Switzerland - Swiss Salt Study 2: Second survey on salt consumption in Switzerland

Unisanté, Department of Epidemiology and Health Systems

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Identification

SURVEY ID NUMBER
10.16909-fsvo-research-dataset-202410-002

TITLE
Swiss Salt Study 2: Second survey on salt consumption in Switzerland

TRANSLATED TITLE
Schweizer Salzstudie 2022 - 2023

COUNTRY

Name	Country code
Switzerland	CHE

ABSTRACT
Elevated dietary salt intake is responsible for a substantial proportion of disease burden worldwide. High sodium intake has been associated with higher arterial blood pressure, a greater risk of cardiovascular disease - especially stroke or the development of chronic kidney disease. High dietary potassium intake, on the other hand, is related to a lower blood pressure and reduced risk of cardiovascular diseases.
In Switzerland, the dietary salt intake in the population has been shown to exceed the WHO recommended maximum of 5 grams per day. Considering that the first nationwide Swiss Survey on Salt Intake (SSS1) was conducted a decade ago, the Swiss Federal Food Safety and Veterinary Office (FSVO) commissioned in 2021 the second National Survey on Salt Consumption in the Swiss general adult population, namely the Swiss Salt Study 2 (SSS2).
The objectives of the mandated study were as follows:
- to estimate salt (NaCl), potassium (K) and Na:K ratio intakes in the Swiss adult population using a single 24h urine collection and a study design similar to that of SSS1 for comparability;
- to assess intra-individual intake variability by collecting a second 24h urine collection from a subset of participants;
- to collect data on salt-related knowledge, awareness, attitude and behaviors;
- to determine the prevalence of hypertension, overweight and obesity, and cardiovascular risk in Switzerland;
- to explore the associations between salt intake, Na:K ratio, arterial blood pressure and obesity indicators;
- to assess changes that occurred over time by comparing SSS2 and SSS1 results.

For more information see :
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https://www.blv.admin.ch/blv/en/home/lebensmittel-und-ernaehrung/forschung/gesundheitliche-risiken/ernaehrungsrisiken/salzstudie.html
- https://efsa.onlinelibrary.wiley.com/doi/abs/10.2903/fr.efsa.2024.FR-0031 (Study report)

KIND OF DATA
Questionnaire data, urine and blood sample. Data from blood samples is not available.

UNIT OF ANALYSIS
Individuals

Version

VERSION DESCRIPTION
Version 1.2

VERSION DATE
2024-12-31

Scope

NOTES

Keywords
- SAMPLE: 863 participants, adult population, 18 years of age and over, Swiss residents, 3 language regions (German, French, Italian), 4 study centers
- SAMPLING: 24-hour urine, blood pressure, online questionnaire, anthropometry
- ANALYTICS: sodium (Na), potassium (K), chloride, creatinine
- EVALUATIONS: salt consumption, potassium consumption, Na:K ratio, hypertension, salt knowledge and behaviors, Body Mass Index (BMI), waist circumference, Waist-to-Hip ratio, intra- and inter-individual variability, comparisons with first salt study (2010/11)

KEYWORDS

Keyword
Adult
Switzerland
Urine
Blood pressure
Salt consumption
Potassium consumption

Coverage

GEOGRAPHIC COVERAGE
National coverage: Switzerland

UNIVERSE
Random sample of 863 adult permanent residents in Switzerland (450 men and 413 women) covering the three main linguistic regions (French, German, and Italian), 18 years of age and over.

Producers and sponsors

PRIMARY INVESTIGATORS

Name	Affiliation
Unisanté, Department of Epidemiology and Health Systems	University Center for Primary Care and Public Health and University of Lausanne

PRODUCERS

Name	Role
Lausanne University Hospital	Recruitment center, analytics
Inselspital, Bern University Hospital	Recruitment center
Regional Hospital of Bellinzona	Recruitment center
Zurich University Hospital	Recruitment center

FUNDING AGENCY/SPONSOR

Name	Abbreviation	Role
Swiss Federal Food Safety and Veterinary Office	FSVO	Primary Funder
Unisanté, Department of epidemiology and health system	Unisanté	Additional financial and logistic support
Recruitment centers of Bern, Bellinzona and Zurich		Additional financial and logistic support

Sampling

SAMPLING PROCEDURE

Sampling strategy

Permanent residents in Switzerland, 18 years of age and over, were randomly sampled by the Swiss Federal Statistical Office (FSO) from Swiss population registries using the FSO's surveys on individuals and households sampling frame (SRPH, https://www.bfs.admin.ch/bfs/de/home/grundlagen/volkszaehlung/volkszaehlung-teil-gesamtsystem/stichprobenrahmen.html).

