemple familial.

Les étudiants du groupe SM+ étaient significativement plus nombreux à s'investir dans une association humanitaire (22,3% versus 6,7%). Les étudiants du groupe SM+ étaient également significativement plus nombreux à avoir déjà participé à une mission humanitaire, à l'étranger ou sur le territoire français (20,5% versus 9,3%). Il s'agissait principalement de missions humanitaires tournées vers la prévention ou l'accompagnement d'enfants handicapés (fig. 1).

Plusieurs objectifs pédagogiques ont été soumis à l'avis des étudiants des groupes SM+ et SM- ; chacun faisait l'objet d'une cotation de 1 à 5, de « pas du tout » à « oui tout à fait ». Les résultats sont retranscrits dans la figure 2.

Il ressort que les étudiants du groupe SM+ considéraient la plupart de ces objectifs comme d'un plus grand intérêt, et témoignaient d'une plus grande facilité à leur donner des notes élevées (4 ou 5). Ainsi les objectifs de plus grande ouverture sur le monde, et de meilleure prise en compte de l'interculturalité dans une relation de soins, recueillaient de la part des SM+ un avis de très bonne correspondance avec un objectif d'enseignement de santé mondiale (fig. 2).

Diverses thématiques ont été proposées pour réfléchir aux étudiants des groupes SM+ et SM- ; chacune faisait l'objet d'une cotation de 1 à 5, de « très peu d'intérêt » à « intérêt majeur ». Les résultats sont reflétés dans la figure 3.

La principale différence entre les deux groupes est que les étudiants du groupe SM+ considèrent la plupart de ces thématiques comme d'un plus grand intérêt, et témoignent d'une plus grande facilité à leur accorder des notes élevées (4 ou 5). Ainsi les thématiques visant l'inégalités de santé et impact du climat sur la santé, étaient notées comme des éléments particulièrement intéressants (notes majoritaires de 5) ; les principales causes de mortalité et de morbidité dans le monde, les maladies chroniques et infectieuses, et la compréhension de l'interculturalité dans une relation de soins, étaient notées comme également intéressantes pour un enseignement de santé mondiale (somme des notes 4 et 5) ; la thématiques du systèmes de santé, de la coopération internationale, et de l'équité et de la jus-

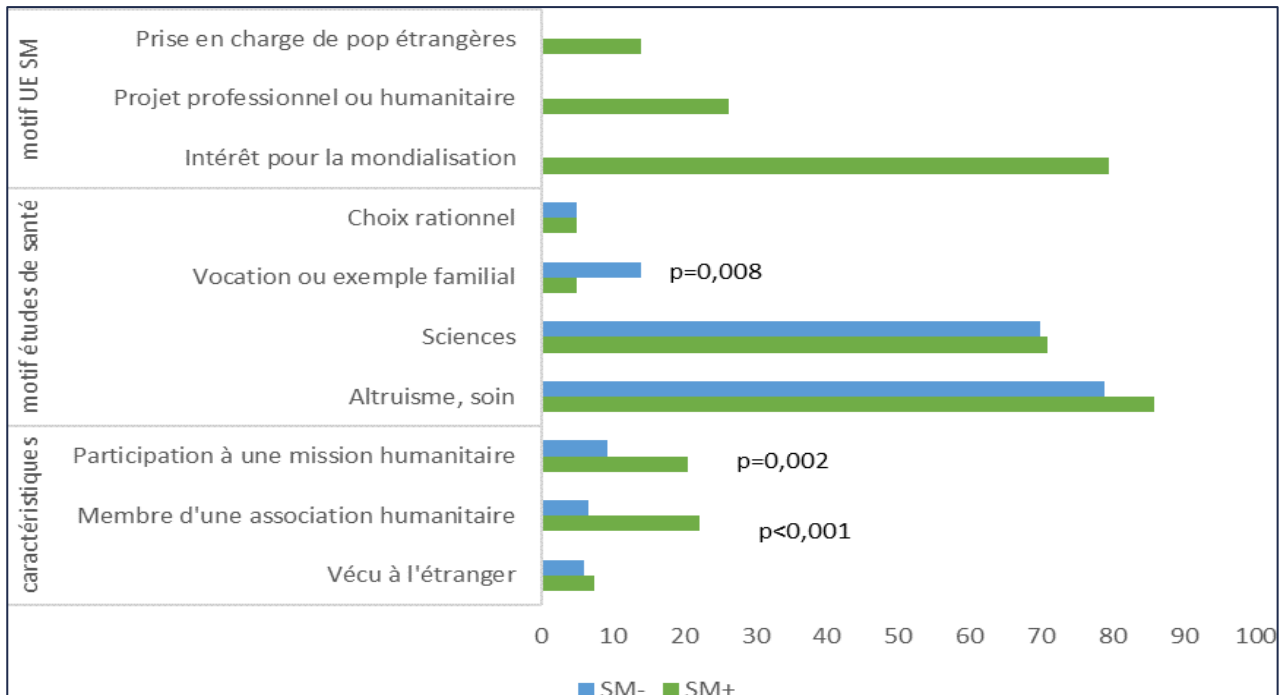


Figure 1. Caractéristiques sociodémographiques et profils de la population d'étude (les résultats sont présentés en pourcentages).

tice sociale, recueillaient davantage de notes intermédiaires (fig. 3).

Les dernières questions portaient sur la projection des étudiants dans leur futur activité. On note que les étudiants inscrits à l'UE de santé mondiale envisageaient avec plus de précision leur avenir professionnel que les étudiants du groupe SM- (différence significative). Ainsi 37% des étudiants du groupe SM+ avaient déjà arrêté leur choix de spécialité, contre seulement 19% pour le groupe SM-. La quasi-totalité des spécialités médicales étaient citées par les étudiants, mais certaines revenaient plus souvent comme la médecine générale, la gynécologie, la pédiatrie et la chirurgie (chirurgie orthopédique et pédiatrique principalement). Les raisons justifiant le choix de la spécialité reprenaient les mêmes thématiques que pour le choix des études médicales, conciliant le soin apporté à autrui, le contact humain et l'attrait pour une pratique particulière comme la chirurgie ou l'aspect scientifique de la médecine.

Plus de la moitié des étudiants du groupe SM+ déclaraient vouloir significativement exercer à l'étranger, contre un peu plus d'un quart du groupe SM- (fig. 4).

Il s'agissait principalement d'un exercice de

courte ou moyenne durée, de 1-2 ans en moyenne avec une majorité désirant partir pour une année. Deux types d'exercice à l'étranger se distinguaient: le premier consistait plutôt dans l'exercice de la spécialité au Canada, aux Etats-Unis ou au sein de l'Union Européenne, et le second à but plutôt humanitaire dans les pays en voie de développement (Afrique, Asie), revenaient fréquemment dans les verbatims (fig. 4).

DISCUSSIONS

La caractéristique démographique la plus remarquable est la dominante féminine des deux groupes d'étudiants, SM+ et SM- ; celle-ci peut être le reflet de la féminisation progressive et continue des études de santé. Elles sont encore plus nombreuses à être inscrites dans le groupe SM+ (70% contre 58%), ce qui peut laisser penser que les femmes ont une tendance plus forte à être tournées vers l'humanitaire que les hommes. Concernant la différence d'âge parmi les deux groupes, le groupe SM-, avec un âge moyen plus jeune, n'était composé que d'étudiants de troisième année, contrairement au groupe SM+, ce qui rejoint le biais de sélection discuté auparavant.

Très peu d'étudiants ont indiqué d'avoir eu une

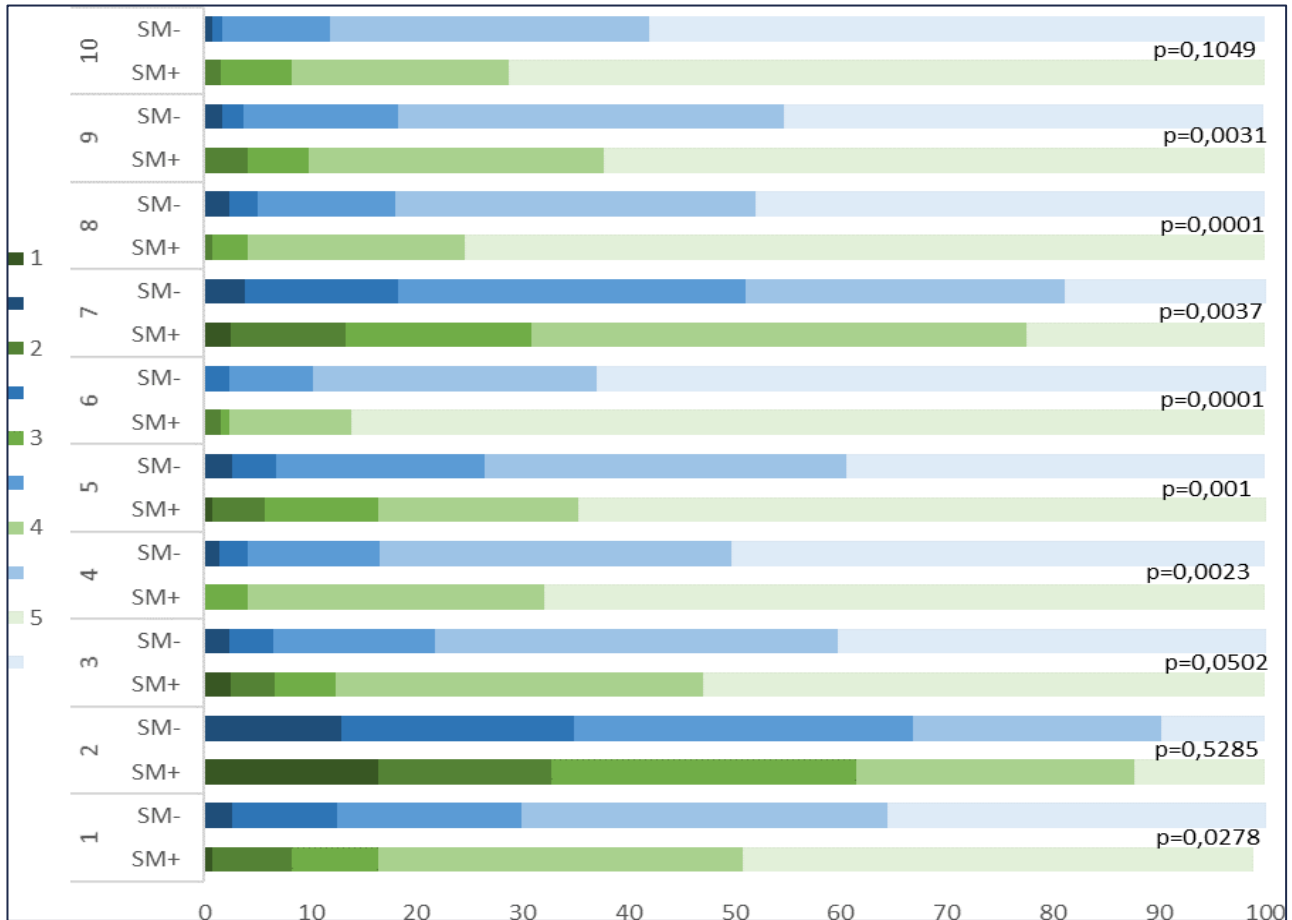


Figure 2. Correspondance des objectifs pédagogiques avec un enseignement de santé mondiale selon le groupe SM+ ou SM- (les résultats sont présentés en pourcentages).

Légende : de 1 = aucune correspondance à 5 = très bonne correspondance

Objectifs pédagogiques proposés à la question :

1. Meilleure prise en charge de populations vulnérables (précaires) en France
2. Augmentation de l'intérêt pour la pratique de la médecine générale en France
3. Augmentation de l'intérêt pour la pratique de la santé publique dans le monde
4. Meilleure pratique de la médecine dans un contexte de ressources limitées
5. Formation de professionnels de santé plus « humanistes »
6. Plus, grande ouverture sur le monde
7. Amélioration du professionnalisme
8. Meilleure prise en compte de l'interculturalité dans une relation de soins
9. Capacité à travailler en dehors de la France
10. Formation à la médecine humanitaire

période vécue à l'étranger, et donc nous avons de ce fait un manque de données pour montrer une différence entre le fait d'avoir vécu à l'étranger, et le choix d'une carrière humanitaire. Les étudiants SM+ sont davantage impliqués dans des actions et associations humanitaires, ce qui justifie leur sensibilisation à la santé dans le monde et à la situation des personnes vulnérables. Ceci reste cohérent avec les motifs qu'ils invoquent pour avoir choisi l'UE santé mondiale (7).

Les étudiants SM+ sont globalement plus prom-

pts à noter de manière affirmée (note de 5) les objectifs proposés, par rapport aux étudiants SM- qui apprécient davantage les objectifs de manière intermédiaire. Ce fait peut être lié à la différence de motivation initiale, car le groupe des étudiants SM+ porte un enthousiasme lié au choix actif de l'option, pour laquelle ils se sentent investis.

Tout comme pour les objectifs d'enseignement, les étudiants SM+ étaient globalement plus tentés à noter d'une manière tranchée les théma-

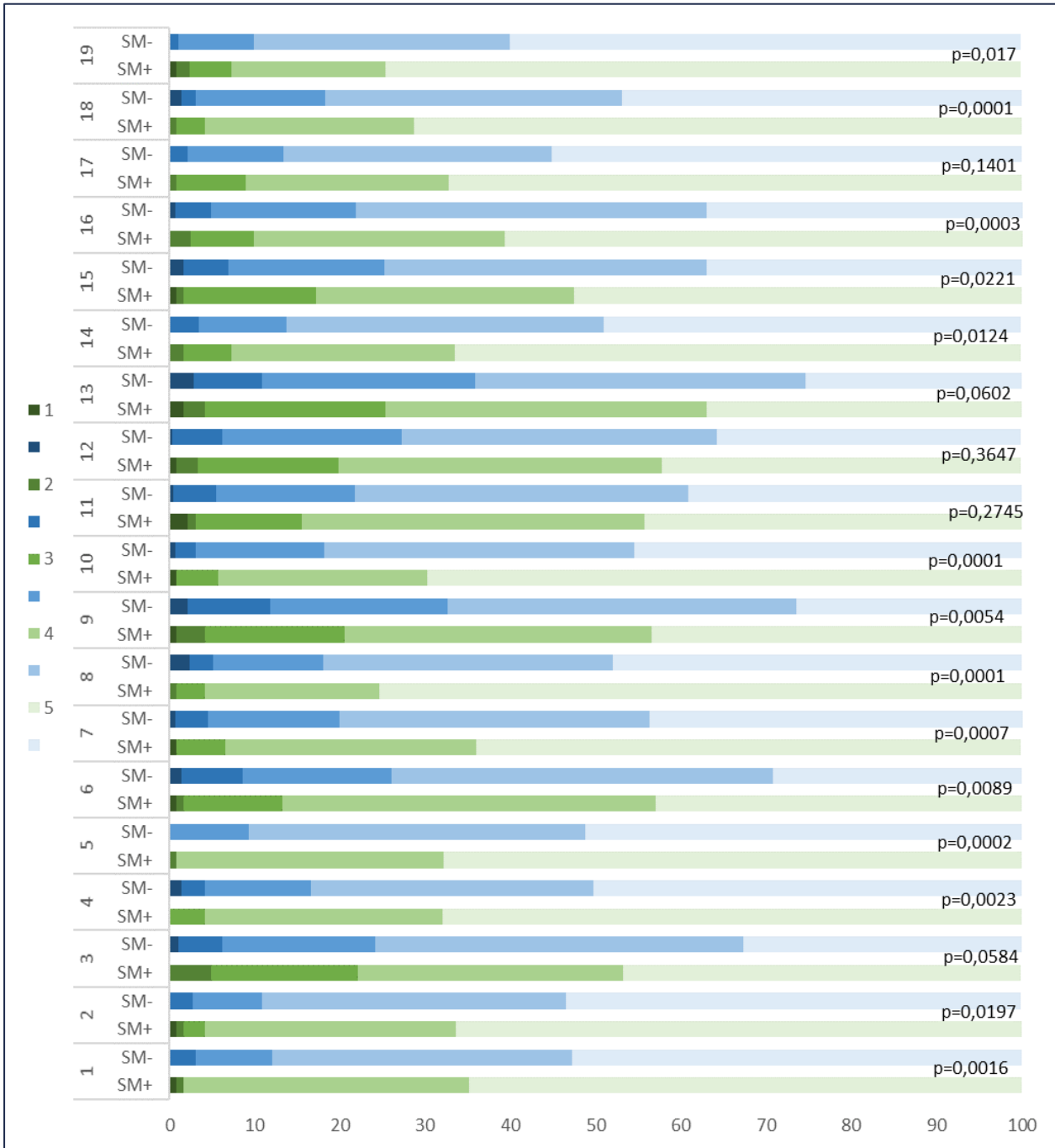


Figure 3. Question 7, intérêt des thématiques pour un enseignement de santé mondiale selon le groupe SM+ ou SM- (les résultats sont rendus en pourcentages).

Légende de 1 = très peu d'intérêt à 5 = intérêt majeur

Thématiques proposées à réfléchir :

1. Principales causes de mortalité dans le monde
2. Principales causes de morbidité dans le monde
3. Santé de la mère et de l'enfant
4. Maladies chroniques
5. Maladies infectieuses
6. Déterminants épidémiologiques et sociaux de la santé
7. Inégalités de santé
8. Impact du climat sur la santé

9. *Systèmes de santé*
10. *Accès aux soins*
11. *Santé des voyageurs*
12. *Coopération internationale*
13. *Équité et justice sociale*
14. *Populations vulnérables (précaires) à l'étranger*
15. *Populations vulnérables (précaires) en France*
16. *Réfugiés et migrants en France*
17. *Exercice de la médecine à l'étranger*
18. *Compréhension de l'interculturalité dans une relation de soins*
19. *Pratique de la médecine humanitaire*

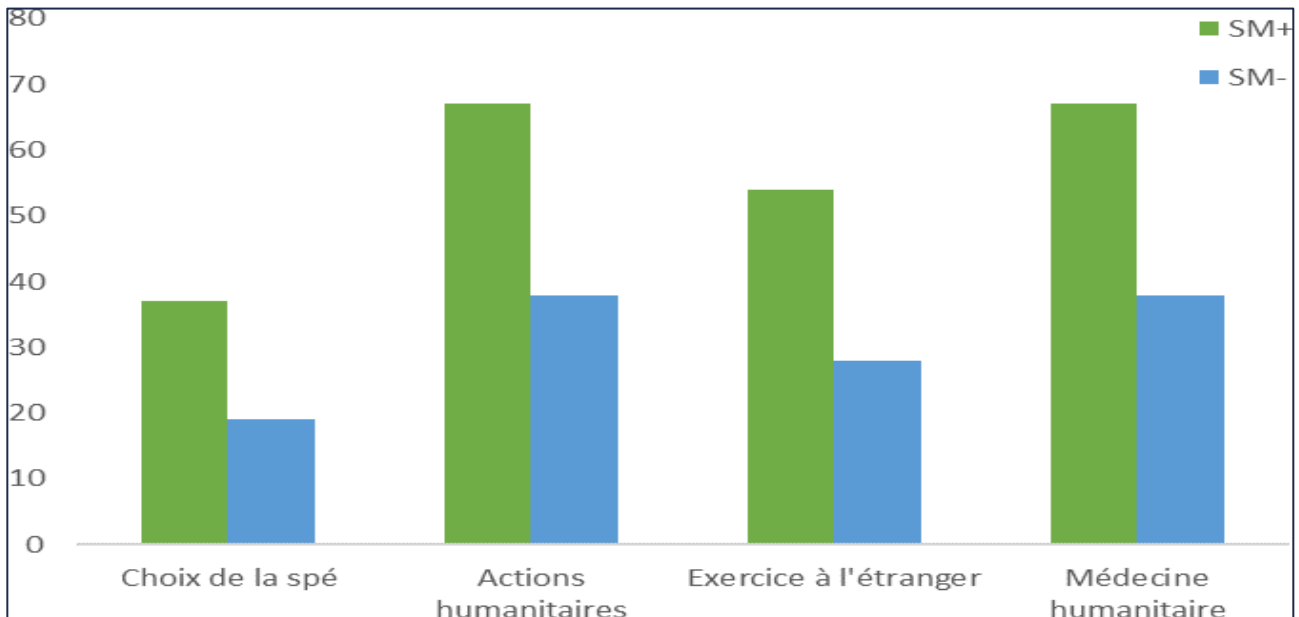


Figure 4. Projection des étudiants pour leur exercice futur selon le groupe SM+ ou SM-.

tiques proposées par une note de 5, en faisant épreuve d'un intérêt majeur de la thématique pour l'enseignement ; cet aspect est global sur toutes les thématiques. Les étudiants SM+ semblent posséder une définition de la santé mondiale assez fine et juste au sujet des thématiques qu'elle comporte, au vu des réponses apportées, et ce même avant le début des enseignements. En effet, au-delà des grandes thématiques, ainsi que les principales causes de mortalité et de morbidité dans le monde, ils considèrent l'accès aux soins et la compréhension de l'interculturalité dans une relation de soins en tant que thématiques assez importantes. Le fait que les thématiques du système de santé, de la coopération internationale et d'équité et de la justice sociale aient recueillis davantage de notes intermédiaires, est le témoin de points de progression significatifs sur lesquels les enseignements vont jouer (1, 8).

Une bonne partie d'étudiants SM+ estime que

l'enseignement de santé mondiale devrait être obligatoire, et tenir ainsi davantage de place au sein du cursus général des études de santé. Néanmoins, ils ne sont pas majoritaires (46% de SM+ et 37% de SM-) ; nous pouvons supposer que la plupart des étudiants estime que cela reste une option motivée par un choix personnel, et ne souhaite donc pas se prononcer sur l'intérêt qu'il pourrait avoir chez les autres.

L'exposition à la Santé Mondiale permet de développer ce profil de professionnel de santé. Les effets de l'enseignement de la santé mondiale chez les étudiants en médecine ont été bien documentés. La plupart des études rapporte des effets bénéfiques suite à la participation à un programme de santé internationale ou de santé mondiale qui le plus souvent comprenait une formation académique et un stage à l'étranger. Les principaux effets rapportés sont une meilleure compréhension des déterminants de santé, le développement des habiletés cliniques, une

utilisation plus efficiente des ressources disponibles, une plus grande sensibilité culturelle avec un respect des cultures et une considération des facteurs culturels dans la dispensation des soins et la communication interculturelle, une plus grande implication dans les décisions et une plus grande appréciation de la santé publique et la valorisation de la participation communautaire (9-10).

Plusieurs facultés de médecine canadiennes se sont engagées ces dernières années à former les étudiants à la fois de santé mondiale et en responsabilité sociale (11). Cette ambition de struc-

turer la formation à la responsabilité sociale et à la santé mondiale est une réponse déterminante pour la formation des futurs professionnels qui auront, entre autres, l'aptitude d'anticiper les réponses de santé face à des crises sanitaires.

Afin de tirer tous les bénéfices de cet enseignement, il sera important de prendre en considération plusieurs critères déterminants bien définis, tels que la durée de l'exposition, la sélection de milieux de stage, la participation à une préparation au départ et au retour s'il s'agit d'un stage ainsi qu'un encadrement favorisant la réflexion.

CONCLUSIONS

1. L'étude réalisée au cours de deux années universitaires à la faculté de médecine à Rouen, est innovante par son aspect sociologique (motivations du choix d'étude, projection professionnelle dans l'avenir de l'étudiant en formation), et par l'implication qu'elle recherche des étudiants interrogés (nature de leurs attentes quant aux objectifs d'un enseignement de santé mondiale). Ce type d'étude permet de mieux connaître le profil et les attentes du public-cible de l'enseignement, pour qu'il y soit également au cœur.
2. Les étudiants inscrits dans l'enseignement de santé mondiale présentaient un profil particulier. Ils étaient majoritairement de sexe féminin, ouverts à l'humanité, impliqués dans le milieu associatif et sensibilisés à l'importance de l'interculturalité dans la relation de soins, et orientés au choix d'une carrière souvent établie déjà.
3. Des évaluations futures sont à encourager, avec des questionnaires qui permettront d'enrichir et d'actualiser le contenu de la formation à travers les résultats de ces enquêtes. En ce qui concerne la crise sanitaire majeure que traverse actuellement la société mondiale (12), il est de plus en plus urgent de mettre en place des enseignements de santé mondiale dans les Ecoles de Médecine.

CONFLIT D'INTÉRÊTS

Aucun conflit d'intérêt déclaré.

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THE ROLE OF BORON IN PREVENTION OF OSTEOARTICULAR DISEASES AND ITS DISTRIBUTION IN THE REPUBLIC OF MOLDOVA

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Keywords: osteoarticular diseases, boron, boron compounds.

Introduction. Boron is a trace mineral that is supposed to be essential for human health. Organic plant based boron compounds are highly bioavailable for humans and can positively influence minerals such as calcium, phosphorus, magnesium and act in synergy with vitamin D, which are beneficial for osteoarticular health.

Material and methods. We made an analysis of 126 bibliographic sources and mapped the Republic of Moldova to the content of boron in deep water and to the adults' prevalence of rheumatoid arthritis and inflammatory polyarthropathy.

Results. Boron is important for osteogenesis and its deficiency can lead to impaired growth and abnormal bones development. It supports bone health in postmenopausal women by reducing urinary loss of the minerals such as calcium, magnesium and phosphorus, which are essential for bone building. In countries where soil was depleted of boron and daily intake of this mineral was 1 mg or lower, the incidence of arthritis was between 20 and 70%. In Moldova, in the regions where boron concentration in deep drinking water were low (0.28 mg/L in well water and 0.51 mg/L in artesian well water) in Soroca in 2019, the prevalence with the rheumatoid arthritis and inflammatory polyarthropathy were high (51.6 per 10000 inhabitants) with one exception, UTA Gagauzia (35.1 per 10000 inhabitants), where we found a high boron concentration in deep drinking water (2.05 mg/L in well water and 2.2 mg/L in artesian well water) in 2015.

Conclusions. Boron can affect bone metabolism. In regions where boron concentration in deep drinking water is low, the osteoarticular morbidity can be higher with the exception of UTA Gagauzia, where we suppose that dietary pattern can be a cause of these results. In the future we will study eating habits in this region and a clearer conclusion will be made.

Cuvinte cheie: boli osteoarticulare, bor, compuși ai borului.

ROLUL BORULUI ÎN PREVENIREA BOLILOR OSTEOARTICULARE ȘI DISTRIBUȚIA ACESTUIA PE TERITORIUL REPUBLICII MOLDOVA

Introducere. Borul este un microelement probabil esențial pentru oameni. Compușii organici ai borului au o biodisponibilitate înaltă pentru oameni și pot influența pozitiv metabolismul calciului, fosforului și al magneziului, acționând în sinergie cu vitamina D, în mod pozitiv pentru oase.

