Quadrimed Crans-Montana

Crans Montana
Séminaire 30 Janvier 2025
13:45-14:35
14:50-15:40

LES MICRONUTRIMENTS (micro-aliments)

COMPLEMENTS UTILES?

POUR QUI?

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BERGER Mette M – Disclosures COI

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Stock shareholder, Bonds	none
Member of guideline groups	ESPEN ICU nutrition ESICM ICU nutrition ESPEN Micronutrients - chair

QUI PARMI VOUS PREND DES COMPLÉMENTS DE MICRONUT?
ET OMEGA3 PUFA?

Définition - utilité versus essentialité

UTILITE

- Caractère, qualité de quelque chose ou de quelqu'un qui sert à quelque chose
- Commodité, convenance

ESSENTIEL

- Ce qui est absolument nécessaire ou fondamental à l'existence, à la structure ou au fonctionnement de quelque chose

Micronutriments Essentiels

TRACE ELEMENTS (11)

Cu	Copper
Se	Selenium
Zn	Zinc
Fe	Iron
Mn	Manganese
Mo	Molybdenum
Cr	Chromium
F	Fluoride
I	Iodine
Co	Cobalt
V	Vanadium
+	Ni, Si, Sn

VITAMINS (13)

A	Retinol
D	Cholecalciferol*
E	Alpha-tocopherol
K	Phyloquinone
B1	Thiamine
B2	Riboflavin
B3	Niacin (PP)*
B5	Pantothenic acid
B6	Pyridoxine
B7	Biotin
B9	Folic acid
B12	Cobalamin
C	Ascorbic acid
Q10	Coenzyme

Antioxidant functions

Immune functions

* Synthesized in the body

The Four Main Biochemical Functions of Micronutrients

1 Cofactors

Trace elements that are frequently an integral element of enzymatic reactions in metabolic processes

2 Coenzymes

Small, organic molecules that are required by an enzyme and that participate in the chemistry of catalysis

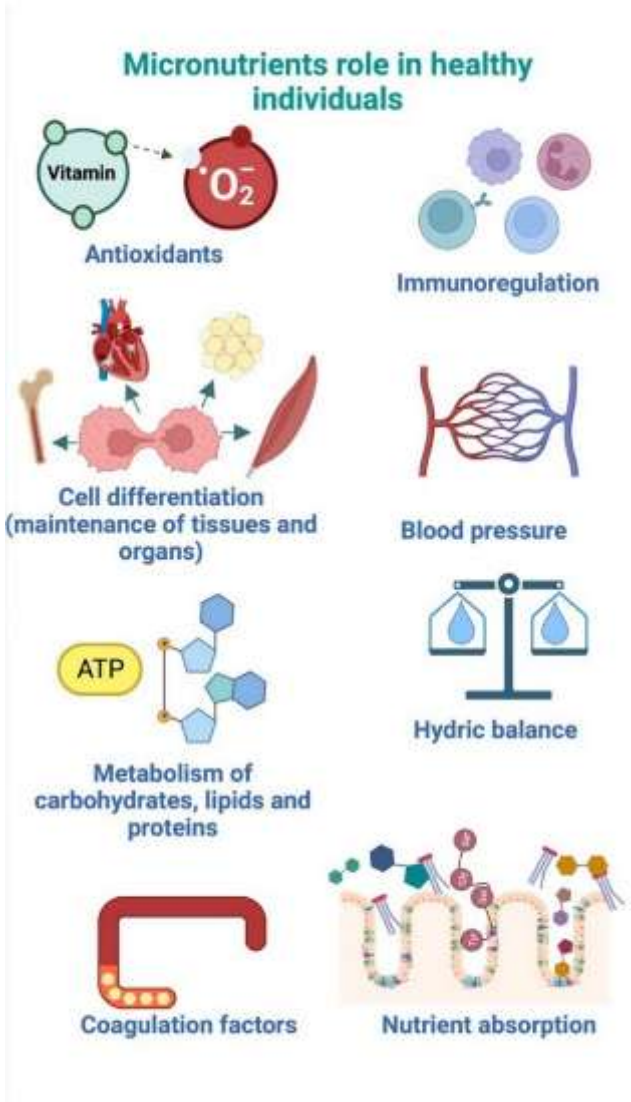
3 Transcription factors

Important factors that have a key role in genetic control

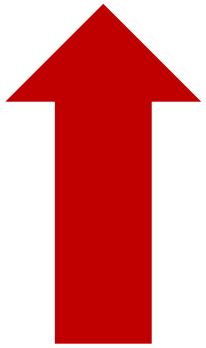
4 Antioxidants

Vitamins that can undergo oxidative phosphorylation and aid in the removal and protection against mediators of systemic inflammation such as reactive oxygen species (ROS) or "free radicals."

https://traineracademy.org/cpt-textbook/micronutrients/



Woundhealing



Hernandez-Flores IJMS 2022

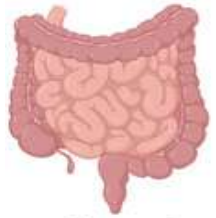
What the clinician needs to know about medical nutrition therapy in critically ill patients in 2023: A narrative review

Dresen et al, Nutr Clin Prac 2023; 38: 479-498

Disease-specific risk of micronutrient depletion/deficiency

Chronic gastritis

C, D, B_9, B_{12}, iron



Chronic intestinal failure

A, D, E, K, B_2, B_7, B_9, B_{12}, A, D, E, K copper, iron, zinc

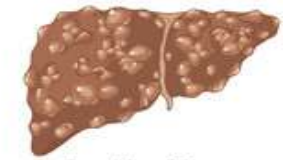
Chronic renal failure

K, D, B_1, B_6, B_9 copper, selenium, zinc

A, C, D, E, K, B_1, B_9, B_{12} copper, Iron, zinc

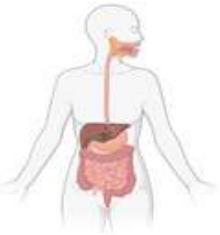
Post bariatric surgery

A, D, E, K, B_1, B_2, B_6, B_7, B_9, B_{12} copper, selenium, zinc



Alcoholism Liver diseases

A, D, E, K, B_1, B_6, B_{12}, iron, selenium, zinc



Inflammatory bowel diseases

Medication Type	Common Examples	Vitamins Depleted	Minerals Depleted	Antioxidants Hormones and Nutrients Depleted
BLOOD PRESSURE	**Diuretics** such as furosemide and Lasix	B1, B6, C	Magnesium, Calcium, Potassium, Zinc, Sodium.	Coenzyme Q10
	Thiazides (HCT)			
	Beta Blockers		Magnesium, Potassium, Sodium	Coenzyme Q10, Melatonin
CHOLESTEROL	**Statins** like Zocor, Lipitor, Crestor	D		Coenzyme Q10
	Fibrates	B2, B6, B12, Folate		
	Colestid, Questran	A, D, E, K, Beta Carotene, B-12, Folate	Iron	
DIABETES	Glucophage and Metformin	B-12, Folic Acid		Coenzyme Q10
PAIN ANTI-INFLAMMATORY	**NSAIDS**: Motrin, Naprosyn, Lodine, Aspirin	C, Folic Acid, B-12	Potassium, Iron, Magnesium	
	Steroids: for pain, asthma, skin conditions, etc.	A, C, D, Folic Acid	Calcium, Magnesium, Potassium, Zinc	
HEARTBURN REFLUX	Prilosec, Prevacid, Aciphex, Nexium, Protonix	B12, Beta Carotene		Protein
	Zantac, Axid, Pepcid, Tagamet, Tums, Rolaids	D, B12, Folic Acid	Calcium, Iron, Zinc	Protein
HORMONE REPLACEMENT	**Oral Contraceptives**: Premarin, Yasmin, as well as estrogen	B2, B3, B6, B12, C, Folic Acid	Magnesium, Zinc	Selenium

Recognizing Signs of Nutritional Deficiencies

Iron

- Pale skin
- Shortness of breath

Vitamin A

- Night blindness
- Compromised immune function
- Skin issues

Vitamin D

- Weakened bones
- Muscle weakness
- Depression
- Fatigue

Zinc

- Suppressed immune function
- Diarrhea
- Poor appetite
- Reduced taste and smell
- Hair loss
- Slow wound healing

Iodine

- Hypothyroidism
- Goiter

Folate

- Fatigue
- Depression
- Cognitive changes
- Sore mouth or tongue
- Numbness
- Tingling

Vitamin B12

- Fatigue
- Depression
- Sore mouth or tongue
- Numbness
- Tingling

Symptoms of vitamin B deficiency

- Depression.
- Diarrhea or constipation.
- Fatigue and weakness.
- Heart palpitations.
- Numbness or tingling in your fingers and toes.
- Problems with balance, concentration or memory.
- Scaly skin.
- Shortness of breath.
- Tongue changes (swelling or redness)

Diagnostic – dosages

- Specific : B1, B6, B9, B12
- Homocysteine <15 µmol/L
- MMA 0.07 - 0.27 µmoles/l

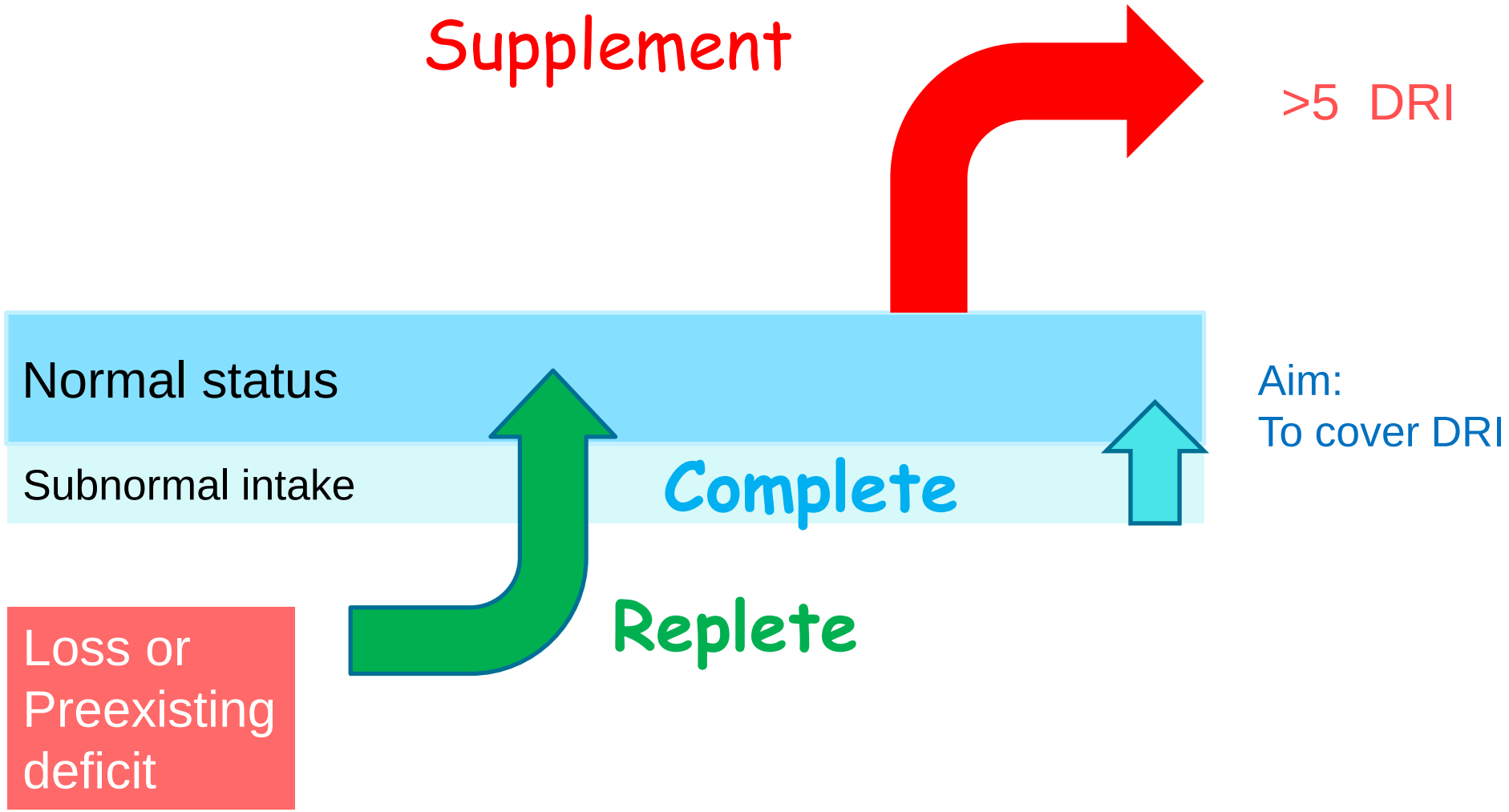
Wording used to describe the type of prescription – Table 5

	Oxford definition	Definition
Complement	The act of adding to something in a way that improves it or makes it more attractive, complete	Complementation will be used to indicate the delivery of MNs to **cover basal needs** (e.g. to complete enteral feeds [4], or PN).
Repletion	The act to make something full again by replacing what has been used	Doses aiming to **restore a normal status**, and where the deficit is known. Sometimes called supplementation but term to be avoided as confusing
Supplement	The act of adding something to something else to improve or complete it	Term used when the aim is to deliver **higher than standard doses** (i.e. superior to DRI or PN recommendation) [41]. The term does not include pharmaconutrition but designates doses higher than basal requirements delivered in an attempt to correct depletion or deficiency.
Pharmacological dose	Connected with the scientific study of drugs and their use in medicine	Treatment with a specific MN to improve host defenses, or any other biological endpoint associated with good clinical evolution and improve the outcome of critically ill patients.

ESPEN MN Guideline, Berger et al Clin Nutr 2022

Complement, Replete or Supplement?

Three different situations with different objectives



Cas 1: Homme de 55 ans, en bsh, poids stable

Il consulte son généraliste au 4e jour d'une «crève monumentale» dont il n'arrive pas à récupérer

Labo:		Norme:
FSS: Hb 135 g/l, Leuco 12 G/l		
Zinc:	550	608 – 1007 ng/ml
Sélénium:	70	84 – 151 ng/ml
Fer:	50	60 - 170 mcg/dL
Vitamine D3:	35	50-125 nmol/l
CRP	42 mg/L	<10

Déficit en
Zn, Se, Fe, Vit D?

Non, pas de déficit – mais ↓ [ ] causée par inflammation.
Valeurs éventuellement à recontrôler hors épisode aigu

Cas 2: Femme de 55 ans, BMI 21 kg/m^2, perte de 8 kg en 3 mois, consulte son gastroentérologue pour un suivi de colite ulcéreuse. Asthénie, anorexie, dégoût alimentaire

Labo:		Norme:
FSS: Hb 100 g/l, Leuco 8 G/l		
Zinc:	450	608 – 1007 ng/ml
Sélénium:	50	84 – 151 ng/ml
Fer:	40	60 - 170 mcg/dL
Vitamine D3:	25	50-125 nmol/l
CRP	62 mg/L	<10

Déficit en
Zn, Se, Fe, Vit D?