The sample list was made of adults residing in Swiss municipalities located within a 30 km radius around the investigation centers. The boundaries of Swiss municipalities were extracted from the swissBOUNDARIES dataset (Swisstopo, FSO, v.04-2021). Municipalities were identified based on the spatial intersection with a 30-km buffer drawn around each investigation center. The analysis was performed in QGIS 3.16 LTR.

A stratification by sex was applied using a 50/50 sex ratio, and by center in order to cover the 3 main linguistic regions of Switzerland with a repartition of 57.0% of individuals living in the German-speaking region (with a 50/50 split between Zurich and Bern), 29.0% in the French-speaking region, and 14.0% in the Italian-speaking region. People from the Italian-speaking region were intentionally oversampled to obtain more stable estimates and a better comparison with other linguistic regions. The targeted net sample size was 840 participants overall, with approximately 240 participants from the French-speaking region, 480 from the German-speaking region, and 120 from the Italian-speaking region.

A total of 9,972 individuals from these sampling lists were initially contacted via postal mail. In the mailed letter, an informational leaflet was included, and recipients were invited to convey their decision to the study team – whether they were interested, undecided, or not interested. Up to three reminder letters were sent to individuals or, if available, they were contacted by telephone by trained collaborators.

Study centers

Participant visits were held at four investigation centers, namely the Centre hospitalier universitaire Vaudois (CHUV, Lausanne University Hospital) in Lausanne, the Universitätsspital Bern (Inselspital, University Hospital Bern) in Bern, the Universitätsspital Zürich (USZ, University Hospital Zurich) in Zurich, and the Ospedale San Giovanni di Bellinzona (Regional Hospital of Bellinzona), located respectively in the Cantons of Vaud (French-speaking region), Bern, Zurich (both German-speaking region), and Ticino (Italian-speaking region).

Exclusion criteria

People were excluded from the study if they were unable to understand the participant information sheets and/or to provide informed consent (e.g. individuals living in institutions, insufficient command of local Swiss languages, etc.), if they were not able to come to the investigating center for at least two consecutive visits, if they were incontinent or unable to perform the 24h urine collection. Pregnant women were also excluded.

DEVIATIONS FROM THE SAMPLE DESIGN

A theoretical participation rate of 15.0% was estimated. However, since the actual participation rate was from the beginning lower than the theoretical rate, a second list was sampled by the FSO using the same criteria. This second list was instrumental to complete the initial sample and reach the targeted net sample size.

RESPONSE RATE

The overall participation rate of the study was 8.7%.

Out of 863 urine collections performed between the first and second visits, 858 could be used to compute the mean urinary salt excretion.

WEIGHTING

Calculation of sampling weights

Marginal totals for each sampling list were obtained from the FSO, and an average sampling frame was calculated to integrate both lists. Sampling weights were defined as the inverse of inclusion probability and were then adjusted to account for non-response. The predicted probability of response to urine collection was estimated using a logistic regression model that considered age group, sex, nationality, household size, marital status, and linguistic region as predictors. Subsequently, a k-means clustering algorithm was used to group subjects with similar predicted response probabilities. The number of clusters was determined based on the ratio of the sum of squares between clusters to the total sum of squares. To correct for non-response, each participant's sampling weight was divided by the average probability of response within their cluster. These weights corrected for non-response were then calibrated to ensure that some characteristics of the sample of respondents match those in the population within different subgroups. The subgroups were defined according to strata (combinations of sex and center), age groups, nationality, household size, marital status, and linguistic region. Additionally, weights were calibrated on the season of urine collection (in consideration of variations in nutritional habits across seasons) by assuming an equal repartition of the population across the 4 seasons. Finally, weight trimming was implemented based

on the approach proposed by Potter et al. An appropriate value denoted as w0 was determined based on the 99th quantile of the theoretical (B) distribution of the reciprocal of scaled weights. All weights exceeding w0 were set to w0, and the remaining weights were adjusted so as to force the sum of weights to equal the size of the sampling frame. This process was repeated iteratively until no further weight trimming was necessary. After applying calibrated weights, both trimmed and untrimmed, the sample characteristics of participants became similar to those of the population within different subgroups. Despite potentially introducing a small bias, trimmed weights were used to calculate weighted means, due to their slightly smaller variability and range compared to untrimmed weights, in order to obtain more precise estimation. The final point estimate (i.e., mean NaCl excretion or Na:K ratio) was obtained by calculating a weighted average of the outcome measured on the participants.
A confidence interval for the weighted mean was constructed using the with-replacement bootstrap procedure described in Bessonneau et al. A total of 200 bootstraps was constructed in this way, with each bootstrap providing calibrated and trimmed weights for the participants. The standard error (SE) of the weighted mean was determined by calculating the standard deviation (SD) of the weighted means obtained across the 200 bootstrap resamples, and the lower and upper limits of 95% confidence interval (95%CI) was subsequently calculated.