Material și metode. Pentru realizarea studiului au fost analizate 126 de surse bibliografice, a fost cartografiată Republica Moldova după concentrația borului în apa potabilă de profunzime și după prevalența adulților prin artrită reumatoidă și poliartropatiile inflamatorii.

Rezultate. Borul este important pentru osteogeneză, iar deficiența acestuia poate compromite creșterea și dezvoltarea oaselor. El susține sănătatea osoasă a femeilor aflate în menopauză prin reducerea pierderii urinare a calciului, magneziului și a fosforului. În țările în care solul este privat de bor, iar aportul zilnic al acestui mineral este de 1 mg și mai puțin, incidența artritei este cuprinsă între 20 și 70%. În Moldova, în regiunile în care concentrația borului în apa potabilă de profunzime a fost joasă (0,28 mg/l în apa din fântâni și 0,51 mg/l în apa din sondele arteziene în Soroca în 2019), prevalența prin artrită reumatoidă și poliartropatii inflamatorii a fost înaltă (51,6 pentru 10000 locuitori), cu o singură excepție – UTA Găgăuzia (35,1 pentru 10 000 locuitori), unde am depistat o concentrație înaltă a borului în apa potabilă de profunzime (2,05 mg/l în apa din fântâni și 2,2 mg/l în apa din sondele arteziene) în anul 2015.

Concluzii. Borul poate afecta metabolismul osos. În regiunile în care concentrația borului în apa potabilă de profunzime este joasă, morbiditatea osteoarticulară poate fi înaltă, cu excepția UTA Gagauzia, unde presupunem că deprinderile alimentare ale locuitorilor pot cauza aceste rezultate. Astfel, modul de alimentație al locuitorilor din această zonă se impune a fi studiat în profunzime și doar atunci vom putea trasa concluzii mai clare.

INTRODUCTION

Boron is a trace mineral that is supposed to be essential for human health. It can enter the body from two main sources: fruits and vegetables in organics form and water in an inorganic form. From all known compounds, the organic, plant-based ones are highly bioavailable for humans and can positively influence minerals such as calcium, phosphorus, magnesium and act in synergy with vitamin D, which are known to be beneficial for osteoarticular health. From scientific evidence we know that boron can positively influence the symptoms and prevent osteoarticular diseases such as osteoarthritis, rheumatoid arthritis and osteoporosis. In countries where soil was depleted of boron and daily intake of this mineral was 1 mg or lower, the incidence of arthritis was very high. We suppose that in the Republic of Moldova can be areas were soil and drinking water is depleted of boron and it may be necessary to study osteoarticular diseases in those regions in the future.

The aim of this study was to determine the role of boron in prevention of osteoarticular diseases from the literature and the possible relationship between the concentration of boron in deep drinking water and the prevalence of rheumatoid arthritis and inflammatory polyarthropathy in 2015-2019 periods in the Republic of Moldova.

MATERIAL AND METHODS

We made a literature review of 126 bibliographic sources that highlighted the boron and its compounds functions and their role in prevention of osteoarticular diseases. We searched the electronic database MEDLINE (PubMed, <https://pubmed.ncbi.nlm.nih.gov/>), Google Scholar (<https://scholar.google.com/>), ProQuest (<https://www.proquest.com/>), Scopus (<https://www.scopus.com/>) until June 2021, using the following key terms: "boron", "boron compounds", "organic boron compounds" combined using the Boolean operator AND "osteoarticular diseases", "rheumatoid arthritis", "osteoarthritis". The reference list from the resulting publications was manually searched for any relevant trials with elimination of results not related to the article topic. The resulting list of publications was limited to include only English.

Also, we collected data on boron concentration

in deep water (wells and artesian wells) from different regional public health centers of the Republic of Moldova for the 2015-2019 period, analyzed them and put the average concentrations on the map of the country. For data analysis was used Microsoft Excel 2010 and for maps – the soft Datawrapper (<https://app.datawrapper.de/>)

Boron concentration in deep drinking water was determined in regional public health centers using the photolorimetric method and the ability of boric acid to change the color of carmine in the presence of concentrated sulfuric acid from red to purple-blue as a result of the formation of the boric acid ether complex. The performance features of the method are set in 0.1-1.0 mg/L range.

We classified boron concentration in deep drinking water as following: low (0-0.8 mg/L), medium (0.9-1.2 mg/L) and high (1.2 mg/L and more). After this, in order to establish a possible connection between boron concentration in deep drinking water and the prevalence with rheumatoid arthritis and inflammatory polyarthropathy of the population, we collected data on population morbidity with these diseases from the Health Data Management Department of the National Agency for Public Health. After that, we mapped the Republic of Moldova of the prevalence with rheumatoid arthritis and inflammatory polyarthropathy for 2016 and 2019 years using the same soft – Datawrapper.

The data obtained will be used in an ecological descriptive epidemiological study in which we will describe the correlation between boron concentration in deep drinking water and the population morbidity with rheumatoid arthritis and osteoarthritis.

RESULTS

The reviewed literature highlights the essential of boron in the normal development of the skeleton, maintenance of bone health throughout life and beneficially influences minerals such as calcium magnesium, and vitamin D (1).

It appears that boron can be primarily found in soil and in deep drinking water in an inorganic form. Then it's processed by plants and microorganisms and is transformed into organic compounds, known as boron containing compounds

(BCC) that is highly available for human body (2).

Thus, the main sources of boron in organic form are fruits and vegetables and in an inorganic form drinking water (especially deep water, in which there is no human impact) (3).

Comparing these two sources, on average, vegetable foods can supply human body with 1.0 mg of B per day and drinking water with 0, 6 mg of B per day (3). We should mention that this amount will vary depending on the region and the boron concentration in rocks and respectively, in deep water.

Studying boron intake from deep drinking water

is an accessible method for the Republic of Moldova, where the water samples are collected and analyzed by the local public health centers and data are sent to the National Agency for Public Health. We chose to study this important boron source because there is no available method of studying boron concentration in fruits and vegetables in the Republic of Moldova.

From 2015 to 2019 number of regions from where deep water samples were collected and analyzed in the environmental hygiene laboratories has increased from 11 (fig.1) to 26 (fig. 2) for artesian wells and from 8 (fig. 3) to 9 for wells (fig. 4).

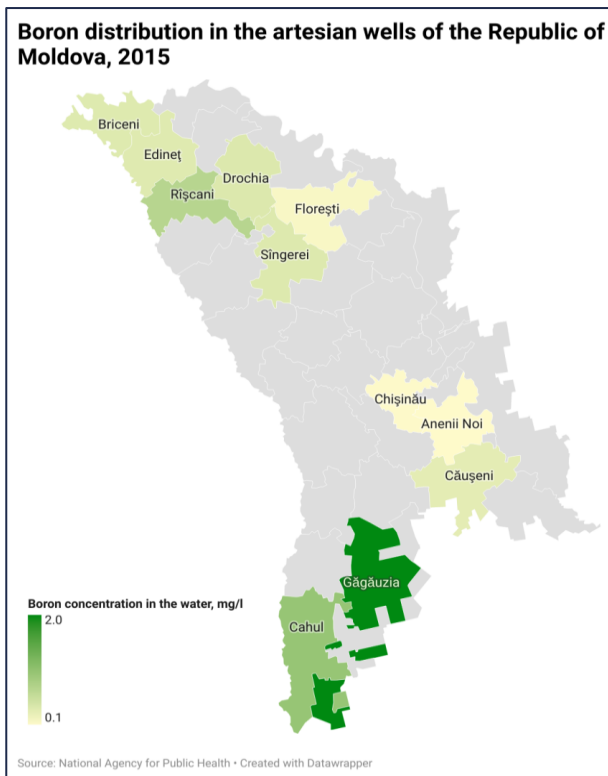


Figure 1. Boron distribution in the artesian wells of the Republic of Moldova, 2015.

Following the map, in 2015, the highest concentration of boron in artesian well was detected in UTA Gagauzia (2.2 mg/L average concentration) and the lowest in Anenii Noi (0.08 mg/L).

Boron concentrations from other regions on the map are listed in the Table 1.

For 2019, also, the highest boron concentration in drinking water from artesian well was detect-

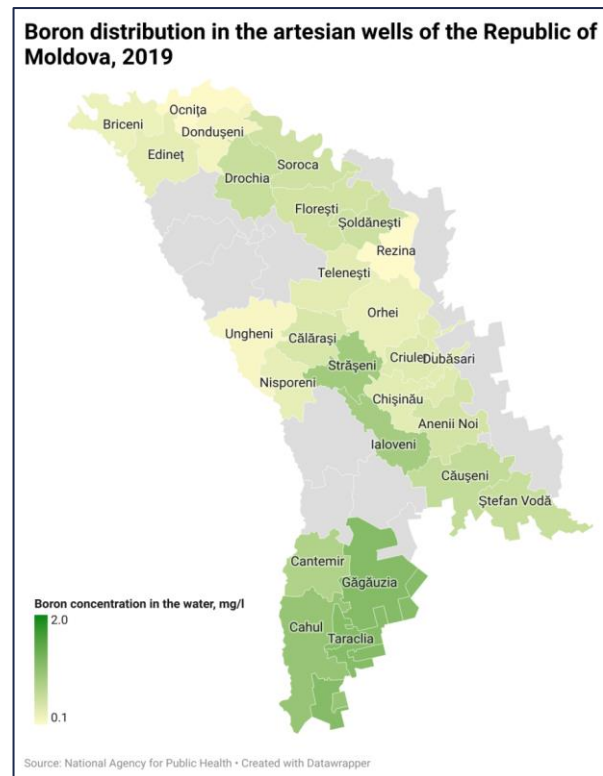


Figure 2. Boron distribution in the artesian wells of the Republic of Moldova, 2019.

ed in UTA Gagauzia, in the south region of the Republic of Moldova (1.15 mg/L) and the lowest in the north part – Ocnita (0.11 mg/L).

In other regions of the Republic of Moldova were found boron concentrations that are between these two values (tab.2).

Table 1. Average boron concentration in the artesian well water from different region of the Republic of Moldova, 2015.

Number	Region of the Republic of Moldova	Average boron concentration in the region, mg/L
1.	Cahul	1.0
2.	Causeni	0.33
3.	UTA Gagauzia	2.2
4.	Anenii Noi	0.08
5.	Chisinau	0.11
6.	Briceni	0.38
7.	Edinet	0.37
8.	Riscani	0.72
9.	Singerei	0.39
10.	Drochia	0.4
11.	Floresti	0.15

Table 2. Average boron concentration in the artesian well water from different region of the Republic of Moldova, 2019.

Number	Region of the Republic of Moldova	Average boron concentration in the region, mg/L
1.	Cahul	1.0
2.	Cantemir	0.78
3.	UTA Gagauzia	1.15
4.	Ocnita	0.11
5.	Causeni	0.61
6.	Stefan Voda	0.57
7.	Dubasari	0.35
8.	Taraclia	1.14
9.	Anenii Noi	0.47
10.	Calarasi	0.42
11.	Chisinau	0.34
12.	Criuleni	0.38
13.	Ialoveni	0.88
14.	Orhei	0.27
15.	Straseni	0.9
16.	Nisporeni	0.3
17.	Ungheni	0.16
18.	Briceni	0.25
19.	Donduseni	0.2
20.	Edinet	0.31
21.	Soldanesti	0.52
22.	Drochia	0.57
23.	Soroca	0.51
24.	Floresti	0.49
25.	Rezina	0.1
26.	Telenesti	0.33

In the well drinking water from UTA Gagauzia situated in the south part of the Republic of Moldova was recorded the highest level of boron –

2.05 mg/L in 2015. The lowest level was detected in the central part, Anenii Noi – 0.04 mg/L.

All the concentration of boron in well drinking water can be seen in the Table 3.

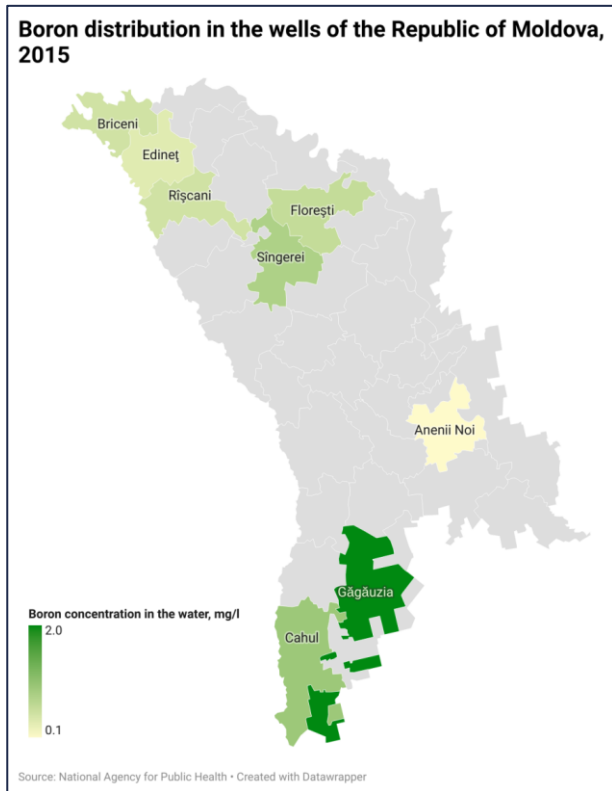


Figure 3. Boron distribution in the wells of the Republic of Moldova, 2015.

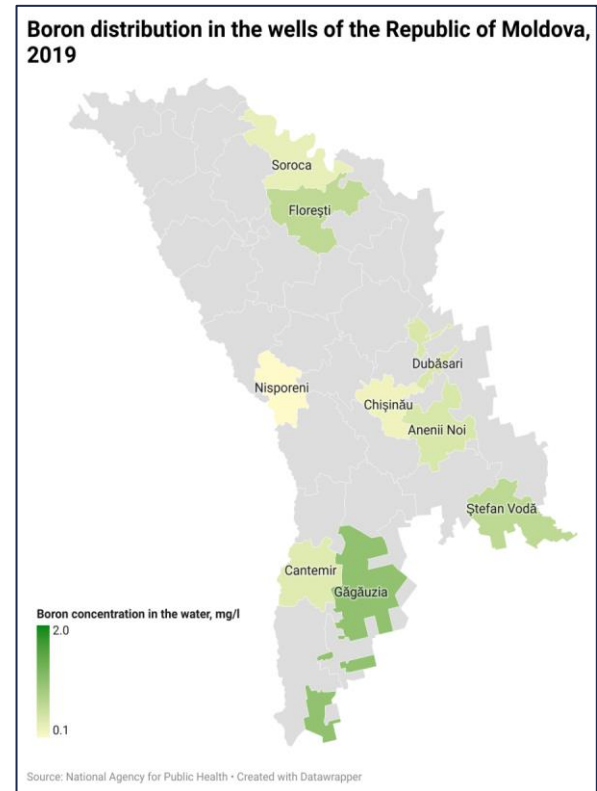


Figure 4. Boron distribution in the wells of the Republic of Moldova, 2019.

Table 3. Average boron concentration in the well water from different region of the Republic of Moldova, 2015.

Number	Region of the Republic of Moldova	Average boron concentration in the region, mg/L
1.	Cahul	0.95
2.	Briceni	0.5
3.	UTA Gagauzia	2.05
4.	Anenii Noi	0.04
5.	Edineț	0.36
6.	Riscani	0.5
7.	Singerei	0.8
8.	Florești	0.61

For 2019, the highest boron concentration in well drinking water was recorded in UTA Gagauzia (1.05 mg/L) and the lowest in the central part of the country, in Nisporeni (0.1 mg/L).

All the boron concentrations in well water for 2019 can be followed in the Table 4.

The data presented above highlighted the regions of the Republic of Moldova with the low and high boron in the soil, the drinking water and in the fruits and vegetables consumed by the population. Also, this suggests that in the area with the lowest boron concentration population

can be more affected by the osteoarticular diseases.

In order to check this possible connection, we mapped adults' prevalence with rheumatoid arthritis and inflammatory polyarthropathy for 2016 and 2019 years.

In the map we used all available data on the adults' prevalence, because we expect in the future next years to collect data of boron containing in deep drinking water from all the regions of the Republic of Moldova.

Table 4. Average boron concentration in the well water from different region of the Republic of Moldova, 2019.

Number	Region of the Republic of Moldova	Average boron concentration in the region, mg/L
1.	Cantemir	0.36
2.	Stefan Vodă	0.66
3.	UTA Gagauzia	1.05
4.	Nisporeni	0.1
5.	Anenii Noi	0.43
6.	Chisinau	0.22
7.	Dubasari	0.42
8.	Soroca	0.28
9.	Floresti	0.64

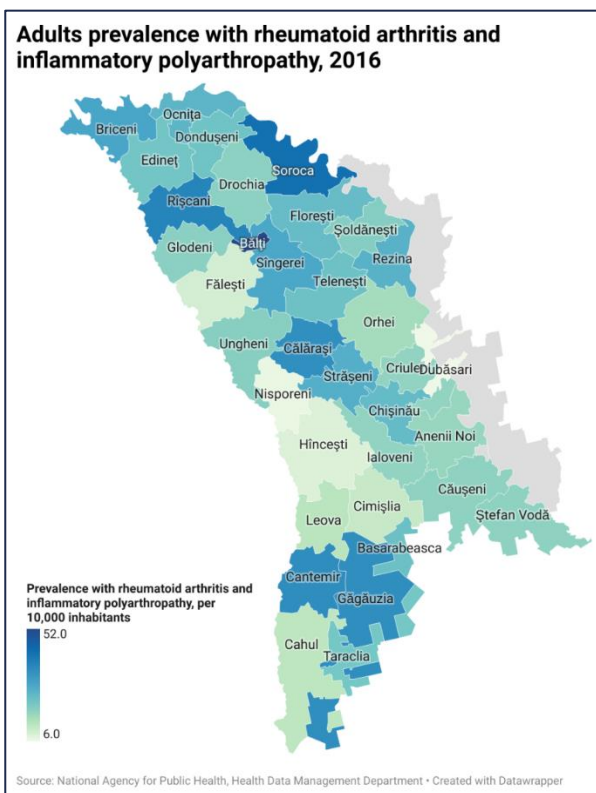


Figure 5. Adults' prevalence with rheumatoid arthritis and inflammatory polyarthropathy in the Republic of Moldova, 2016.

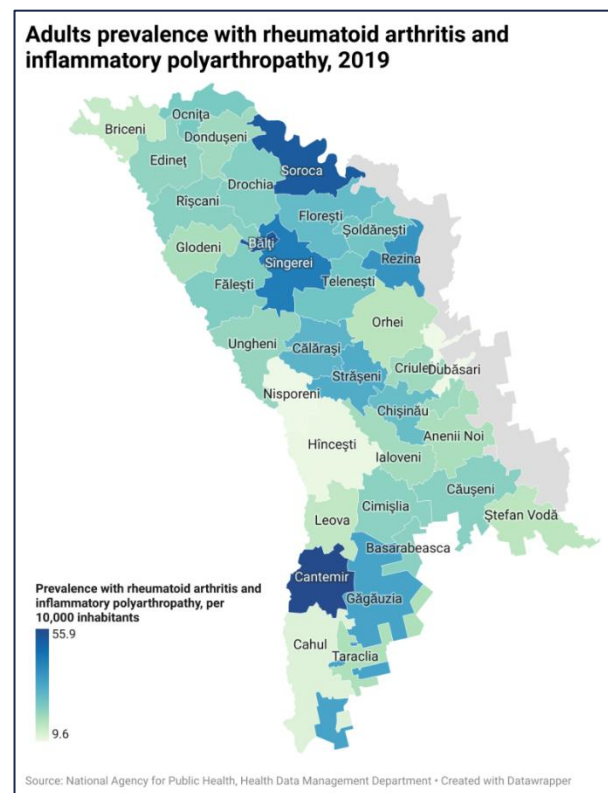


Figure 6. Adults' prevalence with rheumatoid arthritis and inflammatory polyarthropathy in the Republic of Moldova, 2019.

In the following table we will present adults prevalence with rheumatoid arthritis and inflammatory polyarthropathy in the regions where boron concentrations in deep drinking water are known. Following this we will be able to suppose if there is a connection between boron concentration in deep drinking water and population morbidity with rheumatoid arthritis and inflammatory polyarthropathy.

For the regions where boron concentration in

deep drinking water is known, in 2016, the highest prevalence with rheumatoid arthritis and inflammatory polyarthropathy were found in UTA Gagauzia (35.1 per 10000 inhabitants) and in Briceni (29.4 per 10000 inhabitants).

In these regions we found a high boron concentration in UTA Gagauzia (2.05 mg/L in well water and 2.2 mg/L in artesian well water), but a low one in Briceni (0.5 mg/L in well water and 0.38 mg/L in artesian well water).

Table 5. Adults' prevalence with rheumatoid arthritis and inflammatory polyarthropathy from different region of the Republic of Moldova, 2016.

Number	Region of the Republic of Moldova	Prevalence with rheumatoid arthritis and inflammatory polyarthropathy, per 10000 inhabitants
1.	Cahul	12.6
2.	Briceni	29.4
3.	UTA Gagauzia	35.1
4.	Anenii Noi	17.4
5.	Edinet	21.7
6.	Riscani	37.6
7.	Singerei	29.1
8.	Floresti	24.1
9.	Chisinău	24.5
10.	Căusenii	18.5
11.	Drochia	18.7

The situation in UTA Gagauzia, where both prevalence with rheumatoid arthritis and inflammatory polyarthropathy (35.1 per 10000 inhabitants) and boron concentration in deep drinking water (2.05 mg/L in well water and 2.2 mg/L in artesian well water) are high, is one that indicates to the exception from the working theory. We suppose that the cause can be the dietary pattern of the population in this region and people consume less fruits and vegetables, the main sources of boron containing compounds for the human body. We will check this theory during the ecological descriptive epidemiological study in this region where we will study the dietary patterns and will make a clearer conclusion.

We will note that the highest prevalence with rheumatoid arthritis and inflammatory polyarthropathy in 2016, from all Republic was recorded in Bălți (52.0 per 10000 inhabitants), but we do not have the boron concentration from this region, neither for 2015, nor for 2019. This will be a goal to achieve during the next years.

In Cahul, where the lowest prevalence of the diseases was recorded (12.6 per 10000 inhabitants), boron concentration in deep drinking water is at medium level (0.95 mg/L in well water and 1.0 mg/L in artesian well water).

Following the Figure 1 and Figure 3, in the region with the highest boron concentration, UTA Gagauzia (2.05 mg/L in well water and 2.2 mg/L in artesian well water), the prevalence with rheumatoid arthritis and inflammatory polyarthropathy were high in 2016 (35.1 per 10000 inhabitants). In the region were the lowest boron

concentration was recorded, in Anenii Noi (0.04 mg/L in well water and 0.08 mg/L in artesian well water), the prevalence of these diseases was medium in 2016 (17.4 per 10000 inhabitants).

Also, we mapped the Republic of Moldova with adults' prevalence with rheumatoid arthritis and inflammatory polyarthropathy for 2019 year.

Also, we put in the following table the prevalence with rheumatoid arthritis and inflammatory polyarthropathy for the regions in where we know the boron concentrations in the deep drinking water.

For the regions where boron concentration in deep drinking water is known, in 2019, the highest prevalence with rheumatoid arthritis and inflammatory polyarthropathy were found in Cantemir (55.9 per 10000 inhabitants) and in Soroca (51.6 per 10000 inhabitants).

In these regions we found a low boron concentration both in Cantemir (0.36 in well water and 0.78 in artesian well water) and in Soroca (0.28 in well water and 0.51 in artesian well water).

Following the table 6, the lowest prevalence with rheumatoid arthritis and inflammatory polyarthropathy were recorded in Dubăsari (9.6 per 10000 inhabitants), where the boron concentration is at low level (0.42 in well water and 0.35 in artesian well water).

Following the Figure 2 and Figure 4, in the region with the highest boron concentration, UTA Gagauzia (1.05 mg/L in well water and 1.15 mg/L in artesian well water), the prevalence

with rheumatoid arthritis and inflammatory polyarthropathy in 2019 were high (33.7 per 10000 inhabitants). The same as for 2016 year, we suppose that the dietary pattern of the population can be a cause of this results, because not only the drinking water is the dietary source of boron for the human body.

In the regions where boron concentration in deep drinking water were low, Nisporeni (0.1 mg/L in well water) and Ocnita (0.11 mg/L in artesian well water), the prevalence with these diseases was low in Nisporeni (10.0 per 10000 inhabitants) and medium in Ocnita (24.6 per 10000 inhabitants).

Table 6. Adults' prevalence with rheumatoid arthritis and inflammatory polyarthropathy from different region of the Republic of Moldova, 2019.

Number	Region of the Republic of Moldova	Prevalence with rheumatoid arthritis and inflammatory polyarthropathy, per 10000 inhabitants
1.	Cahul	12.0
2.	Cantemir	55.9
3.	UTA Gagauzia	33.7
4.	Ocnita	24.5
5.	Causeni	22.9
6.	Stefan Voda	16.4
7.	Dubasari	9.6
8.	Taraclia	18.2
9.	Anenii Noi	18.8
10.	Calarasi	29.7
11.	Chisinau	27.7
12.	Criuleni	20.3
13.	Ialoveni	19.6
14.	Orhei	16.9
15.	Straseni	31.8
16.	Nisporeni	10.0
17.	Ungheni	21.2
18.	Briceni	15.2
19.	Donduseni	20.1
20.	Edinet	21.8
21.	Soldanesti	25.4
22.	Drochia	23.4
23.	Soroca	51.6
24.	Floresti	28.2
25.	Rezina	37.7
26.	Telenesti	25.8

DISCUSSIONS

From the reviewed literature we know that boron (B) is supposed to be probable essential for human health (2).

From all known compounds, plant-based organic BCC such as sugars and polyalcohol borate esters are very important in human nutrition. They are highly bioavailable for humans and can be used in cell metabolism during which they are at least partially transformed into boric acid (BA) that will subsequently be eliminated as waste (2). It has been known for a long time that B deficiency in soils, leads to depletion of BCCs in fruits and

vegetables in the food supply, was correlated with a high incidence of arthritis (2).

Recently published research reported that people older than 40 years of age can prevent and/or correct arthritis, osteoporosis and osteoarthritis by taking B equal to or higher than 3 mg/day (3).

Although there is evidence from the countries discussed, the global scientific community has not yet accepted that B is an important micronutrient for human nutrition and its important role in human metabolism; however, we hope that in a short term the B essentiality for human will be

proven (3).

To date, the most studied BCC is calcium fructoborate, which benefits were demonstrated by significant reductions in knee discomfort and improved flexibility of patients with osteoarthritis (4, 5).