Déficits probables – malabsorption ? aggravée par l'inflammation.
Apports alimentaires insuffisants objectivés.
Compléter bilan, Consult diététicienne, Compléments Fe, Se, Zn, D

SENSE

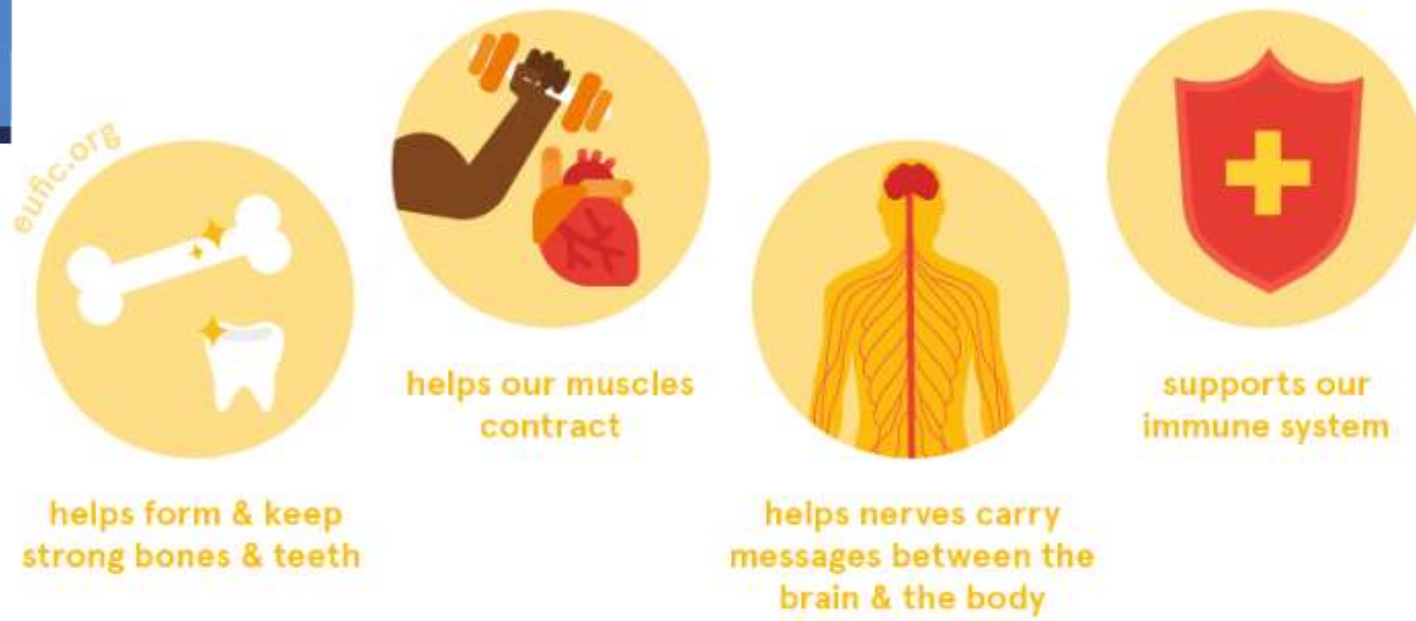
- Cover basal needs
- Cover multi-MN needs
- Diagnose deficiencies based on
  - History & examination
  - Blood tests
- Replete deficits and treat

Vitamin D

- a worldwide public health problem
- deficiency ultra-frequent

foods that contain vitamin D

functions of vitamin D

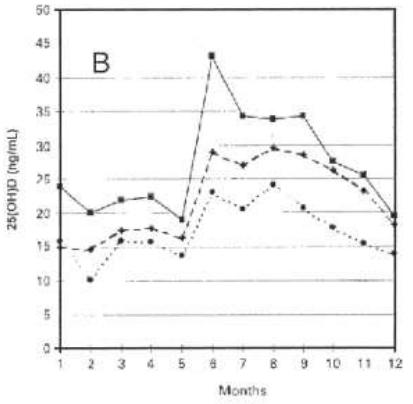


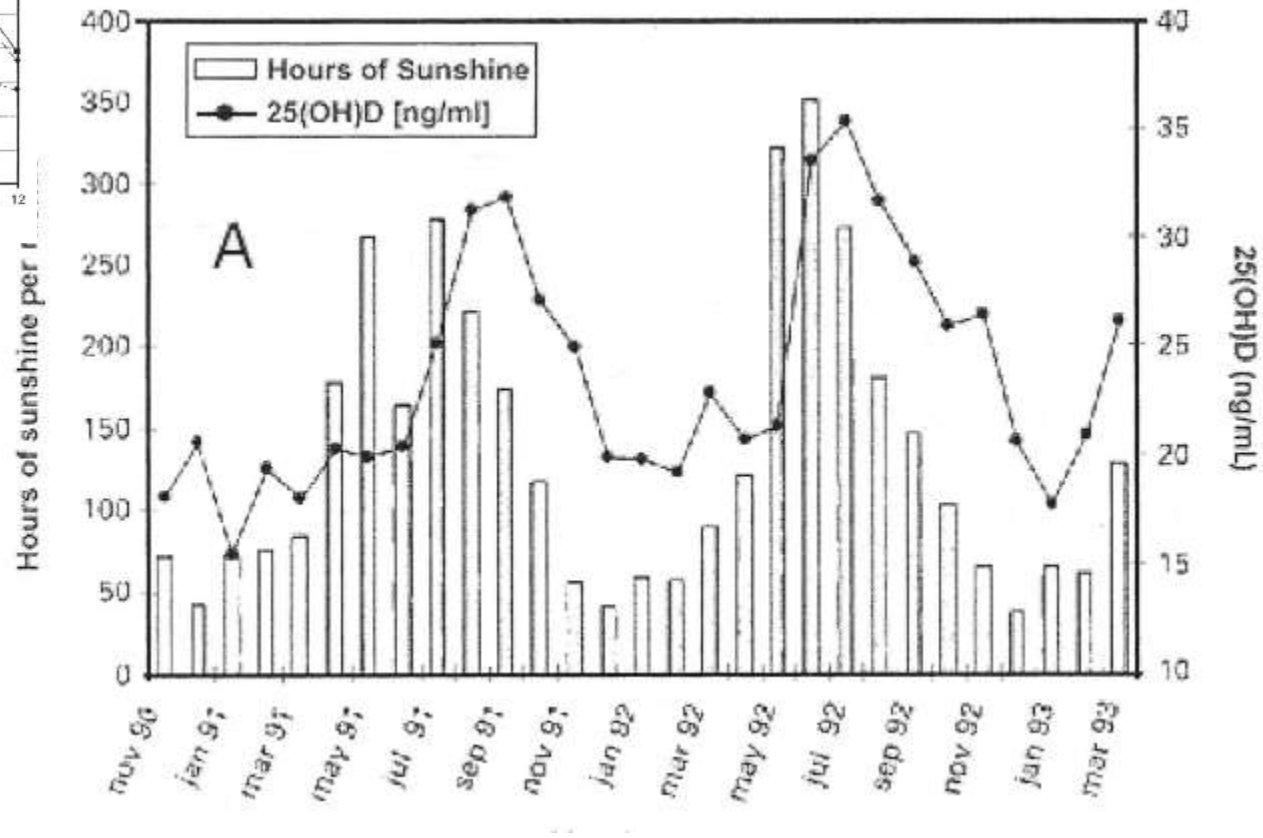
eufic
food facts for healthy choices

Vitamin D deficiency:
a worldwide problem with health consequences

Holick & Chen, Am J Clin Nutr 2008;87(suppl):1080S– 6S.

Vitamin D deficiency is now recognized as a pandemic. The major cause of vitamin D deficiency is the lack of appreciation that sun exposur moderation is the major source of vitamin D for most humans. Very few foods naturally contain vitamin D, and foods that are fortified with vitamin D are often inadequate to satisfy either a child's or an adult's vitamin D requirement.





Adapted form Brot C et al Br J Nutr 2001;86:S97–103

Estimation of exposure durations for vitamin D production and sunburn risk in Switzerland.

Religi A, et al. J Expo Sci Environ Epidemiol 2019;29:742-52

Aim: to quantify solar UV doses needed to trigger 1000 International Units (IU) vitamin D doses and, at the same time, producing sunburn in Switzerland.
Method: Solar UV erythema irradiance (in mW/m2) measured at four meteorological stations in Switzerland for the period 2005–2017 were used to evaluate effective solar UV radiation producing 1000 IU vitamin D doses in skin phototype II and III individuals
Results:
In **summer and spring**, with 22% of uncovered skin, 1000 IU vitamin D doses are synthesized in 10–15 min of sun exposure for adults
In **winter and autumn**, the recommended vitamin D production without sunburn risks **often unachievable, since up to 6.5 h of sun exposure might be necessary considering 8–10% of uncovered skin surface**

Conclusion: Without additional oral vitamin D supplementation, daily doses of vitamin D (1000 IU) are not reachable in autumn and winter months in Switzerland

Vitamin D for the Prevention of Disease: An Endocrine Society Clinical Practice Guideline

Demay MB et al; Journal of Clinical Endocrinology & Metabolism, **2024**, 109:1907–47

Deficiency: The Guideline Development Panel did not find clinical trial evidence that would support establishing distinct 25(OH)D thresholds tied to outcome-specific benefits in the populations examined. Hence, the Endocrine Society no longer endorses the target 25(OH)D level of 30 ng/ mL (75 nmol/L) suggested in the previous guideline

Results: The panel suggests **empiric vitamin D supplementation** …. See Table

Conclusion: The panel suggests **empiric vitamin D** for those aged 1 to 18 years and adults >75 years of age, those who are pregnant, and those with high-risk prediabetes. Due to the scarcity of natural food sources rich in vitamin D, empiric supplementation can be achieved through a combination of fortified foods and supplements that contain vitamin D. Based on the absence of supportive clinical trial evidence, the panel suggests against routine 25(OH)D testing in the absence of established indications.
These recommendations are not meant to replace the current DRIs for vitamin D, nor do they apply to people with established indications for vitamin D treatment or 25(OH)D testing. Further research is needed to determine optimal 25(OH)D levels for specific health benefits.

Empiric administration

Ages 1-18	Ages 19-49	Ages 50-74	Ages ≥75	Pregnancy	Prediabetes
Empiric vitamin D supplementation*	**No empiric vitamin D supplementation***		**Empiric vitamin D supplementation***	**Empiric vitamin D supplementation***	**Empiric vitamin D supplementation***
To prevent nutritional rickets and because of the potential to lower the risk of respiratory tract infections.	Follow the Institute of Medicine Recommended Daily Allowance.		Because of the potential to lower the risk of mortality.	Because of the potential to lower the risk of preeclampsia, intrauterine mortality, preterm birth, small for gestational age birth and neonatal mortality.	Because of the potential to lower the risk of progression to diabetes.

* **Empiric vitamin D supplementation** refers to vitamin D (cholecalciferol [D_3] or ergocalciferol [D_2]) intake (usually in pill or drop form) that (a) exceeds the DRIs and (b) is implemented without testing for 25-hydroxyvitamin D. Vitamin D doses in the included clinical trials varied considerably (see technical remarks under recommendations); hence, optimal doses remain unclear.

* Importantly, this guideline does not address individuals with underlying conditions that substantially alter vitamin D physiology, including various conditions associated with decreased absorption (e.g., short gut, gastric bypass, inflammatory bowel disease), increased catabolism/decreased activation (e.g., some medications), and increased renal losses (e.g., nephrotic syndrome). In addition, this guideline does not address persons known to be at high risk for fractures.

Endocrine Society. Journal of Clinical Endocrinology & Metabolism, 2024;109(8):1907–47

Recommendations N°24 – Vitamin D3 (25-OH)D

Recommendation 24.1

Vitamin D status may be determined in all patients considered at risk of vitamin D depletion or deficiency.

Grade of recommendation 0 – Strong consensus 92%

Recommendation 24.2

Status shall be determined by serum 25-hydroxyvitamin D (25(OH)D).

Grade of recommendation A – Strong consensus 95%

Recommendation 24.5

Vitamin D in doses 4000–5000 IU (100–125 µg) per day should be administered for 2 months in patients with recurrent deficiency to achieve blood levels of 25(OH)D between 40 and 60 ng/ml. Substantially higher doses might be required. Severity of deficiency and dose required for treatment will determine the frequency of blood determination for efficacy and safety.

Grade of recommendation B - Strong consensus 100%

ESPEN MN Guideline, Berger et al Clin Nutr 2022

MAIS IL N'Y A PAS QUE LA VITAMINE D

Beriberi Heart Disease

Jones RH, Circulation, February 1959: 19: 275-283

Que vous évoque ceci

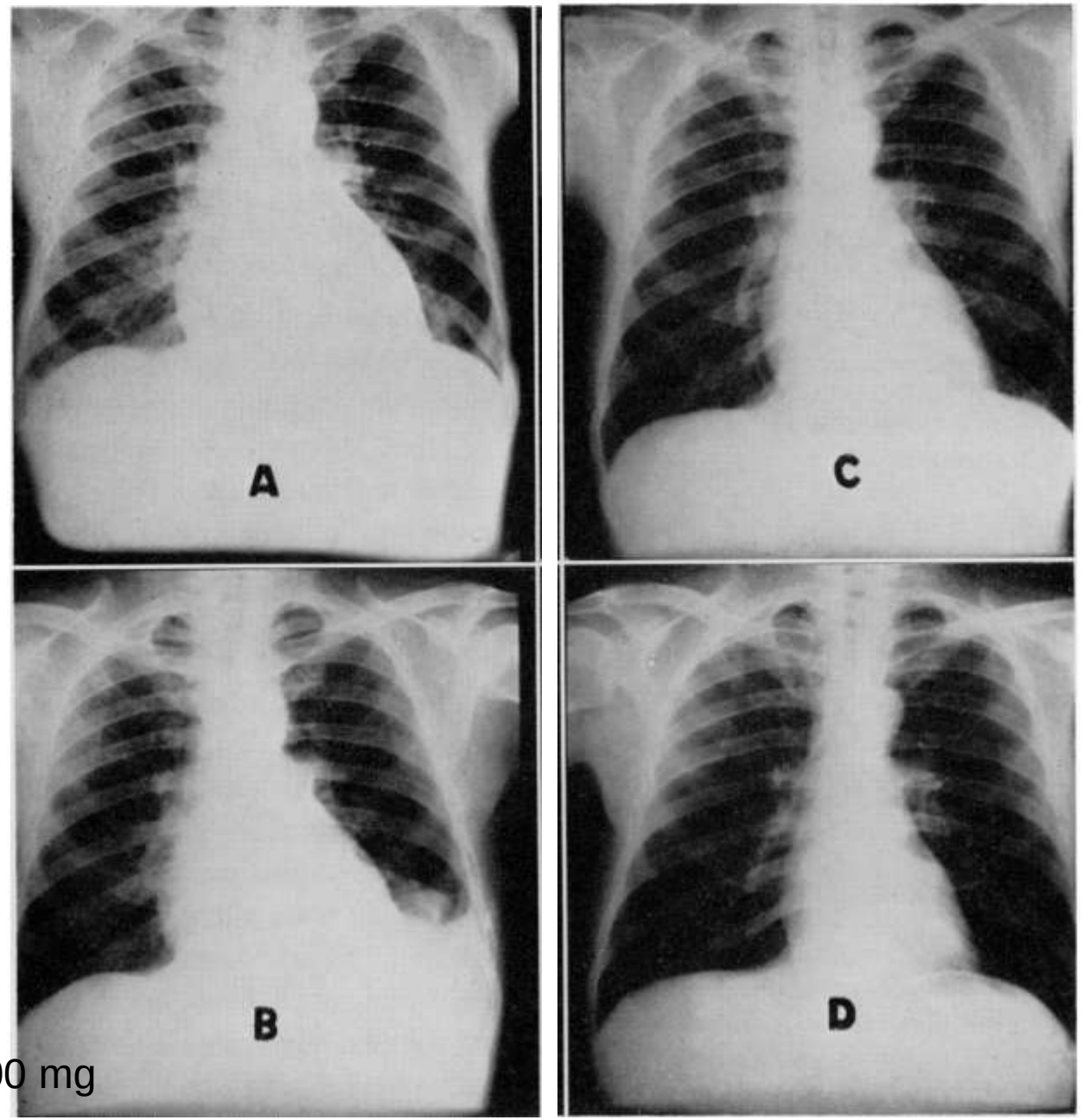
51-yr-old patient having consumed large quantities of alcohol, chiefly in the form of beer.

Grossly deficient dietary history.

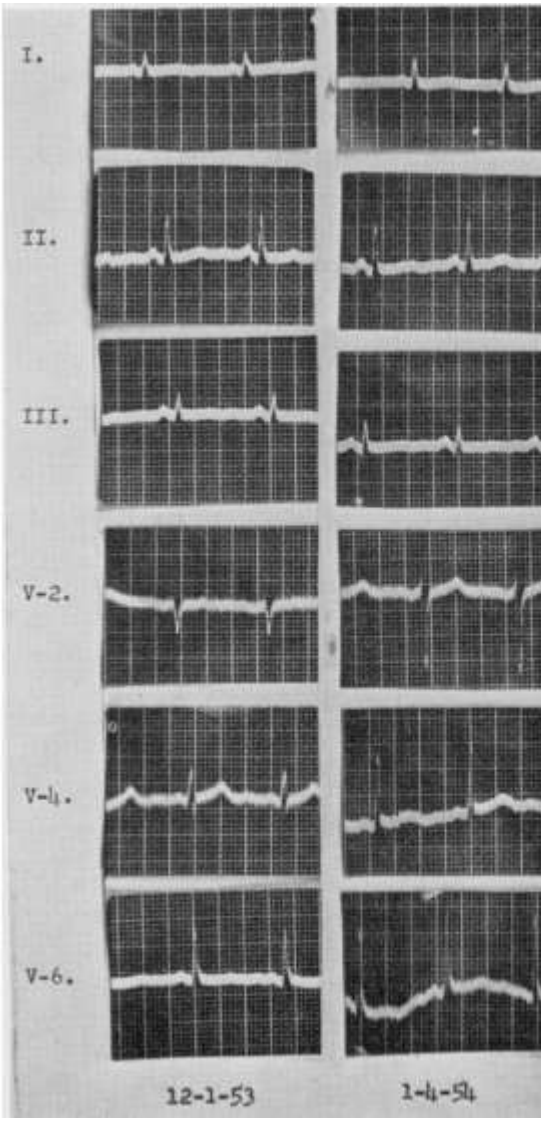
Serial roentgenograms showing progressive ↓ in cardiac size and diminished pulmonary congestion following administration of thiamine chloride.