Data Collection

DATES OF DATA COLLECTION

Start	End
2022-03-01	2023-08-31

DATA COLLECTION MODE
Self-administred questionnaire, administred questionnaire, urine sample collection, blood sample collection

SUPERVISION
The study was coordinated by the Department of epidemiology and health system at Unisanté (University Center for Primary Care and Public Health) in Lausanne (Vaud), which is academically linked to the Faculty of Biology and Medicine of the University of Lausanne.

DATA COLLECTION NOTES
For the study, participants were required to attend at least two visits at the closest investigation center. An optional third visit was proposed to 20% of participants along the recruitment phase. Visit 2 occurred between 1 and 7 days after visit 1, and the visit 3 between 7 days and 5 weeks after visit 2.
At visit 1, participants' weight, height, waist, and hip circumferences were measured. Resting blood pressure was measured five times at each visit. Participants performed a 24h urine collection between visit 1 and visit 2, and for the participants who accepted the 3rd visit, a second collection was performed between visit 2 and visit 3.
Participants were instructed to maintain their daily activities, stay hydrated as usual, and not alter their food intake habits during the 24h urine collection.

24h urine collection
Participants were provided with the material for the 24h urine collection and received standardized written and oral instructions.
The collection started by first emptying the bladder. They were then asked to collect all urine in the designated plastic bottles until approximately 24hours after the start of the collection, which marked the end of the collection period. They were also requested to keep a record of any missed voids or spilled urine during the collection period and to store the urine bottles in a cool environment using frozen cold packs or in the refrigerator.

Questionnaires

QUESTIONNAIRES
Participants were requested to fill a questionnaire, accessible online, at the earliest upon receipt of the invitation letter and at latest during visit 2.
The forty-four-item questionnaire, available in three languages, was either self-administered or administered by the investigators. Self-reported data included socio-demographic information, medical questions, eating habits, self-perception of daily salt consumption, salt-related behaviours, awareness/knowledge of salt-related health risks and attitude toward salt.

Data Processing

DATA EDITING

The study data were collected in coded form and managed using REDCap (Research Electronic Data Capture) database hosted at Unisanté. Prior to performing statistical analyses, the database underwent thorough testing to identify missing information, errors, and plausibility issues (such as impossible values or inconsistencies). Whenever possible, missing information was retrieved, and anomalies related to database entry errors were corrected by the investigators. The missing data reported in this document correspond to information that remained unavailable after the data cleaning process.

Data Appraisal

DATA APPRAISAL

Assessment of the quality of 24h urine collections
Duration and volume of urine collection, and urinary Crt excretion corrected for body weight, were used to assess the quality of the collected urines.

Sensitivity analyses
Reassessment of urinary salt (NaCl) and molar sodium to potassium (Na:K) ratio excretions, and compliance to recommendations after exclusion of low-quality urine collections.

Analytics
Assessment of comparability in laboratory data: 30 urine aliquots that were measured in 2011 (SSS1) and stored frozen since then were re-measured in 2022, using the SSS2 laboratory conditions.

Access policy

CONTACTS

Name	Affiliation	Email	URL
Swiss Federal Food Safety and Veterinary Office (FSVO)	The Federal Department of Home Affairs (FDHA)	datarepository@blv.admin.ch	Link