The primary dietary sources of BCC are dried fruits, nuts (almonds) and avocados that contain between 1 and 4.5 mg of boron/100 g. Fresh fruits, vegetables (especially apples, grape, broccoli, bananas, plum, peach, pomegranate and tomato, celery), and honey, contains between 0.1 to 0.5 mg boron/100 g, whereas animal foods provide only 0.01 to 0.06 mg of boron/100 g. Another important source of boron, in an inorganic form, is water, and the content varies according to geographic location (6).

Also, boron deficiency leads to impaired growth and abnormal bone development (7, 8). With 3 mg/day of boron supplementation the women's daily urinary excretion of calcium can be reduced by 44% (8).

Boron also beneficially impacts vitamin-D utilization. Supplementation with boron stimulates bone growth in vitamin-D deficient animals and alleviates dysfunctions in mineral metabolism characteristic of vitamin-D deficiency (8).

R. E. Newnham investigated the incidence of arthritis in various areas of the world where boron in the soil and water was considerably above or below the normal level. According to his findings in the region were estimated intake of boron was less than 1 mg per day (Jamaica and Mauritius) the arthritis incidence was between 50 and 70%. Opposite this, in the area where boron intake was 6 to 10 and more mg per day (Australia, Israel and New Zealand) the arthritis incidence was between 1% and none (9, 10).

According to our findings, in 2016, in Briceni, the region of the Republic of Moldova where the prevalence with the rheumatoid arthritis and inflammatory polyarthropathy were high (29.4 per 10000 inhabitants) (fig. 5, tab. 5), the boron concentration in deep drinking water were low in 2015 (0.5 mg/L in well water and 0.38 mg/L in artesian well water). (fig. 1, 3, tab. 1, 3)

The same reverse connection we found in 2019, when the highest prevalence with the rheumatoid arthritis and inflammatory polyarthropathy

were in the regions Cantemir (55.9 per 10000 inhabitants) and Sorooca (51.6 per 10000 inhabitants) (fig. 6, tab. 6), with a low level of boron in deep drinking water recorded the same year, 0.36 in well water and 0.78 in artesian well water in Cantemir and 0.28 in well water and 0.51 in artesian well water in Sorooca. (fig. 2, 4, tab. 2, 4)

These findings can support the theory described above and the connection between a lower concentration of B in deep drinking water and a higher morbidity with the rheumatoid arthritis and inflammatory polyarthropathy and vice versa can exist.

Studies on animals demonstrate that the changes in bone structure and formation induced by boron deprivation apparently affect bone strength and could increase the risk of osteoporosis. Calcium fructoborate incorporated into margarine was found to improve bone density in 66 of 100 patients with osteoporosis. As a result, it was concluded that calcium fructoborate could be a good adjuvant in the treatment of osteoporosis (11).

Since 1980 it is considered that boron play a role in regulating mineral metabolism (such as calcium and magnesium) and enhancing the vitamin D activation process in humans. (12)

So far, over 20 reports have appeared indicating that boron can beneficially affect bone growth and maintenance (13).

It's supposed that this mineral is required for normal bone metabolism that can lead to hypothesis of using boron both in the prevention of osteoporosis and in the treatment of osteoarthritis (14). Boron supports bone health in postmenopausal women, reducing the urinary loss of the minerals calcium, magnesium, and phosphorus, which are essential for bone-building (15).

Lower serum levels of boron have been shown in individuals with both rheumatoid arthritis (RA) and osteoarthritis (OA) (16, 17). In patients with RA is recorded a significant lower serum boron level when comparing to patients without RA. Rheumatoid factor titer is significant predictor of low serum boron level (18). This may suggest that boron element may play a role in pathophysiology of RA, OA and its severity. Supplementation with boron element and diets rich in fruits, vegetables, nuts, and pulses may be useful (19).

According to one study, femoral OA bone contains less boron, than does normal bone, suggesting that boron might have a beneficial effect in OA (20).

The supplementation as calcium fructoborate (6 mg per day) can alleviate pain, joint rigidity and increase the mobility of the patients (21, 22).

Following the USA Nutritional Protocol for Osteoarthritis (Degenerative Joint Disease), it is recommended a supplementation of 6 mg of boron per day for patients with osteoarthritis (23).

According to boron concentrations collected from deep water from the Republic of Moldova and the adults' prevalence with the rheumatoid arthritis and inflammatory polyarthropathy, we

suspect the association between low concentration of boron in deep drinking water (0-0.8 mg/L) and a high prevalence with osteoarticular diseases.

According other studies, the population from area with a low boron concentration in deep drinking water may need an additional boron supplementation. Following these, we are going to analyze in details the population osteoarticular morbidity (osteoarthritis and rheumatoid arthritis) in the region of the Republic of Moldova with low and high boron concentration in the deep water in order to recommend an additional boron supplementation for the population from depleted of boron regions.

CONCLUSIONS

1. Boron can affect bone metabolism through regulating mineral metabolism (such as calcium and magnesium) and enhancing the vitamin D activation process in humans.
2. An inadequate intake of less than 3 mg of boron per day can worsen the symptoms of rheumatoid arthritis, osteoarthritis or osteoporosis.
3. In the regions of the Republic of Moldova where boron concentration in deep drinking water is low (0.5 mg/L in well water and 0.38 mg/L in artesian well water) in Briceni, in 2015 and (0.28 in well water and 0.51 in artesian well water) in Soroca in 2019, the prevalence with the rheumatoid arthritis and inflammatory polyarthropathy were high (29.4 per 10000 inhabitants) in Briceni in 2016 and the same (51.6 per 10000 inhabitants) in Soroca in 2019.
4. The only major exception from the working theory is UTA Gagauzia region, where we found a high boron concentration in deep drinking water in 2015 (2.05 mg/L in well water and 2.2 mg/L in artesian well water) and a high prevalence with the rheumatoid arthritis and inflammatory polyarthropathy (35.1 per 10000 inhabitants) in 2016. For this region we don't have a clear scientific explanation, but we suppose that it can be caused by the dietary patterns with a lack of fruits and vegetables in the daily menu. This theory requires further ecological studies.

CONFLICT OF INTERESTS

The authors declare no conflict of interests.

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MENTAL HEALTH DURING THE COVID-19 QUARANTINE IN FIVE COUNTRIES

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Keywords: mental health, COVID-19, quarantine, pandemic.

Introduction. As part of the holistic concept of health, mental health can be focused on prevention of contagion and coping with the disease and its consequences in the context of the current COVID-19 pandemic. The present study describes, compares, and analyzes the association of the impact of the event, perceived stress, coping strategies, emotional regulation, and sociodemographic characteristics during the quarantine in various countries.

Material and methods. This research is a multicentric and epidemiological study with a convenience online snowball sampling of the general population and university students.

Results. 1.179 participants from Colombia, Brazil, Mexico, Italy, and Spain responded to the survey. Most of them included students and workers, with a high educational level and living with family during the quarantine. There are significant differences in the medians of all variables among countries and sociodemographic characteristics. The variables positively and significantly associated with the impact of the event during quarantine included the perceived stress, the coping strategies of alcohol/drug use, planning and active coping, focus on emotions and vent, the emotional regulation strategy expressive suppression, and living in Italy.

Conclusions. These results have contributed to the understanding of mental, emotional, and behavioral response to quarantine, as well as underline the urgency of monitoring mental health among the vulnerable groups, in order to design specific prevention and intervention programs.

Cuvinte cheie: sănătate mintală, COVID-19, carantină, pandemie.

SĂNĂTATEA MINTALĂ ÎN TIMPUL CARANTINEI COVID-19 ÎN CINCI ȚĂRI

Introducere. Ca parte a conceptului holistic de sănătate, în actuala pandemie COVID-19, sănătatea mintală presupune prevenirea contagiunii și gestionarea bolii și a consecințelor acesteia. Prezentul studiu descrie, compară și analizează asocierea impactului evenimentului, stresului perceput, strategiilor de adaptare, reglării emoționale și a caracteristicilor sociodemografice în timpul carantinei în diferite țări.

Material si metode. Studiu epidemiologic multicentric, cu o eșantionare convențională de tipul „bulgări de zăpadă” online a populației generale și a studenților universitari.

Rezultate. A fost realizat un sondaj la care au participat 1.179 de respondenți din Columbia, Brazilia, Mexic, Italia și Spania. Majoritatea dintre ei sunt studenți și muncitori, cu un nivel ridicat de educație, care au locuit cu familia în timpul carantinei. Există diferențe semnificative între medianele tuturor variabilelor între țări și caracteristici sociodemografice. Variabilele asociate pozitiv și semnificativ, cu impactul evenimentului în timpul carantinei, includ: stresul perceput, consumul de alcool/droguri, planificarea și gestionarea activă, concentrarea asupra emoțiilor, strategia de reglare emoțională, suprimarea expresivă și locuirea în Italia.

Concluzii. Aceste rezultate contribuie la înțelegerea reacțiilor mintale, emoționale și comportamentale în timpul carantinei și relevă necesitatea monitorizării urgente a sănătății mintale în grupurile vulnerabile în scopul proiectării unor programe specifice de prevenire și de intervenție.

INTRODUCTION

In the current COVID-19 pandemic, governments responded urgently to the biological threat and economic concerns, however, little effort has been directed to the mental health of the general population (1), which is part of the holistic concept of health, even though it is well known that experiences of quarantine can generate mental health effects (2-10). For example, during the 2003 severe acute respiratory syndrome (SARS) Sim et al. (11), in a study on the general population in Singapore found that psychiatric morbidity was associated with being put in fever stations, younger age, increased sense of guilt, and less substance use, while post-traumatic morbidity was associated with greater use of the coping strategies as denial and planning. On the other hand, Main et al. (12) showed that the number of stressors and the use of avoidance coping strategies positively predicted psychological symptoms. Active coping positively predicted life satisfaction when controlling for stressors. Additionally, all types of coping served as a buffer against the negative impact of stressors on perceived overall health. During the 2015 Middle East respiratory syndrome (MERS) epidemic, Khalid et al. (13) investigated emotions, perceived stressors, and coping strategies in healthcare personnel working in a hospital in Jeddah (Saudi Arabia), finding that as a coping strategy, positive attitudes in the workplace, clinical improvement of infected colleagues, and interruption of disease transmission among healthcare workers after taking strict protective measures eased their fear.

The complexity of the COVID-19 pandemic worldwide, the socio-economic, political, and cultural situation in every single country, where there are many differences in terms of contagion containment measures, restrictions, laws, and sanctions, government and health authorities' management of the situation, type of information disseminated by media, resources available for diagnoses, treatments, and aid, number of infections and deaths, job and economic losses, etc., leads us to wonder about the psychological impact of the quarantine measures and all their implications. For example, during the initial stage of the outbreak, Wang et al. (14) showed that female gender, being a student, physical symptoms (e.g. myalgia, dizziness, coryza), and poor health were significantly associated with a

higher psychological impact, stress, anxiety, and depression. Up-to-date and accurate specific health information (e.g. on treatment and on the local outbreak situation), and particular precautionary measures (e.g. hand hygiene and wearing a mask) were associated with a lower psychological impact, stress, anxiety, and depression. Therefore, it is important to know the perception, beliefs, emotions, and reactions regarding quarantine, since a measure of such a magnitude and length of time, even if it is taken for the good of the population, can usually generate psychological distress (15).

To date, most of the studies on the subject carried out in Asian, North American, European, and Australian countries are retrospective, have evaluated compliance with quarantine measures using ad-hoc scales, and used standardized scales to measure psychological variables, in healthcare personnel, in specific populations subjected to isolation, and in university students. The present study differs from other studies as it seeks to compare the impact of the event, perceived stress, coping strategies, emotional regulation as components of mental health, and sociodemographic characteristics such as gender, age, education level, occupation, and cohabiting during the first phase of the COVID-19 quarantine, in a sample of the general population and university students from various countries in Europe and Latin America.

MATERIAL AND METHODS

An observational and multicentric study was carried out by Universities in Colombia, Italy, Spain, Mexico, Brazil, and an international NGO (Spain). The type of sampling was a non-probabilistic snowball since a digital questionnaire was sent through a link by email, WhatsApp, Instagram, Facebook, etc. Participants were asked to share the link with their contacts. Data were collected in all the countries involved between April and June 2020. Online consent was obtained from participants. The survey was anonymous, and confidentiality of information was assured. Since the online questionnaire design contained the forced answering option, there are no missing data.

The survey was completed by 1.179 participants (27.48% male) aged between 15 to 76 years ($M=33.52$, $SD=13.4$) from Colombia ($N=356$),

Brazil (N=364), Mexico (N=202), Italy (N=166), and Spain (N=91). The first part of the digital questionnaire contained socio-demographic questions about gender, age, education level, occupation, and cohabiting during the first phase of the COVID-19 quarantine. Then the following instruments were included:

1. The Impact of Event Scale-Revised (IES-R; 16-18) is a 22-item self-report scale designed to assess current subjective distress resulting from a traumatic life event, which in the current study corresponded to quarantine. The Cronbach's alphas in the present study for the total scale in the total sample and the Spanish version were .95, for the Portuguese and Italian versions were .94. For the subscales, the Avoidance Cronbach's alphas for the total sample and the Portuguese version were .85, for the Spanish version was .87, and for the Italian version was .80. The Intrusion Cronbach's alphas for the total sample and the Portuguese version were .90, for the Spanish version was .91, and for the Italian version was .89. And the Hyperarousal Cronbach's alphas for the total sample, the Spanish and Portuguese versions were .87, and for the Italian version was .86.
2. The Perceived Stress Scale (PSS-14 items; 19-21) contains 14 items assessing perceived stress in unexpected situations during the last month. The Cronbach's alphas for the total sample and all versions in the three languages were .87.
3. The Coping Orientations to Problems Experienced (COPE; 22, 23) contains 60 items evaluating 15 coping strategies. The Cronbach's alpha for the total scale in the total sample was .87, for the Spanish version .89, Italian version .85, and Portuguese version .88. While for the subscales, Cronbach's alphas range from .77 to .95 for the total sample, .76 to .95 for the Spanish version, .74 to .96 for the Italian version, and .71 to .95 for the Portuguese version.
4. The Emotion Regulation Questionnaire (ERQ; 24-26) is a self-report questionnaire that consists of two scales corresponding to two emotional regulation strategies: Cognitive reappraisal (6 items) and expressive suppression (4 items). The Cronbach's alpha

for the total sample was .79, for the Spanish version was .78, Portuguese and Italian versions were .80. For the subscales, the Cognitive reappraisal Cronbach's alphas for the total sample and the Spanish version were .71, for the Portuguese version was .73, and for the Italian version was .75. The Expressive suppression Cronbach's alphas for the total sample was .87, for the Portuguese version was .86, and for the Spanish and Italian versions were .88.

Cronbach's alpha was calculated to estimate the internal consistency of the scales and subscales in the total sample and the three versions by language. Normality tests were performed to identify the type of distribution of each variable (Kolmogorov-Smirnov), finding that none of them exhibited a normal distribution. Then, non-parametric statistics were performed. To compare differences in medians, Kruskal-Wallis tests with posthoc pairwise comparisons using Dunn's test with Bonferroni correction were employed. Spearman correlations were used to explore the relationship between the different variables. Finally, to analyze the association of the impact of the event (as a continuous variable) with perceived stress, coping strategies, emotional regulation, and socio-demographic variables, Generalized Linear Models (GLM) were employed. These are an extension of linear models that allow the use of non-normal distributions and non-constant variances, with a Gaussian distribution and link = Identity. The final multivariate GLM was selected by using the lowest Akaike's Information Criterion (AIC), the normal residual distribution, and the inflation factor of variance (VIF) to verify the absence of multicollinearity in post-estimation tests. In all analyses $p < .05$ was considered statistically significant. Analysis was performed using the STATA 16 Software.

RESULTS

Table 1 shows that the greatest part of the sample is made of women, youth, and adults, with a high level of education, most of whom are devoted to studying and working, and the majority were living with family during the quarantine period.

In the present study, all the instruments presented good internal consistency. Nevertheless, since for the comparison of groups, Cronbach's

Table 1. Distribution of the study population by sociodemographic characteristics and countries.

Variables	Total Sample N(%)	Countries N(%)				
		Colombia	Brazil	Mexico	Italy	Spain
Gender						
Male	324(27.5)	113(31.7)	83(22.8)	53(26.2)	38(22.9)	37(40.6)
Female	855(72.5)	243(68.3)	281(77.2)	149(73.8)	128(77.1)	54(59.3)
Age (Years)						
15 - 44	693(58.8)	211(59.3)	196(53.8)	146(72.3)	96(57.8)	44(48.4)
45 - 76	486(41.2)	145(40.7)	168(46.1)	56(27.7)	70(42.2)	47(51.6)
Education Level						
Elementary/High school	311(26.4)	81(22.8)	57(15.7)	46(22.8)	80(48.2)	47(51.6)
Professional /Postgraduate	868(73.6)	275(77.2)	307(84.3)	156(77.2)	86(51.8)	44(48.4)
Occupation						
Student & worker	534(45.3)	169(47.5)	136(37.4)	127(62.8)	70(42.2)	32(35.2)
Worker & Other	645(54.7)	187(52.5)	228(62.6)	75(37.1)	96(57.8)	59(64.8)
Live with						
Family	1106(94.1)	341(95.8)	339(94.2)	201(99.5)	141(84.9)	84(92.3)
Alone or Roommates	69 (5.9)	15(4.2)	21(5.8)	1(0.5)	25(15.0)	7 (7.7)

alpha values from 0.7 to 0.8 are considered satisfactory (27), in the present study only the COPE subscales with values above .70 have been used for analysis. In Table 2, it can be seen that there are significant differences in all variables between all countries, except in cognitive reappraisal. The medians of the impact of the event are lower in Colombia and Mexico. The median of perceived stress in Colombia is lower than in the other countries. Also, the median of perceived stress in Mexico is lower than in Brazil. Concerning differences in the medians of coping strategies, Brazil's median of seeking social support is higher than Colombia, Mexico, and Spain. The medians show that turning to religion is less used in European countries; humour is less used in Colombia and Mexico than in Spain; alcohol-drug use in Colombia is lower than in Brazil and Italy; planning and active coping is most used in Colombia and Brazil; focusing on emotions and vent is higher in Brazil; positive reinterpretation is higher in Colombia. Finally, the expressive suppression emotional regulation strategy is higher in Spain.

Table 3 shows that there are significant differences for almost all the socio-demographic characteristics, except among cohabiting groups for which differences were found only in turning to religion and expressive suppression (higher medians in those living with family). The medians of the impact of the event, perceived stress, and focus on emotions and vent are higher in women,

people under 45 years, with low educational levels, and students. At the same time, seeking for social support and turning to religion is higher in women, adults over 45 years, with high educational level, being workers and other (housewives and pensioners), and the same for positive reinterpretation and cognitive reinterpretation, except for the gender for which there were no differences. On the other hand, the medians of humor are higher in men with a high educational level, while the consumption of alcohol or drugs is higher in young men. Planning is higher in men, adults, with a high educational level, workers and other (housewives and pensioners). Finally, expressive suppression is higher in men who live with relatives.

Spearman's correlations among the Impact of Event with Perceived Stress, Coping Strategies, and Emotional Regulation were made. The positive correlations with perceived stress, social support, alcohol and drug use, focus on emotion and vent, and expressive suppression; and the negative correlations with religion, planning, positive reinterpretation, and cognitive reappraisal correspond to what is theoretically expected. It was found that only Humour does not present a statistically significant correlation with the Impact of the event, while moderate and weak, but statistically significant correlation coefficients were found with the other variables (tab. 4). There was no multicollinearity among variables.

Table 2. Comparison of medians (IQR) of Impact of the Event, Perceived Stress, Coping Strategies, and Emotional Regulation by Countries

Total Sample	Impact of the Event	PS	Coping Strategies					Emotional Regulation				
			SSS	TRL	HUM	ADU	PAC	FEV	PRI	CR	ES	
	29(30)	26(14)	19(8)	10(8)	7(6)	4(0)	14(5)	8(4)	8(3)	31(11)	14(8)	
1 Colombia	26(32)	23(12)	18(9)	11(6)	8(5)	4(0)	15(6)	8(4)	9(3)	32(10)	15(7)	
2 Brazil	32(28)	29(13)	20(7)	11(7)	7(4,5)	4(1)	15(6)	9(3)	8(3)	31(10)	14(7)	
3 Mexico	22(29)	26(14)	18(9)	10.5(7)	8(7)	4(0)	14(6)	8(5)	8(4)	31(11)	14(8)	
4 Italy	34(29)	28(12)	19(7)	4(4)	6(4)	4(0)	14(6)	8(4)	8(4)	29(9)	13(8)	
5 Spain	37(32)	28(14)	19(9)	4(5)	8(7)	4(2)	13(5)	9(4)	8(3)	31(13)	15(10)	
Total Differ^a	****	****	****	****	**	**	****	****	*	ND	**	
Differences among countries^b	1:2****	1:2****		4:1****			1:3**					
	1:4****	1:3*	2:1***	4:2****			1:4****					
	1:5**	1:4****	*	4:3****	1:5***	1:2*	1:5****	2:1****	1:4**			
	3:2**	1:5****		5:1****	3:5**	1:4**	2:3**	2:3***			1:5*	
	3:4**	2:3***	2:3***	5:2****			2:4***	2:5**				
	3:5*		2:5**	5:3****			2:5**					

Note: ^aKruskal Wallis; ^bDunntest with Bonferroni correction; **** $p < .0001$. *** $p < .001$. ** $p < .01$. * $p < .05$. IQR - Interquartile range; PS - Perceived Stress; SSS - Seeking social support; TRL - Turning to Religion; HUM - Humour; ADU - Alcohol-drug use; PAC - Planning and active coping; FEV - Focus on emotions and vent; PRI - Positive reinterpretation; CR - Cognitive Reappraisal; ES - Expressive Suppression; TD - Total Difference; ND - No Differences

Table 3. Comparison of medians (IQR) of Impact of the Event, Perceived Stress, Coping Strategies, and Emotional Regulation by Sociodemographic Characteristics.

Socio-demographic Characteristics	Impact of the Event	PS	Coping Strategies					Emotional Regulation				
			SSS	TRL	HUM	ADU	PAC	FEV	PRI	CR	ES	
Gender	****	****	***	****	****	**	**	****	ND	ND	****	
Male	24(30)	23(12)	18(7.5)	9(8)	8(6)	4(1)	15(6)	8(3)	8(3)	30(11.5)	15.5(8)	
Female	32(30)	28(13)	19(7)	10(8)	7(5)	4(0)	14(5)	9(4)	8(3)	31(10)	14(7)	
Age (Years)	****	****	ND	****	ND	**	****	****	****	****	ND	
(15 - 44)	33(32)	29(13)	18(8)	9(9)	7(6)	4(1)	14(6)	9(4)	8(3)	30(11)	14(8)	
(45 - 76)	25(27)	22(12)	19(7)	11(6)	7(6)	4(0)	16(5)	8(3)	9(3)	32(9)	14(8)	
Education Level	****	****	****	****	**	ND	****	**	****	****	ND	
Elementary/ High school	36(33)	29(13)	18(7)	8(8)	7(5)	4(1)	13(5)	9(4)	8(3)	29(12)	14(8)	
Professional/ Postgraduate	27.5(30)	25(12)	19(7)	10(8)	8(5)	4(0)	15(6)	8(3)	9(3)	32(10)	14(8)	
Occupation	****	****	**	**	ND	ND	****	****	****	****	ND	
Student/ Worker	34.5(32)	29.5(13)	18(8)	9(9)	7(6)	4(1)	13(5)	9(5)	8(3)	30(11)	14(8)	
Worker / Other	25(28)	23(13)	20(7)	10(8)	7(5)	4(0)	15(5)	8(3)	9(3)	31(9)	14(8)	
Live with	ND	ND	ND	****	ND	ND	ND	ND	ND	ND	**	
Family	29(29)	26(14)	19(8)	10(8)	7(6)	4(0)	14(5)	8(4)	8(3)	31(11)	14(8)	
Alone or Roommates	35(30)	27(15)	20(8)	7(8)	7(4)	4(1)	15(5)	9(5)	8(2)	30(10)	12(9)	

Note: ^aKruskal Wallis; ^bDunntest with Bonferroni correction; **** $p < .0001$. *** $p < .001$. ** $p < .01$. * $p < .05$. IQR - Interquartile range; PS - Perceived Stress; SSS - Seeking social support; TRL - Turning to Religion; HUM - Humour; ADU - Alcohol-drug use; PAC - Planning and active coping; FEV - Focus on emotions and vent; PRI - Positive reinterpretation; CR - Cognitive Reappraisal; ES - Expressive Suppression; TD - Total Difference; ND - No Differences.

Table 5 shows that the most functional multivariate GLM to explain the Impact of the event during the quarantine period includes perceived stress, the coping strategies Alcohol-drug use,

Planning and active coping, and Focus on emotions and vent, the emotional regulation strategy Expressive Suppression, and living in Italy.

Table 4. Spearman correlation of Impact of Event with Perceived Stress, Coping Strategies, and Emotional Regulation.

	Impact of Event	
Coping Strategies	Perceived Stress	.62***
	Seeking social support	.13***
	Turning to religion	-.08**
	Humour	-.00
	Alcohol-drug use	.25***
	Planning and active coping	-.09**
	Focus on emotions and vent	.53***
Emotional Regulation	Positive reinterpretation	-.17***
	Cognitive Reappraisal	-.13***
	Expressive Suppression	.11***

Note: *** $p < .0001$. ** $p < .01$. * $p < .05$.

Table 5. Multivariate GLM of Impact of Event with Perceived Stress, 7 Coping Strategies, Emotional Regulation, and Country.

Impact of Event	Coef.	Standard Error	z	P> z	95% Conf. Interval	
Perceived Stress	.92	.06	14.7	.001	.80	1.04
Coping Strategies						
Alcohol-drug use	.77	.17	4.33	.001	.42	1.12
Planning and active coping	.49	.12	4.03	.001	.25	.73
Focus on emotions and vent	1.9	.19	10.07	.001	1.54	2.28
Emotional Regulation						
Expressive Suppression	.44	.08	5.62	.001	.29	.60
Country (Ref. Colombia)						
Brazil	-.99	1.09	-.91	.364	-3.15	1.15
Mexico	-.83	1.27	-.66	.512	-3.32	1.65
Spain	1.45	1.70	.85	.395	-1.89	4.79
Italy	4.75	1.34	3.47	.001	2.07	7.43

DISCUSSIONS

Results show statistically significant differences in all variables among countries. Although earlier studies have compared psychological aspects during quarantine and the COVID-19 pandemic in different countries (7, 28), not all of them have included the same countries or instruments as the present study. However, given that the orientations of the citizens of the same country tend to be shaped by a national culture (29), it is expected that there will be cross-cultural differences to assess stressors and implement coping strategies (30). Nevertheless, it is possible to argue that the differences among countries in the present study, in addition to cultural factors

(31), could be due to less restrictive and less clear containment, quarantine, and isolation measures in Latin America than in Europe (7, 32). For example, it can be observed that in Italy and Spain the state of alarm and the quarantine measures have lasted longer because there the outbreak occurred earlier than in Latin American countries, and to date, some restrictions still exist. Another crucial aspect is the term applied to the contagion containment measures and the effect that this can generate on the citizens' perception: in Italy, they were referred to as *lockdown*, in Spain as *confinement*, in Brazil as *social distancing*, in Colombia as *preventive isolation* and in Mexico as *healthy distance*. Despite these

elements, it is important to continue analyzing how cultural factors can contribute to the success or failure of measures to contain the pandemic at a global level.