A. Nov.1, 1953, admission prior to any other treatment except diuretics
B. Nov. 23, 1953, 4 days after thiamine administration.
C. Dec.4, 1954, patient ambulatory.
D. Feb 54 ambulant

B1 200 mg/d x3 followed by 3x100 mg

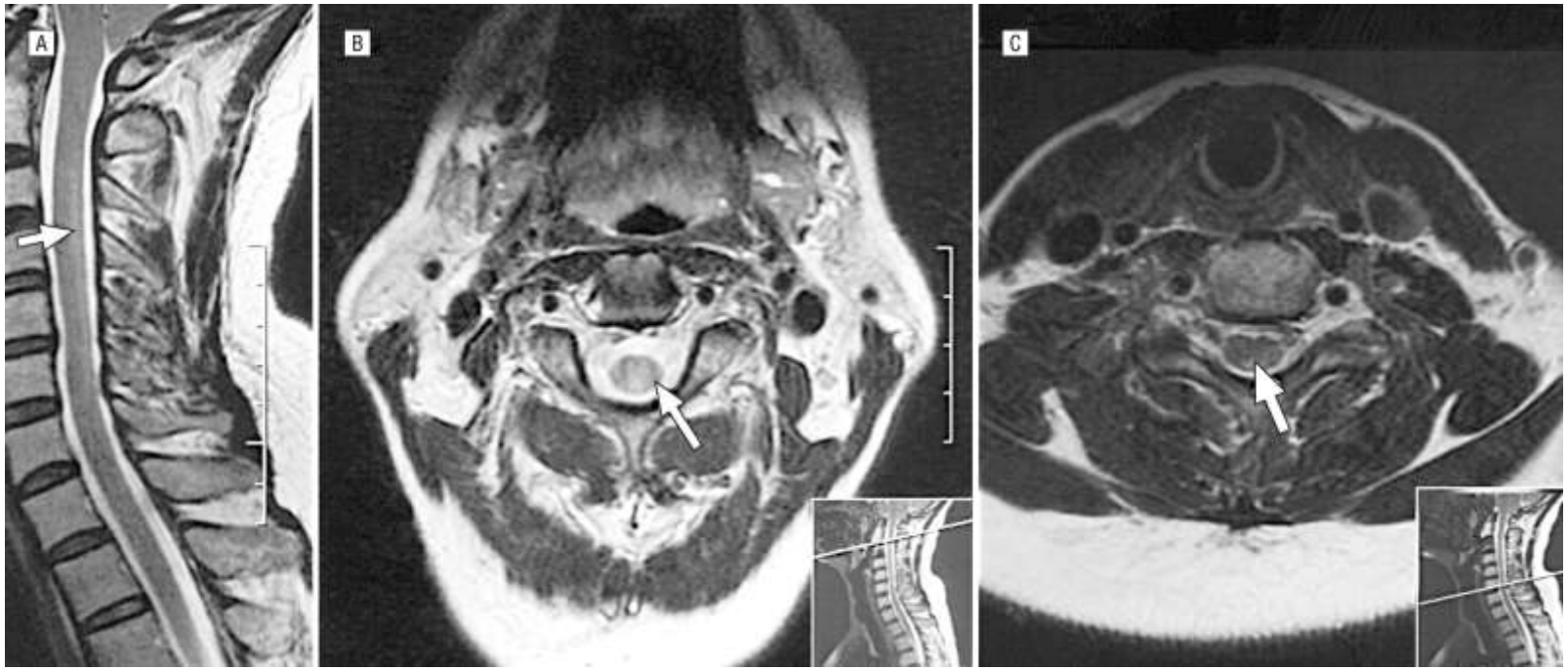


ECG: low T waves



Copper Deficiency Myelopathy

Kumar et al, Arch Neurol. 2004;61(5):762-766. doi:10.1001/archneur.61.5.762



A 49-year-old woman was examined for an 18-month history of gait difficulty and lower limb stiffness. She had foot and distal hand paresthesias that progressed to involve the hands and lower limbs. Coordination difficulty with her hands was particularly evident

Serum copper and ceruloplasmin levels ⬇⬇ to

11 µg/dL (1.7 µmol/L) and 1.6 mg/dL

TTT: 2mg/day for 3 months inefficient

Patient 2. Sagittal (A) and axial (B and C) T2-weighted cervical spine magnetic resonance images show the posteriorly located hyperintense cervical cord signal (arrow) extending from vertebrae C2 (B) to C6 (C).

QUESTION:

Le déficit en MN est-il un problème en Suisse ?

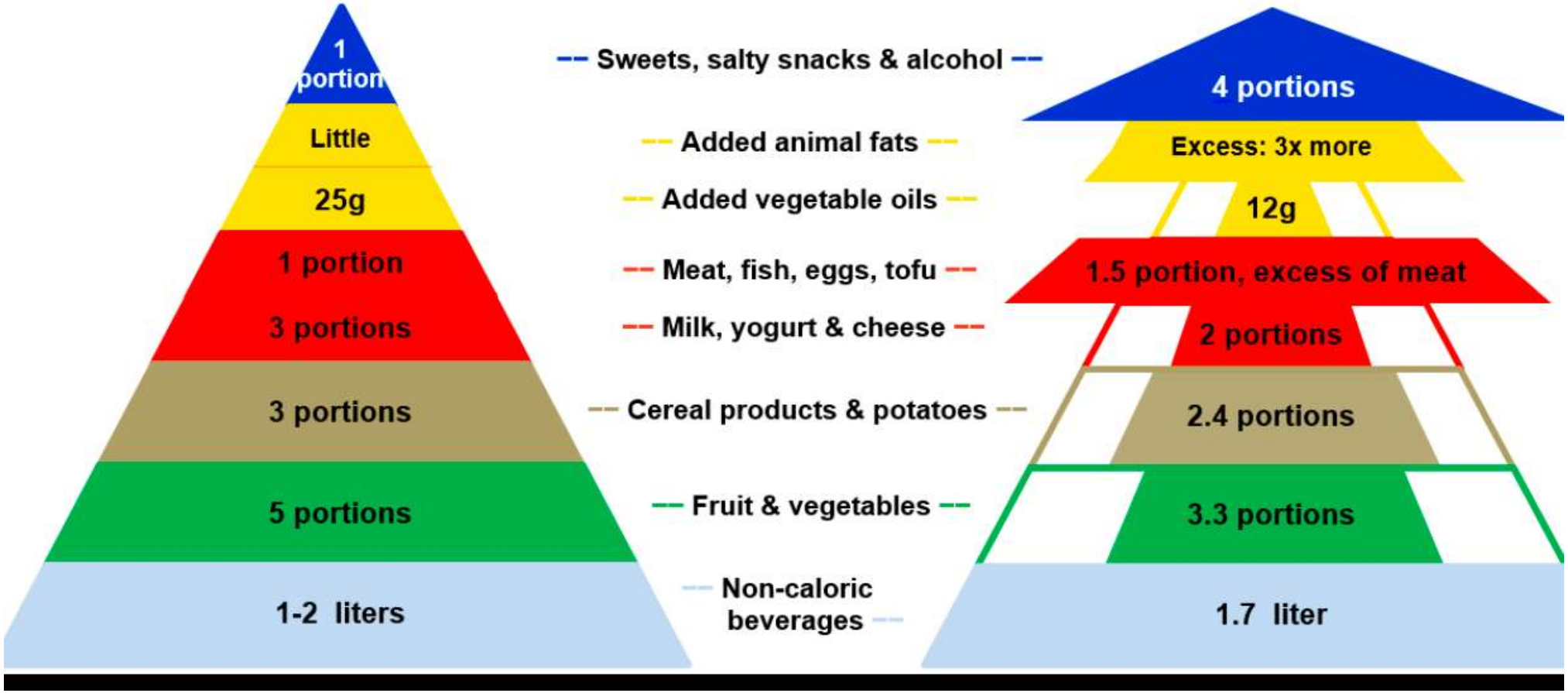
Is micronutrient deficiency a problem in the Swiss population ?

Ist Mikronährstoffmangel ein Problem in der Schweizer Bevölkerung?

Ja / Nicht sicher / Nein
Oui Incertain Non

Major Differences in Diet across Three Linguistic Regions of Switzerland: Results from the First National Nutrition Survey menuCH

Chatelan … Bochud (IUMSP), Nutrients 2017;9:1163



The daily food based dietary guidelines compared to the actual food consumption

Apports nutritionnels de la population Suisse

Groupe d'âge	18-34 ans		35-49 ans		50-64 ans		65 ans et plus	
Genre	Hommes	Femmes	Hommes	Femmes	Hommes	Femmes	Hommes	Femmes
Taille de l'échantillon	246	329	267	342	265	297	168	171
Âge (années)	27.3	27.2	43.2	42.4	57.1	57.0	70.5	70.2
Poids (kg)	78.2	62.3	83.1	65.9	81.6	66.7	81.3	64.7
Sodium (mg)	3701	2699	3788	2530	3244	2486	2989	2330
Potassium (mg)	3027	2612	3156	2634	2981	2789	2780	2611
Chlorure (mg)	5308	3858	5354	3702	4678	3596	4301	3259
Calcium (mg)	991	870	1005	930	1084	928	1014	851
Magnésium (mg)	342	282	363	285	330	287	299	264
Phosphore (mg)	1517	1131	1521	1166	1442	1190	1308	1077
Fer (mg)	10.3	9.0	11.5	8.8	10.5	9.0	9.7	8.5
Iode (µg)	98.0	88.9	110.5	92.5	101.0	92.7	90.7	84.9
Zinc (mg)	12.2	8.8	13.2	9.1	12.0	9.2	11.5	8.8

Bulletin nutritionnel suisse 2021

file:///C:/Users/Mette/Downloads/8.%20Mikronaehrstoffe%20FR.pdf

Figure 2 : apports en certains minéraux **par groupe d'âge et par genre**, comparés aux valeurs de référence D-A-CH (pour l'iode, la recommandation de l'OSAV est la référence).

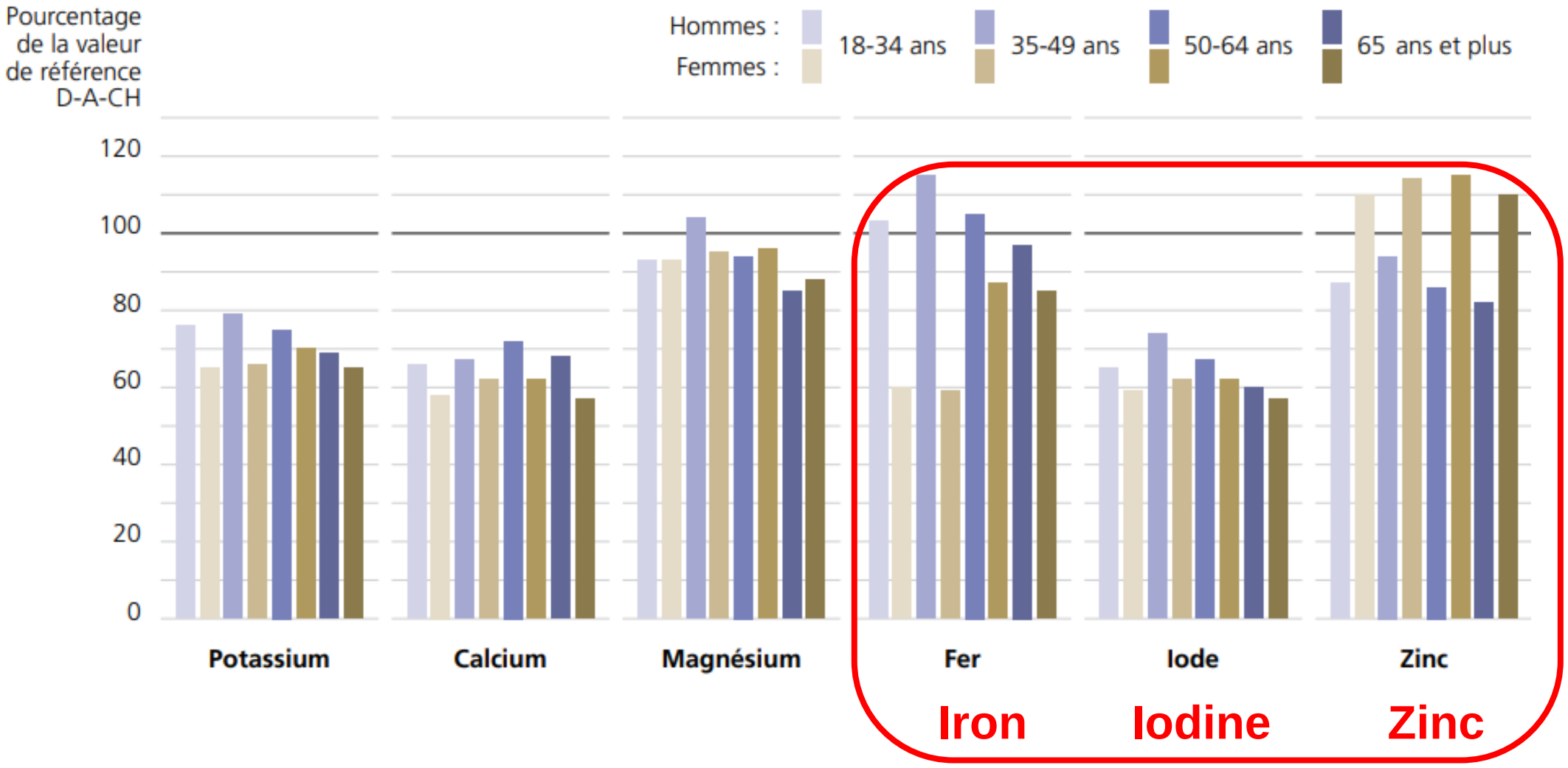


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Fig 4 : apports en certains minéraux **par région linguistique et par genre**, comparés aux valeurs de référence D-A-CH (pour l'iode, recommandation de l'OSAV comme référence)