CONFIDENTIALITY

Confidentiality of respondents is guaranteed by Articles 4 to 15 of the Federal Act on Data Protection (FADP) of 19 June 1992 (Status as of 1 January 2014). De-identification: the data de-identification/coding was performed by Unisanté team. This dataset contains only de-identified data following the standard for de-identification of protected health information, Section 164.514(a) of the Privacy Rule of the Health Insurance Portability and Accountability Act (HIPAA) (http://www.hhs.gov/hipaa/for-professionals/privacy/special-topics/de-identification/#standard). Under this standard, health information is not individually identifiable if it does not identify an individual and if the covered entity has no reasonable basis to believe it can be used to identify an individual. This is done by removing or recoding, direct and indirect, identifiers in the data. The following types of identifiers are examples, such as those identified by HIPAA, that should be considered for removal or recoding to prevent the risk of association of a participant to his / her data. The list includes, but is not limited to, the following: 1) Names and initials, 2) All elements of dates (except year) which can be directly associated with a specific individual (birthdate, etc.), 3) Kit numbers (diagnostic kits) and device numbers (devices used in the trials), 4) Geographic information such as place of work, addresses, zip codes, etc., 5) Telephone numbers, 6) Email addresses, 7) Fax numbers, 8) Account numbers, 9) Social security numbers, 10) Health plan beneficiary numbers, 11) Medical record numbers, 12) Vehicle identifier numbers and serial numbers including license plate numbers, 13) Certificate / license numbers (marriage licenses, etc.) 14) Biometric identifiers including such as MRI, hand voice prints, etc. 15) Full face photographic images or comparable images 16) Web Universal Resource Locators (URLs), 17) Internet Protocol (IP) addresses, and 18) Any other unique identifying number, code or characteristic. All of these 18 items should be considered to be removed from the data set. The original subject id of the study was replaced with a new random subject id. Before being granted access to the dataset, all users have to formally agree: 1. To make no copies of any files or portions of files to which s/he is granted access except those authorized by the data depositor. 2. Not to use any technique in an attempt to learn the identity of any person, establishment, or sampling unit not identified on public use data files. 3. To hold in strictest confidence the identification of any establishment or individual that may be inadvertently revealed in any documents or discussion, or analysis. Such inadvertent identification revealed in her/his analysis will be immediately brought to the attention of the data depositor. This statement does not replace a more comprehensive data agreement (see Access conditions).

ACCESS CONDITIONS
Licensed datasets, accessible under conditions for research purposes. Only the data of study participants, who have given their written consent for the further use of the study data for research purposes, will be made available (n = 824).

To request access to licensed datasets, please register to the website to continue (https://www.studydata.blv.admin.ch/index.php/auth/register). Once your registration will be approved you must login and go to the "DATA ACCESS" tab and fill in the application form for access to the licensed dataset.

This form must be filled and submitted by the Lead Researcher in order to initiate the review process. Lead Researcher refers to the person who serves as the main point of contact for all communications involving this agreement. Access to licensed datasets will only be granted when the Lead Researcher is an employee of a legally registered receiving agency (university, research company, research centre, national or international research organization, etc.) on behalf of which access to the data is requested. The Lead Researcher assumes all responsibility for compliance with all terms of the Data Privacy Agreement by all researchers involved in the respective research project.

This request will be reviewed by the FSVO team, who may decide to approve the request, to deny access to the data, or to request additional information from the Lead Researcher. If your request is reviewed positively, you will receive by e-mail a separate “Data Privacy Agreement” to be signed and returned by the Lead Researcher. The FSVO will only then grant access to data download.

Before filling and submitting the request form, please consult the codebook in order to find out whether or not the available data provide the variable(s) you would need for your project. If in doubt you may contact the FSVO by email (datarepository@blv.admin.ch) for clarification.

CITATION REQUIREMENTS
"Swiss Salt Study 2: Second survey on salt consumption in Switzerland, Version 1.2 of the dataset (2024), provided by the Swiss Federal Food Safety and Veterinary Office (FSVO). www.blv.admin.ch"

ACCESS AUTHORITY

Name	Affiliation	Email	URL
Swiss Federal Food Safety and Veterinary Office (FSVO)	The Federal Department of Home Affairs (FDHA)	datarepository@blv.admin.ch	Link

LOCATION OF DATA COLLECTION
FSVO Data repository

Disclaimer and copyrights

DISCLAIMER
The user of the data acknowledges that the original collector of the data, the authorized distributor of the data, and the relevant funding agency bear no responsibility for use of the data or for interpretations or inferences based upon such uses.

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Metadata production

DDI DOCUMENT ID
10.16909-fsvo-research-dataset-202410-002

PRODUCERS

Name	Abbreviation	Affiliation	Role
Unisanté, Department of Epidemiology and Health Systems	Unisanté	Center for Primary Care and Public Health (Unisanté), University of Lausanne, Switzerland	Primary investigator

Swiss Federal Food Safety and Veterinary Office	FSVO	FDHA	Primary funder

Data Dictionary

Data file	Cases	Variables