Regarding the sociodemographic characteristics, the medians of the impact of the event, perceived stress, and focus on emotions and vent are higher in women, people under 45 years, with low educational levels, and students. At the same time, seeking for social support and turning to religion is higher in women, adults over 45 years, with high educational level, being workers and other (housewives and pensioners), and the same for positive reinterpretation and cognitive reinterpretation, except for the gender for which there were no differences. On the other hand, the medians of humor are higher in men with a high educational level, while the consumption of alcohol or drugs is higher in young men. Planning is higher in adult men, people with a high educational level, workers, housewives, and pensioners. Finally, expressive suppression is higher in men who live with relatives. These results are consistent with those reported in previous studies (2, 33-35) which are explained by the characteristics of women's role in society, which implies an overload of responsibilities, in the workplace, at home, and in child and family care (36). On the other hand, within the age groups it was found that during the COVID-19 pandemic, stress levels were higher in people under 45 years of age (37), who, according to Salari et al. (9), are more concerned about the consequences at a professional and economic level. Furthermore, young people are more exposed to large amounts of information through social networks and media (38-40). Also, it may be hypothesized that younger people have not developed yet the emotional maturity to deal with situations of frustration. Another source of discomfort is the fact that their socialization and learning processes have been interrupted (41).

There are also differences in perceived stress between the educational levels since people with a low educational level tend to make more use of unreliable media and are more influenced by conspiracy theories (39, 40). Moreover, regarding occupation, there are differences between students and workers, and workers and others (i.e. housewives, unemployed, and retired people). Nonetheless, as reported in previous investigations (42), students were the most stressed

category during quarantine. Despite quarantine and all the changes, it entailed from a professional viewpoint, causing an increase in the burden for a large part of the workers, it can be argued that being employed in these pandemic circumstances turns out to be a protective factor not only against possible financial losses, but it also can help maintain well-being, support among colleagues and sense of life (43).

The results about coping strategies and emotional regulation are similar to those reported by Eisenbarth (44) and Makarowski et al. (28) and can be explained according to Sica et al. (23), who stated that gender-related differences in the adoption of coping strategies can be attributed to differences in the stressful situations that are faced: as a matter of fact, women usually face more stressful circumstances associated with family care and health, while men deal with situations more related to work and financial difficulties. Concerning age groups, results are consistent with previous research demonstrating that young people tend to use less active coping strategies than adults (23). As regarding the educational and occupational level, it may be hypothesized that the use of some strategies may be associated with the age and the most used strategies in each group. Furthermore, these results are similar to the ones reported by Pieh et al. (45) and Prati (8) showing that adults under 35 years of age, women, the unemployed, people living alone, and with low-income present the most severe mental health problems.

To explain the association between the impact of the event with perceived stress, coping strategies, and emotional regulation, Lazarus and Folkman (46) proposed that there were two general types of coping with stress: the first, termed problem-focused, is aimed at doing something to solve the situation or modify the stress, whereas the second, the emotion-focused, is aimed at reducing the emotional distress. However, this does not mean that they are positive or negative. People sometimes use adaptive or non-adaptive strategies, and this may be linked to the fact that reactions to the same stimulus are different and may vary depending on circumstances. For example, social support is only a small part of the negative consequences of a stressful event, while personal coping resources can reduce its negative impact. On the other hand, the weak and moderate correlations

in the present study can be explained according to the fact that people facing stressful experiences can deploy various coping strategies that may be theoretically considered mutually exclusive, and at a pragmatic level they may operate independently depending on the situation, context, timing, etc. (47), as found in our GLM.

The most functional model to predict perceived stress during quarantine includes different coping and emotional regulation strategies that should not be dichotomously considered, but should rather be interpreted according to the function they fulfill when used in a specific situation. Given that coping responses try to reduce the stressful situation (46), some reactions are

more functional than others, such as the ones found in the present study aimed at directly facing the problem (planning and active coping). In contrast, those trying to mitigate the discomfort (drug or alcohol use, focus on emotion and vent, and expressive suppression), that may be better for well-being in the short term - for example during the quarantine period - although they are only fulfilling a merely palliative function without modifying the source of stress (48), in the long term, they can affect the quality of life and psychological well-being, since it has been found that people who make more use of avoidance strategies and who are focused on emotional distress, tend to present more mismatch that affects mental health (8, 23).

CONCLUSIONS

1. The results of the present research, which in turn corroborate previous studies, may contribute to the understanding why people react differently during quarantine across different countries, according to sociodemographic characteristics. However, when analyzing the differences in responses to quarantine, it must be considered that the evaluation of these variables was carried out at an individual and not collective level. Therefore, although an attempt has been made to group the results and to interpret them by using general theoretical models, individual differences should be either taken into account. Nevertheless, these results may help to identify the urgency of monitoring mental health in vulnerable groups such as the youth, students and women, in order to design specific prevention and intervention programs.

CONFLICT OF INTERESTS

The authors declare no conflict of interest.

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LONG-TERM TRENDS IN CANCER MORTALITY IN THE REPUBLIC OF MOLDOVA

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Keywords: mortality rate, cancer, Republic of Moldova.

Introduction. Cancer is the second cause-of-death mortality pattern in the Republic of Moldova. The study of both cancer mortality by age and its detailed causes is an important tool for evidence-based public health policy. The study aims at comparing recent changes in cancer mortality with long-term trends, depending on specific causes and age.

Material and methods. This study was carried out on the reconstructed 1965-2018 death time series, according to the 10th revision of the International Classification of Diseases. Standardized death rates were computed.

Results. After a gradual increase in the '70s and '80s of the last century, cancer mortality rate showed "reversed" patterns and started to decline in the '90s. This decline was due to the data quality issue and to the competing risks of dying from other causes sensitive to the social and economic circumstances of the '90s. Since the beginning of the millennium, cancer mortality has resumed its growth that continues up to now. Despite the increasing overall trend in cancer mortality rate during 1965-2018, the analysis by age and specific causes revealed opposite trends.

Conclusions. The malignant neoplasms specific for certain sites and age groups (stomach, uterus, leukaemia in children) showed, however some therapeutic progress, while the situation for other tumour sites (lung, breast, and intestine) worsened significantly. The moderate decrease in lung cancer in the 1990s should be cautiously interpreted.

Cuvinte cheie: mortalitate, cancer, Republica Moldova.

TENDINȚELE DE LUNGĂ DURATĂ ALE MORTALITĂȚII PRIN CANCER ÎN REPUBLICA MOLDOVA

Introducere. Cancerul ocupă locul al doilea în structura mortalității pe cauze de deces în Republica Moldova. Analiza mortalității pe vârste și cauze detaliate de deces este un instrument important în politica de sănătate publică bazată pe dovezi. Scopul studiului este de a contrasta schimbările recente ale mortalității prin neoplasme, cu tendințele sale pe termen lung, în funcție de cauza detaliată și de vârstă.

Material și metode. În acest studiu, ne bazăm pe seriile de timp ale mortalității pentru anii 1965-2018, reconstruite în termenii celei de a 10-a revizuirii a Clasificării Internaționale a Maladiilor, fiind calculate ratele standardizate ale mortalității.

Rezultate. După creșterea treptată în anii '70 și '80 ai secolului trecut, tendința mortalității prin cancer s-a inversat și a început să scadă în anii '90. Atribuim acest declin problemei calității datelor și riscurilor concurente, de a deceda prin alte cauze mai sensibile la circumstanțele sociale și economice din anii '90. De la începutul mileniului, mortalitatea prin neoplasme și-a reluat creșterea, care continuă până în prezent. Deși tendința generală a mortalității prin cancer în anii 1965-2018 este una ascendentă, analiza în funcție de vârstă și de cauză detaliată a relevat tendințe opuse.

Concluzii. Pentru neoplasmale maligne ale anumitor localizări și grupe de vârstă (stomac, uter, leucemie la copii) s-au realizat unele progrese, în timp ce pentru alte localizări (plămân, sân și intestin) situația s-a agravat semnificativ. Declinul moderat al mortalității prin cancer pulmonar din anii '90 trebuie interpretat cu prudență.

INTRODUCTION

The problem of high mortality among the adult population in the former Soviet Union (FSU) countries is well known (1, 2). For these countries, especially those of the European part of the FSU, as Ukraine or Russia, high mortality from diseases of the circulatory system and deaths due to injury and poisoning account for much lower values of life expectancy at birth as compared to Western countries (3) where a continuous population health progress has been recorded since the 1970s mostly due to a spectacular cardiovascular mortality decline known as cardiovascular revolution (4). Furthermore, in the high-income western countries, a decrease in mortality from cancer, which is the leading cause of death there at present, has been reported over the last two decades. This recent improvement was mainly due to favourable mortality trends in the commonest specific cancers, while liver cancer in both sexes and lung cancer in females constitute a priority for prevention (5).

Previous studies on mortality trends in the Republic of Moldova have identified a serious health decline among the adult population since the mid-1960s, though accompanied by recent modest improvement, especially among the female population (6, 7). Nevertheless, the current life expectancy at birth is the same as in the mid-60s of the last century in males (65.8 years in 1965 and 65.9 years in 2020), while females live less than four years over the last 55 years (70.1 years in 1965 and 73.8 years in 2020). The lack of therapeutic progress in males and the slight improvements in females are completely lower than the results achieved across the western countries (more than 11 years in France or even 15 years in Japan). The stagnation of life expectancy in Moldova is explained by a continuous increase in adult mortality from non-communicable diseases, the cardiovascular diseases being the first and foremost among all deaths due to injury and poisoning, which was partially compensated by a decrease in infant and child mortality. In addition, the burden of digestive diseases, and particularly the liver cirrhosis, absolutely worsens the situation, especially among females whose life expectancy, both during the Soviet period and after the independence proclamation, was gradually decreasing as compared to other FSU countries (8). Furthermore, the considerable half-century increase in

mortality due to cardiovascular disease or injury and poisoning dropped down as a result of the 1985 anti-alcohol campaign and the severe socio-economic crisis of the 1990s occurring across the country after the USSR collapse. These short-term rises and falls and the relatively stable tendency in the overall cancer mortality, especially in females, were followed however by a steady increase since the late 1990s. The latter period differs from the situation recorded in other FSU countries, as for example, the cancer death rate in Russia has revealed a decreasing tendency since the mid-1990s, which continues up to now, being mostly associated with lung cancer in males and stomach cancer (9).

Although cardiovascular mortality in Moldova has often been researched (7, 10), less attention was paid to long-term cancer mortality trend. It is mainly explained by methodological issues. The problem is that the long-term studies encounter temporal discontinuities induced by the periodic changes in the classification of death causes. The solution is to analyse the death time series reconstructed by a special method proposed by Meslé and Vallin (11). This method of reconstruction allowed studying the continuous series of deaths described by the 10th revision of the International Classification of Diseases and Causes of Death (ICD-10) during the 1965-2018 period, and which are available within the Human Cause-of-Death Database providing background documentation (<https://www.causesofdeath.org/cgi-bin/main.php>).

The study aims at comparing the recent changes in cancer mortality to their long-term trends by detailed cause and age. The hypothesis of this research is that the cancer mortality trends according to age and detailed causes do not reflect the overall cancer mortality trend; moreover, certain temporal changes may refer to the data quality issues and to the competing life-threatening risks.

MATERIAL AND METHODS

This present research was based on the cause-of-death time series for the Republic of Moldova reconstructed by the author (12) and published in The Human Cause-of-Death Database (HCD) over 1965-2014 years (13) and extended up to 2018 (Penina, unpublished). Mortality data for the 2015-2018 period were provided by the National Agency for Public Health (NAPH).

As regarding the Republic of Moldova, the mortality data were reconstructed based on the 10th Revision of the International Classification of Diseases and Causes of Death (ICD-10). The HCD included the detailed list of causes of death that comprises 211 items. The mortality data for Moldova and presented in the HCD were revised due to some data quality issues regarding the older ages and infancy, which were especially recorded in the 1960s and 1970s. Moreover, the death rate due to ill-defined causes of death (items R00-R99 under ICD-10), including “Senility” (R54 under ICD-10), were reassessed by a special method among other causes of death (found in the HCD background documentation for Moldova).

The annual intercensal estimation data on population during the period 1965-2004 were retrieved from the HCD. For 2004-2014, we used

the annual intercensal estimates performed by the author (Penina, unpublished). Finally, the official post-census population estimates for 2015-2018 were used as referring to common resident population (14).

The direct method of standardization based on the 2013 European standard population was used (15). Age-specific death rates were also standardized by the direct method. The 95% confidence limits were computed based on Byar’s or exact CI method (16). All the studies were analysed via the R software.

Table 1 presents the list of death causes used in the study with the corresponding codes, according to the detailed list of death causes used in the HCD and ICD-10. Ill-defined causes of death (items 193, 194 under the HCD list and R00-R99 under ICD-10).

Table 1. List of death causes included in the study and their corresponding codes based on the detailed list in the Human-Cause-of-Death Database (HCD) and the 10th revision of the International Classification of Diseases and Causes of Death (ICD-10).

Causes of death	HCD detailed list	ICD-10 codes
1. Infectious diseases	1-47	A00-B99
2. Neoplasms, including:	48-79	C00-D48
<i>Upper aerodigestive tract cancers</i>	48-49	C00-C15
<i>Stomach cancer</i>	50	C16
<i>Colon cancer</i>	51-53	C17-C21
<i>Liver cancer</i>	54	C22
<i>Cancer of pancreas</i>	55	C25
<i>Gastrointestinal cancers</i>	56	C23, C24, C26
<i>Respiratory system cancer</i>	57-59	C30-C34, C37-C39
<i>Breast cancer</i>	63	C50
<i>Uterus cancer</i>	64, 65	C53-C55
<i>Female genital cancers</i>	66, 67	C51, C52, C56-C58
<i>Male genital cancers</i>	68, 69	C60-C63
<i>Urinary tract cancer</i>	70, 71	C64-C68
<i>Brain cancer</i>	72	C70-C72
<i>Cancer of lymphoid, haematopoietic tissue</i>	75-78	C81-C96
<i>Other neoplasms</i>	60-62, 73-74, 79	C40- C49, C69, C73-C80, C97, D00-D48
3. Diseases of the circulatory system	101, 106-128	G45, I00-I99
4. Diseases of the respiratory system	129-143	J00-J98, U04
5. Diseases of the digestive system	144-158	K00-K93
6. External causes	195-211	V01-Y98
7. Other diseases and death causes	80-100, 102-105, 159-192	D50-G44, G47-H95, L00-Q99
<i>All causes</i>	1-211	A00-Y98

Source: (13)

RESULTS

At present, neoplasms rank second among other mortality patterns from Moldova for both sexes, and the total mortality rate ranging between 8% - 18% in 1965-2018 (fig. 1). For both sexes, neoplasms were ranked third in the 1970s following the respiratory diseases. Due to a significant lower mortality rate from the latter cause in the 1980s, neoplasms ranked second, constantly competing with other leading causes of death. Among males, cancer mortality had the same incidence as the external causes of death in the late 1970s and the early 1980s or respiratory diseases and digestive diseases by the mid-1980s. Since 2000, however, there has been a considerable difference between neoplasms and the three aforementioned main groups of death causes due to a steady increase in cancer mortality. Since the early 1980s, neoplasm mortality among females, has constantly competed with the digestive diseases until 2000, followed by the same difference in occurrence as in males. In the mid-1980s, just

before the Gorbachev’s anti-alcohol campaign, neoplasms lost the second place in favour of the digestive diseases, which showed a fulminant development.

After the stagnation of the mortality rate in the 1970s and its increase in the 1980s, the trend in cancer mortality has reversed and started to decline in the 1990s. Since the beginning of the millennium, the trend in cancer mortality has resumed its growth and continues so far. The increase in mortality in the 1980s, followed by the decline in the 1990s and, finally, the subsequent growth since 2000 is much more common in men than for women. In males, cancer mortality exhibited a twofold increase between 1969 with the minimum value recorded (193.5, 95% CI 181.6-205.9) and 2018 with the maximum registered one (402.7, 95% CI 388.0-417.8). In 2016, the increase between the minimum value in 1972 (127.3, 95% CI 120.3-134.5) and the maximum one (207.5, 95% CI 199.3-216.0) was 1.6 times among females.

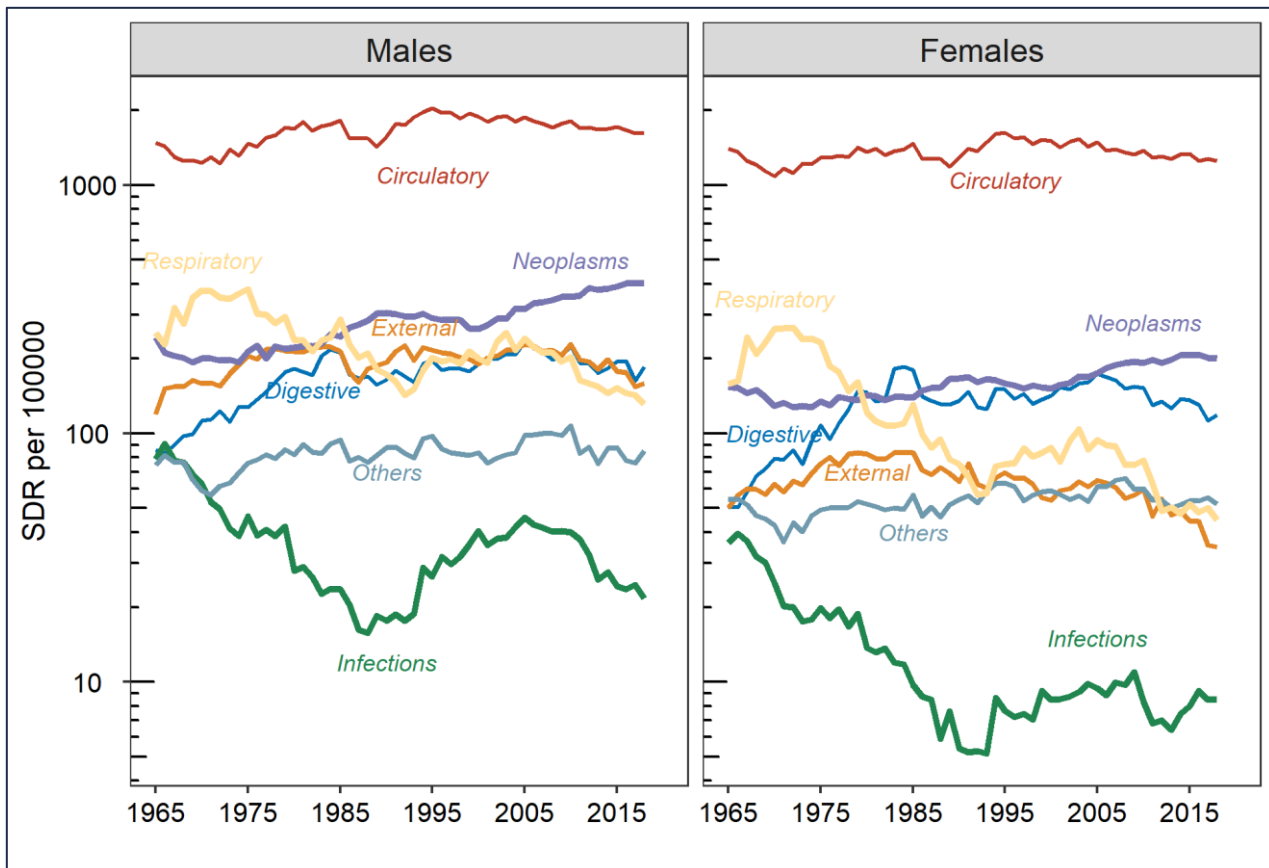


Figure 1. Standardized number of deaths for seven leading causes of death in the Republic of Moldova, 1965-2018, by sex (per 100000). Semilogarithmic scale.

Source: author’s calculations based on HCD Database, NAPH, and NBS.

Cancer mortality occurrence varies considerably depending on age. There has been a constant decrease among children since 2000. Cancer mortality among young adults (15-39 years old) is maintained at the same level throughout the period without any significant difference in genders. The adults (40-64 years old) and the elderly (60 years old and older) show a more pronounced difference in genders. Among mature adult men, the increase in cancer mortality before the 1990s was by far greater than it has been since 2000 (respectively, 1.6 times in 1965-1990 and 10% increase in 2000-2018). Among older men, the situation is reversed. For this age group, the growth observed

from 2000 (twofold increase in 2000-2018) is higher compared to the Soviet period (1.5 times in 1965-1990). In addition, the decline in mortality from neoplasms in the 1990s was more marked in older males than in mature male adults. Cancer mortality among females aged 40-64 years stagnated throughout the study period. Lastly, among older women, the trend in neoplasm mortality is very similar to that among older males. The decrease in old-age mortality in the 1960s is most likely associated with data quality problems such as age heaping and should be interpreted with caution (fig. 2).

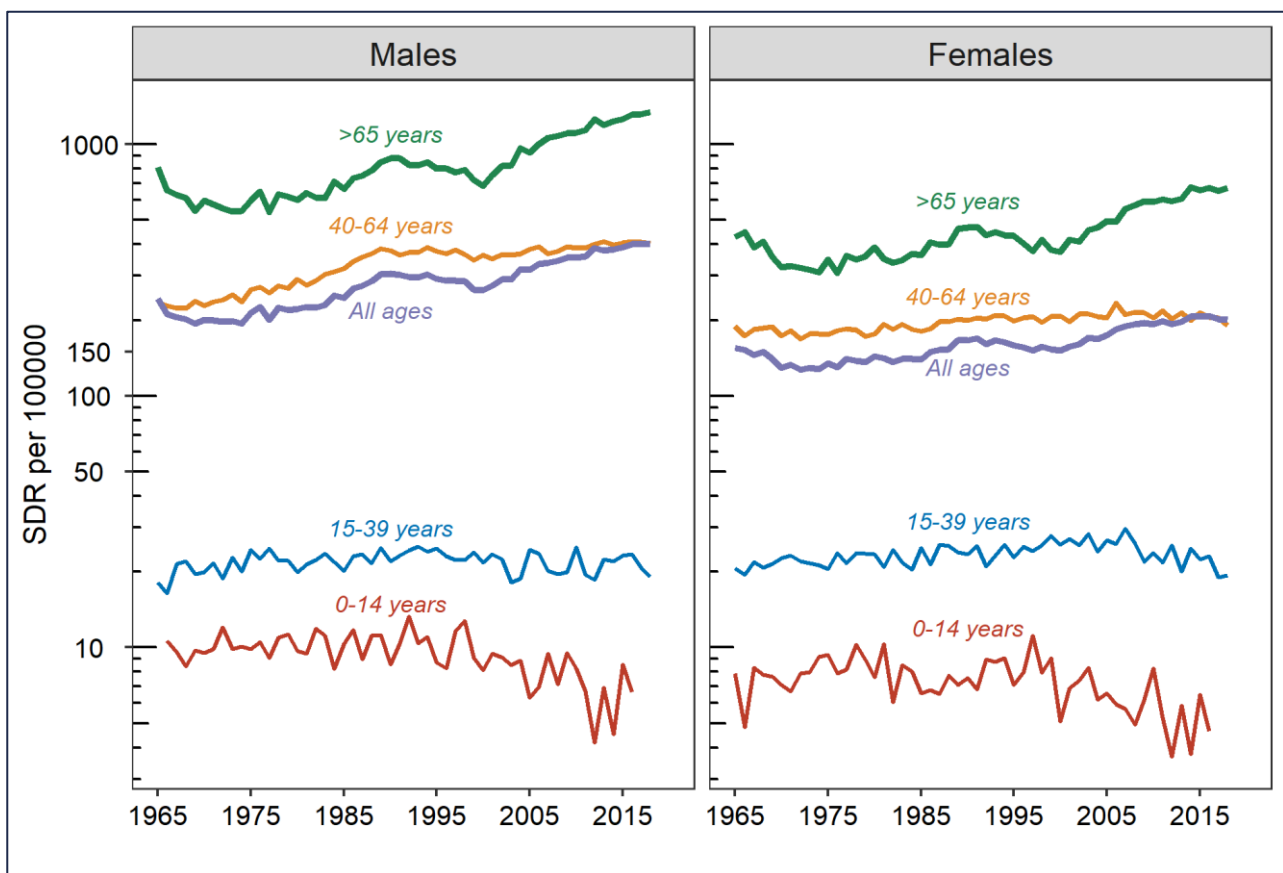


Figure 2. Standardized death rates from neoplasms by main age groups in the Republic of Moldova, 1965-2018, by sex (per 100000). Semilogarithmic scale.

Source: author's calculations based on HCD Database, NAPH, and NBS.

Mortality analysis by detailed cause of death provides a better understanding of the overall trend in cancer mortality. For simplicity, we provide an analysis of cause-specific cancer mortality for all ages and both sexes. It is clear that some cancer sites, such as breast cancer, are closely or exclusively associated with gender. Figure 3 shows trends in standardized death rates from

neoplasms of different locations, except for neoplasms of the genitourinary system and genital organs presented in figure 4. Cancer of the respiratory system and colon cancer are the two leading causes and account for one-third of all deaths from malignant neoplasms in both sexes. Mortality from malignant neoplasms of the digestive system varies widely by location (fig. 3, panel

A). Death rates from malignant neoplasms of the *intestine* continuously increased and more than tripled between 1965 and 2018 (from 12.2 in 1965 to 43.6 in 2018). The share of this cause of death in total cancer mortality increased from 7.0% to 16% over the entire period. Concomitantly, the standardized indicator for stomach cancer reduced twice between 1965 and 2018 (from 42.4 in 1965 to 19.3 in 2018), declining from 23% to 7.0%. Mortality from *liver* cancer and cancer of the *pancreas* has traced a rising trend, so that at present, malignant neoplasms of these two sites have reached the stomach site. Finally, *other malignant neoplasms of the digestive system* have showed a downward trend since the early 1990s.

Mortality from cancer of the *respiratory system* largely represented by lung cancer determines the overall upward trend in cancer mortality and its decline in the 1990s (fig. 3, panel B). The risk of dying from lung cancer increased at a particularly rapid rate during the Soviet period (from 25.4 in 1965 to 48.0 in 1990), while in the 21st century, the growth has slowed down but still continued (from 37.0 in 2000 to 50.1 in 2018). Although the contribution of *upper aerodigestive tract* cancer (lip, oral cavity, pharynx, and oesophagus) to the overall cancer rate is not as large (6% in 2018), neoplasms of this site increased by three times during the whole period. As for neoplasms of the respiratory system, cancer mortality of this location rose especially quickly until the mid-1990s, while during the subsequent years, this remained at the same level.