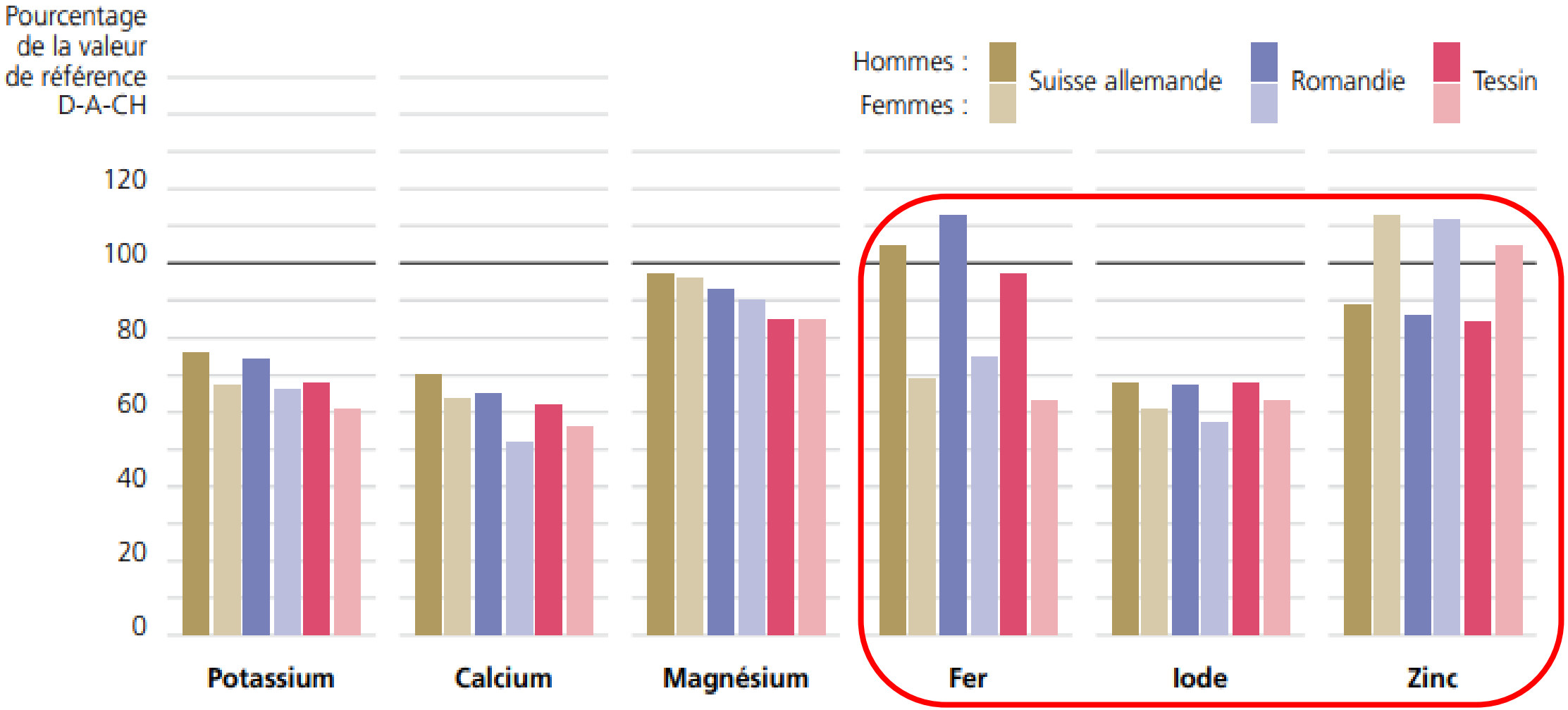

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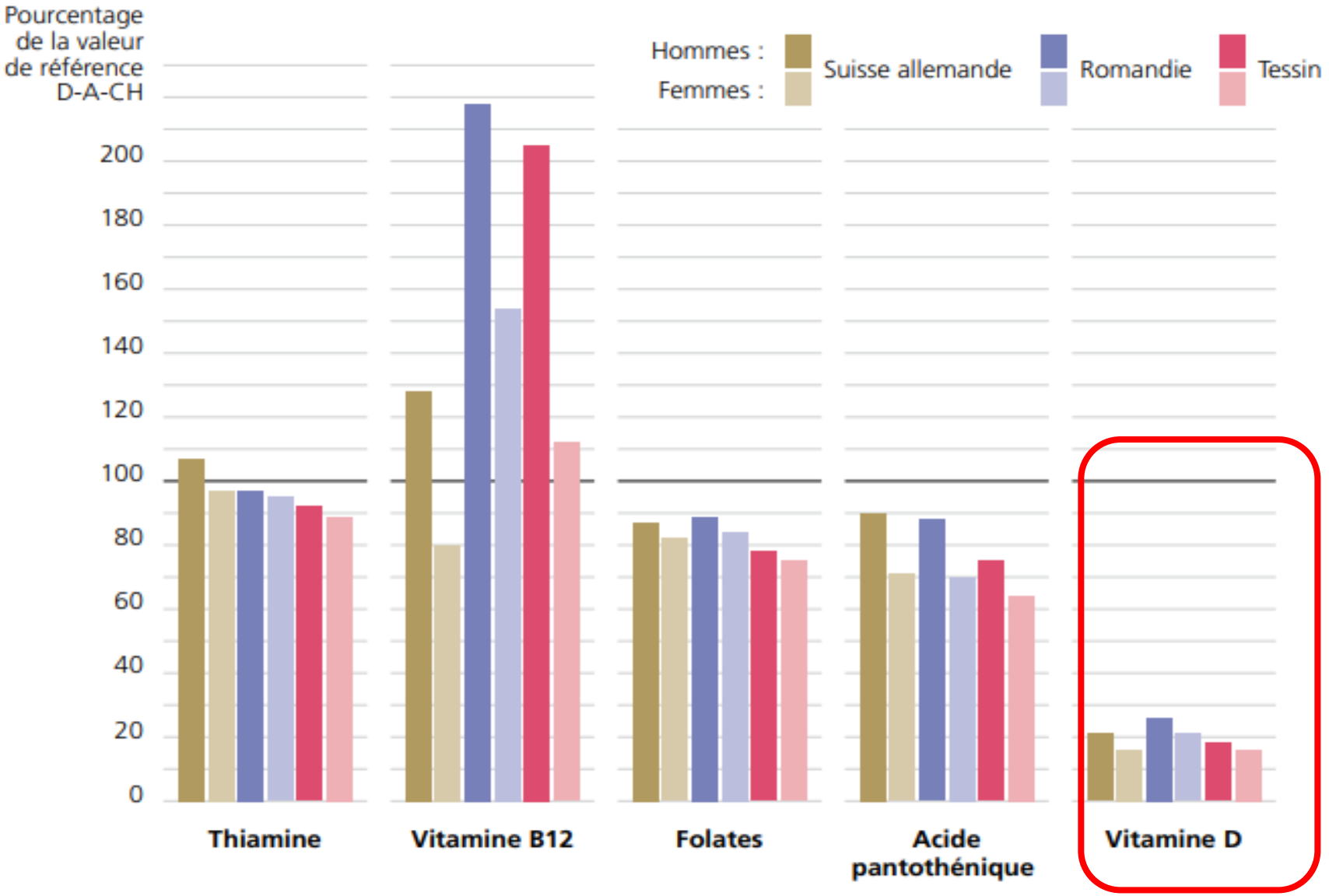
Figure 3 : apports en certaines vitamines **par groupe d'âge et par genre**, comparés aux valeurs de référence D-A-CH (pour la vitamine D, la recommandation de l'OSAV est la référence).



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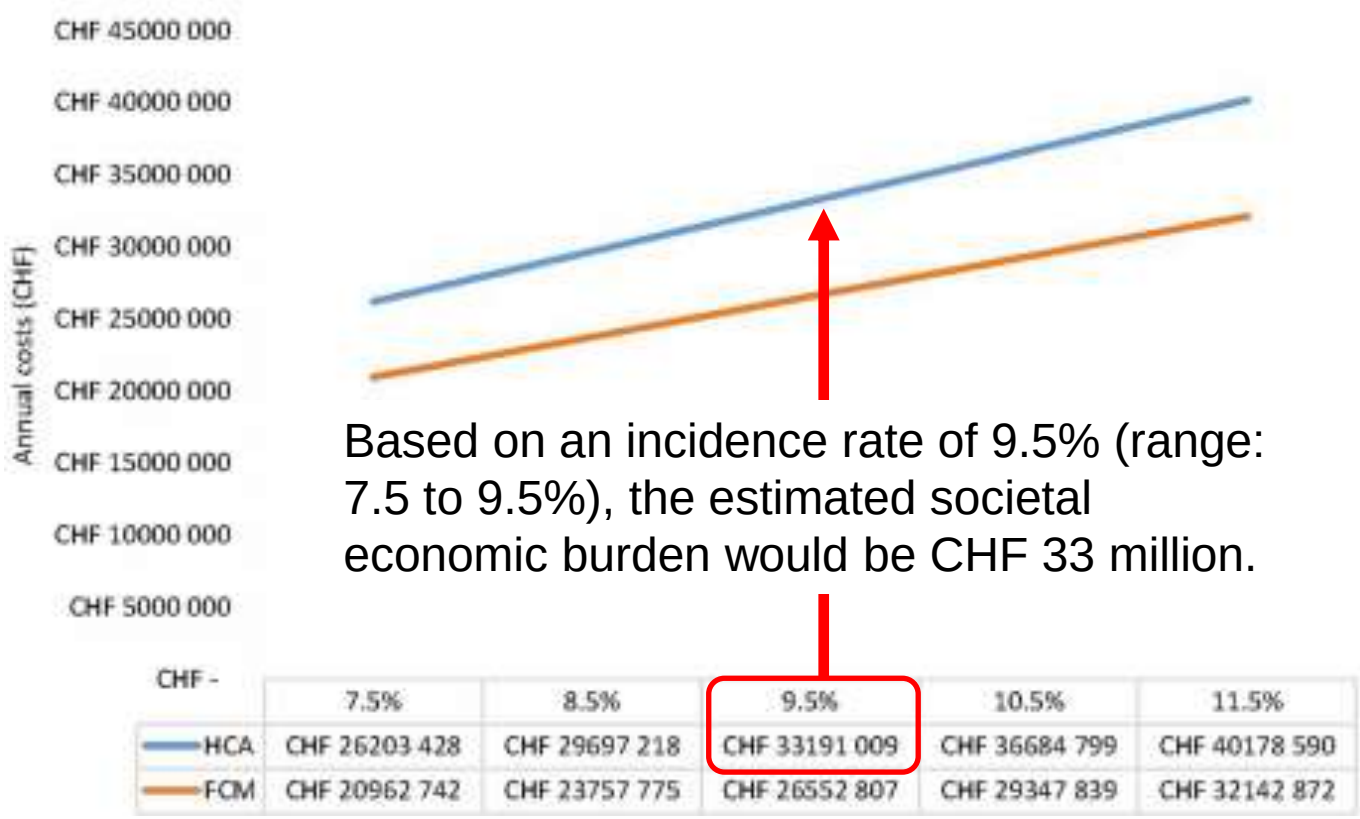
Economic burden of symptomatic iron deficiency - a survey among Swiss women

Blank PR et al BMC, Womens Health. 2019 26;19(1):39.

- Symptomatic iron deficiency (ID) is a disorder affecting 10–20% of menstruating women. (diagnosed by serum ferritin)
- 1010 ID women with a blood test in the last 2 years (mean age: 33.5 years). Most named symptoms were “being tired or exhausted” (96.4%) and reduced physical energy level (41.0%).
- 354 (35.0% of total) patients received an other initial diagnosis: 46.8% were treated prior to the ID diagnosis with a pharmacological medical therapy or psychotherapy.
- 28.5% had to take sick leave due to ID symptoms within a period of 2 years (mean: 5.2 days, i.e. 2.6 days/year).
- Estimated annual indirect costs in Switzerland would be CHF 33 million (human capital approach) or CHF 26 million (friction cost method). B
- Conclusion: The societal and economic burden among women due to debilitating symptoms of ID in Switzerland is substantial

Economic burden of symptomatic iron deficiency - a survey among Swiss women

Blank PR et al BMC Womens Health. 2019 26;19(1):39.



Based on an incidence rate of 9.5% (range: 7.5 to 9.5%), the estimated societal economic burden would be CHF 33 million.

	7.5%	8.5%	9.5%	10.5%	11.5%
HCA	CHF 26203 428	CHF 29697 218	CHF 33191 009	CHF 36684 799	CHF 40178 590
FCM	CHF 20962 742	CHF 23757 775	CHF 26552 807	CHF 29347 839	CHF 32142 872

In Switzerland, a yearly average income of CHF 67,400 (full-time employee) was assumed

Estimated societal economic burden/ indirect costs of ID patients in Switzerland due to sick leave

(HCA: human capital approach; FCM: friction cost method)

Clinical Nutrition ESPEN 43 (2021) 39–48

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journal homepage: http://www.clinicalnutritionespen.com

Narrative Review

Strengthening the immunity of the Swiss population with micronutrients: A narrative review and call for action

Mette M. Berger [a, *], Isabelle Herter-Aeberli [b], Michael B. Zimmermann [c], Jörg Spieldenner [d], Manfred Eggersdorfer [e]

Country	Population (millions)	# Infections	Infection incidence (cases/1000)	# Deaths	Mortality rate (deaths/1000)	Country's
Belgium	11,460	777'608	67.9	22'169	1.934	$ 43'814
Spain	47,430	3'136'321	66.1	70'247	1.481	$ 26'831
Switzerland	**8,560**	**559'845**	**65.4**	**10'014**	**1.170**	**$ 86'673**
Sweden	10,380	675'292	65.1	12'964	1.249	$ 50'339
Netherlands	17,450	1'116,404	64.0	15'824	0.907	$ 53'016
France	67,410	3'870'144	57.4	87'695	1.301	$ 39'257
Austria	8,930	465'322	52.1	8'625	0.966	$ 50'277
Italy	60,320	2'976'274	49.3	98'635	1.635	$ 33'159
Denmark	5,840	213'486	36.6	2'371	0.406	$ 63'829
Germany	83,170	2'472'913	29.7	71'285	0.857	$ 45'466
Norway	5,380	72'923	13.6	632	0.117	$ 67'987
Finland	5,540	59'442	10.7	759	0.137	$ 48'461

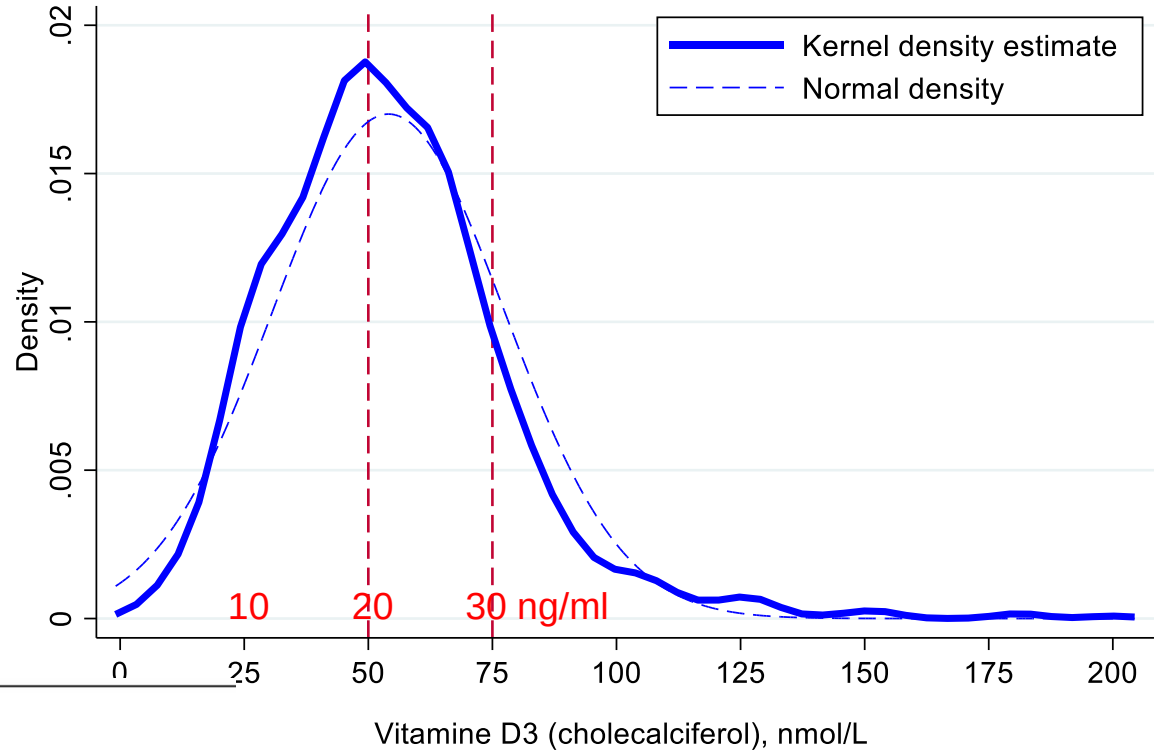
Incidence and mortality for COVID-19 infection for selected European countries classified according to the incidence of infections (adapted from the Johns Hopkins daily dashboard - Last update on February 28th, 2021

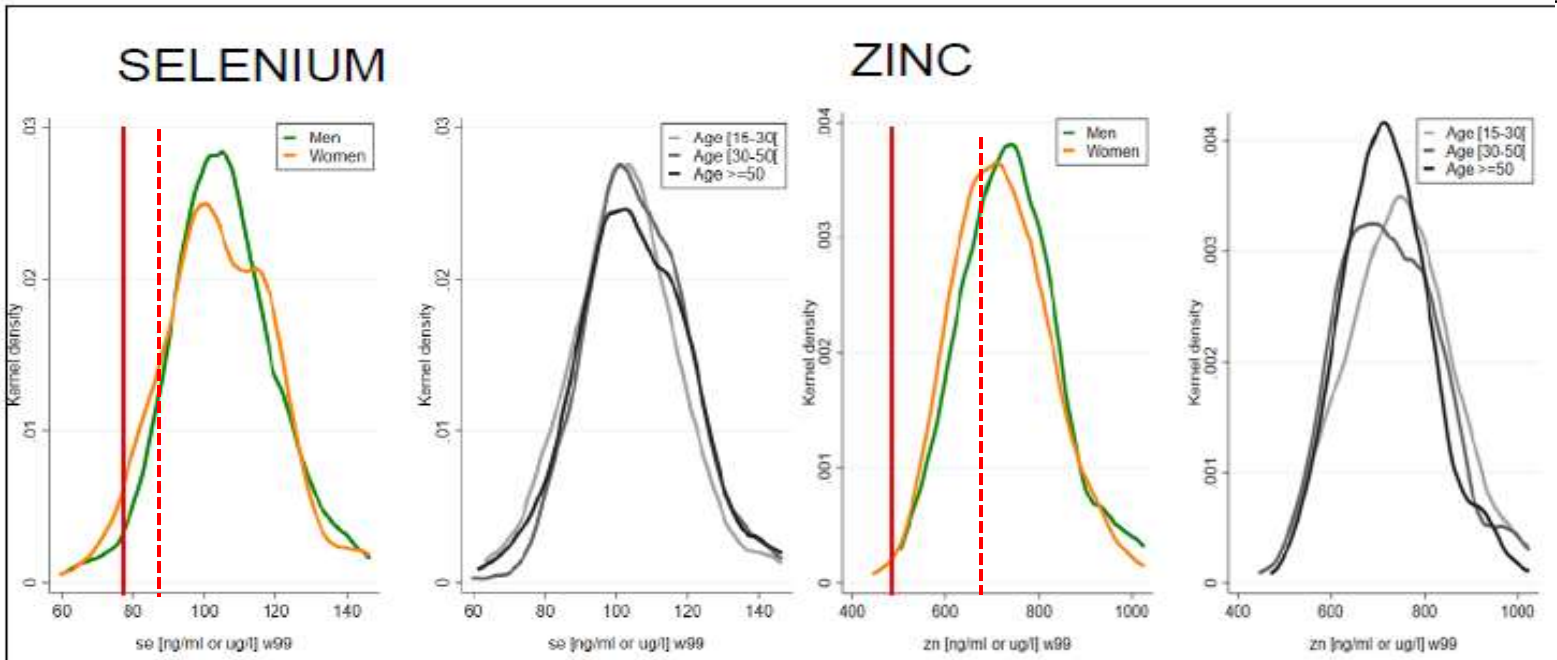
NutriCOVID – sub-study of SeroCOVID – Lausanne