Mortality from *Leukaemia and lymphomas* demonstrated a moderate 40% increase throughout the overall period for both males and females (from 9.4 in 1965 to 13.0 in 2018). Although we analysed cause-specific mortality for all ages, it is important to note that among children, some progress in reducing mortality from leukaemia and lymphomas has been made in recent years. These achievements explain the recent declining trend in overall cancer mortality among children. The situation with mortality from malignant neoplasms of the *brain* deteriorated rapidly over the last twenty years, and this unfavourable trend seems to continue in the future. Finally, the residual group *other neoplasms* is mostly presented by malignant neoplasms of other and unspecified sites (70% in 2018, both sexes). A relatively large contribution of neoplasms of the unspecified loca-

tion reveals the problems associated with clinical differentiation and codification of causes of death in the country.

Breast cancer followed a *growing* tendency for the study period, with standardized death rates increasing 2.5 times between 1965 and 2018. Mortality from *uterus* cancer, on the contrary, declined, especially quickly in the 1970s and 1980s; however, since the mid-1980s, this progress has ceased. These contrasting trends in breast and uterus cancer mortality, which occurred in Moldova like in all the industrial countries, resulted in a crossover between these two conditions in the early 1980s. Mortality from cancer of *other female genital organs* did not change considerably throughout the whole period. Cancer of *male genital organs* mostly presented by prostate cancer has had an increasing tendency accelerated since the early 1990s. Cancer of the *urinary system* dominated by bladder cancer followed the long-term upward trend throughout the whole period we studied (fig. 4).

DISCUSSIONS

The problem of under-registration of cancer mortality in the FSU countries and its unusual decline in the 1990s contrasted to a huge upsurge in cardiovascular mortality and deaths from injury and poisoning found in the literature. There are many researches on the European part of the FSU (Russia, Ukraine, Belarus, the Baltic countries). Shkolnikov et al. (17) studied cancer mortality in Russia and Ukraine and suggested a number of hypotheses that could explain the observed rapid increase in the 1980s followed by a marked decline in the 1990s. The authors provide evidence of a significant under-recording of cancer deaths among the elderly, especially in rural areas, and changes in coding practices in the 1980s. In November 1984, the Ministry of Public Health of the USSR issued Order 1300 to improve the system of cause-of-death registration. Furthermore, the active development of a territorial network of cancer dispensaries in the former republics, including Moldova, at that time could intensify attention to the problem of cause-of-death registration and partially contribute to the growth of cancer mortality at older ages in the 1980s.

In March 1989, the Ministry of Public Health introduced more radical changes in coding practices, which caused a huge growth in the number

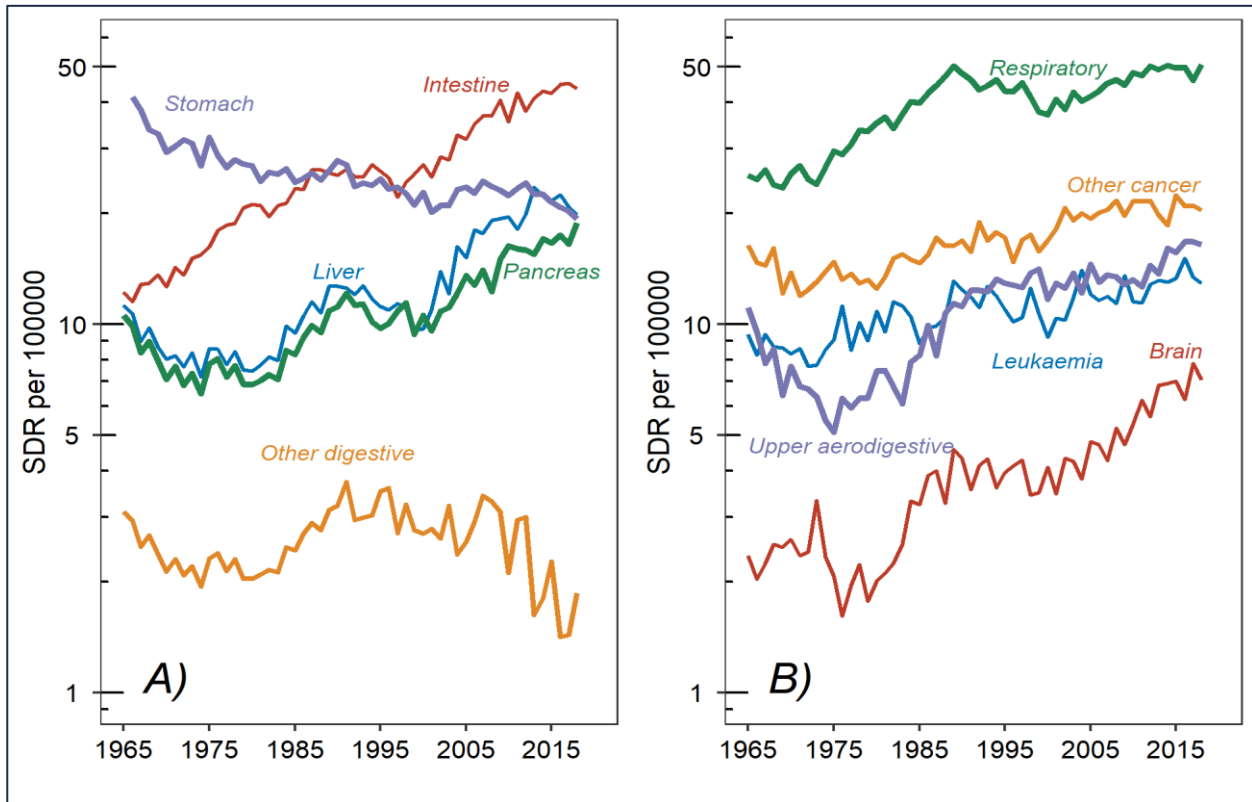


Figure 3. Standardized death rates from neoplasms (without cancer of genital organs and cancer of the genitourinary system) in the Republic of Moldova, 1965-2018, both sexes, all ages (per 100000). Semi-logarithmic scale.

Source: author's calculations based on HCD Database, NAPH, and NBS.

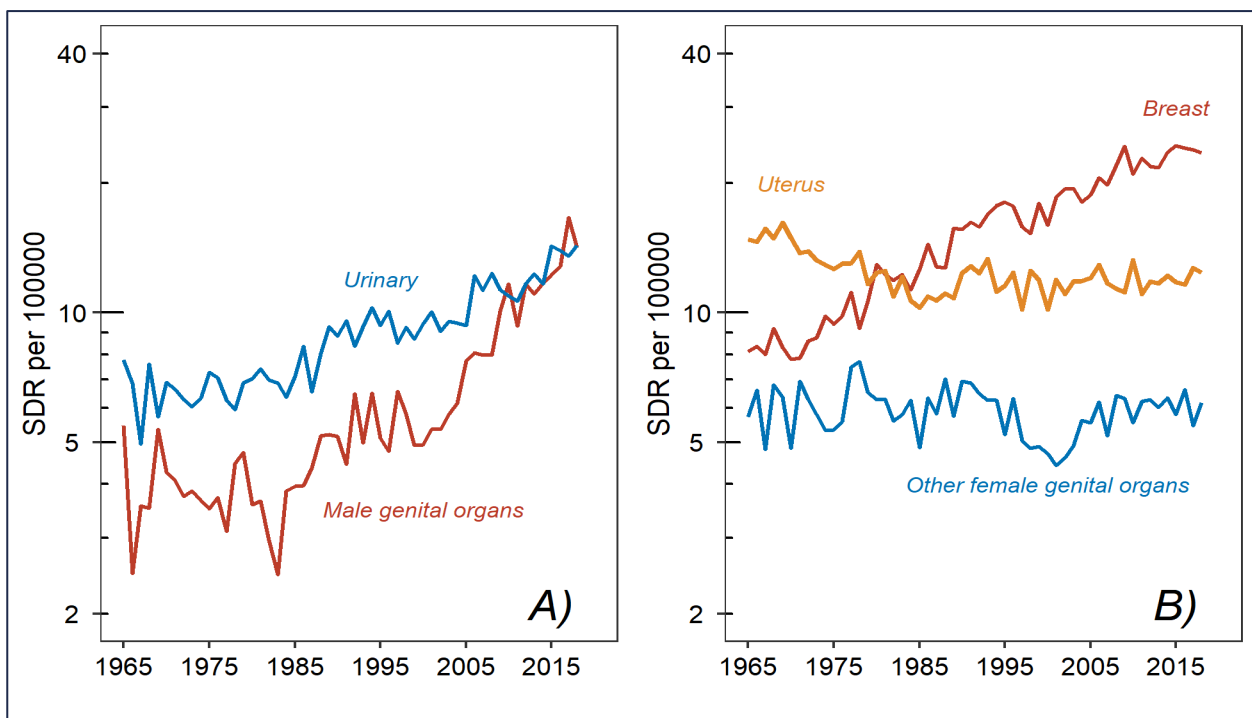


Figure 4. Standardized death rates from cancer of genital organs and the urinary system in the Republic of Moldova, 1965-2018, all ages, both sexes (per 100000). Semilogarithmic scale.

Source: author's calculations based on HCD Database, NAPH, and NBS.

of deaths from “Senility” in the former USSR republics.

According to this directive, if malignant neoplasm co-existed with cardiovascular disease, the former had to be registered as an underlying cause of death. These changes in coding practices in the 1980s and a return to a previous registration custom in the 1990s may serve as a plausible explanation of the increase in cancer mortality among the elderly in the 1980s and its decline in the 1990s. The same authors attribute some reduction in male mortality from cancer in middle age groups in the 1990s to a combination of a cohort effect and a simultaneous sharp rise in mortality from competing causes of death like cardiovascular diseases and accidents.

A higher proportion of the rural population in Moldova as compared to other European ex-Soviet republics may partially lead to a higher proportion of under-registered cancer deaths among the elderly in the 1960s and 1970s. The comparative analysis of life expectancy and causes of death between Moldova and Ukraine (18) demonstrated a lower level of cancer mortality in Moldova, especially among men, in the 1960s and 1970s. The gradual improvement in cancer registration and increased societal attention to this issue, particularly in the aftermath of the Chernobyl disaster in 1986, may account for part of the increase in cancer mortality in the 1980s.

In Moldova, as in Ukraine or Russia, cancer mortality declined steadily in the 1990s, contrasting with large fluctuations in mortality caused by cardiovascular diseases and deaths from injury in the late 1980s and the 1990s. The absolute insensitivity of cancer mortality to the social and economic upheavals of this period demonstrated for Moldova was previously observed for other countries of the ex-USSR (19, 20). In the case of Moldova, the decline in overall cancer mortality in the 1990s is primarily attributed to lung cancer. To explain this mortality reversal, we assume the hypothesis on competing risks earlier proposed by Shkolnikov et al. to explain the same phenomenon, at least partially, in Russia and Ukraine. We suggest that the rapid growth of mortality from diseases of the circulatory system and accidents caused by the economic and the social crisis of the

1990s in the country increased the risk of dying from these causes among people suffering from cancer (17, 21). Indeed, after the end of the economic decline of the 1990s, Moldovan trend in male mortality from lung cancer resumed its slow growth that persists up to now. Furthermore, changes in coding practice along with the growth in the number of deaths from “senility” may also be partly responsible for the decrease in cancer mortality in the 1990s. In Moldova, deaths classified under senility were redistributed by a special method between diseases of the cardiovascular system before the analysis (22).

Similar dynamics in mortality due to lung cancer and other tobacco-related neoplasms among adult males can be observed, for example, in Ukraine and Russia. In Moldova, like in other ex-Soviet countries, the period of growth is directly linked to the spread of tobacco consumption, as well as to the environmental pollution triggered by the rapid development of the industry and agriculture at that time. However, the economic recession in the late 1980s in the former USSR followed by the economic crisis in the newly independent states reduced the industrial and agricultural pollution and tobacco consumption habits in these countries (20).

The lack of progress in mortality from uterus cancer since the mid-1980s and its rapid growth for breast cancer are mainly attributed to insufficiently-organized screening programmes and inadequate diagnostic capacities. Thus, according to the recent population-based study in ten FSU republics, Moldova and Armenia have the largest proportion of cervical cancer (>50%) diagnosed at late stages (II-IV) (23).

The contrasting trends in mortality from stomach and colon cancers described in Moldova and other developed countries refer to the changes in traditions of food preparation and eating habits. Thus, declining mortality from stomach cancer is closely associated with the increased food variety in a diet, while the rise in mortality from cancer of the intestine is positively correlated with the consumption of meat and animal fat (24). In Moldova, as in other countries of the FSU, this phenomenon has showed an enormous delay compared to Western countries.

CONCLUSIONS

1. Despite the increasing trend in overall cancer mortality during 1965-2018, the analysis of deaths by age and specific causes revealed opposite trends. Certain malignant neoplasms (originating in stomach, uterus, leukaemia in children) showed some progress, while the occurrence of other cancers (lung, breast, and intestine cancer) significantly worsened. This requires the strengthening of appropriate preventive measures.
2. The moderate decline in mortality from lung cancer in the '90s should be interpreted with caution. This can refer to the changes in the coding practice of causes of death and to the competing life-threatening risks from the causes that were more sensitive to the social and economic conditions of the 1990s, such as cardiovascular diseases and deaths from injury and poisoning.

CONFLICT OF INTERESTS

The author declares no conflict of interest at.

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PHYSICAL DEVELOPMENT AND EATING HABITS OF A TEENAGE GROUP FROM DIMITRIE CANTEMIR HIGH SCHOOL IN IASI

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Keywords: physical development, eating habits, high school students.

Introduction. Eating habits are formed in the first years of life and sometimes persist throughout lifetime. It is necessary to develop coherent nutritional educational programs to guide adolescents towards a healthy diet.

Material and methods. The study was conducted on a group of 194 students from the ninth and the twelfth grade from Dimitrie Cantemir High School in Iasi. These young people were evaluated for their physical development with the help of body mass index and eating habits. Eating habits were assessed on the basis of a weekly food intake questionnaire. The processing of the results was carried out by the Pearson test.

Results. Physical development was mainly at normal values (68.55%). There were 19.07% underweight students but also 12.37% young people with obesity. Milk was present in menus especially 2-3 times (35.05%) or 1 time (25.77%) per week, with insignificant differences by class and sex. Chicken meat was mainly consumed 2-3 times a week (42.78%) with insignificantly differing in classes, but significant in gender ($p < 0.001$). Vegetables were consumed especially 2-3 times (30.92%) per week or daily (28.35%). Sweets were consumed mainly on a daily basis (29.89%) or 2-3 times (26.28%) per week.

Conclusions. The eating habits of students surveyed were different in girls than in boys, an aspect that draws attention to young females for whom identification with the current ideal of beauty is essential.

Cuvinte cheie: dezvoltare fizică, obiceiuri alimentare, elevi de liceu.

DEZVOLTAREA FIZICĂ ȘI OBICEIURILE ALIMENTARE ALE UNUI LOT DE ADOLESCENȚI DE LA LICEUL „DIMITRIE CANTEMIR” DIN IAȘI

Introducere. Obiceiurile alimentare se formează în primii ani de viață și uneori persistă de-a lungul vieții. Este necesar să se dezvolte programe educaționale nutriționale coerente pentru a ghida adolescenții către o dietă sănătoasă.

Material și metode. Studiul a fost realizat pe un grup de 194 de elevi din clasele a IX-a și a XII-a de la Liceul „Dimitrie Cantemir” din Iași. La acești tineri a fost apreciată dezvoltarea fizică cu ajutorul indicelui de masă corporală și al obiceiurilor alimentare, care au fost evaluate pe baza unui chestionar săptămânal privind consumul de alimente. Prelucrarea rezultatelor a fost efectuată cu ajutorul testului Pearson.

Rezultate. Dezvoltarea fizică s-a încadrat, mai ales, la valori normale (68,55%). S-au identificat 19,07% elevi subponderali și 12,37% tineri cu obezitate. Laptele a fost prezent în meniuri în special de 2-3 ori (35,05%) sau de 1 dată (25,77%) pe săptămână, cu diferențe nesemnificative, în funcție de clasă și de sex. Carnea de pui s-a consumat în principal de 2-3 ori pe săptămână (42,78%), cu diferențe nesemnificative pe clase, dar semnificative după sex ($p < 0,001$). Legumele s-au consumat în special de 2-3 ori (30,92%) pe săptămână sau zilnic (28,35%). Dulciurile s-au consumat mai ales zilnic (29,89%) sau de 2-3 ori (26,28%) pe săptămână.

Concluzii. Obiceiurile alimentare ale elevilor chestionați diferă la fete față de băieți, aspect care atrage atenția asupra adolescentelor pentru care identificarea cu idealul actual de frumusețe este esențială.

INTRODUCTION

A balanced diet will make a decisive contribution to maintaining students' health and ensuring normal growth/development. In high school students, nutrition must be carefully studied because it appears the identification with the current ideal of beauty represented by the thin young woman and the young man with developed muscle masses. Normal body appearance but not overlapping with these desires can become a factor of dissatisfaction and recourse to inadequate diets (1). There are many situations in which adolescents have problems perceiving their own body, which can expose them to the risk of serious health problems. They have a normal weight or are even underweight but they are considered too fat so they keep on to various regimes that are inappropriate (2). Most problems occur in teenage girls, so they need to be closely monitored in and out of school (3).

Eating habits are formed within the family in the first years of life and sometimes persist throughout lifetime. It is important to know the specifics of the population's diet and intervention when needed. In the Romanian population there is a strong anchoring to traditions, so that in most studies the differences calculated by age group and even sex is statistically insignificant (4). These are aspects that need to be known and taken into account by nutritionists when trying to change the eating habits.

Changing eating habits must start from a complex of factors represented by the appropriate nutritional recommendations, the socio-economic situation of the family, the social context and even the current mental state. A study conducted on adolescents in the US reported interesting answers such as eating unhealthy food in a certain social settings (at parties), in moments of joy, anger, stress (5).

Another aspect that must be carefully studied and evaluated by specialists is the absence of consumption of a certain food. It is important to try to evaluate the reasons why some foods are not consumed, as they may be of economic origin, family habits or food displeasure (6). Nutritionists must pay attention to this aspect because you cannot direct the young person to consume food that he does not like in terms of taste.

The objectives of the study: To evaluate the physi-

cal development of high school students; to assess the differences according to the age and taking into account the particularities of the growth process; to study the students' eating habits; to evaluate the conditions in which they change starting from the age group and sex of the person.

MATERIAL AND METHODS

The study group consisted of 194 students from Dimitrie Cantemir High School in Iasi. These were high school students from the 12th grade (82 young people) and the 9th grade (112 students). The distribution by sex was unequal, with 126 girls (64.94%) and 68 boys (35.05%) being surveyed. These young people were appreciated for their physical development and their eating habits were assessed. Physical development was assessed using the Body Mass Index using the special student computer (7). The weight between the student and his height was reported and the interpretation of the results was made according to age and sex. Values fall to a level of underweight, normal or overweight/obesity.

The assessment of eating habits was performed using a weekly food frequency questionnaire. The weekly intake of milk, chicken, meat dishes, vegetables and sweets was appreciated. It goes on the variety of an intake of: never/1 time a week/2-3 times a week/4-6 times a week and daily. The results were processed using the Pearson chi square test.

RESULTS

The study focused towards the students' physical development and their eating habits.

Physical development was appreciated starting from the values of body weight and height, which allows the calculation of the body mass index. The values must be carefully interpreted especially in the 9th grade students where the growth process is still intense. Most students (68.55%) refer to normal values, which is a positive result. There were underweight young people (19.07%) but also overweight/obese (12.37%). It is necessary to follow these students carefully but without interfering, at least in a first stage (tab. 1).

The differences calculated between the classes of students in terms of weight categories defined by BMI were statistically insignificant ($p > 0.05$, $f = 2$, $\chi^2 = 0.782$). Depending on the gender of the stu-

dents, the differences were statistically significant at a $p < 0.01$ ($f=2, \chi^2=11,759$), demonstrating a greater concern of girls for body appearance.

Eating habits were appreciated by studying the weekly intake of food of animal origin (milk, chicken, meat dishes) and vegetables (vegetables and sweets).

Milk is a complete food that must be daily con

sumed according to the requirements of rational nutrition. Unfortunately, the balanced intake was found in 16.49% of students and 13.91% of adolescents with milk consumption of 4-6 times a week. Most students admit the presence of milk in menus only 2-3 times (35.05%) or once (25.77%) per week, while 8.76% of them does not consume milk at all (tab. 2).

Table 1. Characteristics of the study group according to the values of the body mass index.

Weight Category	Underweight	Normal	Overweight / obesity	Total
<i>Data distribution by class</i>				
12th grade	16	54	12	82
9th grade	21	79	12	112
Total (no.)	37	133	24	194
%	19.07	68.55	12.37	
<i>Data distribution by gender</i>				
Female	32	83	11	126
Male	5	50	13	68

Table 2. Frequency of milk intake in students' menus.

Frequency of food intake	Never	Once a week	2-3 times a week	4-6 times a week	Once a day
<i>Data distribution by class</i>					
12th grade	9	23	26	9	15
9th grade	8	27	42	18	17
Total (no.)	17	50	68	27	32
%	8.76	25.77	35.05	13.91	16.49
<i>Data distribution by gender of students</i>					
Female	14	37	38	18	19
Male	3	13	30	9	13

The calculated differences were insignificant by classes viz. $p > 0.05$, $f=4, \chi^2=2.419$, whereas depending on the students' gender - $p > 0.05$, $f=4, \chi^2=6.691$, which shows the presence of similar eating habits.

Chicken meat is rich in protein, but low in fat providing a low-calorie intake. In this context, specific attention should be paid to the consumption of poultry in girls.

The most prevalent chicken intake was 2-3 times a week (42.78%), a result that is not worrying because other types of meat are consumed. A percentage of 8.24 of the students declared a daily consumption of meat, and 1.03% of them did not eat meat at all. The differences assessed depending on classes were statistically insignificant ($p > 0.05$, $f=4, \chi^2=8.737$) and showing similar eating habits in the families of the young people in the study group (tab. 3).

The differences assessed depending on gender were statistically significant at a $p < 0.001$ ($f=4, \chi^2=29.272$) and showed an increased consumption of chicken meat among girls.

Meat dishes are widely used today due to the ease with which they can be added to menus. The prevalent intake was 2-3 times a week (31.95%), daily intake (12.88%) as well as not eating meat at all (9.28%) (tab. 4).

The differences assessed depending on class distribution were statistically insignificant ($p > 0.05$, $f=4, \chi^2=2.078$) and showing similar eating habits according to the age group. Girls consumed meat dishes less often, the differences calculated according to the gender of the students being statistically significant at a $p < 0.05$ ($f=4, \chi^2=11.976$).

Vegetables have a low-calorie value providing little protein and fat to the human body. In most cases they are present in menus 2-3 times a week

(30.92%) or daily (28.35%). These products are rich in carbohydrates, minerals and vitamins; thus, they should be included in a balanced diet. (tab. 5).

Table 3. Consumption of chicken meat.

Frequency of food intake	Never	Once a week	2-3 times a week	4-6 times a week	Once a day
<i>Data distribution by class</i>					
12th grade	1	10	34	29	8
9th grade	1	30	49	24	8
Total (no.)	2	40	83	53	16
%	1.03	20.61	42.78	27.32	8.24
<i>Data distribution by gender</i>					
Female	1	29	44	36	16
Male	1	11	39	17	0

Table 4. Frequency of consumption of meat dishes.

Frequency of food intake	Never	Once a week	2-3 times a week	4-6 times a week	Once a day
<i>Data distribution by class</i>					
12th grade	9	22	23	18	10
9th grade	9	31	39	18	15
Total (no.)	18	53	62	36	25
%	9.28	27.32	31.95	18.55	12.88
<i>Data distribution by gender</i>					
Female	17	38	33	23	15
Male	1	15	29	13	10

Table 5. Presence of vegetables in students' menus.

Frequency of food intake	Never	Once a week	2-3 times a week	4-6 times a week	Once a day
<i>Data distribution of results by class</i>					
12th grade	3	11	19	22	27
9th grade	2	14	41	27	28
Total (no.)	5	25	60	49	55
%	2.57	12.88	30.92	25.25	28.35
<i>Data distribution by gender</i>					
Female	4	15	34	29	44
Male	1	10	26	20	11

The calculated differences in vegetable intake were statistically insignificant by classes ($p > 0.05$, $f = 4$, $\chi^2 = 4,704$) but also by gender ($p > 0.05$, $f = 4$, $\chi^2 = 7,812$).

Sweets are rich in carbohydrates providing an increased calorie intake. However, they must be present in balanced quantities within the diet. The prevalent daily intake is 29.89% and 4-6

times a week – 25.25%. On the other hand, 2.06 % of students denied any consumption of sweets (tab. 6).

The differences assessed by classes were statistically insignificant ($p > 0.05$, $f = 4$, $\chi^2 = 6.866$) but those calculated according to the gender were significant at a $p < 0.05$ ($f = 4$, $\chi^2 = 12.557$), in girls the daily intake was dominant.

Table 6. Frequency of sweets consumption.

Frequency of food intake	Never	Once a week	2-3 times a week	4-6 times a week	Once a day
<i>Data distribution by class</i>					
12th grade	0	15	23	16	28
9th grade	4	17	28	33	30
Total (no.)	4	32	51	49	58
%	2.06	16.49	26.28	25.25	29.89
<i>Data distribution by gender</i>					
Female	4	15	34	29	44
Male	1	10	26	20	11

DISCUSSIONS

Given the media pressure focused on overweight students, often neglecting the underweight, in recent years, several studies have investigated the physical development and eating habits of adolescents.

In our study, students' physical development was dominant at normal values, which is a positive aspect.

The comparative evaluation carried out on adolescents in Bucharest in 2010 and 1977 highlights an interesting aspect represented by the existence of a small percentage of young people with obesity. In 2010 the percentage of obese students was 5.5% for girls and 8.62% for boys, and in 1977 4.75% for girls and 7.27% for boys (8).

In a group of young people from Saudi Arabia, the percentage of young people with obesity was 36.35%, and those with obesity grade III is 43.86% (9).

Self-perception of body weight is also important because there are people who are overweight but consider themselves normal and thin people who consider themselves obese. Students in Iran are 22.25% overweight and 4.41% obese, normal weight being assessed in only 53.08% of cases (10).

It is important to appreciate correctly the situation that is very different from one geographical area to another, from one family to another. Knowledge of the family situation sometimes becomes essential because many studies reveal the link between the body mass index of mother and child, especially of girls. Mothers become role models for weight loss and dietary restrictions, which is not a positive thing (11).

The evaluation of eating habits is therefore neces

sary but also of the possibility of changing them. In the population of the northern part of Romania there is a strong anchoring to traditions (4).

According to the rules of rational nutrition, a daily milk intake is recommended, which was reported only in a few students from the study group.

Young people in Austria recognize an average weekly milk intake of 2.2 ± 1.0 , which is insufficient but somewhat similar to the results of our study (12). Young people in Sudan admit a milk intake especially on a daily basis (37.1%) but there are also 20.5% negative responses (13). In the students of Rawalpindi, the consumption of milk is daily in 44.9% of them but absent in 32.6% of young people (14). Young people in Iran admit a daily milk intake in 19.39% of cases but in 35.90% of them milk consumption is absent (10). There are differences that must be known and carefully interpreted.

Chicken meat is present in the menus of the surveyed students, especially 2-3 times a week.

Consumption 2-3 times a week is also recognized by young people in Rawalpindi (50.4%), while in Sudan chicken is consumed mainly once a week (42.9%) (14). The results obtained are important because they highlight different eating habits in different populations.

Meat dishes are high in fat so it is easy to understand the reaction of girls concerned about their body appearance.

Vegetables are foods that have a low nutritional value due to their low protein and fat content. We must insist on normal intake while avoiding exaggerations, especially in girls. In terms of nutritional value there are no major differences between types of vegetables but it is important in terms of taste and nutritional education. There

are cases in which certain vegetables are not eaten because the taste, color or smell is not accepted, they are not eaten in the family, they are not consumed by someone in the family or the method of preparation is not known (15). Modern nutrition addresses more and more problems, not just the simple answer to how many times a week a type of food is consumed.

Sweets must be present in the menus due to the intake of carbohydrates they provide. The nervous system and red blood cells use them as the only source of energy so they are needed but in

adequate amounts. The dominant contribution to the students in the study group is daily or 4-6 times a week, with a high percentage of girls giving this answer. Adolescents in Austria admit an average consumption of 2.6 ± 1.1 which is totally insufficient (12). Young people in Iran have a dominant intake of 3-6 times a week (46.26%) with 10.35% negative responses (10).

It is important to evaluate the diet of young people for the correct orientation of nutritional education programs.

CONCLUSIONS

1. The physical development and eating habits of the students were evaluated, which allows a real knowledge of the situation on the field.
2. Physical development was prevailing at normal values (68.55%) with a small percentage of underweight (19.07%) or obese (12.37%) students. Depending on the gender of the students, the differences were statistically significant, demonstrating a greater concern of girls for body appearance. These results must be carefully interpreted because the students in the ninth grade are still in full process of growth and development.
3. The eating behavior of the investigated students revealed inappropriate aspects because there were quite a few situations in which young people admitted that they do not consume a certain group of foods at all (milk – 8.76% of students, chicken – 8.24%, meat dishes – 9.28%).
4. Intakes by food groups showed statistically insignificant differences by classes, indicating the presence of similar eating habits.
5. Statistically significant differences were identified by gender, with girls having a high intake of chicken and sweets and a low intake of meat dishes.
6. Such studies are essential for maintaining the health of students and for educating their eating habits.

CONFLICT OF INTERESTS

The authors declare no conflict of interest.

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EPIDEMIOLOGICAL FEATURES OF COVID-19 FAMILY OUTBREAKS IN CHILDREN

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Introduction. The population of all ages is susceptible to SARS-CoV-2 virus. It is important to determine the role of the child in COVID-19 cases maintenance and spreading. Some research showed that most COVID-19 cases in children were associated with their families.

Material and methods. The descriptive study is carried out on the basis of family outbreaks epidemiological peculiarities evaluation, concerning the age of the children, the onset of the disease, communities living environment. The research group included 160 family outbreaks, which required hospitalization at MCHCDC PMSI, between January and February 2021.

Results. The number of family outbreaks increased ($n=88$ versus $n=72$) in February versus January 2021. The rate of outbreaks in schoolchildren increased from 37.5% in January to 53.4% in February. The onset of the disease in the outbreaks varies depending on the age category of the involved children: in 0-6 years - the parents become initially ill (40.7%) or the disease begins simultaneously (32.55%). In school-age children outbreaks in about half of the cases (51.35%) the children manifest the disease the first. There is a tendency of outbreaks percentage increase in the cases where the children, the organized ones as well (from 43% to 62.5%) constitute the primary source of infection.

Conclusions. SARS-CoV-2 viral infection epidemiological particularities evaluation in family outbreaks is one of the most important conditions in developing action and response strategies to COVID-19 infection in the community.

Cuvinte cheie: infecția COVID-19, copii, focare familiale, surse de infecție.

PARTICULARITĂȚI EPIDEMIOLOGICE ALE FOCARELOR FAMILIALE COVID-19 CU IMPLICAREA COPIILOR

Introducere. Populația de toate vârstele este susceptibilă la SARS-CoV-2. Este important însă să se determine rolul copilului în menținerea și răspândirea cazurilor de COVID-19. Unele cercetări au arătat că majoritatea cazurilor de COVID-19 la copii au fost asociate familiei.

Material și metode. Determinarea particularităților epidemiologice ale focarelor familiale, în funcție de vârsta copiilor, debutul bolii, mediul de trai, apartenența la colectivități a fost realizată în baza unui studiu descriptiv. Lotul de cercetare a inclus 160 de focare familiale, care au necesitat spitalizare în IMSP SCMBCC, în perioada ianuarie-februarie 2021.

Rezultate. În luna februarie vs luna ianuarie 2021 a crescut numărul de focare familiale ($n=88$ vs $n=72$). Rata focarelor cu implicarea elevilor s-a majorat de la 37,5% în ianuarie până la 53,4% în luna februarie. Debutul bolii în focarele familiale variază în funcție de categoria de vârstă a copiilor implicați: vârsta 0-6 ani - inițial se îmbolnăvesc părinții (40,7%) sau se înregistrează un debut concomitent al bolii (32,55%); vârstă școlară - în circa o jumătate dintre cazuri (51,35%) copilul primul manifestă boala. Se atestă o tendință de creștere a ponderii focarelor în care copii reprezintă surse primare de infecție, precum și a focarelor cu implicarea copiilor organizați (de la 43% la 62,5%).

Concluzii. Determinarea particularităților epidemiologice ale infecției cu virusul SARS-CoV-2 în cadrul focarelor familiale reprezintă una dintre condițiile importante în elaborarea strategiilor de acțiune și de răspuns la infecția COVID-19 în comunitate.

INTRODUCTION

COVID-19 infection has caused huge medical, social and economic impact, rapidly becoming a major public health problem worldwide (1). In 2020, COVID-19 infection control measures largely depended on non-specific prophylactic measures such as: physical distance, hand hygiene, protective masks wear, isolation and quarantine, thus outbreaks investigation became a very important aspect in transmission prevention (2).

The schools were closed in more than 190 countries around the world, affecting 1.57 billion children, and about 90% of the world's student population in the first months of COVID-19 pandemic (3).

The family environment involves close contact and thus a high probability rate of transmission no matter what age or society position (4). The spread of COVID-19 within families is an accelerator of the epidemic. Non-specific prophylactic measures are considered to be effective, but there is little opportunity to support community members reducing the risk of COVID-19 in families (5).

Home isolation measures - implemented as a means in pandemic control have reduced human mobility (6). Thus, the time spent at home increased and SARS-CoV-2 virus transmission in households intensified. Some countries, such as Iceland, have reported a shift in exposure from international travel and social exposure to domestic exposure. In China, the most cases locally generated were detected in households (7).

The studies done to determine the spread of Covid-19 infection in familial outbreaks are useful to obtain clear data on SARS-CoV-2 transmission dynamics and to gain insight into the main determinants (8). Some researches elucidate the role of households/families as one of the most important SARS-CoV-2 infections spread in the population (4, 8, 9, 10). Households will continue to be a significant place for SARS-CoV-2 transmission, as patients with suspected or confirmed SARS-CoV-2 infection are asked to self-isolate at home (10).

A study conducted in China determined that family contacts present the highest risk of transmission, being followed by social and community contacts. Health care contacts constitute the lowest risk, indicating adequate protection measures for patients and medical staff from Hunan (6). In addition, susceptibility to infection (de-

fining as the risk of primary case infection) varies with age: children aged 0-12 are significantly less sensitive than people aged 26-64, but the patients over 65 are much more sensitive (6).

Despite its worldwide spread, COVID-19 epidemiological and clinical patterns remain largely unclear, especially among children (11). Published data on the transmission of SARS-CoV-2 among children in healthcare workers (HCW) families are few (12). A study realized in Spain during the first pandemic wave revealed a high level of SARS-CoV-2 detection in healthcare workers' children, especially when both parents were symptomatic, emphasizing the great impact of family groups in SARS-CoV-2 transmission (12).

Data on contacts epidemiological surveillance in Shenzhen, China, confirmed the role of children in transmitting the infection, with similar data being reported both in children, adults from individual households (13).

Other studies (Netherlands) suggest that SARS-CoV-2 infection is more commonly spread among adults or from adult family members to children (13), especially during the period when schools were closed (13). Family transmission can be conditioned by socio-cultural factors and living conditions; therefore, the results cannot be extrapolated to other populations. Nowadays data on familial transmission of SARS-CoV-2 infection in Western Europe and the role of children in this process are limited (8).

Multiple studies revealed that children of all ages were susceptible to SARS-CoV-2 infection (11). Emerging evidence suggests that young children are at higher risk of COVID-19 than it was initially foreseen (14). Continuous surveillance is needed to understand better the epidemiology, clinical model and transmission of COVID-19 in order to develop effective preventive strategies against COVID-19 in the paediatric population (14).

Several examples of SARS-CoV-2 clusters were linked to a wide range of settings, especially the indoor ones. Few reports came from schools, more from households, and an increasingly high number was reported in hospitals and nursing homes across Europe (10).

Some experts say that the opening of schools, despite the safety measures for symptoms monitoring, personal hygiene, masks wear and distancing among students - did not cause

significant outbreaks concerning school (3). However, accumulating the data, it was found that a significant proportion of children and adolescents are asymptomatic or less symptomatic. Summing up can be said that children and adolescents with COVID-19 appear to have higher SARS-CoV-2 viral loads in nasopharyngeal lavage than adults.

Thus, the impact of school opening in diverse epidemiological situations from different communities must be carefully examined (3). Complex epidemiological studies are needed to determine the role of children in the spread of SARS-CoV-2 infection, returning to organized preschool activities and education at all levels (15).

Study hypothesis: the role of children in SARS-CoV-2 infection transmission was initially underestimated the analysis of the epidemiological features of family outbreaks may highlight the impact of the children in infection spread in these outbreaks.

MATERIAL AND METHODS

The aim of the study was to determine some epidemiological features of COVID-19 family outbreaks, emphasizing the impact of the child in the epidemic chain maintenance.

A cross-sectional descriptive observational epidemiological study of 160 family outbreaks sample was performed for this purpose. The primary material used for this research was collected from the clinical observation sheets of the patients diagnosed with COVID-19, who were hospitalized in SCMBCC IMSP, during January-February, 2021. The study involved Covid-19 infection family outbreaks epidemiological features determination. The information was

grouped and analysed according to the age of the children, the onset of the disease, the primary sources of the outbreak, the living environment, the children's belonging to communities. The statistical processing of the collected data was performed with the help of Microsoft Excel 2019 program. Statistic assessment was carried out by comparative checking of the studied indices, establishing the statistical threshold of $p < 0,05$.

RESULTS

To assess the role of the child in the transmission of SARS-CoV-2 infection, we analysed the epidemiological features of COVID-19 in people with family outbreaks. It should be noted that at the stage of this research, in accordance with the provisions of PCN New Corona viral Infection (COVID-19), edition IV, hospitalization was mandatory for all the children with COVID-19, excepting those with asymptomatic forms. The motivation for conducting the study was Covid-19 morbidity decrease in the Republic of Moldova in January (16) and the increase in the number of cases in February (17), during the reopening of educational institutions in January-February 2021.

Out of the total outbreaks analysed for January, it was found that the outbreaks which predominate involved preschool children - 45 (62.5%) versus those of school-age children 27 outbreaks (37.5%), there is no statistical difference $t=2,09$, $p > 0,05$.

In the group of outbreaks with preschool children - 25 (34.72%) were the outbreaks involving children up to 1 year old. Family outbreaks concerning the children up to 1 year came from urban areas in 72% cases (tab. 1).

Table 1. Age structure, living environment in COVID-19 family outbreaks, January, 2021.

Age of children in family outbreaks	Nr. outbreaks		urban		rural		organised*	
	n	%	n	%	n	%	n	%
0-12 months	25	34.72	18	72.0	7	28.0	0	0.0
1-3 years	13	18.06	11	84.62	2	15.38	2	15.40
4-6 years	7	9.72	7	100.0	0	0.0	5	71.42
Total preschoolers	45	62.5	36	80.0	9	20.0	7	15.55
7-10 years	4	5.56	4	100.0	0	0.0	4	100.0
≥11 years	19	26.39	16	84.21	3	15.79	16	84.21
Different ages	4	5.56	3	75.0	1	25.0	4	100.0
Total pupils	27	37.5	23	85.18	4	14.82	24	88.88
Total, outbreaks	72	100.0	59	81.9	13	18.1	31	43.05

Note: * belong to a social group or communities (nursery, kindergarten, school)

An important element of our analysis was to determine the primary sources of infection in the family outbreak. Thus, it was established that in infants outbreaks (0-12 months) the first to show signs of disease in about half (52.0%) of cases were parents, in 24.0% of cases the onset of the disease occurred simultaneously in children and parents, which denotes a possible common exposure to the infectious agent, but in

other 24.0% of outbreaks - the child was the first to manifest the disease (tab. 2).

In the case of the family outbreaks involving the children aged 1-3 years, analysed for January - most came from urban areas, pre-school children accounted 84.61% (tab. 1). Parents' infection was registered in 46.15%, concomitantly in children and parents - 46.15%, and the onset of the disease in children - 7.70% of outbreaks (tab. 2).

Table 2. Primary sources of COVID-19 infection in family outbreaks, January, 2021.

Age of children in family outbreaks	The onset of the disease in the family outbreak						
	concomitant		child		parents		total
	n	%	n	%	n	%	n
0-12 months	6	24.00	6	24.00	13	52.00	25
1-3 years	6	46.15	1	7.70	6	46.15	13
4-6 years	1	14.29	2	28.57	4	57.14	7
Total preschoolers	13	28.89	9	20.00	23	51.11	45
7-10 years	1	25.0	2	50.00	1	25.0	4
≥11 years	0	0.00	9	47.37	10	52.63	19
Different ages	1	25.00	2	50.00	1	25.00	4
Total pupils	2	7.41	13	48.15	12	44.44	27
Total	15	20.83	22	30.56	35	48.61	72

In the case of family outbreaks in children aged 4-6 years - the majority (71.42%) of children were organised (tab. 1). The disease started primarily in adults - 57.14%, simultaneously in adults and children - 14.29% of cases, and in 28.57% the child became ill first (tab. 2).

Generally, in the focus group involving preschool children, hospitalized in January (tab. 2), the first to show signs of COVID-19 were the adults (parents or caregivers) - 51.11%, concomitant onset of the disease - 28.89% and in only 20.0% of outbreaks the child was the primary infected family member.

Among the outbreaks in school-age children, the highest percentage (70.37%) was in children aged 11 and more. The majority (84.21%) of children were organized, from urban areas (tab. 1). The first in the family to get infected were the adults about 1/2 (52.63%) of cases; in 47.36% - the children were the first to show clinical signs (tab. 2).

An interesting element is the fact that in school-age children outbreaks, the children hospitalized in January, were the first to manifest the disease being the primary sources of infection in families - 13 outbreaks (48.15%), in other 12 outbreaks (44.44%) - the parents were initially affected,

and in only 2 outbreaks (7.40%) the onset of the disease was concomitant both in children and adults (tab. 2).

Analysing the data for January it was determined that 81.9% of the total outbreaks were from urban areas in 43.05% of outbreaks (tab. 1). The adults were predominantly registered as primary sources of infection in the family (48,61%) or concomitant illness was observed (20.83% of outbreaks), which does not exclude common exposure to the source of infection. Only in 30.56% outbreaks the onset of the disease was primarily reported to affect children (tab. 2).

In February, it was observed the following rate preschool children - 41 (46.59%), school-age children 47 (53.41%), organized children increased to 62.50% (t=1.76, p>0.05) (tab. 3).

Analysing the data for February family outbreaks, the following particularities were established: infants (0-12 months) in 16 outbreaks, of which 37.50% of cases in caregivers, or children - the first showing clinical symptoms. In the rest of the cases (25.0%) the clinical signs started at the same time (tab. 4).

In February, young children (1-3 years) in 13 outbreaks, 84,62% from urban areas (tab. 3)

Table 3. Structure of epidemiological features in COVID-19 family outbreaks, February, 2021.

Age of children in family outbreaks	Nr. outbreaks		urban		rural		organised*	
	n	%	n	%	n	%	n	%
0-12 months	16	18.18	12	75.00	4	25.0	0	0.00
1-3 years	13	14.77	11	84.62	2	15.38	6	46.15
4-6 years	12	13.64	11	91.67	1	8.33	8	66.67
Total pre-schoolers	41	46.59	34	82.93	7	17.07	14	34.14
7-10 years	10	11.36	6	60.00	4	40.0	9	90.00
≥11 years	26	29.55	20	76.92	6	23.08	25	96.15
Different ages	11	12.50	8	72.73	3	27.27	7	63.63
Total pupils	47	53.41	34	72.34	13	27.66	41	87.23
Total, outbreaks	88	100.0	68	77.27	20	22.73	55	62.50

Note: * belong to a social group or communities (nursery, kindergarten, school)

were the first to get ill in 53.84% of outbreaks, in 23.08% of outbreaks the adults were the first to get infected – or concomitant infection occurred (tab. 4).

In February, pre-schoolers (4-6 years old), 91.67% from urban areas were identified – 12 outbreaks. The disease manifested more fre-

quently in adults – 5 outbreaks (41.67%), in children – 33.33%, simultaneous – 25.0% (tab.4).

In school-age children outbreaks – 53.19% of cases the child was the first to manifest the disease, 40.42% - the first to become infected were the parents, but in 6.38% outbreaks – the disease was concomitant (tab. 4).

Table 4. Primary sources of COVID-19 infection in family outbreaks, February, 2021.

Age of children in family outbreaks	The onset of the disease in the family outbreak						
	concomitant		child		parents		total
	n	%	n	%	n	%	n
0-12 months	4	25.0	6	37.50	6	37.50	16
1-3 years	3	23.08	7	53.84	3	23.08	13
4-6 years	3	25.00	4	33.33	5	41.67	12
Total pre-schoolers	10	24.39	19	46.34	12	29.27	41
7-10 years	0	0,0	7	70.00	3	30.00	10
≥11 years	4	15.39	12	46.15	10	38.46	26
Different ages	4	36.36	4	36.36	3	27.28	11
Total pupils	3	6.38	25	53.19	19	40.43	47
Total	13	14.77	44	50.00	31	35.23	88

Overview, some epidemiological features of COVID-19 were found in February – a higher percentage (53.41% in February versus 37.5% in January, $t=1.33$, $p>0.05$) of outbreaks involving school-age children; the predominance of the onset of the disease in children and an increase in the percentage of organized children (from 43% in January to 62.5% in February, $t=1.76$, $p>0.05$). In February, there was a higher percentage (50.0% versus 30.56%, $t=1.54$, $p>0.05$) of outbreaks in which children were the first to get sick.

DISCUSSIONS

This study describes the impact of the child in COVID-19 infection transmission, even though it

was thought to be insignificant. The opening of schools in Chisinau can be considered a catalyst in COVID-19 transmission among paediatric population. We can emphasize that the selection of measures to control COVID-19 infection in the community must also estimate these particularities of infection transmission among children, in the family, or at school. The opening of schools is accepted with good safety measures, symptoms monitoring, personal hygiene, masks wear and social distance.

Data accumulation and analysis proved that a percentage of asymptomatic or symptomatic children can be significant (18). Moreover, children and adolescents with COVID-19 have higher viral loads than adults do in the early stages of

the disease (19, 20, 21).

Schools and kindergartens closure and reopening is a major issue of education, politics and public health worldwide. There are concerns about the transmission of SARS-CoV-2 virus among children and teachers in the school environment (3).

At the same time, there are limited data on transmission among children that could lead to major outbreaks, especially in school. A systematic review suggested that children are unlikely to be the most important factors in COVID-19 pandemic (22). It is unclear whether the dynamics of the virus transmission in the paediatric population differs from that of adults, or this may be because most schools remain closed for extended periods there may be other factors that need exploration.

However, the most common sources of infection for paediatric cases of COVID-19 appear to be members of their adult family according to some studies children are not the primary source of infection and have not caused major outbreaks in communities (23). Referring to our results, where children were the source of infection in

their families there is a significant number of outbreaks, thus we can conclude that they are involved in catalysing the epidemic process in SARS-CoV-2 virus infection.

Our study suggests the need to apply anti-epidemic measures to the child population. Proper masks wear is a way to reduce the spread of the virus in the community by stopping its spread through respiratory secretions from sources of infection, including children. Wearing protective masks in public, children can help stop the spread of COVID-19 - and to protect their families, communities and themselves.

The teachers in institutions can be exposed to a much higher risk of infection with SARS-CoV-2 virus, interacting with children who are an important source of infection. Teachers' protection and prevention from SARS-CoV-2 viral infection is vaccination.

This entails close epidemiological surveillance of children, especially adolescents, taking into account their increased potential for infection outside family outbreaks. In this context, the results of our study are consistent with previously published studies (24).

CONCLUSIONS

1. The number of outbreaks requiring hospitalization at Municipal Clinical Hospital of Contagious Diseases in Children increased in February compared to January.
2. It was determined in January that in family outbreaks the hospitalized adults as primary sources of infection were predominantly registered or due to a concomitant illness which was determined, without excluding the common exposure to the source of infection.
3. A higher percentage of outbreaks involving school-age children made in February; an increase in the percentage of organized children and a higher percentage of outbreaks in which children became ill the first.
4. The epidemiological aspects of SARS-CoV-2 virus transmission in family outbreaks are necessary in the development of action and response strategies in COVID-19 infection.

CONFLICT OF INTERESTS

Nothing to declare.

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MĂSURI DE ERADICARE A RABIEI ÎN FAUNA SĂLBATICĂ DIN REPUBLICA MOLDOVA

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RABIES ERADICATION MEASURES IN WILDLIFE IN THE REPUBLIC OF MOLDOVA

Introduction. Rabies is one of the most dangerous zoonoses in the world with a lethality rate around 100% of infected animals. The main factor in rabies' control is the prophylactic immunization of domestic and wild carnivores.

Material and methods. As a research material for this manuscript, a number of rabies cases in wildlife over the last 5 years was studied, as well as some data from the national program regarding the vaccination of wildlife animals in the Republic of Moldova.

Results. The annual incidence of rabies in wildlife was determined to range between 12 to 25% of the total number of rabies cases at national level. Due to vaccination by combining some methods (aerial and manual), the incidence of positive cases of rabies in wildlife has decreased by 48% in the last 5 years.

Conclusions. The use of the mixed vaccination method of wildlife animals (manual and the distribution of baits by plane) contributed significantly to reducing the incidence of rabies in wildlife.

Cuvinte cheie: rabie, vulpi, virus, vaccinare, incidență.

Introducere. Rabia rămâne una dintre cele mai periculoase zoonozele la nivel global, cu o rată a letalității de 100%. Factorul principal în controlul rabiei îl constituie imunizarea profilactică a carnișierelor domestice și sălbatică.

Material și metode. Materialul utilizat pentru această lucrare a fost reprezentat de datele primare colectate pe parcursul a cinci ani privind cazurile de rabie din fauna sălbatică, dar și datele cu privire la vaccinarea animalelor, extrase din programul național din Republica Moldova.

Rezultate. Incidența anuală a cazurilor de rabie din fauna sălbatică constituie 12-25% din totalul cazurilor de rabie raportate la nivel național. Datorită vaccinării prin metoda combinată (aeriană și manuală) în ultimii 5 ani incidența rabiei din fauna sălbatică s-a redus cu 48%.

Concluzii. Utilizarea metodei mixte de vaccinare a animalelor sălbatică (manual și distribuirea momelelor cu avionul) a contribuit semnificativ la reducerea incidenței rabiei în fauna sălbatică.

INTRODUCERE

Până la momentul actual rabia rămâne una dintre zoonozele cu cea mai înaltă rată de letalitate (în jur de 100%) atât la animale, cât și la oameni (1, 2).

În pofida multipleror tulpini vaccinale utilizate în scop profilactic la efectivele de animale și oameni, precum și a programelor de prevenire și combatere a bolii nu s-a realizat menținerea sub control imunologic stabil a rabiei. Menționăm, că rezervorul bolii este reprezentat de fauna sălbatică, unde vulpile reprezintă veriga principală în răspândirea rabiei la alte animale sălbatice precum și la cele domestice, inclusiv și la oameni (3, 4).

Situația epidemiologică variabilă, instabilă, cu riscuri majore pentru sănătatea animalelor și a oamenilor persistă stabil la nivel global. Programele de prevenire a bolii recomandate de către Organizația Mondială pentru Sănătatea Animalelor sunt axate pe vaccinarea sistematică a carnasierelor domestice și sălbatice (5, 6, 7).

Dacă efectivele de carnasiere domestice (câini, pisici) pot fi vaccinate având și o evidență coordonată, atunci mai complicat este de a crea un fon imun stabil la carnasierile sălbatice. În Republica Moldova vaccinarea antirabică se efectuează anual. Modul de aplicare a vaccinurilor până în 2020 a fost numai prin metoda manuală, care prevede plasarea momelelor cu vaccinuri lângă vizuinile vulpilor sau pe cărările pe care vulpile se deplasează pentru adăpare la rezervoarele de apă. Această metodă permite formarea unei imunizări colective parțiale, deoarece consumul momelelor vaccinale nu este uniform de către toate animalele sălbatice.

O problemă majoră în menținerea și răspândirea focarelor de rabie o constituie și câinii maidanezi din regiunile urbane, unde capturarea acestora, sterilizarea și vaccinarea contra rabiei este parțială și neuniformă.

Începând cu anul 2020 în Republica Moldova a fost lansat un program de vaccinare antirabică a animalelor sălbatice, care prevedea distribuirea momelelor vaccinale cu avionul. Inițial, conform acestui program, administrarea vaccinurilor a fost preconizată pentru zona bufer de 50 km dintre România și Republica Moldova. Ulterior, s-a preconizat extinderea programului de vaccinare în toate fâșiile forestiere din republică.