Samples May 2020 –1st COVID wave

991 (1043) subjects

- 206 COVID PCR proven cases «index»
- 294 close contacts
- 490 general population





ssian, bandwidth = 4.6979

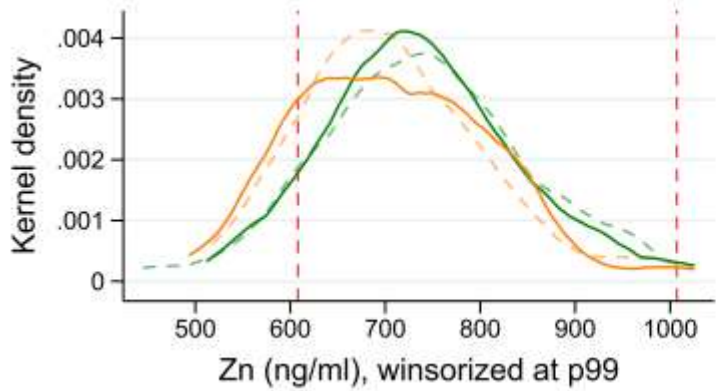
Equey … Bochud M. Clin Nutr 2023

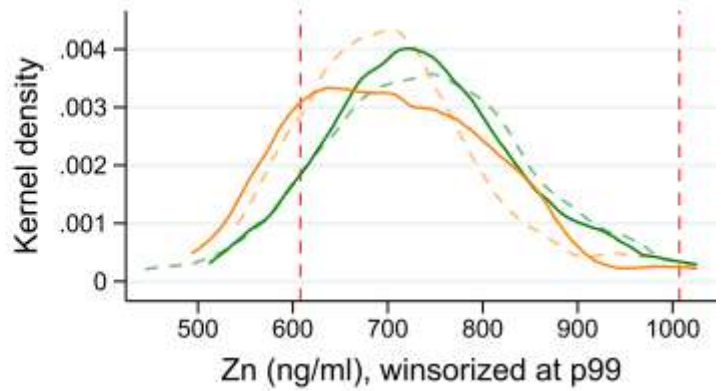
unisanté Centre universitaire de médecine générale et santé publique · Lausanne

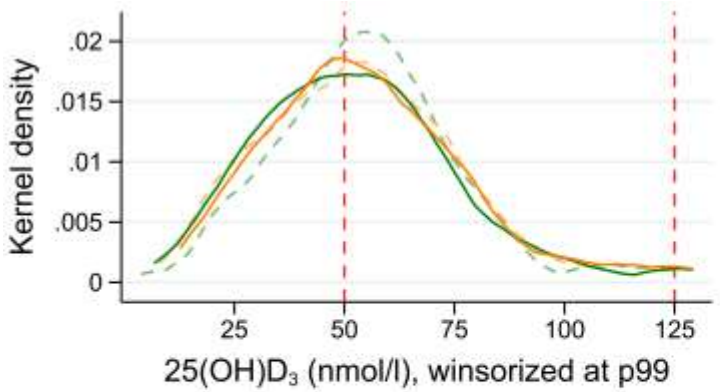
Association of plasma zinc levels with anti-SARS-CoV-2 IgG and IgA seropositivity in the general population: A case–control study

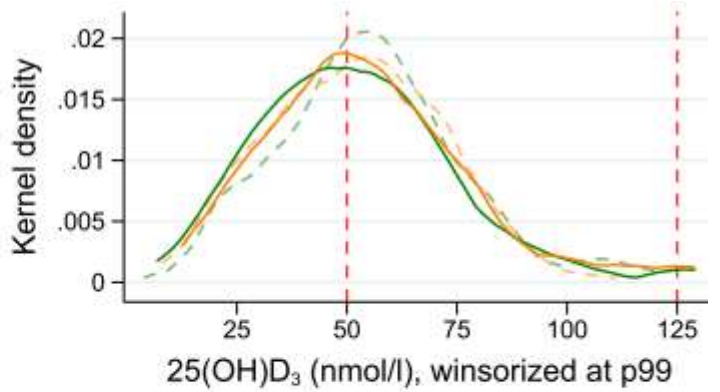
Antoine Equey [a, †], Mette M. Berger [b, *, †], Semira Gonseth-Nusslé [a], Marc Augsburger [c], Serge Rezzi [d], Andrew C.C. Hodgson [d], Sandrine Estoppey [a], Giuseppe Pantaleo [e], Céline Pellaton [e], Maïwenn Perrais [c], Sébastien Lenglet [c], Valentin Rousson [a], Valérie D'Acremont [a, #], Murielle Bochud [a, #]

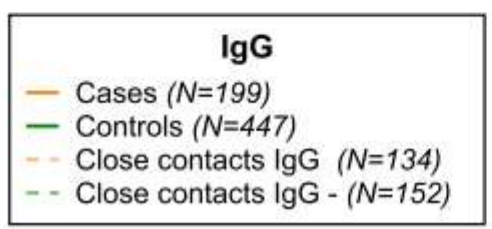
Clinical Nutrition 2023; 42;972

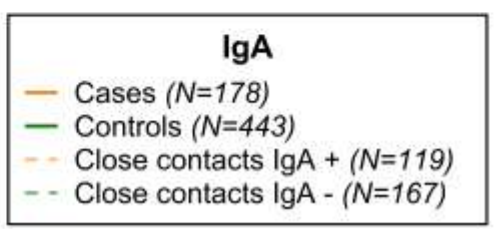


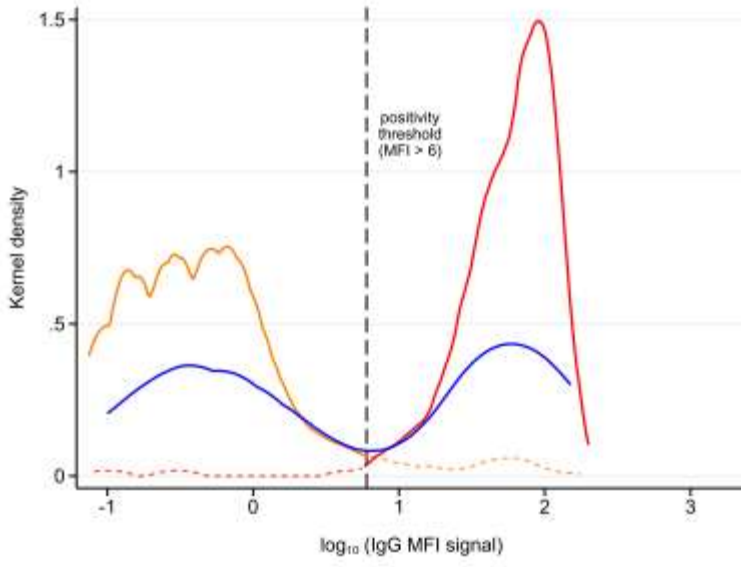


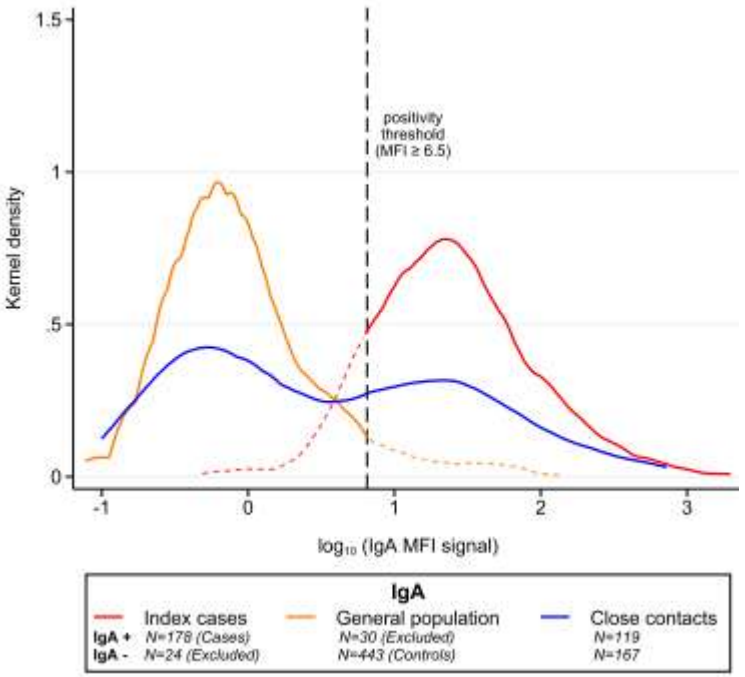






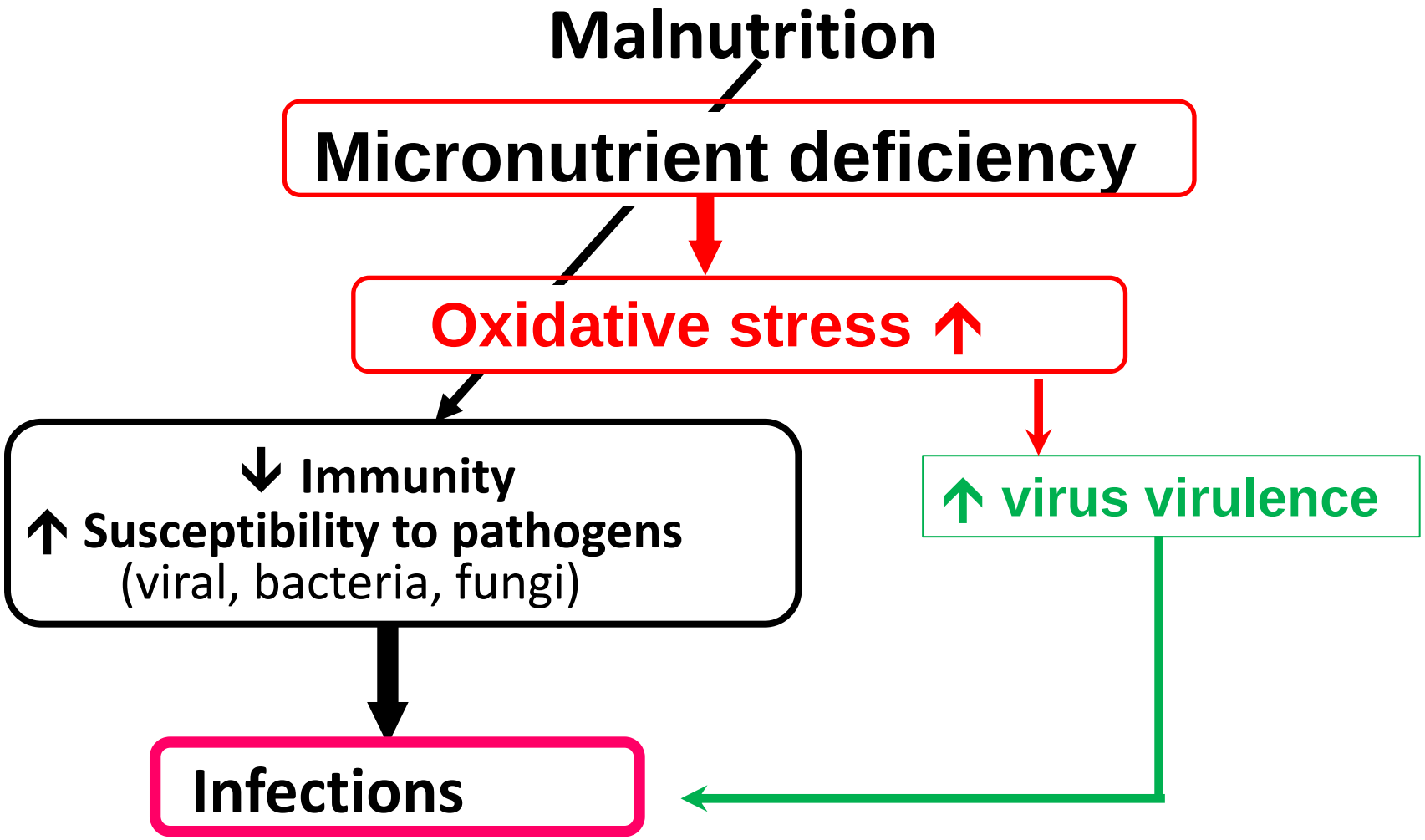






Malnutrition and Infection

Alternative model - *Beck MA 1999*



sge Schweizerische Gesellschaft für Ernährung
ssn Société Suisse de Nutrition
ssn Società Svizzera di Nutrizione

White paper:

Nutritional status in supporting a well-functioning immune system for optimal health with a recommendation for Switzerland

Expert Panel:

- Prof. Mette M. Berger, MD, PhD | UNIL
- Prof. Heike A. Bischoff-Ferrari, MD, DrPH | USZ
- Prof. Michael Zimmermann | ETHZ
- Dr. Isabelle Herter | ETHZ and SSN
- Dr. Jörg Spieldenner | Innosuisse | Ligue Pulmonaire
- Prof. Manfred Eggersdorfer | University Groningen

Recommendation for a well-balanced diet

+ daily

- **Vitamin C:** 200 mg/day.
- **Vitamin D:** 2000 IU (50 µg)
- **DHA and EPA:** 500 mg
- **Selenium:** 50 -100 µg (low in Se in CH)
- **Zinc:** 10 mg

This white paper was taken off the SGE site upon request of BLG/OSAV after one week

High prevalence of severe vitamin D deficiency during the first trimester in pregnant women in Switzerland and its potential contributions to adverse outcomes in the pregnancy.

Christoph P, et al. Swiss Med Wkly 2020;150:20238

The recommendations of the Swiss Federal Commission for Nutrition include a supplement of 600 IU of vitamin D to all pregnant women, despite the lack of data for this population in Switzerland

Retrospective, observational cross-sectional study of 1382 pregnant women attending prenatal care at our department between 2012 and 2015.
Serum 25(OH)D levels determined in the first trimester.

The majority (73.23%) of the population studied found to be vitamin D deficient, with serum levels of 25(OH)D <50 nmol/l.
Severe vitamin D deficiency (25(OH)D levels <25 nmol/l) present in one third (34.2%) of all pregnant women. The mean 25(OH)D level was 36.72 ± 19.63 nmol/l.
An association between low 25(OH)D serum level and gestational diabetes (p = 0.0116)

The current recommendations of vitamin D supplementation of 600 IU (15 µg) in pregnant women are therefore **insufficient**, and novel strategies, such as general screening for vitamin D deficiency, pre-conceptional timing of the supplementation and individually tailored dosing of vitamin D supplementation seem mandatory

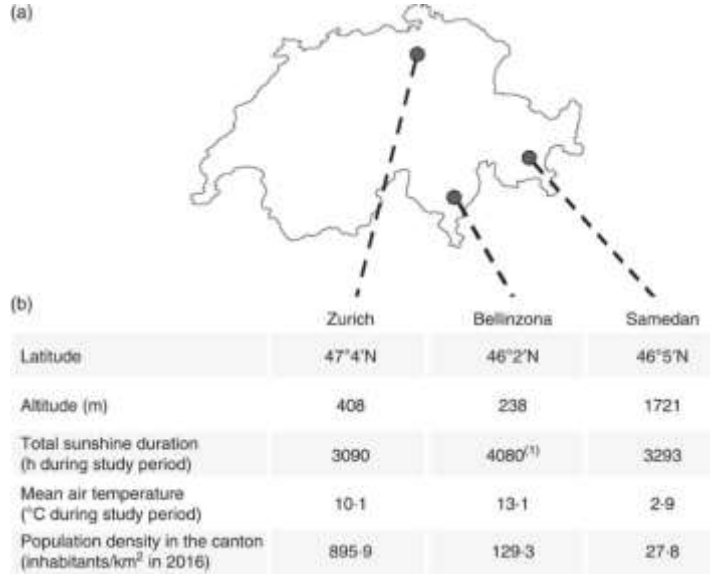
Prevalence and determinants of vitamin D deficiency in the third trimester of pregnancy: a multicentre study in Switzerland

Krieger JP et al, BMJ 2018; 119: 299

A three-centre study was conducted in the obstetric departments of Zurich, Bellinzona and Samedan (Switzerland)

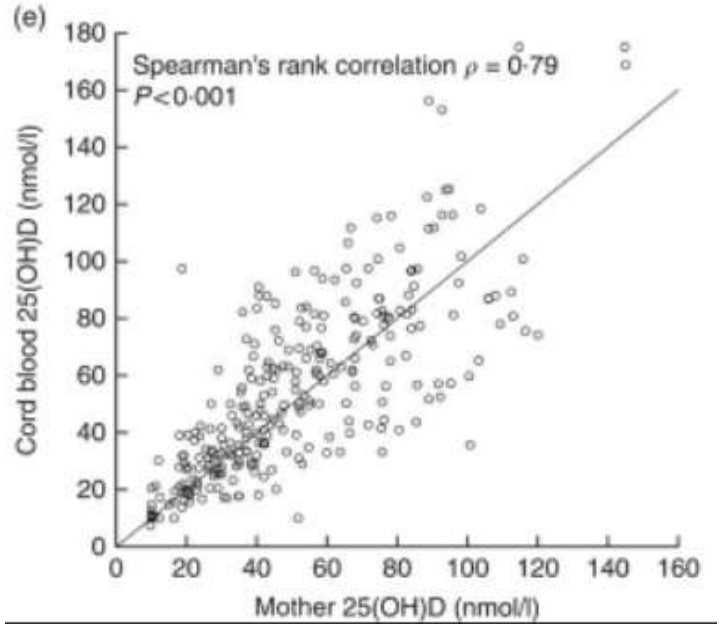
Significant determinants of vitamin D deficiency in pregnant women were centre of study, country of origin, season of delivery and vitamin D supplement intake.
Near-term BMI, skin colour, use of sunscreen and mothers' education, although each not individually significant, collectively improved the ability of the model to explain vitamin D status.

Overall, **prevalence of vitamin D deficiency was 53·4 %** in the study sample.
Median serum 25(OH)D concentration was 46·0 nmol/l (IQR: 30·5–68·5) and was significantly higher in Bellinzona than in Zurich (P<0·005) and Samedan (P<0·0005).