Luând în calcul cele menționate, *scopul studiului* a fost de a efectua o analiză a situației epidemiologice și a incidenței rabiei în fauna sălbatică (la vulpi) în dependență de metoda de aplicare a momelelor vaccinale (manual și aerian).

MATERIAL ȘI METODE

În studiu au fost folosite datele cu referire la incidența cazurilor de rabie în fauna sălbatică (la vulpi) din Republica Moldova, în perioada 2015-2020, precum și unele date a programului național cu referire la vaccinarea animalelor sălbatice. Concomitent, au fost folosite datele statistice cu referire la cazurile de rabie din baza de date a Agenției Naționale pentru Siguranța Alimentelor.

Diagnosticul de rabie a fost confirmat la CRDV (Centrul Republican de Diagnostic Veterinar) prin examinarea directă a imunofluorescenței asupra amprentelor digitale ale hipocampului, cerebelului și medularei oblongate, colorate cu conjugat fluorescent specific (conjugat nucleocapsid anti-rabic adsorbit liofilizat) pentru testarea nucleocapsidelor genotip 3 lizavirus (virus Mokola), 5 Lizavirus, (EBLV 1) și 6 (EBLV 2), producător „BIO-RAD”, Franța. Testul la examinarea directă a imunofluorescenței (IFD) a fost ulterior completat cu examenul histopatologic care relevă prezența corpusculilor Babeș-Negri în secțiunile histologice examinate.

REZULTATE

Anual în Republica Moldova sunt înregistrate numeroase cazuri de rabie la diferite specii de animale domestice și sălbatice. În Tabelul 1 sunt prezentate datele în ansamblu a situației epidemiologice față de rabie, cu numărul de cazuri (anual) la vulpi.

Conform planului strategic al măsurilor anti-epidemice coordonat de către ANSA (Agenția Națională pentru Siguranța Alimentelor) vaccinarea antirabică este obligatorie pentru carnasierile domestice (câini și pisici), inclusiv vaccinarea se efectuează și în fauna sălbatică, în special la vulpi. Vaccinările respective sunt îndeplinite de către medicii veterinari de liberă practică de două ori pe an, în perioada de primăvară și toamnă, când temperatura mediului este de +4+15°C, cuprinzând imunologic un număr cât mai mare de animale sălbatice, precum și puietul nou născut.

Tabelul 1. Incidența anuală a cazurilor de rabie la animale.

Nr. crt.	Anul	Numărul de cazuri total înregistrate	Inclusiv la vulpi	Incidența cazurilor de rabie la vulpi (%)
1	2015	167	29	17,4
2	2016	79	12	15,2
3	2017	59	13	22,1
4	2018	78	16	20,5
5	2019	91	14	15,4
6	2020	121	15	12,4

În pofida măsurilor de vaccinare efectuată sistematic, incidența cazurilor de rabie are o evoluție variabilă la diverse specii de animale domestice, cu o frecvență mai înaltă la câini, bovine, pisici, ovine, dar și la unele specii de animale sălbatice precum: veverițe, ratonii, vulpi etc. Totuși, o importanță majoră în răspândirea cazurilor de rabie le revine vulpilor. Populația acestora variază de la an la an, fiind influențate de mediul ambiant și de sursele de alimentație etc. Transmiterea virusului de la vulpi la animalele domestice are loc în perioadele prodromale ale fazelor clinice de boală, când animalele contaminate pierd instinctul de autoconservare, intră în contact cu acestea și le provoacă mușcături. Din acest considerent, menținerea fonului imun antirabic la un număr cât mai mare de animale sălbatice (vulpi) este factorul decisiv în diminuarea incidenței cazurilor de rabie în fauna sălbatică, precum și transmiterea virusului rabic la animalele domestice.

Datele din Tabelul 1 indică că incidența cazurilor de rabie în fauna sălbatică are variații diferite în fiecare an. Cea mai mare incidență a cazurilor de rabie la vulpi a fost înregistrată în anul 2017, având 22,1% din numărul total de probe pozitive, iar cea mai mică incidență a cazurilor de rabie (12,4%) a fost înregistrat în anul 2020. Această scădere a incidenței cazurilor de rabie poate fi motivată prin faptul că în anul 2020 a fost lansat programul bilateral Republica Moldova-România, care a avut ca scop vaccinarea animalelor sălbatice contra rabiei prin metoda combinată, manual și cu avionul. Metoda tradițională manuală constă în distribuirea momelilor cu vaccin lângă vizuinele vulpilor, iar metoda aeriană prevede distribuirea brichetelor din avion pe o zonă de 50 km la frontiera cu România (zona „TAMPON”). Vaccinarea s-a efectuat în 2 etape – primăvara și toamna, când temperatura mediului este de +4 - +5°C.

Pentru distribuția aeriană au fost analizate datele electronice criptate și decriptate, rutele/traseele de zbor efectuate, distanțele parcurse de avioane în intervalele de timp consemnate/înregistrate pentru fiecare zbor în parte. În timpul campaniei au fost utilizate un număr de 10 avioane, zborurile fiind efectuate de pe Aeroportul Internațional Mărculești, r-nul Florești, iar densitatea momelilor distribuite prin metoda aeriană a fost de 25 momeli/km².

La etapa I, perioada 09-13.07.2020, au fost recepționate un număr de 543200 momeli vaccinale (seriile 2627 și 2727) pentru distribuția aeriană și 73 800 momeli vaccinale (seria 2727) pentru distribuția manuală.

La etapa II, perioada 13-21.11.2020, un număr de 574443 momeli vaccinale au fost utilizate pentru distribuția aeriană, iar pentru distribuția manuală au fost utilizate 73 800 momeli vaccinale.

În total au fost distribuite pe calea aeriană 1117643 momeli, iar prin aplicarea manuală 147600 de momeli cu vaccin.

Datele studiului epidemiologic au demonstrat, că vaccinarea prin metoda combinată a redus semnificativ numărul de cazuri de rabie la vulpi de la 29 cazuri în anul 2015 până la 14 cazuri în anul 2020, astfel, incidența cazurilor pozitive s-a redus cu 48%. Sistemul de vaccinare a animalelor sălbatice poate fi racordată la practica internațională, ce recomandă utilizarea combinată a distribuției vaccinurilor manual și pe cale aeriană, care ar majora considerabil numărul animalelor imunizate și care ar reduce evident posibilitatea transmiterii virusului rabic de la animalele sălbatice la cele domestice, fapt care pozitiv s-ar reflecta și la siguranța sănătății oamenilor.

DISCUȚII

Rabia este o zoonoză de origine virală care prezintă interes atât pentru sănătatea animalelor, cât și pentru sănătatea omului. Luând în considerare acest fapt, la nivel mondial sunt lansate multiple programe de prevenire și eradicare a acestei boli, în permanență se elaborează noi metode de diagnostic, dar și diverse tipuri de vaccinuri pentru imunizarea activă a animalelor și a oamenilor. În pofida realizărilor din domeniul medicinei veterinare, dar și a medicinei umane, rabia a rămas o problemă majoră până la momentul actual. Anual sunt vaccinați milioane de oameni (în scop profilactic și la necesitate), însă sute de mii de oameni și de animale mor din cauza rabiei. Cunoaștem că vectorul principal de

transmitere a bolii sunt vulpile, de aceea tot mai avansate devin și metodele de imunizare – vaccinurile sunt produse prin metode moleculare, iar modul de administrare este adaptat la posibilitățile naționale, luând în calcul și practica internațională. Distribuția vaccinurilor prin metoda aeriană s-a dovedit a fi mult mai eficientă comparativ cu cea manuală, fapt ce a dus la reducerea semnificativă a numărului de cazuri pozitive de rabie în fauna sălbatică din republică. Acest indice denotă faptul că în perspectivă va fi necesar de elaborat o strategie de vaccinare prin distribuție aeriană a vaccinurilor antirabice pentru fauna sălbatică din toate fâșiile forestiere la nivel național.

CONCLUZII

1. Vectorul principal de menținere și răspândire a focarelor de rabie în fauna sălbatică din Republica Moldova, dar și la animalele domestice rămân în continuare vulpile, fapt care trebuie luat în considerare ca element de bază în eradicarea rabiei la nivel național.
2. Utilizarea metodei mixte de vaccinare a animalelor sălbatice (manuală și distribuția momelelor pe cale aeriană) a contribuit la reducerea semnificativă a cazurilor de rabie în fauna sălbatică, fapt ce argumentează necesitatea extinderii acestei metode pe tot teritoriul republicii.

CONFLICT DE INTERESE

Nu exista conflicte de interes.

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ASPECTE LEGATE DE EFECTELE PANDEMIEI DE COVID-19 ASUPRA SĂNĂTĂȚII COPIILOR

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CONCERNS ON IMPACT OF COVID-19 PANDEMIC ON CHILD HEALTH

Introduction. The unexpected situations (lockdown, online school, social distancing) introduced from March 2020 to stop the spread of COVID-19 in most countries worldwide, have affected every citizen. Currently, after more than a year and a half, one of the most affected categories are the children. There is growing concern among researchers about the pandemic impact on the physical, mental development and health of children.

Material and methods. A quantitative research was conducted among parents and their children from a gymnasium school in Bucharest regarding the way they perceive how the pandemic restrictions changed their habits. The research methods used were online, using questionnaires created and applied through Google forms. No sample methods could be applied and about 40% of them responded in pairs parent-child.

Results. The results showed that the impact of online schooling is not only about the learning effectiveness, but mostly related to the health and development of children who are at risk from the increased time spent on the Internet. Health issues like sedentary lifestyle, obesity, vision and posture impairment, spine problems have increased, being doubled by psychological and mental disorders: stress, isolation, anxiety, depression, lack of attention and concentration, as well as an increase in the number of children exposed to cyberbullying and other online risks.

Conclusions. The study analysis showed that there are differences between parents and children's perceptions of the collateral side effects of the pandemic both on physical and mental health of children.

Cuvinte cheie: restricții legate de pandemia de COVID-19, școala online, sănătatea mentală și fizică a copiilor.

Introducere. Situațiile neașteptate (carantină, școală online, distanțare socială) impuse pentru a opri răspândirea COVID-19 începând cu martie 2020 în majoritatea țărilor din întreaga lume au avut efecte pentru fiecare cetățean. Una dintre categoriile cele mai afectate de aceste schimbări sunt copiii. Îngrijorările cu privire la modul în care sunt afectate dezvoltarea fizică și psihică și sănătatea copiilor sunt în creștere în mediul academic.

Material și metode. Am realizat o cercetare cantitativă cu părinții și copiii lor de la o școală gimnazială din București cu privire la modul în care restricțiile pandemice au dus la schimbarea obiceiurilor. Metodele de cercetare au fost online, folosind chestionare aplicate prin intermediul formularelor Google. Nu s-au putut aplica metode de eșantionare și 40% dintre ei au răspuns în pereche (părinte-copil).

Rezultate. Rezultatele au arătat că efectele școlii online nu se referă doar la eficiența învățării, sănătatea și dezvoltarea copiilor fiind expuse riscului datorită creșterii timpului petrecut cu folosirea internetului. A crescut incidența problemelor precum sedentarismul, obezitatea, vederea sau postura și problemele coloanei vertebrale, ele fiind dublate de probleme psihice și mentale: stres, izolare, anxietate, depresie, lipsa de atenție și concentrare și de creșterea numărului de copii expuși la cyberbullying și alte riscuri online.

Concluzii. Analiza a arătat că există diferențe între percepțiile părinților și ale copiilor cu privire la efectele colaterale ale pandemiei, atât la nivel fizic, cât și psihic, mental pentru copii.

INTRODUCERE

Încă dinainte de declanșarea crizei sanitare datorate COVID-19 putem afirma că nivelul de sănătate al copiilor din România se plasa la un nivel mediu, cele mai vulnerabile aspecte fiind legate de sănătatea fiziologică a lor, și avem în vedere aici cu precădere probleme derivate din activitatea fizică scăzută, obezitatea, diabetul, ca și o serie de boli cronice (cum ar fi viciile de refracție).

Înainte de anul 2020 liniile directoare și cerințele OMS stipulau faptul că în medie copiii trebuie să facă minim 60 de minute efort fizic de intensitate moderată sau intensă în fiecare zi (1). Care era însă situația în România? Datele "Eurobarometru-lui special pentru activitate fizică" (2) indicau faptul că în urmă cu trei ani, copiii din țara noastră în vârstă de 11-15 ani făceau mai puțină activitate fizică decât media celor din Uniunea Europeană. Astfel, în 2018, procentul copiilor de 11-15 ani care au raportat participarea la activități fizice în conformitate cu recomandările OMS, era relativ scăzut, mai exact 17,8% dintre băieți și 10,4% dintre fete (3). Pentru același an calendaristic media europeană indica faptul că 23% din băieții și 16% din fetele de 11-15 ani îndeplineau recomandările OMS pentru activitatea fizică (3).

În România incidența diabetului la copii (la 100.000 locuitori) a fost plasată pe un trend ascendent înainte de pandemia COVID-19. Evoluția ratelor de incidență a diabetului a fost următoarea: 7,7 la copiii 0-14 ani în 2006; 7,9 la copiii din grupa de vârstă 0-14 ani în 2009, și 13,3 la copiii 0-14 ani, în anul 2015 (4).

Conform datelor statistice anterioare pandemiei COVID-19 ratele excesului de greutate ale adolescenților din România au fost mai scăzute decât media UE, dar s-au dublat în ultimii ani, crescând de la 7% în 2005-2006 la 16% în 2013-2014 (5). În ceea ce privește diferențele dintre mediile de rezidență, același raport indica faptul că în cazul mediului rural, la fete a fost mai mare dizarmonia prin plus de greutate, iar la băieți a predominat dizarmonia prin minus de greutate. În cazul copiilor din mediul urban însă dezvoltarea dizarmonică prin surplus de greutate a fost mai mare decât cea prin minus de greutate indiferent de genul copiilor (5).

Din perspectiva bolilor cronice 9,2% dintre elevi declarau în anul 2015 că suferă de o boală cronică pentru care aveau un diagnostic medical (6). Conform Studiului HSBC 2014/2015 (6) nu au existat

diferențe semnificative între diferite categorii de vârstă, 9,3% copii de 11 ani declarând că au boli cronice, 7,7% dintre cei de 13 ani afirmând acest lucru și 10,5% copii de 15 ani declarând aceasta. Nici între genuri nu au putut fi observate diferențe semnificative între fete și băieți pentru aceste boli cronice, incidența fiind de 8,4% pentru băieți și de 9,9% la fete) (6).

Distribuția bolilor la copiii din mediul rural versus cei din mediul urban a fost relativ similară. Astfel, pentru perioada 2015-2016 viciile de refracție - 23,7%, urmate de obezitatea de cauză neendocrină - 10,1% și deformările câștigate ale coloanei vertebrale - 8,8% au fost cele mai frecvente boli în rândul copiilor din mediul urban, în timp ce în mediul rural acestea au fost: viciile de refracție - 11,7%, obezitatea neendocrină - 10,1% și hipotrofia ponderală - 8,4% (5).

Din perspectiva problemelor legate de sănătate mentală, în anii 2018-2019 conform Raportului național „Evaluarea nivelului de dezvoltare fizică și a stării de sănătate pe baza examenelor medicale de bilanț la copiii și tinerii din colectivitățile școlare din mediul urban și rural - an școlar 2018-2019” (7) prevalența incidenței la 100.000 de locuitori pentru tulburările mentale și de comportament era de 323,0 (0-4 ani), 784,2 (5-9 ani) și 745,0 (10-14 ani). În același timp, pentru copiii dispensarizați în cabinetele medicale școlare în anul școlar 2018-2019, prevalența tulburărilor de adaptare școlară a fost de 0,36%, tulburările nevrotice au avut o incidență de 0,43%, retardul psihic și intelectual a avut o prevalență de 0,46%, iar tulburările de vorbire de 0,59% (7).

În ceea ce privește depresia, prevalența acestei afecțiuni a fost redusă în anul 2019 pentru copiii de 5-14 ani - numai 355,15 cazuri la 100.000 locuitori (8). Și mai redusă a fost incidența altor afecțiuni (identificate ca parte integrantă a DALY - „Disability Adjusted Life Years”): anxietatea (cu o incidență de 237 la 100.000 de copii) și migrena (cu o incidență de 207 la 100.000 de copii) (9).

După un an și jumătate problemele de sănătate ale copiilor asociate pandemiei COVID-19 au devenit evidente. Astfel, la Conferința Internațională de Tulburări Alimentare care a avut loc în iunie 2021 la Roma (Italia) specialiștii au atras atenția că emoțiile negative asociate restricțiilor au dus la explozia cazurilor de tulburări alimentare în rândul copiilor și adolescenților în întreaga lume (10).

Articolul de față caută să prezinte modul în care copiii și părinții de la o școală din București percep modul în care restricțiile pandemice au dus la schimbarea obiceiurilor lor cotidiene și efectele pe care pandemia COVID-19 le-a avut asupra sănătății lor fizice și mentale.

MATERIAL ȘI METODE

Cercetarea în școala gimnazială din București s-a desfășurat după încheierea semestrului I al anului școlar 2020-2021 (perioada 8-15 februarie, 2021). Eșantionul a fost compus din 83 părinți și 53 de elevi de gimnaziu (clasele 5-8). Structura eșantionului este prezentată în tabelul 1.

Tabel 1. Structura eșantionului – părinți și copii.

Părinți	Elevi
83 răspunsuri – aprox. 30% părinți	53 răspunsuri – aprox. 20% elevi
93% respondenți – mame	56% – clasa a 5-a
70% respondenți cu vârsta între 30-45 de ani	21% – clasa a 6-a
30% respondenți cu vârsta peste 46 de ani	23% – clasa a 7-a

Metoda de cercetare a fost cantitativă – mai exact, ancheta pe bază de chestionar. Chestionarul a cuprins atât întrebări închise cât și deschise. Datorită restricțiilor în vigoare în România, adunarea datelor a fost realizată online, chestionarele fiind aplicate prin intermediul formularelor Google. Linkul chestionarului a fost trimis tuturor părinților cu copii cu vârsta cuprinsă între 11 și 14 ani din școală.

REZULTATE

Răspunsurile părinților au indicat faptul că marea majoritate, peste 75% dintre părinți au fost mulțumiți de modul în care școala și profesorii s-au adaptat școlii online. 64% dintre aceștia au fost de părere că timpul pentru teme este suficient pentru copiii lor, în timp ce 16% considerau că acest timp nu era suficient. Jumătate dintre părinți (50%) au declarat că își ajută des și foarte des copiii la teme, în timp ce 22% nu i-au ajutat aproape deloc cu temele. În același timp răspunsurile au indicat o raportare contradictorie la tehnologie. Astfel, deși 80% dintre părinți au apreciat că în această perioadă copilul lor exagerează cu tehnologia și 77% au spus că fiul sau fiica lor se joacă jocuri care implică tehnologia, mai mult de jumătate dintre ei (mai exact 44%) au declarat că acest consum nu este mai mare decât în trecut în ceea ce privește televizorul („copilul NU se uită prea mult la TV, desene animate, filme”).

În ceea ce privește rutina cotidiană, 85% dintre părinți au declarat că aceasta este respectată de către copiii lor. Deși 89% dintre părinți au spus că

dieta copiilor lor este echilibrată, 63% dintre respondenții părinți au recunoscut că aceștia mănâncă mai multe „gustărele” decât de obicei și 85% dintre ei au recunoscut că exercițiile fizice făcute de copiii lor nu sunt suficiente.

Din perspectiva stării emoționale a copiilor lor imaginea oferită de părinți indică faptul că 47% dintre aceștia declară că fiul sau fiica lor se plânge mai des decât de obicei, 68 % consideră că starea de nervozitate a copiilor lor este mai mare și 62% au declarat că fiul sau fiica lor se simt mai triști decât anterior declanșării pandemiei COVID-19.

Dacă părinții au oferit această perspectivă asupra efectelor pandemiei COVID-19 asupra rutinelor cotidiene a copiilor lor rezultatele ne-au indicat și perspectiva copiilor asupra acestei perioade. Astfel, conform declarațiilor copiilor ierarhia aspectelor care au „lipsit” din viața lor de zi cu zi a cuprins socializarea în grupurile primare (colegii, profesorii), ieșirile în afara casei (în natură, cu prietenii sau părinții, excursii, tabere), activitățile sportive și educaționale extra-școlare (tab. 2).

Activitățile în afara casei anterior menționate au fost înlocuite de copii cu interacțiunile virtuale, realizate pe internet. Astfel, copiii au jucat mai multe jocuri online în grupurile de prieteni și de colegi, s-au întâlnit cu aceștia online, au vizionat mai multe filme, sau au făcut sport în casă (tab. 3).

Această deplasare a copiilor de la o viață activă offline la una dependentă de mediul online a condus la o serie de efecte pe care aceștia le-au experimentat. Conform cu răspunsurile înregistrate, 55% dintre copii au declarat că au avut dureri de

cap datorită timpului petrecut online, 45% au indicat existența unor probleme cu spatele, 43% au spus că au probleme cu vederea. 36% au indicat

stările de nervozitate ca efect, 30% au afirmat că au probleme cu somnul și 22% au reclamat dificultăți de concentrare și de atenție.

Tabelul 2. Ce le-a lipsit copiilor în această perioadă.

	Procent (%)
Întâlnirile cu colegii, la școală	83
Ieșirile afară în natură	53
Ieșirile în oraș cu prietenii, părinții	47
Excursiile, taberele	43
Interacțiunea cu profesorii	34
Activitățile sportive extra-școlare	21
Activitățile educaționale extra-școlare	11

Tabelul 3. Cu ce au înlocuit copiii activitățile care le-au lipsit.

	Procent (%)
Am jucat jocuri online cu colegii	62
Am stat mai mult pe internet	40
Întâlniri online cu prietenii	38
M-am uitat mai mult la filme	34
Am citit mai mult	15
Am făcut sport în casă	9

DISCUȚII

Ce efecte a avut pandemia COVID-19 la nivelul copiilor, conform percepției lor și opiniilor părinților?

Rezultatele anchetei realizate cu părinții și copiii indică existența unor puncte de schimbare. Acestea se referă la timpul petrecut online, modalitatea de predare și învățare, socializarea în grupurile primare și/sau secundare și riscurile legate de sănătatea fizică și psihologică a copiilor.

În afara timpului petrecut online pentru școală, din lipsa posibilităților de a face alte activități, o mare parte dintre copii au prelungit timpul pe internet, utilizându-l pentru joacă, comunicare, informare. Totodată, copiii au făcut și activități cu părinții și mai rar au jucat jocuri care să nu

implice tehnologia. Întâlnirile online cu colegii, au înlocuit cu succes întâlnirile fizice, față – în – față, dar au existat și situații în care a crescut cyberbulgingul sau conflictele online.

Din perspectiva riscurilor legate de sănătatea fizică datele indică faptul că lipsa de mișcare, de activitate fizică afectează negativ copiii. Sedentarismul, problemele de vedere, de postură, pe care le resimt copiii constituie un semnal de alarmă legat de starea lor de sănătate. În ceea ce privește riscurile legate de sănătatea psihică putem spune că stresul datorat limitărilor și schimbărilor impuse de pandemia COVID-19 a condus la efecte negative în cazul copiilor. Singurătatea, nervozitatea, anxietatea, chiar depresia au fost realități cu care copiii s-au confruntat în această perioadă, așa cum demonstrează și datele înregistrate.

CONCLUZII

1. Rezultatele cercetării noastre au indicat faptul că efectele pandemiei, schimbările și stresul generat tuturor sunt o realitate și pot fi comparate în ceea ce privește copiii, cu trecerea prin evenimente traumatice majore

provocate de cataclisme naturale. Afectările de ordin fizic și psihologic se manifestă diferit pentru fiecare și de aceea este important să privim fiecare situație în parte și să le dăm copiilor oportunitatea de a se exprima.

2. Totodată, asigurarea unui cadru de siguranță fizică și psihică în toate contextele, oferirea de oportunități pentru a face mișcare și a ieși în natură sunt prioritățile tuturor, familiei și școlii deopotrivă, pentru asigurarea unui climat pozitiv pentru dezvoltarea mentală și fizică a copiilor.
3. Deși această cercetare are o serie de limite, fiind derulată cu perechi de părinți și copiii lor doar într-o școală și astfel lipsită de reprezentativitate statistică, rezultatele ei sunt importante pentru toți cei interesați de efectele școlii online în perioada pandemiei. Mai mult decât pierderile din perspectivă curriculară și rămănerile în urmă la învățatură anticipate de profesioniștii în educație, emerg o serie de efecte negative asupra dezvoltării sănătoase, din punct de vedere fizic și psihic a copiilor, de care trebuie ținut cont în luarea deciziilor viitoare.
4. Se constată că există mici diferențe între opiniile părinților și copiilor vizavi de efectele asupra obiceiurilor zilnice, dar unanimitate vizavi de afectările ce apar la nivel fizic – probleme legate de sedentarism, lipsa activităților în aer liber, afectarea posturii, a coloanei vertebrale, a ochilor și vederii, dureri de cap – dar și la nivel psihic – generate de stres, frica de îmbolnăvire, lipsa interacțiunii cu colegii și expunerea prelungită la ecrane și internet.
5. Profesioniștii din educație, cei responsabili de luarea deciziilor vizavi de protecția față de riscurile pandemiei, trebuie să țină cont de toate acestea și să echilibreze măsurile luate, astfel încât acestea să nu aibă un impact negativ cu consecințe pe termen lung asupra tinerei generații.

CONFLICT DE INTERESE

Autorii declară că nu există conflict de interese.

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UTILIZAREA BIOMASEI DIN STREPTOMICETE CA STIMULATOR AL UNOR INDICI SANGUINI LA TINERETUL AVICOL

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THE USE OF BIOMASS OF STREPTOMYCETES AS A STIMULATOR OF SOME BODY INDICES OF CHICKENS

Introduction. Currently, various biologically active substances, preferably of biological and not synthetic origin, with having a growth stimulating effect, are frequently used as food additives in the poultry industry. Some of these substances with a stimulating effect on the growth of chickens are represented by the biomass obtained from apathogenic strains of Streptomyces.

Material and methods. The investigations were conducted within the ILR "Avicola Sărătenii-Vechi" v. Sărătenii Vechi, Telenești district. The biological material was one-day-old Adler's silver chickens. The research was carried out on 150 chickens (one control and two experimental), which were randomly distributed in three groups of 50 chickens in each.

Results. The dynamics of body weight was higher in the experimental group of chickens which, received biomass of Streptomyces, indicating that the chickens in experimental group II recorded a 5.1% increase in body weight compared to chickens from the control group. The analysis of blood indices showed a slight increase of the number of lymphocytes and eosinophils, from 4 to 9% in experimental group II.

Conclusions. The use of biomass of Streptomyces in feeding the experimental group of chickens demonstrated an increase of body weight with 5.1% compared to the chickens from the control group. The biomass of Streptomyces stimulated an increase of the number of lymphocytes and eosinophils in chickens from the experimental group II, thus demonstrating an immunostimulatory effect.

Cuvinte cheie: pui, biomasa de Streptomicete, masa corporală, rezistență.

Întroducere. În industria avicolă sunt utilizate frecvent, ca aditivi furajeri, diferite substanțe biologice active, cu efect stimulator, de creștere, cu predilecție de origine biologică și nu de ordin sintetic. Unele dintre aceste substanțe, cu efect stimulator de creștere a tineretului avicol, sunt reprezentate de biomasa obținută din Streptomicete apatogene.

Material și metode. Investigațiile au fost organizate în cadrul SRL „Avicola Sărătenii-Vechi” s. Sărătenii Vechi, r-nul Telenești. Materialul biologic a fost reprezentat de puii de rasa Argintie de Adler, în vârstă de o zi. Cercetările au fost realizate pe trei loturi a câte 50 de pui, distribuiți aleatoriu (unul martor și două experimentale).

Rezultate. Analiza dinamicii greutatei corporale a demonstrat faptul că puii din lotul experimental II, cărora li s-a administrat biomasa de streptomicete, au înregistrat o creștere de 5,1 % în greutatea corporală, comparativ cu puii din lotul martor. Analiza sângelui a demonstrat o creștere ușoară a numărului de limfocite și eozinofile cu 4-9%, la lotul II experimental.

Concluzii. Utilizarea biomasei de Streptomicete în rația tineretului avicol a influențat pozitiv indicii de masă corporală, puii din lotul experimental înregistrând o creștere în greutatea corporală de 5,1%, comparativ cu lotul martor.

INTRODUCERE

Anual, în lume, cerințele consumatorilor pentru valoarea biologică și siguranța produselor din avicultură, precum și calitățile gustative ale acestora, sunt în creștere. O alimentație sănătoasă a omului este imposibilă fără hrănirea rațională a păsărilor agricole (1). Creșterea cerințelor consumatorilor pentru calitatea produselor animaliere, precum și pentru proprietățile gustative ale acestora, a condus la interzicerea utilizării stimulentelelor de creștere și a antibioticelor în alimentația păsărilor agricole în țările europene, iar acest lucru, la rândul său, a condus la căutarea de noi substanțe biologice active, capabile să sporească sănătatea și productivitatea păsărilor, pentru ca în final să se obțină produse de o calitate înaltă (2). Preparatele de origine microbiologică, sunt cele mai promițătoare în această direcție, datorită disponibilității lor, a absenței efectelor secundare nedorite, a unei game largi de efecte terapeutice și a lipsei dezvoltării rezistenței acestora la microorganismele. Unul dintre aceste preparate, cu efect stimulator de creștere, este reprezentat de biomasa obținută din *Streptomicete* apatogene (3 - 5). Produsul de sinteză microbiană a *Streptomicetelor* este utilizat sub formă de preparat complex, care suplinește rețeta de nutriție, ceea ce duce la optimizarea metabolismului, fortificarea sistemului imun și la creșterea productivității (6 - 9). Pe lângă valoarea nutritivă, aceasta posedă și activitate antimicrobiană și imunomodulatoare, care favorizează digestia furajelor și inhibă dezvoltarea microflorei patogene în intestine. Scopul cercetărilor propuse constă în studierea

influenței biomasei de *Streptomicete*, administrată în rețetele de nutriție, asupra creșterii și dezvoltării tineretului avicol, precum și asupra unor indici sanguini ai puilor.

MATERIAL ȘI METODE

Pentru realizarea scopului investigațiilor efectuate, în cadrul SRL „Avicola Sărătenii-Vechi” s. Sărătenii Vechi, r-ul Telenești a fost organizat un experiment asupra puilor de găină de rasa Argintie de Adler. Din puii, în vârstă de o zi, prin eșantionare aleatorie au fost formate trei loturi de pui, a câte 50 de pui în fiecare, dintre care, un lot martor și două loturi experimentale, care ulterior au fost incluse în cercetare. Metodele de lucru utilizate au fost cele înscrise în literatura de specialitate. Durata investigațiilor a fost de 7 săptămâni. Cântăririle de control s-au efectuat la vârsta de 15, 30 și 49 de zile, zilnic ducându-se evidența furajului consumat. La finele experimentului au fost prelevate probe de sânge pentru efectuarea analizelor propuse. Datele experimentale obținute, în urma cercetărilor efectuate, au fost prelucrate prin utilizarea testului statistic Student.

Schema efectuării investigațiilor este redată în tabelul 1.

Nutrețul combinat administrat puilor din experiment asigură necesarul acestora în energie, proteină și restul nutrienților, corespunzător vârstei.

Structura rețetelor administrate puilor din experiment sunt prezentate în tabelul 2.

Tabelul 1. Schema experimentului.

Loturile	Materialul biologic	Cap.	Caracterul alimentației
Martor	tineret avicol de 1 zi	50	Nutreț combinat (NC)
Experimental I	tineret avicol de 1 zi.	50	NC + 0,05% biomasă de streptomicete
Experimental II	tineret avicol de 1 zi.	50	NC + 0,1% biomasă de streptomicete

Pe parcursul investigațiilor s-au determinat:

- indicii de creștere a tineretului de găină pe parcursul investigațiilor (greutatea corporală, sporul mediu zilnic și consumul specific);
- indicii biochimici ai sângelui;
- indicii morfologici ai sângelui.

Pentru puii din experiment s-au creat condiții identice de întreținere, în baterii cu cuști, cu respectarea condițiilor igienice și de microclimat, în conformitate cu normelor prevăzute pentru categoriile de vârstă, enunțate anterior.

REZULTATE

Indicii care reflectă performanțele de creștere a puilor de găină sunt greutatea corporală și sporul mediu zilnic. Un indice important, care determină eficiența creșterii puilor de găină, este consumul specific, care de asemenea a fost stabilit în cercetările efectuate.

Rezultatele evoluției greutății corporale, a sporului mediu zilnic și a consumului specific sunt prezentate în tabelul 3.

Tabelul 2. Structura și valoarea nutritivă a rețetelor de nutreț combinat utilizate în experiment.

Specificare	Cota de includere, %	
	vârsta 0-21 zile	vârsta 22-49 zile
Porumb	54,1	50,5
Grâu	11,0	18,5
Șrot soia	28,1	24,0
Făină de pește	3,0	3,0
Ulei	1,0	1,0
Premix	1,0	1,0
Monocalciu Fosfat	1,8	2,0
TOTAL	100	100
EM, kcal/kg furaj	2850	2688
PB, %	21,9	19,4
Celuloză, %	3,1	3,3

Tabelul 3. Evoluția indicatorilor de creștere a puilor din experiment.

Loturile	Greutatea corporală la vârsta 49 zile		Sporul zilnic, g	Consumul specific, kg
	g	%		
Martor	514,0±6,1	100	9,5	4,3
Experimental I	497,5±6,4	96,8	9,1	4,5
Experimental II	540,0±5,8**	105,1	10,0	3,9

** B = 0,99

Datele prezentate în tabel ne indică faptul că, puii din lotul experimental II au înregistrat o creștere în greutatea corporală cu 5,1% mai mare, decât cea a puilor din lotul martor.

Sporul mediu zilnic de asemenea a înregistrat valori mai mari în lotul experimental II și a fost cu 5,2% mai mare, comparativ cu puii din lotul martor.

Indicele consumului specific a înregistrat valori mai mici în lotul experimental II, fapt ce indică un consum mai eficient a furajului și a fost mai mic cu 9,9%, comparativ cu puii din lotul martor.

Pentru controlul stării fiziologice a puilor din experiment au fost prelevate probe de sânge, cu scopul stabilirii unor indici biochimici ai acestuia. Rezultatele investigațiilor sunt prezentate în tabelul 4.

Tabelul 4. Indicii biochimici a sângelui prelevat de la puii din experiment.

Lotul	Indicii			
	Proteină total, g/l	Albumină, g/l	Hemoglobină, g/l	Colesterol, mg/100 ml
Martor	31,9±0,84	14,0±0,13	79,3±3,19	6,9±0,16
Experimental I	32,0±1,21	14,9±0,42	80,2±6,21	7,2±0,61
Experimental II	32,3±0,96	15,2±0,28	82,4±2,24	6,9±0,29

Conform datelor prezentate în tabel putem menționa că, loturile din experiment nu au prezentat diferențe semnificative în ceea ce privește conținutul de proteină, albumină și hemoglobină din serul sanguin. De asemenea, nu am găsit niciun efect al biomasei de Streptomicete asupra conținutului de colesterol. În serul sanguin al puilor, din toate loturile din experiment, acesta a fluctuat diferit și în limite nesemnificative.

Totodată, au fost preluate probe de sânge cu scopul studierii indicilor hematologici ai formulei leucocitare, care este esențială în argumentarea stării de reactivitate imunologică și de rezistență a organismului la acțiunea diferitor contaminanți biologici. Rezultatele obținute sunt prezentate în tabelul 5.

Tabelul 5. Formula leucocitară a probelor de sânge prelevate de la puii din experiment

Lotul	Formula leucocitară, %				
	Neutrofile segmentate	Limfocite	Eozinofile	Bazofile	Monocite
Martor	25,00±3,21	66,67±1,45	2,80±1,11	0,33±0,33	4,67±2,67
Experimental I	29,75±3,50	49,25±5,15	7,50±0,96	0,75±0,25	12,75±2,06
Experimental II	31,33±1,86	53,00±1,00	6,00±0,58	0,33±0,33	9,33±1,20

Analiza indicilor sanguini prezentați în tabel a demonstrat o creștere ușoară a numărului de limfocite și eozinofile cu 4-9% la lotul experimental II, puii care au primit în nutrețul combinat biomasa de Streptomicete, fapt ce denotă o acțiune imunostimulatoare asupra organismului puilor.

DISCUȚII

Posibilitatea îmbunătățirii cantitative și calitative a produselor avicole, prin intervenție nutrițională, aduce în atenția nutriționiștilor un nou termen și anume nutriția funcțională, utilizarea furajelor cu adaos de substanțe biologice active, care contribuie la valorificarea superioară a

acestora, buna funcționare a organismului și sănătatea acestuia.

În acest context, rezultatele obținute în urma cercetărilor efectuate au demonstrat că, utilizarea biomasei de Streptomicete, în calitate de preparat furnizor de substanțe biologice active, a influențat pozitiv indicii de creștere a puilor de găină.

Concomitent cu aceasta, valorile indicilor biochimici și morfologici analizați, în probele de sânge prelevate de la puii din experiment, au demonstrat o stare fiziologică mai bună a puilor din lotul experimental, cărora li sa administrat biomasa de streptomicete în proporție de 0,1%.

CONCLUZII

1. Administrarea de biomasă din streptomicete în proporție de 0,1% în nutrețul combinat, destinat alimentației puilor de găină, a contribuit la obținerea unui spor în greutate de 5,1% și a unui spor mediu zilnic de 5,2%, concomitent cu micșorarea de 9,9% a consumului specific.
2. În urma analizelor biochimice efectuate la probele de ser sangvin, obținut din probele de sânge, prelevate de la puii din experiment, nu au fost stabilite diferențe semnificative în ceea ce privește conținutul de proteină, albumină, hemoglobină și colesterol.
3. Analizele morfologice a probelor de sânge, prelevate de la puii din experiment, au demonstrat o creștere ușoară a numărului de limfocite și eozinofile (cu 4 și 9% respectiv) în lotul pui care a primit în nutrețul combinat biomasa de Streptomicete în proporție de 0,1%, fapt ce denotă o acțiune imunostimulatoare asupra organismului puilor.

CONFLICT DE INTERESE

Nu exista conflicte de interes.

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**EVENTS/ANNIVERSARIES – EVENIMENTE/ANIVERSĂRI –
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VITATEA DOAMNEI ANA VOLNEANSCHI**

*Cel care-i chemat să realizeze lucruri mari
într-un anumit domeniu știe aceasta, în
chip tainic înlăuntrul său, încă din tinerețe,
și își îndreaptă activitatea într-acolo, ca
albinele la clădirea stupului lor.*

Schopenhauer, Aphor, 5,48

Dna Ana Volneanschi s-a născut în satul Hancăuți, raionul Edineț. Studiile primare le-a făcut în școala din satul natal, apoi a studiat la școala nr. 1 din Chișinău. Studiile superioare le-a făcut la Facultatea Igienă și Sanitarie a Institutului de Stat de Medicină din or. Chișinău, pe care le-a absolvit cu mențiune. După absolvirea facultății a fost angajată la Institutul de Cercetări Științifice în Igienă și Epidemiologie, or. Chișinău, în funcția de cercetător științific inferior, apoi, în perioada anilor 1976-1979, și-a făcut studiile postuniversitare prin doctorat, specialitatea Igienă. A susținut teza de doctor în științe medicale la specialitatea Igienă, obținând gradul științific de doctor în științe. Deține titlul științific de conferențiar cercetător și categoria superioară de calificare la specialitatea 331.02. Igienă.

Doamna Ana Volneanschi este un specialist de înaltă calificare, cu cunoștințe vaste din diferite domenii – igienă, toxicologie, genetică, imunologie, cu spirit de responsabilitate, inițiativă și aptitudini de manager. Pe parcursul anilor a activat în calitate de cercetător științific și șef laborator în instituțiile de cercetări științifice (1972-1995 - Institutul de Cercetări Științifice în Igienă și Epidemiologie și Institutul de Cercetări în Medicina Preventivă și Clinică), șefă a secției Știința și secretar științific (1995-2001), vicedirector, medic-șef adjunct sanitar de stat al RM (2001-2003), director general al Centrului Național Științifico-Practic de Medicină Preventivă și medic - șef adjunct sanitar de stat al RM (2003), vicedirector, medic-șef adjunct sanitar de stat al RM (2003-2010) și secretar științific (2010 – până prezent) al ANSP.

Activitatea rodnică și rezultatele de performanță în domeniul sănătății publice au fost apreciate cu distincțiile de stat: titlul onorific "Om Emerit" (1998) și medalia "Meritul Civic" (2020), Diplome de gradul I (2016) și 2 (2008) a Guvernului RM, multiple diplome ale Ministerului Sănătății, Medalia 70 ani a Academiei de Științe a Moldovei (2016), diplome ale Academiei de Științe a Moldovei (2012, 2020), diploma Ministerului Educației, Culturii și Cercetării (2020), multiple diplome și 2 medalii (2011, 2020) a instituției, în care activează.

Este lider la capitolul asigurării bunăstării sănătății populației, pledând pentru perfecționarea suportului legislativ și normativ în domeniul sănătății publice și armonizarea lui la rigurile Uniunii Europene.

Mulți ani prosperi, Doamna Ana VOLNEANSCHI!

Cu profund și deosebit respect, consiliul de
redacție al Revistei *One Health & Risk Management*

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The manuscript should comprise the following sub-headings (capitalized):

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The summary should not include tables, charts, and bibliographic notes; information not included in the article.

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În rezumat nu vor fi incluse tabele, grafice și note bibliografice; informații care nu sunt prezentate în studiu.

Figuri. Textul inclus în figuri trebuie să fie scris cu font Cambria, dimensiune 10 puncte. Fiecare figură trebuie să fie însoțită de titlu și legendă. Ele vor fi numerotate cu cifre arabe și vor fi menționate în text în paranteze (ex: fig. 1). Titlul (ex: Figura 1) și legenda figurii trebuie să fie scrisă centrat, sub figură.

Tabele. Textul inclus în tabele trebuie să fie scris cu font Cambria, dimensiune 10 puncte. Fiecare tabel trebuie să fie însoțită de titlu. Tabelele vor fi inserate în text, fără a depăși lățimea unei pagini. Ele vor fi numerotate cu cifre arabe și vor fi menționate în text în paranteze (ex: tab. 1). Titlul tabelului va fi poziționat deasupra tabelului centrat (ex: Tabelul 1).

Referințele trebuie să fie numerotate în ordinea apariției în text. Citarea sursei de referință va fi conform stilului *AMA*, plasată la sfârșitul articolului și va include doar referințele citate în text (menționând numărul de referință în paranteză rotundă). Dacă aceeași referință este citată de mai multe ori, ea va fi trecută în text cu același număr ca la prima citare. Numărul total de referințe nu va depăși 50 de surse. Acuratețea datelor ține de responsabilitatea autorului.

Pentru mai multe informații consultați: http://journal.ohrm.bba.md/index.php/journal-ohrm-bba-md/editing_guidelines

EXIGENCES POUR LES AUTEURS

Normes de rédaction

La préparation des manuscrits (rédigés en roumain, anglais, français et russe) sera conforme aux instructions publiées dans *Uniform Requirements for Manuscripts Submitted to Biomedical Journals (1994) Lancet 1996, 348, V2 ; 1-4* (www.icmje.org). Les manuscrits doivent être en police Cambria, taille 11 points, espacés à l'intervalle 1,0, alignement justifié, champs 2 cm de tous les côtés. Toutes les pages doivent être numérotées consécutivement (dans le coin inférieur droit) et inclure une numérotation continue des pages. Les abréviations doivent être expliquées lors de la première apparition dans le texte et ne doivent pas être utilisées de manière excessive. Les manuscrits ne doivent pas dépasser (sans mentionner le titre, l'affiliation, le résumé et la bibliographie) le volume suivant: pour articles de synthèse/rapports – 4500 mots; pour les articles de recherche – 3000 mots; pour les opinions d'experts – 2500 mots; présentation de cas et photos de la pratique clinique/de laboratoire – 1700 mots; notes expérimentales et cliniques – 1300 mots; commentaires et présentations de livres – 2000 mots; articles pédagogiques – 4000 mots. Le volume des tableaux et des figures ne doit pas dépasser $\frac{1}{3}$ du volume du manuscrit. La revue se réserve le droit d'apporter toute autre modification de formatage. Les manuscrits rejetés ne sont pas retournés.

Tous les manuscrits à publier doivent être accompagnés par deux résumés: dans la langue originale et en anglais.

Titre et auteurs

Le titre doit être le plus court que possible (maximum – 120 signes avec espaces), éloquent pour le contenu du manuscrit. Les noms des auteurs seront écrits complets: prénom, nom (*ex: Albert LEBRUN*). Quant à l'affiliation, on devra indiquer: Section/ Département/Chaire, Université/Hôpital, Ville, Pays – pour chaque auteur. Les données de l'auteur correspondant et les coordonnées – adresse e-mail (*ex: auteur correspondant: Albert Lebrun, e-mail: albert.lebrun@gmail.com*) seront obligatoires ci-dessous.

Structure du manuscrit

Le manuscrit comprendra les sous-titres suivants (avec lettres majuscules):

- **RÉSUMÉ** (voir les exigences ci-dessous)
- **INTRODUCTION** (reflétera l'actualité et la présentation générale du problème étudié, le but et l'hypothèse de l'étude)
- **METHODES**
- **RESULTATS**
- **DISCUSSIONS**
- **CONCLUSIONS**

- **CONFLIT D'INTERETS**
- **REMERCIEMENTS ET FINANCEMENT**
- **APPROBATION ÉTHIQUE** (préciser la présence ou l'absence d'avis favorable du comité d'éthique: no, date, institution et consentement éclairé)
- **REFERENCES**

Le **résumé** contiendra 1600 signes avec espaces:

- **Introduction**
- **Méthodes**
- **Résultats**
- **Conclusions**
- **Mots clés:** 3-5mots.

Le résumé ne comprendra pas des tableaux, graphiques et des notes bibliographiques; des informations non présentées dans l'étude.

Figures. Le texte inclus dans les figures doit être écrit avec police Cambria, taille 10 points. Chaque figure doit être accompagné par un titre et une légende. Ceux-ci seront numérotés avec des chiffres arabes et mentionnés dans le texte entre parenthèses (*ex: fig. 1*). Le titre (*ex: Figure 1*) et la légende de la figure doivent être centrés, au-dessous de la figure.

Tableaux. Le texte inclus dans les tableaux doit être écrit avec police Cambria, taille 10 points. Chaque tableau doit être accompagné par un titre. Les tableaux seront numérotés avec des chiffres arabes, mentionnés dans le texte entre parenthèses (*ex: tab. 1*), et seront insérés dans le texte, sans dépasser la largeur d'une page. Le titre du tableau sera placé au-dessus du tableau, centré (*ex: Tableau 1*).

Les **références** doivent être numérotées dans l'ordre où elles apparaissent dans le texte. La citation de la source de référence sera de style *AMA*, placée à la fin de l'article et n'inclura que des références citées dans le texte (mentionnant le numéro de référence entre parenthèses rondes). Si la même référence est citée plusieurs fois, elle sera transmise dans le texte avec le même numéro que celui de la première citation. Le nombre total de références ne dépassera pas 50 sources. La responsabilité pour l'exactitude des données est à la charge de l'auteur. Il faut indiquer dans le manuscrit seulement les références vraiment consultées par les auteurs. Les composants des sources de référence doivent être rédigés strictement selon les exigences.

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ТРЕБОВАНИЯ ДЛЯ АВТОРОВ

Правила составления

Подготовка рукописи (разработанной на румынском, английском, французском и русском языках) будет осуществляться в соответствии с инструкциями, опубликованными в: *Uniform Requirements for Manuscripts Submitted to Biomedical Journals (1994) Lancet 1996, 348, V2; 1-4* (www.icmje.org). Авторы должны использовать шрифт Cambria, размер 11 точек, с интервалом 1,0, выравнивание по ширине, поля 2 см со всех сторон. Все страницы должны быть пронумерованы последовательно (в правом нижнем углу) и включать непрерывную нумерацию страниц. Сокращения должны быть объяснены при первом появлении в тексте и не должны использоваться чрезмерно. Объем рукописей не должен превышать (без названия, принадлежности, резюме и литературы): для обзорных статей/рефератов – 4500 слов; для научных статей – 3000 слов; для экспертных заключений – 2500 слов; для презентации случаев из клинической/лабораторной практики – 1700 слов; для экспериментальных и клинических заметок – 1300 слов; для рецензий и презентаций книг – 2000 слов; для учебных статей – 4000 слов. Объем таблиц и рисунков не должен превышать 1/3 от объема рукописи. Журнал оставляет за собой право вносить любые другие изменения форматирования. Отклоненные рукописи не возвращаются.

Все рукописи, представленные для публикации, должны сопровождаться двумя резюме: на языке оригинала статьи и на английском языке.

Название и авторы

Название должно быть как можно короче (максимум – 120 знаков с пробелами), но достаточно информативным для содержания рукописи. Фамилии авторов будут написаны полностью: имя, фамилия (*например*: Иван ИВАНОВ). Принадлежность будет включать: Отделение/ Департамент/Кафедра, Университет /Больница, Город, Страна для каждого автора. Данные соответствующего автора и контактная информация – адрес электронной почты (*например*: контактная информация: Иван Иванов. e-mail: ivan.ivanov@gmail.com) будут обязательно ниже.

Структура Рукописи

Рукопись будет включать в себя следующие подзаголовки (они должны быть заглавными):

- **РЕЗЮМЕ** (см. требования ниже)
- **ВВЕДЕНИЕ** (будет отражать актуальность и общее представление изучаемой проблемы, цель и гипотезу исследования)
- **МАТЕРИАЛЫ И МЕТОДЫ**
- **РЕЗУЛЬТАТЫ**
- **ДИСКУССИИ**

- **ВЫВОДЫ**
- **КОНФЛИКТ ИНТЕРЕСОВ**
- **БЛАГОДАРНОСТИ И ФИНАНСИРОВАНИЕ**
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- **ЛИТЕРАТУРА**

Резюме должно содержать 1600 знаков с пробелами и будет включать в себя следующие подзаголовки:

- **Введение**
- **Материалы и методы**
- **Результаты**
- **Выводы**
- **Ключевые слова:** 3-5 слов

Резюме не должно включать таблицы, диаграммы и библиографические заметки, информацию, не представленную в исследовании.

Рисунки (графики, диаграммы). Текст, включенный в рисунки, должен быть написан в Cambria, размер 10 пунктов. Каждый рисунок должен сопровождаться заголовком и описанием. Название (*например*: Рисунок 1) и описание рисунка должны быть вписаны по центру, в низу рисунка. Они должны быть пронумерованы арабскими цифрами и указаны в тексте в скобках (*например*: рис. 1).

Таблицы. Текст, включенный в таблицы, должен быть написан в Cambria, размер 10 пунктов. Каждая таблица должна сопровождаться заголовком. Они должны вставляться в текст, не превышая ширину страницы. Должны быть пронумерованы арабскими цифрами и указаны в тексте в скобках (*например*: таб. 1). Название таблицы должно располагаться над таблицей в центре (*например*: Таблица 1).

Литература. Источники должны быть пронумерованы в порядке их появления в тексте. Ссылки на источники должны быть в стиле АМА, помещены в конце статьи и включать только источники, цитируемые в тексте (упоминание номера источника в круглых скобках). Если один и тот же источник цитируется несколько раз, он будет передан в тексте с тем же номером, что и первый раз. Общее количество источников не должно превышать 50. Ответственность за точность данных лежит на авторе. Будут цитироваться только те источники, с которыми ознакомились авторы рукописи. Компоненты справочных источников должны быть написаны строго в соответствии с требованиями.

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Conceptul *One Health*

Sănătatea umană



OMS a definit în 1946 sănătatea ca fiind „o stare pe deplin favorabilă atât fizic, mintal cât și social, și nu doar absența bolilor sau a infirmităților”, cu o completare ulterioară „capacitatea de a duce o viață productivă social și economic”.

Sănătatea animală



OIE definește bunăstarea animalelor în 2008: un animal este în bună stare dacă este sănătos, se bucură de confort, este bine hrănit, se află în siguranță, poate să își manifeste comportamentul înăscut (natural) și nu suferă din cauza unor stări neplăcute, precum durere, frică și stres.

Sănătatea plantelor
și mediului



Sănătatea mediului se referă la acele aspecte ale sănătății umane ce includ calitatea vieții determinată de factorii fizici, biologici, socio economici și psiho sociali din mediul ambiant. Interrelațiile omului cu mediul preocupă medicina, atunci când un sistem ecologic este în stare de echilibru, prevalează starea de sănătate a populației.

La nivel global conceptul *One Health* este o strategie mondială de extindere a colaborărilor interdisciplinare și a comunicărilor în toate aspectele legate de îngrijirea sănătății oamenilor, animalelor domestice sau a faunei sălbatice, care nu mai poate fi abordată separat ci doar în comun.

One Health se referă nu numai la preocupările legate de bolile ce apar la oameni și animale, ci și la aspecte legate de stilul de viață, dietă, exercițiu, impactul diferitelor tipuri de relații om-animal și expuneri de mediu care pot afecta ambele categorii populaționale. Pentru a se atinge efectele scontate este nevoie și de o educație a populației care să conștientizeze factorii de risc și beneficiile prevenției, dar și de comunicare și înțelegere între pacienți și furnizorii de servicii de sănătate.

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