(b)

	Zurich	Bellinzona	Samedan
Latitude	47°4'N	46°2'N	46°5'N
Altitude (m)	408	238	1721
Total sunshine duration (h during study period)	3090	4080[1]	3293
Mean air temperature (°C during study period)	10·1	13·1	2·9
Population density in the canton (inhabitants/km² in 2016)	895·9	129·3	27·8



Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra

Département fédéral de l'intérieur DFI
Office fédéral de la sécurité alimentaire et des affaires vétérinaires OSAV
Denrées alimentaires et nutrition

Information | **nutrition**

3. Recommandations pour l'apport journalier en vitamine D

Selon le groupe de population, les besoins en vitamine D peuvent varier.

Groupe de population	Apport journalier recommandé
Nourrissons durant la 1re année de vie	400 UI/jour (10 µg/jour)
Enfants durant la 2e et la 3e année de vie	600 UI/jour (15 µg/jour)
Personnes de 3 à 60 ans Femmes enceintes ou qui allaitent	600 UI/jour (15 µg/jour)
Personnes de 60 ans et plus	800 UI/jour (20 µg/jour)

UI = unités internationales. 1 µg = 1 microgramme = 1/1000 milligramme

Femmes enceintes comme population générale 💣

What can not see

does not exist

If you do not measure (or test) you will not diagnose a deficiency

Trends in Micronutrient Laboratory Testing in Switzerland: A 7-Year Retrospective Analysis of Healthcare Claims Data

Huber CA et al, International J Gen Med 2020:13 1341–1348

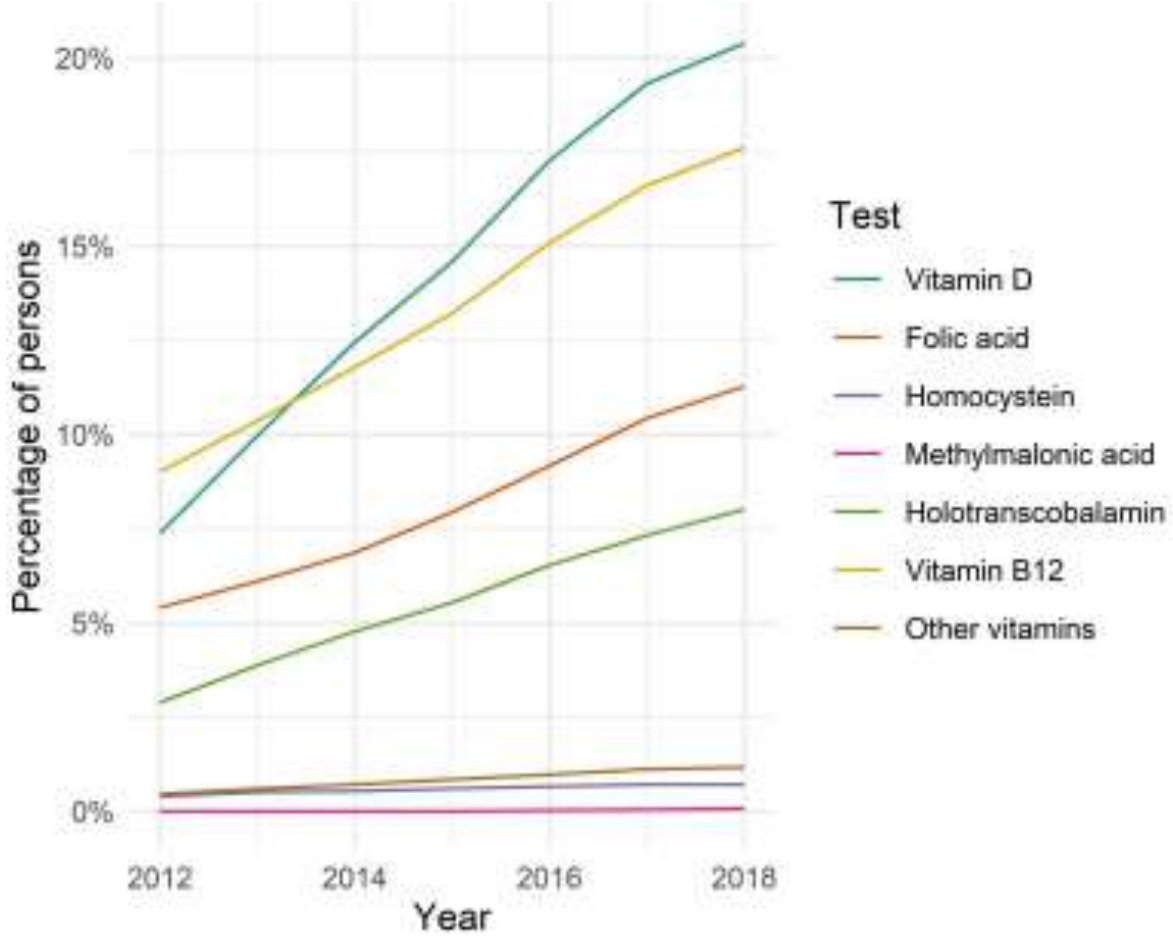


Figure 1 Temporal use of vitamin tests (2012–2018).

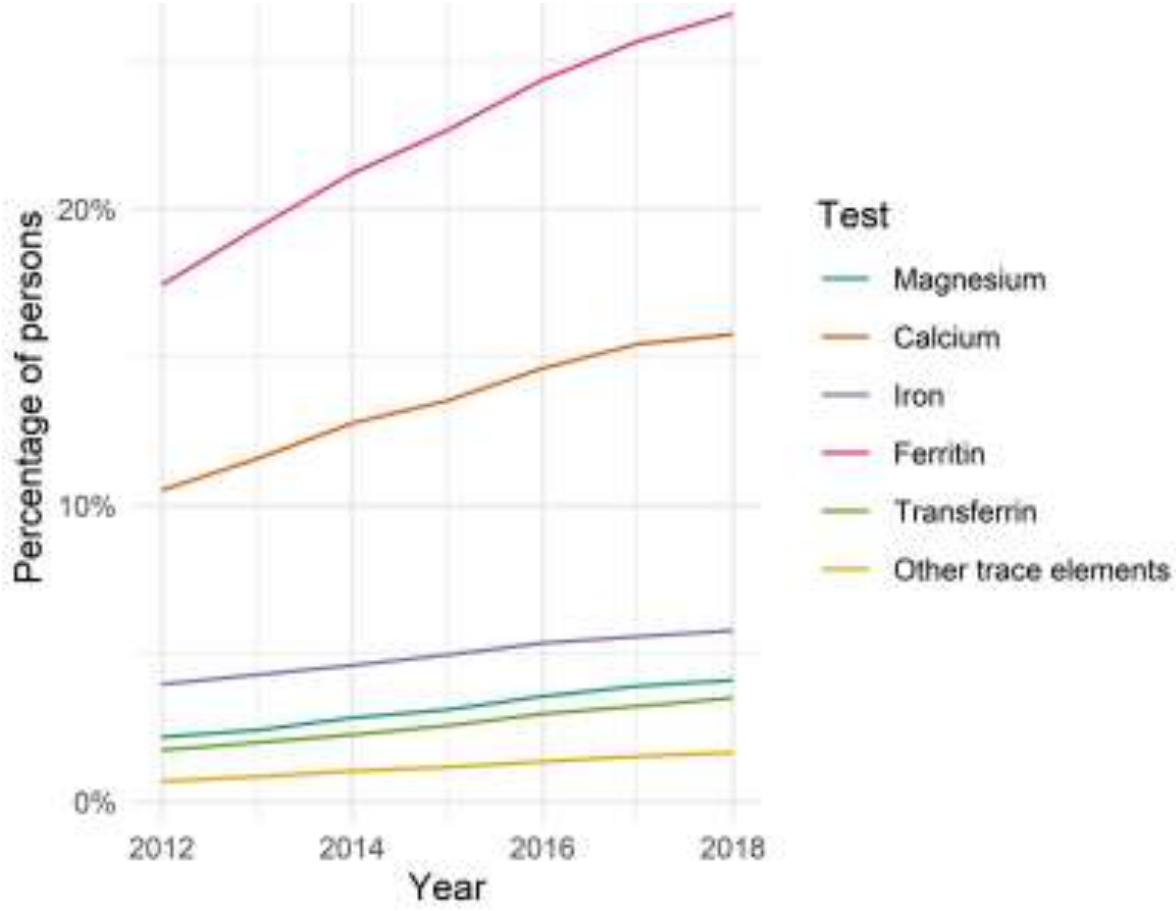


Figure 2 Temporal use of mineral and trace elements tests (2012–2018).

Method: longitudinal design with a 7-year observation period (2012–2018) and for yearly testing frequency we used a cross-sectional design (2018 only). database consisted of nationwide insurance claims from adult persons

OFSP-OPAS - Liste des analyses

Edition du 1er mars 2023 - Département fédéral de l'intérieur (DFI)

- CRP: 9.-CHF (N° 1245.00) pour les labos et 14.2 (analyse rapide, N° 1245.01) les cabinets des praticiens

ET	Points	Vitamine	Points
Cuivre icp-ms	39.6	B1 thiamine	68.4
Sélénium icp-ms	94.5	B2 riboflavine	68.4
Zinc icp-ms	39.6	B3 niacine	52.2
Fer	47.7	B6 PP pyridoxal	61.2
Ferritine	7.1	B9 folate (erythro)	11.80 (18.90)
		B12 cobalamine MMA Ac. Méthylmalonique	22.5 99.00
CRP	9.0	C ascorbic acid	36.9
		E tocophérol	61.2
		A rétinol	61.2
		D 1,25(OH) Vit D (D3)	76.5 (47.70)

No laboratory package available

ESPEN micronutrient guideline

Mette M. Berger [a, 1, *], Alan Shenkin [b, 1], Anna Schweinlin [c], Karin Amrein [d], Marc Augsburger [e], Hans-Konrad Biesalski [f], Stephan C. Bischoff [c], Michael P. Casaer [g], Kursat Gundogan [h], Hanna-Liis Lepp [i], Angélique M.E. de Man [j], Giovanna Muscogiuri [k], Magdalena Pietka [l], Loris Pironi [m], Serge Rezzi [n], Cristina Cuerda [o]

https://doi.org/10.1016/j.clnu.2022.02.015

Recommendation 1

Adequate amounts of all essential trace elements and vitamins shall be supplied to all patients receiving medical nutrition from the beginning of the period of nutritional support.

Grade of recommendation A – Strong consensus 100%

Recommendation 2

Micronutrient supplements shall be provided orally or enterally if this can be done safely and effectively.

Grade of recommendation A – Strong consensus 100%

Recommendation 3

C-reactive protein should be determined at the same time as any micronutrient analysis.

Grade of recommendation B – Consensus 87%

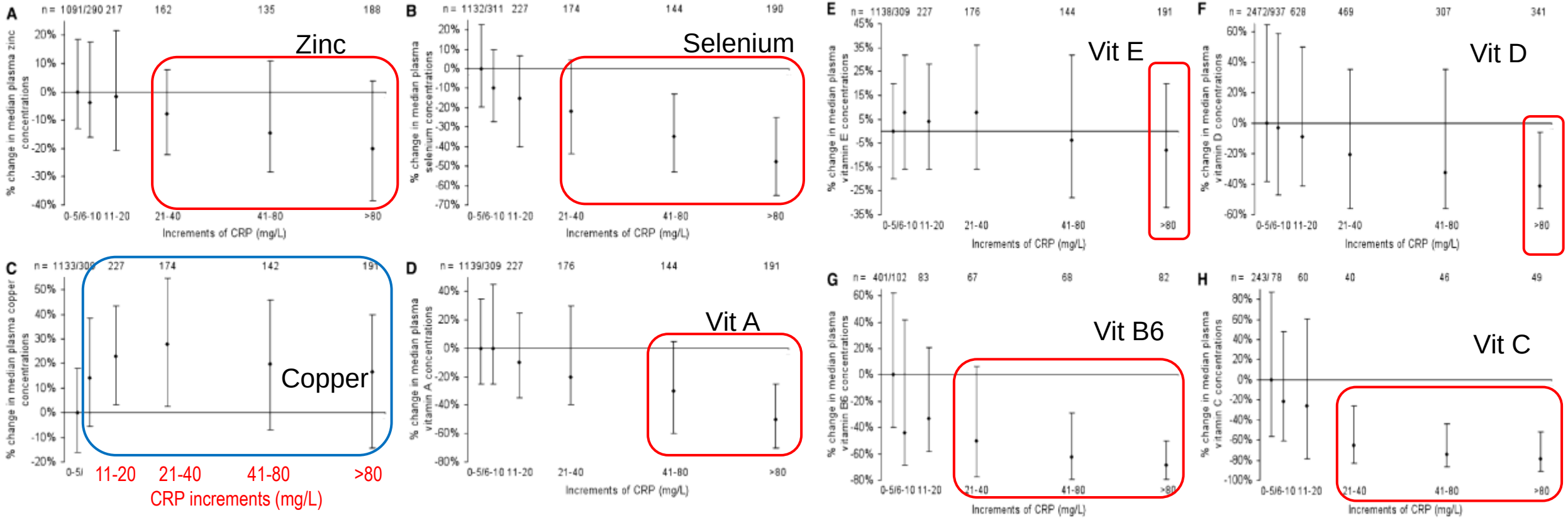
ESPEN MN Guideline, Berger et al Clin Nutr 2022

Quantitative data on the magnitude of the systemic inflammatory response and its effect on micronutrient status based on plasma measurements[1–3]

Andrew Duncan, Dinesh Talwar, Donald C McMillan, Fiona Stefanowicz, and Denis St J O'Reilly

The American Journal of CLINICAL NUTRITION

Am J Clin Nutr 2012;95:64–71.



Results (2217 blood samples in 1303 patients) of routine micronutrient screens (plasma Zn, Cu, Se, and vitamins A, B-6, C, and E) and all vitamin D results (4327 blood samples from 3677 patients) were extracted from the laboratory database

IS SUPPLEMENTATION ALWAYS SUCCESSFUL ? OR USEFUL?

Monthly High-Dose Vitamin D Treatment for the Prevention of Functional Decline A Randomized Clinical Trial

Bischoff-Ferrari H et al, JAMA Intern Med. 2016;176(2):175-183

AIM To determine the effectiveness of high-dose vitamin D in lowering the risk of functional decline.
DESIGN: One-year, double-blind, RCT in Zurich CH.
Participants: 200 community-dwelling men and women ≥70 years with a prior fall.

INTERVENTIONS: **3 study groups** with monthly:

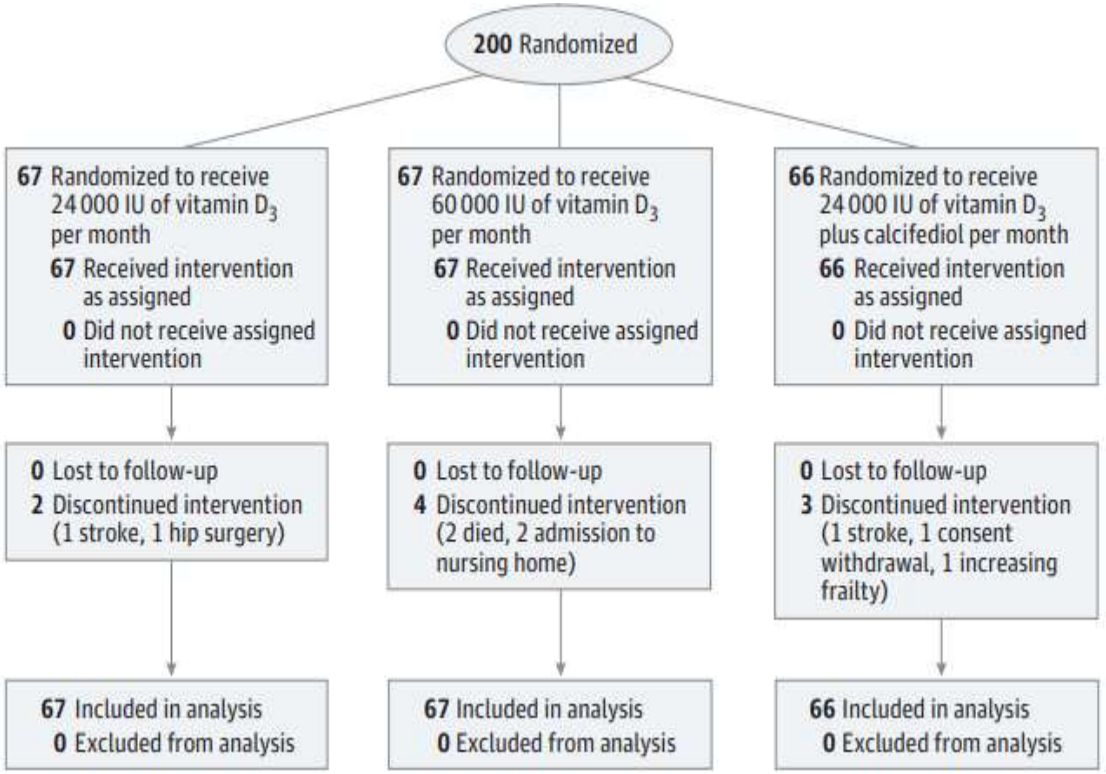
- low-dose control : 24 000 IU vitamin D3 * (600 µg)
- group 60 000 IU vitamin D3 (1500 µg)
- group 24 000 IU vitamin D3 plus 300 µg of calcifediol

Primary end point = improving lower extremity function

RESULTS: mean age 78 years, 67.0% female.

Upon enrolment 58.0% (116 of 200) vitamin D deficient.

Over the 12-month follow-up, the incidence of falls differed significantly, with higher incidences in the 60'000 IU group.



* one 5-mL drink solution of 24 000 IU (600 µg) of vitamin D3 once per month, equivalent to 800 IU/d, plus 3 placebo capsules once/month

DO-HEALTH: Vitamin D3 - Omega-3 - Home exercise - Healthy aging and longevity trial - Design of a multinational clinical trial on healthy aging among European seniors

Bischoff-Ferrari H et al, Contemporary Clinical Trials 2021; 100: 106124

Design: multi-center clinical trial among 2157 community-dwelling European (M & F) aged ≥ 70yrs. Without major comorbidities i.e. **healthy**

The **2x2x2 randomized-control factorial** design trial tested the individual and additive benefit, as well as the cost-effectiveness, of **3 strategies over 3 years**:

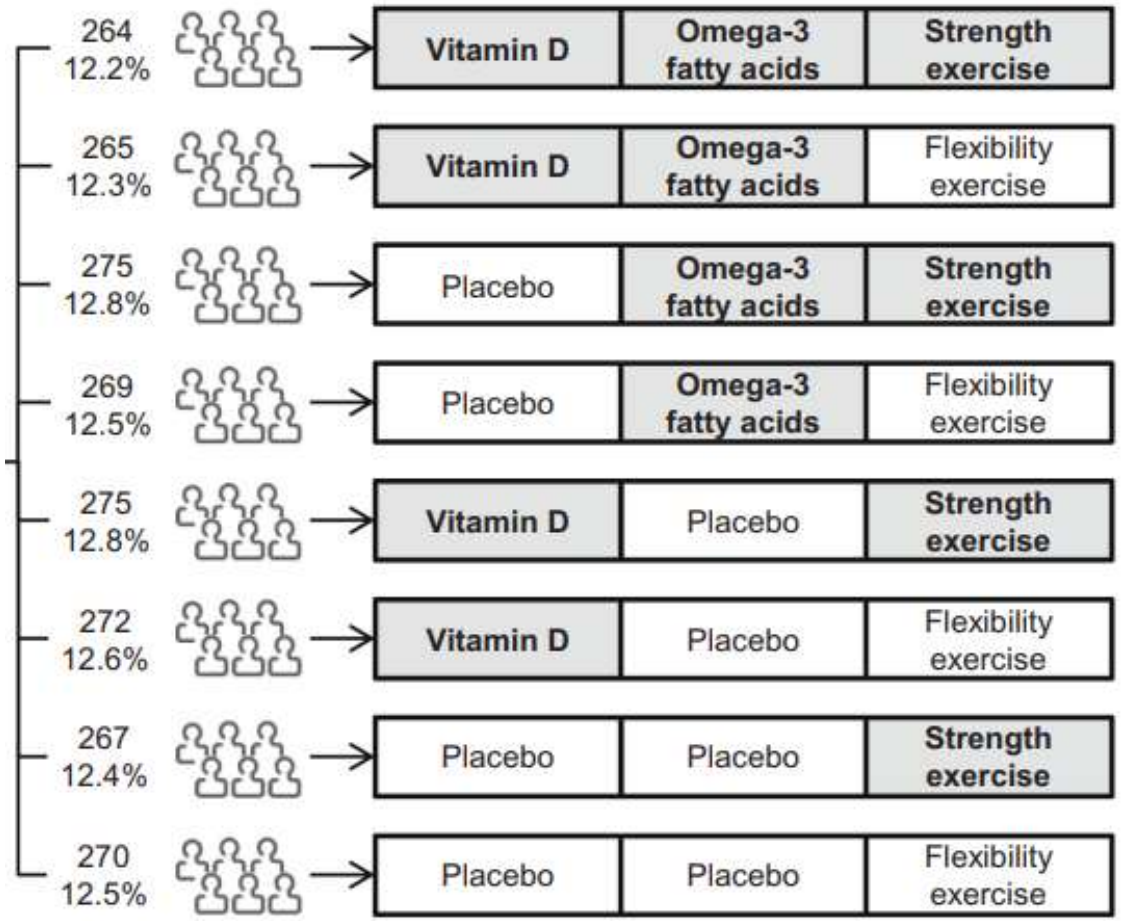
Interventions:

- vitamin D 2000 IU/day (50 μg)
- omega-3 FAs 1 g/day (EPA+DHA, ratio 1:2),
- 30-min 3 x/week home exercise (flex strength)

Outcomes:

6 primary endpoints in 5 domains (cardio, bone, muscle, brain, immunity)

Additional secondary endpoints that supported the primary endpoints and extended to other organ systems



JAMA | Original Investigation

Effect of Vitamin D Supplementation, Omega-3 Fatty Acid Supplementation, or a Strength-Training Exercise Program on Clinical Outcomes in Older Adults

The DO-HEALTH Randomized Clinical Trial

Bischoff-Ferrari HA et al, JAMA 2020

OBJECTIVE To test whether vitamin D, omega-3s, and a strength-training exercise program, alone or in combination, improved 6 health outcomes among older adults.

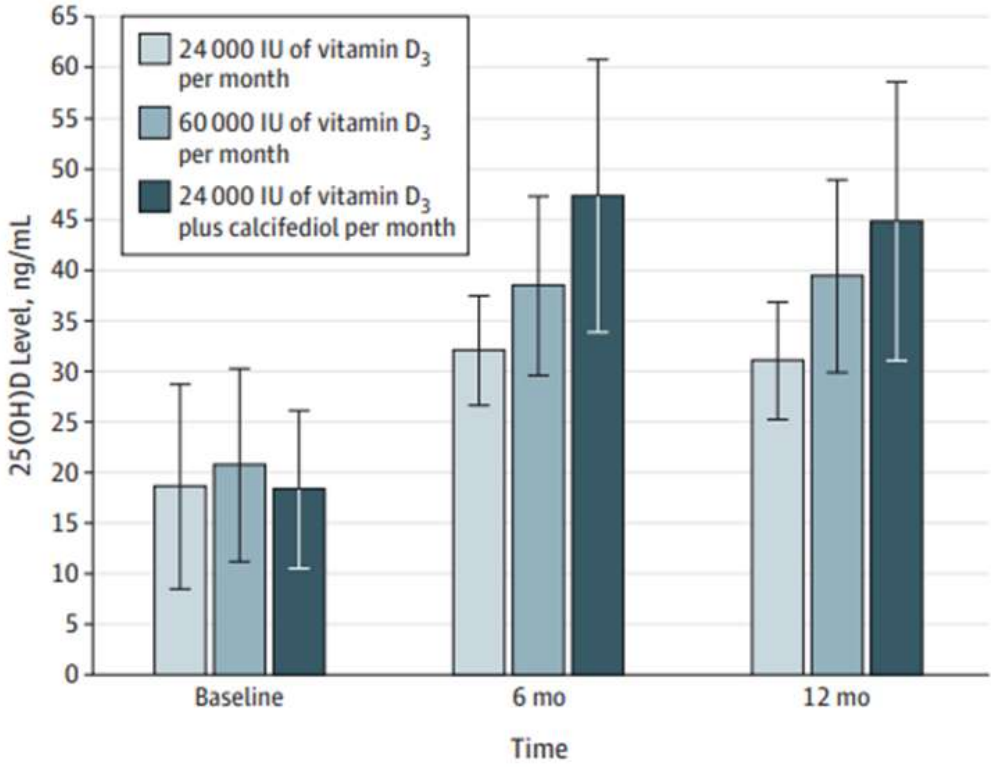
DESIGN: Double-blind, placebo-controlled, 2 × 2 × 2 factorial RCT including 2157 adults aged ≥ 70 years who had no major health events in the 5 years prior to enrolment and had sufficient mobility and good cognitive status.

RESULTS: 1900 subjects (88%) / 2157 completed the study. Mean age, 74.9 years; 61.7% women.

Median follow-up was 2.99 years.

Overall, there were **no statistically significant benefits** of any intervention individually or in combination for the 6 end points at 3 years

Figure 2. Unadjusted 25(OH)D Levels by Treatment at Baseline, 6 Months, and 12 Months



- 24 000 IU D3 = 600 µg
- 60 000 IU D3 = 1500 µg

Si vous donne des compléments a sujets sains pas d effet

The health effects of vitamin D supplementation: evidence from human studies

Roger Bouillon[1], Despoina Manousaki[2], Cliff Rosen[3], Katerina Trajanoska[4], Fernando Rivadeneira[5] and J. Brent Richards[6,7]

Supplementation of vitamin D-replete individuals does not provide demonstrable health benefits. This conclusion does not contradict older guidelines that severe vitamin D deficiency should be prevented or corrected.

Table 1 | **Overview of the large vitamin D supplementation clinical trials 2017–2020**

Study	Country	Number of patients	Age (years, mean ± SD)	Ethnicity[a] (% white ethnicity)	Serum 25OHD (ng/ml)		Duration of follow-up (years)	Intervention (vitamin D vs placebo)	Primary outcome(s)
					Baseline	Final[b]			
VITAL[c]	USA	25,874	67 ± 7	71	30.8 ± 10	42 ± 10	5.3	2,000 IU per day	Cancer and cardiovascular disease
ViDA	New Zealand	5,110	66 ± 8	83	26.5 ± 9[d]	54 ± 16	3.3	One dose of 200,000 IU and 100,000 IU per month	Cardiovascular events and mortality
D2d	USA	2,423	60 ± 10	67	28.0 ± 10.2	54 ± 15	2.5	4,000 IU per day	T2DM
DO-HEALTH	Europe	2,157	74.9 ± 4.4	NM	22.4 ± 8.4	37.6 ± 11.3	3	2,000 IU per day[e]	Six health outcomes[f]
Calgary	Canada	373	62 ± 4	94	31 ± 8	80 ± 16[g]	3	400, 4,000 or 10,000 IU per day	BMD

In conclusion, the data generated by the 2017–2020 megatrials of vitamin D supplementation in largely vitamin D-replete adults (Table 1) demonstrate that increasing the serum 25OHD concentration into the high normal range (based on the IOM and most recent guidelines published over the past decade12, in the range of 50–125 nmol/l or 20–50ng/ml) does not generate benefits.

NON-SENSE

- To consider MN as magic bullets
- To deliver high dose single MN
- Administer MN to patients with normal status
- To consider only Vitamins and forget Trace elements
- To consider all subjects and age groups equal

MN in practice

Most frequent deficiencies in European & CH population

- Iron
- Zinc
- Vitamin D
- Vitamins B ….. and with growing food insecurity Vit.C

Treatment requires a diagnosis based on blood tests (costly)

But deficiencies usually affect several MNs

ESPEN MN-Special Interest Group created in 2023 gives orientation

OSAV & OFSP are reluctant (scarred) do recommend complements

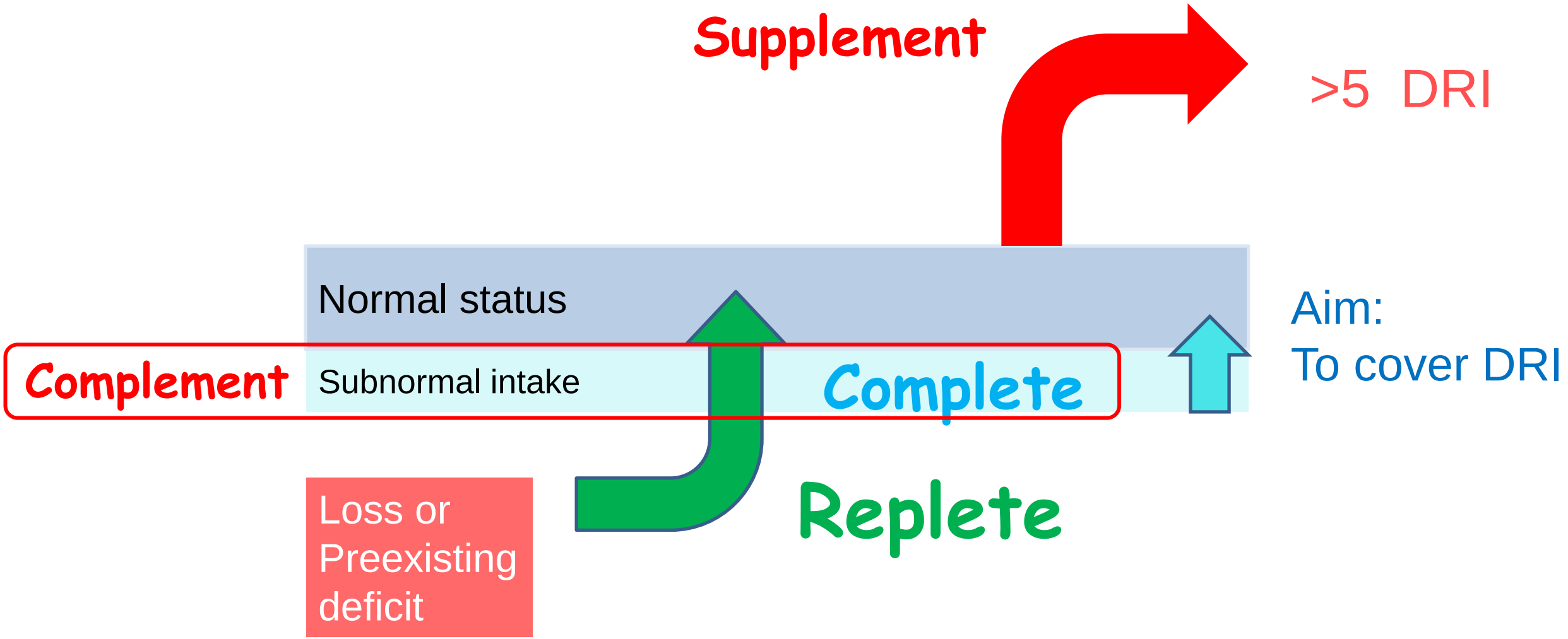
Proliferation of products (many useless and unbalanced) on market is partly generated by absence of clear recommendations

MN IN DAILY PRACTICE? QUE FAIRE ?

Risk groups

- AGE: teenagers, pregnant and lactating women, old adults
- RESTRICTIVE DIETS: vegan, monotonous diets ← poverty
- HISTORY: obesity, bariatric surgery, gastrointestinal surgery
- Persistent fatigue

Complement, Replete or Supplement?
Three different situations with different objectives



Old adults > 65? >75 yrs? Seniors

SSN - Société Suisse de Nutrition 2011

Recommandations:

- Vitamin D
- Calcium
- Vitamin B12
  - –Less meet, gastric changes

Add

- Selenium (Brazil nuts)
- Zinc

Vitamin D deficiency is highly prevalent in malnourished inpatients and associated with higher mortality

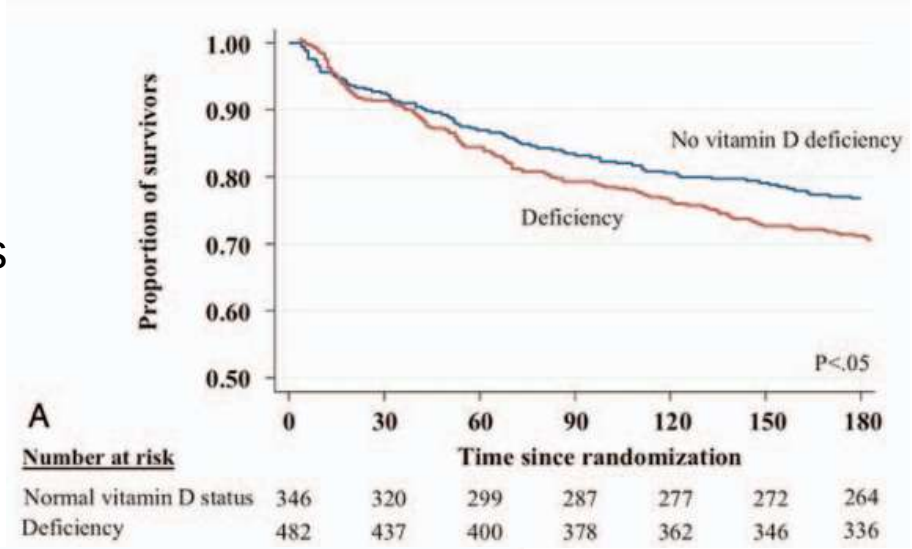
A prospective cohort study

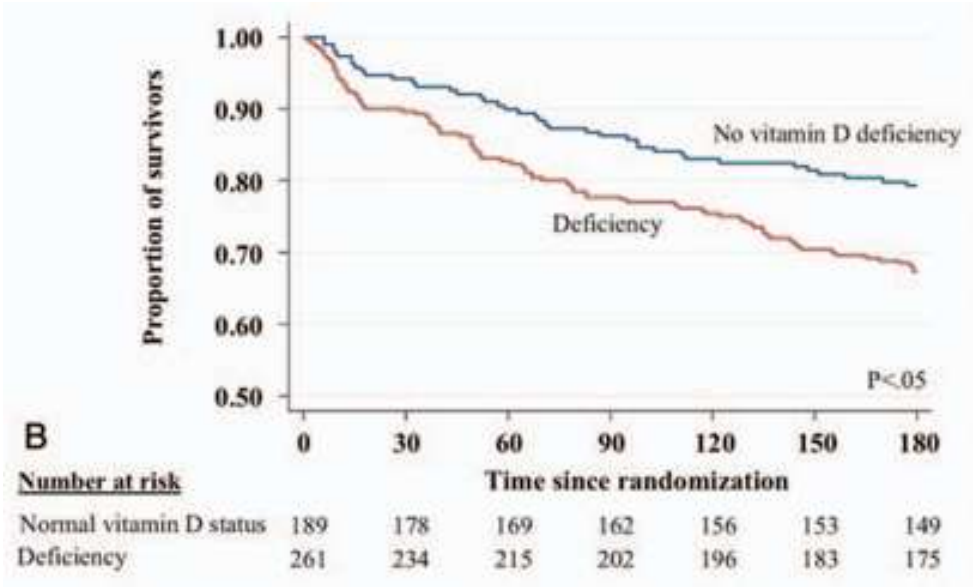
Secondary analysis of EFFORT-CH

Medicine

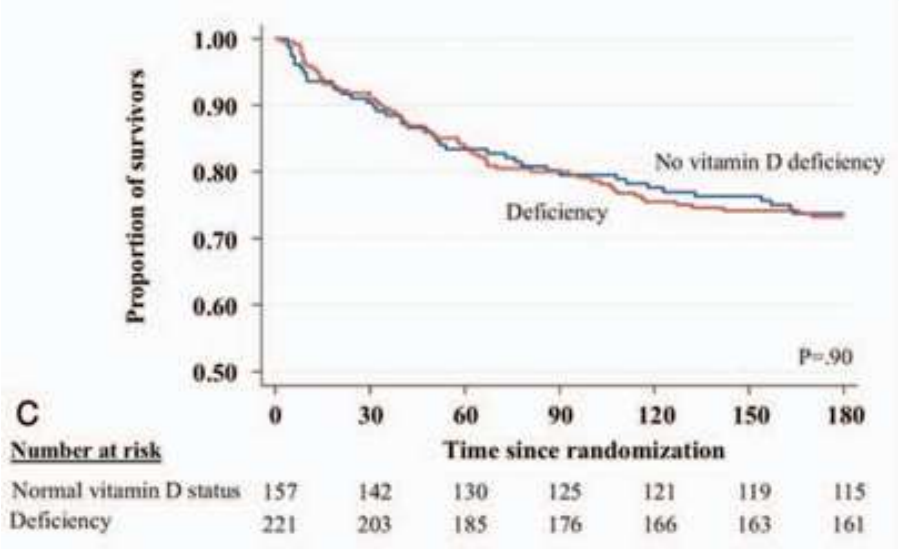
Merker et al, 2019; 98:48

Definition of Vitamin D deficiency when levels were <50 nmol/l
Cohort median values: Age 76 years, BMI 24 kg/m2, all NRS ≥3
Prevalence of vitamin D deficiency in 828 patients upon admission was 58.2% (n=482). Severe deficiency (<25 nmol) in 188 patients (22.7%).
Vitamin D deficiency: ↑ 180-day mortality rates from 23.1% to 29.9% (odds ratio 1.42, 95% CI 1.03–1.94, P=0.03).





Patients who never received vitamin D ttt (adjusted OR 1.63[95%CI 1.01–2.62] P=0.04)



Patients receiving vitamin ttt: **no** significant association OR 0.98 [95%CI0.60–1.61] P=0.95)

A case – Female, 68 years, BMI 25.01 kg/m²

	Lab Ref value	03 mai 23	10 nov 23
Zinc (µmol/l)	10,7-23,0	**8,1**	10,2
Copper (µmol/l)	12,0-24,0	17,8	19,2
Selenium (µmol/l)	0,89-2,20	1,3	1,37
Hs-CRP (mg/l)	<5,0	0,8	2,5
Hb (g/l)	120-160	140	145

Eating habits: omnivore predominant vegetarian with low meat intake

Action: ↑ eggs & meet to 3 days/week, some oysters
1 cp/day week/month Supradyn®

SUPRADYN Vital 50+ cpr pell QAB

Bayer (Schweiz) AG

compendium.ch®

Thiamine chlorhydrate (2.1 mg) , Riboflavine (vitamine B2, E101) (2.4 mg) , Nicotinamide (18 mg) , Acide pantothénique (6 mg) , Pyridoxine chlorhydrate (3 mg) , Biotine (75 µg) , Acide folique (0.3 mg). Cyanocobalamine (Vitamine B12) (1.5 µg)

Acide ascorbique (vitamine C, E300) (90 mg)

Rétinol palmitate (1333 UI)

Cholécalciférol (Vitamine D3) (200 UI)

Tocophérol D-alfa (Vitamine E) (15 mg)

Calcium, ionisé (160 mg) , Magnésium (120 mg) Ginseng extrait sec (50 mg)

RDA zinc

19+ years	11 mg	8 mg

Fer (5.6 mg)

Zinc (6 mg)

Cuivre (1 mg)

Iode (60 µg)

Manganèse (1.4 mg)

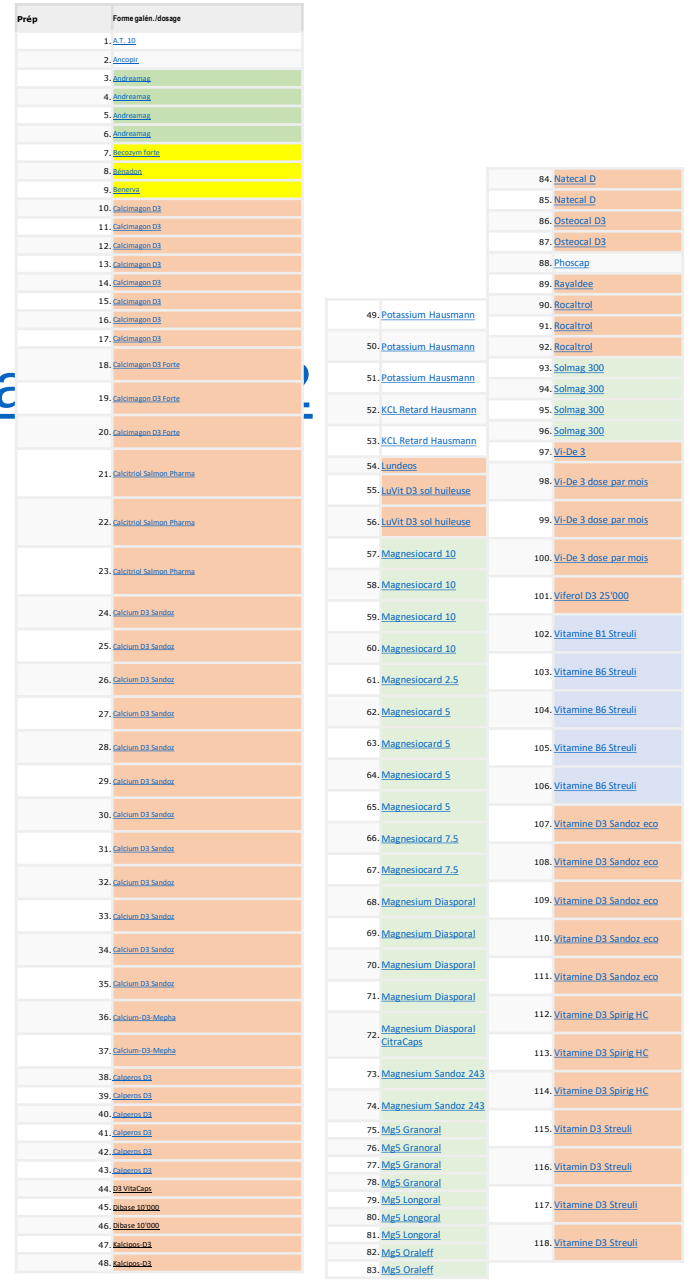
Sélénium (28 µg)

Complement was insufficient

Decision after 2nd blood control: buy Zinc products in France containing 20 mg

Remboursement

Assurance de base: inclut "Specialty List"
(https://www.spezialitätenliste.ch/).
En particulier, chapitre 07.02 "Minerals and vitamins"
https://www.xn--spezialittenliste-yqb.ch/ShowPreparations.aspx?searchType=ItCode&searchVa



Prép	Forme galén./dosage
1.	A.T. 10
2.	Ancopir
3.	Andreamag
4.	Andreamag
5.	Andreamag
6.	Andreamag
7.	Beconym forte
8.	Bevadon
9.	Benervia
10.	Calcimagon D3
11.	Calcimagon D3
12.	Calcimagon D3
13.	Calcimagon D3
14.	Calcimagon D3
15.	Calcimagon D3
16.	Calcimagon D3
17.	Calcimagon D3
18.	Calcimagon D3 Forte
19.	Calcimagon D3 Forte
20.	Calcimagon D3 Forte
21.	Calcitriol Salmon Pharma
22.	Calcitriol Salmon Pharma
23.	Calcitriol Salmon Pharma
24.	Calcium D3 Sandoz
25.	Calcium D3 Sandoz
26.	Calcium D3 Sandoz
27.	Calcium D3 Sandoz
28.	Calcium D3 Sandoz
29.	Calcium D3 Sandoz
30.	Calcium D3 Sandoz
31.	Calcium D3 Sandoz
32.	Calcium D3 Sandoz
33.	Calcium D3 Sandoz
34.	Calcium D3 Sandoz
35.	Calcium D3 Sandoz
36.	Calcium-D3-Mepha
37.	Calcium-D3-Mepha
38.	Calperos D3
39.	Calperos D3
40.	Calperos D3
41.	Calperos D3
42.	Calperos D3
43.	Calperos D3
44.	D3 VitaCaps
45.	Dibase 10'000
46.	Dibase 10'000
47.	Kalcipos-D3
48.	Kalcipos-D3
49.	Potassium Hausmann
50.	Potassium Hausmann
51.	Potassium Hausmann
52.	KCL Retard Hausmann
53.	KCL Retard Hausmann
54.	Lundeos
55.	LuVit D3 sol huileuse
56.	LuVit D3 sol huileuse
57.	Magnesiocard 10
58.	Magnesiocard 10
59.	Magnesiocard 10
60.	Magnesiocard 10
61.	Magnesiocard 2.5
62.	Magnesiocard 5
63.	Magnesiocard 5
64.	Magnesiocard 5
65.	Magnesiocard 5
66.	Magnesiocard 7.5
67.	Magnesiocard 7.5
68.	Magnesium Diasporal
69.	Magnesium Diasporal
70.	Magnesium Diasporal
71.	Magnesium Diasporal
72.	Magnesium Diasporal CitraCaps
73.	Magnesium Sandoz 243
74.	Magnesium Sandoz 243
75.	Mg5 Granoral
76.	Mg5 Granoral
77.	Mg5 Granoral
78.	Mg5 Granoral
79.	Mg5 Longoral
80.	Mg5 Longoral
81.	Mg5 Longoral
82.	Mg5 Oraleff
83.	Mg5 Oraleff
84.	Natecal D
85.	Natecal D
86.	Osteocal D3
87.	Osteocal D3
88.	Phoscap
89.	Rayaldee
90.	Rocaltrol
91.	Rocaltrol
92.	Rocaltrol
93.	Solmag 300
94.	Solmag 300
95.	Solmag 300
96.	Solmag 300
97.	Vi-De 3
98.	Vi-De 3 dose par mois
99.	Vi-De 3 dose par mois
100.	Vi-De 3 dose par mois
101.	Viferol D3 25'000
102.	Vitamine B1 Streuli
103.	Vitamine B6 Streuli
104.	Vitamine B6 Streuli
105.	Vitamine B6 Streuli
106.	Vitamine B6 Streuli
107.	Vitamine D3 Sandoz eco
108.	Vitamine D3 Sandoz eco
109.	Vitamine D3 Sandoz eco
110.	Vitamine D3 Sandoz eco
111.	Vitamine D3 Sandoz eco
112.	Vitamine D3 Spirig HC
113.	Vitamine D3 Spirig HC
114.	Vitamine D3 Spirig HC
115.	Vitamin D3 Streuli
116.	Vitamin D3 Streuli
117.	Vitamine D3 Streuli
118.	Vitamine D3 Streuli

Sur 118 lignes	produits
Magnésium	35
Vitamine D	67
B1 thiamine	2
B3 niacine	1
B6 pyridoxine	5
B12	1
Fer	35

No Vitamin C, copper, zinc, selenium
No multi-micronutrient

Reimbursed products – *French links*

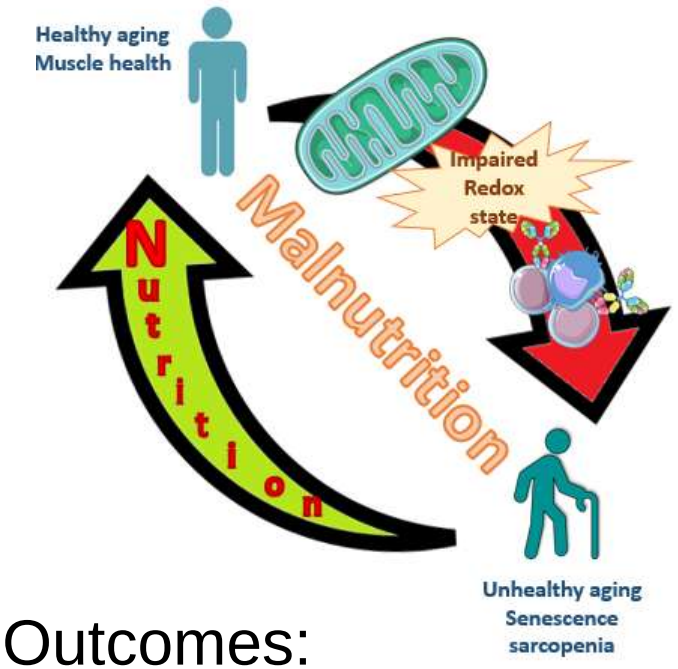
https://www.listedesspecialites.ch/default.aspx

https://www.listedesspecialites.ch/ShowPreparations.aspx

	Préparation	Forme galén. /dosage	emballage	P-Exf TVA excl.	PP TVA incl.	QP	Lim-Pt	Lim	LSIC	Code Swissmédic	Titulaire de l'autorisation	Princip actif
1.	Viferol D3 25'000	sol buv 25000 UI/ml	amp 4 pce	5.96	15.05			L	Non	67173001	OM Pharma Suisse SA	Cholecalciferolum (Vitamin D3)
	Maltofer	cpr pell 100 mg	100 pce	19.46	35.90				Non	55363006	Vifor (International) Inc.	Ferrum(III) ionisatum
	Duofer	cpr pell adult	blist 100 pce	14.49	26.75				Non	38423002	Andreabal AG	Ferrum(II) ionisatum
	Duofer Fol	cpr pell (nouveau)	blist 40 pce	7.69	14.20				Non	53048001	Andreabal AG	Ferrum(II) ionisatum
	Ferinject	sol inj 500 mg/10ml	flac 10 ml	140.25	177.40				Non	57851004	Vifor (International) Inc.	Ferrum(III) ionisatum

MIMOSA Project

Maintaining Immune and Mitochondrial functions in Old adults with SAfe nutrition: the MIMOSA study - Pr. P. D'Amelio, G. Pantaleo, MM Berger



Design: RCT – 3 groups

N= 240 patients admitted to acute geriatric ward

- Control – 1-2 SNOs per day (30-40 g protein)
- BCAA – 1-2 SNOs + 4 g BCAA
- Micro nut: 1-2 SNOs + below combination

Component	Control	BCAAs	MN	DRI [30, 31]	UL[32]
Retinol (µg RE (IU))	240		900 (3000)	800	3000
Vitamin D3 (µg (IU))	2.6		25 (1000)	10	50
Thiamine B1 (mg)	0.4		100	1.5	ND
Cobalamin B12 (µg)	1.3		10	2	ND
Ascorbic acid C (mg)	30		200	60	ND
Iron (mg)	3		30	15	60
Selenium (µg)	16		100	60	300
Zinc (mg)	2.6		20	12	50
Omega-3 PUFA (g)	0.4		0.6	0.5	none

RE = retinol equivalent, ND = Not determinable due to lack of data of adverse effects

Outcomes:

Primary: mitochondrial bioenergetics – oxidative stress

Secondary: infections – MN status – Clinical outcome

Unil | Université de Lausanne

CHUV Centre hospitalier universitaire vaudois

MICRONUTRIENTS- CONCLUSION

- Perception of the importance of MN remains limited, & medical training poor
- In the population, deficiencies are more frequent than generally acknowledged, because MN not measured and insurances reluctant to reimburse
- Products are available – but big business makes it difficult for non experts to find out – costly for individuals – overdosing possible
- Our health system is built to addresses illness, but not health and prevention – insurances prefer to pay for illness ttt.
- Diagnosis is essential to enable **targeted treatment**
- Consider risk groups first

Merci pour votre attention

QUESTION

RÉPONSE